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Self-Efficacy About Sexual Behavior Among Islamic Boarding School Students

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Abstract

Having premarital sexual intercourse has a broad risk impact on health. This is following the teachings of Islam that should be upheld by all Muslims, with no exception for students living in Islamic boarding schools. To Islamic values and culture, students should have strong self-efficacy to prevent them from engaging in sexual behavior. This study aims to determine the effect of self-efficacy on the sexual behavior of students living in Islamic boarding schools. This cross-sectional study was conducted between June and August 2023. The sample was 150 students who lived in an Islamic boarding school in Semarang, Indonesia, taken by random sampling technique. Data was collected through interviews and then analyzed by logistic regression. Students at Islamic boarding schools who had premarital sex were more likely to be found in adolescents aged <19 years (15.2%), male (9.5%), had low self-efficacy (18.2%), and ever accessed pornography (23.1%). Accessing pornography was influenced by sex (p = 0.021, OR = 0.235), while premarital sexual intercourse behavior was influenced by age (p = 0.013, OR = 10.716) and self-efficacy (p = 0.043, OR = 4.602). Younger students with low self-efficacy are more likely to practice premarital sexual intercourse. This study found that accessing pornography did not affect the practice of sex carried out by students in Islamic boarding schools. The health ministry needs to work with the religious affairs ministry to design programs aimed at increasing self-efficacy among students in Islamic boarding schools.

INTRODUCTION

Adolescence is one of the stages in human life. This stage is critical because it is the transition stage from childhood to adulthood. At this time, the desire to find oneself and gain recognition from family and environment is high. Sometimes to get recognition from their environment, teenagers do things that are outside of ethics and rules. School is an extension of the family in laying the foundation of behavior for the child's next life, including health behavior. The population of schoolchildren in a community is quite large between 40% - 50%. Therefore health promotion in schools is very important. Pesantren which are non-formal educational institutions have not been intervened much in terms of health. Health education in schools is a human investment for nation-building (Kusnadi et al., 2017; Zaini et al., 2022).

A school is a place for the delivery of knowledge material (teaching) and at the same time a place for the formation of attitudes, values, beliefs, and elements of desired behavior, where knowledge material about health can be given, both as a special subject and integrated with other existing teachings (Nyoko & Hara, 2020). For formal schools that generally have a specific teaching plan or curriculum, the placement of health education materials can be designed and sorted more carefully. The process of maturing adolescents of school age has been more prominent and exposure to

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external influences that can damage healthy living behavior becomes very vulnerable, such as smoking, drinking, narcotics and drug abuse, sexual deviation, and other acts of violence. Health education efforts in this group should be integrated into adolescent health programs if they already exist. Therefore, it should not be ignored the existence of educational institutions that may have informal status but have the very potential to engage in risky behavior.

Indonesian adolescents are currently experiencing increased vulnerability to various health risks, especially those related to reproductive health, including increased threats from PMS/HIV/AIDS, unwanted pregnancy, and abortion, which are receiving international attention. Other problems are related to drugs, liquor, cigarettes, student brawls, promiscuity, and violence against children/adolescents. Among students, diseases or health problems that are often faced are those related to skin diseases (scabies), malnutrition, and reproductive health including menstrual personal hygiene, homosexuality, the risk of contracting HIV / AIDS, sexual behavior, and smoking (Ahmed et al., 2014; Hayee et al., 2021; Mendolia et al., 2018). Therefore, the Ministry of Religious Affairs and the Ministry of Health have even compiled training modules on adolescent reproductive health in Islamic nuances, by including the postulates of the holy book of the Qur'an in it.

Zina is practicing sex outside of marriage. Every student living in an Islamic boarding school is Muslim so they know that committing an act close to zina is a grave sin. Muslims are strictly forbidden to commit it (Ghozali & Nasrulloh, 2022). Nonetheless, adolescence is already in the stage of sexual maturity. In addition, media exposure in the current generation Z causes students to easily obtain information. If the information they get is valid, then they will behave healthily. On the contrary, there is also a lot of dangerous information that they can access freely. The bulwark that can prevent adolescents from behaving in premarital sex is self-efficacy. Therefore, this study aims to determine the relationship between self-efficacy of students and sexual behavior.

METHOD

This is a cross-sectional study conducted in Semarang, the capital city of Central Java, from June to August 2023. The population in this study is students from an Islamic boarding school located in Semarang as many as 5,481 students. Based on the minimum sample size formula by Lemeshow and random sampling techniques, 150 students participated in this study. All the data was collected by a self-administered questionnaire. The study was authorized by the Ethics Committee (Approval ID: 403/EA/KEPK-FKM/2023) of the Faculty of Public Health, Universitas Diponegoro.

The independent variables in this study were student characteristics (age, sex, education, father's occupation, mother's occupation) and self-efficacy. The dependent variable is sexual behavior (accessing pornography and the practice of sexual intercourse). Access to pornography is measured by questions about whether or not they have ever accessed pornography (images, writings, or videos), while the practice of sexual intercourse is measured by questions about whether or not they have had premarital sexual intercourse. A score of 0 is given for the answer "yes/ever" and a score of 1 is given for the answer "no/never". Self-efficacy was measured by 10 valid and reliable questions, including questions about students' ability not to access pornography and maintain abstinence until marriage. The self-efficacy variable is normally distributed so that the cut-off point in its categorization uses the mean rate. Self-efficacy is categorized as "low" if the total score is < 9 and categorized as "high" if the total score is ≥ 9. Kolmogorov Smirnov's test shows that all questions are valid. Each question is also reliable (cronbach alpha>0.60). The data was analyzed by univar¬iate to obtain the frequency distribution of each variable (age, sex, education, parent's occupation, accessing porn, and practicing sexual intercourse). Logistic regression is used to determine the relationship between age, sex, education, parent's occupation, accessing porn, and practicing sexual intercourse (p-value = 0.05).

RESULTS AND DISCUSSION

Islamic Boarding School is an educational institution with the concept of boarding school education with the Ministry of National Education curriculum integrated with Islamic lessons. In this study, boarding school is a residence for students who are receiving formal education outside boarding school. Usually, students who live in boarding schools are from elementary school to college (Mustikawati et al., 2017). Of the 150 students who were respondents in this study, most were female (72%), aged ≥19 years old (69.3%), and were studying (78.7%). At this age, adolescents are experiencing psychosexual development with physiological reproductive organs. Sexual development is caused by an increase in testosterone in men and estrogen in women. An increase in this hormone causes increased sex drive in adolescents. In reality, adolescent sexual behavior is often manifested in unhealthy sexual behavior. Unhealthy sexual behaviors include having sexual intercourse, unwanted pregnancy, and contracting sexually transmitted infections. Unhealthy sex behavior can also be judged by not using condoms in sex and having more than 1 sex partner (Shaluhiyah et al., 2020).

Most of their fathers jobs are employees while their mothers do not work (housewives). Being away from parents means that students living in Islamic boarding schools do not receive enough supervision from parents. The supervisor in the boarding school is the ustadz who is assisted by older students. Boarding schools with weak supervision will make it easier for students to try to perform behaviors prohibited by the school, such as interacting with the opposite sex which leads to zina (Ridha et al., 2023; Sudjak et al., 2017).

The study found that 8.7% of students had accessed pornography and 6.7% admitted to having had premarital sex intercourse. This is very worrying because students know very well that it is not allowed. Students at Islamic boarding schools have a social influence that is not only religious but also teaches about hygiene and health in Islam. They have religious values that have always been the rule of life. Value is a measure or principle that is believed and used as a standard of code of conduct that is considered good, appropriate, and correct. Religious values are derived from religious norms which are the rules of religious teachings that bind its followers. Religious norms contain commandments and prohibitions for adherents to obtain happiness in the world and the hereafter. If his followers violate these rules, they are considered to have sinned and placed in the afterlife (Bobyreva et al., 2019).

Self-efficacy influences a person's behavior. The more confident a person is in abstinence, the more likely he is not to have premarital sex, and vice versa. From Table 1 it can be seen that as many as 78% of students have high self-efficacy, but 22% of others have low self-efficacy. Students with low self-efficacy tend to be unable to refrain from watching pornography and/or having premarital sex. Increasing knowledge about reproductive health and sexuality is essential to improving sexual self-care (Indraswari, Widjanarko, et al., 2023). This is because changing a person's behavior by improving their self-efficacy can be a protective factor against high-risk sexual behaviors, such as the prevention of AIDS and STIs in sexual intercourse (Assarzadeh et al., 2019).

A previous study reported topics like relationships and sex were taboo to discuss. Talking about sex is considered appropriate only by husband and wife. This is dangerous because it causes teenagers to obtain information about sex from misleading sources (Indraswari et al., 2021). From the results of crosstabulation, it is known that students who access pornography are more male (19%) and have low self-efficacy (18.2%). Females and males are equal when it comes to accessing pornography. Results of crosstabulation revealed that students aged <19 years are more likely to have premarital sex (15.2%) than students over 19 years old (2.9%). Male students are more likely to have premarital sex (9.5%) than female students. Most of them also had low self-efficacy (18.2%). As many as 23.1% of students who watched pornography also had premarital sexual intercourse. Students in this study belong to Generation Z. The characteristic of this generation is very good at finding information. The internet has existed since they were born in the world (Prakash Yadav & Rai, 2017). Previous research even found that students had been exposed to pornography

Table 1. The Characteristics of Respondents

Variables	n	%
Sex		
Female	108	72.0
Male	42	28.0
Age		
<19 years old	46	30.7
≥19 years old	104	69.3
Education		
Junior high school	5	3.3
Senior high school	27	18.0
College	118	78.7
Father's occupation		
Civil servant	17	11.3
Employee	65	43.3
Entrepreneurship	39	26.0
Unemployment	29	19.3
Mother's occupation		
Civil servant	12	8.0
Employee	36	24.0
Entrepreneurship	20	13.3
Unemployment	69	46.0
Passed away	13	8.7
Self-efficacy		
High	117	78.0
Low	33	22.0
Accessed porn		
Yes	13	8.7
Never	137	93.3
Had sex		
Yes	10	6.7
Never	140	93.3

Source: Primary Data, 2023

since the age of 5. This is very worrying because it can affect individual and social values. In the end, adolescent behavior becomes unhealthy because it considers premarital sex behavior to be accepted in the surrounding environment (Indraswari, Kusumawati, et al., 2023).

Table 2 shows the frequency distribution of students' answers measuring their self-efficacy. Only 88% of students were sure they could refuse their boyfriend's invitation to have sex, while 12% said they were not sure they could refuse. Most students believe they can keep their virginity and abstinence because premarital sex does not follow the teachings of their religion. All respondents were Muslim and participated in every religious activity regularly held by the boarding school. In Islam, sexual intercourse can only be performed with a legal wife or husband in marriage. This is because Islam believes that a person will bear a great sin if he has premarital sex. This belief is very strong because it is firmly written in the Quran, the holy book of Muslims. Therefore, premarital sex is strongly opposed by Muslims and it is certainly known by all students studying at Islamic boarding schools. However, not all students feel confident that they can refuse their girlfriends to enter their rooms, even though it is a strict prohibition

Table 2. The Distribution of Frequency of Student's Self-efficacy

Component Self-efficacy	Yes		No	
	n	%	n	%
1. I was able to refuse if invited to have sex with my boy/girlfriend.	132	88.0	13	12.0
2. I can cling to the stance of not having sexual relations before marriage because it does not follow religious teachings.	142	94.7	18	5.3
3. I was able to keep my virginity until I got married.	142	94.7	8	5.3
4. I was able to hang on to my decision not to have sex before marriage for fear of getting pregnant.	140	93.3	10	6.7
5. I believe I can refrain from having sexual relations with my boy/girlfriend even if I have to break things off.	142	94.7	8	5.3
6. I believe I can refrain from having sex before marrying my boy/girlfriend, even though my friend thinks it's perfectly normal.	141	94.0	9	6.0
7. I was able to give my boy/girlfriend an excuse not to have sexual intercourse before marriage.	143	95.3	7	4.7
8. I'm sure I can refuse if my boy/girlfriend asks me to watch porn.	138	92.0	12	8.0
9. I was sure I could forbid my boy/girlfriend from coming into my room.	137	91.3	13	8.7
10. I was sure that I would not have sexual relations before marriage for fear of getting venereal diseases or sexually transmitted infections.	142	94.7	8	5.3

Source: Primary Data, 2023

in Islamic boarding schools. Islamic boarding schools are very strict in regulating interactions between men and women because it is feared that it leads to adultery or sexual behavior with people who are not their muhrim. Muhrim is a person who cannot be married, in Islamic rules (Ghozali & Nasrulloh, 2022). Students who have high religiosity scores will be more likely to avoid watching pornography and premarital sex intercourse (Shapiro et al., 2017).

From Table 3 it is known that gender (p = 0.021) affects students in accessing pornography. Male students are 0.235 times more likely to access pornography than female students. Age (p = 0.013) and self-efficacy (p = 0.043) affected intercourse sexual practices (Table 4). Students younger than 19 were 10,716 times more likely to have sex than students over 19. Students with low self-efficacy were 4,602 times more likely to have sex than students with high self-efficacy. Accessing pornography is prohibited for all students living in Islamic boarding schools. Not all students can afford to refuse their boyfriend's invitation to watch porn together. Sexual content may be more prominent, or perhaps more appealing, to viewers who have a permissive attitude, so the consumption of sexual content reinforces permissiveness for those who already have that attitude (Dillman Carpentier & Stevens, 2018). It will manifest distress at the potential of having premarital sexual intercourse (Hennegan et al., 2019).

CONCLUSION

Some students who live in Islamic boarding schools have low self-efficacy. They are unable to resist their boyfriend's invitation to access pornography and engage in premarital sexual intercourse. The study found that students at Islamic boarding schools who had premarital sex were more likely to be found in

Table 3. Result of Multivariate Analysis on Students' Characteristic Toward Accessing Pornography

Variable	β	SE	Wald		Sig	Exp (β)	95% CI	
							Lower	Upper
Sex	-1.493	0.647	5.328	1	0.021	0.235	0.063	0.798
Age	0.229	0.837	0.075	1	0.785	1.257	0.244	4.478
Father's occupation	0.118	0.253	0.216	1	0.642	1.125	0.685	1.847
Mother's occupation	0.049	0.159	0.093	1	0.760	1.050	0.769	1.434
Self-efficacy	1.042	0.633	2.711	1	0.100	2.834	0.820	9.793

Note: β = Beta Coefficient; SE= Standard Error; df= Degree of Freedom; Sig.=Significance; Exp ( )= Beta Exponential; CI= Confidence Interval
Source: Primary Data, 2023

Table 4. Result of Multivariate Analysis on Student's Characteristic Toward Practicing Sexual Intercourse

Variable	β	SE	Wald	df	Sig	Exp (β)	95% CI	
							Lower	Upper
Sex	-0.662	0.805	0.675	1	0.411	0.516	0.107	2.500
Age	2.372	0.957	6.142	1	0.013	10.716	1.642	69.927
Father's occupation	0.368	0.368	1.000	1	0.317	1.445	0.702	2.971
Mother's occupation	0.005	0.195	0.001	1	0.978	1.006	0.686	1.475
Self-efficacy	1.526	0.755	4.090	1	0.043	4.602	1.048	20.201
Accessing porn	1.535	0.912	2.833	1	0.092	4.640	0.777	27.719

Note: **β**= Beta Coefficient; SE= Standard Error; df= Degree of Freedom; Sig.=Significance; Exp (**β**)= Beta Exponential; CI= Confidence Interval
Source: Primary Data, 2023

adolescents aged <19 years, male, had low self-efficacy, and had accessed pornography. Access to pornography is influenced by sex. Males are more likely to access pornography than females. The practice of premarital sexual intercourse is influenced by age and self-efficacy. Younger students with low self-efficacy are more likely to practice premarital sexual intercourse. This study also found that accessing pornography is not the determinant of premarital sexual intercourse among students in Islamic boarding schools.

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Referral Flow for Maternal and Child Health in Central Java Province during Health Crises Management

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Abstract

Central Java Province is one of the provinces that often experiences disasters. During the period 1 May 2023 – 31 May 2023, 72 incidents of strong winds, 8 incidents of land moving, 107 incidents of flooding, 94 incidents of landslides, 6 volcanic eruptions, and 2 incidents of fire were recorded. In disaster emergencies, the health needs of mothers and children are often overlooked. This study aims to analyze the flow of maternal and child health referrals in health crisis management in the focus location regencies in Central Java Province. This research is descriptive research with a qualitative approach. Data was collected through Focus Group Discussion (FGD) in March 2023. The research locations were Semarang Regency, Brebes Regency, Grobogan Regency, and Klaten Regency. The sample selection technique used was purposive sampling. The integrated referral system is not yet running optimally. The health referral flow carried out is not yet specialized in treating mothers and children. Pentahelix collaboration is carried out in managing health crises. The supporting factors in disaster management are the existence of policies, the availability of infrastructure for evacuating victims, as well as coordination from various sectors. Meanwhile, the inhibiting factors are the lack of trained human resources, limited logistics, and low public awareness regarding disasters. Thus, there is a need to develop a special referral pathway for maternal and child health involving multi-sectors, increase public awareness of disaster management, and strengthen Pentahelix collaboration in health crisis management.

INTRODUCTION

Health crises are increasingly becoming a concern due to unpredictable and uncontrollable risks in global society. The frequency of health crises has increased over the last decade. Health risk management is very important to protect society from emergencies and disasters and build health systems and community resilience (Pan American Health Organization, 2016). Indonesia is located between three large plates in the world, namely the Indo-Australian plate, the Eurasian plate, and the Pacific plate. Data from the Center for Volcanology and Geological Disaster Mitigation records that

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there are 129 volcanoes, most of which are active and 80 are in the dangerous category. Indonesia's geographical location makes it prone to tectonic and volcanic earthquakes which can be followed by large tsunamis with the presence of the Indian Ocean and Pacific Ocean (Direktorat Pengurangan Risiko Bencana BNPB, 2016). Most of Indonesia's territory is waters consisting of 17,508 islands, with five large islands. Hydrometeorological disasters have the potential to occur with diverse and complex topography, hilly areas, and many river flows accompanied by the influence of climate change. Indonesia's geography, geology, hydrology, demography, climate change, and environmental degradation in Indonesia influence the high frequency of disaster events (Bhaskara & Purwaningsih, 2023).

From 2005 to 2015, the Indonesian Disaster Information Data (DIBI-BNPB) recorded that more than 78% of disaster events were hydrometeorological, such as floods, extreme waves, land and forest fires, drought, and extreme weather. Meanwhile, another 22% are geological disasters, namely earthquakes, tsunamis, volcanic eruptions, and landslides. Ethnic, cultural, and political diversity accompanied by triggers can also give rise to social (Direktorat Pengurangan Risiko Bencana BNPB, 2016). Central Java Province is one of the provinces that frequently experiences disasters. These include landslides, floods, tidal waves, moving land including landslides, strong winds, fires, forest and land fires, earthquakes, volcanic eruptions, and others. According to BPBD data, during the period 1 May 2023 – 31 May 2023, 72 incidents of strong winds, 8 incidents of land moving, 107 incidents of flooding, 94 incidents of landslides, 6 volcanic eruptions, and 2 incidents of fire were recorded (BPBD Jawa Tengah, 2023).

All of these disaster events can cause a Health Crisis. Health Crisis is regulated in the Regulation of the Minister of Health of the Republic of Indonesia Number 75 of 2019 concerning Health Crisis Management. A Health Crisis is an event or series of events that results in casualties, injuries/illness, displacement, and/or potential dangers that impact public health that require a rapid response outside of normal practice and inadequate health capacity. Health crisis management is carried out through three stages, namely before a health crisis occurs (pre-health crisis), during a health crisis emergency, and after a health crisis occurs (post-health crisis). Health Crisis Management aims to implement coordinated, planned, integrated, and comprehensive Health Crisis Management to protect the community from threats, risks, and impacts of health problems (Pusat Krisis Kesehatan Kemenkes RI, 2023). The health crisis causes deaths, injuries, illnesses, refugees, paralysis of health services, infectious diseases, environmental sanitation, mental disorders, and other health problems. And without exception, the victims are mothers and children.

In disaster emergencies, the health needs of mothers and children are often overlooked. Risk of complications for women during pregnancy or childbirth because they are forced to give birth without the help of trained health personnel. Risks of unwanted pregnancy, sexual violence, and psychological disorders can also occur in disaster situations. A study conducted in India showed the likelihood of an increase in acute illnesses in children by 9–18%, an increase in malnutrition by 7%, and a decrease in complete immunization in children in disaster-affected areas by 18% in crises (Datar *et al*., 2013). The availability of maternal and child health services in disaster situations will save lives. Post-disaster maternal and child health services are very necessary. The implementation of maternal and child health services is 2 antenatal care, 1 post-natal care, 1 neonatal care, 2 family planning consultations, and trauma healing for children (Nurtyas, 2019). Capacity in disaster management must refer to the national disaster management system contained in the Law on Disaster Management and its derivative regulations. However, challenges in efforts to manage the Health Crisis still exist, especially in creating referral channels for maternal and child health in health crisis management. In carrying out health management in crises, a clear flow of health services is needed to minimize casualties. This research aimed to analyze the flow of maternal and child health referrals in health crisis management in the focus location regencies in Central Java Province.

METHOD

This research is descriptive research with a qualitative approach with a focus on the referral flow of maternal and children during health crisis management in each regency. Primary data was obtained through Focus Group Discussion (FGD) activity carried out in March 2023. The selected research locations were Semarang Regency, Brebes Regency, Grobogan Regency, and Klaten Regency. Sampling was carried out using a purposive sampling technique based on areas with a risk of disaster in Central Java Province. The research informants involved were representatives from the District Health Office (2 people) and the Regional Disaster Management Agency (1 person) from each Regency. Total informants were 8 informants from District Health Offices and 4 informants from Regional Disaster Management Agencies. Informed consent had been approved by all informants before the FGD started. The dimensions as the focus of this research were the referral flow of maternal and child health, the Pentahelix collaboration, support, and inhibiting factors during health crisis management. Data were analyzed using the content analysis method (Martha and Kresno, 2017). This research has obtained ethical approval from the Health Research Ethics Committee Faculty of Public Health Universitas Diponegoro number 666/EA/KEPK-FKM/2023.

RESULT AND DISCUSSION

The preparation of Disaster Crisis Guidelines is being carried out by each region referring to the Minister of Health Regulation No. 75 of 2019 regarding Health Crisis Management, which includes neonatal emergencies and referral systems. Apart from local governments, in this case, the Health Service, hospitals are required to have a Hospital Disaster Plan (HDP) as a plan for facing disasters. So that a referral flow can be arranged in dealing with disasters that occur in the area and there will be no difficulties in referring disaster victims.

"We refer to PMK No. 75, the SOP covers neo emergencies, as well as a referral system. We strengthen PSC to support Magneto emergencies from pre to post. The output can be a draft preparation." … (DK.M)

"We have just reminded you of the HDP again because hospitals are required to have an HDP, namely a plan for dealing with disasters. We still do light concepts like fire, etc. From now on, hospitals will have HDPs for their areas too, hospitals must be prepared to create referral channels if there is a disaster in their area. This is what we will gradually develop further. This is the provincial SPM." … (BPBD.S)

The integrated referral system is not yet running optimally, in some cases independent referrals are still made from Public Health Centers, including in maternal and neonatal cases. More massive collaboration from various sectors such as the Health Service, FKTP, hospitals, BPBD, and representatives from the community regarding referral flow is needed so that disaster victims can be treated quickly and precisely. Integration in the referral system for several sectors from pre- to post-disaster simplifies the process of handling disaster victims. Currently, coordination is carried out in disaster management in several areas, namely through WhatsApp groups, consisting of representatives from various OPD sectors, health centers, hospitals, and other organizations.

"The integrated referral system is at maternal and child health. We at the Public Health Center level often wait but there is no answer for referrals. For neonatal mothers, we went directly to a private doctor because the referral system was still working on their own." ... (DK.S)

"We are encouraging strengthening PONED, and early detection of risk factors in hospitals and FKTP. Strengthening referral system too. Collaboration between hospitals, the private sector, and government is needed. We evaluate BDLS and DLS for blood availability. Because there are often maternal deaths because there is a need for blood for mothers to give birth but the blood is scarce..." ... (DK.S)

"We created a WAG that we have to coordinate referrals, within the group there are many related agencies and also other organizations. This makes coordination easier and speeds up referrals." …. (DK.K1)

Humanitarian emergencies, such as pandemics and disasters, will have impacts that

cannot be predicted in advance, including on the provision of routine health services (Park *et al.*, 2020; Pati *et al.*, 2021). The occurrence of an emergency in an area can disrupt health services, including for the most vulnerable groups such as children and pregnant women (Chen *et al.*, 2020; Rasmussen *et al.*, 2020). Identifying vulnerable groups in disaster situations is one of the important things to do. Problems are often found in vulnerable groups, namely toddlers and pregnant women, while the main conditions that require attention are vulnerable groups, new mothers, injury victims, and residents who are in unhealthy conditions. In general, women have been identified as a vulnerable group during disasters, which is supported by reports that women and children tend to die more often during disasters and are more vulnerable to mental disorders than men (Nour, 2011). During the COVID-19 pandemic, women and children had direct effects such as serious illness and even death. Both of these groups also have dramatic indirect effects such as undernutrition and mortality due to the disruptions to health and food systems caused by the pandemic (Osendarp *et al.*, 2021). In managing a health crisis, an appropriate flow or road map is needed that can be understood by all parties. So that evacuation actions can be carried out quickly and precisely. Every resident has the right to receive basic services at a minimum in a health emergency, including vulnerable groups of mothers and children. The referral flow for maternal and child health services has been prepared as follows.

The maternal and child health referral flow from Grobogan Regency and Klaten Regency has the same scheme. The handling flow starts from (1) Relief actions at the disaster location. This action has an important role in determining life safety and reducing the risk of disability in victims; (2) Field triage and coordination. Pre-healthcare facility emergency management includes triage, initial stabilization, and evacuation. In providing emergency services, multi-party coordination is carried out, such as field command, victim search and rescue command (BASARNAS), TNI, Polri, and stakeholders from government and non-government. The success of this handling is determined by continued preparedness and coordination during the pre-disaster period. Arrangements for the flow of handling victims must be carried out to avoid a second disaster that could happen to the rescuer; (3) Referral to health service facilities. The emergency service area acts as the main gate for patients to enter. Patients from emergency services can be sent to another room or can be referred to another health service facility.

"*When a disaster occurs at a location, coordinate at the location. BPBD and hospitals*

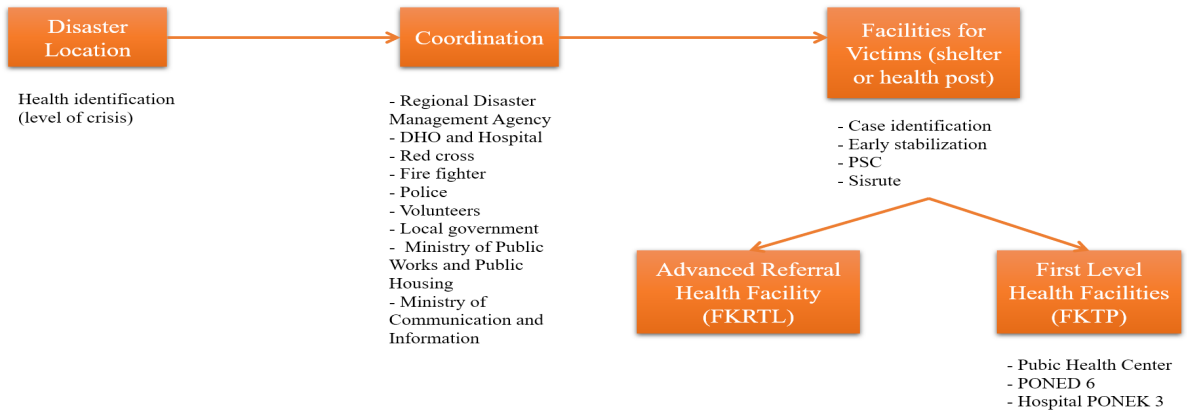

FIGURE 1. Maternal and Child Health Referral Flow in Grobogan Regency

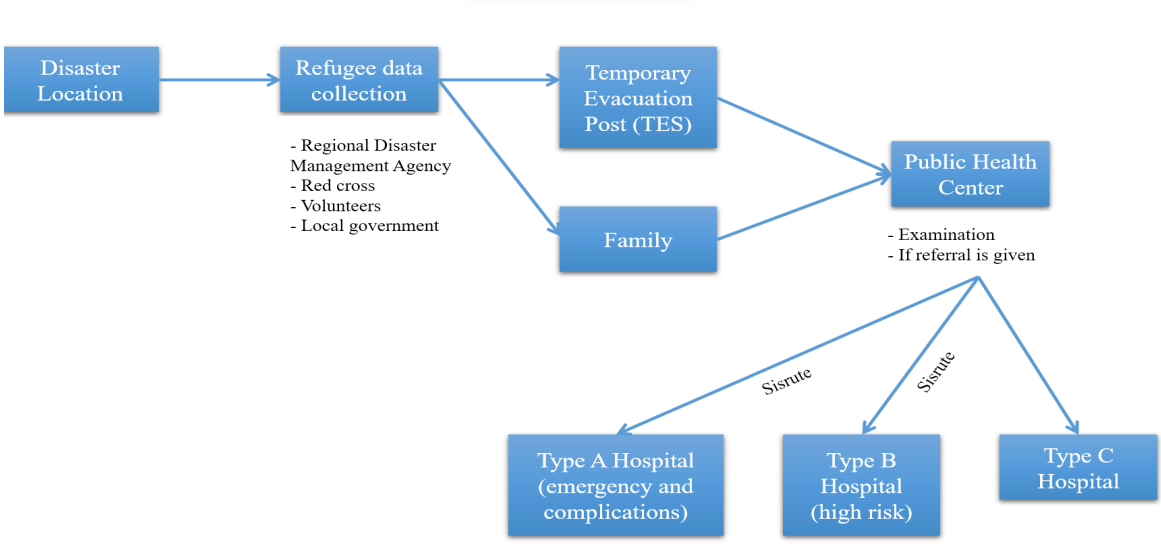

FIGURE 2. Maternal and Child Health Referral Flow in Klaten Regency

must be alert, including volunteers, TNI, village government, Polri, PUPR, and Kominfo who have already collected data. If maternal and child health occurs in a refugee camp when the health center is submerged, an evacuation will be carried out assisted by BPBD if the service center is paralyzed and if services cannot be provided, then they will be referred to the nearest service center. If the case can be handled at the health facility, it will be resolved at the health facility. If not, a referral can be made to the hospital in Grobogan. Refugee health posts can go directly to the hospital if the Public Health Center is not available. There are 6 PONEDs." … (DK.G)

"Regarding disasters, sometimes we are in areas that cannot be reached, when a disaster occurs the BPBD and volunteers collect data. "Then BPBD used a temporary evacuation site and collected data which we then separated according to inspection needs." … (DK.K)

Policies related to disaster management in Grobogan Regency already exist, namely the stipulation of the Emergency Command Decree (SK) which explains the reference points for disaster victims. In Klaten Regency, all cases resulting from disasters are served by Public Health Centers, including maternal and neonatal care. When paralysis occurs at a Public Health Center, a referral will be made to the non-PONED Public Health Center or the nearest hospital. There are 7 hospitals with NICU/PICU services that provide maternal neonatal services. The Regional Secretary of Klaten Regency issued a decree for "paseduluran villages" where if the shelter in the village experiencing a disaster is not fulfilled then it can be moved to a neighboring village.

"In *the Regency, there is already an emergency command decree, and the nearest referral point has also been determined."… (DK.G)*

"Matneo cases are carried out by non-PONED health centers, then if they are not PONED they don't stop by, then they are immediately referred to the nearest hospital. NICU/PICU Hospitals in 7 hospitals represent points following the decree and directions from the regent." … (DK.K)

The results of the research carried out obtained an overview of the flow of maternal and child health referrals in Brebes Regency and Semarang Regency. The flow of handling disaster victims starts from (1) the Submission of initial information, where all parties assist the BASARNAS team in evacuating victims. At this stage the community also plays a role in reporting disaster events to health service facilities; (2) Carrying out Rapid Assessments such as triage, resuscitation, and initial stabilization. This treatment can be carried out by health workers and can involve special lay people. Apart from that, the public can also contact the Public Safety Center (PSC) 119 call center; (3) Refer the victim to the nearest health

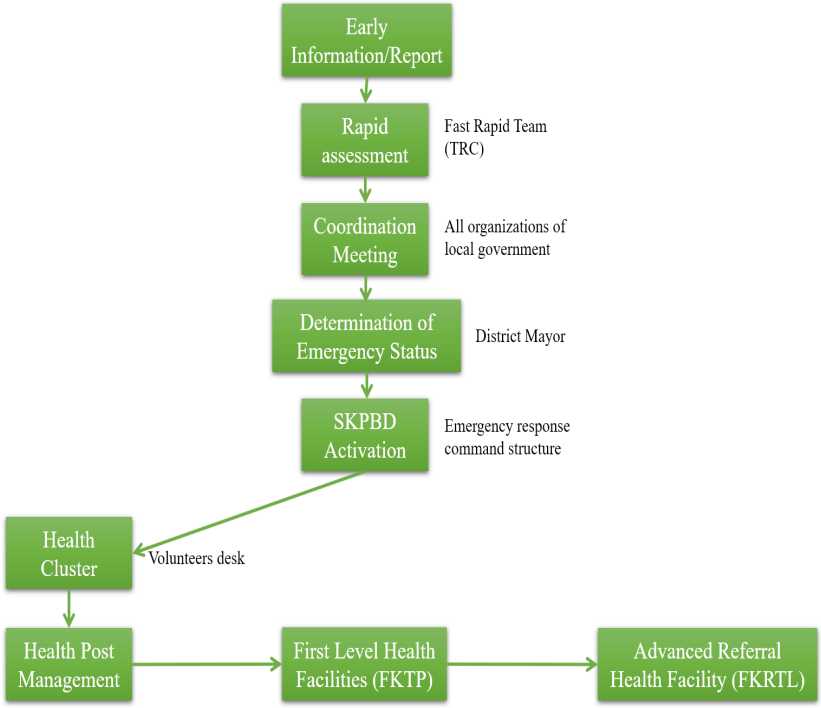

FIGURE 3. Maternal and Child Health Referral Flow in Brebes Regency

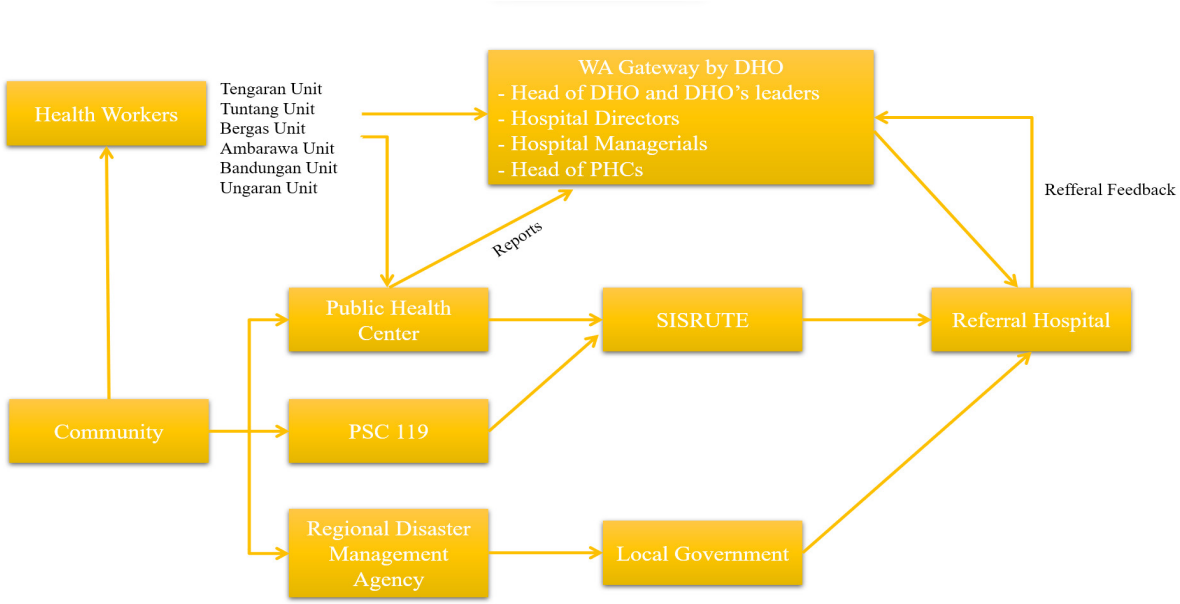

FIGURE 4. Maternal and Child Health Referral Flow in Semarang Regency

service facility. The services provided to victims are emergency services. Furthermore, patients can be transferred or referred according to the results of the examination; (4) Cross-sector and OPD coordination. Coordination can be done using the Health Service WA Gateway (in Semarang Regency). Then the status is determined by the OPD and continued with the construction of a disaster post.

"The Brebes area is the westernmost region in Central Java and is an area prone to disasters. When initial information from the village community enters the BPBD, there is a rapid reaction team to carry out a rapid

assessment that already has a decree, which then identifies the risk of disaster, and the type of disaster, which is then reported to the BPBD and then the disaster status is determined by the regent. Following the main duties and functions, there is a health cluster which is overseen by the health service. There is a base of volunteers who will determine which sub-cluster you fall into (nutrition, health, etc.) and there are also posts set up in the field. "One of them is a health post where there was a disaster in one of the areas." …. (DK.B)

"For Regency level disaster emergency response, the flow is the same. Maternal and child health referral flow and case reports can be made by the community or by the health worker who finds them. The Key Performance Index must have a presentation reported, in the PMB it must also be reported on the WA Gateway. 600 midwives are divided into 6 branches. The branch WA gateway is included in the Health Office's WA gateway which consists of Kadin, and structural officials, as well as the director and management team at the hospital."... (DK.S)

Handling of disaster victims in Brebes Regency, in the health cluster, only general health services are provided, there are no special differences for maternal and neonatal care. The Health Service coordinates the needs of medical personnel, medicines, ambulances, and others. There is a disaster crisis emergency team in the field of Disease Control and Environmental Health at the Health Service.

"What is already running, health posts in general health services, we at DKK coordinate the needs of medical personnel, and others including medicines, ambulances. Currently, it's still general health, there are midwives and doctors." …. (DK.B)

Based on the results, it is stated that there is no specific referral flow for maternal and child health in health crisis management, health services are still provided in general. This is a common challenge in managing the health crisis for mothers and children. A study in Malaysia showed that the COVID-19 pandemic significantly impacted health services for maternal and child health (Ujang *et al*., 2023). The severity of the impact of disasters and pandemics related to maternal and child health is very significant (Sahoo *et al*., 2021). Allocation of maternity rooms at flood posts, distribution of birthing equipment to midwives, and training of pregnant women in self-care, especially in disaster-prone areas are very important. Obstetricians and gynecologists should be involved in disaster relief, as they can handle pregnancy and delivery complications (Fredricks *et al*., 2017). In disaster preparedness, it is necessary to build cooperation between hospitals and develop a medical information management system (Miki & Ito, 2022). In crises, many victims are found due to disasters, and hospitals and health facilities face big challenges and need to provide more services (Takahashi *et al*., 2007). Therefore, hospital capacity in responding to the impact of disasters needs to be increased, including the allocation of health facility service resources during and after a disaster (Yi *et al*., 2010). Low access to healthcare was also one of the biggest challenges during the pandemic which led to high mortality, not only mortality related to the pandemic but also mortality on other diseases that were impacted due to the low access to healthcare (Sochas *et al*., 2017; Komasawa *et al*, 2023). Coordination of health facilities is one of the medical emergency response strategies to ensure the continued provision of medical services during a disaster (Tippong *et al*., 2022).

Pentahelixis a model of stakeholder collaboration between government, business, academics, society, and the media or non-governmental organizations (NGOs) (Latif, Isrofah and Priharwanti, 2020). Efforts to handle disasters in the regions are impossible without good collaboration between stakeholders. The collaboration concept is intended so that parties outside the government, such as the community and the business sector, can participate in the accelerator of set goals, and determine policy direction and program development. Apart from that, the disaster problems that arise are certainly not problems that can only be managed by the government. The following is the role of the Pentahelix elements in handling health crises at the research location.

Managing the health crisis cannot be handled by the government alone but requires cooperation from various sectors. Pentahelix Collaboration is a reference for developing

TABLE 1. The Role of the Pentahelix Elements in Crisis Situations

Element	Grobogan Regency	Klaten Regency	Brebes Regency	Semarang Regency
Government	Develop policies/ SOPs Provide a budget Carrying out program monitoring and evaluation	Carrying out monitoring and evaluation Issuance of SK PONEK and creation of SOP Role in budgeting	Providing support in the form of policies	Providing comprehensive health service facilities, from health centers and hospitals
Public	-	Assist in collecting data on refugees	Formation of disaster-resilient villages	Assist in reporting disaster victims Assist in evacuating disaster victims
Business world	Assisting disaster victims	Sending aid (food and production kits)	CSR from companies, BUMD, Baznas → Natura	Emergency transportation support from the business world (CSR company ambulance)
Academics	-	Trauma healing	There is UNDIP assistance The existence of a Student Activity Unit regarding disasters (pre-, during)	Assistance from LPPM UNDIP in implementing AMP-SR
Media	-	Conduct outreach to the community regarding the conditions/disaster crises that occur	Provide information related to disaster events	Information about disaster events is provided via Suara Serasi Radio and Social Media

Source: Primary Data, 2023

collaboration between agencies. Each element has a function or role in achieving a goal. Academics are an element that has a role in conducting research, mapping potential hazards resulting from disasters, as well as providing education, and increasing community capacity in dealing with disasters (Bhaskara & Purwaningsih, 2023). With technological developments, the media plays an important role in disseminating disaster information to the wider community. Apart from that, the media can provide information to the wider community so they can participate in evacuation, mitigation, and rehabilitation.

Elements of the business world play a role in helping communities affected by disasters (Arfani, 2022). The assistance provided includes logistics for evacuating disaster victims, such as providing rubber tires and ambulances. Logistics for affected communities can include providing food, medical supplies, and medicines.

Health crisis management will run optimally if it is supported by adequate facilities and infrastructure as well as resources. The success of disaster management can be supported by many factors. The supporting and inhibiting factors in health crisis management are as follows.

Preparation is the most crucial thing during disaster management (Gudi & Tiwari, 2020). Success in managing a health crisis is influenced by various things. The existence of policies from the local government such as SK and SOP can increase commitment and collaboration from various sectors in disaster management. Research found that the existence

TABLE 2. Supporting and Inhibiting Factors in Disaster Management

	Supporting factors	Obstacle factor
Policy	Existence of SOPs and SKs for disaster management	There is no SK/SOP regarding the maternal and child health referral flow at the Regency level
Human Resources	The existence of a special disaster management team (along with SK) and a disaster risk reduction forum	Health workers have not been trained in disaster mitigation Limited human resources for services at the PONED Public Health Center There are not enough health workers trained in PONED due to promotions or transfers
Budget	Availability of budget for disaster management from the Regency government	Limited budget for disaster management
Health Facilities	Adequate health facility services in each Regency (Pukesmas and hospitals)	Large area, so there are areas where access to a referral hospital takes a long time (long distance) Access to the disaster location is difficult to reach
Infrastructure	There are evacuation places when a disaster occurs in each village Availability of supporting infrastructure for disaster management such as united ambulances, tents, heavy equipment, blood banks, and WA groups for coordination	Logistical limitations Infrastructure for pre-referral neonatal procedures is still lacking
Public	There is a community of volunteers who help during and after a disaster	Public awareness of evacuation in disaster areas is still low Referral information from the community is incomplete

Source: Primary Data, 2023

of policy will improve the caring quality environment in crisis management (Suroso, Yuliarti, Mardiyaningsih, 2017). Coordination carried out in the regions via WhatsApp groups makes the disaster management process easier. Apart from that, facilities and infrastructure must be provided, especially in areas prone to disasters. Community preparedness is also an important thing that can minimize the impact of disasters. The main inhibiting factor that is often faced in disaster management is the problem of the limited budget, human resources, facilities, and infrastructure. Other research also found that the obstacles during health crisis management were the lack of PPE and health support tools (Merlin & Vanchapo, 2021). Research during the COVID-19 pandemic showed that China built two hospitals to increase health facilities during the pandemic, however, the UK experienced conversely that they were short on general practitioners, beds, and PPE (Wang *et al*., 2020; Hunter, 2020). A study on 76 countries showed that higher levels of healthcare professionals will impact to lower death rate, even though the country has a high rate of infection during the pandemic (Guha & Niyogi, 2024). However, a study found that community empowerment such as volunteer groups is a strength factor that could help impacted victims to survive during a disaster (Mensah & Johnson, 2024). The challenges that exist can be overcome by optimizing good collaboration with the private sector, community, CSR, and media (Choi *et al*., 2020; Abbas *et al*., 2021; Shamshiri *et al*., 2023). The government also needs to have long-term strategic planning to prepare the future pandemics or health crises (Moncada & Nguyen, 2024).

CONCLUSION

The integrated referral system in disaster management in the 4 locus regency is not yet running optimally. Referrals are still made individually and the response from health service facilities is not fast enough, so sometimes new problems arise in treating victims. The health referral flow implemented is still general, there are no special services for maternal neonates. Pentahelix collaboration has been carried out in all regions, thereby creating cooperation between various elements in managing the health crisis. Supporting factors in handling disasters in the locus area are the existence of policies related to disaster control, the availability of a budget, the existence of a special disaster management team, the availability of adequate health facilities in each area, and the existence of a volunteer community that assists in evacuation and disaster mitigation. Meanwhile, inhibiting factors include the absence of a special policy for maternal and neonatal services in disaster control, the limited number of human resources trained in disaster mitigation, access to disaster locations that are difficult to reach, limited logistics, and public awareness of evacuation is still lacking. Thus, there is a need to develop a special referral pathway for maternal and child health involving multi-sectors, a need to increase public awareness of disaster management, and strengthen Pentahelix collaboration in health crisis management. Logistical limitations and public awareness regarding evacuation are still lacking. Thus, there is a need to develop a special referral pathway for maternal and child health involving multi-sectors, a need to increase public awareness of disaster management, and strengthen Pentahelix collaboration in health crisis management. Logistical limitations and public awareness regarding evacuation are still lacking. Thus, there is a need to develop a special referral pathway for maternal and child health involving multi-sectors, a need to increase public awareness of disaster management, and strengthen Pentahelix collaboration in health crisis management.

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The Severity Level of Knee Osteoarthritis is a Predictor of Falls Among the Elderly

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Abstract

Knee osteoarthritis is the most common degenerative disease that leads to the disability in elderly. Changes in the joint structure that cause pain, functional limitations, and decreased the quality of elderly life. Muscle weakness and decreased proprioception associated with the decrease of balance can cause someone with Knee OA to have an increase the risk of falling. This study aimed to determine whether the severity level of knee OA is interdependent with the risk of falls among the elderly. Cross-sectional study an observational analytic approach, carried out at University Hospital of Muhammadiyah Malang, in May 2023. The sample consisted of 30 elderly subjects recruited and used purposive sampling for a clinical trial. Oxford Knee Score (OKS) is used to measure the severity of KOA and the Morse Falls Scale (MFS) is used to measure the risk of falls of the elderly. The correlation between the severity of knee OA and the risk of falls was identified through the Fisher exact test. Among 30 subjects with knee OA. The prevalence of knee OA with poor joint function was 20%. There is a relationship between the degree of KOA and the level of fall risk. The results of this study show that there is a relationship between the degree of KOA and the level of risk of falls in the elderly at UMM Hospital where, the higher the degree of KOA, the higher the level of risk of falls in the elderly.

INTRODUCTION

The elderly population in Indonesia is predicted to increase compared to the population in other Asian countries after 2050. In 2010, Indonesia was in the top 5 largest number of elderly in the world with 18.10 million elderly population. Indonesia experienced an increase in the elderly population to 20.7 million people (8.2%) in 2014 and is expected to increase to 27 million people in 2020 (Misnaniarti, 2017). Elderly is an individual who has entered the age of 60 years and over. The elderly experience changes with age such as changes in musculoskeletal systems, increased bone fragility, loss of cartilage resistance, reduced elasticity of ligaments, loss of muscle strength, and redistribution of fat which reduce the ability of tissues to carry out their normal function (Gheno et al., 2012). Physiological changes that happen in the elderly can lead to decreased body function, susceptibility to various kinds of diseases, problems in balance, and the risk of falling. Based on epidemiological research done in Jakarta, reported that the prevalence of falls in the elderly is 38%, and the prevalence of elderly who are not afraid of falling is 33-

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46%, while the prevalence of elderly who are afraid of falling is almost 70% (Nuruzzaman & Satyawati, 2020).

The risk of falling in the elderly is related to chronic musculoskeletal diseases such as low back pain (LBP), rheumatoid arthritis, and osteoarthritis (OA) which especially occurs in the joints of the lower extremities such as hip and knee (Dore et al., 2015). Knee osteoarthritis is a common cause of disability, especially among the elderly population (Khalaj et al., 2014). The pathogenesis of KOA is the result of interactions between mechanical loads, damage to articular cartilage, and incomplete repair mechanisms (Neelapala et al., 2018). The percentage of KOA in Indonesia started from the age of 40 years and overreaches around 5%, increases to 30% in the age group 40-60 years, and massive increases to 65% in the ages of 61 years and over. According to the Riskesdas database in 2013, diagnosis of the joint disease in Indonesia was reported to have a prevalence of 11.9%, and prevalence based on symptoms is 24.7% (Suari et al., 2015). Pratiwi (2015) reported that the prevalence of OA in Malang reaches 21.7%, reported, women at 15.5% and men at 6.2%.

Changes in the subchondral bone, loss of hyaline cartilage, development of osteophytes, inflammation of the synovium, meniscal injuries, ligament laxity, and muscle weakness are the products caused by KOA. These joint changes cause pain, functional limitation, and decreased quality of life. Decrease quadriceps function and decreased proprioception are associated with decreased balance and may put a person with KOA at higher risk of falling (Taglietti et al., 2017). Persons with KOA have a greater risk of falling compared to groups of individuals without OA and more than half of individuals with reported falls during the previous year (Manlapaz et al., 2019).

TABLE 1. Participants Demographics

Characteristic of Respondents	**Total (*n*)**	**Percentage %**
Sex		
Male n (%)	7	23%
Female n (%)	23	77%
Age (years)		
60-74 n (%)	29	97%
75-90 n (%)	1	3%
BMI		
Normal n (%)	7	23%
Underweight n (%)	1	3%
Overweight n (%)	14	47%
Obesity n (%)	8	27%
Occupation		
Housewife n (%)	14	47%
Retired persons n (%)	7	23%
Self-employed n (%)	6	20%
Etc n (%)	3	11%
Severity of KOA		
Mild to moderate n (%)	6	20%
Moderate to Severe n (%)	16	53%
Severe n (%)	8	27%
Level of Risk of Fall		
Low Risk n (%)	2	6%
Medium Risk n (%)	8	27%
High Risk n (%)	20	67%

Source: Primary Data, 2023

TABLE 2. Fisher Exact Analysis

Degree of KOA	Level of Risk of Fall		Total	P value
	Low Risk	High Risk		
Mild	6	0	6	*0.000
Moderate	4	20	24	

Source: Primary Data, 2023

The purpose of this study was to determine the relationship between the severity of KOA and the level of risk of falling in the elderly at Muhammadiyah Malang University Hospital. We hypothesized that individuals who reported having mild KOA would have a moderate to high chance of experiencing falls and worse functional performance and quality of life.

METHODS

This was a cross-sectional study that enrolled a convenience sample of patients with knee OA at the University of Muhammadiyah Malang Hospital in May 2023 to participate in this study. The ethical committee of the Faculty of Medicine University of Muhammadiyah Malang approved the study (approval number: No.E.5.a/118/KEPKUMM/V/2023.), and written informed consent was obtained from all the participants before enrollment. The inclusion criteria were as follows: (1) 60 years of age or over. (2) diagnosed with KOA confirmed by American College Criteria, (3) without cognitive impairment confirmed by Montreal Cognitive Assessment, (4) willing to be respondents. The Exclusion criteria were as follows: (1) people with cognitive impairment, (2) have been diagnosed with knee pain other than KOA. In this study, the Oxford Knee Score was used to measure the severity of KOA, and the Morse Falls scale was used to measure the level of falling. Both tests are reliable, valid, and responsive in individuals with pathological knee conditions. Fisher exact tests were used to examine the correlation between the Oxford knee score and the Morse Falls scale.

RESULTS AND DISCUSSIONS

In total, 30 participants (7 males and 23 females) met the criteria of inclusion and participated in this study. The mean age of the participants was 60 years old. Among 30 participants, 23% (n=7) have normal BMI, 3% (n=1) have underweight BMI, 47%(n=14) have overweight BMI, and 27% (n=8) with obesity BMI. Fourteen participants (47%) were housewives, 7 (233%) participants were retirees, and 6 (20%) were self-employed, and 3 (11%) participants were having several kinds of jobs. Oxford Knee Score was used to measure the severity of KOA, and it shows that among 30 participants, 6 (20%) participants have mild to moderate KOA, followed by 16 (53%) participants have moderate to severe KOA, and lastly 8 (27%) have severe KOA. Morse falls scale was used to measure the risk of falling of the participants with the results, 2 (6%) participants have low risk of falls, 8(27%) participants have medium risk of falls, and 20(67%) participants have high risk of falls.

Table 2 shows that of the total of 30 research respondents, there were 6 people (20%) with mild KOA and 24 people (53%) with moderate KOA. 10 research respondents with mild KOA had a low risk of falling and 20 people had a high risk of falling. The Fisher exact test results are P value < α (0.05) so that H0 is rejected and H1 is accepted. The test results show that there is a relationship between the degree of knee osteoarthritis (KOA) and the level of risk of falls in the elderly at the Muhammadiyah University Hospital, Malang. The objectives of this study were to determine the correlation between the severity of KOA with Risk of falls in mild to moderate patients. The total participants are 30 elderly people with knee OA. The severity of KOA is measured by the Oxford Knee Score and the risk of falls of the elderly is evaluated by Morse Falls Scale.

In this study, 30 participants diagnosed with KKOA at the University of

Muhammadiyah Malang reported having a larger percentage of female than male patients. A previous study done by Szilagyi et al. (2022) the prevalence of risk factors of KOA in general is higher in females compared to male patients. The hormone stronger can be the cause of the high number of KOA sufferers in Female patients. When entering the menopause phase there is a decrease in estrogen levels in females (Ranganathan & Aggarwal, 2019). The hormone estrogen plays an important role in maintaining cartilage homeostasis, so a decrease in estrogen has an impact on damage to the collagen matrix, causing cartilage damage (Peshkova et al., 2022). Anatomically, the femur in females is smaller and the patella is thinner than in males, this can also increase the risk of KOA in female patients (Nurningsih, 2012).

The mean age in this study was 60-74 years old which was categorized as elderly by WHO. A previous study reported that those aged over 55 years are more likely to experience KOA compared to patients aged under 55 years (ji eat all, 2023). Lespasio (2017) in their study reported that age and KOA are closely related, with KOA mostly occurring at the age of 65 years and 75% of those who are over 75 years old. The aging process results in the inability of chondrocytes to produce proteoglycans to maintain the cartilage matrix which provides compressive strength to the cartilage and failure to maintain homeostasis. Thus, the tissue tends not to heal when stressed, causing degeneration of the articular cartilage, and leading to OA (Berteau, 2022). This study reported that respondents were categorized as overweight and obese. Munthe et al. (2021) stated that patients with abnormal BMI can experience narrowing joint space and increase the load in the joint causing the bones to work harder. A previous study by Vasilic-Brasnjevic et al. (2016) stated that body weight influences the severity of KOA, every 5kg increase in body weight increases the risk of KOA by 36%. Obesity reported to increase the risk of KOA due to high joint load and changes in body composition, including decreased physical activity and decreased muscle strength (Wluka et al., 2013). The overload on the knee joint due to excess body weight causes increased mechanical stress which can accelerate joint cartilage degeneration, thereby worsening cartilage thinning. Previous studies reported increased hip abduction and varus malalignment of the knee in obese patients to avoid thigh contact when walking thereby predisposing to damage to the medial aspect of the articular cartilage (Bliddal et al., 2014).

In this study, the participants were reported to have occupations such as housewives, retiree and only a few of the respondents worked as entrepreneurs, farmers, construction workers, and household assistants. Domestic workers and entrepreneurs are in the medium work category, retirees are in the light work category and farmers and construction workers are in the heavy/severe work category (Husnah et al., 2019). An increase in the incidence of KOA can occur due to the many activities that put pressure on the knee joints such as squatting, up and down stairs activity, lifting weight, and other activities. Repetitive squatting activities can cause meniscal or ligament damage in the knee that can lead to articular cartilage degeneration (Utomo et al., 2022). The present study found that there is a relationship between the severity of KOA and the level of risk of falls in the elderly at UMM Hospital were, the higher the level of KOA, the higher the level of risk of falls in the elderly. Kurtoglu et al. (2020) explained that KOA is a risk factor for falls so it can affect daily activities. Knee injuries can be a risk factor for KOA. Elderly people with a history of knee injury are 3 to 6 times more likely to have a KOA. Individuals with KOA are 30% more likely to fall than those without KOA (Driban et al., 2015). Hicks et al. (2020) elderly people with knee pain caused by KOA reported having twice the risk of falling, this may be related to a progressive decline in function, increased muscle stiffness, and joint pain. The high risk of falls can cause bone fractures in elderly KOA (Saelee & Suttanon, 2018).

A previous study done by Cai et al. (2022) knee pain and KOA-related symptoms caused by quadriceps muscle weakness and poor balance, thereby increasing the risk of falls. Pain can cause muscle atrophy and muscle immobilization which can lead to decreased muscle strength. Decreased muscle strength was reported to be associated with knee joint

instability, increased postural sway, inhibiting the muscle's ability to maintain postural stability (Aljehani et al., 2021). KOA leads to changes in pressure in the joint and plays an important role in balance and movement, thereby causing changes in knee biomechanics. The pressure is caused by a high load on the medial knee, which affects the severity of KOA and knee pain. A previous study reported that in KOA patients usually have an increase or decrease of the Q-angle that leads to the genu varus or genu valgus condition, a change in the angle can increase the risk factor for causing muscle weakness (Favre & Jolles, 2016). Quadriceps muscle weakness can be caused by abnormal alignment resulting in pressure on the joint. Continuous pressure on one joint results in instability in the position of the patella. Alignment abnormalities are caused by an increase in the Q-angle, this can also increase the risk of falls (Zeng et al., 2022). Increased loading in the joint or stress in the joint further exacerbates the development of KOA, and these factors are thought to create a vicious circle between muscle weakness and KOA (Bozbaş & Gürer, 2018)

CONCLUSIONS

Knee Osteoarthritis often occurs, especially in the elderly. Females were reported to have a higher possibility of having KOA than males. BMI is correlated with the incidence of KOA, Overweight is reported to have a higher chance to have KOA. KOA causes sufferers to have a high risk of falling, this is related to a progressive decline in function, increased muscle stiffness, and pain in the joints which results in weakness of the quadriceps muscles resulting in decreased proprioception. The elderly at UMM Hospital on average experience a moderate degree of KOA with a high risk of falling. The higher the degree of KOA, the higher the risk of falls in the elderly.

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Giving Baby Porridge Made from Moringa Leaves and Snakehead Fish to Toddlers in Yogyakarta, Indonesia

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Abstract

Problems in toddlers who are inadequate in MP-ASI consumption, one of the effects is stunting. Stunting is a major health problem for people in developing countries. This study aims to determine the effect of giving baby porridge complementary foods made from moringa leaves and snakehead fish on body weight. The research method uses a randomized controlled trial (RCT) that investigates the effect of feeding baby porridge supplementation made from moringa leaves and snakehead fish on the weight of toddlers. The sample size calculated was 30 respondents. The sample size of 30 toddlers aged 1-12 months was divided into 15 toddlers who were given treatment and 15 toddlers who were not given treatment. The results showed that the percentage of underweight children in the intervention group decreased from a mean of 6513.33 to 6706.67 while the control group only reduced from a mean of 6500.00 to 6586.67. Overall, the weight status of toddlers in the intervention group changed significantly ($p<0.000$).

Introduction

Complementary foods for breast milk (MP-ASI) are additional foods given to babies after the baby is 6 months old to the baby is 24 months old. So in addition to Complementary Foods, Breast Milk must still be given to babies, at least until the age of 24 months, the role of complementary foods for breast milk is not to replace breast milk at all but only to complement breast milk, so in this case complementary foods for breast milk are different from weaning foods given when the baby no longer consumes breast milk.(Mc Govern et al., 2017). Problems in toddlers who are inadequate in MP-ASI can cause stunting. Stunting is a major health problem in people in developing countries. Indonesia is the fifth country with the largest prevalence of stunting. Stunting or short growth is a condition of failure to grow in infants (0-11 months) and children under five (12-59) months. Malnutrition occurs from the time the baby is in the womb and in the early days after the baby is born, but stunting conditions will be seen after the child is 2 years old (Aguayo & Menon, 2016). The United Nations International Children's Emergency Fund (UNICEF), explained that the number of stunted children under five in 2020 increased by 26.7 million compared to 2000 which reached 20.6 million (UNICEF, 2021). 80% of stunted children under five are spread across 14 countries around the world and

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Indonesia is ranked fifth in the country with the highest number of stunting (Beal et al., 2018). According to WHO (2018) in Indonesia, there are 37% of children who are stunted (World Health Organisation (WHO), 2018). Stunting data in Indonesia shows that the prevalence of stunting has increased from 35.6% (2010) to 37.2% (2013). This condition illustrates that around 8.9 million Indonesian children experience suboptimal growth or one in three children is stunted.

According to the Ministry of Health, in the results of the 2021 Indonesian Nutrition Status Study (SSGI), the study's results on the number of chronic nutritional problems or stunting decreased by 3.3% to 24.4% from the 2019 data. According to SSGI 2021 data, the prevalence of stunting in Sleman reached 16 percent below the prevalence rate of Yogyakarta province, which was 17.3 percent. Currently, the prevalence of stunting in Indonesia reaches 24.4 percent, targeted to drop to 14 percent by 2024. Meanwhile, in Sleman Regency it is still at 16 percent. Factors that affect stunting include low exclusive breastfeeding, low protein energy intake, feeding toddlers, poor MP-ASI feeding, low family income, and complete immunization. Giving MP-ASI that does not follow the baby's age and needs can impact the health and nutritional status of toddlers. Toddlers who are given exclusive breastfeeding and complementary foods according to their needs can reduce the risk of stunting. Another impact of the lack of nutritional intake of toddlers will be susceptible to infectious diseases that can interfere with linear growth by first affecting the nutritional status of children under five. This happens because infectious diseases can decrease food intake, interfere with nutrient absorption, cause direct loss of nutrients, and increase nutrient needs. Infectious diseases that often occur in children are COPD and diarrhea. ISPA and diarrhea can make children have no appetite so there is a lack of the amount of food and drink that enters their body which can result in malnutrition. Furthermore, toddlers will experience short-term growth and development disorders (Al Rahmad, 2016; Fitriahadi et al., 2021; Najib et al., 2023). Toddlers can also experience brain disorders, physical growth disorders, and metabolic disorders in the body. Long-term impact, toddlers who experience stunting are more likely to experience stunting in adulthood. Data from Basic Health research shows that the prevalence of stunting has decreased from 37.2% in 2013 to 30.8% in 2018. However, the decline is still far from the government's expectations and targets that stunting will fall to 14% by 2024 (de Onis & Branca, 2016; Tanjung et al., 2020) (Santosa et al., 2022; Woldeamanuel & Tesfaye, 2019).

Several studies have reported an increase in the prevalence of morbidity and mortality due to nutritional status disorders, especially stunting in toddlers compared to normal toddlers in the same age group. According to UNICEF's conceptual framework on the determinants of malnutrition, food intake is one of the determinants of nutritional status (Almuneef et al., 2019) (UNICEF., 2021). Poor food intake in most toddlers is caused by a dysfunction resulting from oro-motor disorders, as a characteristic of stunting conditions. Therefore, strategies that increase nutrient density in food can help increase nutrient intake in stunted toddlers. The weight status of toddlers in the control group did not differ significantly between baseline and endline ($p = 0.109$). A significant difference in the prevalence of pain rates between the two groups was also observed at the end line ($p = 0.003$) with a prevalence of 24.6% and 51.8% on toddlers in the intervention and control groups, respectively, with the conclusion that consumption of moringa leaf-enriched porridge significantly increased body weight in children under five.

The consumption of moringa leaves and snakehead fish in toddlers as a fortificant in various food formulations including soups and complementary foods for breast milk has been the subject of research due to their high nutritional value and is widely recognized in the literature. Improvement in protein malnutrition and calcium and iron deficiency in toddlers has been reported after intervention with moringa leaves. In related publications, the authors have also reported the potential of moringa leaf fortification to increase protein and vitamin A content in fermented finger millet porridge (Farzana et al., 2017; Sandeep

et al., 2019) (Zongo, 2018) (Malla et al., 2021). The Food and Agriculture Organization (FAO) is currently promoting the use of local plants that are easily found in different regions as an economically sustainable strategy to improve food security and address community welfare (Thompson & Amoroso, 2014). However, there are still few studies that discuss the feasibility of local food-based nutrition to overcome malnutrition in the context of disease, especially stunting. The lack of rigorous and systematic testing of nutrition from local food fortification materials to reduce malnutrition in stunted toddlers is a gap that this study seeks to address. This study was conducted to determine the effect of giving baby porridge supplementation made from moringa leaves and snakehead fish on toddler weight.

Method

The research was conducted at the Dewi Sartika Posyandu located in Sidoarum District, Sleman Regency, Yogyakarta, Indonesia from February to April 2023. Posyandu Dewi Sartika is a posyandu (community clinic) for toddlers that has many toddler patients. Sidoarum District is one of the densest and largest informal settlements in Sleman Regency and has a large number of toddlers with more than 50% of mothers under five as housewives. The design of this study uses a randomized controlled trial (RCT) that investigates the effect of infant porridge supplementation made from moringa leaves and snakehead fish on the weight of toddlers at the Dewi Sartika Posyandu. This study consisted of two study groups: the control group (did not receive baby porridge made from moringa leaves and snakehead fish) and the intervention group (received baby porridge made from moringa leaves and snakehead fish). This research was approved by the Ethics Committee of Aisyiyah University Yogyakarta with No. 2884/KEP-UNISA/V/2023. Trials whose results are published have been retrospectively registered. This is due to limited prior knowledge about trial registration. However, this did not affect the reporting of findings and the methodology of the study. The authors confirm that all ongoing and related trials for this intervention have been enrolled.

This study adopts the formula of Noordzij M et al (2010) for the calculation of sample size in the study. Sample size calculation is based on primary results (moringa leaves and snakehead fish); The test strength is 80% and the significance level is 5% ($\alpha = 0.05$) according to the recommendation. Population averages and variances were obtained from the results of a pilot study conducted for this study. The sample size calculated was 30 respondents. The sample size (Noordzij et al., 2010) of 30 toddlers aged 1-12 months was divided into 15 toddlers who were given treatment and 15 toddlers who were not given treatment.

After recruitment, the researchers randomly allocated toddlers in a 1:1 ratio into two study groups (control and intervention). Randomization is performed by an independent biostatistician using a computerized random number function in Microsoft Office Excel 2008. The resulting numbers are printed on a piece of paper, folded flat, and the toddler's mother is asked to choose one. Toddlers are placed into groups depending on the number that the mother of the toddler chooses and that has been allocated through a randomization process. A total of 30 toddlers were recruited and randomized in this study. All participants from the intervention group completed all infant porridge and follow-up interventions for three months during the study period (February-April 2023). Baby porridge (baby porridge made from moringa leaves and snakehead fish) is well tolerated. There were no adverse reactions caused by the baby porridge products during the study period.

Toddlers in the control group received baby porridge. The porridge is prepared by caterers and cooks, follows standard procedures, and is given to toddlers. Each child received a daily serving of porridge equivalent to 250 ml in a cup in the morning, five days a week, for three months. Toddlers in the intervention group received porridge made from moringa leaves and snakehead fish. As presented in articles related to publications. The same procedure was used for the control group followed in the preparation and administration of enriched porridge for toddlers in the intervention group.

This study targets toddlers aged 1-12 months who are at risk of weight loss, who live

in the Sidoarum Godean area, Sleman Regency, Yogyakarta, Indonesia, and mothers of toddlers. Mothers who have toddlers aged 1-12 months who are willing to be respondents and are not sick are included in this study. Toddlers who met the inclusion criteria and mothers of toddlers were willing to participate in the study by giving their consent and were randomly put into the intervention or control group by the researchers. Two cooks with Diploma III education in midwifery were recruited and trained on porridge recipe standards and serving portions. They were trained in their role of preparing porridge and weighing portions as well as weighing and recording the remaining portions of each research participant. The cooks work closely with the data collector. Four data collectors with a minimum of midwifery diploma were recruited into the research team. Previous experience in surveys is an added advantage. Data collectors were trained for 2 days by researchers regarding their roles and expectations; research ethics; recruitment of research participants; how to manage data collection tools and all data collection procedures.

Result And Discussion

Basic socio-demographic and economic characteristics by study group, no differences were found in the socio-demographic and economic characteristics of the participants of the two groups in the initial study, which is an indication that randomization was successful.

Based on Table 1, it is known that the respondents under five at the Dewi Sartika Sidoarum Godean Posyandu in this study were dominated by 60% female, while 40% were male. Based on Table 2, shows that the weight gain of toddlers who were given the intervention before the administration of baby jellyfish made of moringa leaves and snakehead fish reached a mean figure of 6513.33, and after the administration reached a mean figure of 6706.67 within 3 months of the study, there was an increase of 193.34 body weight. Table 2 also shows that there was a weight gain of toddlers who were used as a control group reaching a mean figure of 6500.00 during 3 months of research reaching 6586.67, with an increase of 86.67, this shows that the control group also experienced weight gain but not significantly as in the intervention group, where

Table 1. Sample Distribution By Gender

No	Gender	n	%
1	Male	12	40
2	Female	18	60
	Total	30	100

Table 2. Weight Gain Before and After the Intervention Group and Control Group

Body Weight	Intervention Mean	Control Mean
Body weight before (gr)	6513.33	6500.00
Body weight after (gr)	6706.67	6586.67

Table 3. The Effect of Baby Porridge Made from Moringa Leaves and Snakehead Fish on Weight Gain in Toddlers

Body Weight	Given		Not Given		p-value
	n	%	n	%	0.000
Increase	14	93,3	0	0	
Not Increase	1	6,7	15	100	
Total	15	100	15	100	

the intervention group achieved an increase of 193.34.

Based on Table 3, after 3 months of giving the baby jellyfish made of moringa leaves and snakehead fish, body weight results were obtained in 15 toddlers in the intervention group, 14 toddlers experienced weight gain, It presented an average of 93.3% of respondents experienced weight gain, and there was only 1 toddler with an average of 6.7% who did not experience weight gain that reached the normal limit of weight gain at the age of 1-12 months. The results of the statistical test using the chi-square test obtained a chi-square value of 22,634, while based on df = 1 chi-square price table = 3,841 and p-value: 0.000. According to the provisions, if the price of chi-square is calculated to be greater than the H0 dining table, it is rejected and Ha is accepted. This means that there is an effect of giving baby jellyfish made from moringa leaves and snakehead fish on the weight gain of toddlers.

This study was conducted to determine the administration of MP-ASI baby porridge made from moringa leaves and snakehead fish on the weight of toddlers. Randomization was successful because the intervention and control groups had similar basic characteristics. The nutritional intake of toddlers in this study initially did not show a significant difference in the intake of moringa leaf pulp and snakehead fish between the two research groups. Meanwhile, in the final stage, significant differences are observed. A study in Uganda reported that the average daily nutrient intake from other foods outside the treatment (unfortified finger millet porridge and finger millet porridge enriched with 7% M. oleifera leaf powder or 17% C maxima meat) consumed by toddlers did not show any significant differences between the groups because the toddlers sampled were drawn from similar socio-economic characteristics (Evyline Isingoma et al., 2018).

In this study, the significant differences observed between the groups at the end of the study could be attributed to the differences in the nutritional content of the porridge given to each group. Groups are compared to the size of the portion consumed. Research in Uganda also observed that toddlers who were given porridge with the addition of moringa leaves and snakehead fish provided protein needs for toddlers. Therefore, giving nutrient-rich food to toddlers is very important to compensate for the usually insufficient food intake and feeding challenges that are characteristic of toddlers. With this, maximizing nutrient intake by providing additional moringa leaves and snakehead fish is very important for the health of toddlers (Evyline Isingoma et al., 2018).

Effect of consumption of porridge enriched with moringa leaves and snakehead fish on the weight of toddlers. This study was designed to test the effect of MP-ASI baby porridge made from moringa leaves and snakehead fish on the weight of toddlers. The results of this study showed that the consumption of MP breast milk porridge enriched with moringa leaves and snakehead fish increased the weight of toddlers. This is in line with previous research that by adding moringa leaves to baby porridge increases protein (Akirov et al., 2017; Bharadwaj et al., 2016).

A significant increase was observed at the end among the intervention group compared to the control research group, mentioning the effectiveness of moringa leaves and snakehead fish in increasing the weight of toddlers so that the nutritional status of children improved. The addition of MP-ASI enriched with moringa leaves and snakehead fish can also increase serum vitamin A levels after consumption for 3 months of research. During the 3-month intervention, it may be too short to show the effects of the treatment. Another study conducted in Burkina Faso reported that after 6 months of intervention with moringa leaf powder, the proportion of toddlers with weight increased significantly in the control and treatment study group (Boateng et al., 2018).

However, there was no significant difference between the groups in the later stages thus linking the toddlers' weight gain to other factors besides the intervention. Our study eliminated known confounding factors by random placement of study participants in a study group (Randomized Clinical Trials). In addition, the randomization process in this study was successful because the research groups had similar basic characteristics. This

suggests that significant differences observed between groups in the late stages concerning the weight of toddlers can be attributed to the intervention. In related publications, the authors have reported an increase in the nutritional content of MP-ASI porridge enriched with moringa leaves and snakehead fish which has the potential to reduce malnutrition among nutrient-vulnerable populations (Zongo, 2018) (Malla et al., 2021).

The effect of MP-ASI porridge consumption enriched with moringa leaves and snakehead fish on the weight of toddlers in the study BMI scores for age Z of toddlers in the two research groups differed significantly at the end of the study (p-value: 0.000). The percentage of underweight children in the intervention group decreased from a mean of 6513.33 to 6706.67 while in the control group only decreased from a mean of 6500.00 to 6586.67. Overall, the weight status of toddlers in the intervention group changed significantly (p<0.000) compared to the control group which did not experience significant changes (p = 0.109). The observed increase in the weight status of toddlers in the intervention study group was due to the consumption of MP-ASI, moringa leaf-enriched porridge, and snakehead fish in toddlers. The findings of this study show the effectiveness of the consumption of MP-ASI baby porridge enriched with moringa leaves and snakehead fish in increasing BMI scores for age Z in toddlers.

The effect of consumption of MP-ASI with moringa leaf and snakehead fish enriched porridge on the prevalence of morbidity in toddlers, a significant difference in morbidity status between groups was observed at the end of the study with toddlers in the intervention group, showing a significant improvement in morbidity status compared to the control group which did not show significant changes. However, in studies in other countries, records from Volunteer Health Coaches showed that healthcare-seeking habits in all groups did not differ significantly. The findings of the current study consolidate the relationship between food intake, disease, and nutritional status, especially body weight, as contained in the literature. Another factor that becomes uncertain concerning nutritional intake in toddlers following the Healthy Society Framework is economic factors where economic factors and environmental factors are two factors that have an impact on nutritional intake for toddlers (Evyline et al., 2018; De Vita et al., 2019; Smith & Lawrence, 2015; UNICEF., 2021; Nugroho et al., 2023).

Conclusion

The effect of consumption of MP-ASI porridge enriched with moringa leaves and snakehead fish on the weight of toddlers in the study BMI scores for age Z of toddlers in the two research groups differed significantly at the end of the study (p-value: 0.000). The percentage of underweight children in the intervention group decreased from a mean of 6513.33 to 6706.67 while in the control group only decreased from a mean of 6500.00 to 6586.67. Overall, the weight status of toddlers in the intervention group changed significantly (p<0.000) compared to the control group which did not experience significant changes (p = 0.109). The observed increase in the weight status of toddlers in the intervention study group was due to the consumption of MP-ASI, moringa leaf-enriched porridge, and snakehead fish in toddlers. The findings of this study show the effectiveness of the consumption of MP-ASI baby porridge enriched with moringa leaves and snakehead fish in increasing BMI scores for age Z in toddlers.

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The Improvement of Oral Hygiene and Knowledge Through Dental Health E-Book Program for Elementary School Students

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Abstract

Riskesdas 2018 shows that the highest percentage of dental problems in Indonesia is dental caries (45.3%). The provision of dental health services in school is UKGS. Counseling methods and tooth-brushing demonstrations to promote dental health are routinely carried out for elementary school students. This method is used to change the behavior of maintaining dental health by brushing teeth properly and correctly. With current technological developments, Android use become common in learning activities. Android applications can be media favored by children. The educational program named "e-book dental and oral health maintain" with an android application is an innovative way to increase the behavior of maintaining dental and oral hygiene in children. The research objective was to determine the effect of e-book program with an android application on the maintenance of dental health in children, so do the role of parents. The sample consisted of 100 students of 5th grade elementary school. The increase of knowledge and the role of parents in improving dental health was significantly different between before and after the intervention, where p-value = 0.001. The research concluded that the knowledge and parent role, is vital in improving children's dental health.

Introduction

The Ministry of Health reports that the prevalence of cavities in early childhood is very high, reaching 93%, which means that only 7% of Indonesian children are free of cavities. This number is still far from the World Health Organization (WHO) target, which targets that 93% of children aged 5-6 years are caries free. The average number of cavities in children aged 5-6 years is 8 teeth or more. According to the 2018 Basic Health Survey (Riskesdas), the highest proportion of dental problems is damaged/cavities/sick teeth (45.3%). Most of the Indonesian population experience dental and oral health problems due to swelling of the gums and/or abscesses (14%). In Indonesia, the prevalence of cavities is 88.8%, and the incidence of cavities at the roots of the teeth is 56.6%.

96.5% of the Indonesian population aged 10-14 years have brushed their teeth every day, but only 2.1% brush their teeth twice a day at the right time, in the morning and at night before going to bed. From the data on the proportion of dental and oral health problems and treatment by dental medical personnel based on the age group in Indonesia, it is known that 55.6% of the population aged 10-14 years experiences dental and oral problems and only 9.4% receive treatment from dental medical personnel. The 2018 Riskesdas showed that the DMF-T in children aged 12 years was 1.9, an increase compared to the 2013 Riskesdas results which stated the DMF-T was 1.4. This means that

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there was an increase in the DMF-T index of 0.5 from 2013 to 2018. It does not follow the DMF-T target stated by WHO in the Global Goals for Oral Health 2020, which is < 1. Caries incidence in the 12-year-old group in Indonesia is also still high at 72%.

Dental and oral health in children is a factor considered as early as possible because tooth decay in childhood can affect the growth of teeth in the future. Dental and oral health services are vital for maintaining and improving the health status of the community, in the form of improving dental health, preventing and treating dental disease, and restoring dental health in an integrated and sustainable manner (Ramos-Jorge et al., 2014). Cavities and toothache are the biggest problems in Indonesia, occurring in 45.3% of the population. Another oral health problem experienced by Indonesians is swollen gums and/or abscesses, amounting to 14% (Kemenkes RI, 2020). Riskesdas mentioned the representation of the population providing dental and oral health care increased from 23.2% to 25.9% in 2007 and 2013. 93.8% of children aged ≥10 years brush their teeth every day. The problem is that most residents (79.7%) still brush their teeth in the morning and evening while bathing. Data released by the Ministry of Health shows that 94.7% of Indonesians brush their teeth every day, but only 2.8% brush their teeth at the right time, after breakfast and before going to bed (Riskesdas, 2018b). Public awareness of dental and oral hygiene is still not good. There are remote areas that contribute to a lack of health information. DKI Jakarta and Denpasar, Bali (98.5%), West Java (95.8%), and East Kalimantan (95.5%) are provinces with good dental health outcomes. The provinces of NTT (74.7%) and Papua (58.4%) have low achievement in brushing their teeth. Bali Province is one of the provinces in Indonesia with a higher prevalence of dental caries than the national prevalence, which is 68.2%. Parents, especially mothers, have a vital role in developing children's positive behavior toward dental and oral health. Participation in maintaining their dental and oral health is by paying attention to their behavior regarding dental and oral health and diet. Mother's knowledge, attitudes, and behavior significantly influence children's knowledge, attitudes, and behavior (Ggodme & Jin, 2010).

Dental and oral health is related to knowledge, attitudes, and behavior closely. The environment plays a vital role in forming attitudes and behavior in preschool-aged children (kindergarten children). The closest environment where preschoolers are located is the family (parents and siblings) and the school environment. The role of parents and teachers is crucial in changing children's attitudes and behavior in maintaining oral health (Schroth et al., 2010). Global Burden of Disease Study (2016) states that dental and oral health problems, especially dental caries, are diseases experienced by almost half of the world's population (3.58 billion people). In Indonesia, the prevalence of dental caries reaches 88.8% with a tendency for an average individual caries experience (DMF-T = Decay Missing Filling-Teeth) ranging from 7.0-7.2, which means that on average Indonesian people have as many dental caries as 7 per person, while WHO has set the DMF-T index of 3. Dental and oral disease is exacerbated by attitudes or behaviors that ignore dental and oral hygiene because they are unaware of the importance of maintaining healthy teeth and mouth, such as being lazy to brush their teeth and often eating sweet foods and drinks (Schroth et al., 2010). Dental caries is the most common oral cavity disease in children, adolescents, adults, and the elderly (Kassebaum et al., 2015).

Self-care is a mandatory skill for children to maintain healthy teeth and mouth. Personal hygiene is an effort to keep teeth and mouth clean. The goal of dental and oral hygiene is to keep the oral cavity, tongue, and teeth clean from all food residue by brushing the teeth at least twice a day, the aim is to free the mouth from disease and tooth decay (Saldunaite et al., 2014). Dental and oral health education in early childhood is vital for various health problems in children, such as dental caries. Methods and approaches are needed to create the knowledge, attitudes, and behaviors required to maintain oral health. The study aimed to obtain a comparative description of the debris index and knowledge about dental and oral health for 5th-grade elementary school students in Jakarta and Denpasar, Bali, after counseling was carried out through the dental health e-book training program.

Researchers are interested in further research in DKI Jakarta and Denpasar, Bali, because both are provinces whose residents have a good record of brushing their teeth. Riskesdas 2018 mentioned that 97.8% of DKI Jakarta residents brushed their teeth well, while in Bali, 92.89%. Researchers compared the debris index and knowledge about the oral health of 5th-grade elementary school students in Jakarta and Denpasar, Bali. The research is expected to be usable in efforts to improve dental and oral health. The result is an innovative counseling intervention program in the form of an Android "E-Book Dental and Oral Health Maintain" application, which can be usable as an educational tool for dental health workers to maintain the dental and oral hygiene of the community. In this case, the UKGS program in elementary schools. The program "E-Book Dental and Oral Health Maintain" with an Android

application should be able to reduce the burden of dental health costs in the community. This program also improves the skills of parents to prevent dental caries in children as early as possible by brushing their teeth regularly. The program "E-Book Dental and Oral Health Maintain" with an Android application can be usable as a guide for maintaining community dental health, in line with dental health program policies, namely dental and oral health services in promotive and preventive efforts. This intervention aims to strengthen families in the community and increase knowledge about oral health, both in rural and urban communities.

METHOD

This research method is a new one. It uses the educational program "E-Book Dental and Oral Health Maintain" with an Android application to improve dental and oral hygiene. This study is a follow-up to a previous study conducted in 2021 at elementary schools in Jakarta and Denpasar, Bali. The research was conducted in 2022, with trials on 5th-grade students at SD Negeri Cinere 1 Jakarta and SD Saraswati I Denpasar, Bali. A group of 50 people was given dental health education through a demonstration of brushing teeth using a dental phantom with the "E-Book Dental and Oral Health Maintain" program with an Android application. The main sources needed for this research are 1) toothbrushes and dental phantoms; 2) elementary school students; 3) elementary school teachers; 4) parents of students; and 5) the "E-Book Dental and Oral Health Maintain" program with an Android application. The following are figures related to the "E-Book Dental and Oral Health Maintain" program with an Android application.

The "E-Book Dental and Oral Health Maintain" program with an Android application is the result of collaboration with the State Electronics Polytechnic Surabaya (PENS), which has been tested for validity and reliability on elementary school students in Denpasar, Bali, and has been used by elementary school students in Manado. This program has also received legalization as a copyright (HAKI) with registration letter number 00039789 dated November 1, 2022, issued by the Ministry of Law and Human Rights. The multi-step research protocol includes: 1) Evidence-based education and delivery of the "E-Book Dental and Oral Health Maintain" with an Android application training program; 2) Enhancing the skills of elementary school teachers and parents to actively participate in the use of the "E-Book Dental and Oral Health Maintain" program with an Android application; 3) Monitoring teeth brushing activities

Fig 1. Display of the E-Book Program with Android Application

Fig 2. Lay-out of the E-Book Program with Android Application

with the "E-Book Dental and Oral Health Maintain" program with an Android application; 4) Direct testing with field studies; and 5) Conclusions and suggestions.

RESULT AND DISCUSSION

The results of the study concluded that counseling and tooth brushing demonstrations using the "E-Book Dental and Oral Health Maintain" program with an Android application can improve dental and oral hygiene for 5th-grade elementary school students in Jakarta and Denpasar, Bali. Another factor is the role of parents and teachers who have shown a strong interaction with students' knowledge to improve dental and oral health (Đorđević, 2018; Khanduri et al., 2018). This study shows that the role of health educators and dental health workers, dental cadres or teachers and parents who actively participate in conducting education and educational innovation with the help of the "E-Book Dental and Oral Health Maintain" program with an Android application will improve skills in maintaining dental and oral health, which ultimately creates optimal dental and oral health for elementary school students. Therefore, it is necessary to increase the involvement of parents and teachers to increase dental and oral health knowledge in elementary school students in Jakarta and Denpasar, Bali.

The selection of the experimental method was based on the theory that dental health can be maintained by brushing teeth and demonstrating how to brush teeth using a dental phantom. Strengthening using the "E-Book Dental and Oral Health Maintain" program with an Android application greatly supports dental and oral health improvement. The community can play an active role as a companion, coach, or motivator, with teacher supervision and fostering student dental health behavior by parents as a vital role in maintaining their children's dental health (Mitrakul et al., 2012). Providing an "E-Book Dental and Oral Health Maintain" educational program will increase students' knowledge of maintaining healthy teeth. Dental and oral health is influenced by student compliance and the intensity of parental assistance in maintaining

Table 1. Mean Distribution of Debris Index (DI), Knowledge, and Parental Roles Before and After Dental and Oral Health Education to Elementary School Students in Jakarta and Denpasar, Bali

Variables	Mean	Deviation Standard	Error Standard	p-Value	N
Debris Index Jakarta					
Measurement I	2.03	0.5275	0.0746	0.001	140
Measurement IV	1.23	0.4716	0.0667		140
Debris Index Denpasar, Bali					
Measurement I	1.72	0.6091	0.0861	0.001	140
Measurement IV	0.83	0.2182	0.0308		140
Knowledge Jakarta					
Before	12.2	2.9	0.04	0.001	140
After	21.5	2.2	0.03		140
Knowledge Denpasar, Bali					
Before	15.2	1.99	0.32	0.001	140
After	18.7	1.64	0.26		140
Parents' Role Jakarta					
Before	4.7	0.86	0.16	0.001	140
After	6.6	0.63	0.12		140
Parents' Role Denpasar, Bali					

dental and oral health (Shetty et al., 2016). The positive impact of the "E-Book Dental and Oral Health Maintain" program with an Android application is an increase in the dental and oral hygiene of students, as seen from the decrease in the debris index in students given the educational, as shown in Table 1.

The results of research in Jakarta and Denpasar, Bali, showed a significant decrease in Debris Index score. Respondents in Jakarta experienced a decreased Debris Index from 2.03 to 1.23. While respondents in Denpasar, Bali, experienced a decrease from 1.72 to 0.83. The results of this study are significant by obtaining a p-value = 0.001. This method, which is a combined dental health care theory and tooth brushing with a demonstration using a dental phantom, equipped with an "E-Book Dental and Oral Health Maintain" program with an Android application, achieves better results when compared to without the use of an Android application. Parental involvement is necessary for care, education, encouragement, and supervision. Parents, especially mothers, play a vital role in maintaining the health of their children's teeth by developing positive behaviors and efforts to improve their children's dental health (Tamura, 2005). Parents' attitudes in maintaining dental health significantly impact children's behavior (Mahmoudi et al., 2016). An e-book educational program about maintaining oral and dental health delivered through an Android application is proven to improve the habit of maintaining healthy teeth and mouth. And in the end, children can brush their teeth better. Children's dental and oral health is highly influenced by children's obedience and the intensity of parental assistance in maintaining dental and oral health. Along with developing skills and commitment of parents to care for their children's teeth from an early age, it will have a positive impact by increasing knowledge about maintaining healthy teeth and mouth. The results are in Table 1.

This study aims to find differences in the knowledge before and after the intervention with the "E-Book Dental and Oral Health Maintain" program with Android applications. Respondents' knowledge in Jakarta experienced a very significant increase before and after treatment, with p-Value = 0.001 < 0.05, where the mean knowledge of respondents after receiving the "E-Book Dental and Oral Health Maintain" program with the Android application was 21.5 +/- 2.2, which is up from 12.2 +/- 2.9. Respondents' knowledge in Denpasar, Bali, increased significantly before and after treatment, with p-Value = 0.001 < 0.05, where the mean knowledge of respondents after receiving the "E-Book Dental and Oral Health Maintain" program with the Android application was 15 .2 +/- 1.99 from the previous 18.7 +/- 1.64. Providing an "E-Book Dental and Oral Health Maintain" program with an Android application can increase elementary school students' knowledge of maintaining oral and dental health.

The health education intervention program provides demonstrations and additional interventions in the form of an e-book program through an Android application and will improve the skills of parents as a small group in the community as agents for early prevention of dental caries, with the habit of brushing their teeth regularly, will improve skills in maintaining health teeth in elementary school students. Parents will accompany and monitor good and correct tooth brushing habits. The intervention program "E-Book Dental and Oral Health Maintain" with an Android application can be used as an innovation in dental and oral health services to carry out various promotive and preventive

Table 2. Bivariate Analysis between Debris Index Variables and Sex, Knowledge, Parents' Role through the "E-Book Dental and Oral Health Maintain" Program to Elementary School Students in Jakarta and Denpasar, Bali

No	Variables	p-value	Related/Not Related
1	Sex	0,613	Not related
2	Knowledge	0,001	Related
3	Parents' Role	0,001	Related

activities in dental and oral health. Intervention programs increase family participation and capacity to maintain oral health through family community arrangements and dental and oral health services in rural and urban areas. The role of mother/parents in maintaining dental and oral hygiene influences improving children's dental and oral health (Jackson et al., 2011). The results of the study are in Table 1.

Research in Jakarta succeeded in showing significant differences in the role of parents before and after the intervention of the "E-Book Dental and Oral Health Maintain" program with an Android application, with a p-value = 0.001 < 0.05, where the mean role of parents reached 6.6 from initially 4.7. Research in Denpasar, Bali also showed significant differences in the role of parents of students before and after the intervention with the e-book education program, with a p-value = 0.001 < 0.05, where the mean role of the parents of students receiving the e-book program intervention reached 6.77 from 5.73 initially. It can be concluded that the "E-Book Dental and Oral Health Maintain" program with an Android application is proven to be able to increase parents' role in maintaining dental and oral hygiene. In this study, the role of parents in Bali is higher than in Jakarta, although if it is accumulated, it can be seen that the increase in parents in Jakarta is better by 1.9 compared to Bali, which is only 1.04.

In multivariate analysis with linear regression, 3 (three) variables related to the Debris Index, namely sex, knowledge, and parents' role. To create a multivariate model with 3 (three) variables, a bivariate chi-square analysis was performed using the Debris Index as the dependent variable. Variables with p < 0.25 on the bivariate and of substantial significance can be used for inclusion in the multivariate model. The results of the bivariate analysis between the independent variables and the dependent variable are in Table 2.

Table 2 shows the bivariate relationship of the variables related to the Debris Index. Based on the table, only 2 variables are closely related, namely knowledge and parents' role, with a p-value < 0.25, so they are candidate models.

Table 3 shows that after multivariate testing using logistic regression, the two variables tested together have a significant effect in changing the Debris Index score, as evidenced by the p-value = 0.001. For the variable included in the multivariate test, only one variable had a significant effect on the Debris Index, namely the parents' role variable, which gave a decrease in the Debris Index score 68 times better than without the parents' role, while knowledge variable provides a reduction in the Debris Index score 34 times better than in children with poor knowledge. In this study, a strong interaction between parental roles and knowledge was shown by an increase in oral hygiene as measured by the Debris Index.

The innovative "E-Book Dental and Oral Health Maintain" program with an Android application is a new step in implementing interactive media technology to improve elementary school dental and oral health in Jakarta and Denpasar, Bali. In this case, children's knowledge, and parents' role, represented by the mother, about dental and oral health are important in shaping behavior that supports the children's dental and oral health maintenance. Parents' lack of knowledge about maintaining children's dental and oral health will be a non-conducive predisposing factor to behavior to monitor children's dental and oral health (Lauris et al., 2012; Shetty et al., 2016). Parents are the main social force that influences children's development, including dental and oral health care (Bozorgmehr et al., 2013).

Health education is a simple and cost-effective approach (Duguma, 2019; Garbin et al., 2015; Suma Sogi et al., 2016). Education, equipped with real practice and integrated with the "E-Book Dental and Oral Health Maintain" program with an Android application, will make it easier for children and parents, especially mothers, to expand their children's knowledge about maintaining healthy teeth and mouth. E-book programs with Android applications help children and mothers to always participate actively in monitoring their children's teeth and mouth health. The attention of parents, especially mothers, to maintaining children's dental and oral health from an early

Table 3. Advanced Analysis between Debris Index Variables and Knowledge and Parents' Role through the "E-Book Dental and Oral Health Maintain" Program to Elementary School Students in Jakarta and Denpasar, Bali

No	Variables	p-value	OR
1	Knowledge	0,001	68
2	Parents' Role	0,001	34

age makes healthy family behavior, a daily habit (MirzaeiAlavijeh et al., 2013).

A parent's role is influential in maintaining their children's teeth and mouth health. By changing the parents' attitudes and behavior about maintaining healthy teeth and mouth, the family has a vital role in improving children's dental and oral health. Families will create a healthy lifestyle environment, increase self-esteem, and help form good habits (Saldunaite et al., 2014). Behavior and health practices are greatly influenced by the attitudes and behavior of parents when intervening with their children to maintain dental health (Almoudi et al., 2016). The role of parents, especially mothers, can be role models for children when they learn to find idols whom they see and hear, as well as from their life experiences. Children learn by observing the activities of their parents or teachers. Children learn from what they hear from parents, teachers, and the environment. Children modify their parents' activities to gain experience from their life experiences (Gauba et al., 2013). The more actively parents participate in their child's education, the better the child's positive behavior changes. Parents not only participate and contribute to a healthy lifestyle, but also improve dental health status due to the influence of health behavior factors, including factors related to knowledge, attitudes, and practice (Qiu et al., 2016). Therefore, the role of parents is vital in guiding, providing information, and providing the best role models so that children grow and develop properly. Parental responsibility and attention to children are needed to maintain good dental and oral health. Teachers can represent parents at school and are the closest people to children at school, so the teacher's role and behavior are also vital in maintaining and improving the dental and oral health of students (BrogÅrdh-Roth et al., 2009).

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Digital Health Literacy for Bachelor Program Students at Indonesia University Year 2022

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Abstract

Currently, it is easier for people to access information through various devices connected to internet technology. However, this raises many new concerns, including the spread of false or inaccurate information. To overcome this, a more specific literacy approach is needed, namely digital health literacy. This study aims to determine the relationship between personal determinants of digital health literacy in bachelor program students at Indonesia University. This study uses secondary data analysis with a cross-sectional design. Data was collected through a survey conducted by a research team from the Faculty of Public Health, University Indonesia, using the eHEALS instrument about digital health literacy. The analysis uses multiple linear regression with health literacy as the dependent variable and social determinants including gender, age, science groups, and pocket money as independent variables. The results showed that the level of digital health literacy in bachelor program students was in a good category (M=3.14; SD=0.501). The results of the unadjusted model regression test show that the variables age (ß=0.205; 95% CI = 0.015-0.396) and pocket money (ß=1.011; 95% CI = 0.140-1.882) are significantly related to digital health literacy, while the results of the adjusted regression test the model shows that no variable has a confounder effect. The conclusion of this study is that age and pocket money affect the level of digital health literacy in bachelor program students at Indonesia University. Therefore, efforts are needed to develop health education programs that can reach students from various backgrounds.

INTRODUCTION

Currently, most health information can be accessed easily by the public through Internet technology. As the use of the internet as a source of information continues to increase, the health information obtained is also often not credible or does not come from trusted experts (Wijaya & Kloping, 2021), so it can lead to inaccurate and reliable information for the public. Kessler found that 40% of the 112 million posts related to COVID-19 information on social media came from untrusted sources (Bin Naeem & Kamel Boulos, 2021). A different health literacy approach is needed, namely digital health literacy. Norman, as a pioneer, defines digital health literacy as the ability to seek, find, understand, and assess health information from electronic sources and apply the knowledge gained to overcome or solve health problems (Norman & Skinner, 2006). Not many studies related to digital health literacy have been conducted in Middle and Low-Income Countries, including Indonesia.

Digital health literacy can be an approach to measure the level of health in the community, especially for people who routinely use various new technologies to solve their health problems. The current student group is part of Z generation, born in 1997-2012. Generation Z has the characteristic of being more fluent

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in using technology than the previous generation. Previous research found that 57% of Generation Z use the internet for more than 8 hours per day (Maulidina & Ridho, 2020). Measuring the level of digital health literacy is still minimal in Indonesia. Previous research has focused more on measuring health literacy, mental health literacy, and nutritional literacy. Based on the research results, measuring digital health literacy using the eHEALS instrument in Indonesia, especially with the target population, namely college students only found in Semarang (Nurjanah & Rachmani, 2015) and Bandung (Sjamsuddin & Anshari, 2023). The two studies have something in common. The population comes from college students at the Faculty of Public Health. The research conducted by researchers is expected to provide an overview of digital health literacy for students with various backgrounds. This research also observes various determinants that affect the level of digital health literacy.

Increasing digital health literacy at the population level can address health inequalities, the digital divide, and public awareness of using health technology. This phenomenon occurred during the COVID-19 pandemic, where digital health literacy was key in finding information on COVID-19 through internet-based media (Yang et al., 2022). One model that can be used to explain health literacy is the Pawlak model. Pawlak described health literacy as influenced by social determinants such as age, genetics, cognition, language, race and ethnicity, culture, education, employment, socioeconomic status, and access to health services and information technology (Pawlak, 2005). Meanwhile, Paige, in her research, stated that the social determinants that influence digital health literacy skills include personal, relational, knowledge, and technology determinants (Paige et al., 2018). We used a modified (Pawlak, 2005) and (Paige et al., 2018) model as a research conceptual framework. The personal determinants used in this study include gender, age, academic background, and pocket money. The previous research found that gender (Mitsutake et al., 2012; Norman & Skinner, 2006), age, education (Tennant et al., 2015), and economic status (Neter & Brainin, 2012) have a relationship with the level of digital health literacy. Based on these facts, it is important to understand digital health literacy in students by examining various determinants related to digital health literacy as a basis for solving health problems in the present and reducing the impact of disease in the future. The determinants studied included gender, age, science groups, and pocket money. Gender and age are physical personal attributes attached to each individual. The science groups were studied to find variations in digital health literacy among students of the health and non-health groups. While pocket money is a reflection of an indicator of the economic ability. This study aims to provide an overview of digital health literacy in University Indonesia students and the personal determinants that influence digital health literacy. We choose Indonesia University because it's one of the best state universities in Indonesia. We hoped that the results of this research can encourage other universities in Indonesia, both public and private, to be interested in research related to digital health literacy.

METHOD

This research analyzed secondary data from the Health Literacy Study 2022 with a cross-sectional design. Data collection took time in December 2022 using an online questionnaire with the Google Form application. Links to online questionnaires were distributed to the batch coordinators in each faculty to be shared through their communication network. The following process, namely, secondary data analysis, will be carried out in 2023. The sample size calculation is carried out to calculate the power study size. Based on power study calculations, we obtained a minimum sample size of 390 people in this study. The sample of respondents collected was 680 respondents. Respondents who did not meet the inclusion criteria were 22 respondents (3.6%).

The data collection instruments used in this study consisted of 2 types, namely the respondent's personal data questionnaire and the eHEALS questionnaire. The first instrument included questions to respondents about the respondent's gender, age, faculty, and the amount of pocket money the respondent received every week. The eHEALS instrument was adapted from (Norman & Skinner, 2006)

Table 1. Distribution of Bachelor Program Student Respondents based on Gender Characteristics, Science Groups, Type of Class, and Pocket Money

Demography Characteristics (n=658)	Frequency (n)	Percentage (%)
Student Gender		
Male	147	22,3
Female	511	77,7
Science Group		
Health Science Group	390	59,3
Non-Health Science Group	268	40,7
Type of Class		
Reguler Class	609	92,4
Paralel Class	31	4,7
Employee class	17	2,6
International Class	2	0,3
Pocket Money		
Student allowance ≤ IDR 500 thousand per week	563	85,5
Student allowance > IDR 500 thousand per week	95	14,4

yet there remain few tools available to assess consumers' capacity for engaging in eHealth. Over 40% of US and Canadian adults have low basic literacy levels, suggesting that eHealth resources are likely to be inaccessible to large segments of the population. Using information technology for health requires eHealth literacy - the ability to read, use computers, search for information, understand health information, and put it into context. The eHealth Literacy Scale (eHEALS research and has been translated into Indonesian to make it applicable. This instrument consists of 8 questions about the respondent's ability to search, find, understand, and assess health information from electronic sources and apply

Table 2 Distribution of Respondents based on Age Characteristics

Variable	Mean	Median	SD	Min-Max	95% CI
Age	19,61	19,00	1,612	17-28	19,49-19,73

Table 3. Distribution of Respondents' Answers based on the eHEALS Questionnaire Items

No	**Questions**	**Mean**	**SD**
eHEALS 1	I know how to find helpful health resources on the Internet	3,31	0,639
eHEALS 2	I know how to use the Internet to answer my health questions	3,24	0,638
eHEALS 3	I know what health resources are available on the Internet	3,25	0,585
eHEALS 4	I know where to find helpful health resources on the Internet	3,23	0,596
eHEALS 5	I know how to use the health information I find on the Internet to help me	3,21	0,582
eHEALS 6	I have the skills I need to evaluate the health resources I find on the Internet	3,07	0,643
eHEALS 7	I can tell high quality from low-quality health resources on the Internet	3,07	0,663
eHEALS 8	I feel confident in using information from the Internet to make health decisions	2,76	0,756
Average of All Questions		3,14	0,501

the knowledge obtained to overcome or solve health problems. This instrument has also been previously tested on 130 students of higher education public health study programs in Bandung. The criteria for the trial sample were students who were active in September 2022. The trial results showed sufficient inter-item reliability values (Cronbach Alpha = 0.789) and had a positive association with health literacy (HLS-EU-Q16) as an indicator of criterion validity (r= 0.183, p=0.037) (Sjamsuddin & Anshari, 2023). This research has also gone through ethical review procedures at the Research Ethics and Community Service Commission, Faculty of Public Health, University Indonesia, and declared feasible to be carried out, with the issuance of an ethical approval certificate Number Ket-433/UN2.F10. D11/PPM.00.02/2023.

RESULT AND DISCUSSION

The data collection obtained 658 respondents with demographic characteristics including gender, science groups, type of class, allowance (Table 1), and age (Table 2). The data processing showed more female respondents (77.7%) than male respondents (22.3%). Most respondents came from the health sciences group (60.1%) and the rest from the non-health sciences group (39.9%), namely the technology science group and the humanities social sciences group. Based on the type of class taken by student respondents, most respondents came from the regular class (91.3%), and the rest came from parallel, employee, and international classes. Most respondents have pocket money of less than or equal to 500 thousand rupiah per week (85.5%), and the rest are students who have pocket money of more than 500 thousand rupiah per week. Table 2 shows that the average age of student respondents is 19.61 years, with a variation of 1.612 years. The youngest student respondent is 17 years old, while the oldest is 28 years old. The analysis concluded that 95% of the student respondents who participated in this study were in the age range of 19.49 years to 19.73 years.

Table 3 shows the highest answer value is in the first question, with an average value of 3.31 and a variation value of 0.639. The lowest answer value is found in the eighth question, with an average value of 2.76 and a variation value of 0.756. When viewed from all questions, the average value obtained is 3.14 with a variation of 0.501. The first to fifth questions each have an average score that is greater than the average score of all questions, while the sixth to eighth questions each have an average score that is lower than the average score of all questions. Based on these average values, the level of digital health literacy in bachelor program students at Indonesia University can be categorized as leading to a good or high score with an average percentage of 78.5%. These results were obtained based on a comparison of the average percentage with previous research, namely Nurjanah (Nurjanah & Rachamni, 2015) at 75% (good category) and Salehi (Salehi & Arani, 2021) at 65.2% (moderate category). Based on Table 4, most respondents answered Agree (S) on each eHEALS question item. The answer choice Strongly Agree (SS) is the second most in the acquisition of each question, except for the eighth question found the answer Disagree (TS) is the second most answer

Table 4 Proportion of Respondents' Answers based on the eHEALS Questionnaire Items

Questions Item	Strongly Agree		Agree		Disagree		Strongly Disagree	
	n	%	n	%	n	%	N	%
e-HEALS 1	12	1,8	28	4,3	364	55,3	254	38,6
e-HEALS 2	11	1,7	40	6,1	385	58,5	222	33,7
e-HEALS 3	6	0,9	33	5,0	411	62,5	208	31,6
e-HEALS 4	7	1,1	37	5,6	410	62,3	204	31,0
e-HEALS 5	6	9,0	38	5,8	424	64,4	190	28,9
e-HEALS 6	13	2,0	76	11,6	422	64,1	147	22,3
e-HEALS 7	11	1,7	91	13,8	399	60,8	157	23,9
e-HEALS 8		4,9	191	29,0	340	51,7	95	14,4

Tabel 5 Digital Health Literacy Regression Analysis with Age, Gender, Science Group, and Pocket Money

Variables	Mean	SD	*Unadjusted model*		*Adjusted model*	
			ß	95% CI	ß	95% CI
Age	19,61	1,612	0,205	0,015 – 0,396	0,191	0,001 - 0,382
Gender						
Female	25,13	3,917	Ref		Ref	
Male	25,15	4,341	-0,019	-0,756 – 0,719	-0,096	-0,851 – 0,658
Science Groups						
Non-Health Group	24,87	4,178	Ref		Ref	
Health Group	25,32	3,889	-0,442	-1,067 – 0,182	-0,478	-1,118 – 0,161
Pocket Money						
≤ IDR 500 thousand per week	24,99	3,898	Ref		Ref	

choice (29.0%). Univariate analysis of digital health literacy found an increase in the choice of Disagree (TS) answers from the sixth to the eighth question.

Table 5 shows that the average digital health literacy score for men (M=25.15; SD = 4.341) is slightly higher than that of women (M=25.13; SD=3.917). Respondents from the health sciences group had an average score of greater digital health literacy (M=25.32; SD=3.889) than respondents from the non-health sciences group (M=24.87; SD=4.178). Based on student pocket money as an indicator of student economic ability, respondents who have pocket money of more than 500 thousand rupiahs per week have an average score of higher digital health literacy (M=26.00; SD=4.559) than respondents who have less pocket money or equal to 500 thousand rupiahs per week (M=24.99; SD=3.898).

Table 5 also presents the results of the adjusted model regression test for age, gender, science group, and pocket money on the digital health literacy level of student respondents. In general, age (ß=0.205; 95% CI = 0.015-0.396) and pocket money (ß=1.011; 95% CI = 0.140-1.882) have a significant positive effect on the value of the digital health literacy regression coefficient, which means age and money pocket has a relationship to health literacy. Gender (ß=-0.019; 95% CI = 0.756-0.719) and science group (ß=0.442; 95% CI = -1.067-0.182) do not have a significant effect on the digital health literacy regression coefficient, which means that gender and the science cluster has no relationship with digital health literacy. The following analysis is using the adjusted model regression test. After controlling for other variables, the coefficient values for age and pocket did not change, indicating that the relationship between the independent variables and the dependent one was not mutually influenced. These findings show that there are no variables that have a confounder effect.

The discussion will explain about overview of bachelor program students' digital health literacy and relationship between personal determinants and digital health literacy. The results of this study indicate that bachelor program students at the University of Indonesia have a good level of digital health literacy, but still have difficulties in assessing health information obtained from the internet (13.6%), distinguishing between high or low-quality health information (15.5). %), and make decisions based on health information obtained (33.9%). These results are consistent with several previous studies on college students in Semarang (Nurjanah & Rachmani, 2015) and in Iran (Salehi & Keikavoosi-Arani, 2021) that the value of digital health literacy in college students leads to a good score, but still have difficulties in evaluating health information found on the internet, determining the quality or not quality health information and using information obtained from the internet to make decisions about health.

Different results were expressed in (Dashti *et al.*, 2017) research, which mentions the level of digital health literacy among students in Iran in the low category. This difference can be caused by the level of digital health literacy, which continues to increase over time and considering the frequency of internet use. The frequency of internet use can generally be measured based on the level of internet penetration. Indonesia's Internet Profile Data for 2022 shows the

internet penetration rate in Indonesia has reached 77.02% (Asosiasi Penyelenggara Jasa Internet Indonesia, 2022) while the internet penetration rate in Iran in 2017 only reached 55% (Dashti *et al*., 2017).

Riley divided the eight eHeals question items into 3 dimensions based on social cognitive theory. The first dimension is knowledge about innovation and technology, including knowing various health information and health resources available on the internet, consisting of the first and second questions. This dimension is influenced by environmental factors related to a person's exposure to various sources of electronic information about health information and health resources (Sudbury-Riley *et al*., 2017). University Indonesia students are generally considered to have been exposed to health information, especially during the COVID-19 pandemic. The student environment, which at that time was still in a pandemic, also encouraged students to use the internet to be more active in seeking information or answers related to health. Previous research found that 91% of Generation Z actively seek health information about COVID-19 (Roselina *et al*., 2021).

Furthermore, the second dimension is related to the skills needed by someone to access various health information and health resources via the internet, consisting of questions three to six. This dimension is influenced by personal factors such as barriers and motivation (Sudbury-Riley *et al*., 2017). It is also evidenced by the internet penetration rate at the age range of 19-34 years, reaching 98.64%. (APJII, 2022). Another fact is that Generation Z seeks health information related to certain diseases because of curiosity (71.1%) and wanting to get the latest information (56.5%) (Roselina *et al*., 2021). It motivates students to use internet-based media in seeking health information behavior. Finally, the third dimension comes from the sixth to eighth eHEALS question items. Perception of belief is firmly visible in this dimension, which relates to a person's belief in utilizing health information obtained from the internet (Sudbury-Riley *et al*., 2017). It can be due to various reasons, including students who have not been able to utilize the health information they obtain to assist in making decisions related to their health. The role of parents as the closest family is often the final decision-maker regarding the student's health.

Another reason is that students are also considered unable to distinguish between quality and poor health information. Previous research found that the spread of inaccurate health information on social media reached 28.8% (Do Nascimento *et al*., 2022). Student decisions based on unreliable sources of information can highly affect their safety and health (Bak *et al*., 2022). It must be avoided so that students are not trapped in a behavior of self-treatment or self-diagnosis. The study shows that gender is not related to digital health literacy. The results are inconsistent with several previous studies in Iran (Salehi & Keikavoosi-Arani, 2021) and Saudi Arabia (Alhodaib, 2022), that male students have a higher level of digital health literacy than female students. However, the findings in this study are consistent with a study conducted by (Tsukahara *et al*., 2020) that there is no significant difference in the level of digital health literacy between men and women. In Indonesia, there has also been an increase in access to the internet among men and women. From 49% in 2014 to 77.55% in 2022 in the male group and from 51% in 2014 to 76.48% in 2022 in the female group (Asosiasi Penyelenggara Jasa Internet Indonesia, 2022).

The results of this study indicate that age is significantly related to digital health literacy. The older the age, the higher the level of digital health literacy. These results are in line with a study conducted by (Alhodaib, 2022) on high school-aged children in Saudi Arabia. However, these two studies show a different direction of relationship where the younger age has a higher level of digital health literacy than the older age. Another study (Nurjanah & Rachmani, 2015) found no significant relationship between age and digital health literacy. The results are probably due to the population only semester 1 students. Students registered at Indonesia University are considered to have sufficient basic knowledge about health because of their good educational background, so these students are also considered to have good health information retrieval abilities. The older the student, the better the level of knowledge. This level of knowledge can affect a person's ability to search and find various health information on the internet (Sudbury-Riley *et al*., 2017).

The results of this study indicate that the science groups are not significantly related to digital health literacy. The results are inconsistent with research conducted by (Hsu *et al*., 2014) that students from the health sciences group have a higher level of digital health literacy than students from the non-health sciences group. The results of a study conducted by (Schäfer *et al*., 2021) on students in Germany also found that there was an increase in the frequency of searching for health information at least once a day before and during the COVID-19 pandemic, which was 7% before the pandemic (June-July 2019) to 33.3% during the pandemic (June-July 2020). The COVID-19 pandemic has encouraged students, both from the health sciences and non-health sciences, to actively seek the health

information they need.

Pocket money in this study can be considered an indicator of economic ability for students. The results of this study found that there was a significant relationship between pocket money and student digital health literacy. The results are consistent with several previous studies in Tiongkok (Liu *et al*., 2022) and in Israel (Neter & Brainin, 2012) that respondents with higher economic status have a higher level of digital health literacy than respondents with lower economic status. Liu, in his research, revealed that respondents whose family income is higher have a higher level of digital health literacy than respondents whose family income is lower (Liu *et al*., 2022). A person can get pocket money in different amounts related on their family income (Mukhtar & Javaid, 2018). Slightly different results were found in (Dashti *et al*., 2017) research on university students in Iran. This difference is likely due to differences in pocket money in Indonesia and Iran. The lowest amount of pocket money for students in Iran ($ 160 / month = IDR 595,000 / week) is equal to the highest amount of pocket money for students in Indonesia (> Rp 500.00,-). This amount of money can be used as a benchmark for the student's economic ability to access health information via the internet.

Pocket money as an indicator of a student's economic ability can be used as a description of the economic status of the student's family. There will probably be an increasing trend of students with high and medium economic backgrounds and a decrease in students with low economic backgrounds. Students with low economic backgrounds still get free internet access from the university but cannot use it regularly. Students with lower pocket money will allocate it for more vital needs, such as daily meals and housing costs. Previous research found that students spend their pocket money on education (43.8%), then food and clothing (38.2%), and the rest for other needs such as the internet (18%) (Mukhtar & Javaid, 2018). In contrast, students who have higher allowances tend to be able to allocate their pocket money for internet quota needs and don't even use their pocket money allocation. Generally, these students live in apartments that provide internet for 24 hours.

CONCLUSION

The digital health literacy level of bachelor students at the University of Indonesia is categorized as good. Students still have difficulties in assessing and differentiating the quality of health information obtained from the internet and applying this information to make health-related decisions. Male students have higher digital health literacy than female students. The older the student, the better the digital health literacy score for students. Students from the health sciences group have higher digital health literacy than students from the non-health sciences group. The greater the pocket money students receive, the better the value of digital health literacy for students. Gender and science group variables do not have a significant effect on digital health literacy. The variables of age and pocket money significantly affect digital health literacy and do not show that there are variables that have a confounder effect. We recommend future research to involve other factors potentially related to digital health literacy, such as asset ownership or the amount of Single Tuition Fee (UKT) as an indicator of determining socioeconomic status in students. We hope that the population selection in the next study will be able to take a wider population and different age groups to provide a better picture of digital health literacy. Future research is also expected to adjust measurement instruments according to technological developments and current dissemination of health information and use other instruments as alternatives in measuring digital health literacy.

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Analyzing 2017 Indonesia Demographic Health Survey: Knowledge, Socio-demographics, and HIV/AIDS Prevention among Housewives

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Abstract

The spread of HIV/AIDS in Indonesia is increasing and dominated by housewives. This study aims to analyze the knowledge and socio-demographics that influence HIV/AIDS prevention behavior among housewives in Indonesia through data from the 2017 Indonesian Demographic and Health Survey (IDHS 2017). The data used were women of childbearing age (15-49 years) with 12,445 samples. cross-sectional study design with Chi-square test on bivariate analysis and logistic regression test on multivariate test. The results showed that there was a significant relationship between knowledge and HIV/AIDS prevention behavior. Women who had better knowledge about HIV/AIDS tended to use condoms more often and take HIV tests and had positive attitudes towards safe sex, which also positively correlated with better prevention behavior. Regression results also revealed that socio-demographic factors such as knowledge, age, latest education, economic status, and place of residence had a significant impact on HIV/AIDS prevention behavior. It suggests improving knowledge and education for housewives, promoting economic empowerment, implementing neighborhood-level initiatives, and enhancing community-wide awareness efforts.

INTRODUCTION

Ministry of Health Regulation No. 21 Year 2013 on HIV and AIDS Response states that HIV (Human Immunodeficiency Virus) is a virus that infects white blood cells to reduce immunity and result in AIDS (Acquired Immuno Deficiency Syndrome). AIDS is a collection of symptoms of reduced self-defense capabilities caused by the entry of HIV into a person's body (Menteri Kesehatan Indonesia, 2013). Until now, HIV/AIDS is still an iceberg phenomenon because the number of reported cases is less than the actual cases (Hanif et al., 2022). The HIV is usually found in body fluids such as blood, sperm fluid, vaginal fluid, and breast milk (Yeshaneh et al., 2023). This virus causes the body's inability to fight infections that enter the body, so people with HIV / AIDS will be vulnerable to various diseases. HIV infection will cause a reduction in the number and function of CD4 cells, resulting in a progressive decline in the immune system (Vijayan et al., 2017). HIV patients with poor immune systems, and not working effectively, will increase the risk of severity of opportunistic infections that coincide with increasing mortality and morbidity of HIV patients (Tegegne et al., 2022)

Worldwide, there are an estimated 2000 children under the age of 15 every day who contract HIV, about 1400 children under the age of 15 who die, and more than 6000 people of productive age who are infected with HIV. WHO (World Health Organization) reported approximately 36,900,000 people living with HIV positive, with 2.1 million being children under the age of 15 (WHO, 2023). The Ministry of Health reported that in Indonesia, as of June 2017, there were more than 255,000 cases of HIV incidence. It is estimated that 0.8% of adults aged 15-49 years are infected with HIV, with the incidence rate more in women than men.

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Data on AIDS cases reported every 3 months in the period 2003-2013 by the Ministry of Health showed that the highest number of AIDS cases in women were housewives and increased in 2023 (Dirjen Kesehatan Masyarakat Kemkes RI, 2023). The majority cause of housewives' risk of HIV/AIDS transmission is transmission from their husbands who have indiscriminate sex. If HIV infection occurs in women during pregnancy and breastfeeding, there is a risk of transmission from the mother to her child (Paneru et al., 2014).

HIV/AIDS transmission among housewives can occur due to a lack of knowledge about HIV/AIDS prevention behavior. Knowledge is a reflection of one's behavior. A person with low knowledge about HIV/AIDS prevention behavior will often allow risky behavior to be carried out without any prevention. In addition to knowledge, demographic factors such as age, education level, occupation, economic status, area of residence, and media exposure are also some of the factors that influence preventive behavior in housewives. Age affects a person's mindset. With age, the mindset will develop so that a person will more easily acquire knowledge. Housewives have a high risk of HIV/AIDS transmission through their partners, which is supported by the lack of information and efforts to prevent transmission. Education is closely related to knowledge. The higher a person's education, the broader the insight and the more information they get about the world of health so they can behave in HIV/AIDS prevention. This reason is also supported by (Bunyasi & Coetzee, 2017), which states that a higher level of education is more likely to allow a person to have better knowledge about HIV prevention, more accepting of health care, more able to negotiate for safe sex, and all factors that can reduce HIV transmission.

The work environment can also be a bridge for a person to gain knowledge and experience about HIV/AIDS prevention. Economic factors determine the availability of access to information and the utilization of healthcare infrastructure. A high economic level will facilitate access to information through various mass media. The family economy depends on the head of the family. This is the cause of the difficulty of housewives in controlling HIV/AIDS transmission because they are unable or reluctant to refuse relationships or ask partners to use condoms as a preventive behavior. Low income will put a person in a risky situation in meeting their daily needs, such as being willing to do work that is vulnerable to HIV/AIDS transmission (Ogunmola et al., 2014). In terms of area of residence, according to (Pellowski, 2013), individuals residing in rural areas are particularly at risk of HIV/AIDS transmission because they do not have adequate access to health care, both in terms of transportation and health services. The dissemination of information related to HIV/AIDS prevention is also inseparable from the role of the media in its dissemination. The importance of mass media in health promotion and disease prevention plays a vital role in increasing knowledge and awareness of public health behavior (Jung et al., 2013). Based on this description, it is necessary to research the relationship between knowledge and demographic factors on HIV/AIDS prevention behavior in housewives.

METHOD

This study is an analytic observation with a cross-sectional study design using secondary data from the 2017 Indonesian Demographic Health Survey (IDHS 2017). The 2017 IDHS was conducted by the Central Statistics Agency (BPS) in collaboration with the National Population and Family Planning Agency (BKKBN) and the Ministry of Health. The survey has also met the standards of the ICF Institutional Review Board (IRB). The sample selection procedure in this data is a two-stage stratified sampling, first by sorting by urban, rural, and welfare index categories. The number of census blocks selected in each district or city was determined by a systematic PPS (probability proportional to size) calculated from the 2010 census. Second, 25 households were systematically selected from each selected census block. The dataset used is IDIR71SV, which contains survey data of 49,627 women of childbearing age (15-49 years). This study aimed to determine the relationship between knowledge and sociodemographic factors with HIV/AIDS prevention behavior efforts among housewives. The inclusion criteria were those

who filled out the questionnaire and joined the 2017 IDHS, while the exclusion criteria were mothers who did not answer and did not know and variables with missing data were excluded. The sample obtained after being done by the criterias was 12,445.

The dependent variable of this study was HIV/AIDS prevention behavior efforts grouped into two categories: low and high. Low preventive behavior is performing behaviors that are at risk of HIV/AIDS, while the high category of preventive behavior is respondents who do not perform risky behaviors. The independent variables were HIV/AIDS knowledge, age, latest education, marital status, occupation, economic status, residence, and exposure to HIV/AIDS-related media. HIV/AIDS knowledge consisted of four parts, namely: HIV/AIDS, how it is transmitted, how to prevent it, and Prevention of Mother to Child Transmission (PMTCT) (Tang et al., 2019). The knowledge was categorized into two categories: low and high knowledge. Knowledge is low if the value is >81.125, while it is high if the respondent's answer is >81.125. The analysis was conducted in stages, from univariate analysis by presenting the frequency distribution of each variable to testing the relationship between the dependent and independent variables using the chi-square test. Finally, a multiple logistic regression test with a predictive model was used to assess the dominant factor associated with the dependent variable.

RESULT AND DISCUSSION

In this study, more respondents made low-level than high-level prevention efforts. There were 10,593 (85.1%) respondents whose HIV/AIDS prevention efforts were still low, while 1,852 (14.9%) other respondents had proper HIV/AIDS prevention efforts. In the variable of knowledge level, respondents with low knowledge were 5,389 (43.3%), while respondents with high knowledge level related to HIV/AIDS were 7,056 (56.7%). In this study, there were 7 categories in age, including 15-19 years, as many as 170 (1.4%), 20-24 years as many as 1,165 (9.4%), 25-29 years as many as 2,238 (18%), 30-34 years as many as 2,538 (20.4%), 35-39 years as many as 2,518 (20.2%), 40-44 years as many as 2,161 (17.4%), and 45-49 years as many as 1,655 (13.3%). More respondents have a high level of education than respondents with a low level of education. Respondents with a high level of education were 10,778 (86.6%), while respondents with a low level of education were only 1,667 (14.4%).

More respondents were employed than those who were not. In this study, 8,135 (65.4%) people had jobs, while the remaining 4,320 (34.6%) were respondents who did not have jobs. In the economic status variable, respondents who had low economic status were 3,153 (25.3%), middle economic status as many as 2,368 (19%), and upper economic status as many as 6,924 (55.6%). There were 4,437 (35.7%) respondents who lived in rural areas compared to 8,008 (64.3%) who lived in urban areas. More respondents were exposed to information media about HIV/AIDS, namely 10,662 (85.7%), compared to respondents who were not, namely 1,783 (14.3%).

The results of the chi-square test showed a p-value on the HIV/AIDS knowledge variable of (<0.001) < (0.05), which means that there is a significant relationship between the knowledge variable and HIV/AIDS prevention behavior in housewives. Knowledge is one of the sources in shaping a person's behavior that will play a role in decision-making before taking action so that the transmission of HIV/AIDS in the household, especially in transmission by mother to child, can be prevented (Yeshaneh et al., 2023). Before adopting a behavior, a person must understand the meaning and benefits of the behavior for self, family, and society. This knowledge is the basis for someone to make decisions and determining an action. Knowledge related to HIV/AIDS will be useable in recognizing the disease more deeply, from causes to prevention. The study is in line with research (Dewi et al., 2019), where the p-value (0.000). It means that there is a relationship between knowledge and HIV/AIDS prevention behavior in housewives. Knowledge can be obtained through direct experience or from the experience of others.

Age is one of the factors describing physical, psychological, social maturity, and the maturity of positive thinking in making decisions. A person's experience increases as

Table 1. HIV/AIDS Prevention Behavior Efforts in Indonesia 2017 IDHS Data

Variables	**N**	**%**
Prevention behaviour Efforts		
Low	10.593	85,1%
High	1.852	14,9%
HIV/AIDS knowledge		
Low	5.389	43,3%
High	7.056	56,7%
Age		
15-19	170	1,4%
20-24	1.165	9,4%
25-29	2.238	18,0%
30-34	2.538	20,4%
35-39	2.518	20,2%
40-44	2.161	17,4%
45-49	1.655	13,3%
Latest education		
Low	1.667	13,4%
High	10.778	86,6%
Working status		
No	4.310	34,6%
Yes	8.135	65,4%
Economic Status		
Low	3.153	25,3%
Middle	2.368	19,0%
Upper	6.924	55,6%
Place of residence		
Rural	4.437	35,7%
Urban	8.008	64,3%
Media Exposure		
No	1.783	14,3%
Yes	10.662	85,7%

Indonesian Demographic and Health Survey 2017

they get older (Van Dijk et al., 2020). Human adults will better consider the risks that occur before taking action. The test results show a p-value at the age of 15-19 years of (0.007) < (0.05) and age 20-24 of (<0.001), which means that someone aged 15-24 years has a low level of preventive behavior. This study is in line with the 2012 IDHS study, which states those aged 15 to 19 years old have less knowledge than other age groups, as much as 99.7%. When in the logistic regression model, those ages 15-19 and 20-24 are not significant to HIV/AIDS knowledge (Erma Pradnyani et al., 2019). Adolescents and young adults tend to be less aware of the risk of HIV/AIDS transmission from free lifestyle behaviors than adults, so they are more prone to unsafe sexual behavior.

The results of the chi-square test showed a p-value of (<0.001) on the education variable, which indicates that education has a significant relationship with HIV/AIDS prevention behavior among housewives. In general,

education is all efforts to influence, urge, invite, persuade, and end with the willingness of others to do what is expected. Low education will affect a person's level of knowledge and understanding of HIV/AIDS as well as poor HIV attitudes and behaviors (Nutakor et al., 2023). An educated person has better absorption and understanding of information, especially health information (Paterick et al., 2017). The results of this study are also in line with research (David et al., 2020). The risk of HIV decreases with higher education, reaching a peak of 80% lower risk for individuals with postgraduate degrees. It was noted that, in comparison to illiterate women, those with some schooling experienced a higher reduction in the risk of HIV. It shows that the higher the level of education, the higher awareness of health status is because it is a determining factor in women's empowerment, access to information and health services so that they can determine health not only for themselves but also their loved ones (Mude et al., 2020).

Work is an activity that aims to make a living or livelihood. The results of the chi-square test resulted in a p-value of (0.003) < (0.05), which means that there is an association between employment status and HIV/AIDS prevention behavior among housewives. Someone who works can be more likely to get health facilities, especially in health care and HIV prevention, one of which is the existence of HIV / AIDS tests on workers (Maulsby et al., 2020). The results of the chi-square test on economic status variables with HIV/AIDS prevention behavior among housewives, the p-value <0.001 and PR value = 1.885 (95% CI: 1.654-2.148) in low economic status. While the middle economic status with PR value = 1.466 (95% CI: 1.281-1.281). It shows that mothers who are in the lower and middle economic status tend to have lower HIV/AIDS prevention behavior efforts compared to the upper economic status whose risk is 1.885 times and 1.466 times, respectively. Based on previous research, there is a significant relationship between economic status that affects knowledge and preventive behavior towards HIV/AIDS (Erma Pradnyani et al., 2019; Nutakor et al., 2023). Another study conducted in South Africa showed a relationship between better economic status and better knowledge about HIV prevention, seeking or receiving health services, and negotiating for safe sex (Bunyasi & Coetzee, 2017).

The results of the chi-square test on the variable of residence showed a significant relationship with HIV/AIDS prevention behavior in housewives P-value = <0.001 and PR value = 1.058 (95% CI: 1.042-1.073), which means that mothers who live in villages have a greater low effort of prevention behavior compared to mothers who live in cities. Based on previous studies conducted in Ethiopia, it is known that rural women have a lower probability of having comprehensive HIV knowledge than urban women. However, there was a negative association with comprehensive HIV knowledge only in women who had never had an HIV test (Abate et al., 2020). Other findings show that individuals living in rural areas have limited access to public sources of HIV/AIDS-related information, thus affecting their knowledge and awareness of HIV prevention methods (Hasan et al., 2022; Wen et al., 2015).

The results of the chi-square test on the variable media exposure with HIV/AIDS prevention behavior in housewives showed a significant relationship with a p-value = 0.015 PR value = 1.027 (95% CI: 1.007-1.047). Based on research on women of productive age, media exposure such as television, radio, magazines, the internet, and other media is associated with increased knowledge related to HIV/AIDS. Media exposure is evidence that it can change HIV/AIDS risk behavior ((Agegnehu & Tesema, 2020). This finding is consistent with women who are exposed to media-based information about HIV being more likely to visit health facilities for HIV testing (Nutakor et al., 2023; Onsomu et al., 2013; Sano et al., 2016). It means that information media has the potential to increase understanding and knowledge and may have the potential for HIV/AIDS prevention, including the use of HIV testing (Sano et al., 2016).

Table 3 shows that the results of multivariate test analysis on the knowledge variable showed a p-value = <0.001 (p <0.05) and OR = 1.511, meaning that after controlling

Table 2. Bivariate Analysis of HIV/AIDS Prevention Behavior Efforts in Indonesia 2017 IDHS Data

Variable	HIV/AIDS Prevention Behavior				PR 95 CI	*P-Value*
	Low		**High**			
	N	%	N	%		
HIV/AIDS knowledge						
Low	4791	88,9	598	11,1	1,081 (1,066-1,097)	*<0,001**
High	5802	82,2	1254	17,8		
Age						
15-19	158	92,2	12	7,1	2,277 (1,247-4,159)	*0,007**
20-24	1046	89,8	119	10,2	1,520 (1,204-1,919)	*<0,001**
25-29	1899	84,9	339	15,1	0,969 (0,810-1,158)	0,727
30-34	2128	83,8	410	16,2	0,898 (0,756 -1,066)	0,218
35-39	2143	85,1	375	14,9	0,988 (0,830-1,177)	0,894
40-44	1808	83,7	353	16,3	0,886 (0,742- 1,058)	0,180
45-49	1411	85,3	244	14,7	Ref	
Latest education						
Low	1559	93,5	108	6,5	1,116 (1,099-1,133)	*<0,001**
High	9034	83,8	1744	16,2		
Working status						
No	3725	86,4	585	13,6	1,024 (1,008-1,039)	*0,003**
Yes	6868	84,4	1267	15,6		
Economic Status						
Low	2830	89,8	323	10,2	1,885 (1,654-2,148)	*<0,001**
Middle	2065	87,2	303	12,8	1,466 (1,281- 1,281)	*<0,001**
Upper	5698	82,3	1226	17,7	Ref	
Place of residence						
Rural	3914	88,2	523	11,8	1,058 (1,042-1,073)	*<0,001**
Urban	6679	83,4	1329	16,6		
Media Exposure						
No	1552	67	231	13	1,027 (1,007-1,047)	*0,015**
Yes	9041	84,8	1621	15,2		

*p<0,05

Indonesian Demographic and Health Survey 2017

for other variables, respondents with low knowledge levels were 1.511 times lower in implementing HIV/AIDS prevention efforts compared to respondents with high knowledge levels. In the age variable, only the age range of 15-19 years old and 20-24 years old have a significant relationship with HIV/AIDS prevention behavior efforts, which have a p-value of 0.027 and 0.001, respectively. The last education level variable showed a p-value = <0.001 and OR=2.368, which means that after controlling for other variables, respondents with low education levels had a 2.368 times greater risk of low implementation of HIV/AIDS prevention efforts among housewives. In terms of economic status, low economic status has an OR=1.367, meaning that after controlling for other variables, respondents

Table 3. Multivariate Analysis of HIV/AIDS Prevention Behavior Efforts in Indonesia 2017 IDHS Data

Variable	B	SE	Wald	OR (CI 95)	*p*-value
HIV/AIDS knowledge	0,413	0,055	57,121	1,511 (1,358-1,682)	<0,001
Age 15-19	0,686	0,310	4,892	1,986 (1,081-3,657)	0,027
Age 20-24	0,392	0,122	10,424	1,481 (1,167-1,879)	0,001
Age 25-29	-0,007	0,093	0,005	0,993 (0,828-1,192)	0,943
Age 30-34	-0,068	0,089	0,582	0,934 (0,784-1,113)	0,446
Age 35-39	0,026	0,090	0,083	1,026 (0,860-1,225)	0,773
Age 40-44	-0,122	0,092	1,776	0,885 (0,740-1,059)	0,183
Latest education	0,862	0,106	65,861	2,368 (1,923-2,216)	<0,001
Low Economic Status	0,312	0,074	17,819	1,367 (1,1820-1,580)	<0,001
Middle Economic Status	0,210	0,071	8,653	1,233 (1,073-1,419)	0,003
Place of residence	0,168	0,060	7,724	1,183 (1,051-1,2332)	0,005

Indonesian Demographic and Health Survey 2017

with low economic status are 1.367 times more likely not to implement HIV/AIDS prevention efforts. Not only that, respondents with middle economic status also have a risk of 1.233 times more to be the cause of low implementation of HIV/AIDS prevention behavior in housewives. Living conditions showed a p-value = 0.005 and OR = 1.183, meaning that it has a significant relationship with HIV/AIDS prevention efforts. Based on the results of statistical tests using a logistic regression test, the most dominant factor associated with HIV/AIDS prevention efforts among housewives is the education level because it has the smallest p-value (<0.001) or the highest Wald value (65.861).

Education, in general, will affect respondents' awareness of preventing HIV transmission. A woman who has a higher education will be more open to new ideas and changes in obtaining a proportional health service (Parvazian et al., 2017).

CONCLUSION

The implementation of HIV/AIDS prevention behavior among housewives was influenced by knowledge level (p<0.001), education level (p<0.001), working status (p=0.003), residence (p<0.001), and media exposure (p=0.015). Low HIV/AIDS prevention behavior was more prevalent among housewives aged 15-24 years with lower-middle economic status. Based on the research findings, there is hope that community-wide interventions focusing on improving knowledge and education among housewives, particularly younger ones with lower-middle economic status, will enhance their understanding of HIV/AIDS risks and prevention methods. Moreover, promoting economic empowerment and initiatives that can help individuals who are not working to become financially independent and reduce their risk of HIV/AIDS. In residential settings, consider implementing neighborhood-level initiatives to raise awareness and facilitate access to HIV/AIDS prevention resources for

housewives. The aspiration is for the entire community, especially housewives, to actively seek information about HIV/AIDS through outreach activities and mass media. Health workers and policymakers are expected to increase awareness among all stakeholders involved in HIV/AIDS prevention programs, facilitating proactive communication, socialization, and education.

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Perspectives and Socioeconomic Influences of Personal Protective Equipment Waste Management on Post-COVID-19

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Abstract

The COVID-19 pandemic brought an upsurge in Personal Protective Equipment (PPE) usage, leading to emergent challenges in its post-use management, especially in urban centers like Jakarta. This study conducted a quantitative exploration, employing simple random sampling techniques, to investigate Jakarta citizens; perceptions of PPE waste management. Two significant factors, "Safe Management and Regulation" and "PPE Waste Handling," were identified as paramount in addressing the issue. Through cluster analysis, the population was segmented into three distinct clusters: "Regulatory-Driven Safety Respondents," "Operational PPE Focus Respondents," and "Minimal Management Respondents." The study also unveiled a notable influence of socioeconomic variables on PPE waste management attitudes, particularly occupancy and income. These findings give policymakers, urban planners, and researchers invaluable insights, emphasizing the need for a dual-focused approach encompassing regulatory and operational strategies tailored to specific demographic segments for optimal impact.

INTRODUCTION

In the face of unprecedented global challenges, the importance of understanding and implementing sustainable practices has never been more pronounced. The world, propelled by the stark realities of climate change, diminishing natural resources, and rampant urbanization, is swiftly transitioning towards sustainable frameworks (Khan, 2022; Suryawan & Lee, 2023). One such pressing issue is the management of Personal Protective Equipment (PPE) waste, which has surged significantly due to the global pandemic of COVID-19 (Ardusso et al., 2021; De-la-Torre et al., 2021; Sari, Inoue, et al., 2022). With millions using single-use PPE daily, the ramifications on waste management and environmental health have been profound (Haque et al., 2021).

Jakarta, Indonesia's bustling capital, exemplifies the challenges and complexities of managing such waste, especially in dense urban settings (Husen & Samadi, 2021; Suryawan & Lee, 2023). As a metropolis known for its cultural diversity, economic significance, and rapid development, Jakarta grapples with waste management and environmental sustainability

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challenges. The recent influx of PPE waste adds to the existing problem, posing severe threats to its environment, public health, and urban infrastructure. The management of PPE waste, if not addressed strategically, can exacerbate existing challenges such as land scarcity for landfills, environmental degradation, and public health concerns (Kulkarni & Anantharama, 2020; Sari, Yosafaat, et al., 2022). Furthermore, the narrative of waste management transcends mere logistics and taps into deeper societal dimensions. Public perceptions, knowledge, and attitudes towards sustainability play a pivotal role in the success or failure of any waste management strategy (Debrah et al., 2021; Soares et al., 2021). Historically, sustainability issues, including waste management, have been approached with a top-down strategy, predominantly driven by regulations and directives. However, for long-lasting and holistic solutions, the involvement and perspectives of the community are paramount.

While the importance of PPE in combating the spread of COVID-19 has been well-documented in the literature (Ammendolia et al., 2021; Patrício Silva et al., 2021; Rhee, 2020), there needs to be more studies focusing on the post-use management of these essential tools, especially in densely populated urban areas like Jakarta. Current research primarily emphasizes the medical and preventive aspects of PPE (Atthar et al., 2022; Haji et al., 2020), with little attention given to the environmental and logistical challenges posed by their disposal. Moreover, as urban centers continue to grapple with the challenges posed by waste management, the sudden influx of PPE-related waste further complicates these issues. The specific challenges PPE waste poses, environmental implications, and potential health risks if not adequately managed remain underexplored in (Septiariva et al., 2022). The influence of socioeconomic factors on PPE waste management practices and perspectives remains an area ripe for exploration. Understanding these influences can help craft more effective, targeted interventions and policies for improved waste management in the future. The primary aim of this study is to delve into the perspectives and practices related to PPE waste management post the Covid-19 pandemic in Jakarta. As the capital city of Indonesia and a major urban center, Jakarta has witnessed a surge in PPE usage due to the pandemic, making PPE waste management a significant concern for public health and environmental sustainability. Specifically, the study seeks to identify the factors influencing these practices, evaluate their relative importance, and segment the population based on their attitudes and practices towards PPE waste management using cluster analysis.

METHOD

This study illuminates the pertinent PPE domestic waste management issue within Jakarta, Indonesia's bustling capital city. Drawing from a robust quantitative methodology, the research endeavors to harness insights from the student population, a segment pivotal in shaping the future trajectories of sustainability practices. This study followed a systematic and robust quantitative approach, beginning with a thorough literature review. The aim was to identify previous methodologies, interventions, and practices related to PPE waste management, especially in similar urban contexts. The gathered insights from the literature laid the foundation for framing the research methodology and tailoring the questionnaire to the unique context of Jakarta. Jakarta is a testament to the confluence of traditions, cultures, and rapid urbanization, as captured in Figure 1.

This sprawling metropolis on Java's northwest coast offers a canvas rich in diversity and perspectives, making it a strategic choice for this research. Given the city's sheer scale and demographic intricacies, the methodology adopted ensured inclusivity and representation. It led to the adoption of a two-pronged approach for data collection, entailing a combination of digital platforms like Google Forms and traditional face-to-face interviews. This hybrid methodology catered to the diverse preferences of Jakarta's residents. It ensures that the study captured a comprehensive cross-section of the population. Simple random sampling was employed to emphasize the elimination of biases, especially during participant selection. In research, biases can significantly alter outcomes, often leading to skewed conclusions.

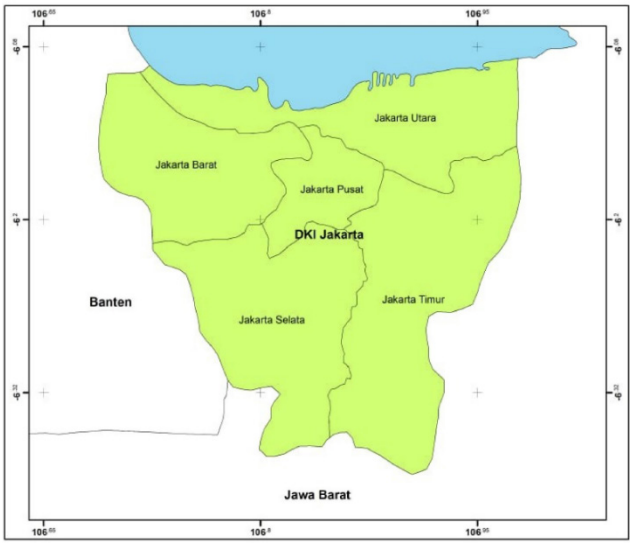

FIGURE 1. Study Location (Suryawan *et al*., 2023)

The beauty of simple random sampling lies in its egalitarian approach, wherein every individual within the population has an equal probability of being chosen. This approach is especially crucial for a city as demographically intricate as Jakarta. To ensure that the sample size was statistically valid and representative, Slovin's equation was put into play. Therefore, this study encapsulated the views and insights of 529 respondents, making them symbolic of Jakarta's broader student cohort.

The structured questionnaire played a pivotal role in the data collection process (Table 1). Divided into distinct sections, the questionnaire captured vital demographic details of the respondents and delved deep into their perspectives, understanding, and practices related to PPE waste management. The choice of a 5 Likert scale facilitated the nuanced capture of respondents' sentiments, allowing them to express their agreement or disagreement with specific statements (Suryawan et al., 2023; Sutrisno et al., 2023). The scale's versatility and widespread acceptance in social research made it apt for this study. Drawing inspiration from global paradigms and comparing with literature such as (Rahmalia et al., 2022; Ranjbari et al., 2021), the study aimed to not only understand the technicalities of PPE waste management but also to dive deep into the socio-cultural and emotional facets of the issue. Engaging with these dimensions, especially in an educational context, cannot be overstated. As educational institutions are hubs for future change-makers, ensuring that the ethos of sustainable waste management is ingrained early on is of paramount importance.

Data was processed and analyzed using SPSS, a statistical software in social research. Initial steps included cleaning the data and removing any incomplete or incongruent responses. Subsequent steps included descriptive statistics, such as frequency distributions and measures of central tendency, to gauge the initial patterns and trends in the data. Factor analysis was then employed to identify latent variables that underpin student perspectives on sustainability. Factors were extracted using the principal component method, and the rotation method chosen was Varimax with Kaiser normalization. Eigenvalues higher than one were considered significant. The suitability of the data for factor analysis was verified through the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity. A KMO value greater than 0.6 and a significant Bartlett's test are typically deemed acceptable for factor analysis. Once the underlying factors were discerned, a reliability test, specifically Cronbach's alpha, was conducted to gauge the consistency of the items within each factor (Suryawan et al., 2023).

Subsequent to factor analysis, a cluster analysis was employed to group the respondents based on their perspectives on PPE waste

TABLE 1. Indicators and Questions in Questionnaire

No	Keywords	Question
1	Containment of PPE waste	In my opinion, the containment of PPE waste at home should be separated from other garbage because PPE waste is infectious.
2	Treatment with disinfectants	I believe that PPE waste at home should be treated with disinfectants to protect it from viruses.
3	Destruction of PPE waste	I believe PPE waste at home should be destroyed to prevent reuse.
4	Collection by officials	I think officials should collect PPE waste and manage it in places separate from other domestic waste (food waste, paper, garden, etc.).
5	Provision of waste management facilities	I believe the government should provide domestic PPE waste management facilities, such as PPE waste banks, PPE 3R temporary disposal sites, and waste collection companies.
6	Treatment following regulations	I think treating PPE waste should follow the applicable regulations, such as disinfection, incineration, pyrolysis, or autoclaving.
7	Public awareness campaigns	I believe the government needs to conduct socialization regarding safe PPE waste management.
8	Government regulations	I think the government needs to create regulations/policies on the limitation and safe management of disposable PPE use.
9	Provision of PPE waste bins in public places	In my opinion, the government needs to provide specific PPE waste bins in public places/facilities.
10	Action against illegal disposal	I believe the community/government needs to take quick action regarding the illegal disposal of PPE waste, such as dumping in open land, rivers, or the sea.

management. The hierarchical method was chosen for the clustering process, which began with each case being a single cluster and ended when all cases were combined into one overarching cluster. A dendrogram, a tree-like diagram, was employed to showcase the clustering process and determine the optimal number of clusters. Once the clusters were finalized, each cluster's characteristics were analyzed and interpreted based on the factors derived from the factor analysis.

RESULTS AND DISCUSSION

Table 2 provides a factor analysis of PPE management strategies implemented after the Covid-19 pandemic. Two principal components emerged, highlighting the primary focus areas in managing PPE waste. From a statistical perspective, the Eigenvalues for both factors are above the typical threshold of 1, indicating their significance in explaining the variance in the data. Factor 1 has an Eigenvalue of 2.180, which denotes its higher variance than Factor 2, with an Eigenvalue of 1.194. In terms of the percentage of variance explained, Factor 1 accounts for 20.533%, whereas Factor 2's contribution is slightly less. While Cronbach's Alpha for both factors is around 0.5, suggesting moderate reliability, it is essential to consider that values acceptable reliability coefficients of 0.4 to 0.8 are generally more desirable for greater internal consistency (Ekolu & Quainoo, 2019).

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy stands at 0.703. Typically, a KMO value above 0.6 is considered adequate, suggesting that the sample is suitable for factor analysis. Bartlett's Test of Sphericity further confirms the appropriateness of the factor analysis, with a significant value (Sig. = 0.000). The test's significance implies some relationships between the variables, and it is appropriate to proceed with the factor analysis. The first factor, termed 'Safe Management and Regulation,' underscores the importance of regulation and structured mechanisms to ensure the safe disposal and handling of PPE waste. This factor encompasses the

TABLE 2. Factor Analysis Results for PPE Management Post-Covid-19

Indicators	Components		Eigenvalue	% of variance	Cronbach's Alpha
	1 = Safe Management and Regulation	2 = PPE Waste Handling			
Destruction of PPE waste	0.791		2.180	21.647	0.5
Provision of waste management facilities	0.608				
Government regulations	0.554				
Treatment in accordance with regulations	0.538				
Containment of PPE waste		0.660	1.194	20.533	0.5
Collection by officials		0.616			
Public awareness campaigns		0.542			
Treatment with disinfectants		0.537			
KMO and Bartlett's Test					
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.703				
Bartlett's Test of Sphericity	361.658				

"Destruction of PPE waste," which is crucial to prevent any secondary contamination and the virus's possible spread. It also comprises the "Provision of waste management facilities," ensuring that adequate and specialized facilities are available for PPE waste disposal.

Furthermore, this factor emphasizes the importance of "Government regulations" in guiding and setting standards for PPE waste management. Lastly, the "Treatment following regulations" points to the adherence and execution of set guidelines in treating PPE waste. The second factor, 'PPE Waste Handling,' leans more towards the processes and measures involved in treating and handling PPE waste. It begins with the "Containment of PPE waste," which is the first step in ensuring that PPEs don't pose a risk to the environment or public health. The "Collection by officials" denotes a structured collection mechanism, likely with trained personnel to minimize the risk of contamination. "Public awareness campaigns" within this factor emphasize the role of information dissemination and ensuring that the general public is aware of proper PPE disposal methods. Finally, "Treatment with disinfectants" highlights the importance of treating PPE waste to eradicate pathogens.

Regarding "Safe Management and Regulation," previous research by (Salim et al., 2019; Ulhasanah & Goto, 2018) emphasized the integral role of stringent government regulations in maintaining the integrity of waste management systems. They underscored that safety protocols can often be overlooked without clear rules and consistent enforcement, leading to environmental and public health risks. (Nwedu, 2022) essence suggested that managing hazardous waste, including PPE, is only as robust as the regulatory framework supporting it. Our findings concur with this perspective, as the factor demonstrates respondents' weight on

TABLE 3. Cluster Analysis and Classification of Respondent Perspectives

Factor	Clusters			Mean Square	df	F	Sig.
	1	2	3				
Safe Management and Regulation	2.24	-4.598	-4.126	162.357	526	420.096	0.000
PPE Waste Handling	-1.494	2.185	-3.442	109.839	526	187.385	0.000
	Regulatory-Driven Safety	Operational PPE Focus	Minimal Management Approach				

regulations and their proper implementation, especially in the aftermath of a health crisis like COVID-19. On the other hand, "PPE Waste Handling" encapsulates the operational aspect of PPE management. In a study by (Sari, Inoue, et al., 2022; Sari, Yosafaat, et al., 2022), the significance of proper PPE waste containment, collection, and treatment was brought to the forefront. (Fam et al., 2018; Leuders et al., 2022) highlighted that irrespective of the strength of the overarching regulatory framework, if the actual waste handling practices are subpar, it can lead to severe ramifications. They stressed community engagement, public awareness campaigns, and the importance of using disinfectants and other treatments to ensure that PPE waste does not become a source of secondary contamination. Our study resonates with these sentiments, as this factor underscores respondents' prioritization of PPE waste management's tangible, ground-level operations

In comparing our findings with these literary benchmarks, it becomes evident that while regulatory and operational facets are crucial, they cater to different aspects of the PPE management continuum. The "Safe Management and Regulation" factor parallels the top-down approach (Aung et al., 2019; Chartier, 2014) advocated, emphasizing governmental oversight. In contrast, the "PPE Waste Handling" factor aligns more with the bottom-up strategy highlighted by (Anderson et al., 2019; Sekarningrum et al., 2020), underscoring community involvement and awareness. Table 3 presents a cluster analysis that segments the data into three distinct clusters based on their approach to PPE management: Regulatory-Driven Safety, Operational PPE Focus, and Minimal Management Approach. The Regulatory-Driven Safety cluster aligns closely with the "Safe Management and Regulation" factor. This suggests that entities or individuals in this cluster adhere stringently to the regulatory guidelines laid out for PPE disposal and management. Their primary emphasis is ensuring that PPE waste is destroyed effectively and treated by official guidelines. They also value adequate waste management facilities and consider government regulations a cornerstone of effective PPE management. A notable 52.7% (or 279 respondents) fall under this category, making it the most prevalent approach in the dataset.

The Operational PPE Focus cluster centers more on the "PPE Waste Handling" factor. Entities in this cluster prioritize the actual hands-on processes involved in treating and handling PPE waste. They ensure the containment of PPE waste, have structured collection mechanisms (most likely with trained personnel), and invest in public awareness campaigns to spread the message of proper PPE disposal. Their strategies also incorporate treating PPE waste with disinfectants to mitigate any risks associated with pathogens. This approach was adopted by 43.7% (or 231 respondents) of the sample. The last cluster, the Minimal Management Approach, presents a challenge. Entities in this cluster do not show a

TABLE 4. Socioeconomic Variable Influence on Respondent Clusters

Socio-demography		Regulatory-Driven Safety Respondent		Operational PPE Focus Respondent		Minimal Management Respondent	
Age	20-29	164	31.00%	128	24.20%	13	2.46%
	30-39	88	16.64%	86	16.26%	5	0.95%
	>39	27	5.10%	17	3.21%	1	0.19%
	LLR = 3.252, df=4, pvalue=0.517						
Higher Education	Senior high school and below	125	23.63%	98	18.53%	6	1.13%
	Bachelor's degree and above	154	29.11%	133	25.14%	13	2.46%
	LLR = 1.392, df=2, pvalue=0.490						
Occupancy	Formal	217	41.02%	202	38.19%	9	1.70%
	Non-Formal	62	11.72%	29	5.48%	10	1.89%
	LLR = 19.425, df=2, pvalue=0.000						
Income	< IDR. 5.000.000	69	13.04%	30	5.67%	13	2.46%
	IDR. 5.000.000-IDR.10.000.0000	109	20.60%	102	19.28%	4	0.76%
	IDR. 10.000.001-IDR.15.000.0000	83	15.69%	83	15.69%	2	0.38%
	> IDR.15.000.0000	18	3.40%	16	3.02%	0	0.00%
	LLR = 33.411, df=6, pvalue=0.000						

positive inclination towards either of the factors, "Safe Management and Regulation" or "PPE Waste Handling." It suggests a potential laissez-faire approach towards PPE management or a lack of resources or awareness. Fortunately, this cluster represents a small fraction of the sample, with only 3.6% (or 19 respondents).

Table 4 encompasses demographic indicators such as age, higher education, occupancy (formal vs. non-formal), and income brackets. A likelihood ratio (LLR) test is used to determine if there's a significant association between the response categories and the variable of interest. Starting with occupancy, the analysis reveals a significant association with the variable of interest. An LLR value of 19.425 and a p-value of 0.000 (with 2 degrees of freedom) indicates a strong association, meaning that the occupancy type (whether formal or non-formal) notably impacts the outcome variable. It could imply that respondents' living arrangements or housing type significantly influence their perspectives or behaviors. Next, the Income variable also displays a substantial association. The p-value of 0.000 (with 6 degrees of freedom) solidifies the influence of income on the variable of interest. The different income brackets specified (ranging from below IDR. 5.000.000 to above IDR.15.000.000) show variances in the outcome variable. The LLR value of 33.411 further confirms the strength of this association. It suggests that financial capacity or economic standing significantly influences behavior or perspective. Contrastingly, the table does not indicate significant associations between age and higher education with the outcome variable, suggesting that these factors might not play a determinative role in influencing the variable of interest in this study.

In understanding the cluster divisions within PPE management post-COVID-19, the nuances in people's behaviors, and the influence of socio-demographic factors, we can draw comparisons to past literature on waste management behaviors and patterns. The Regulatory-Driven Safety Respondent cluster resonates with the findings from a study by (Gollakota et al., 2020), where participants were inclined to adhere to waste management

practices when there was a clear regulatory framework. This adherence, particularly in urban environments and amongst those in higher socioeconomic brackets, underscores the importance of regulatory guidelines in shaping behavior.

The Operational PPE Focus Respondent group, emphasizing the pragmatic handling of PPE waste, shares similarities with insights from a research piece by (Atthar et al., 2022). They highlighted the significance of practical interventions in changing waste disposal behaviors. This cluster's focus on the tangible facets of PPE disposal suggests that operational strategies can play a crucial role in influencing positive waste management behaviors when communicated effectively. In contrast, the Minimal Management Respondent cluster's passive approach resembles observations from (Nunkoo et al., 2021; Phan et al., 2022). Their research on waste management in developing economies found that lower-income groups often exhibited minimal participation in waste management due to economic constraints and a lack of awareness.

On the significance of income levels, a study by (Amoah & Addoah, 2021; Kala et al., 2020; Knickmeyer, 2020) on waste management behaviors across different socioeconomic segments found that higher income groups often have better waste management practices, not just because of greater access to resources but also due to heightened awareness. It mirrors our observation of the Regulatory-Driven Safety cluster, where higher-income respondents seemed more inclined towards safety regulations. Our findings both corroborate and expand upon the existing literature. While certain behaviors, such as regulatory adherence among urban, formally-housed individuals, have been previously documented, our research highlights nuanced facets, particularly around operational aspects of PPE management and the influence of income. The interplay between socio-demographic factors and PPE management underscores the need for targeted, multi-pronged interventions to ensure effective waste management across different population segments.

The outcomes of this study bring forth several significant policy recommendations and implications, especially as the world grapples with the aftermath of the COVID-19 pandemic and the challenges associated with PPE management. Firstly, there is a pressing need for a comprehensive and robust regulatory framework for managing and disposing of PPE waste. While the "Safe Management and Regulation" factor indicated an inclination towards regulations, it is evident that sporadic guidelines are insufficient. A cohesive, well-structured framework that integrates global best practices, considering the local nuances, can ensure streamlined and safe disposal of PPE waste. Moreover, the "PPE Waste Handling" factor underscores the importance of tangible ground-level operations. Governments and local authorities should invest in infrastructure, ensuring adequate provision of waste management facilities. It involves establishing more disposal units and ensuring that these units are equipped with the necessary resources to handle and treat PPE waste properly (Cubas et al., 2023; Hantoko et al., 2021). It also extends to training personnel adequately and ensuring that the collection and disposal methods meet international safety standards.

Furthermore, public awareness is paramount. While regulations and facilities play their part, the success of any PPE waste management initiative hinges on public participation. As evidenced by the significance of public awareness campaigns in our findings, there is a clear indication that people need to be informed, educated, and empowered. Authorities should roll out extensive public awareness campaigns, harnessing the power of traditional and digital media to reach broader audiences informing them of the correct disposal methods and the implications of improper handling. The distinction between the clusters, especially the "Minimal Management Respondent," points towards a population segment that might not adequately align with the importance of proper PPE waste management. Targeted interventions, in the form of workshops, community sessions, or educational programs, might be beneficial in bridging this gap. Lastly, the demographics and socioeconomic variables play a pivotal role. Policy interventions should consider these factors to ensure inclusivity.

The significant findings associated with occupancy and income levels suggest that socioeconomic disparities might influence PPE waste management behaviors. Policies should be designed to cater to diverse income brackets, ensuring that everyone, regardless of their economic standing, has access to PPE disposal facilities and is aware of the importance of their proper use. The findings of this study lay the groundwork for a holistic approach to PPE waste management, integrating robust regulations, effective on-ground operations, and widespread public awareness. Governments, stakeholders, and communities must unite to pool resources and expertise to tackle this challenge head-on (Suryawan & Lee, 2023; Sutrisno et al., 2023), ensuring environmental safety and public health.

The implications of these findings are manifold. For policymakers and urban planners, there's a clear indication that a dual approach is required. Regulatory measures need to be complemented with operational strategies on the ground. Further, the disparities in PPE waste management practices based on socioeconomic variables suggest that targeted interventions addressing specific population segments might be more effective than blanket policies. Engaging communities, especially in areas with a higher propensity for "Minimal Management," will be crucial in reshaping and refining PPE waste disposal behaviors. While the pandemic has underscored the importance of PPE in safeguarding public health, the subsequent waste management challenges demand urgent attention. Through this study, we hope to shed light on these challenges specific to Jakarta, offering insights and avenues for further research and policy interventions. The ultimate goal is a holistic approach to PPE waste management that is environmentally sustainable and conducive to public health.

CONCLUSION

The COVID-19 pandemic necessitated a significant global increase in Personal Protective Equipment (PPE) use, resulting in unprecedented challenges related to its post-use management. This study, centered on Jakarta, a bustling urban metropolis, has elucidated the complexities and intricacies surrounding PPE waste management in the aftermath of the pandemic. Our findings underscore the emergence of two pivotal factors in PPE waste management in Jakarta: "Safe Management and Regulation" and "PPE Waste Handling." While both factors are integral to effective waste management, their nuances reveal different dimensions of the problem. Safe Management and Regulation accentuate the critical role of governmental oversight, regulations, and infrastructural provisions in assuring environmentally and medically safe disposal of PPE waste. On the other hand, PPE Waste Handling underscores the importance of grassroots-level activities, including containment, collection, public awareness campaigns, and disinfectant treatment.

Through cluster analysis, the study further segmented the population into three distinct groups: "Regulatory-Driven Safety Respondents," "Operational PPE Focus Respondents," and "Minimal Management Respondents." These clusters' varied preferences and attitudes demonstrate the multifaceted nature of PPE waste management perceptions among Jakarta's residents. A significant revelation of this research was the influence of socioeconomic variables, especially occupancy and income, on PPE waste management practices. The strong linkage between these socioeconomic aspects and PPE waste management practices offers a nuanced understanding of the issue, revealing that economic and living conditions can have a pronounced impact on individual and community behaviors regarding waste disposal.

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Knowledge and Attitude Related to Chemical Hazards Among Employees in Dental and Oral Hospital, Indonesia

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Abstract

The risk of chemical exposure in hospitals is a critical issue in the field of healthcare. Exposure to hazardous chemicals can harm the health of healthcare workers operating in hospital environments. Hospitals utilize various chemicals; exposure can occur through inhalation, ingestion, and skin absorption. This research, conducted in the year 2023, aims to assess the knowledge and attitudes of hospital employees regarding chemical hazards. The study employed a cross-sectional design with a total population sampling technique, with a sample size of 154 employees including doctors, nurses, pharmacists, laboratory technicians, radiologists, and support staff divided into three units: medical services, medical support, and management. Data analysis utilized bivariate analysis and the chi-square test for relationship testing. Multivariate analysis was also employed using logistic regression. The study's results reveal that 63% of the individuals are under 30 years of age, the majority are female (67.5%), 66.2% have less than 3 years of work experience, 62.3% work in medical service units, and 77.3% have an education level of a bachelor's degree or higher. Additionally, 52.6% of the employees are unmarried. 76% of employees exhibit a positive attitude, and 89% possess good knowledge of chemical hazards. The study demonstrates a relationship between individual characteristics (age, gender, work experience, and unit) and the level of knowledge of chemical hazards among hospital employees. The multivariate analysis revealed that age and work unit are the influential variables. This research concludes that the majority of employees at the Dental and Oral Hospital possess good knowledge of chemical hazards and can recognize chemical hazard symbols following the GHS. Furthermore, most of them exhibit a positive attitude toward preventive measures and an understanding of chemical hazards. The data analysis results indicate that there is a relationship between age, length of service, and work unit with the level of chemical hazard knowledge.

INTRODUCTION

The risk of chemicals in hospitals is a growing concern faced by healthcare professionals and supervisory authorities daily (McDiarmid, 2006). Exposure to dangerous substances in the hospital setting can lead to adverse effects on the well-being and overall quality of life of healthcare professionals. The extent of this exposure can differ greatly based on the specific clinical departments and job roles, and it may stem from a variety of sources. (Chhabra, 2016). Hospitals are places where various types of chemicals, ranging from medications to cleaning agents, are extensively used for patient care, sterilization, and facility maintenance (Charlier et al., 2021; ILO, 2021; Rutala & Weber, 2015). Exposure to chemicals within the hospital environment may manifest in

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two forms: acute poisoning or as a consequence of sustained, long-term contact with low levels of contaminants among healthcare workers. This can result in harm to the nervous system, blood-forming system, or reproductive system, and may potentially be linked to the development of cancerous conditions. (Leso et al., 2019; Stewart-Evans et al., 2013). Chemicals can enter the human body through two main mechanisms: inhalation, where substances are inhaled through the respiratory system, and ingestion, where substances are swallowed through the mouth. There are several ways for chemicals to enter the body, namely inhalation, absorption, and ingestion (ILO, 2021). Previous research explained that the prevalence of occupational respiratory symptoms of hairdressers in Palembang was 40% and they are vulnerable groups (Desheila Andarini et al, 2019). This has been attributed to their exposure to several toxic elements used in the coiffures, including sprays, hair colors, and, more importantly, bleaching agents, specifically per sulfate salts, although the mechanism of inducing occupational asthma has not been demonstrated (Desheila Andarini et al, 2019).

Ensuring the health and safety of the workplace is of paramount importance, primarily because of the elevated occurrence of illnesses and fatalities among employees exposed to workplace hazards. It's estimated that around 100,000 individuals lose their lives as a result of work-related illnesses, and approximately 400,000 new cases of occupational diseases are diagnosed annually (Amosu et al., 2011). According to the European Agency for Safety and Health at Work's 2015 report, 17% of workers in the European Union (EU) reported exposure to chemicals or substances for at least a quarter of their working time (Work, n.d.). Previous research indicates that the prevalence of exposure to asthma-inducing agents, carcinogens, and ototoxic agents reaches significant levels, namely 98.7%, 28.1%, and 7.6%, respectively. Meanwhile, exposure to anesthetic gases reaches 6.2%, and antineoplastic drugs reach 2.2%. The most prevalent exposures pertain to latex, cleaning solutions, and disinfectants within the category of asthma-inducing agents. Formaldehyde ranks as the most frequent substance responsible for exposure within the carcinogenic group, and p-xylene is commonly encountered as an ototoxic agent. Situations leading to exposure include the use of latex gloves, bleach, and chlorhexidine for cleaning, the utilization of formaldehyde as a disinfectant, both in laboratory settings and elsewhere, and the use of p-xylene within laboratory environments. (Rai et al., 2020).

Hospital employees, including doctors, nurses, laboratory technicians, and support staff, often work close to potentially hazardous chemicals (Hundhammer et al., 2023). These chemicals can pose health risks if not handled and managed properly. Therefore, it is crucial for healthcare workers to have a comprehensive understanding of the chemical hazards present in their workplaces and to be fully aware of the potential risks associated with their exposure. The objective of this study is to evaluate the comprehension and consciousness of hospital employees concerning workplace chemical hazards. By doing so, we can identify areas where additional training and safety measures may be needed to protect the health and well-being of healthcare professionals.

METHOD

In this research, a cross-sectional study design was employed to gather information through surveys conducted at a specialized dental and oral hospital, involving 154 participants with diverse roles in medical, medical support, and management. Ethical approval for this study was obtained from the ethics committee at the Faculty of Nursing and Health Sciences, University of Muhammadiyah Semarang, under reference number 228/KE/09/2023. Subsequently, interviews using a questionnaire were conducted to assess employees' knowledge and attitudes regarding chemical hazards in the workplace. The questionnaire comprised 9 questions related to chemical hazard knowledge, 11 questions assessing knowledge of chemical hazard symbols based on the Globally Harmonized System of Classification and Labeling of Chemicals (GHS), and 10 questions regarding attitudes toward chemical hazards. Employee knowledge and attitude scores were calculated, assigning equal weight (one point) to each question. The

TABLE 1. Individual Characteristics

Variable	Category	*n*	%
Age	≥ 30 years old	57	37,0
	< 30 years old	97	63,0
Gender	Female	104	67,5
	Male	50	32,5
Years of service	< 3 years	52	33,8
	≥ 3 years	102	66,2
Unit section	Medical support	20	13,0
	Medical services	96	62,3
	Management	38	24,7
Level of education	College Degree and Higher	119	77,3
	Lower than a College Degree	35	22,7
Marital status	Married	81	52,6
	Single	73	47,4
Attitudes	Positive	117	76,0
	Negative	37	24,0
Level of knowledge of chemical hazards	Good	89	57,8
	Poor	65	42,2

Source: Primary Data, 2023

data analysis in this study involved bivariate analysis to test relationships using the chi-square test. Additionally, multivariate analysis was performed using logistic regression.

RESULT AND DISCUSSION

Based on Table 1, it can be explained that the characteristics of employees in the Dental and Oral Hospital are as follows: the majority is the age of <30 years, accounting for 63%; 67.5% are female; 66.2% have worked for ≥ 3 years. The majority of Dental and Oral Hospital employees are in medical service units, accounting for 62.3%, with 77.3% holding a college degree or higher. The married status is greater at 52.6% compared to the unmarried status. The level of knowledge about chemical hazards is mostly good, at 57.8%.

Based on Table 2 it is explained that employees have a good knowledge of chemical hazards by 90.9%. Good knowledge of the effects of chemical hazards on health 82.5%, good knowledge of relevant types of PPE 74.7%, employees know. Good against hazards other than chemical hazards 72.1%, and knowing the importance of emergency exits 92.2%. In addition, employees know about Material Safety Data Sheets 51.9%, know well about workplace safety rules 79.2%, employees know well about hospitals must maintain worker health 96.8%, and employees know how to identify, handle, and address if there are leaks or chemical spills in hospitals 74.7%.

Table 2 explains that 87% of employees know the symbol of explosion risk, 90.3% know the symbol of flammable substances, 59.1% know the symbol of oxidizing agents, 58.4% know the symbol of gas under pressure, 55.2% know the symbol of toxic substances, 72.1% know the symbol of irritating the skin, 60.4% know the symbol of risk to health, 71.4% know the symbol of harmful to the environment, 64.3% know the symbol of biological hazard, and 81.8% knew the danger symbol of radioactive materials. According to ANSI Z535 and ISO 3864 signs and symbols must be understood by at least 85% and 67% of people (Jahangiri M, Omidvary F, 2018). Chemicals, as they progress through various stages from production to handling, transportation, and usage, pose a significant risk to both human health and the environment. To ensure the safe handling,

TABLE 2. Level of knowledge of chemical hazards and the symbol in the workplace

Variable	Level of knowledge of chemical hazards			
	Good		Poor	
	n	**%**	***n***	**%**
Level of knowledge of chemical hazards				
Know chemical hazards	140	90,9	14	9,1
Know the Effects of Chemical Hazards on Health	127	82,5	27	17,5
Knowing relevant personal protective equipment (PPE)	115	74,7	39	25,3
Know hazards other than chemicals	111	72,1	43	27,9
Emergency exit is important	142	92,2	12	7,8
Know the material safety data sheet	80	51,9	74	48,1
Know any safety rules in this workplace	122	79,2	32	20,8
Have information on occupational health	149	96,8	5	3,2
Knowing How to Identify, Handle, and Address Chemical Leaks or Spills in the Hospital	115	74,7	39	25,3
Level of Knowledge of Chemical Hazard Symbols				
Know Explosive Risk Symbol	134	87,0	20	13,0
Know flammable substances symbol	139	90,3	15	9,7
Know oxidizing substances symbol	91	59,1	63	40,9
Know gas under pressure symbol	90	58,4	64	41,6
Know corrosive substances symbol	85	55,2	69	44,8
Know toxic substances (acute toxicity) symbol	103	66,9	51	33,1
Know the skin irritant symbol	111	72,1	43	27,9
Know the risk to health symbol	93	60,4	61	39,6
Know harmful to the environment symbol	110	71,4	44	28,6
Know biological hazards symbol	99	64,3	55	35,7
Know the danger of radioactive materials symbol	126	81,8	28	18,2

Source: Primary Data,2023

transport, and disposal of chemicals, there is a need for global standardization in classifying these hazards. This involves categorizing chemicals based on their potential dangers and proposing uniform hazard communication elements, such as labels and safety data sheets, as outlined in the Globally Harmonized System of Classification and Labelling of Chemicals (GHS). The GHS employs consistent criteria for classifying substances and mixtures according to their health, environmental, and physical risks, as well as for communicating these hazards through labeling requirements, including hazard and prevention statements and pictograms (UNECE, 2017). The symbol is described in Figure 1.

Based on Table 3, the findings of this research reveal the patterns of employee attitudes in the Dental and Oral Hospital of Universitas Muhammadiyah Semarang regarding chemical hazards. A significant 84.4% of employees exhibit a negative attitude towards workplace statements perceived as harmful to health, and an equivalent percentage, 84.4%, holds a negative attitude regarding the utilization of Personal Protective Equipment (PPE) during chemical contact. Nevertheless, noteworthy positive attitudes are observed among the employees. Specifically, 89% express a positive attitude towards the

TABLE 3. Attitudes Towards Chemical Hazards in the Workplace

Variable	Attitudes toward chemical hazards in the workplace			
	Positive		Negative	
	n	%	*n*	%
The workplace is hazardous to health	130	15,6	24	84,4
I should use PPE during work	130	15,6	24	84,4
The employer has a responsibility to reduce exposure to hazards	137	89,0	17	11,0
All PPE has the same level of protection	129	83,8	25	16,2
I should always use PPE	145	94,2	9	5,8
PPE is relevant in the workplace	149	96,8	5	3,2
Employer provides PPE	135	87,7	19	12,3
I have undergone chemical safety training	139	90,3	15	9,7
The supervision of Personal Protective Equipment (PPE) use during contact with chemicals is in place	150	97,4	4	2,6
Feel satisfied with my work	151	98,1	3	1,9

hospital's assertion of responsibility in reducing exposure to chemical hazards. Furthermore, 83.8% maintain a positive attitude concerning the belief that all PPE provides the same level of protection. A substantial 94.2% hold a positive attitude towards compliance with work safety regulations, and an impressive 96.8% convey a positive attitude towards the appropriateness of the provided Personal Protective Equipment.

In addition, positive employee attitudes extend to various aspects, including the hospital's provision of PPE (87.7% positive attitude), employee participation in safety training related to chemicals (90.3% positive attitude), positive attitudes towards supervision regarding the use of PPE during chemical contact (97.4% positive attitude), and a remarkable 98.1% of employees expressing satisfaction with their work. These attitude patterns reflect the complex dynamics in the workplace concerning safety and the overall work environment at the Dental and Oral Hospital. While certain areas indicate noteworthy negative attitudes, the substantial positive responses underscore the effectiveness of measures taken by the hospital, such as safety training provision and regulatory compliance. These steps can be seen as indicators of awareness and commitment to creating a safe work environment and ensuring the well-being of employees.

Based on Table 4 the results of the relationship test explain that there is a relationship between age and the level of chemical hazard knowledge p = 0.001, there is a relationship between working life and the level of chemical hazard knowledge p = 0.010, and there is a relationship between the unit of work part and the level of chemical hazard knowledge p = 0.000. While the test explained that there was no relationship between sex and the level of knowledge of chemical hazards p = 0109, there was no relationship between the level of education and the level of knowledge of chemical hazards p = 1.000, and there was no relationship between marital status and the level of knowledge of chemical hazards p = 0.581. The results in Table 5 the multivariate test explained that the influential variables were age and part of the unit.

Knowledge related to chemical hazards is important for hospital employees because chemicals are commonly used in hospitals every day. Various chemicals used in the Dental and Oral Hospital include chemicals in dental casting, fixing and developing agents, chemicals used in dental health services, and chemicals used in workplace cleaning (Lajolo *et al*., 2019). The use of these chemicals can pose various

TABLE 4. Bivariate Analysis of the Relationship between Individual Characteristics and Level of Knowledge of Chemical Hazards in the Workplace

Variable	Category	Level of knowledge of chemical hazards				*p*
		Good		**Poor**		
		n	**%**	***n***	**%**	
Age	≥ 30 year	43	48,3	14	21,5	0,001*
	< 30 year	46	51,7	51	78,5	
Gender	Female	55	61,8	49	75,4	0,109
	Male	34	38,2	16	24,6	
Years of service	< 3 year	38	42,7	14	21,5	0,010*
	≥ 3 year	51	57,3	51	78,5	
Unit section	Medical support	18	20,2	2	3,1	0,000*
	Medical services	57	64,0	39	60,0	
	Management	14	15,7	24	36,9	
Level of education	College Degree and Higher	69	77,5	50	76,9	1,000
	Lower than a College Degree	20	22,5	15	23,1	
Marital status	Married	49	55,1	32	49,2	0,581
	Single	40	44,9	33	50,8	

** p<0.05 indicates a significant relationship*

Source: Primary Data, 2023

TABLE 5. The Most Related Variables

Variable	β	p
Age	1,343	0,001*
Units (2)	2,915	0,001*

Source: Primary Data, 2023

health risks. Employee knowledge regarding chemical hazards is crucial in protecting them from the chemicals used. The goal of creating the GHS is to provide the correct classification of chemicals based on their potential hazards and to convey important information about these chemicals to users through standard pictograms, signal words, hazard statements, and precautionary statements on labels and safety data sheets (Mehrifar *et al*., 2016; Rossete & Ribeiro, 2021).

RSGM has established adequate facilities for chemical management in the workplace. These facilities include secure storage areas and a controlled disposal system, equipped with standard hazard symbols. Additional amenities such as eye washers and spill kits have been introduced to provide a swift response to chemical emergencies, especially in cases involving eye contact or chemical spills. To ensure employee safety, RSUGM has implemented stringent chemical safety policies. Employees undergo regular training covering the understanding of hazard symbols, the use of personal protective equipment (PPE), and procedures for the prevention and emergency response related to chemical substances. Storage policies governing secure and locked storage areas further support the creation of a chemical-safe work environment, contributing to a better understanding of chemical risks and the necessary safety measures among employees.

Based on the research results, it is explained that 57.8% of employees have good knowledge of chemical hazards. Most workers

are aware of chemical hazard symbols that are in line with the GHS. Additionally, the majority of employees have a positive attitude towards prevention and other information related to chemical hazards. According to the relationship test results, there is a relationship between age and knowledge of chemical hazards in the hospital, with a p-value of 0.001. The employees' awareness of chemical hazards is positively influenced by the hospital's commitment to enhancing workplace safety. This commitment is reflected in the hospital's proactive measures, including the formulation of policies governing the use of chemicals and the implementation of regular training sessions, conducted at least annually, to prevent accidents in the workplace. The older a person is, the more likely they are to have a greater willingness to learn and acquire information compared to younger individuals (Tsitsimpikou *et al*., 2021). Previous research has also indicated that laboratory workers aged 31-40 years, constituting 51.7%, have good knowledge of chemical hazards compared to those under 30 years old (Papadopoli *et al*., 2020).

Research has linked exposure to hazardous chemicals in the workplace to both mild and severe acute effects, such as skin rashes, eye irritation, or burns, as well as severe impacts, including adverse reproductive outcomes (including infertility, spontaneous abortion, and congenital malformations), and possibly leukemia and other cancers (Fransman *et al*., 2014; Lawson *et al*., 2012). Whereas in research or healthcare laboratories, attention has been particularly devoted to biological hazards (Papadopoli *et al*., 2019). Gender does not show a relationship with knowledge of chemical hazards, with a p-value of 0.109. Of those, 61.8% of female employees have good knowledge of chemical hazards. Women may be more vulnerable to pesticides than men due to their greater sensitivity related to physical characteristics, such as a higher percentage of body fat that allows for the accumulation of pesticides, hormonal-sensitive tissues, and their productive age (Chen *et al*., 2018; Silvia *et al*., 2020). Despite the theory, both men and women need to acquire this knowledge. Therefore, knowledge about chemical hazards is essential for both genders. The relationship test results explain that there is a relationship between length of employment and knowledge of chemical hazards, with a p-value of 0.010. Workers with more than 3 years of experience are more likely to have good knowledge of chemical hazards, with a rate of 57.3%. The longer a person works, the longer their exposure to a chemical hazard accumulates. Health risks from chemicals depend on several factors, including the intrinsic characteristics of the substance and the duration of exposure (Videnros *et al*., 2020). Regular training and knowledge enhancement are important to improve and refresh employee knowledge regarding chemical hazards.

There is a relationship between the unit department and knowledge of chemical hazards, with a p-value of 0.000*. The hospital departments in this study are divided into three categories: medical services, medical support, and management. Employees in hospitals have varying levels of exposure to chemical hazards, whether in medical services, medical support, or management. In hospitals, not all employees are exposed to the same level of chemical hazards. There are differences in exposure levels, and often, the most exposed employees are doctors, nurses, laboratory technicians, and pharmacists (Papadopoli *et al*., 2020; Rai *et al*., 2021; Zhang *et al*., 2016). This is due to their primary roles in providing healthcare to patients and performing medical procedures that involve the use of specific chemicals. For example, doctors and nurses often deal with medications and medical procedures that use various types of chemicals. Laboratory technicians and pharmacists also routinely interact with chemicals for laboratory analysis and medication preparation.

This study is not consistent with previous research that found a significant relationship between the level of education of nurses and their overall knowledge of health and safety measures (Ahmed & Shareef, 2019). There is no relationship between education level and knowledge of chemical hazards in this study, which does not align with previous research that showed a relationship between education level and knowledge of workplace hazards (Usman N O, 2021). This is due to other factors, such as a higher percentage of

employees with a bachelor's degree or higher (77.3%) compared to those with an education level below a bachelor's degree (22.7%). Marital status does not show a relationship with employee knowledge of chemical hazards. This result is in line with previous research conducted on janitorial staff measuring their knowledge of physical environmental hazards in hospitals (Ilesanmi et al., 2015). Marital status is a personal condition that indicates whether someone is married or unmarried. On the other hand, knowledge of chemical hazards in hospitals among employees relates to an individual's understanding of potential hazards in their workplace, particularly those related to the chemicals used in medical treatment or hospital care.

Conclusion

This study explains that as many as 57.8% of employees have good knowledge related to chemical hazards. Most workers are aware of chemical hazards and chemical hazard symbols that comply with GHS. Most employee attitudes lead to a 76% positive attitude regarding prevention and other information related to chemical hazards. The results of the relationship test explained that there was a relationship between age, length of service, and part units with knowledge of chemical hazards in Dental and Oral Hospital employees. The importance of training related to chemical hazard knowledge is provided to all employees regularly.

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Perceptions of Covid-19 Vaccines among Students at DEBESMSCAT-Cawayan Campus, Cawayan, Masbate, Philippines

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Abstract

This study investigated students' perceptions at DEBESMSCAT Cawayan Campus regarding COVID-19 vaccines. A descriptive survey method was used, and data were collected using a questionnaire. The findings revealed that most students at DEBESMSCAT Cawayan Campus had received COVID-19 vaccinations, falling short of the targeted vaccination rate of 70% mandated by the Commission on Higher Education (CHED) for the resumption of face-to-face classes. Some unvaccinated students expressed willingness to receive the vaccine. Overall, the COVID-19 vaccine was perceived as a crucial tool in preventing and protecting individuals from the virus, ensuring the safety of students' health in the face of the COVID-19 pandemic. However, a portion of students harbored doubts about the vaccine's Efficacy in protecting against the virus. The study identified common reasons behind vaccine hesitancy among students, including fear of potential side effects, lack of trust in the vaccine's safety and effectiveness, and exposure to misinformation about the vaccine. These findings highlight the importance of addressing the concerns of hesitant students through educational initiatives and awareness campaigns emphasizing the benefits of vaccination. Such efforts will play a vital role in promoting vaccine acceptance and ensuring the well-being of students and the broader community in the face of the ongoing pandemic. Further research is warranted to explore the underlying factors influencing students' decision-making processes regarding vaccination.

Introduction

The COVID-19 pandemic has had far-reaching consequences globally, causing significant morbidity and mortality (Smith et al., 2020). In response to this unprecedented crisis, researchers have swiftly developed vaccines that effectively prevent severe illness and death associated with COVID-19 (Polack et al., 2020; Voysey et al., 2021). However, despite the availability of vaccines, vaccine hesitancy remains a challenge, influenced by factors such as concerns about side effects, lack of trust, and misinformation (Fisher et al., 2021; Freeman et al., 2020). The COVID-19 pandemic has prompted the implementation of various preventive measures, including social distancing, personal hygiene, and quarantine protocols, to mitigate the spread of the virus (Ahmed, 2020; Arya, 2020). These measures have been significant in low-income countries, where limited resources and weaker health systems make pandemic control more challenging (Vieira et al., 2020). Despite the challenges, these measures have effectively reduced the spread of the virus and highlighted the need for global collective action in combating the pandemic. These measures have had significant socioeconomic impacts, with businesses forced to close, increasing unemployment and dependence on government support (Deb et al., 2020). In the educational sphere, students have had to adapt to new modes of learning, such as online and modular approaches, relying on electronic

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devices.

Developing and deploying effective COVID-19 vaccines have become crucial in ending the pandemic. These vaccines have undergone rigorous testing to ensure their safety and Efficacy in combating the virus (Bhartiya et al., 2021). However, vaccines' rapid development and deployment have also raised doubts and misconceptions among individuals. In this context, this study aims to explore the perceptions and opinions of students at the DEBESMSCAT Cawayan Campus regarding the COVID-19 vaccine. Vaccines have been pivotal in controlling pandemics, including influenza and other infectious diseases (Pogue et al., 2020). The expedited development of COVID-19 vaccines, achieved within nine months of virus identification, represents an unprecedented achievement through political will, global collaboration, and favorable circumstances (Bhartiya et al., 2021). However, this accelerated timeline has contributed to doubts and misconceptions that warrant investigation.

The objective of this study is to examine the perceptions of students at the DEBESMSCAT Cawayan Campus concerning the COVID-19 vaccine. Specifically, the study aims to determine the reasons behind vaccine hesitancy among certain students. By addressing these objectives, this study intends to contribute to the existing body of knowledge on vaccine perceptions and inform the development of effective strategies to address concerns related to COVID-19 vaccination. As the COVID-19 vaccination program gains momentum, understanding the factors influencing vaccine acceptance and hesitancy is essential for ensuring its successful implementation. The findings of this study will provide valuable insights into the attitudes and concerns of students, who represent a significant demographic in the population, contributing to evidence-based strategies for promoting vaccine acceptance and addressing hesitancy.

Method

For this study, a descriptive research design was used to gather information about the perception of the COVID-19 vaccine among students at the DEBESMSCAT Cawayan Campus. Descriptive research is suitable for this study as it aims to describe and understand the students' perceptions without manipulating or controlling variables. A convenience sampling technique was employed to select the sample for this study. Convenience sampling involves selecting participants based on their availability and willingness to participate rather than using a random selection process. In this case, the researchers selected students who were readily accessible and willing to participate. The total number of respondents targeted for this study was 150 students. Since convenience sampling does not ensure representativeness, the findings of this study may be limited to the characteristics of the students who participated and may not be generalizable to the entire population of the DEBESMSCAT Cawayan Campus.

This study's primary data collection method was a questionnaire administered through Google Forms. The researchers adopted Mant et al.'s survey questionnaire (2021), which consisted of questions related to perceptions of the COVID-19 vaccine. The questionnaire was designed to be easily understandable and accessible to the students. To distribute the questionnaire, the researchers shared the link to the survey questionnaire on social media platforms such as Facebook and Messenger. Specifically, the link was shared in the Group Chat of the students of DEBESMSCAT Cawayan Campus. This method allowed for convenient and efficient data collection, considering the limitations posed by the ongoing pandemic.

The collected data will be analyzed using descriptive statistics. The researchers aim to calculate the mean, frequency, and percentage of students' perception of the COVID-19 vaccine at the DEBESMSCAT Cawayan Campus. To calculate the mean, the formula $\bar{x} = \sum fx/N$ was utilized, where $\bar{x}$ represents the mean, $\sum fx$ denotes the sum of all frequencies, and N represents the total number of observations. The researchers also computed the percentage of each perception using the formula $\% = \sum fx/N \times 100\%$, where % represents the total percentage, $\sum fx$ is the sum of all frequencies, and N is the total number of respondents. Based on the convenience sample obtained, these analytical techniques will provide insights into the students' perception of

the COVID-19 vaccine at the DEBESMSCAT Cawayan Campus. However, it is essential to acknowledge the limitations of convenience sampling and interpret the findings cautiously, considering the potential bias the sampling method introduces.

Results and Discussion

The table analyzes vaccinated and unvaccinated students at the DEBESMSCAT Cawayan Campus. It provides insights into the student's vaccination status, preferred vaccines, experienced side effects, and willingness to be vaccinated. The findings shed light on the students' perceptions and choices regarding COVID-19 vaccination. Out of the 150 respondents, 55.3% reported being vaccinated, while 2% indicated being partially vaccinated. In contrast, 42.7% of the students said they had not received the vaccine yet. These numbers reflect the current vaccination status of students at the DEBESMSCAT Cawayan Campus. Notably, the mass vaccination program in the Philippines is expected to increase the number

Table 1. Analysis of Vaccinated and Unvaccinated Students

Questions	Frequency	Percentage
1. Are you vaccinated?		
Yes	83	55.3
Partially vaccinated	3	2.0
Not yet vaccinated	64	42.7
2. What was your preferred vaccine?		
Pfizer	32	21.3
Sinovac	32	21.3
Johnson & Johnson	13	8.7
Moderna	7	4.7
AstraZeneca	2	1.3
3. What were the side effects?		
Fever	30	20
Swelling	6	4
Headache	30	20
Dizziness	6	4
Feeling weakness	36	24
Migraine	1	0.7
Coldness	1	0.7
Sleepy	1	0.7
None	15	10
4. Are you willing to be vaccinated?		
Yes	109	72.7
No	41	27.3
5. What was your preferred vaccine?		
Pfizer	37	24.6
Sinovac	28	18.7
Johnson & Johnson	16	10.7
Moderna	9	6
AstraZeneca	3	2

of vaccinated individuals.

The table reveals the students' preferred vaccines among those who responded. Pfizer and Sinovac emerged as the top choices, receiving 21.3% of the responses. Johnson & Johnson followed with 8.7%, Moderna with 4.7%, and AstraZeneca with 1.3% of the responses. This preference aligns with a survey conducted in the Philippines, where Sinovac Biotech and Pfizer-BioNTech were the most recommended COVID-19 vaccine brands (Liu et al., 2021). Sinovac, a Chinese vaccine, accounted for most of the vaccines received in the country then. Regarding the side effects experienced, the table shows that fever and headache were the most commonly reported, affecting 20% of the respondents, and feeling weak after vaccination was experienced by 24% of the students. At the same time, 4% reported swelling at the injection site and dizziness. A smaller percentage of students experienced migraine, coldness, and sleepiness. Notably, 10% of the respondents reported no adverse side effects. It is essential to acknowledge that most of the reported side effects were minor and short-lived, lasting only a few days (Kaur et al., 2021). These findings provide insights into the experiences of vaccinated students at the DEBESMSCAT Cawayan Campus.

Results showed that over half of the students (42.70%) remained unvaccinated, which can be related to vaccination reluctance. Concerns about vaccination safety continue to be among the leading causes of vaccine reluctance. Multiple studies confirm the conclusions of this study, indicating that persons who are hesitant to acquire a COVID-19 vaccination prioritize safety (Brandt et al., 2021). Some issues with the COVID-19 vaccine were its novelty and quick development (Bell et al., 2020). greater vaccine effectiveness has also been linked to an increase in intention to get vaccinated against COVID-19, with the projected advantage of greater Efficacy serving as a significant positive predictor of intent to be vaccinated using a COVID-19 vaccine (Kaplan et al., 2019). Consequently, safety and effectiveness concerns are significant, independent predictors of vaccination hesitation.

Concerns with COVID-19 vaccinations are widespread (Lin et al., 2020). Despite vaccination reluctance, vaccine demand grows over time, with significant variations in vaccine access among and between countries (Kothari et al., 2021). Even though the fundamental reasons for vaccination hesitancy are frequently context-specific, several experts concur that trust and confidence in the COVID-19 vaccine are crucial in promoting vaccine adoption (King et al., 2021). By Palgi et al. (2021), vaccination reluctance predicts a quantitative and substantial fraction of COVID-19 vaccine side effects, indicating that side effects in vaccinated persons include a psychosomatic nocebo component. The data also demonstrated varied risk levels of subsequent side effects, indicating the necessity for tailored public health messaging.

Despite the potential adverse effects for the public, Merkley and Loewen (2021) found that consumers ranked the brand as the most critical feature, notably Pfizer and Moderna, amongst other brands. Furthermore, vaccines with an effectiveness of 90% or above were chosen, with one out of every 100 patients reporting adverse effects. When selecting a COVID-19 vaccine, we found that safety and Efficacy are the most important considerations. Interestingly, consumers' preferences for accessible vaccinations were shown to be driven by their knowledge and comprehension of the COVID-19 vaccine. Meanwhile, weakness, fever, and headache were discovered to be the most prevalent negative consequences of post-Covid 19 vaccination, which was validated by Hatmal et al. (2021), who investigated a broad spectrum of probable post-vaccination side effects independent of the type of COVID-19 vaccine received. The most prevalent adverse effects included fatigue/tiredness, injection site discomfort and swelling, headache, drowsiness and lethargy, chills, myalgia, joint pain, and fever.

The quick creation of COVID-19 vaccines due to the pandemic's urgency, technology improvements, and current vaccine candidates (Ball, 2021) has led to several rumors. Vaccine rumors are pervasive during the post-vaccination interval. A small fraction of individuals indicated interest in getting involved in vaccination experiments (Abu-Farha et al., 2020). Another study

discovered that COVID-19 disinformation and conspiracy theories have a detrimental effect on vaccination reluctance. This might be a pivotal hurdle to effectively managing the epidemic. Vaccine hesitancy was associated with a reliance on social media as the primary source of information for COVID-19 vaccines (Sallam et al., 2021). As a result, because multiple vaccines are being utilized in the Philippines' national immunization program, there is an urgent need to examine adverse reactions and perceptions following vaccination to combat vaccine hesitancy and myths.

The table indicates that 15.3% of the students who have not yet been vaccinated expressed their willingness to receive the vaccine. On the other hand, 27.3% of the students said they were not willing to be vaccinated. These findings are consistent with a study conducted in Kuwait, where approximately 53.1% of the participants expressed willingness to accept a COVID-19 vaccine (Alqudeimat et al., 2021). Factors such as gender, perception of vaccine health hazards, previous influenza vaccination, and self-perceived risk of infection influenced individuals' willingness to be vaccinated. Despite the adverse effects of COVID-19 vaccines, it was shown that practically all responders were willing to be immunized. This finding is reinforced by Caple et al. (2021), who found that most respondents (62.5%) were willing to get vaccinated against COVID-19. To reduce the enormous health, social, and economic harm of COVID-19, the Philippines is launching a nationwide immunization effort to combat the worldwide pandemic. Caple et al. investigated COVID-19 immunization intent in the country by launching a national open-access online survey two months before the national vaccination campaign began. According to the Health Belief Model (HBM), individuals with enough motivation and cues to act are more likely to embrace disease-preventative activities and accept medical treatments such as immunizations.

Finally, results revealed significant vaccine brand preference among Filipino student respondents. Most participants were 'willing' (72.7%) to be vaccinated using a COVID-19 vaccine made in the USA. These findings mirror those reported by Caple et al. (2021) already described above, which showed that most Filipinos who were opting to get vaccinated preferred the Pfizer vaccine. In contrast, most participants indicated they needed vaccination (64 or 42.7%). Regardless of the reasons, this vaccine preference has to be managed by the national government to prevent Filipinos from unnecessarily delaying immunization to obtain their preferred vaccine brand.

Among the students who expressed willingness to be vaccinated, Pfizer was the most preferred vaccine, with 24.6% of the responses. Sinovac followed with 18.7%, Johnson & Johnson with 10.7%, Moderna with 6.0%, and AstraZeneca with 2.0% of the responses. These preferences align with a survey in the Philippines, where Sinovac and Pfizer were the top choices (Social Weather Stations, 2021). These results highlight the students' preferences regarding vaccine brands if allowed to choose. According to the study, many pupils (42.7%) remain unvaccinated against COVID-19 and are still hesitant to get immunized (27.3%). The study identified vaccine hesitancy, or a reluctance to vaccinate, as one of the primary reasons respondents did not get vaccinated, despite evidence that immunizations are vital in enhancing public health outcomes. With this inadequate healthcare and other medical problems, the healthcare system is unlikely to satisfy the needs of people living within its capabilities. The epidemic further strained countries, which has overloaded several healthcare systems.

Table 2 presents the students' diagnosis, symptoms, vaccine hesitancy, influences, perceptions, and realizations. Of the 150 responses received, four students (2.7%) from DEBESMSCAT Cawayan Campus reported being diagnosed with COVID-19, while 146 students (97.3%) stated they had not been diagnosed. The results demonstrated a downward trend in the proportion of confirmed COVID-19 cases. It might be a reason that prevents students from being immunized. Caple et al. (2021) discovered that Filipinos' tolerance to the COVID-19 vaccine led to brand preference. They had little interest in immunizations for personal reasons, claiming ineffectiveness and severe side effects. In the

words of Fisher et al. (2020), refusal to receive vaccines can be linked to anti-vaccine views, beliefs, feelings, dislikeness, desire, or faith. Additional immunization difficulties led some to assume that the COVID-19 vaccine had been ineffective.

Regarding the symptoms experienced by the students diagnosed with COVID-19, the table reveals that 18.0% reported having a fever, 10.7% experienced a loss of taste and smell, and 3.3% had shortness of breath. These symptoms align with typical manifestations of COVID-19 infection reported in various studies and highlight the importance of identifying and monitoring such symptoms for early detection and appropriate management. The COVID-19 pandemic remains a significant global concern, with an enormous impact on various aspects of life. To effectively reduce the transmission of COVID-19, it is crucial to develop efficient treatments, and vaccination has been proven to be a routine and practical approach to controlling infectious diseases (Hajj et al., 2015).

According to Santos et al. (2021), COVID-19 patients may have a quick loss of smell, usually accompanied by a loss of taste. These symptoms may occur without a runny or stuffy nose. Among individuals who tested positive for COVID-19, 68% lost fragrance and 71% lost taste. Other self-reported symptoms associated with a positive COVID-19 test were fatigue (81%), fever (70%), fatigue or arthritis (63%), diarrhea (48%), and nausea (27%). The most common symptoms in the initial patients were fever, cough, myalgia, and difficulty breathing (Jotz et al., 2020). However, when the pandemic subsided, additional signs and symptoms became accepted as normal clinical presentations of the disease, prompting the community to discontinue vaccination. However, one unique symptom began to occur in a growing percentage of patients: smell and taste dysfunction, characterized by a loss of responsiveness to taste and smell.

Most learners, a unique group of young individuals, were unwilling to get vaccinated owing to concerns about the security and effectiveness of vaccinations, considering their speed and technology of manufacture (Mant et al., 2021). As a consequence, an individual under the age of 25 was determined as a super transmitter of the COVID-19 virus: well-educated, unvaccinated, and unwilling to follow physical distance and protective mask guidelines. Finally, students, the study's respondents, although being a more well-informed demographic group, may still have health literacy gaps, which is concerning as students assume greater responsibility for their well-being and make autonomous health decisions.

The most commonly cited reason was that their parents would not allow them to get the vaccine, accounting for 28.0% of the respondents. Other reasons included concerns about their immune system not being ready (27.3%), potential adverse side effects (24.0%), fear of death (8.0%), allergies (8.7%), and being diabetic (0.7%). Vaccine reluctance has hampered COVID-19 adult immunization initiatives in numerous countries. According to this survey, data on reluctance among children and adolescents is mainly limited to the parental perspective (28.0%). Vaccination reluctance trends are continually changing, even within countries, and are impacted by vaccination safety reports, the variation of coronavirus that may be circulating, and current infection rates. Understandably, investigations of COVID-19 vaccination reluctance have primarily focused on adults, with few data on children and adolescents. This suggested that the reasons for avoiding immunization were due to students' misinformation regarding the advantageous effects of the COVID-19 vaccine.

Others believe that mistrust of authorities, political interests, and pharmaceutical business lobbyists played a significant influence. Users expressed concerns about the authenticity and integrity of information and the objectives of certain persons, organizations, or institutions in advocating vaccination, citing prior wrongdoing. Individuals, for example, believed that the pharmaceutical industry's sole motivation for promoting COVID-19 immunization was financial benefit. Furthermore, several students stated that their immune systems were insufficient for dealing with a potential infection and did not require vaccination. Users were also concerned about probable adverse effects and vaccine-related

Table 2. Diagnosis, Symptoms, Vaccine Hesitancy, Influences, Perceptions, and Realizations

Questions	Frequency	Percentage
1. Are you diagnosed with COVID-19?		
Yes	4	2.7
No	146	97.3
2. What were the symptoms you experienced?		
Fever	27	18.0
Loss of taste and smell	16	10.7
Shortness of breath	5	3.3
3. What are your reasons for not getting the COVID-19 vaccine?		
Might have negative side effect	36	24.0
My immune system might not be ready	41	27.3
I might die	12	8.0
My parents will not allow me to get the vaccine	42	28.0
Allergy	13	8.7
Diabetic	1	0.7
4. What are your reasons for not getting the COVID-19 vaccine?		
Travel pass	36	24.0
Health immunization	41	27.3
Mandated by the LGU office	12	8.0
To attend face-to-face classes	42	28.0
For my safety	1	0.7
5. Who influenced you to be vaccinated?		
Neighbor	9	6.0
Family	58	38.7
News from TV/Radio	20	13.3
Health personnel	34	22.7
Friends	1	0.7
Self-motivation	3	2.0
Church mate	3	2.0
Teachers	1	0.7
6. What are your perceptions on the COVID-19 vaccine before getting vaccinated?		
It contains microchip	13	6.0
Not safe and can cause death	62	41.3
It is still on the test because it was developed quickly	55	36.7
Can create variant or mutant	14	9.3
Can cause people to be magnetic	8	5.3
Vaccine is safe	1	0.7

7. What are your realizations on the COVID-19 vaccine after getting vaccinated?		
It prevents me from getting the COVID-19	48	32.0
Helps me to boost my immune system	39	26.0
Helps not to be afraid to go to places with lots of people	51	34.0
It is not good for those who have not felt good about their health	1	0.7
None	24	16.0

harm, leading to declining immunization.

In general, parents were opposed to their children's COVID-19 vaccine. Thus, concerted education to reassure concerned parents about the vaccine's safety is critical to increasing immunization coverage. The most straightforward predictors of parents' COVID-19 vaccine rejection for children are a lack of assurance regarding the vaccine's safety and effectiveness, followed by a lack of trust in the government, beliefs that children are immune to the illness, and a lack of family and community backing for COVID-19 vaccination (Karlsson et al., 2021). Positive sentiments regarding vaccination experiences or results may also influence parents' desire to immunize their children. Demographic factors have also been linked to parental COVID-19 vaccination uptake. These include better parental financial status, educational attainment, and whether the parent has gotten the COVID-19 immunization (Szilagyi et al., 2021).

The findings indicated that many parents are unwilling to immunize their young ones, even if they have taken it. Parents' rejection of their children's vaccinations significantly impacted their vaccine reluctance. As a result of gender, moms had a statistically significant impact on vaccination hesitation compared to dads. As a result, moms should increase their attitude toward their children's COVID-19 vaccinations. On the other hand, causes of vaccine hesitancy include disinformation about vaccine side effects. 24.0% of students expressed more dread of potential vaccine side effects than contracting COVID-19, which can be explained by social media and personal experiences from social circle members that bolstered these fears.

The finding that parents' permission plays a significant role in the decision not to get vaccinated highlights the importance of parental influence on the vaccination choices of students. It suggested that interventions and educational campaigns should target the students and engage parents in discussions to address their concerns and provide accurate information about the vaccine's safety and Efficacy. Interestingly, the concern about the readiness of the immune system was another prevalent reason among the participants. This suggests a need for targeted educational efforts to dispel misconceptions and provide evidence-based information about the vaccine's ability to protect individuals with different immune statuses. A notable proportion of the participants expressed the fear of potential adverse side effects and the fear of death. These concerns may arise from misinformation or sensationalized reports on social media or other sources. Efforts to enhance vaccine literacy and provide clear, accessible information about the vaccine's safety profile can help alleviate such fears and promote informed decision-making.

It is worth noting that a small percentage of participants mentioned allergies and being diabetic as reasons for not getting vaccinated. This highlights the importance of addressing specific health concerns and providing tailored guidance for individuals with pre-existing conditions. Healthcare professionals and vaccination campaigns should emphasize the importance of consulting with medical experts to assess individual risk factors and address concerns related to allergies or other medical conditions. Comparing these findings with previous studies, a study titled "College Students' COVID-19 Vaccine Hesitancy" reported that 23.5% of respondents responded negatively to vaccinating (Jain et al., 2021). The higher proportion of vaccine hesitancy observed in our study (44.0% comprising

negative responses) suggests that specific factors, such as parental influence and concerns about immune readiness, play a significant role among the student population at the DEBESMSCAT Cawayan Campus.

Another study titled "COVID-19 Knowledge, attitude, and Practice among Medical Undergraduate Students in Baghdad City" found that students had a high level of overall awareness (91.8%) regarding COVID-19, with social media being the primary source of knowledge (Singh et al., 2020). These findings highlight the need to utilize social media platforms effectively to provide accurate and reliable information about the COVID-19 vaccine, address concerns, and counter misinformation. The findings emphasize the influence of parental permission, concerns about immune readiness, potential side effects, fear of death, allergies, and pre-existing medical conditions. Future interventions and educational campaigns should address these concerns and provide accurate information to increase student vaccine acceptance. Additionally, leveraging social media to disseminate reliable information can be crucial in promoting vaccine literacy and combating vaccine hesitancy. The table presents the various reasons reported by the respondents for getting vaccinated. The most commonly cited reason was "health immunization," accounting for 45.3% of the responses. A significant proportion, 24.7%, mentioned that obtaining a travel pass was their primary motivation for vaccination. Additionally, 12.7% indicated that they perceived it as a requirement mandated by the LGU office. A smaller percentage of respondents, 4.7%, expressed their desire to be vaccinated in preparation for attending face-to-face classes. Lastly, only 2.7% mentioned their safety as the driving factor behind their decision to receive the COVID-19 vaccine.

Comparing these findings with a study conducted by Mant et al. (2021) on the perceptions of the COVID-19 vaccine among students in some Canadian universities, it is evident that most students in both contexts express an intention to get vaccinated. However, it is essential to note that there may be nuanced concerns regarding the Efficacy and safety of the vaccine among this student population, which public health authorities should consider as they facilitate vaccine distribution and education. Among the participants, nine individuals (6.0%) stated that their neighbors influenced them, while the majority, 58 participants (38.7%), mentioned that their families played a significant role in their decision to get vaccinated. Approximately 13.3% of respondents reported being influenced by news from TV or radio, while 22.7% mentioned that health personnel influenced their vaccination decision. Some respondents indicated being influenced by their self-motivation, churchmates (2.0%), friends, and teachers (0.7%).

The findings highlight the diverse range of sources individuals rely on for information regarding COVID-19, including television, radio, newspapers, social media, friends, coworkers, healthcare practitioners, scientists, and governments. These sources of information hold the power to shape individuals' acceptance or rejection of COVID-19 vaccines. Therefore, it is crucial to effectively communicate transparent and trustworthy information about vaccine safety and Efficacy to build public trust, especially among those who may harbor concerns or hesitations towards vaccines (Siegrist & Zingg, 2014). The influence of family members emerges as a significant factor in the decision-making process, with 38.7% of respondents attributing their vaccination decision to their families. This underscores the role of interpersonal relationships and support networks in influencing individuals' attitudes toward vaccination. Future efforts to promote vaccine acceptance should consider targeting family units and engaging with family members to address concerns or misinformation.

The influence of health personnel is also noteworthy, as 22.7% of respondents cited them as influencers. This finding highlights the importance of healthcare professionals in providing accurate and reliable information about COVID-19 vaccines. Strengthening communication channels between health personnel and the public can enhance vaccine acceptance and dispel misconceptions. It is worth noting that other sources of influence, such as friends, self-motivation, churchmates, and teachers, had a minor impact on the

decision to get vaccinated. However, regardless of its magnitude, every influence contributes to the overall landscape of vaccine acceptance.

The table showcases the frequencies and percentages of different perceptions among the respondents. Before getting vaccinated, many respondents held various concerns and misconceptions about the COVID-19 vaccine. Among the respondents, 6.0% believed that the vaccine contains a microchip, 41.3% perceived it as unsafe and potentially causing death, 36.7% thought that the vaccine was still being tested due to its rapid development, 9.3% believed it could create variants or mutants, 5.3% said it could cause people to become magnetic, and only 0.7% considered the vaccine to be safe.

These findings align with previous research conducted by Nurul Azmawati Mohamed et al., which revealed that respondents with positive perceptions about the protective nature of vaccines were nine times less likely to refuse vaccination for their children due to negative media exposure. This suggests that addressing misconceptions and providing accurate information about the COVID-19 vaccine can positively influence vaccination decisions. After receiving the COVID-19 vaccine, respondents reported a shift in their perceptions. Among those who responded, 32.0% stated that the vaccine prevented them from contracting COVID-19, 26.0% believed that it helped boost their immune system, 34.0% felt less fearful about going to crowded places, and only 0.7% expressed concerns about its effects on individuals not feeling well health-wise. Cristie (2021) has highlighted the effectiveness of vaccines in strengthening the body's natural defenses and reducing the risk of severe illness and death. While it is important to note that no vaccine provides 100% immunity, vaccinated individuals are more protected and are likely to experience milder symptoms if they contract the disease. It aligns with the WHO's statement that vaccination is a simple, safe, and effective strategy to defend against hazardous diseases before contracting them.

Conclusion

The study revealed that many students have not yet received the COVID-19 vaccine. It is a cause for concern, as vaccination is one of the most effective ways to prevent the spread of the virus. There are many reasons why students may have yet to be vaccinated, including concerns about parental permission, immune system readiness, and potential side effects. However, some motivations for vaccination include health immunization, travel pass acquisition, and compliance with LGU office requirements.

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Mosquito Nets Installation in Livestock Sheds as a Basis of Accelerated Malaria Vector Control Development

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Abstract

The decrease in the incidence of malaria has only reached 66.67%, from the target of 90% in 2030; *Anopheles spp* mosquitoes are zoophilic, So mosquitoes are more numerous in cattle sheds. The research is intended to change vector control policies by considering livestock sheds to accelerate malaria elimination. This study was a Pre-experiment with the design of the static group comparison, mosquito capture used a *spot survey* of six houses; three houses have goat sheds and three cowshed houses; mosquito catching with WHO guidelines that one house there are two catchers; likewise in cattle sheds. Arrests were made *all night* from 06.00 pm-06.00 am. The results, the ratio of *Anopheles spp* mosquitoes caught in livestock sheds is 36.5 times more than at home; while the vector is 2.5 more. The results of the statistical analysis are significant (p=0,000). Livestock sheds can be used as an alternative to malaria vector control to accelerate the decrease in density so that the incidence of malaria also decreases.

Introduction

Malaria from 2015 to 2022 has decreased from around 300 to below 100 per 1000 population (WHO, 2022). This decrease is due to two controls, namely malaria treatment and vector control. The treatment used using artemisinin-based combination therapy (ACT) has a significant impact (Tse, Korsik, and Todd, 2019), vector control is done with indoor residual spraying (IRS) (Makhanthisa et al., 2022) and insecticide-treated nets (ITN) installed on all beds of residents in malaria-endemic areas (Mrema et al., 2023). ITN is a risk factor for malaria cases (Sutarto et al., 2019). Another thing to look out for is migration surveillance (Ahmad, Isworo and Indriani, 2018).

The WHO target of elimination by 2030 is to reduce the incidence by 90% from 2015, currently worldwide can reduce 66.67%. Control of Anopheles spp. mosquitoes through these two programs are less effective, this is because mosquitoes are zoophilic (Mrema et al., 2023), and mostly feed on the blood of warm-blooded animals, especially mammals, mosquitoes are attracted to the results of the body's metabolism, namely in the form of CO2 and odor (Alonso San Alberto et al., 2022). Efforts to reduce the density of Anopheles spp. mosquitoes are the keywords for the success of breaking the chain of malaria transmission because these mosquitoes are the main vector of transmission. Controlling mosquito density up to 90% can reduce the number of bites from 300/year to 30/year so that the prevalence of malaria decreases (Manson, 2009). Vector

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control efforts must be maximized, to reduce the incidence of malaria (Kouassi et al., 2023). Purworejo Regency in 2022 is the only one that has not been eliminated, although it can reduce cases in 2015 by 1400 cases, and in 2020 there were no cases of malaria, in 2021 Purworejo Regency saw a spike in cases. The largest distribution in the Loano sub-district was 77 cases, and in Krajan sub-district 57% or 44 cases, the results of epidemiological investigations were known to be an index of indigenous cases with P. falciparum and on September 25 there were 14 cases in one night.

Research on installing insecticide-treated mosquito nets in livestock sheds has not yet made program recommendations to be implemented. This research is a preliminary study to determine two basic things, namely whether there are more livestock pens than at home and which two models of mosquito nets are better for getting more mosquitoes. The results of this research are the academic basis for the development of the installation of insecticide-treated mosquito nets in livestock sheds. The purpose of this study to prove the number of mosquitoes caught based on location, namely in houses and livestock sheds, and the best mosquito net model preferred by mosquitoes perched, secondly proves the cluster model between breeding, resting, and feeding no more than 400m.

Methods

This study was used to determine the best model of mosquito nets, as a new model of livestock cage-based malaria control, compared to previously based at home. Mosquitoes move freely in nature, so getting vectors when catching mosquitoes cannot be done randomly, but follows WHO standard procedures. This is intended to obtain vectors, so theoretical bases and field data are needed so that the chances of obtaining malaria vectors are greater. Two criteria of the arrest station include: first, Malaria sufferers are in groups. The results of the study of malaria cases in Krajan hamlet were 57% or 44 cases and on September 25 there were 14 cases in one night, within a radius of less than 400 m; second, The existence of livestock sheds and breeding places, the transmission model is in the form of clusters (Katale and Gemechu, 2023).

Method of catching mosquitoes Anopheles spp. As for the method of catching mosquitoes Anopheles spp., there are three criteria, namely: first, the catching procedure used WHO recommendations, there were six mosquito catchers spread over three houses; Each of the two catchers lasted for one hour with details of 40 minutes inside the house, 10 minutes of moving and 10 minutes outside the house. The other two people in the cattle shed; second, the method of catching with spot surveys is all-night arrest starting at 06.00 pm to 06.00 am. This method complements routine observations and obtains a representation of the presence of mosquitoes including species and the number of mosquitoes caught. The mosquito-catching procedure is carried out with the Standard Operating Procedure for performing a Human Landing Catch at James Cook University. The results of the capture were put in paper cups, differentiated every hour of capture time based on location and model of mosquito nets; third, the catching was made in six houses, with three goat sheds and three cowsheds.

Types of research: Pre-experiment, the Selection of sample point locations is carried out in a non-probabilistic way (AlHaqwi et al., 2023) based on WHO criteria, with the design of the static group comparison (Anggraini, Murni and Sakur, 2018). The treatment is in the form of installing mosquito nets in livestock pens as a new method to prove that Anopheles spp mosquitoes in livestock sheds are more abundant than at home. A positive control was used in the study: the number of mosquitoes caught in the home; there are three models of mosquito nets installed, namely open in front, on the side, and closed around the cage. Installation of mosquito nets with the following criteria: first, the mosquito net is installed 30cm from the lowest roof of the cage, this is intended to provide sufficient airflow to the livestock inside; second, the distance of mosquito nets from the walls of the cage is 90 cm, this is to avoid reaching the heads of farm animals; third, the bottom of the mosquito net is tied to bamboo slats to avoid blowing wind.

The data was analyzed as follows: Coordinate data of mosquito catching, breeding,

and patient location determination points were analyzed by spatial analysis (Katale and Gemechu, 2023); The number of mosquitoes caught based on location and model of mosquito nets was analyzed with a one-way ANOVA (Meredith, Furuya-Kanamori and Yakob, 2019) if normality requirements are met, if not, then use Krusskal Wallis, if significant further tests are carried out.

Results and Discussion

The location of the arrest was carried out in Krajan Hamlet, Loano District, Purworejo Regency, the results of the spatial analysis look at a circle of 100 m, the presence of breeding, vectors, and cases in a radius of less than 400m, so they are cluster-shaped, The picture is as follows:

The results of spatial analysis (figure 1) showed the gathering of malaria patients, livestock sheds, breeding, Anopheles spp. mosquitoes and malaria vectors, in a radius between 100-400m so that it is cluster-shaped. The Kemejing Dukuh Krajan Village area is a hilly area of Menoreh, very lush between intertwined plant canopies, thus blocking sunlight from penetrating the ground directly, between hills flow small rivers. Rainfall 1495-3449 mm/year. High rainfall, low temperatures, and high humidity have a significant impact on malaria prevalence (Oheneba-Dornyo et al., 2022).

Malaria is always associated with environmental conditions and geography including height (Kubana et al., 2023) The condition of malaria in Purworejo is closely related to hilly environmental conditions, and limited road access, The community is very dependent on the availability of raw materials in nature such as perennials and abundant bamboo groves, and the abundance of water sources as breeding place larvae ensures the survival of Anopheles spp mosquitoes so that malaria transmission occurs (Table 2), The condition of remote villages like this is a contributor to malaria cases (Rosas-Aguirre et al., 2021) .

In 2021 in Purworejo Regency, Central Java Province, there were extraordinary events and the most cases in the Banyuasin Health Center area, Loano District. The number of cases is 135, the highest in Kemejing village with 77 cases and the highest in Krajan hamlet with 44 cases in the same village, with the peak of cases occurring in September, during the dry season, and tends to fall until December. The distribution is as follows:

The peak of malaria in Krajan village occurred in September (Figure 2), This month is known as the dry season, if there is a spike

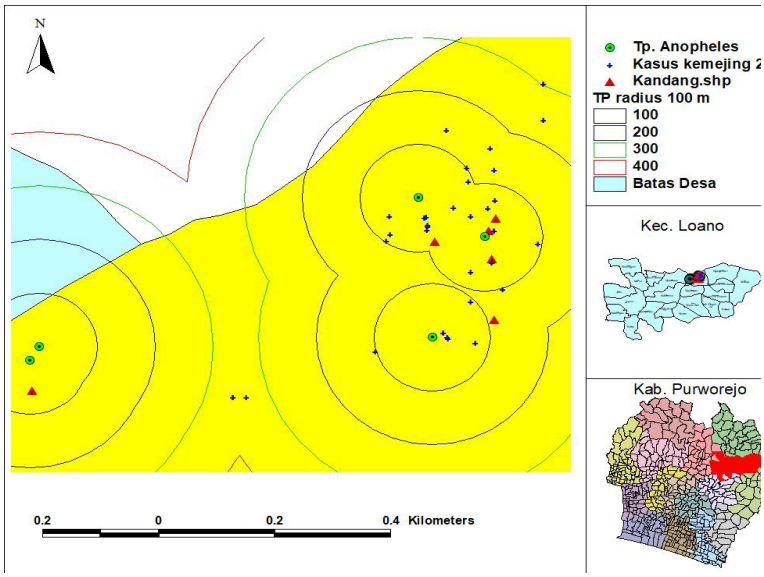

Figure 1. Satellite images of breeding, livestock sheds, and sufferers in Krajan Hamlet, Kemejing Village

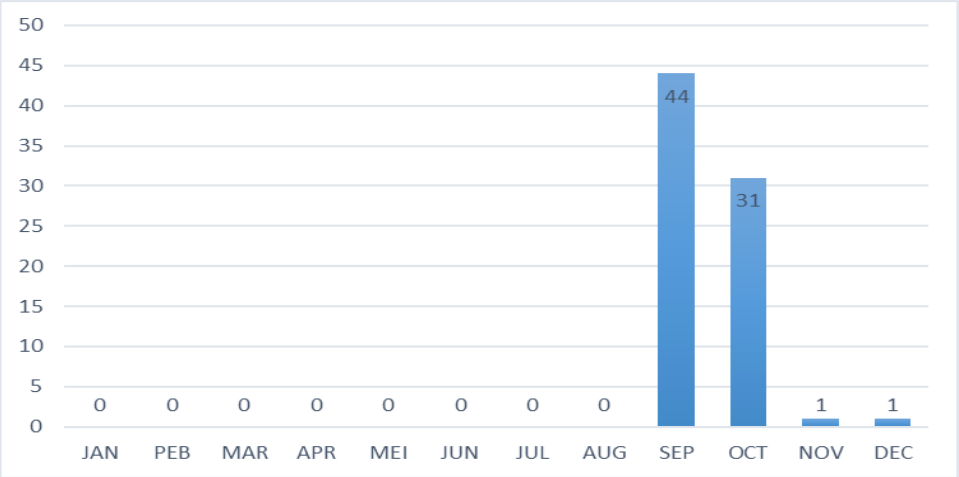

Figure 2. Distribution of Malaria Cases in Krajan Hamlet According to Time at Banyuasin Health Center, Purworejo Regency, Year 2021

in malaria cases in this season shows an abundance of environmental carrying capacity in the form of many breeding along dry rivers that leave puddles and small springs (Cross et al., 2021), Second, the existence of a plant canopy that blocks sunlight from entering the soil surface, so it becomes a good resting for mosquitoes(Villena, Ryan and Murdock, 2022) and third, the adaptability of Anopheles spp. mosquitoes can also adapt to dry seasons, Adaptability is carried out by mechanically closing the spiracles using a valve mechanism is a physiological adaptation that reduces water loss in insects (Katusi et al., 2022), So that mosquitoes can surpass their sporogony age and transmission will occur (Guissou et al., 2022).

Anopheles spp mosquitoes are indicators of potential transmission both vectors and those that have not. In Table 1, the number of Anopheles spp mosquitoes in livestock sheds is 36.5 times more than at home, while for vectors namely An. balabacensis, maculatus, and aconitus 2.5 times more, and if added with vector potentials namely An. vagus 28.5 times more than at home. In the goat shed 4.5 times more than at home, while the number of vectors is 1.5 times greater; while in the cowshed dominated by An. vagus 4.3 times more than other species or 81.25%. The number of mosquitoes caught in cages was 58.9% caught in mosquito nets. The results of his arrest are as follows:

The results of catching Anopheles mosquitoes are three types of vectors in

Table 1. Results of Anopheles spp Mosquito Capture by Location of Capture

Species	Sum Mosquitoes in Goat Shed			Sum Mosquitoes in Cowshed		
	Shed	Nets	House	Shed	Nets	House
An. maculatus	0	1	0	0	0	0
An. balabacensis	1	1	2	0	1	0
An. vagus	0	2	0	20	32	0
An. kochi	1	0	0	2	2	0
An. barbirostris	2	1	0	4	2	0
An. aconitus	0	0	0	0	1	0
Total	4	5	2	26	38	0

Source: processed primary data

Purworejo Regency, namely An. balabacensis, An.maculatus and An.aconitus (Cahyaningrum and Sulistyawati, 2018), All three have different habitats. An.balabacensisi lives in hills with forests as in Purworejo (Malijan et al., 2021), in Lampung, Indonesia confirmed the same vector as Plasmodium knowlesi and lives in forests (Wibowo et al., 2020), so in Sabah Malaysia, this vector is dominant in the forest (Chua et al., 2019). An.maculatus is also near forests and hills (Henderson et al., 2023), An. balabacensis and Anopheles maculatus can have malaria infection hazard rates of statistical significance (Permana et al., 2022).

An. Aconitus has a slightly different habitat, which lives near waters, is found in houses and livestock sheds, and likes unpolluted clean waters (Yuniawan, Utomo and Arwati, 2019). This is what makes Purworejo a comfortable habitat for all types of Anopheles spp species (Table 1), This is what can explain the formation of clusters of malaria sufferers, feeding in the form of human shelters and livestock sheds (Afnaniya, Santjaka and Bahri, 2023), and breeding that supports each other. An. vagus although has not been declared as a vector in Purworejo, has been confirmed as a vector using ELISA in Kulon Progo, but it has not been confirmed microscopically, although the two are still one epidemiological region. Other research results were also found An. balabacensis, An. aconitus, An. barbirostris, An. vagus, An. anularis, An. kochi, An. maculatus, An. indifinitus, and An. subpictus (Raharjo et al., 2015), the same method is also used in Maluku(Sejati, Ardhitya and Sofiana, 2015).

58.9% caught in mosquito nets, so there are two functions of mosquito nets, namely a place to rest after mosquitoes suck blood and as a barrier for mosquitoes from the cage to go to the nearest resident's house (Brown et al., 2018; Mofua et al., 2019). The results of catching malaria vectors in cages are higher than at home (table 1) this is due to the presence of cages no more than 5 meters from the house, so primary vectors are also found in cages in greater numbers, this result is to refute that in livestock sheds there are no primary vectors. Other research results in Indonesia, Anopheles balabacensis is found in homes and livestock sheds, so it is indiscriminate meaning it bites just any human as well as livestock, this is the uniqueness that exists in Purworejo, Central Java Province, Indonesia. Therefore these results served as the basis for the development of long-lasting insecticidal nets (LLINs) used in cattle sheds. The primary vector was captured 1.5m from the residence, while the secondary vector was captured >5m (Katusi et al., 2023).

The presence of Anopheles larvae is an indicator of the presence of adult Anopheles mosquitoes and the survival of mosquitoes as well as the potential for malaria transmission. Larval surveys were conducted at a radius of 400 m, on malaria transmission clusters. The results survey of larval/pupae in Table 2. in some types of habitats close to residential areas after rearing is identified An. balabacensis; and An. maculatus. The location of the discovery of malaria vector breeding places in a radius of 100 m and 200 m from the distribution of malaria cases. As for the full result:

The results of larvae capture after rearing the results are the same as adult mosquito capture, thus there is a relationship between larvae and adult mosquitoes in one epidemiological area (Yuniawan, Utomo and

Table 2. Results of Larval Identification by Habitat Type

Habitat Type	Sum	Positive	Category	Rearing Results	Description
Puddle and tire treads	3	1	Pupae larvae	An. balabacensis	Pupae 4, instar 2 1 larvae
Potential breeding	16	0	-	-	riverside
Breeding	3	2	larvae	An. balabacensis An. maculatus An. aconitus	1 There were aquatic plants

Source: Processed Primary Data

Arwati, 2019), This is related to environmental conditions as the main habitat of both adult mosquitoes and larvae(Rohani et al., 2018). Larva An. Balabacensis is in car tire marks and excavated soil(Rohani et al., 2018) In the shade, slightly rocky, the presence of plankton. So did An. maculatus, while An. Aconitus occurs in breeding existing aquatic plants and rice fields(Maretasari et al., 2019). The results of statistical analysis according to the location and model of mosquito nets are as follows:

The results of the test are statistically significant, while the results of further tests are also significant the most in cowsheds (p=0,000), with cows getting the most mosquitoes, while any model of mosquito nets has the same number of mosquitoes caught. The significance of the cage of the location of this capture is due to the presence of mosquitoes in livestock cages because female mosquitoes have nerve cells, called cpA neurons that have receptors to detect carbon dioxide (CO2) and odor (Alonso San Alberto et al., 2022), So that mosquitoes can feel clumps of exhaled air, mosquitoes are also attracted to human skin even in the absence of carbon dioxide. Other research results show an increase in carboxylic acids in the skin brings more mosquitoes, as well as lactic acid (De Obaldia et al., 2022). Odors result from metabolic processes (Emami, Hajkazemian and Mozūraitis, 2019). Both are gases, so they are free to move following the pressure difference from cold to warmer air (Jung et al., 2023).

It is known that all three fishing sites are significant, with the most cowsheds, another study is the same, namely mosquitoes are caught in cowsheds three times more than in goat sheds (Tchouassi et al., 2016). The smell produced depends on the type of animal food(Janni, 2020). At the study site, the food is relatively the same, namely grass, so the influence of food is relatively the same and the process of urine decomposition, the results of research using cow urine were developed to attract malaria vectors and other mosquitoes(Katusi et al., 2022). The results of statistical analysis showed no difference in the number of mosquitoes caught in mosquito nets (p = 0.534; Table 3), This confirms that mosquitoes come from all directions randomly, although the number of mosquitoes caught in the side mosquito nets is higher. There have been no studies that discuss the model of installing mosquito nets related to the number of mosquitoes caught. The installation of this non-insecticide mosquito

Table 3. Results of Statistical Analysis

Location	Average	Homogenitas	Krusskal Wallis	Post Hoc (U Mann Whitney)		
				Between locations	Mean p Different	
House	0,028	0,000	0,000	Cow House and Barn	-1,750	0,000
Cowshed	1,778			House and goat shed	-0,222	0,000
Goat shed	0,25			Cowsheds and goat sheds	-1,528	0,000

Model mosquito net	Average	Homogeneity	Anova test
Open in front	1.000	0,116	0,534
Open next to	1.280		
Covered everything	0,75		

net is based on the behavior of mosquitoes after biting rest indoors and outdoors (Saili et al., 2023), as well as in cattle sheds (Eshetu, Eligo and Massebo, 2023). The mosquito net model is intended to ensure air circulation in the cage so that farm animals remain comfortable. Thus the ability of the mosquito net model to reduce mosquito dust is the same, if for practical purposes opening in front is preferred.

Conclusion

Mosquitoes caught in mosquito nets in livestock sheds are more numerous and significant than at home; breeding, resting, feeding vectors and malaria patients are in the same cluster less than 400m; any model of mosquito net has the same ability to be infested by Anopheles spp mosquitoes.

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Nutritional Status of Young Athletes in Central Java, Indonesia

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Abstract

Proper nourishment is vital for persons who participate in physical activity and require increased amounts of important nutrients. Adolescents should give priority to this matter, as their developing bodies require greater nutritional requirements to support their growth and physical activity. An investigation carried out on adolescent athletes in Indonesia revealed that sports schools and athlete training facilities frequently encounter insufficient food consumption, which may have an impact on athlete performance and long-term well-being. The study aimed to examine the nutritional factors that influence body fat in young athletes who are enrolled in sports schools in Central Java, Indonesia. The study was conducted with the participation of 110 young athletes. The data for this study were analyzed using Pearson correlation and multiple linear regression. The result shows a relationship between gender, energy intake, protein intake, physical activity, and body fat percentage, as well as a correlation between age and BMI for age. The result of the multivariate analysis suggests that gender had the most effect on body fat percentage (r=0.77; p-value=<0.0001). Young athletes should receive comprehensive education and monitoring from certified experts to ensure eating and exercise habits that enhance performance and promote long-term health.

INTRODUCTION

Nutritional intake is crucial for individuals who engage in physical activity and have a heightened need for essential nutrients. Adolescents must prioritize this issue as their maturing bodies necessitate increased dietary needs to facilitate their growth and physical activity. The performance and achievements of young athletes depend heavily on providing an adequate energy supply and addressing their vital nutrient needs. (Szeja et al., 2017). Athletes, both junior and elite, are prone to dietary deficiencies according to several studies (Jenner et al., 2018a; Kim et al., 2019; Michael et al., 2019; Ong and Brownlee, 2017). A study conducted on adolescent athletes in Indonesia has found that sports schools and athlete training facilities often face inadequate dietary intake (Penggalih et al., 2018, 2017, 2016).

During adolescence, individuals are more susceptible to fluctuating emotions and actions about their bodies, such as changes in dietary patterns and physical activity. Studies have found that school-age teenagers have a significant occurrence of eating behaviors that are harmful to their health. Several factors in the environment might influence adolescent physical activity, such as parental attitude and encouragement towards sports participation, the amount of time spent outdoors, the geographical location, and the season (Macedo-Uchôa et al., 2019).

Researchers have conducted numerous studies to focus on the nutritional status of athletes and develop detailed nutrition guidelines. Nevertheless, there still needs to be more comprehensive knowledge regarding the nutritional status of young athletes due to the

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diverse range of sports and training methods. This situation necessitates extensive research and screening to ensure young athletes' proper growth and development (Chalcarz and Radzimirska-Graczyk, 2009). According to data acquired from the Football Association in Indonesia (PSSI) in 2014, it was found that 53.33% of body fat is considered excessive for a U-19 football athlete. Furthermore, it is observed that athletes often experience an elevation in their body fat levels during holiday tournaments. Research has also demonstrated that 27% of athletes undergo a rise in body weight during the off-season (Penggalih et al., 2017). Based on the given data, it is evident that the nutritional status of young athletes in Indonesia is suboptimal. This study aimed to assess the factors that influence the nutritional status of adolescents participating in school sports, such as nutrition intake and physical activity, and to conduct a comprehensive analysis of the nutritional status within this population.

METHOD

This descriptive study uses a cross-sectional design to analyze the relationship between nutrition intake, physical activity, and nutritional status of young athletes attending sports schools in Central Java, Indonesia. This research was carried out in 2023 at two sites, namely Student Sports Education and Training Center (BPPLOP), Semarang City, and Football Academy Safin, Pati Regency, with an ethical clearance number of 356/KEPK/EC/2023. The sites were selected because of their proximity and accessibility to the community, as well as the availability of the respondents required for the study, as they are among the leading sports schools in Central Java.

The research population consisted of male and female young athletes attending sports schools who were categorized in the young adult age group between 10 and 23 years old at the time of the interview. The chosen student-athletes participated in the sports games, such as football, basketball, sepak takraw, table tennis, volleyball, and softball. The minimum sample size required for the research was 100 young athletes, determined using the Lemenshow formula. A dropout rate of 10% was taken into account when selecting the research participants. The study included 124 young athletes from Central Java, Indonesia, using simple random sampling in the population of 138 young athletes, divided into 86 young athletes from BPPLOP and 38 young athletes from Safin. By the study's conclusion, the population had decreased to 110, as subjects withdrew due to being out of school, selection for regional sports competitions, illness, injury, and returning home.

Body weight was measured using the OMRON Digital Personal Weight Scale Type HN-289 (0.1 kg precision level), and height was measured using the GEA Wireless Body Height Meter Type HT-721 (0.1 cm precision level). Standard measuring techniques and standard equipment were used. Before height measurement, the respondent was asked to remove their footwear and headdress (if applicable). They were then requested to stand upright, facing the measurer, with their arms at their sides, feet flat on the floor, and heels firmly against the wall. In addition, participants were given instructions to maintain a direct gaze at eye level. To obtain a precise measurement, participants were instructed to take off their wristwatches or bracelets, eyeglasses, footwear, and hats, as well as empty their pockets (Gibson, 2005). The nutritional condition of the individuals was assessed using the World Health Organization's body mass index (BMI) and BMI-for-age categorization.

The thickness of the subcutaneous fat was measured using the Karada Scan Body Composition Monitor Type HBF-375. The energy and nutrient adequacy levels were obtained from interviews about daily food intake using a 24-hour recall. Three non-consecutive food recalls were conducted to measure the average food consumption by young athletes to consider their typical dietary intake. This method was used since it is a quantitative tool that is globally accepted for evaluating food consumption trends. A 24-hour food recall encompasses a comprehensive account of all food and beverages ingested, including the cooking techniques employed and the specific brand names (Gibson, 2005). The results of the interview regarding the average daily intake would be converted into units of

calories (energy) and grams (macronutrients) and compared with the energy and nutrient requirements for athletes, who are based explicitly on TEE (Total Energy Expenditure) calculations.

The Bleep Test was employed for the quantification of physical activity. The Multistage Fitness Test (MSFT) is an alternative name for it. The 20 m MSFT is a widely used high-intensity running aerobic fitness test. The test consists of continuous jogging between two lines that are 20 meters apart while recording the sounds. Participants are required to persist in the test for as long as they can, until they are unable to reach the end line between two consecutive beeps or choose to quit the test themselves, typically due to fatigue. The acquired data was analyzed utilizing Microsoft Excel and SPSS 26. Univariate analyses were applied to describe data collection and convert it into valuable insights. Bivariate analyses were used to examine the association between physical activity, dietary intake, and nutritional status. The study employed the Pearson correlation test, followed by multivariate analysis with multiple linear regression, to conduct the statistical tests. The significance level (α) of this study was judged to be 5% (0.05).

RESULT AND DISCUSSION

Table 1 shows the participants' socio-demographic characteristics. The table stated that adolescent boys account for 74.5% of the total. A significant proportion of the participants (70.9%) were between the ages of 10 and 17, classified as adolescents based on the Indonesian Ministry of Health. Adolescents commonly fluctuate emotionally due to several rapid changes, especially physical transformations. These alterations often result in embarrassment or self-doubt over one's physical shape or low self-esteem. During adolescence, individuals are more vulnerable to peer influence, leading them to explore new activities that may harm their well-being. The environment often influences the health issues that teenagers commonly face, such as problems related to nutrition intake (National Academies of Sciences, 2019). Additionally, 50.0% of the participants were involved in soccer. Most participants had normal nutritional status based on BMI or BMI-for-age indicator (83.6%).

TABLE 1. Socio-demographic Characteristics of the Participants

Characteristics	n	%
Gender		
Boys	82	74.5
Girls	28	25.5
Age (year)		
10.0 – 17.9	78	70.9
18.0 – 23.0	32	29.1
Sports		
Basketball	11	10.0
Sepak takraw	22	20.0
Soccer	55	50.0
Softball	11	10.0
Table tennis	6	5.5
Volleyball	5	4.5
Nutritional status*		
Underweight	4	3.7
Normal	92	83.6
Overweight	12	10.9
Obese	2	1.8

*Nutritional status using BMI or BMI-for-age

TABLE 2. Anthropometric Measurements Result

Measurements	Total (n=110)	Boys (n=82)	Girls (n=28)
Body weight (kg)	59.33±7.71	60.93±0.82	54.65±1.27
Height (m)	167.33±8.83	170.42±0.83	158.26±1.07
BMI (kg/m2)	21.17±1.96	20.94±0.19	21.84±0.46
BMI/age (z score)	0.06±0.75	-0.02±0.08	0.33±0.17
Body fat (%)	16.42±6.20	13.42±0.36	25.21±0.75

TABLE 3. Nutrition intake and Physical Activity Result

Components	Total (n=110)	Boys (n=82)	Girls (n=28)
Energy (kkal)	2177.34±601.16	2317.74±65.34	1766.19±78.74
Protein (g)	85.82±22.96	90.83±2.44	71.14±3.61
Fat (g)	81.34±36.51	83.69±2.76	74.44±11.09
Carbohydrate (g)	285.89±98.58	301.76±11.04	239.43±14.92

Anthropometric measurements were conducted on all subjects to assess nutritional status and body fat percentage. The average nutritional status using the BMI or BMI-for-age indicator was normal, which was 21.17±1.96 kg/m2 for BMI and between -2 SD and +1 SD for BMI-for-age. The mean body fat percentage among participants was 16.42±6.20%. A higher body fat percentage was found in girls (25.21±0.75%) compared to boys (13.42±0.36%) (Table 2).

Table 3 shows the results of nutrition intake and physical activity. The means of energy, protein, fat, and carbohydrate intake were 2177.34±601.16 kcal, 85.82±22.96 gram, 81.34±36.51 gram, and 285.89±98.58 gram, respectively. The mean energy intake for both genders was pretty good—88.93% for boys and 83.05% for girls—of the required intake. To meet the energy requirement, adolescent boys need 2000–2650 kcal, and adolescent girls need 1900–2250 kcal (Ministry of Health, Republic of Indonesia, 2019). During adolescence, it is necessary to have sufficient energy to fulfill the requirements of both growth and development, as well as the energy demands associated with physical activity, training, and competition. The optimal energy consumption for adolescents is subject to variation based on their age, gender, and level of physical activity (Aerenhouts et al., 2011). Modifications in training and competition intensities, engagement in multiple competitive sports, part-time work, or simultaneous compensatory inactive behaviors can all influence the energy required. The energy required for growth, which is a part of the energy needs of teenage athletes, can be divided into two components: the energy utilized for synthesizing new tissues and the energy stored in the growing tissues (Desbrow, 2021).

Like the energy intake, the fat intake for both genders has met the standard. Compared to the Recommended Dietary Allowance (RDA), the respondents' fat intake already met 100.58% of the requirement for boys and 109.05% for girls. Sufficient consumption of dietary fat is necessary to fulfill the need for fat-soluble vitamins and essential fatty acids and supply energy to promote development and maturity (Petrie et al., 2004). Given the link between consistently elevated fat consumption and heightened risk of chronic diseases, the guidelines for the type and total amount of fat intake among adolescent athletes align with public health recommendations. Generally, these recommendations propose that dietary fat should comprise 20–30% of total energy consumed, saturated fatty acids should not exceed 10% of total energy intake, and trans-fats should be less than 1% of total energy intake (World Health Organization, 2018).

Regarding the protein intake, it was found that the respondents' intake for both genders was higher than standard (124.08% for boys and 112.37% for girls). Based on RDA,

the protein intake for adolescent boys and girls should be within 65–85 g and 55–65 g, respectively. Protein is necessary for adolescents to facilitate overall growth and development and improve their ability to respond to exercise training (Petrie et al., 2004; Witard et al., 2019). During the highest growth phase, lean body mass can increase by roughly 2.3 grams per day in girls and 3.8 grams per day in males. This represents a threefold increase compared to the time before puberty (Desbrow, 2021). Furthermore, longitudinal data demonstrate that young individuals who engage in physical activity experience more substantial gains in lean body mass than their inactive counterparts (Baxter-Jones et al., 2008). An intake of around 1.5 grams of protein per kilogram of body weight per day should compensate for any amino acid losses caused by exercise, improve overall protein balance, and promote average growth and development in adolescent athletes (Aerenhouts et al., 2011).

Respondents' carbohydrate intake was quite good, with 76.73% of the requirement for boys and 77.13% for girls. Exercise duration and intensity impact patterns of carbohydrate use and the need for replenishing. Furthermore, both external and internal carbohydrate availability impact the training adaptations induced by exercise. Current research indicates that the consumption of carbohydrates in teenagers is similar to that of adults. The dietary carbohydrate requirements should be considered considering the training loads and competitive tendencies that typical adolescent athletes exhibit. There are multiple ways in which these differ from the efforts of adult athletes. Adolescent athletes often participate in many organizations, such as schools, clubs, and regions, which results in varying competition schedules and formats, including sports carnivals, representative events, and trials. Furthermore, it is customary for ambitious adolescent athletes to engage in various sports. It is crucial to consider the various energy demands and corresponding carbohydrate requirements, especially while participating in multiple sports simultaneously (Desbrow, 2021). A carbohydrate-rich diet improves both endurance and intermittent high-intensity performance due to an increased store of carbohydrates in the muscles and liver known as glycogen. It is generally established that athletes must replace glucose storage in the body, particularly during periods of hard training or competition. Consuming carbs during workouts lasting more than an hour can also improve performance and delay the onset of weariness. According to research, athletes who participate in intermittent sports like basketball and soccer should consume more carbs during training and competition. This is not surprising given that carbs, as opposed to protein and dietary fat, are the most efficiently broken down and digested form of energy in the body (usa.org). Studies have shown that a high-CHO diet improves endurance performance (Ahlborg et al., 1967; Karlsson and Saltin, 1971). High CHO availability is favorable for endurance exercise and high-intensity training (Hawley, 2002; Stellingwerff et al., 2006). To achieve glycogen super-compensation, athletes should consume a high CHO intake (10 g/kg) the day before a competition, around 36 hours after their last training session, and engage in physical inactivity (Domínguez et al., 2017; Thomas et al., 2016). However, it may not be necessary for low-intensity workouts (Thomas et al., 2016). The American College of Sports Medicine recommends appropriate nutrition during contests. However, there is no common prescription for optimal intake.

Bivariate analysis suggests a correlation between gender and physical activity and body fat percentage (p-value = 0.0001). However, the strength of its correlation was moderately positive (Table 4). Additionally, the intake analyses for energy (p-value = 0.0001), protein (p-value = 0.0001), and carbohydrates (p-value = 0.004) all showed a weakly positive and significant correlation with body fat percentage. The only intake that did not show a significant correlation with body fat percentage was fat (p-value = 0.387). There was no significant correlation between all independent variables and BMI (p-value >0.05) in the present study, and only the age variable correlated with BMI-for-age (p-value = 0.004) (Table 4).

The study found a strong positive link between energy, protein, and carbohydrate intake and body fat percentage. This means that an increase in calorie or macronutrient intake

directly corresponds to an increase in body fat percentage (Jiménez, 2013). Adolescent athletes may engage in unhealthy weight-control practices, such as rapid weight loss or gain, dehydration ion, or use of supplements, to achieve a desired body composition or performance. These practices can have negative consequences for their health, growth, and development, as well as their performance and well-being (Mardiana et al., 2022). Therefore, young athletes must receive appropriate education, monitoring, and counseling from qualified professionals, such as sports dietitians, coaches, and physicians, to help them adopt healthy eating and exercise habits that promote optimal performance and well-being (Caine et al., 2016). An Athlete may require support to continue with performance-based nutrition plans in periods surrounding body composition assessment (Jenner et al., 2018b).

The bivariate analysis reveals a modestly positive correlation between physical activity and body fat percentage. The negative correlation indicates that higher physical activity levels may cause an elevated body fat percentage. The findings differ from those of other researchers, indicating a negative correlation (Dewi et al., 2021; Effendy et al., 2018; Mateo-Orcajada et al., 2022). In other words, the higher the level of physical activity, the lower the body fat percentage. Body fat percentage refers to the relative amount of fat mass in an individual's body. The body fat percentage (BFP) is directly and significantly associated with the elevation of risk factors for cardiovascular disease, including total cholesterol, triglyceride, low-density lipoprotein cholesterol, and fasting plasma glucose. According to the study, BFP is a better indicator of cardiovascular illness because it is more closely linked to BMI (Effendy et al., 2018).

Insufficient physical activity is not only linked to a higher percentage of body fat but also leads to a reduction in relative muscle mass. The greater the amount of muscle mass engaged during exercise, the more substantial the impact of the muscular pump on venous return. Hence, increasing muscle mass enhances cardiac output and overall physical fitness (Dewi et al., 2021). Enhanced physical exercise is also associated with muscular strength, flexibility, and satisfaction with life (Mateo-Orcajada et al., 2022). The other research showed that In this sample of middle-aged adults from the general community, physical activity was found to be inversely related to BMI and body fat percentage. Among those with the same BMI, those who were more active had a lower body fat percentage. Physical activity alone cannot maintain BMI and body fat overweight and high body fat percent in the population percent, but it can reduce the risk of overweight and high body fat percent in the population (Kesavachandran et al., 2009). A multivariate analysis performed using multiple linear regression revealed that carbohydrate intake had no significant effect on body fat percentage, so it was excluded from the modeling, and a reanalysis was carried out. The final result of the multivariate analysis demonstrates that gender, energy intake, protein intake, and physical activity were the variables that had a 64% effect on respondents' body fat percentage (Table 5). Age had no impact on BMI-for-age in

TABLE 4. Relationships Between Independent and Dependent Variables

Variable	%BF		BMI		BMI/age	
	Correlation (r)	p-value	Correlation (r)	p-value	Correlation (r)	p-value
Gender[a]	0.77	<0.001*	0.27	0.135	0.20	0.077
Age	0.10	0.320	0.17	0.348	0.32	0.004*
Energy intake	0.35	<0.001*	0.02	0.839	0.06	0.569
Protein intake	0.24	<0.001*	0.04	0.674	0.04	0.665
Fat intake	0.08	0.387	0.01	0.952	0.03	0.766
Carbohydrate intake	0.27	0.004*	0.01	0.949	0.09	0.342
Physical activity	0.44	<0.001*	0.17	0.084	0.15	0.118

*p-value <0.05: significant

TABLE 5. Multivariate Analysis of Body Fat Percentage

Variable	Coefficient B	p-value	R square
(Constant)		<0.001	
Gender	0.684	<0.001	
Energy intake	0.239	0.016	0.640
Protein intake	0.218	0.026	
Physical activity	-0.195	0.002	

this study after controlling for other variables.

Multivariate analysis suggests that gender, energy intake, protein intake, and physical activity significantly affect body fat percentage. Gender variable has the most substantial effect on body fat percentage. Adolescent boys generally exhibit a lower body fat percentage than girls due to their regular engagement in physical activities (Sitoayu et al., 2023). Boys have a body fat percentage of <25%, and girls have a body fat percentage of <35% when they have an average body weight (Marques-Vidal et al., 2008). It suggests that the majority of participants had a healthy body fat percentage. An elevation in body fat percentage typically signifies a disparity between energy intake and expenditure, resulting in the storage of excess intake as adipose tissue reserves. This ultimately contributes to an augmented BMI, heightened susceptibility to degenerative diseases, and the development of metabolic syndrome (Sitoayu et al., 2023). We did not investigate several dietary aspects related to the body fat percentage of adolescents, such as knowledge, snacking behaviors, and the use of dietary supplementation, which became limitations of this study.

CONCLUSION

In conclusion, the present study's findings show that energy intake, protein intake, and physical activity are important modifiable factors to be considered by young athletes, as those aspects impact body fat percentage. Young athletes should receive comprehensive education, monitoring, and counseling regarding their gender from certified experts to ensure eating and exercise habits that enhance their performance and promote long-term health.

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RELATIONSHIP BETWEEN PHYSICAL FITNESS AND PSYCHOLOGICAL WELL-BEING ON THE QUALITY OF LIFE OF THE ELDERLY

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Abstract

This study aims to analyze the relationship between physical fitness and psychological well-being, on the quality of life of the elderly, who are members of gymnastics groups. This cross-sectional study used the World Health Organization QOL short-form questionnaire (WHOQOL-BREF), a senior fitness test, and a psychological well-being scale. The sample consisted of 99 people aged 65 years and members of the elderly exercise community. As a result, no significant relationship was observed. Only three senior fitness test items 6-minute walk, 2-minute step, and sit and reach best explained the overall quality of life in physical, psychological, and environmental domains in the study group. The physical domain and overall quality of life are less significant for all dimensions of psychological well-being. The physical domain correlates only with the environmental mastery dimension, and overall, quality of life correlates better with the two psychological well-being dimensions. In conclusion, psychological well-being is closely related to quality of life, especially in the psychological, social, and environmental domains.

INTRODUCTION

The significant structure of Indonesia's population is the elderly population, indicated by the percentage of the elderly population in 2020 which will reach more than 10 percent. In fact, from the results of population projections, in 2045 the Indonesian elderly are estimated to make up nearly one-fifth of the entire Indonesian population. In 2020, the total population of Indonesia, which is in the age category of 60 years and over, is estimated to reach 28 million people or 10.7 percent of the total population (Badan Pusat Statistik, 2021b). The increasing number of elderly people has an impact on increasing life expectancy. The data from Badan Pusat Statistik, (2021a) states that there has been an increase in life expectancy from 69.44 in 2019 to 69.67 in 2021 for men. As for women, there is also an increase in life expectancy from 73.33 in 2019 to 73.55 in 2021. The increasing number of elderly people will also be a challenge for health workers, especially community psychiatric nurses where the elderly will experience an aging process that affects the emergence of setbacks in their physical, psychological, and social conditions so that the elderly have limitations (Liotta et al., 2018).

One important factor affecting the health condition of the elderly is physical activity (Chodzko-Zajko et al., 2009; Isroin, 2016; Vanhees et al., 2005). Physical activity systematically supports the treatment of chronic diseases and enables a healthy and active life without functional barriers (Bouaziz et al., 2016, 2017; Hillman et al., 2008). Recent studies highlight that systematic physical activity and proper dosage can delay aging process (Gopinath et al., 2018; Rebelo-Marques et al., 2018). It also allows the elderly to maintain their physical fitness at a level that will enable them to function more independently (Buford et al., 2014; Rivera-Torres et al., 2019). Evidence from observational studies supports the beneficial effects of physical activity on cognition (Carvalho et al., 2014; Gheysen et

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al., 2018). However, robust evidence from randomized controlled trials is lacking, and for example, in the LIFE study, beneficial effects of physical activity on cognition were only seen in subgroup analysis (Fielding et al., 2017; Sink et al., 2015). In addition, reduced physical activity in the elderly increases many chronic diseases, including hypertension, diabetes, obesity, cardiovascular disease, stroke, and several types of cancer (Booth et al., 2012; Lavie et al., 2019). All kinds of chronic diseases suffered by the elderly can affect their psychological well-being.

From an evolutionary perspective, psychological well-being is associated with quality of life and mental health (Loera-Malvaez et al., 2017; Popescu, 2016; Sarafraz et al., 2019). In this case, quality of life is understood from a multidimensional perspective that addresses the most relevant individual dimensions of life (Cancino et al., 2016; Losada-Puente, 2018). It includes material and non-material aspects, as described in Maslow's hierarchy of needs - physiological, safety, love, and belonging to a social group. However, mental health, which concerns psychological well-being, is only associated with non-material factors with different clinical interpretations. Some of these factors are the creation of affective relationships with significant others, as well as the coaching and development of self-esteem, self-concept, or self-image (Latief & Retnowati, 2019).

The concept of psychological well-being considers the personal and social dimensions subjectively assessed by individuals. Thus, many authors simultaneously included questions related to the areas of social and emotional relations (Latipun et al., 2019; Rosa-Rodríguez et al., 2015), as well as aspects related to family and work contexts (Mafud, 2016; Millán et al., 2017; Soto & Almagiá, 2017). Although psychological well-being is commonly a personal effort to continuously improve oneself, with a clear goal of self-realization in a positive way (Ballesteros de Valderrama, 2006), it should be noted that other ideas also exist. Subjective judgments about well-being by individuals must be understood as perceptions of the absence of problems and/or the presence of pleasurable and satisfying sensations (Freedman et al., 2017; Posada et al., 2003; Valle Raleig et al., 2011). The conceptualization above inherits the classical components of subjective well-being, which emphasize satisfaction with one's own life, capacity development, and self-realization.

Ryff, (1989) incorporates different frameworks into a stratified model of psychological well-being, in which well-being is presented as a multidimensional and dynamic process that includes multiple psychological aspects. This model mentions six different dimensions of positive psychological functioning. The first dimension is described as a positive evaluation of oneself and one's past life (self-acceptance); the second as a sense of continuous growth and development as a person (personal growth); the third is the ability to have a purpose and direction in life as well as a feeling that one's life is purposeful and meaningful (purpose in life); the fourth as the ability to build relevant relationships with others based on trust and warmth, experience strong feelings of empathy and compassion and create intimate relationships (positive relationships with others); the fifth as the ability to effectively manage one's life and the world around it (environmental mastery); and sixth as a goal to be confident and independent and have a sense of self-determination (autonomy).

Psychological well-being and health are inextricably linked, and the relationship may become more important at older ages, if only because the prevalence of chronic disease increases with age. As life expectancy rises and treatment of life-threatening diseases becomes more effective, the issue of maintaining well-being in old age becomes even more vital. Studies of parents show that quality of life evaluations are affected by a person's state of health. But, the frequent finding that the average self-reported life evaluation in the population increases with age suggests that psychological well-being is influenced by many factors, apart from health. It includes material conditions, social and family relationships, social roles and activities, and factors that also change with age. There is a growing research literature showing that psychological well-being may even be a protective factor in health, reducing the risk of chronic physical illness and increasing longevity. It has also been argued that

psychological well-being should be addressed in health assessment measures, and considered in the allocation of healthcare resources (Dolan & White, 2007). This study aims to analyze the relationship between physical fitness and psychological well-being on the quality of life in the elderly. For this purpose, two main research questions were formulated: 1) Is physical fitness level related to quality of life among the study participants? and 2) Is there any relation between the research participants' psychological well-being and the quality of life?

METHOD

This study aims to analyze whether there is a relationship between the level of physical fitness and psychological well-being in the quality of life of the elderly. The research method used was a response with ex post facto, quantitative, transverse, correlational, and descriptive designs, with an initial sample of 99 people from two groups of elderly gymnastics in Magelang (n=42) and Yogyakarta (n=57) aged 60-75 years. The variables in the research methodology design were physical fitness, psychological well-being, and quality of life. Three methods were used for data collection. The first is a senior physical fitness test instrument. This test is intended for the elderly and consists of six fitness tests to evaluate upper and lower body strength and flexibility, endurance, motor coordination, and balance (Jones & Rikli, 2002). The alpha coefficient was used to measure the consistency of physical fitness tests as follows: chair standing test (pa = 0.682; pi = 0.632), arm curl test (pa = 0.905; pi = 0.654), 6-Min Walk Test (pa = 0.875; pi = 0.870), 2 Minute Step Test (pa = 0.947; pi = 0.910), Seat and Reach Test (pa = 0.935; pi = 0.915), Back Scratch Test (pa = 0.938; pi = 0.9843), and 8 - FT Up&Go Test (pa = 0.971; pi = 0.549).

Second, Ryff's Psychological Wellbeing Scale (1989) was adapted by van Dierendonck (2004). This scale collects data on psychological well-being variables, based on subjective assessment of various situations and questions related to their life and their perceptions of success in aspects of daily development and achievement, taking into account six dimensions: self-acceptance, positive relationships with others, environmental mastery, autonomy, purpose in life, and personal growth. The scale consists of 42 items in a Likert-type format with values ranging from 1 to 6, where 1 strongly disagrees and 6 strongly agrees. Cronbach's alpha is used to measure the internal consistency of the psychological well-being subscale as follows: self-acceptance (0.83), positive relationships with others (0.81), environmental mastery (0.71), autonomy (0.73), purpose in life (0.83), and personal growth (0.68).

Third, the World Health Organization Quality of Life (QOL) Standardized Questionnaire, Short Form (WHOQOL-BREF) to assess the level of quality of life based on WHOQOL 100, which is designed for subjective quality of life assessment (Skevington et al., 2004). This instrument analyzes four main areas of life: physical, psychological, social, and environmental, as well as overall quality of life and self-assessment of health. On the physical front, older adults were assessed: activities of daily living, dependence on medicinal substances and medical aids, energy and fatigue, pain and mobility discomfort, sleep and rest, and work capacity. In the psychological field: body image and appearance, negative feelings, positive feelings, self-esteem, spirituality/ religion/personal beliefs, thinking, learning, memory, and concentration. In the social field: personal relationships, social support, sexual activity. In the field of environment: financial resources, freedom, physical safety and security, health condition, and social care (accessibility and quality), home environment, opportunities to acquire information and new skills, participation and opportunities for recreational/leisure activities physical environment, (pollution, noise, traffic, climate), and transportation (Wong et al., 2018). The score for a given domain is determined by calculating the arithmetic mean of the positions belonging to that particular domain. Scoring has a positive direction, meaning that the more points, the better the quality of life (Suárez et al., 2018). According to (Jaracz et al., 2006), who described the psychometric properties of the WHOQOL-BREF showing high validity ranging from 0.62-0.76 for the physical domain, 0.55-0.78 for the psychological domain, 0.68-0.85 for the social domain, and 0.58-0.68 for the

Table 1. Relationship of Physical Fitness and Quality of Life

Correlations								
		Chair Stand	Arm Curl	6-Min Walk	2-Min Step	Chair Sit and Reach	Back Scratch	8-FT Up & Go
Overall QOL	Pearson Correlation	.211*	.169	.283**		.312**	.162	-.113
	Sig. (2-tailed)	.036	.095	.004	.002	.002	.108	.266
	N	99	99	99	99	99	99	99
Physical domain	Pearson Correlation	.209*	.185	.287**		.313**	.174	-.142
	Sig. (2-tailed)	.038	.067	.004	.002	.002	.085	.162
	N	99	99	99	99	99	99	99
Psychological domain	Pearson Correlation	.082	.100	.264**	.244*	.260**	.187	-.191
	Sig. (2-tailed)	.419	.325	.008	.015	.009	.064	.058
	N	99	99	99	99	99	99	99

environmental domain.

RESULT AND DISCUSSION

A correlation was shown between QOL and senior fitness test results in the elderly (Table 1). In these results, no less significant relationship is observed. Overall, QOL and physical domain correlated with the four senior fitness test items (standing in a chair, 6 minutes walking, 2 minutes walking, and sitting and reaching for a chair). The psychological domain was correlated with three senior fitness test items (6-minute walk, 2-minute steps, and sitting chair and reach). The environmental domain was correlated with five senior fitness test items (curved arms, 6-minute walk, 2-minute steps, chair sit and reach, and back scratch). Meanwhile, the social domain is less significant with all items on the senior fitness test. In addition, 8-FT Up & Go is also less significant with all domains in WHOQOL-BREF (Table 1).

The analysis continued on the correlation of QOL and psychological well-being in the elderly (Table 2). In the results of correlation calculations, there is also a less significant relationship. QOL, as a whole, is correlated with two dimensions of psychological well-being (environmental mastery and life goals). The physical domain is correlated with only one dimension of psychological well-being (environmental mastery). Meanwhile, the psychological domain, social domain, and environmental domain have a significant correlation with all dimensions of psychological well-being (self-acceptance, positive relationships with others, autonomy, environmental mastery, personal growth, and life goals) (Table 2).

The regression analyses were performed step by step for the parametric outcomes of seven senior fitness test items (stand-in chair, roll arms, walk 6 minutes, walk 2 minutes, sit and reach for chair, back scratch, 8-FT up & go) and six domains of well-being psychological (self-acceptance, positive relationships with others, autonomy, environmental mastery, personal growth, purpose in life). The three-item senior fitness test (6-minute walk, 2-minute steps, and chair sit and reach) best describes the overall QOL, physical domain, psychological domain, and environmental domain variables in the studied group. Meanwhile, the social domain is less significant with all items on the senior fitness test. The most dominant QOL area for the elderly is the environmental domain. Safety, health care, proper materials, living conditions, access to information, and realization of

Table 2. Relationship of Psychological Well-Being and Quality of Life

Correlations							
		Self-Acceptance	Positive Releation with Other	Autonomy	Environmental Mastery	Personal Growt	Purpose in Live
Overall QOL	Pearson Correlation	-.071	-.119	.066	.298**	-.036	-.267**
	Sig. (2-tailed)	.484	.242	.514	.003	.721	.008
	N	99	99	99	99	99	99
Physical domain	Pearson Correlation	.057	-.018	.161	.335**	.020	-.193
	Sig. (2-tailed)	.576	.857	.112	.001	.845	.056
	N	99	99	99	99	99	99
Psychological domain	Pearson Correlation	.589**	.486**	.608**	.553**	.493**	.482**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000
	N	99	99	99	99	99	99
Social domain	Pearson Correlation	.550**	.431**	.349**	.462**	.329**	.424**
	Sig. (2-tailed)	.000	.000	.000	.000	.001	.000
	N	99	99	99	99	99	99

interests play vital roles in assessing QOL.

Indonesia does not have specific standards for assessing the physical fitness of the elderly. The results of this study can be related with great care to standards developed in the US, in which 7,183 people were tested (Rikli & Jones, 1999). In such comparisons, Indonesians aged 60 and over are not on par with older American adults. Specifically, in the "2-min step" and "8-FT up & go" tests, the results in the examined group were significantly below the lower limit of the norm; only in upper and lower extremity strength do elderly Indonesians reach lower limits for age groups comparable to the US population.

International studies similar to ours have been carried out by Grześkowiak & Wieliński, (2009; Ignasiak et al., (2009); Katan, A., Kaczorowska, A., & Ignasiak, (2013); Lepsy et al., (2021). In this study, the results were also much worse than the American population. The difference in the results obtained can be attributed to the low level of physical activity among the elderly in Indonesia. A cross-sectional study by Puciato et al., (2017) among more than 1000 participants using the WHOQOL-BREF showed that the overall QOL, physical, psychological, social, and environmental domains were significantly better in people with higher physical levels. The activity was assessed using the International Physical Activity Questionnaire Short Version (IPAQ-SF). The highest mean indicators of overall perceived health status, QOL and QOL in the physical, psychological, social, and environmental domains were shown in older adults with the highest physical activity, which is in agreement with our results.

Nawrocka et al., (2019) showed that the level of physical activity is significantly related to the social domain of QOL. The researchers identified differences in functional fitness

(tests of senior fitness and handgrip strength) and QOL (WHOQOL-BREF) in people over 60 years depending on the level of physical activity objectively measured according to the Global Recommendations on Physical Activity for health. It shows a significant relationship between upper body strength, dynamic balance, and the social domain of QOL. In addition, the results of this study also reveal that all dimensions of psychological well-being (self-acceptance, positive relationships with others, autonomy, environmental mastery, personal growth, and life goals) can significantly affect the quality of life of the elderly, especially in the psychological, social, and environmental domains. Meanwhile, the physical domain and overall QOL are less significant with all dimensions of psychological well-being. The physical domain was only correlated with the environmental mastery dimensions and overall QOL correlated better with the two dimensions of psychological well-being (environmental mastery and life goals).

These results are consistent with the findings of Gómez et al., (2010) and (de Castro et al., 2012). Elderly with good psychological well-being tend to have a high quality of life. According to Refahi et al., (2015), good psychological well-being will affect positive attitudes, feelings of satisfaction, intimacy about relationships, feelings of independence, life goals, and feelings of strength in life. In conclusion, the results of this study confirm the role of autonomy, purpose in life, positive relationships with others, personal growth, self-acceptance, and environmental mastery in influencing psychological well-being among the elderly. The results also confirm the importance of psychological well-being in the quality of life of the elderly. Regarding the results achieved, we suggest that other researchers repeat this study in various regions or countries to achieve more accurate and general results. We also recommend for elderly families to pay more attention to the psychological well-being of the elderly to improve and maintain a good quality of life. Good intervention programs or modules can also be created to increase psychological well-being and quality of life among the elderly.

CONCLUSION

The elderly who are members of the gymnastic group show a good level of QOL. In addition, they also showed good physical fitness, had high independence in daily activities, and assessed their own QOL better. The overall QOL, physical, psychological, and environmental domains are important in QOL assessment in older adults. Older people's positive assessment in terms of QOL is associated with their level of physical fitness, in particular: lower body mobility and flexibility. In addition, all dimensions of psychological well-being (self-acceptance, positive relationships with others, autonomy, environmental mastery, personal growth, and life goals) in the elderly can significantly affect the quality of life, especially in psychological, social, and environmental aspects. Meanwhile, the physical domain and overall QOL are less significant with all dimensions of psychological well-being. The physical domain is only correlated with environmental mastery, and overall QOL correlated better with the two dimensions of psychological well-being (environmental mastery and purpose in life).

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IDENTIFYING MALNUTRITION RISKS IN VULNERABLE GROUPS IS KEY TO COMPLEMENTARY THERAPY IN HEALTH CRISES

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Abstract

Malnutrition poses a significant challenge globally, especially impacting children and the elderly in vulnerable communities. This study sought to uncover malnutrition risk factors within these populations and evaluate the role of complementary therapy in addressing health crises stemming from nutritional deficiencies. Through a detailed survey encompassing structured questionnaires, open-ended inquiries, and group discussions, data was collected from various at-risk communities. Results highlighted critical issues like food insecurity, limited healthcare access, poverty, lack of dietary variety, and micronutrient shortages as key contributors to malnutrition. Feedback on complementary therapies was generally favorable, pointing to their potential in nutritional support, with a strong emphasis on the necessity for community involvement and integration into existing health frameworks. The research underscores the need for well-informed, targeted actions to combat malnutrition and enhance the well-being of those most at risk, providing valuable insights for developing effective, sustainable interventions.

Introduction

Malnutrition continues to be a critical global health challenge, particularly among vulnerable populations, such as children and the elderly, in both developed and developing countries. The World Health Organization (WHO) estimates that malnutrition contributes to over one-third of all child deaths worldwide, making it a leading cause of mortality in children under the age of five (Hossain et al., 2017). Malnutrition can become a major concern, especially in the institutionalized elderly population, where the incidence of malnutrition ranges from 12% to 50% (Norman et al., 2021). Despite various efforts to combat this issue, malnutrition persists, and its complex interplay of factors in vulnerable groups necessitates further investigation.

The existing literature provides valuable insights into malnutrition and its impact on vulnerable populations (Akhtar, 2016; Maestre et al., 2017). However, a significant gap in current research lies in the lack of comprehensive studies specifically focusing on identifying the risk factors associated with malnutrition within these at-risk groups (Alert et al., 2012; Olivares et al., 2014; Reber et al., 2019). While previous research has highlighted general risk factors for malnutrition, a more targeted examination of factors affecting vulnerable populations is essential to develop precise and tailored interventions(Munoz et al., 2022). Addressing this gap can help healthcare professionals and policymakers design more effective strategies to alleviate malnutrition in these specific populations and reduce associated morbidity and mortality rates.

The novelty of this research lies in its

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Table 1. Indicators and Questions of Important Risk Factors of Malnutrition

Indicators	Sub Indicators	Items of Quantitative Question	Items of Qualitative Question
Food Insecurity	Lack of Access to Food	How accessible is food with a balanced diet for your kids or the elderly, on a scale of 0 to 5?	Could you share your experiences with insufficient food quantity? What challenges have you faced regarding this issue?
	Insufficient Food Quantity	How would you grade (on a scale of 0 to 5) the likelihood that your children or elderly members suffer from inadequate food quantity when there isn't enough to eat?	Can you describe the impact of insufficient food quantity on your daily life, health, and well-being?
Limited Access to Healthcare	Distance to Healthcare Facility	On a scale of 0 to 5, how would you rank the difficulties you have getting your kids or the elderly to a medical facility?	Could you describe the challenges you encounter in reaching a healthcare facility?
	High Healthcare Costs	How would you rank, on a scale of 0 to 5, the impact that excessive healthcare prices have on your children's or the elderly's ability to get medical care?	How do high healthcare costs impact your ability to access medical care? Can you provide specific examples of how this has affected your children or elderly?
Low Socio-Economic Status	Unemployment or Underemployment	On a scale of 0 to 5, how would you rank the job prospects in your community?	Could you describe the employment opportunities available to your children or elderly?
	Low Household Income	How would you rank (on a scale of 0 to 5) the state of the economy as a whole, with a focus on low-income households?	In terms of household income, how would you assess the financial stability of your family or community?
Insufficient Dietary Diversity	Limited Availability of Foods	How varied do you think the food alternatives are in your location, on a scale of 0 to 5? Are there any particular foods that are frequently absent?	Can you provide examples of how inadequate availability of food choices and nutrition for your children or elderly?
	Inadequate Dietary Knowledge	On a scale of 0 to 5, how knowledgeable do you think your children or elderly are eating a varied and well-balanced diet?	Can you share examples of how limited dietary knowledge affects food choices and nutrition in your children or elderly?
Inadequate Micronutrient Intake	Mineral Deficiency Knowledge	How well-informed are your children or elderly on vitamin and mineral deficits, on a scale of 0 to 5?	Could you describe the most common misconceptions or beliefs related to mineral deficiencies in your children or elderly?
	Vitamin Deficiency Knowledge	How much do your children or the elderly know about the importance of vitamins and the risks associated with vitamin deficiencies, on a scale of 0 to 5?	What practices or beliefs influence the dietary choices that lead to vitamin deficiencies in your children or elderly?

Table 2. Indicators and Questions of Perspectives on Complementary Therapy

Indicators	Sub Indicators	Items of Quantitative Question	Items of Qualitative Question
Potential Efficacy in Nutrition Support	Improvement of Nutritional Status	On a scale of 0 to 5, how effective has the implemented complementary therapy been in improving the nutritional status of the target group?	How have you observed the nutritional status of the children or the elderly improving since the introduction of Complementary Therapy?
	Prevention of Nutrient Deficiencies	Please rate, on a scale from 0 to 5, the extent to which the complementary therapy has succeeded in preventing nutrient deficiencies among the targeted population	In your experience, how effective has Complementary Therapy been in preventing nutrient deficiencies in the targeted group?
Importance of Community Engagement	Community Participation in Programs	To what degree, on a scale of 0 to 5, have community members actively participated in the malnutrition mitigation programs?	What level of participation and involvement have you noticed from the local community in Complementary Therapy programs for malnutrition mitigation?
	Empowerment of Local Health Practices	On a scale of 0 to 5, please evaluate the level of empowerment local health practices have achieved in the context of complementary therapy!	Can you describe any instances where Complementary Therapy has empowered local health practices or traditional healing methods in your community?
Integration with Existing Healthcare	Collaboration with Healthcare Providers	How well, on a scale from 0 to 5, did the complementary therapy foster collaboration between the community and healthcare providers?	How would you rate the collaboration between Complementary Therapy programs and established healthcare providers in the region?
	Coordinated Treatment Plans	Please rate, on a scale of 0 to 5, the effectiveness of the coordinated treatment plans in addressing malnutrition within the target population.	Have you observed well-coordinated treatment plans being implemented for children and the elderly as part of the Complementary Therapy approach?

intention to conduct a comprehensive survey specifically targeting vulnerable groups at risk of malnutrition. This research adopts an inclusive approach to encompass not only the children but the elderly vulnerable populations also. By doing so, it seeks to explore and identify unique risk factors that might be overlooked in more generalized studies. Moreover, this research aims to explore the potential of complementary therapy as an innovative approach to mitigating health crises resulting from malnutrition in these vulnerable groups. Complementary therapy offers a novel perspective on addressing malnutrition by integrating traditional and alternative healing practices, which may yield promising results in enhancing nutritional status and overall health outcomes among at-risk populations. The findings of this research can potentially inform evidence-based policies and interventions that specifically target these vulnerable groups, thus paving the way for more targeted, sustainable, and successful efforts in mitigating health crises caused by malnutrition. Ultimately, this research seeks to empower

healthcare professionals and policymakers with the knowledge and tools needed to make a substantial and lasting impact on the health and well-being of vulnerable populations around the world.

Methodology

The primary objectives of this research were twofold: firstly, to identify the risk factors associated with malnutrition in vulnerable groups, and secondly, to explore the potential of complementary therapy as an effective approach to mitigating health crises caused by malnutrition within these populations. To achieve these objectives, a comprehensive survey was designed and conducted, focusing on children and the elderly population. A comprehensive survey was employed as the primary method of data collection to gain insights into malnutrition and its risk factors in vulnerable communities. The survey aimed to encompass children (n=28) and the elderly (n=36) populations. By targeting those vulnerable groups, the research aimed to capture and generate findings that could be generalized to similar populations.

Purposive sampling approaches were employed to identify certain vulnerable communities and non-randomly chose participants from broader populations at Posyandu Purwomartani, Yogyakarta, to collect data. The objective of this methodology was to encompass persons from diverse socio-economic backgrounds and age groups, thereby offering a comprehensive picture of the issues associated with malnutrition in various disadvantaged areas. The survey was designed meticulously to address the research objectives effectively. Structured questionnaires were administered during face-to-face interviews to collect quantitative data related to several important risk factors, including inadequate dietary diversity, low socioeconomic status, restricted access to healthcare, and inadequate intake of micronutrients, which contributed to malnutrition (Table 1). Additionally, open-ended questions allowed participants to share their perspectives and experiences, enriching the data with qualitative insights (Table 2). Focus group discussions with health cadres of Posyandu (n=21) were also conducted to gather qualitative information, fostering meaningful discussions on the potential of complementary therapy in mitigating health crises linked to malnutrition.

This research adhered to research ethics principles, despite not undergoing formal ethical commission approval. Informed consent was obtained from all participants, ensuring their voluntary involvement. Anonymity was maintained in data reporting to protect participants' privacy. Data handling and analysis followed strict confidentiality procedures. The study prioritized the welfare and dignity of the vulnerable groups studied. Researchers maintained transparency and communicated the objectives and potential benefits of the study. While not subject to an ethical commission, ethical research principles were upheld to safeguard the rights and well-being of all participants.

Result and Discussion

The comprehensive survey conducted in this research yielded valuable data on the risk factors associated with malnutrition in diverse vulnerable communities. The study included participants from different age groups, such as children and the elderly. Here, we present the key findings from the survey, which shed light on the challenges faced by vulnerable populations and the potential role of complementary therapy in health crisis mitigation.

Table 2 provides a more detailed breakdown of the prevalence of malnutrition risk factors, exploring sub-indicators within each indicator. For food insecurity, lack of access to food was reported by 0.8 of the average score from participants, while 1.4 faced insufficient food quantity. Limited access to healthcare was influenced by distance to healthcare facilities (3.3) and high healthcare costs (3.6). Low socio-economic status was characterized by unemployment or underemployment (4.2) and low household income (3.5). For insufficient dietary diversity, a 3.2 average score faced limited availability of foods and 4.6 experienced inadequate dietary knowledge. In terms of inadequate micronutrient knowledge,

Table 3. Prevalence of Malnutrition Risk Factors in Vulnerable Communities

Indicators	Sub Indicators	Average Score (0-5)
Food Insecurity	Lack of Access to Food	0.8
	Insufficient Food Quantity	1.4
Limited Access to Healthcare	Distance to Healthcare Facility	3.3
	High Healthcare Costs	3.6
Low Socio-Economic Status	Unemployment or Underemployment	4.2
	Low Household Income	3.5
Insufficient Dietary Diversity	Limited Availability of Foods	3.2
	Inadequate Dietary Knowledge	4.6
Inadequate Micronutrient Intake	Mineral Deficiency Knowledge	4.7
	Vitamin Deficiency Knowledge	4.5

4.7 average scores suffered from mineral deficiency, and 4.5 experienced vitamin deficiency knowledge.

Table 3 delves into the perspectives on complementary therapy for health crisis mitigation, exploring sub-indicators within each indicator. Regarding the potential efficacy of nutrition support, 3.2 average scores of participants believed complementary therapy could improve nutritional status while 3.1 saw it as a preventive measure for nutrient deficiencies. The importance of community engagement was indicated by 4.3 average scores of participants who favored community participation in programs and 4.8 who valued the empowerment of local health practices. Integration with existing healthcare involves collaboration with healthcare providers (3.5) and coordinated treatment plans (3.2). The need for training and education highlighted health practitioners' competence (3.1) and the understanding of complementary therapy (3.2). The detailed data offers deeper insights into the perceptions of vulnerable communities, providing a foundation for designing targeted and culturally sensitive interventions for health crisis mitigation.

Food Insecurity: Interviews with participants revealed that the quantitative data on food insecurity only scratched the surface. Participants shared that the lack of access to food was not merely a matter of physical distance but often a result of factors like food deserts, limited transportation options, and cultural barriers. For example, reported a lack of local markets offering fresh produce, making it challenging to access nutritious food. Participants mentioned the high cost of transportation as a barrier to reaching affordable food sources. Additionally, interviews highlighted that the cultural context and traditional dietary practices influenced the perception of food quantity, indicating that

Table 4. Perspectives on Complementary Therapy for Health Crisis Mitigation

Indicators	Sub Indicators	Average Score (0-5)
Potential Efficacy in Nutrition Support	Improvement of Nutritional Status	3.2
	Prevention of Nutrient Deficiencies	3.1
Importance of Community Engagement	Community Participation in Programs	4.3
	Empowerment of Local Health Practices	4.8
Integration with Existing Healthcare	Collaboration with Healthcare Providers	3.5
	Coordinated Treatment Plans	3.2
Need for Training and Education	Health Practitioners' Competence	3.1
	Understanding of Complementary Therapy	3.2

quantitative measures alone could not capture the complexity of this issue.

Limited Access to Healthcare: Field observations conducted unveiled the harsh realities of limited access to healthcare facilities. While quantitative data suggested that high healthcare costs were a significant barrier, qualitative insights indicated that the actual costs extended beyond monetary expenses. Participants in these communities expressed concerns about the time and labor required to reach the nearest healthcare center, often taking a full day of travel, resulting in lost wages and missed work. These observations underscore the multifaceted nature of healthcare access challenges that quantitative metrics might not fully capture.

Low Socio-Economic Status: Qualitative data enriched the understanding of low socio-economic status. Participants shared their experiences of underemployment, explaining how inconsistent work opportunities, such as seasonal agriculture work, led to periods of low income. Moreover, interviews highlighted that unemployment was linked to a lack of vocational skills and education, which were not adequately captured by quantitative indicators. This nuanced perspective revealed the need for comprehensive livelihood support programs to address the root causes of low socio-economic status.

Insufficient Dietary Diversity: Qualitative data elaborated on the factors contributing to insufficient dietary diversity. Field observations revealed that the limited availability of foods in certain areas was not solely due to geographic location but often tied to infrastructure challenges. For instance, participants described how roads blocked during the rainy season disrupted the supply chain of perishable goods. In contrast, field observations indicated that dietary knowledge deficits were partly due to a lack of awareness about the nutritional value of local foods. This nuanced information could guide community-specific interventions to improve dietary diversity.

Inadequate Micronutrient Intake: The qualitative insights into inadequate micronutrient intake uncovered the cultural and behavioral aspects influencing this issue. Participants explained how their dietary practices were rooted in traditional beliefs, often leading to a reluctance to adopt new dietary habits. Additionally, field observations highlighted the role of convenience and affordability in determining food choices, which were not entirely captured by quantitative data. Qualitative findings emphasized the importance of culturally sensitive nutritional interventions to address micronutrient deficiencies effectively.

Complementary Therapy Perspectives: Interviews uncovered the nuanced perspectives of participants regarding complementary therapy. While quantitative data indicated general agreement, interviews highlighted the concerns and expectations of vulnerable communities. For example, participants expressed that the success of complementary therapy hinged on the recognition of traditional healing practices and the active involvement of community members in the design and implementation of such programs. Qualitative data underscored the need for training and education to ensure that healthcare providers were culturally competent, an aspect not entirely captured by quantitative scores.

The resulting data provides crucial insights into the risk factors contributing to malnutrition in diverse vulnerable communities. Food insecurity, limited access to healthcare, low socio-economic status, insufficient dietary diversity, and inadequate micronutrient intake were identified as key challenges. Additionally, the survey highlighted the potential of complementary therapy in health crisis mitigation, emphasizing the importance of community engagement and integration with existing healthcare systems. These findings can serve as a foundation for evidence-based interventions and policies aimed at improving the health and well-being of vulnerable populations. Overall, the qualitative insights added depth and context to the quantitative data, offering a more comprehensive understanding of the challenges and potential solutions related to malnutrition in vulnerable communities. These findings could guide the development of more effective and culturally sensitive interventions to mitigate health crises associated with malnutrition.

Potential Efficacy in Nutrition Support:

Through in-depth interviews, participants expressed optimism about the potential efficacy of the implemented Complementary Therapy in providing valuable nutritional support. Caregivers noted improvements in the overall well-being of the targeted group, including increased energy levels and a visible enhancement in their physical health. Participants, consisting of caregivers and those directly impacted by Complementary Therapy, shared a collective sense of optimism. Their voices echoed the transformative impact on the well-being of the targeted group. Caregivers, in particular, became storytellers of improvement, narrating tales of increased energy levels and visible enhancements in physical health. It was not merely about the nutrients provided; it was about the restoration of vitality and the promise of a healthier future.

Importance of Community Engagement: Observations in the field emphasized the significant role of community engagement. The community actively participated in program activities, demonstrating a strong sense of ownership. This engagement was found to be crucial for the success and sustainability of Complementary Therapy initiatives. The community's active participation in program activities was not a passive involvement but a vibrant display of ownership. This engagement, as evidenced by the palpable sense of belonging, emerged as a linchpin for the success and sustainability of Complementary Therapy initiatives. The program wasn't just an intervention; it was a shared endeavor, a communal commitment to better health.

Integration with Existing Healthcare: The qualitative data shed light on the dynamics of integrating Complementary Therapy with existing healthcare structures. While collaboration with healthcare providers received positive feedback, challenges in coordinating treatment plans were identified. Further exploration revealed the need for improved communication channels and shared protocols. While collaboration with healthcare providers received a commendation, it wasn't immune to challenges. Coordinating treatment plans emerged as a focal point, revealing intricate dynamics. The need for enhanced communication channels and shared protocols became apparent, underlining that for Complementary Therapy to reach its full potential, it must harmonize with existing healthcare systems seamlessly.

Need for Training and Education: Interviews and field observations underscored the importance of training and education. Respondents stressed the necessity for enhancing health practitioners' competence in understanding and delivering Complementary Therapy. Limited awareness among practitioners and the community highlighted a crucial area for intervention. The narrative illuminated a deficiency in health practitioners' competence regarding Complementary Therapy. Respondents emphasized the necessity for a comprehensive understanding among practitioners, echoing a sentiment that this form of therapy requires more than technical skills; it demands a deep appreciation of its principles and applications. Simultaneously, the limited awareness among practitioners and the community emerged as a red flag, indicating a critical area for intervention. The potential for positive impact could only be fully realized when both the providers and recipients were well-informed.

Qualitative findings complementary therapy stands at the intersection of promise and pragmatism. It holds the promise of transforming nutritional landscapes and fostering community well-being, but to realize this promise, pragmatic solutions are required — from refining healthcare collaborations to investing in comprehensive education. The story is not only about what has been achieved but about what can be achieved with a deeper understanding, a more engaged community, and a healthcare system that seamlessly incorporates the principles of Complementary Therapy into its framework. The qualitative narrative becomes a guide, illuminating the path forward toward a healthier, more resilient community.

The findings from the comprehensive survey conducted in this research provide valuable insights into the risk factors associated with malnutrition in vulnerable communities. These results align with existing theories and data from previously published studies on malnutrition and its impact on at-risk

populations. The prevalence of food insecurity reported in this study is consistent with the global trend of insufficient access to nutritious food among vulnerable groups (World Health Organization, 2020). The high percentage of individuals facing limited access to healthcare echoes previous research, which highlights the challenges faced by marginalized communities in obtaining adequate medical services (Bonevski et al., 2014).

The analysis of the findings from the comprehensive survey on malnutrition risk factors in vulnerable communities highlights several crucial aspects that contribute to our understanding of this pressing global health issue. Firstly, the prevalence of food insecurity among the surveyed individuals underscores the urgent need for targeted interventions to ensure access to sufficient and nutritious food for vulnerable populations. Addressing food insecurity requires comprehensive strategies that consider not only immediate food assistance but also long-term solutions such as agricultural development, income support, and social safety nets (Smith & Glauber, 2020). Additionally, empowering vulnerable communities to participate in decision-making processes related to food security can enhance the effectiveness and sustainability of interventions (Johnson et al., 2018; Hantrais et al., 2020).

The study's finding on limited access to healthcare further emphasizes the importance of improving healthcare infrastructure and services in marginalized communities. Enhancing access to healthcare not only involves increasing the availability of medical facilities but also addressing socio-economic barriers, transportation challenges, and cultural factors that may deter individuals from seeking healthcare services (Ahmed et al., 2016; Agyemang-Duah et al., 2019). Integrating nutrition counseling and malnutrition screening into existing healthcare systems can improve early detection and management of malnutrition-related conditions (Malone & Hamilton, 2013; Silver et al., 2018).

The link between low socioeconomic status and malnutrition has been extensively documented in numerous studies (Tette et al., 2015; Husseini et al., 2018). The present research corroborates these findings, indicating that socioeconomic factors play a crucial role in shaping nutritional outcomes among vulnerable populations. The prevalence of insufficient dietary diversity aligns with previous research highlighting the importance of a balanced diet in preventing malnutrition and promoting overall health (Kumar et al., 2015; Olatunji et al., 2021). Additionally, the high percentage of participants reporting inadequate micronutrient intake is consistent with data demonstrating widespread nutrient deficiencies in vulnerable communities (Hwalla et al., 2017; Puwanant et al., 2022).

Moreover, the association between low socio-economic status and malnutrition reaffirms the urgent need for poverty alleviation measures to uplift vulnerable populations. Efforts to address malnutrition must go hand in hand with poverty reduction strategies, which may involve income support programs, livelihood development, and improved educational opportunities (Opoku et al., 2019; Singh & Chudasama, 2020). Targeted interventions that focus on enhancing the economic well-being of vulnerable communities can have far-reaching impacts on their nutritional status and overall health outcomes.

The data indicating insufficient dietary diversity and inadequate micronutrient intake emphasize the importance of nutrition education and behavior change interventions. Promoting diverse and nutritious diets requires raising awareness about the value of balanced nutrition and the selection of locally available foods rich in essential nutrients (De Castro, 2013; Bvenura & Sivakumar, 2017). Nutrition education programs can empower individuals to make informed dietary choices, leading to improved dietary diversity and better nutritional outcomes.

Regarding the potential of complementary therapy in health crisis mitigation, the survey results are in line with existing literature on the role of traditional and alternative healing practices in addressing malnutrition (Girard et al., 2021). The study's participants acknowledged the potential efficacy of complementary therapy in nutrition support, reflecting the growing interest in incorporating such interventions in healthcare practices. The

emphasis on community engagement resonates with research emphasizing the importance of involving local communities in designing and implementing nutrition interventions to ensure their relevance and sustainability (Domingo et al., 2021). Integrating traditional and alternative healing practices with conventional healthcare can offer holistic and patient-centered approaches to address malnutrition-related health crises (Davison & Jassal, 2016; Pemunta & Tabenyang, 2021). However, it is essential to approach complementary therapy with caution, ensuring evidence-based practices and safety standards are followed (Lindquist et al., 2018). Rigorous research and evaluation of complementary therapy interventions are needed to assess their effectiveness and long-term impact on vulnerable communities.

Moreover, the call for integration with existing healthcare systems aligns with the principles of holistic healthcare, where traditional and modern medicine are seen as complementary rather than exclusive approaches (Pemunta & Tabenyang, 2021). The need for training and education to ensure the safe and effective application of complementary therapies is consistent with research emphasizing the importance of evidence-based practices and professional competence (Kretchy et al., 2016; Lindquist et al., 2018). Overall, the findings from this research contribute to the body of knowledge on malnutrition in vulnerable communities and the potential of complementary therapy in health crisis mitigation. The alignment between the study's results and existing theories and data provides further credibility to the research's conclusions. By building upon the existing evidence base, the study reinforces the importance of targeted interventions and policies to address malnutrition and improve the health outcomes of vulnerable populations. Future research may focus on evaluating the effectiveness of specific complementary therapy interventions and exploring the long-term impact of comprehensive nutrition support programs on at-risk communities.

Conclusion

The comprehensive survey on malnutrition risk factors in vulnerable communities has provided valuable insights into the challenges faced by at-risk populations. The study revealed that food insecurity, limited access to healthcare, low socio-economic status, insufficient dietary diversity, and inadequate micronutrient intake are significant contributors to malnutrition. These findings align with existing research, emphasizing the need for targeted interventions and policies to address the complex interplay of factors influencing malnutrition in vulnerable groups. Additionally, the research explored the potential of complementary therapy as an innovative approach to health crisis mitigation. The study's participants acknowledged the potential efficacy of complementary therapy in nutrition support, highlighting the importance of community engagement and integration with existing healthcare systems. By building upon the existing evidence base, this research contributes to a better understanding of malnutrition among vulnerable communities and paves the way for evidence-based strategies aimed at improving the health and well-being of at-risk individuals worldwide. Further research on the effectiveness of specific complementary therapy interventions and the long-term impact of comprehensive nutrition support programs is recommended to guide future efforts in mitigating health crises related to malnutrition.

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The Phenomenon of Intergenerational Child Marriage Practice and Its Causes

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Abstract

The prevalence of child marriage has not been lowered even though the age limit for marriage has been raised to 19 years according to the law. Grobogan is the region with the highest prevalence of married and pregnant women at the age of children (less than 19 years old) in Central Java in the last 5 years. The purpose of the study was to find out the practice of child marriage and its causes, the marriage pattern of boys and girls, and the relationship between parental marriage history and the incidence of child marriage in the community. Secondary data research from marriage dispensation documents at the Purwodadi Religious Court Class 1A. The study used a purposive sampling technique, namely couples married in the Grobogan district in the last 5 years (2018-2022) where one or both of them were less than 19 years old and both of their parents were still alive, a sample of 2,103 couples was obtained. The data was analyzed quantitatively using the Chi-square test. The results of the study found that women are the most likely to get married at the age of children. The most common causes of child marriage practices are dating behavior (76.8%), pregnancy (15.9%), having proposed (6.7%), having given birth to a child (0.4%), and having actively engaged in sex (0.1%). There is a significant relationship between the marriage history of mothers and the marriage of their daughters. Mothers who marry at a child's age also cause child marriage in their daughters (p-value 0.0002).

Introduction

Indonesia currently ranks eighth in the world and second in ASEAN countries with the highest prevalence of child marriage. Central Java is one of the provinces in Indonesia with the prevalence of female marriage and pregnancy at the age of children (less than 19 years old) is a high challenge in Indonesia, and it is still a challenge that must be solved (Indraswari et al., 2023). Grobogan is one of the regions in Central Java with a high prevalence of women getting married and getting pregnant at a young age (less than 19 years old). The prevalence of child marriage in Grobogan during 2018 was 59.88%, in 2019 it was 51.24%, in 2020 it was 52.81%, in 2021 it was 54.33%, and in 2022 it was 52.15%. Likewise, the prevalence of first pregnancy less than 19 years old is also very high, reaching 30.92% in 2019. This prevalence increased in 2020 to 35.76%, in 2021 to 36.48% and 32.87% in 2022 (BPS Central Java Province, 2022).

Marriage of women at a child's age has become a serious problem. Some studies have shown that women who marry at the age of 10-19 are at almost 5 times greater risk of dying during pregnancy and childbirth compared to those who marry at the age of 20-24. Mothers aged 15-19 years are also more at risk of pregnancy and childbirth complications than

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mothers aged 20-24 years. Early marriage can cause various adverse health impacts such as miscarriage, stillbirth, high fertility, and morbidity (Adhikari et al., 2009; Nasrullah et al., 2014; Adedokun et al., 2016; Hotchkiss et al., 2016; Paul, 2019, 2020; Bappenas, 2020). This condition also occurs in the Grobogan district. Over the past three years, it has always been the region with the highest percentage of maternal mortality under the age of 20 in Central Java. There have been 3 cases of maternal deaths under 20 years old (8.3%) out of a total of 36 maternal deaths in 2019. Everything happens during the postpartum period. Likewise, in 2020 and 2021, 2 cases (6.4% of the total 31 maternal deaths) in 2020 and 5 cases (5.95% of the total 84 maternal deaths) in 2021. The case occurred during pregnancy and the postpartum period (Central Java Health Office, 2021).

The impact of child marriage also occurs in children who are born. Women who become pregnant at an early age have a 1.55 times greater risk of infant mortality when compared to women who become pregnant at an older age. Children born to underage women are also more at risk of stunting, being thin, and being underweight. Babies with low birth weight (BBLR) are more born to mothers aged 16-19 years (17.80%) than mothers aged 20-30 years (12.33%) (Raj, 2010; BPS RI, 2020). A study of 3,400 babies born to women under 30 years old in Grobogan district, Central Java, during 2020-2021, obtained the result that women who became pregnant at the age of less than 20 years had a 1,728 times greater risk of giving birth to a BBLR baby compared to women who gave birth at the age of more than 20 years (Azinar et al., 2021).

The above facts show that child marriage must be avoided so that early pregnancy can be prevented. Child marriage is caused by individual factors such as free sexual behavior, family factors such as economic factors, arranged marriage, and the existence of a culture or tradition of young marriage (BKKBN, 2012; Malik, 2014; 'Pandya YP, Bhanderi DJ. An epidemiological study of child marriages in a rural community of Gujarat', 2015). Knowledge, attitudes, and self-efficacy are also individual factors that greatly determine the decision of a teenager to get married at an early age (Bandura, 2012; WHO, 2016).

Cases of girl marriage that often occur in society are not only the will of individual teenagers, but many of these marriages are also decisions and even coercion from parents or families. The motives and social phenomena of the intergenerational marriage of women and children that occur between generations in the community before and after the amendment of the Marriage Law in Indonesia are very important to analyze. The objectives of this study are: 1) to analyze the trend of child marriage cases in the period before and after the enactment of the amendment of the Marriage Law in the last 5 years, 2) to analyze the motives of child marriage that occurred, 3) to analyze the correlation of child marriage between generations in society.

Method

The research was conducted by quantitative method with secondary data analysis, namely marriage dispensation case documents at the Purwodadi Religious Court Class 1A. The study population is women and their spouses who applied for marriage dispensation (under 19 years old) granted by the Purwodadi Religious Court Class 1A within the last 5 years (2018-2022), namely a total of 2,676 married couples. The sample selection was carried out using the purposive sampling technique, with the criterion that both parents were still alive. Based on these conditions, a sample of 2,103 couples was obtained. The data collected includes 1) the age of the woman's parents at the time of marriage; 2) the age of the woman who is going to get married; 3) the age of the man who becomes her spouse; 4) the reason for child marriage. The data were analyzed to describe the trend of cases and causes of child marriage, as well as bivariate analysis with the Chi-square test to analyze the relationship between parents' marriage history and child marriage.

Results and Discussion

Cumulatively in the last 5 years (2018-2022), there were 2,676 marriage dispensations granted by the Purwodadi Religious Court Class 1A. This means that 2,676 male and female couples have child marriage (less than

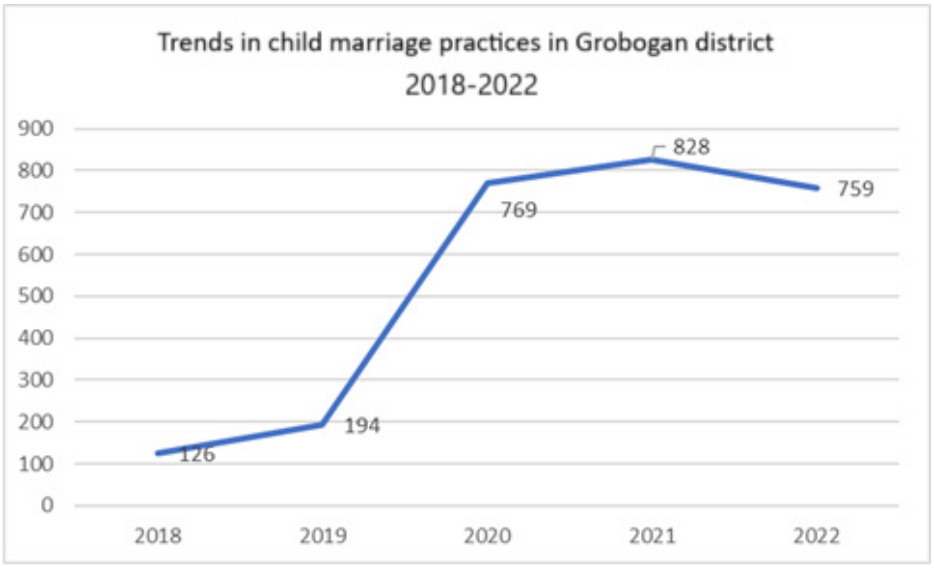

Figure 1. Trends in child marriage practices in Grobogan district in the last 5 years (2018-2022).

19 years old) and are registered at the Ministry of Religious Affairs Office. Looking at the trend in the last five years, child marriage in the Grobogan district tends to increase every year even though the minimum age limit as a condition for marriage has been increased from 16 years to 19 years according to the new Marriage Law.

Figure 1 shows that the practice of child marriage in the Grobogan district of Central Java every year has experienced a significant increase. Data from the study stated that in 2018 there were 126 cases of child marriage. The following years were 194 cases in 2019, 769 cases in 2020, 828 cases in 2021, and 759 cases in 2022. Based on the causes, the following is a distribution of the causes of child marriage practices in the last 5 years in the Grobogan district of Central Java.

Based on the sample inclusion requirements, the sample was selected from married couples whose one or both were less than 19 years old and whose parents were still alive, so the sample became as many as 2,103 couples. Table 1 shows that the most common cause (76.8%) of child marriage practices (under 19 years old) is courtship behavior (premarital sexual behavior). Courtship behavior makes their relationship even closer and even inseparable from each other. Marriage at an early age is chosen as a solution to avoid the occurrence of premarital sexual behavior that is at risk of premarital pregnancy. However, the practice of child marriage also occurs because the woman has experienced a pregnancy before marriage, known as a teenage pregnancy or unwanted pregnancy (15.9%). Other causes are having carried out a proposal or engaged

Table 1. Distribution of Causes of Child Marriage Practice in the Last 5 Years (2018-2022)

Causes of Child Marriage	Total	%
Dating	1.615	76,8
Have had sex	3	0,1
Pregnant	335	15,9
Already proposed (engaged)	141	6,7
Has given birth	9	0,4
Grand Total	2.103	100,0

Source: Religious Court marriage dispensation data (2018-2022).

Table 2. Comparison of Marriage Cases in Boys and Girls in the Last 5 Years (2018-2022).

Year		Man		Woman		Total
< 19 years old		≥ 19 years old	< 19 years old	≥ 19 years old		
2018	Amount	52	40	78	14	184
	% total	28.26	21.74	42.39	7.61	100.00
2019	Amount	44	91	124	11	270
	% total	16.30	33.70	45.93	4.07	100.00
2020	Amount	99	544	638	5	1,286
	% total	7.70	42.30	49.61	0.39	100.00
2021	Amount	75	572	643	4	1,294
	% total	5.80	44.20	49.69	0.31	100.00
2022	Amount	95	491	579	7	1,172
	% total	8.11	41.89	49.40	0.60	100.00
Grand Total	Amount	365	1,738	2,062	41	4,206
	% total	17.35	82.55	98.05	1.95	100.00

Source: Religious Court marriage dispensation data (2018-2022).

Table 3. Comparison of Marriage Cases in Boys and Girls in the Last 5 Years (2018-2022)

Age		Woman		Total
Age < 19 years old		Age ≥ 19 years old		
Man				
Age < 19 years old	Amount	327	38	365
	%	15.5	1.8	17.4
Age ≥ 19 years old	Amount	1,735	3	1,738
	%	82.5	0.1	82.6
Grand Total	Amount	2,062	41	2,103
	%	98.1	1.9	100.0

Source: Religious Court marriage dispensation data (2018-2022).

(6.7%), the woman has given birth (0.4%), and the two married couples have been actively involved in sexual relations (0.1%).

Table 2 shows that of the 2,103 male and female couples who have been married in the last 5 years, where one or both of them are less than 19 years old, it is known that women who marry at the age of children (less than 19 years) reach 98.05%, while men are only 17.36%. Women are the party with the most marriages under the age of 19. In contrast, more men are married at a more mature age (over 19 years old).

Table 3 shows that when viewed from the pattern of child marriage couples that occurred in Grobogan district, Central Java in the last 5 years, it is known that the most common pattern of child marriage is women of child age (less than 19 years old) married adult men (more than 19 years old), which is 82.5%. There are 15.5% of child marriage practices between women and men who are both under 19 years old. In addition, 1.8% of marriages occurred between adult women (over 19 years old) and men under 19 years old, and there were 0.1% of women married to men who were both 19 years old.

Child marriage when viewed based on their parents' marriage history as seen in Table 4, is known that from the 2,103 child marriage practices that occurred, 98.2% of child marriage

Table 4. The Relationship between Parental Marriage History and Child Marriage Practice.

Parents' Marriage History < 19 years old (age of child)		Male Marriage		Female Marriage	
		≥ 19 years old (adult)	< 19 years old (age of child)	≥ 19 years old (adult)	
Father					
Married young (< 19 years old)	Amount	23	93	112	4
	%	19.8	80.2	96.6	3.4
Married adults (≥ 19 years)	Amount	342	1,645	1,950	37
	%	17.2	82.8	98.1	1.9
	P-value	0.551		0.282	
Mother					
Married young (< 19 years old)	Amount	356	1,730	2,049	37
	%	17.1	82.9	98.2	1.8
Married adults (≥ 19 years)	Amount	9	8	13	4
	%	52.9	47.1	76.5	23.5
	P-value	0.001		0.0002	

Source: Analysis of marriage dispensation data of the Religious Court (2018-2022).

practices occurred on the side of women whose mothers also had a history of marriage at the age of children. Data analysis showed that no relationship between the father's marital history and child marriage occurred in their boys or daughters (p-value> 0.05). This means that there is no significant difference in the age of child marriage between boys and girls between those whose fathers married at a young age or adulthood. On the other hand, on the mother's side, there is a significant relationship between the mother's marriage history and the marriage practices carried out by their daughters and sons. This means that mothers who married at a young age (less than 19 years old) tend for their daughters to also practice marriage at a young age (p-value 0.0002). Likewise, mothers who married in adulthood tend to be followed by their children to marry at an adult age as well (p-value 0.001).

Based on the results of the study, it is known that the practice of child marriage in Grobogan district is most often caused by courtship behavior (premarital sexual behavior), pregnancy before marriage (unwanted pregnancy), and there has been a proposal. Social norms give a negative stigma to these behaviors. Therefore, marriage at an early age is the solution to this problem. These findings are in line with previous research that states that sexual behavior before marriage is the cause of unwanted pregnancy (KTD) in adolescents. This pregnancy encourages the practice of child marriage (Karjono et al., 2017; Hardiani and Junaidi, 2018; Windiarti and Besral, 2018). Similar findings in another study also found that poverty, teenage pregnancy, and cultural norms such as engagement, and pressure from those closest to them as drivers of child marriage (Ahonsi et al., 2019; Psaki et al., 2021). Adolescent pregnancy is a driving factor significant occurrence of child marriage (Petroni et al., 2017; Asnong et al., 2018; Misunas et al., 2021; Harvey et al., 2022).

Based on the incident, the practice of child marriage occurs more in girls than in men. Women are the most likely to get married under the age of 19. This makes women the most vulnerable group to marry or be married at a young age (early marriage). These findings are in line with WHO data, which states that child marriage is often the result of deep-rooted gender inequality in society, causing girls to be disproportionately affected by the practice. Globally, the prevalence of child marriage among boys is only one-sixth that of girls. The results of the study are in line with research in Nepal which shows that female marriage at an early age is common compared to men (Choe, Thapa and Mishra, 2005). The research

is in line with other studies that have found that women are more likely to marry due to gender inequality. An estimated 650 million girls and women today are married before the age of 18 (Efevbera et al., 2017; Efevbera and Bhabha, 2020; Tomar et al., 2021).

Based on its relationship with the marital age history of its parents, the results of the study stated that almost all marriages of women under the age of 19 occur in children whose mothers also have a history of marriage at the age of less than 19 years. This finding is in line with research that states that there has been a phenomenon of marriage and childbirth at an early age that is repeated from generation to generation. This social phenomenon has explained how the younger generation follows their parents in starting to give birth early. Although the younger generation has their value in making decisions related to marriage, their attitudes and practices are shaped by their observations of their parents' marriages (Widyastari, Isarabhakdi and Shaluhiyah, 2020). There is a strong pattern of early marriage and motherhood between mother and daughter, thus reinforcing the hypothesis of this study and consistent with the existing literature. The age of the mother first getting married and giving birth affects the risk of early marriage and the first birth of her daughter (Bates, Maselko and Schuler, 2007; Rijken and Liefbroer, 2009; Kolk, 2014; Morosow and Trappe, 2018; Kavas, 2022). Child marriage is a social problem that has a major impact on the entire life of a person, family, and society. Projections from the study (E.P. and Poonia, 2015), child marriage will continue in the future and will have an impact on at least two generations if the prevalence and attitudes continue to the present.

Conclusion

Child marriage (less than 19 years old) occurs more often in women. The cause of the practice of child marriage in the community is due to dating behavior that does not follow societal norms, teenage pregnancy (unwanted pregnancy), being proposed, having given birth, and has both been active in sexual intercourse. Women who practice child marriage often occur in families where parents, especially mothers, also marry at a young age. Mothers' marital histories are significantly related to their daughters' marital practices. Mothers who marry at a child's age (less than 19 years old) influence the occurrence of child marriage in their daughters.

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Family History and Smartphone Use Associated with Refractive Error in School-Aged Children

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Abstract

The prevalence of Refractive Error (RE) in school children tends to increase. The study aims to analyze the prevalence and determinants of RE in elementary school children. The research was carried out in 2022, using a cross-sectional design. The research population is 110 students in grades V and VI of Krapyak State Elementary School, Semarang City. A total of 80 students were selected as samples with purposive sampling techniques. Data collection was carried out by interview techniques using questionnaires. RE is measured by Snellen Chart examination and pinhole lens. The multiple logistic regression multivariate test was used for risk factor analysis. The bivariate analysis resulted in 6 variables eligible for inclusion in the multivariate analysis model. The results of the multivariate analysis showed that there were 2 risk factors for RE, namely: smartphone use ≥ 2 hours continuously per day (OR = 14.622 95% CI 1.124 - 190.181) and parental history (OR = 11.194, 95% CI 1.827 -65.567). The probability of RE if a student has both risk factors is 71%. The use of smartphones ≥ 2 hours continuously per day and the presence of parental history of RE are risk factors for RE events in elementary school students.

Introduction

Refractive error (RE) is an eye health problem with an increasing prevalence (Sharma et al., 2012). RE can occur in all age groups, including school children. Research shows that most RE begins to occur in childhood. Some studies show that the prevalence of myopia increases in children aged 6-12 years (Lindquist, Cama and Keeffe, 2011; Gao et al., 2012; Alem and Gebru, 2021). RE contributes as one of the causes of vision loss. Uncorrected RE is the main cause of Low Vision in the world (Hashemi et al., 2018; Sharma et al., 2020). In Indonesia, the prevalence of RE ranks first in eye diseases. From year to year, RE shows an increasing trend. It is estimated that a quarter of Indonesia's population experiences RE. RE is the first rank in the top ten eye diseases in Indonesia (Ministry of Health, 2019).

A preliminary study conducted on grade V students of Krapyak State Elementary School, Semarang City, showed that 25% of students experienced RE. RE in children is a problem that must be addressed immediately. Visual impairment in school children can affect student learning achievement. In general, 80% of information during the first 12 years of a child's life is obtained through vision. In addition, 30% of information will be absorbed through vision. Because the delay in making refractive corrections, especially in school-age children, will greatly affect the ability to absorb learning materials. This will lead to a reduced potential for increased intelligence (Sharma et al., 2012; Al Wadaani et al., 2013; Khouj et al., 2023). Children with RE often do not complain

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of visual impairment. The child only shows symptoms that indicate visual impairment through daily behavior (Al-Bahhawi et al., 2018; Santiago et al., 2023). Therefore, a study is needed to determine the magnitude of the RE problem and its determinants. The purpose of the study was to analyze the prevalence and risk factors of RE in elementary school children.

Method

This study is an observational study with a cross-sectional design. The research was carried out in March – July 2022. The research population is 110 students of Class V and VI of Krapyak State Elementary School Semarang. The minimum number of samples is calculated by the following formula:

$$n = \frac{Z^2_{1-\alpha/2}\, p\,(1-p)\, N}{d2\,(N-1) + Z^2_{1-\alpha/2}\, p\,(1-p)}$$

n = number of samples; N = total population; d = Error rate (5%); Z21-α/2 = Z value based on 95% confidence (1.96); p = proportion of refractive error (25%).

Based on the calculation of the minimum number of samples, a total of 80 students were obtained. The sample was selected by purposive sampling technique. The inclusion criteria for the sample were: 1) the child was willing to participate in research activities; 2) children present at school during the implementation of research. The sample exclusion criteria are: 1) children with eye diseases other than refractive errors; 2) the child is uncooperative in the examination; and 3) children who use visual aids and whose vision is normal.

The study-bound variable was RE. The independent variables are: 1) length of reading/writing activities per day, 2) distance between eyes and reading/writing objects, 3) distance from watching television, 4) length of continuous smartphone use every day, 5) mother's work, 6) mother's education, 7) parent's RE history, 8) age; 9) gender, 10) nutritional status.

Data collection was carried out by interviews using instruments in the form of questionnaires. RE is measured by Snellen Chart examination and pinhole lens. The data were analyzed univariately, bivariate, and multivariate using multiple logistic regression. The research has received ethical feasibility from the UNNES Health Research Ethics Committee with letter number 041/KEPK/EC/2022.

Results and Discussion

Most of the research subjects were females. The characteristics of the age of the research subjects are in the range of 10 to 12 years. The distribution and frequency of research subjects by gender and age are shown in table 1:

The results showed that the prevalence of RE was 22.5%. Until now, there is no data from a national survey on the prevalence of RE in elementary school children. However, the prevalence of 22.5% found in this study is almost the same as several other studies that teach RE to elementary school children (Rezvan et al., 2012; Paudel et al., 2014; Okafor et al., 2021). The analysis of RE risk factors can be seen from the results of the bivariate analysis

Table 1. Characteristics of Research Subjects.

Characteristic		Frequency (n)	Percent (%)
Gender	Woman	47	58.8
	Man	33	41.3
	Total	80	100.0
Age	10 years	33	41.3
	11 years	33	41.3
	12 years	14	17.5
	Total	80	100.0

Source: Primary data of research, 2022.

Table 2. Results of Bivariate Analysis of RE Risk Factors.

Independent Variable	Exist	Refractive Disorders			P-value	RP, 95% CI
		Not	Total			
Length of reading/writing activities	≥2 hours	16 (53.3)	14 (46.7)	30 (100.0)	0.0001	3.333 (3.293 – 53.991)
	< 2 hours	2 (4.0)	48 (96.0)	50 (100.0)		
Eye distance to read/write objects	≥30 cm	13 (44.8)	16 (55.2)	29 (100.0)	0.0001	4.572 (1.813 – 11.533)
	> 30 cm	5 (9.8)	46 (90.2)	51 (100.0)		
Distance watching television	< 7x the width of the TV	14 (60.9)	9 (39.1)	23 (100.0)	0.0001	8.674 (3.190 – 23.582)
	≥ 7x the width of the TV	4 (7.0)	53 (93.0)	57 (100.0)		
Smartphone usage time	≥ 2 hours per day	17 (58.6)	12 (41.4)	29 (100.0)	0.0001	29.897 (4.192 – 213.223)
	< 2 hours per day	1 (2.0)	50 (98.0)	51 (100.0)		
Mother's work	work	4 (30.8)	9 (69.2)	13 (100.0)	0.475	1.473 (0.576 – 3.766)
	not working	14 (20.9)	53 (79.1)	67 (100.0)		
Mother's education	Not graduating from junior high school	5 (31.3)	11 (68.8)	16 (100.0)	0.338	1.538 (0.642 – 3.686)
	More than a junior high school graduate	13 (20.3)	51 (79.7)	64 (100.0)		
Parent's RE history	There is a history	14 (56.0)	11 (44.0)	25 (100.0)	0.0001	7.70 (2.817 – 21.049)
	No history	4 (7.3)	51 (92.7)	55 (100.0)		
Age	9–12 years	18 (22.5)	62 (77.5)	80 (100.0)	-	-
	6–8 years	0	0	0		
Gender	Woman	15 (31.9)	32 (68.1)	47 (100.0)	0.016	3.511 (1.104 – 11.164)
	Man	3 (9.1)	30 (90.9)	33 (100.0)		
Nutritional status	Malnutrition	4 (36.4)	7 (63.6)	11 (100.0)	0.256	1.792 (0.721 – 4.457)
	Usual	14 (20.3)	55 (79.7)	69 (100.0)		

Source: Primary data of research, 2022

as shown in the following Table 2:

Table 2 shows that 3 independent variables were not shown to be associated with RE events. The three independent variables are maternal employment, maternal education, and nutritional status of students. One variable cannot be analyzed because of the same variability, namely the age variable. This can be seen from the age distribution of students who have the same age category range. The results of the bivariate analysis in Table 2 show that 6 independent variables are significantly proven as risk factors for RE, namely: 1) the duration of reading activities; 2) the distance between the eyes and the reading object; 3) TV viewing distance; 4) The length of continuous smartphone use every day; 5) Family history with RE; 6) Gender. Based on the results of the bivariate analysis, a multivariate analysis was then carried out. The independent variable of the study that had a p-value of < 0.25 was included in the multivariate modeling. Table

Table 3. Results of Multivariate Analysis

Variable	*P-value*	Exp (B)	95% CI	
			Lower limit	Upper limit
Length of reading or writing activities per day	0.220	11.297	0.234	545.319
Eye distance to read/write objects	0.621	0.507	0.034	7.488
Distance watching television	0.879	1.227	0.087	17.308
The length of continuous use of smartphones every day	0.040	14.622	1.124	190.181
Family RE history	0.009	11.194	1.827	68.567
Gender	0.300	3.040	0.372	24.872

Source: Primary data of research, 2022.

2 shows that 6 variables have a value of p< 0.25. The results of the multivariate analysis of multiple logistic regression can be seen in the following table 3:

The results of the feasibility test on the multivariate model in Table 3 show the significance of the Hosmer and Lemeshow test of 0.567. This means that multivariate models have feasibility. Table 3 shows that of the 6 independent variables included in the model, 2 variables are significantly related to the incidence of RE in elementary school students. The two variables are: 1) Parent's history of RE, and 2) Duration of smartphone use per day.

Table 2 shows that the parental history variable has a p-value < 0.05 with OR = 11.194, 95% CI 1.827 -65.567. The long variable of continuous smartphone use also has a p < value of 0.05 with OR =14.622 95% CI 1.124 - 190.181. The OR value with a confidence interval of more than 1 indicates that this variable is a risk factor for RE in elementary school children. Meanwhile, the results of the Negelkerke R square analysis from the multivariate model showed a value of 0.713. The multivariate analysis model in this study shows that the history of RE in the family and the length of smartphone use are risk factors for RE in elementary school students. The results of the multivariate analysis showed that students who had a family history of ER had an almost 11 times greater risk of developing ER than students who did not have a parental history of RE. Students who have the habit of playing smartphones ≥ 2 hours continuously per day have almost 14 times greater risk of experiencing RE than students who play smartphones < 2 hours per day.

The results of the Negelkerke R square analysis of the multivariate model showed a value of 0.713. This means that if a student simultaneously has 2 risk factors for having a family history of RE and has the habit of playing smartphones ≥ 2 hours per day, then the student has a probability of experiencing RE of 71%. The results of the study showed that family history as a risk factor for RE was in line with previous research. Previous research has shown that children whose parents have a history of RE, the child is 2 times more likely to develop RE (Jones-Jordan et al., 2010; Lim et al., 2014). Another study found that the risk of ER in children with a parental history is 3 times greater to experience RE (Alem and Gebru, 2021; Worku et al., 2023).

Parental history as a risk factor for ER turns out to be more influential if both parents have a history. Research by Lim et al. (2014), in elementary school-age children in China found that the prevalence of RE is increasing with the presence of a parent's history of RE. In the study, it was found that the prevalence of RE in children without parental history was 49.77%. The prevalence of RE in children with a history of one parent is 59.62%. The prevalence in children with a history of both parents is 64.42% (Lim et al., 2014).

Family history as a risk factor for RE is a variable that cannot be modified (Ezhilvathani, Suruthi and Jeiganesh, 2019). Nevertheless, early detection of RE is indispensable. The introduction of RE risk factors is very necessary

as an effort to prevent RE problems early. Students who have a history of parents need to receive special education. The student must receive the attention of the school to be able to control other risk factors, especially related to behavioral factors of eye health (Okafor et al., 2021; Wang et al., 2022).

In addition to parental history, this study proves that smartphone use ≥ 2 hours continuously is a risk factor for RE events. Prospective observational studies on children and adolescents in Hong Kong also showed similar results. The study found that exposure to smartphones or tablets for more than 2 hours per day increased the risk of RE events (Red et al., 2020). Meanwhile, the research by Enthoven et al. (2021) shows that teenagers in the Netherlands use smartphones for about 4 hours per day. Continuous smartphone use for more than 20 minutes is associated with the incidence of RE, especially in adolescents who do not do much outdoor activity (Enthoven et al., 2021).

The duration and frequency of smartphone use in adolescents seem to be inversely proportional to the time spent doing physical activities outdoors. This is confirmed by Wang et al. (2019), in his research, it was proven that rural people who are used to doing physical activities outdoors have a lower risk of experiencing RE than urban people (Money et al., 2019). Continuous use of smartphones ≥ 2 hours per day can lead to conditions where the eyes are unable to maintain focus on objects at close range. This will cause shadows that enter the retina to be out of focus, causing biochemical changes in the structure of the sclera and choroids that play a role in regulating the axial elongation of the eyeball (Jaiswal et al., 2019; Angmalisang, Moningka and Rumampuk, 2021).

The use of smartphones in school children in the last 2 years has increased significantly. This is because the online learning method during the COVID-19 pandemic requires students to access learning through online media (Angmalisang, Moningka and Rumampuk, 2021; Rochmayani and Cahyaningsih, 2021). Currently, the use of smartphones or tablets is not only for the sake of learning, but students also use smartphones for play activities. This causes the length of exposure to the smartphone screen to be longer (Lanca and Saw, 2020; Foreman et al., 2021). Efforts to prevent RE in elementary school children can be carried out through surveillance and early detection (Sharma et al., 2020; Chu et al., 2023). Students who have experienced RE must get corrective action so that their condition does not worsen (Al-Bahhawi et al., 2018). Education to students, parents, and school residents is also very necessary. Education is expected to increase health literacy (Budiono et al., 2024), especially literacy about eye health. Good eye health literacy is needed to increase awareness of RE problems in elementary school children (Lanca and Saw, 2020; Chu et al., 2023).

Conclusion

Based on the results of the study, it can be concluded that the prevalence of RE in students of Krapyak State Elementary School, Semarang City is 22.5%. Variables that are significantly proven to be risk factors for RE are: 1) Duration of smartphone use; and 2) Parental history. The probability of RE if students simultaneously have a risk factor for prolonged smartphone use ≥ 2 hours per day and a history of parents is 71%. Based on the findings of research that show the high prevalence of refractive errors, it is recommended to carry out early detection of RE in students periodically. The results of early detection can be followed up by communication to the student's parents and public health service centers. Education related to exposure to smartphones that can cause eye health problems also needs to be carried out to children and parents of elementary school students.

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Analysis of Sport Tourism Potential, Occupational Safety and Health in Tandem Paragliding

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Abstract

This research aims to analyze the level of tourism security and safety in the tandem paragliding aspect in the Kemuning village area. The problem that arose was that there was a tandem paragliding accident, namely a tourist fell on Kemuning Hill, in this accident there was no insurance for tourist accidents. The research uses a mixed method model by taking into account the Kemuning paragliding tourism environment. Analysis of tandem paragliding tourism potential using SKKNI no. 157 of 2019 for tandem paragliding aerospace scouting. Data management uses SPSS 23, and the respondents studied are Kemuning paragliding tandem managers, paragliding tandem pilots, tourists, and parties concerned with the Kemuning tourism tandem. Located in Segoro Mountain, Kemuning Village, Ngargoyoso District, Karanganyar Regency. The research results show that tourism safety data for tandem paragliding in Kemuning village is in the Very Suitable category. There needs to be a new sports tourism sector that supports the main tourism so that it can increase community income and increase the health of tourism visitors.

INTRODUCTION

The tourism industry has an important role in improving regional development nationally in Indonesia. Currently, the tourism industry is a leading aspect to improve the regional economy. In 2023, the increase in the creative economy sector and tourism in the regions began to increase with the existence of new rides or places that increased in each region (Kemenparekraf, 2024). Tourism that develops in the region, can change a lot of people's economic improvement, reduce the number of poverties, create jobs, and increase development in the region. Indonesian tourism is the fastest growing by ranking 9th in the world, third in Asia, and number one in the Southeast Asia region. The achievement in the tourism sector was also recognized by a media company in the UK, The Telegraph, which listed Indonesia as "The Top 20 Fastest Growing Travel Destinations". Efforts to increase tourist interest need to improve management so that tourists who come can feel comfortable, safe, and guaranteed safety and security.

The World Tourism Organization in 1991 recommended efforts that can be implemented for tourism safety, namely with each country to develop a national policy in the field of tourism safety that is carried out side by side with efforts to prevent risks to tourists. An important factor of security and safety in the workplace in Indonesia is found (Law 1970 number 1 article 1 paragraph 1 contains "the workplace is any room or field, closed or open, mobile or fixed, where labor works, or which is often entered by labor for a business and where there are sources or sources of danger including places". In the law, some efforts can be made to carry out security and safety in the workplace, one of which is in tourism. Tourism destinations

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that have a high risk of safety and security of tourists must pay attention to factors that will occur such as the physical environment and the non-physical environment such as the presence of animals, trees, or other things.

The territory of Indonesia, which consists of islands where the land conditions in the islands are generally mountainous and hilly, has great potential for the development of tandem paragliding tourism. The nature that is spread out with stunning scenery is another potential that is worth developing. The need for land at the location of the beginning and end of the activity that is minimal but beautiful and natural is a basic requirement for tandem paragliding tourism, while free and clean air is an open vehicle for this activity to take place. As one of the tourism products, tandem paragliding tourism is one of the opportunities as a source of foreign exchange, which in turn requires the support of Human Resources who have standardized competency abilities.

One of Indonesia's main areas of attention is the growth of sports tourism there. Through internet trends and the promotion of tourism hotspots, like the F1 Powerboat World Championship event on Lake Toba, efforts have been undertaken to maximize regional economic development (Widianingsih et al., 2023). There are known obstacles to entering the sports sector, which includes sports tourism, including a lack of funding, expertise, experience, and human resources (Julianti P et al., 2023). Travel habits have also been impacted by the COVID-19 outbreak, with travelers now gravitating toward outdoor pursuits and sports tourism. It has been determined that Gianyar Regency in Bali has the potential to grow its sports tourism industry, which when paired with cultural tourism, can make the area stand out (Agustin et al., 2022). To improve the sports tourism experience, it is necessary to address the issues around service quality and satisfaction in the organization of sporting events (Mulya, 2022). Overall, even though Indonesia has prioritized the growth of tourism, there are still certain aspects that need to be addressed, like environmental sustainability, infrastructural development, and risk management related to terrorism (Koerner et al., 2023).

Paragliding is a type of free-flying sport that involves using cloth wings, commonly known as parachutes, to fly. It utilizes the thrust generated by the wind during takeoff and lands using the feet (Zulafah et al., 2022). The performance of a paraglider is affected by factors such as wing section drag, intake drag, and the deformation of the wing between ribs (Babinsky, 1999). Mathematical modeling and simulation have been used to study various flying situations of a paraglider, including constant headwind/tailwind, variations in headwind and tailwind combined with upwind, varying pilot mass, and parameters in the form of interval quantities (Nguyen et al., 2021). Parachutists, who engage in skydiving, have been found to have varying temperament features, need for stimulation, and risk-taking tendencies (Boldak & Guszkowska, 2013). Paragliding flights have been shown to have an impact on adrenaline, cortisol, and insulin levels, as well as heart rate, with experienced pilots exhibiting different physiological responses compared to first-time passengers (Çalık et al., 2021).

Paragliding is the sport of free flying using fabric wings that take off with the feet for recreational or competition purposes. FASI is the parent organization of paragliding where PORDIRGA is under the auspices of FASI. The wind that is used as a source of lift that causes this parachute to float high in the sky consists of two kinds, namely the rising wind that hits the slope and the rising wind caused by thermal. By utilizing both sources, pilots can fly very high and reach long distances. Paragliding is unique because everything is done without the use of machines, only solely utilizing the wind. Tandem paragliding uses a wing or umbrella large enough to accommodate two people, a pilot or instructor at the back as a controller and a passenger at the front. Tandem paragliding is a recreational paragliding sports tour conducted by two people where one person is the passenger and the other is the pilot/controller. Central Java has a geographical area rich in hills and mountains, therefore Central Java has many sites that can be used for tandem paragliding including Kemuning Karanganyar Regency, Ungaran Semarang Regency, Tembalang Bukit Meteseh Semarang, Bukit Lengkong and Kahyangan Skyline Wonosobo Regency, Purwodadi, Wonogiri, and Batang.

These areas have become paragliding flying sites carried out by local communities in addition the area already presents a place of nature tourism, one of which is the tandem paragliding Kemuning Pesona Karanganyar Regency. But the tandem flying which is commercial in nature is only carried out at the Kemuning flying site in Karanganyar Regency. The latest news from (Soloraya, 2024), that at the Kemuning Paragliding Tandem tourist spot, there was a flight failure accident on Wednesday, July 5, 2023, which resulted in tourist victims falling and being seriously injured from paragliding. From the Karanganyar Dispora data, the incident was purely an accident and from the Kemuning Paragliding Tandem manager there is no safety insurance to cover tandem paragliding tourists. From the initial research, the place already has commercial flying, the managerial is not optimal, the supporting facilities and infrastructure are quite adequate, there is no overall organizational SOP, and insurance for tandem paragliding tourists does not exist. With the standardization of tandem paragliding management by using the SKKNI regulation criteria no 157 of 2019 aerospace guiding tandem paragliding. Tourism management is currently one of the important aspects of regional tourism development. In this management, it is expected to provide security and safety for tourists so that accidents do not occur.

METHOD

Mixed methods is a research method that combines or combines quantitative methods with qualitative methods to be used together in a research activity, so that more comprehensive, reliable, objective, and valid data are obtained. Convergent Parallel Mixed Methods Design. In this approach, researchers collect quantitative and qualitative data simultaneously, analyze the results of both data separately, and then compare the results to see whether the research findings support each other or not (Creswell & Hirose, 2019). The main assumption of this approach is that qualitative and quantitative data will provide different types of information. By different types of information, we mean the detailed views of informants obtained qualitatively and the scores on the research instruments quantitatively. The results of the qualitative and quantitative approaches should lead to the same conclusions. The purpose of this method design is to get a more complete understanding of the two types of data, prove the results of different methods, and compare several levels in a system.

The data collection model about the potential of tandem paragliding in Central Java is carried out using a quantitative approach, namely by using a closed Google

Table 1. Indonesian National Work Competency Standard Number 157 of 2019

No.	Indicator
1	Prepare Administration and Information
2	Performing traveler identification
3	Apply flight regulations
4	Manage Equipment and Supplies
5	Applying Site and Weather Science
6	Planning a paragliding tandem flight
7	Apply tandem flight risk management
8	Communicating with Travelers
9	Perform tandem paragliding flight techniques
10	Perform emergency handling during tandem flight
11	Make a traveler satisfaction analysis (feedback)
12	Make a tandem paragliding flight report

Resources: (SKKNI, 2019)

Form Questionnaire. While about the direct description of the potential place of tandem paragliding in general, this study uses a qualitative approach using an open questionnaire interview (open-ended questionnaire). Therefore, this mixed research design uses a strategy of using two approaches (mixed methods), namely a convergent parallel strategy to complement the information obtained about existing conditions with constraints at the tandem paragliding location based on SKKNI No. 157 of 2019 concerning tandem paragliding aerospace guiding. A procedure in data collection, where only part of the population is taken and used to determine the desired properties and characteristics of a population is called a sample. The purpose of determining the sample is to obtain information about the object of research by observing part of the population, namely tourism managers, tandem paragliding pilots, and tandem paragliding tourists.

In this study, researchers used a case study type of research. The research site is Kemuning paragliding tandem in Segoro Gunung, Kemuning Village, Ngargoyoso District, Karanganyar Regency, Central Java Province. The research subjects were 1 manager, 4 tandem paragliding pilots, and 12 tandem paragliding tourists. The instruments in this study include observation by recording thoroughly and finding out about the analysis of the potential of tandem paragliding tourism by using SKKNI regulation number 157 of 2019 concerning the Application of the Indonesian National Work Competency Standards in the field of aerospace tourism paragliding flying sites in Kemuning Karanganyar Regency. The research instruments used in this research are observation, interviews, and documentation by taking a direct approach to the flying site area. The data analyzed in this study are primary data from research findings; data collection techniques in the research that the author carries out are two types of techniques, namely qualitative techniques (case studies) followed by quantitative techniques (experiments). Strategy is a comprehensive master plan that explains how to achieve all the goals that have been set (Maryam, 2018).

RESULT AND DISCUSSION

The potential Tandem Paragliding tourism sport in Kemuning is interesting because Tandem Paragliding has its uniqueness, namely using the power of the wind to be able to float. Geographically, the place in Kemuning has sufficient wind potential to carry out tandem paragliding tourism sports. The paragliding tandem sport also requires high adrenaline because the implementation is in a high place. The place of tandem paragliding Kemuning also has a very beautiful and attractive natural beauty, which makes it one of the factors of attraction for tourists to try tandem paragliding.The results showed that the potential of tandem paragliding tourism in the Kemuning hills of Karanganyar Regency is in the very suitable category (Score 85) this is supported by 8 indicators that have very

Image 1. Kemuning Paragliding Tandem Spot

suitable criteria and only 4 indicators that show suitable criteria to see the distribution of this data can be seen in the table and graph below:

The table above shows that the potential of tandem paragliding tourism at Kemuning Hill in Karanganyar has very suitable criteria (Score 85) this is indicated by 11 indicators that have very suitable criteria and only 1 indicator that has suitable criteria, namely making a tandem paragliding flight report. Judging from the results of qualitative data reduction, the results of the analysis are not much different, meaning that the 5 indicators are indeed in the criteria Not suitable and doubtful, among others:

1. The manager has prepared adequate tandem Paragliding Flight Administration and Information, but there are no tandem flight documents. as a result of incidents that have been experienced
2. Has not yet conducted tourist identification but is not yet complete and detailed
3. Have implemented paragliding flight regulations in a simple manner
4. Has not yet managed Paragliding Equipment and Supplies optimally, because umbrellas and equipment are carried by each of them.
5. ilots are starting to apply knowledge about Paragliding Flight Locations and Weather through YouTube facilities and other social media
6. In planning tandem paragliding flights, the manager has difficulty when there are tourists, because the weather and wind direction of the Kemuning Karanganyar hill are relatively unstable, especially in the rainy season. Tourists often wait for laminar winds to be ready to take off.
7. Already implemented risk management for tandem paragliding flights, including communication with health centers and hospitals.
8. Communicating with Tourists runs quite well considering that the average tourist visiting is a domestic tourist.
9. Most pilots have PL 2 to tandem licenses so that the indicators for carrying out tandem paragliding flight techniques are well mastered.
10. Performing emergency handling during tandem paragliding flights pilots have mastered and are good at doing this indicator.
11. Analyzing tourist satisfaction (feedback) is done, this indicator in writing usually

Table 2. Analysis of the Potential of Tandem Paragliding Tourism at Kemuning Hill, Karanganyar Regency

No.	Indicator		Criteria
1	Prepare Administration and Information	83,7	Very suitable
2	Performing traveler identification	87,3	Very suitable
3	Apply flight regulations	88,1	Very suitable
4	Manage Equipment and Supplies	88,9	Very suitable
5	Applying Site and Weather Science	85,9	Very suitable
6	Planning a paragliding tandem flight	84,4	Very suitable
7	Apply tandem flight risk management	88,0	Very suitable
8	Communicating with Travelers	86,7	Very suitable
9	Perform tandem paragliding flight techniques	87,1	Very suitable
10	Perform emergency handling during tandem flight	88,7	Very suitable
11	Make a traveler satisfaction analysis (feedback)	84,0	Very suitable
12	Make a tandem paragliding flight report	85,9	Suitable
	Average	**85**	**Very suitable**

by direct question and answer, and recording.

12. Make a tandem flight paragliding report, in the form of direct interviews and recorded as material when evaluating.

The advantage of the Bukit Kemuning Karang Anyar flying site is has all the ideal potential for a tandem paragliding flight. It can be seen from the integration with other destinations is very supportive: Camping Ground, river tubing tourism, jeep adventure, selfies of natural scenery, also as a paragliding training ground for Central Java athletes becomes a special sight for tourists. The results of qualitative research show that the tandem tour of Kemuning Hill in Karanganyar includes a very ideal area for tandem flying because this area is integrated with other tourist activities, among others: 1) Kemuning jeep adventure tour, 2) Kemuning Sky Hill (glass bridge), 3) camping ground Sumilir Valley, 4) Sua Foto, 5) Sukuh Temple, 6) Kali Pucung River tubing, 7) Kemuning tea garden etc. So that the existence of tandem paragliding provides additional destinations that are more interesting. Based on SKKNI No. 157 of 2019 tandem paragliding tourism in Kemuning has several findings, among others:

1. Managing equipment and equipment in the very suitable category (Score 88.9) shows that equipment and management of flying equipment are carried out periodically. The centralized location of equipment storage in one post makes it easier for managers to carry out maintenance. Given that paragliding umbrellas have flying hours that must be taken seriously.
2. Implementing tandem flight risk management: The tandem paragliding community in Kemuning cooperates with the local health center to anticipate when a flight incident occurs so that the risk of a more severe accident can be well anticipated.
3. Setting up administration and information: Kemuning Hill is located far from BTS (Base Transceiver station), so access to outgoing communication is somewhat hampered, so information services are carried out manually.

Urban security, government marketing, business sponsorship, and mass transit planning are the most important criteria for sustainable sports tourism development, with local festivals being the most influential factor (J.-J. Yang et al., 2020). Six factors influencing tourism in small-scale sports events are communication, staff, electronic word-of-mouth, destination image, satisfaction, and future intentions (Vegara-Ferri et al., 2020). The top three attributes influencing sustainable sports tourism are disease prevention and treatment, local social welfare and protection, and sports diversity (C.-C. Yang et al., 2021). Personality, push factors like socialization and pull factors like access, affordability, and other attractions significantly influence sports tourists' satisfaction and loyalty to destinations and teams (Min et al., 2023). Uncertain and unsafe environments diminish people's willingness to visit destinations, which can negatively influence sports tourism (Nicolau, 2021). Sports events affect the tendency of citizens towards entrepreneurship, which in turn influences sustainable tourism development through sports events (Tsekouropoulos et al., 2022). Sports tourism helps build a unique identity closely linked to sustainability goals, highlighting natural and cultural beauty and improving destinations' profiles (Morfoulaki et al., 2023).

Risk management in sports tourism involves identifying and addressing various risk issues that may arise during active sports tourism events. These risk issues can be categorized into areas such as safety, financial, environmental, technical equipment, operations, human resources, political, legal, tourist behavior, and relationships (Zhang et al., 2023). Tourism companies' risk exposures can be identified based on textual risk disclosure of financial statements, helping stakeholders develop reasonable and timely risk management strategies (Li et al., 2020). Sports enterprises can use decision trees and data mining to assess risk and predict possible risks, ensuring information security and financial risk management (Zhao, 2021). Risk management in sports tourism involves a planned process to manage active crises, allowing organizations to adapt more easily to crises (TSAPOVA et al.,

2021). Optimal training and safety management can reduce sports injury risk by addressing factors like climatic characteristics, equipment cleaning, and maintenance, and public safety (Han & Jia, 2023). Risk management is seen as a crucial aspect of managing operations in the tourism sector, allowing for the assessment of vulnerabilities and influencing decision-making processes.

CONCLUSION

From the results of the study, it can be concluded that based on the Analysis of the Potential of Tandem Paragliding Tourism Based on SKKNI No. 157 of 2019 concerning Tandem Paragliding Aerospace Guidance in Bukit Kemuning Karanganyar, the criteria are very suitable (Score 87). this is indicated by 11 indicators of SKKNI No. 157 of 2019 having very suitable criteria and only 1 indicator that has suitable criteria, namely making tandem paragliding flight reports. Improve service to tourists and sport tourism. There needs to be a new sports tourism sector that supports the main tourism so that it can increase community income and increase the health of tourism visitors.

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Severe Malaria Risk Factors in Lupane District, Zimbabwe. A Retrospective Cohort Study

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Abstract

Zimbabwe envisions becoming a malaria-free country. However, a malaria resurgence has been reported in some of the elimination districts. This cohort study, guided by the Health Belief Model, aimed to examine risk factors associated with malaria severity in Lupane districts. Using proportionate stratified sampling, the study recruited 1207 individuals, comprising 1056 individuals who acquired malaria locally and 151 individuals who acquired malaria outside Lupane as captured in the DHIS2 electronic malaria-tracker database. The study used IBM SPSS 29.0.2.0(20)] for data analysis and odds ratios (ORs) were used to estimate relative risk (RR; 95% C.I; p<0.05). The study revealed relative risk for individuals who had not traveled 29.7 (8.74; 100.0), no Long-Lasting Insecticidal Nets 12.3 (7.02; 21.4), possessed LLINs but not used 7.83 (4.29; 14.3), hosted visitors 6.19 (4.16; 9.22), lived in rural residence 1.94 (1.35; 2.79), slept outdoors during the night 1.93 (1.36; 2.74), and adults 0.22(0.13; 0.36) compared to the corresponding reference groups. As the country continues to fight against malaria, it is critical to address perceived risk factors that can reintroduce the disease and sustain the gains made in malaria elimination districts.

INTRODUCTION

Malaria is an infectious disease with high morbidity and mortality rates worldwide (Centers for Disease Control and Prevention, 2023; Chipoya & Shimaponda-Mataa, 2020; Darnius & Siahaan, 2023). In 2021, the global malaria landscape reported approximately 247 million cases, a slight increase from the 2020 figure of 245 million cases. This increase was concentrated in the WHO African Region. In 2020, the mortality rate increased to 15.1 (World Health Organization, 2023) but slightly decreased to 14.8 in 2021 globally (World Health Organization, 2023).

Globally morbidity and mortality due to falciparum malaria remain high (World Health Organization, 2023). Plasmodium falciparum stands as the predominant malaria parasite species in Zimbabwe, constituting over 98% of all reported cases (National Malaria Control Program, 2023). Malaria eradication has been a primary global health initiative for decades (Kumari et al., 2022), with member states setting goals to eliminate the disease in over 35 countries by 2030 as part of the World Health Organization's (WHO) Global Technical Strategy for Malaria (Ahmad et al., 2022).

Zimbabwe has adopted a subnational malaria elimination approach since 2012, which started with seven districts (11%) in Matabeleland South (Ministry of Health and Child Care, 2020; National Malaria Control Program, 2017). A total of (13) thirteen low-burden districts transitioned to malaria pre-elimination activities in Bulawayo Metropolitan, Midlands, Mashonaland West,

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and Matabeleland North provinces in 2015. Lupane is one of five elimination districts in Matabeleland that obtained its pre-elimination status in 2015 (Ministry of Health and Child Care, 2020; National Malaria Control Program, 2017).

By the end of 2022, the country had increased the number of pre-elimination districts to 30 (48%) out of 62 (National Malaria Control Program, 2023). In 2017, Zimbabwe released guidelines for foci investigation and response. These guidelines set standards for data analysis, foci delimitation, classification, finding drivers of transmission, reporting, and response activities that are meant to deal with drivers of transmission (National Malaria Control Program, 2017). However, the malaria resurgence has been reported among some of the elimination districts in Zimbabwe including Lupane district (National Malaria Control Program, 2023).

From 2021 to 2023, Lupane District reported 3116 confirmed malaria cases (National Malaria Control Program, 2023), despite obtaining its World Health Organisation-certified malaria elimination in 2015 (National Malaria Control Program, 2017). The district had an annual parasite incidence (API) of 2.0 to 3.5 between 2021 and 2023 (National Malaria Control Program, 2023), whereas the National Malaria Control and Elimination Strategic Plan (2021–2025) sets national targets of 0.18 per 1000 population, 0.10 per 1000 population, and 0.05 per 1000 population in 2021, 2022 and 2023, respectively (Ministry of Health and Child Care, 2020).

During the same period, Lupane reported an overall of 2787 (89%) local malaria cases, against the national elimination goal of maintaining zero local malaria transmission in this malaria elimination district (Ministry of Health and Child Care, 2020; National Malaria Control Program, 2023), showing that malaria continues to be a significant public health issue in the Lupane district. In Beitbridge (one of Zimbabwe's malaria elimination districts), a previous study found that out of 75 cases, 63 (84.0%) had no travel history exposure (Mundagowa & Chimberengwa, 2020). Malaria elimination requires interrupting the local transmission of human malaria parasites (Hasyim et al., 2024). Countries, provinces, and districts that report zero indigenous cases for at least three consecutive years are considered to have eradicated malaria (Ministry of Health and Child Care, 2020; World Health Organization, 2020).

The World Health Organisation defines re-introduction as an outbreak or the re-establishment of endemic malaria in previously eliminated areas (Guth et al., 2022; World Health Organization, 2020). A combination of prevention and control strategies achieved previous progress in combating malaria. However, these measures now face emerging challenges, leading to a resurgence of malaria (Bharti et al., 2020; Mbunge et al., 2021). To improve the effectiveness of the malaria elimination program, immediate action is required (Hasyim et al., 2024).

This retrospective cohort study, therefore, seeks to determine risk factors associated with severe malaria in Lupane District in Zimbabwe for the period from 01 January 2021 to 31 December 2023. The specific objectives of the study were (i) To identify socio-demographic characteristics that affect malaria severity, (ii) To identify and describe the effect of malaria prevention practices on malaria severity, and (iii) To model severe malaria risk factors using multivariate binary logistic regression.

The Health Belief Model (HBM), developed in the 1950s has six constructs (Hidayati et al., 2020), and holds the principle that health behavior change is a function of the individual's perceptions (Kushner, 2016). These constructs are proposed to vary between individuals and predict engagement in health-related behaviors (Hidayati et al., 2020). The model examines peoples' health-related thought processes and behavior (Jones et al., 2015). The HBM guided the present study to examine the risk factors associated with malaria severity along six dimensions. In this study, these constructs are perceived malaria susceptibility, perceived malaria severity, perceived benefits from the malaria interventions, perceived barriers to malaria prevention, self-efficacy, and cues of action.

METHOD

This analytical observational research

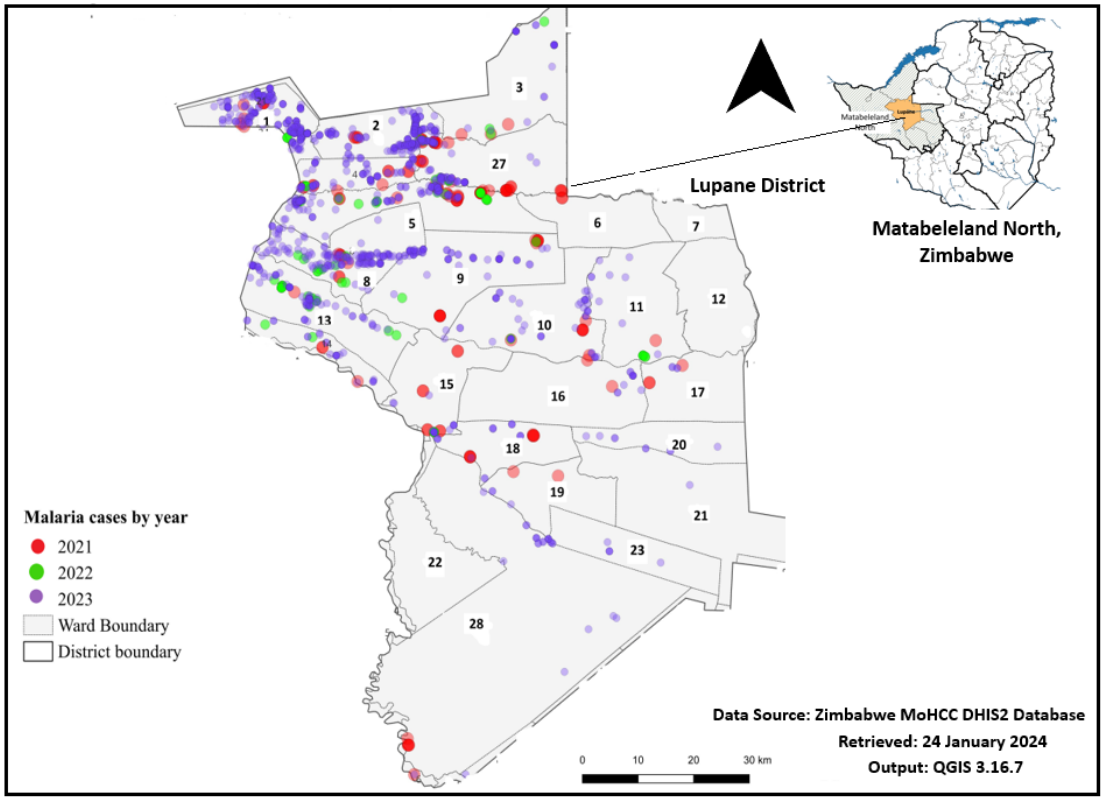

Figure 1. Map of the Study Area

utilized a retrospective cohort study to compare two groups. The exposed group consisted of individuals who contracted malaria outside Lupane, as confirmed by laboratory tests, and had traveled to a malarious area within six weeks before diagnosis. The unexposed group included individuals who acquired malaria locally in Lupane, as confirmed by laboratory tests, and had no travel history within six weeks before diagnosis. This present study assumed an odds ratio (OR) of 2.7 (Mundagowa & Chimberengwa, 2020) for locally acquired malaria compared to imported cases. The study used a proportion of 84.0% for non-exposed individuals with no travel history (Mundagowa & Chimberengwa, 2020), set a two-sided significance level (1-alpha) of 95.0%, a power (1-beta) of 90.0%, and an assumed ratio of unexposed to exposed (r = 7) for sample size determination.

The study employed multistage stratified random sampling to recruit 1207 individuals across all age groups and sexes, comprising 1056 cases of local malaria and 151 cases of imported malaria from secondary data reported by Lupane in the DHIS2 malaria-tracker database. The study used IBM SPSS 29.0.2.0(20)] for data analysis, and odds ratios (ORs) were used to estimate relative risk (RR; 95% C.I; $p<0.05$). The independent variable, which was obtained at a p-value of less than five (<0.25), proceeded to multivariate analysis. The study used the Cox and Snell R-squared and the Nagelkerke R-squared pseudo-parameters to quantify the range variation explained by the model. The Hosmer-Lemeshow test assessed the model's goodness-of-fit with a non-significant result (P-value > 0.05), suggesting good calibration and fit to the data (Darnius & Siahaan, 2023).

Lupane district is the provincial capital of Matabeleland North, with a population of about 107,248 (Zimbabwe National Statistics Agency, 2022). Malaria transmission is highest in the lowland areas of Zimbabwe (Gwitira et al., 2020; Pellegrino et al., 2022). However, Lupane is one of the districts located within the mid-Zambezi River Basin (Mpofu, 2014). The rural wards of Lupane border Binga district,

are characterized by unstable and regular seasonal malaria transmission (Maseko & Nunu, 2020). The district is semi-arid and in agroecological region four (Mukungurutse et al., 2018). Major rivers, such as the Gwayi and Shangani, which flow northward and converge at the Gwayi Shangani Dam, and the Bubi River, which feeds into the Lupane Dam, cross through this district (Mukungurutse et al., 2018). The main livelihood activities in the Lupane district include smallholder irrigation and farming, artisanal mining, vending, cross-border trading, livestock rearing, and formal employment in public service (Mpala, 2016; Mpofu, 2014).

RESULT AND DISCUSSION

The results showed that most individuals, 928 (77%), were male. The predominant age group was five years and above, with 1085 (90%) individuals. The percentage of severe malaria was lower, 187(17%), among five years and older compared to individuals below 5 years 64 (52%). In the bivariate analysis, the relative risk (RR) of severe malaria was 0.19 [(95% CI: 0.13-0.29); $p < 0.001$], showing that individuals aged 5 years and older were 0.19 times less likely to develop severe malaria than those aged < 5 years. The study showed that a higher proportion of individuals residing in rural areas, 176 (29%), had severe malaria compared to 75(12%) individuals residing in urban areas. Individuals residing in rural areas were approximately 2.97 times more likely to develop severe malaria compared to those in urban areas in Lupane (Table 1).

The distribution of individuals based on malaria species indicated a higher proportion of

Table 1. Bivariate Analysis of Socio-demographic Risk Factors

Variable	Malaria Severity						Chi-square	Bivariate Analysis	
	Uncomplicated		Severe		Total				
	n	%	n	%	n	%		RR; 95% CI	P-value
Travel History									
Yes	148	98	3	2	151	100		1	
No	808	77	248	23	1056	100	N/A	15.1(4.79;47.9)	<0.001*
Age group									
<5years	58	48	64	52	122	100		1	
5 years +	898	83	187	17	1085	100	<0.001*	0.19(0.13;0.29)	<0.001*
Sex									
Female	196	70	83	30	279	100		1	
Male	760	82	168	18	928	100	<0.001*	0.52(0.38;0.71)	<0.001*
Occupation									
Minor	320	75	105	25	425	100		1	
Student	128	80	33	20	161	100		0.79(0.51;1.22)	0.28
Unemployed	111	69	50	31	161	100	<0.001*	1.37(0.92;2.05)	0.12*
Working	397	86	63	14	460	100		0.48(0.34;0.68)	0.00*
Had visitor(s)									
No	534	92	46	8	580	100		1	
Yes	422	67	205	33	627	100	<0.001*	5.64(4.00;7.96)	<0.001*
Residence									
Urban	534	88	75	12	609	100		1	
Rural	422	71	176	29	598	100	<0.001*	2.97(2.20;4.00)	<0.001*

RR ≈ Relative Risk; Statistically significant Chi-square ($p < 0.05$*); 1 = Reference Group

Table 2. Bivariate Analysis of Malaria Prevention Practices for Lupane

Variable	Malaria Severity						Chi-square P-value	Bivariate Analysis	
	Uncomplicated		Severe		Total				
	n	%	n	%	n	%		RR; 95% CI	P-value
Prompt treatment									
Within 24 hours	564	78	156	22	720	100		1	
After 24 hours	392	81	95	19	487	100	0.36	0.88(0.66;1.17)	0.37
Malaria species									
Other	29	97	1	3	30	100		1	
Malariae	141	89	18	11	159	100	N/A	3.70(0.48;28.8)	0.211*
Falciparum	786	77	232	23	1018	100		8.56(1.16;63.2)	0.035*
LLINs use									
Owned used	412	96	17	4	429	100		1	
Owned unused	169	71	69	29	238	100	<0.001*	9.90(5.65;17.3)	<0.001*
None	375	69	165	31	540	100		10.7(6.35;17.9)	<0.001*
Slept outdoors									
No	488	82	110	18	598	100		1	
Yes	468	77	141	23	609	100	0.042*	1.34(1.01;1.77)	0.042*

RR ≈ Relative Risk; Statistically significant Chi-square ($p < 0.05$*); 1 = Reference Group

severe malaria, 18(11%) and 232(23%) among individuals infected with Plasmodium malaria and Plasmodium falciparum, respectively. The relative risk (RR) of severe malaria among those infected with Plasmodium falciparum was 8.56 [(95% CI: 1.16-63.2); p = 0.035] times higher than that of the reference group in the Lupane district. Individuals who had no LLINs were 10.7 [(95%C.I: 6.35-17.9), p < 0.001] times higher, as well as individuals who had LLINs but had not used them were 9.90 [(95%C.I: 5.65-17.3, p < 0.001)] times higher to develop severe malaria than the individuals who had LLINs and used them, respectively (Table 2).

The Chi-square Omnibus results revealed that nine variables (travel history, age group, sex, occupation, had visitor(s), malaria parasite species, residence, LLINs use, and sleeping outdoors during the night) were significantly associated with the outcome at a p-value less than 0.25. The prompt treatment variable was higher than 0.25 at bivariate selection, but it is an important variable for malaria severity as the outcome of interest. As a result, ten variables continued into the multivariate model for the Lupane district. In the multivariate analysis, the study revealed that individuals who had no travel history were approximately 29.7 [(95% CI: 8.74-100.0), p<0.001) times more likely to develop severe malaria compared to those with travel history exposure after controlling for the confounding variables. The regression demonstrated a good fit ($\chi^2 = 412.1$, $p < 0.05$) with 85.0% accuracy and explained variation ranging from 29% to 45% (Cox and Snell R-square = 0.289, Nagelkerke R-squared = 0.452).

From Table 4, the logistic regression equation obtained for the variables that influenced the incidence of severe malaria is as follows:

$$Logit\ (Y) = k + b_1x_1 + b_2x_2 + \cdots + b_ix_i$$

To calculate P (1)-probability of severe malaria and P (0)-probability of uncomplicated malaria, the study used the following equation to input the dummy values for each predictor. The following logistic regression model estimates the association between travel history exposure and severe malaria, adjusting for the confounding variables in the equation. The study used the logistic regression equation to estimate the probability of severe malaria based on the significant risk factors. Below is

Table 3. Multivariate Analysis Results

Variable	B	SE	Wald	Delta Exp(B)	RR; 95% CI	P-value
Travel History						
Traveled				Hold constant	1	
Not traveled	3.392	0.624	29.53		29.7(8.74;100)	<0.001*
LLINs use						
Owned-used					1	
Owned-unused	2.058	0.307	44.94	35%*	7.83 (4.29;14.3)	<0.001*
None	2.506	0.284	77.80		12.3(7.02;21.4)	<0.001
Slept Outdoor						
No					1	
Yes	0.657	0.180	80.37	51%*	1.93(1.36;2.74)	<0.001*
Age group						
< 5years					1	
5 years +	-1.539	0.259	35.33	47%*	0.22(0.13;0.36)	<0.001*
Sex						
Female					1	
Male	-0.237	0.196	1.462	26%*	0.79(0.54;1.16)	0.227
Occupation						
Minor					1	
Student	0.121	0.279	0.189		1.13(0.65;1.95)	0.664
Unemployed	0.702	0.258	7.391	27%*	2.02(1.22;3.33)	0.007
Employed	0.003	0.227	0.000		1.00(0.64;1.56)	0.990
Had visitors						
No					1	
Yes	1.823	0.203	80.37	75%*	6.19(4.16;9.22)	<0.001*
Residence						
Urban					1	
Rural	0.664	0.184	12.99	27%*	1.94(1.35;2.79)	<0.001*
Treatment						
Within 24 hrs					1	
After 24 hours	0.006	0.185	0.001	32%*	1.01(0.70;1.43)	0.973
Constant	-6.911	0.783	7.891	n/a	n/a	<0.001*

1= Reference: RR≈ Relative risks: Confounding (>10%)*: Statistically significant (p < 0.05*)

the logistic regression equation for the overall model:

The equation with dummies in the exposure groups

The result from the regression equation for Lupane obtained result (0.32497...). This revealed that under the conditions of no travel history, no ownership and no use of LLINs, ownership of LLINs but not used the previous night, sleeping outdoors, having visitors, rural residence, being five years or older, the individuals had a 32.5% chance of experiencing severe malaria in Lupane district. The equation with dummies in the non-exposure groups:

The obtained result (0.00319) means that

Logit p (Severe malaria) = -6.911 + 3.30*Travel history + 2.51*LLINs1 + 2.06*LLINs2 + 0.66*Slept outdoors + 1.82*Had visitors + 0.66*Residence – 1.53*Age group

The equation with dummies in the exposure groups

Logit p (Severe malaria) = -6.911 + 3.30(0) + 2.51(1) + 2.06(1) + 0.66(1) + 1.82(1) + 0.66(1) – 1.53(1)

= -0.731

P(1) = 1/(1+e^(-(logit p)))

= 1/(1+e^(-(-0.731)))

= 0.324975…

= 32.5%

Logit p (Severe malaria) = -6.911 + 3.30(1) + 2.51(0) + 2.06(0) + 0.66(0) + 1.82(0) + 0.66(0) – 1.53(0)

= -3.611

P(0) = 1/(1+e^(-(logit p)))

= 1/(1+e^(-(-3.611)))

= 0.0263136…

= 2.63%

RR ≈ p_1/p_o

≈ (0.324975...)/(0.0263136…)

≈ 12.4

under the conditions of having travel history, ownership and use of LLINs in the previous night, not sleeping outdoors, not having visitors, urban residence, and being under five years, the individuals had a 2.63% chance of experiencing severe malaria Lupane district

The present study revealed that found that individuals who had no travel history were approximately 29.7 times more likely to develop severe malaria compared to those with travel history exposure after controlling for the confounding variables. The risk ratio revealed that the individuals with the specified risk factors (no travel history, no ownership and no use of LLINs, ownership of LLINs but not used in the previous night, sleeping outdoors, had visitors, rural residence, and being five years and above), were approximately 12.4 times more likely to develop severe malaria compared to the baseline population. These findings concur with HBM constructs of perceived malaria susceptibility, perceived malaria severity, perceived benefits from the malaria interventions, perceived barriers to malaria prevention, and self-efficacy, probably because Lupane district obtained the malaria-free status over 5 years back from 2015. This could have led the individuals to have a low perceived risk of malaria infection and the progression of the disease to severe malaria. The HBM states that people are less likely to practice preventative measures if they do not believe that a certain disease is a serious illness that threatens life. This study revealed a similar

pattern concerning the severity of malaria in Lupane. The significant risk among individuals without a travel history suggests a potential gap in the community's awareness of their vulnerability. Despite the high risk, individuals could not perceive themselves as susceptible to malaria, especially if they have not traveled to high-risk areas.

In this study, individuals who had no LLINs were 12.3 times more likely to develop severe malaria than those who had LLINs and used them after adjusting for confounders. Contrarily, a community-based survey conducted on the Kenyan coast reported individuals who used LLIN the previous night had a lower risk of developing malaria odds ratio (OR = 0.45, $p<0.001$) (Kamau et al., 2022). The study further revealed that individuals who had LLINs but had not used them were 7.82 times more likely to develop severe malaria than those who had LLINs and used them, respectively, after adjusting for confounders. Research conducted in the Majene Regency of Indonesia revealed that those who do not utilize mosquito nets at night had a 1,844 times higher chance of contracting malaria (Fadliati, 2022; Firmansyah et al., 2022).

Perceived benefits can refer to an individual's belief in the effectiveness of using long-lasting insecticidal nets (LLINs) to prevent malaria, while self-efficacy refers to their confidence in their ability to consistently use LLINs correctly to reduce the risk of infection in line with HBM. Individuals with LLINs who did not use them were significantly more likely to develop severe malaria, indicating a gap in self-efficacy. Despite possessing the required resources (LLINs), the present study's findings indicate that these individuals might have not understood the significance of their consistent use for continued malaria prevention. Prior research repeatedly confirms that those not utilizing insecticide-treated nets are at a higher risk of developing malaria (Hassen & Dinka, 2022; Wubishet et al., 2021).

The study showed that individuals who had visitors were approximately 6.190 times more likely to develop severe malaria than those who had no visitors after controlling for confounding variables. This discrepancy raises the possibility that visitors from other places, especially where malaria is more prevalent, could have increased malaria transmission levels to the residents. The HBM highlights the importance of perceived susceptibility and action cues to preventive behaviors. This study's findings suggest that individuals might not have perceived the presence of visitors as a significant risk factor in the presence of the malaria vectors to transmit malaria, as if some of the visitors had the parasite in their bodies. Previous research done in China provides strong evidence for this attribution, with the finding that visitors who had traveled to visit family or friends accounted for 19.1% of malaria cases (Yin et al., 2023).

In this study, individuals who resided in rural areas were 1.94 times more likely to develop severe malaria compared to those in urban areas after accounting for confounding variables in Lupane. The rural wards of Lupane are next to Binga district, where malaria transmission is primarily characterized by instability and a moderate level of endemicity (Maseko & Nunu, 2020). Consequently, this could have resulted in a higher prevalence of severe malaria cases in Lupane rural as opposed to its urban wards. The presence of these water bodies due to main rivers such as the Gwayi and Shangani rivers (Mukungurutse et al., 2018) , which provide conducive mosquito breeding grounds, might have facilitated the increase in the vector population and local malaria transmission in these rural wards.

The study revealed that the relative risk of developing severe malaria was approximately 0.215 times lower among individuals aged 5 years and above compared to those under 5 years. Malaria is more prevalent in children under the age of five due to the ongoing development of their immune systems (Gari et al., 2018; Haghiri et al., 2023). Furthermore, children are frequently less inclined to implement preventive measures effectively because of their dependence on carers for their implementation. In contrast, an earlier study in Sahah the Eastern state of Malaysia found no significant link between age and malaria. (Ramdzan et al., 2020).

The association between severe malaria and sleeping outdoors during the night was another significant finding in this current study.

After controlling for confounding factors, the study indicated that people who slept outside had a 1.928 times greater chance of developing severe malaria than people who did not. Similarly, a matched case-control research in the Ziway-Dugda District of Ethiopia revealed that one of the factors contributing to malaria was spending time outdoors in the evening (AOR = 2.99) (Wubishet et al., 2021). The HBM also highlights the role played by perceived barriers to preventive actions. The finding suggests that there might be cultural, social, or practical barriers that promote sleeping outdoors behaviors, including preferences for cooler outdoor environments. With the HBM, this finding further suggests these individuals could not perceive themselves as susceptible to malaria and underestimated the risk of suffering from severe malaria.

Conclusion

The study concluded that individuals who had not traveled were more likely to develop severe malaria compared to individuals who had a travel history. Building on the study's findings, there is a need to increase awareness about the risks of local malaria transmission through community-based education programs, to strengthen the universal distribution of LLINs coupled with regular follow-up campaigns to ensure consistent usage. Additionally, malaria screening and educational programs for visitors to take preventive measures during their stay in Lupane. Regular community dialogue meetings and visible public health messages can serve as effective cues to reduce the incidence of severe malaria, especially in rural areas. The study further recommends the strengthening of malaria control measures targeting children under five years old. By addressing these areas, Lupane district can move closer to the goal of a malaria-free district.

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Energy Consumption and Nutritional to Status Emotional Eating Behavior Among Pregnant Women in Malang, Indonesia

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Abstract

Emotional eating behavior and increased food intake during emotional conditions are some factors that can contribute to obesity in pregnant women. This study examined the relationship between emotional eating behavior with energy consumption and nutritional status of pregnant women. This study was conducted from January to March 2024 and used an analytical observational method with a cross-sectional study. The subjects were 59 pregnant women in the second and third trimesters at Kedungkandang Community Health Center, Malang, Indonesia. Emotional eating, energy consumption, and nutritional status was tested with correlation rank spearman test. In this study, 45.7% of respondents were high emotional eaters, 40.7% had sufficient energy intake, and 72.9% had a normal nutritional status. Spearman correlation test showed $p<0.05$ for energy consumption ($p=0.008$) and $p>0.05$ for nutritional status ($p=0.548$). We concluded that emotional eating behavior has a significant relationship with energy consumption but has no relationship with nutritional status. It is important to consider the larger context in which emotional eating behaviors take place to comprehend nutritional status during pregnancy. Therefore, future studies should examine other different populations or areas.

Introduction

Nutritional problems are one of the problems that need attention. Many nutritional problems occurred, including excess and deficiency of nutrients in the body. Excess nutrition in the body or obesity is a health problem due to excessive energy intake and lack of physical activity. Obesity is an abnormal or excessive accumulation of fat that can harm health (WHO, 2021). Excess weight, especially obesity, reduces almost all aspects of health, from reproductive and respiratory function to memory and mood. Obesity increases the risk of several debilitating and deadly diseases, including diabetes, heart disease, and some types of cancer (Harvard T.H Chan, 2020). Nutritional problems such as obesity can occur at all ages, including pregnant women. Pregnant women are a group of people who are vulnerable to the risk of obesity. Based on 2018 Riskesdas data, currently the number of obesities in Indonesia for the population of pregnant women in 2007 was 10.5%. In 2013, it was 14.8% and increased in 2018 by 21.8%

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(Ramadhan, 2019).

Obesity can affect fertility in pregnant women, and they have a higher risk of miscarriage than non- obese women (Kerrigan & Kingdon, 2010). Apart from that, the baby will also be affected by the mother's excess weight, such as the risk of complications in the baby, such as birth defects, macrosomia, stillbirth, shoulder difficulties, and an increased risk of obesity and diabetes in adulthood. Pregnant women who are obese are also advised to undergo delivery by caesarean section. It is because obesity will make it difficult for the mother to give birth naturally and risks complications and bleeding if she continues to give birth naturally. Excessive nutrition or obesity in pregnant women can trigger bleeding during childbirth (Stubert et al., 2018). Being overweight or obese is not only influenced by the amount of calories consumed not matching those expended but also influenced by eating behavior. Emotional eating is an eating behavior that has the potential to cause obesity. Emotional eating is the tendency to increase food intake in response to pleasant and unpleasant emotions. We usually think of it as a strategy for regulating emotions. Emotional eating is the tendency to eat in response to negative emotions. People who experience emotional eating tend to choose foods with high fat, sugar, and simple carbohydrates that quickly make them feel full and relieve stress or emotional tension. In addition, continued emotional eating can affect inappropriate eating patterns, body weight, and health (Madalı et al., 2021).

A study conducted in Norway during the pandemic found that emotional eating occurs more frequently in women and is present in more than half of the sample (54%) (Bemanian et al., 2020). The study in Türkiye explained that the score of emotional eating in tall women and emotional eating common in obese people (43.5%) compared to standard weight (33.5%) and thin (18.4%) people (Madalı et al., 2021). A study on pregnant women in Mexico examined the relationship between pregnant women's sociodemographic and eating behaviors. It showed that eating behaviors were related to maternal education, maternal sociodemographic, and reproductive variables. In addition, it was found that in pregnant women, emotional eating (EmoE) had a medium-high correlation with external eating (ExtE) and a low correlation with restrained eating (RestE) (Flores-Quijano et al., 2023). From that study, pregnant women can have emotional eating behavior. Some conditions, such as stress, fatigue, and hormonal changes in the body of pregnant women, can trigger poor eating patterns leading to emotional eating behavior, and this has the potential to result in obesity. Apart from that, feelings of pressure to fulfill the role of mother and the burden of household duties can also be risk factors for emotional eating (Lindsay et al., 2017). Some studies showed that emotional eating behavior has a relationship with energy consumption and nutritional status. A study conducted on men in Sweden showed that emotional eating can affect their energy consumption. Emotional eating is also associated with increased consumption of sweet and high-fat foods. In addition, a study conducted on hospital and university employees in Algeria showed that obese participants had higher emotional eating scores than normal participants (Benbaibeche et al., 2023).

Furthermore, a previous study in 2016 found that the level of obesity among pregnant women in Malang City was quite high, where of the 11,870 pregnant women there were 5,935 who were obese. Besides, research conducted in 2018 showed that 4 out of 18 second-trimester pregnant women in Malang City experienced weight gain that exceeded the recommendation. In addition, in several community health centers in Malang City, there are still many cases of pregnant women who are obese. The highest case of obese pregnant women is in the Kedungkandang Community Health Center, which is 40.77% (Ramadhan, 2019). Besides that, the researchers also examined the relationship between emotional eating and energy consumption since energy consumption also affects nutritional status (Winerungan et al., 2018). Moreover, there is still little research that addresses the issue of emotional eating behavior in pregnant women and its relationship with their nutritional status. Therefore, it is important to look further into whether emotional eating has a particular effect on pregnant women. Especially on their

nutritional status. This study aimed to examine the relationship between emotional eating behavior with energy consumption, and the nutritional status of pregnant women.

Methods

This research uses an analytical observational method with a cross-sectional study. The dependent variable in this study was nutritional status and energy consumption, and the independent variable was emotional behavior. The nutritional status of pregnant women in this study was measured based on the size of the mother's middle upper arm circumference (MUAC). Then, the energy consumption was measured using 24-hour food recalls conducted for 3 days (2 days on weekdays and 1 day on weekend) within one week. The definition of emotional eating behavior in this study was one of the overeating behaviors that arose to cope with negative emotions such as stress, anger, and sadness a month ago, measured by the Emotional Eater Questionnaire (EEQ). The results of the EEQ are classified into 4 groups. Namely, not an emotional eater with a score of 0-5, moderate emotional eater with a score of 6-10, high emotional eater with a score of 11-20, and very high emotional eater with a score of 21-30. EEQ has good validity and reliability ($r > 0.430$, $p = 0.01$), and internal consistency Cronbach's alpha is 0.733.

The subjects in this study were second and third-trimester pregnant women with good health, good reading and writing skills, and were willing to participate in a series of studies by signing informed consent. Pregnant women who had hyperemesis gravidarum, excessive nausea and vomiting during pregnancy, or did not meet the above criteria were excluded from the study. Data in January 2024 showed that there were 120 pregnant women in the second and third trimesters in the work area of the Kedungkandang Community Health Center, Malang, Indonesia. This data was obtained from regional midwives and integrated service post (posyandu) cadres. Refer to the data, researchers used the Slovin formula to determine the sample needed. Researchers used a confidence level of only 90% with several considerations after discussing with integrated service post (posyandu) cadres and community health center midwives, that is limited research time, respondent willingness, and research areas that were not easy to reach. Based on these calculations, the minimum sample size that must be used in research is 55 respondents. At the start of the study, 62 subjects who participated in this research, but three subjects did not fill out the questionnaire and were excluded, so only 59 respondents remained.

The research took time from January to March 2024. The data collection was in February 2024 after the observation of the respondents was finished. The data in this research was taken using two methods. Cluster random sampling and Simple random sampling. Cluster random sampling was used to determine the number of samples in this study, and simple random sampling method was used to determine respondents or research samples in each sub-district. The data processing and analysis process for the data obtained in this research used SPSS (Statistical Package for the Social Sciences) 23.0 for Windows software. The data obtained in this research was analysed using two types of analysis, namely univariate and bivariate. Univariate analysis was used in this research to analyse each variable studied including the sociodemographic characteristics (age, education level, and number of children). In this study, the relationship between emotional eating behavior with maternal energy consumption and the nutritional status of pregnant women was tested using the Spearman rank correlation test with p-value<0.01. We obtained ethical clearance issued by Universitas Airlangga Faculty of Dental Medicine Health Research Ethical Clearance Commission on February 2, 2024, with the number 0065/HRECC.FODM/II.2024.

Results and Discussion

Characteristics of the study population, including age, last education, and number of children were presented in Table 1. The results showed that most respondents were 21-30 years with a percentage of 64.4% (n = 38). Several respondents who were still underage and in school, so permission and assistance from the respondents' parents was needed. Most respondents had the final education at the

Table 1. Respondent's Characteristics

Categories	Frequency	%
Age (years)		
<20	2	3.4
21-30	38	64.4
31-40	19	32.2
Last Education		
Elementary school	9	15.3
Junior high school	13	22
Senior high school	21	35.6
Diploma	3	5.1
Bachelor's degree	13	22
Number of children*		
0	25	42.4
1	17	28.8
2	13	22
3	2	3.4
> 3	2	3.4
Emotional eating behavior		
Non	8	13,6
Moderate	22	37,3
High	27	45,7
Very high	2	3,4
Energy consumption		
Very less	11	18.6
Less	19	32.2
Enough	24	40.7
Over	5	8.5
Nutritional status		
Underweight	3	5,1
Normal	43	72.9
Overweight	13	22

Note: *The number of children is calculated based on children born alive (dead children and pregnancy losses are not included).

senior high school level (35.6%). In addition, most respondents were mothers who did not have children when the study was conducted, with a percentage of 42.4% (n = 25).

In Table 1, most respondents (45.7%) are high-emotional eaters. It supports previous research findings, which state that pregnant women have a fairly high risk of experiencing emotional eating behavior due to several conditions such as stress, fatigue, and hormonal changes in the body of pregnant women can trigger poor diet, which lead to emotional eating behavior. Apart from that, feelings of pressure to fulfill the role of mother and the burden of household duties can also be risk factors for emotional eating [13]. Then, in the energy consumption section, most respondents had sufficient energy intake with a percentage of

Table 2. Emotional Eating Behavior Distribution Based on Energy Consumption

EEQ	Energy Consumption									
	Very less		Less		Enough		Over		Total	
	n	%	n	%	n	%	n	%	n	%
Non	3	5.1	2	3.4	3	5.1	0	0	8	13.5
Moderate	6	10.2	9	15.2	5	8.5	2	3.4	22	37.3
High	2	3.4	8	13.5	14	23.7	3	5.1	27	45.8
Very high	0	0	0	0	2	3.4	0	0	2	3.4

Source: Primary Data

Table 3. Emotional Eating Behavior Distribution Based on Nutritional Status

EEQ	Nutritional Status							
	Underweight		Normal		Obese		Total	
	n	%	n	%	n	%	n	%
Non	0	0	5	8.5	3	5	8	13.6
Moderate	2	3.4	16	27.1	4	6.8	22	37.3
High	1	1.7	22	37.3	4	6.8	27	45.7
Very high	0	0	0	0	2	3.4	2	3.4

Source: Primary Data

40.7% (n = 24). However, in terms of numbers, it can be said that more pregnant women with less and very little energy intake than those with standard and excessive energy intake, with 30 pregnant women or around 50.9% of all respondents. Apart from that, this research shows that the prevalence of pregnant women with normal nutritional status is 72.9%, then underweight pregnant women are only 5.1%; while overweight pregnant women are higher at 22%.

Emotional eating behavior distribution based on energy consumption is presented in Table 2. It shows that most pregnant women have sufficient energy consumption (following recommendations) but high levels of Emotional Eaters (EE). In this study, most pregnant women with very low energy intake are moderate EE (10.2%). Meanwhile, a small percentage of pregnant women with low energy intake are non-EE (3.4%), and most are moderate EE (15.2%). Some pregnant women with excessive energy intake are higher EE (5.1%) than moderate EE (3.4%).

Emotional eating behavior distribution based on nutritional status is presented in Table 3. In this table, most respondents (37.3%) have normal nutritional status but high EE. Of the 3 pregnant women who had underweight nutritional status, 2 (3.4%) had moderate EE, while the remaining 1 person (1.7%) had high EE. Meanwhile, among pregnant women who are obese, most had moderate EE and high EE

Table 4. Result of Spearman Rank Test

Emotional eating behavior	Energy consumption		Nutritional status	
	p-value	Spearman's ρ (rho)	*p-value*	Spearman's ρ (rho)
	0.008	0.342**	0.548	-0.102

Note: **Correlation is significant at the 0.01 level (2-tailed).

Source: Primary Data (Analysis Result)

with a percentage of 6.8% each; then 3.4% had very high EE; while non-EE is higher at 5%.

The relationship between emotional eating behavior with energy consumption and nutritional status was tested using the Spearman rank correlation test, which can be seen in Table 4. Spearman correlation test showed $p<0.05$ for energy consumption ($p=0.008$). We concluded that emotional eating behavior has a significant relation with energy consumption. Besides, the Spearman correlation test showed $p>0.05$ for nutritional status ($p=0.548$).It shows no significant relationship between emotional eating behavior and the nutritional status of pregnant women.

Emotional eating behavior in this study was measured using EEQ. The EEQ is a questionnaire that identifies three factors, including questions related to disinhibition (lack of control) of food under certain conditions, the type of food that respondents find most difficult to control and the patient's emotions and their relationship with weight gain and feelings of guilt about eating "forbidden" foods such as sweets or snack. Energy consumption in pregnant women was measured using 24-hour food recalls conducted for 3 days within one week. The nutritional status of respondents in this study was measured based on the size of the mother's MUAC. WHO classified the MUAC into 3 groups to determine the nutritional status of pregnant women. MUAC < 23 cm indicates undernutrition, MUAC 23 - 33 cm means normal nutritional status, while MUAC > 33 cm indicates obesity. It is supported by the previous study, which stated that the MUAC threshold for diagnosing obesity during pregnancy is 33 cm (Okereke et al., 2013).

In addition to the mother's nausea and vomiting condition during pregnancy, the energy needs of pregnant women are also adjusted to other factors that can affect such as the mother's age, gestational age, and physical activity. The calculation of the energy consumption of pregnant women is also adjusted to the ideal weight that pregnant women should have during pregnancy according to the proportion of height that the mother has. Researchers calculated the energy needs of pregnant women one by one according to the condition of each respondent. Researchers used the Harris-Benedict formula to determine the energy needs of pregnant women. There are some examples of calculations of the energy needs of pregnant women used by researchers:

When collecting data regarding energy consumption, we found that several respondents had the same type of food at breakfast and lunch. Some of them even have the same meal menu from breakfast to dinner. In addition, pregnant women who are highly emotional eaters or experience emotional eating behavior tend to eat foods that are high in fat and contain simple carbohydrates. At the time of the interview, most respondents had no problems describing their food. We tried to get the right amount of food that respondents ate through pictures of food utensils, and so on. Apart from that, we also tried to check precisely the amount of certain types of food ingredients that influence the number of calories they consume, such as cooking oil, flour mixture, and sugar. The calories consumed is calculated using the NutriSurvey application and adjusted to the types of food available in Indonesia.

In this study, researchers hypothesized that emotional eating behavior is related to the mother's energy consumption. In this study, the Spearman rank correlation test showed that emotional eating behavior is significantly related to energy consumption. It is per a theory, stating that restrained (sometimes referred to as dietary restraint), external, and emotional eating can affect daily food intake. One of these 3 eating behaviors is usually more dominant in an individual and can be different for each person. In previous research, higher levels of emotional eating behavior can harm a person's nutrition, including increased intake of foods that can increase weight, such as fast food and snacks high in fat and/or sugar (Benbaibeche et al., 2023). Apart from that, the research conducted on female nursing students shows that emotional eating behavior has a strong and significant relationship with food intake, especially sweet foods, fast food, and soft drinks (Iglesias López et al., 2023).

In the aspect of maternal nutritional status, researchers provide exclusion criteria in this study where pregnant women who are sick or have infectious diseases that can affect nutritional status, such as diarrhea

Table 5. Calculations of Energy Needs of Pregnant Women

Mother's age (years)	Pregnancy age (weeks)	Mother's ideal weight during pregnancy* (kg)	Mother's height (cm)	Physical activity**	Additional calorie needs*** (cal)	Total energy needs (cal)
25	20	61	160	1.3	300	2,145.5
23	31	60.35	155	1.3	300	2,137.5
30	25	61	158	1.4	300	2,249.5
28	35	57.25	150	1.3	300	2,056.4
35	28	68.3	165	1.4	300	2,333

Note:

*Maternal weight at pregnancy was calculated based on the mother's ideal weight before pregnancy, maternal height, and gestational age.

**Physical activity was adjusted to the daily activities of pregnant women (1.1=bed rest, 1.2=bed rest but still moving freely, 1.3=light activity, 1.4=moderate activity, 1.7=heavy activity) (Evifebriyanti, 2021).

***Addition of calorie needs based on pregnancy trimester in AKG Kemenkes 2019.

Source: Primary Data

and tuberculosis, are not respondents in this study. Before the study, researchers conducted interviews and brief health screening to confirm whether pregnant women were healthy. If the pregnant women are healthy, the research can continue. The researcher would stop the data collection process if the pregnant woman sick. In this study, researchers also hypothesized that emotional eating behavior is related to the mother's nutritional status during pregnancy. Based on the correlation spearman rank test (presented in table 3), emotional eating behavior is considered to be related to the nutritional status of pregnant women if $p<0.05$. However, the test results above show that p-value=0.548, which is >0.05. It shows that whether H0 is accepted or there is no significant relationship between emotional eating behavior and the nutritional status of pregnant women. During the research, the researchers discovered one unique thing that pregnant women who were obese in higher numbers had emotional eating behavior that was still within the normal range or were not even emotional eaters. Although the respondents who were very high emotional eaters (3.4%) all came from obese pregnant women. Based on these findings, researchers assume that the nutritional status of mothers during pregnancy may be influenced by poor diet. It is in line with research which states that pregnant women may develop unhealthy eating habits, such as consuming too much sugar or fat, which can cause excessive weight gain and other health problems (Kusrini et al., 2021).

Apart from that, the nutritional status of pregnant women may have been experienced by pregnant women before pregnancy and was not influenced by the emotional eating behavior of pregnant women during pregnancy. It is in line with previous research, which states that obesity before pregnancy can increase the risk of obesity in pregnancy (Eriksson et al., 2014) to the risk of gestational diabetes, preeclampsia, neonatal and perinatal death (Poston et al., 2016). Obesity before pregnancy has a complex 2-way relationship with perinatal mood disorders, where someone who is obese can increase the risk of depression, and people with depression also have the potential to increase their risk of obesity. Besides, research in 2023 showed that 95,4% of women who were malnourished pre-pregnancy also experienced malnourished during pregnancy (Helmizar, Ferry, Elda, & Azrimaidaliza, 2024). It follows previous research showing obese people can have depressive moods and can experience a significant increase in depression (Ha et al., 2017). It can be applied during pregnancy so that it can be strongly predicted that pregnant women will experience excessive weight gain during pregnancy if the mother experiences pre-pregnancy obesity or depression (Hecht et

al., 2021). Depression during pregnancy can be related to emotional eating behavior because, basically, emotional eating behavior is one way a person responds to the negative emotions they feel. Emotional eating behavior is often associated with physical problems, including weight gain and negative psychological effects such as depression, eating disorders, and poor psychological health (Spinosa et al., 2019).

In this study population, there was no significant relationship between emotional eating behavior and nutritional status in pregnant women. According to another study, emotional eating does not affect the mother's diet during pregnancy, where diet is one of the things that influences the mother's nutritional status during pregnancy (Shriver et al., 2023). Apart from that, obesity or excessive weight gain in pregnant women is more associated with internal negative emotions such as depression and anxiety, not with eating behavior caused by these negative emotions (Banafshe et al., 2024). Several studies show that nutritional status in pregnant women is mostly related to nutritional intake, infectious diseases, level of education, knowledge of pregnancy, age at pregnancy, and pregnancy spacing (Ervinawati et al., 2019). Apart from that, a study states that the nutritional status of pregnant women is related to the economic status of the family, where inadequate family income can cause malnutrition in pregnant women (Ramadhani et al., 2021). However, some studies found that emotional eating is described as a reason for increasing BMI or even one of the things that hinders weight loss over time (Ruiz et al., 2023). It does not mean that there is completely no relationship between emotional eating behavior and nutritional status, despite a lack of studies examining this relationship in other populations. Therefore, it is important to carry out further research regarding the relationship between emotional eating behavior and nutritional status.

Conclusions

In this study, most respondents are highly emotional eaters. Then, the majority of respondents had sufficient energy intake. However, in terms of numbers, it can be said that there are more pregnant women who have less and very low energy intake than those who have normal and excessive energy intake. Apart from that, this research shows that most of the respondents had normal nutritional status. Then there were more obese respondents than underweight respondents. In this study, emotional eating behavior had a significant relationship with maternal energy consumption during pregnancy. Meanwhile, emotional eating behavior has no relationship with the mother's nutritional status during pregnancy. It is imperative to conduct additional studies related to this topic to clarify deeper understanding. For future research, researchers can use indicators of acute nutritional status, such as maternal weight gain during pregnancy, so that the results of measuring the nutritional status of pregnant women are more focused while minimizing the influence of the mother's nutritional status before pregnancy. Apart from that, matters relating to the nutritional status of mothers during pregnancy, such as the tendency for obesity in pregnant women caused by factors other than food, also need further and specific attention, so that research results relating to the nutritional status of pregnant women can be more accurate and clearer.

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Analysis of Respondents' Characteristics with Tuberculosis and Adherence Using Morisky Medication Adherence Scale

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Abstract

Tuberculosis (TB), an infectious disease caused by Mycobacterium tuberculosis, results in approximately 10 million new cases and 1,5 million deaths annually worldwide. This research method is an observational analytic study using a cross-sectional design. The target population of this study was all patients with Pulmonary TB who completed the intensive stage of treatment and participated in the DOTS program at selected health centers during the three months, namely patients diagnosed with Tuberculosis and registered as outpatients at the Hospital Nacional Guido Valadares (HNGV) Dili, Klibur Domin Tibar, Liquiça and at the Hospital Sentru Saúde Bairro Pite, Dili, Timor-Leste. The inclusion criteria in this study involved tuberculosis patients who were receiving anti-tuberculosis drug therapy for at least four weeks since the initial stage of treatment, aged more or equal to 17 years, and were able to understand oral and written instructions. Data collection took place between September and November 2023, involving a sample of 69 respondents. These results provide an overview of respondent characteristics that are significant in analyzing treatment adherence in patients with pulmonary TB. Tuberculosis is a contagious disease caused by infection with the Mycobacterium tuberculosis germ, usually affecting not only the lungs but also other organs.

INTRODUCTION

Tuberculosis (TB), an infectious disease caused by Mycobacterium tuberculosis, results in approximately 10 million new cases and 1,5 million deaths annually worldwide. The incidence of TB varies widely across regions. In most high-income countries, TB cases are around 10 per 100,000 people, whereas in low- and middle-income countries, the number of cases reaches 500 per 100,000 people (Smith et al., 2022). In developing countries, 75% of TB cases are found in the productive age between 15 and 50 years (Ratnasari, Marni, and Husna 2019). According to WHO (2018), Indonesia ranks third globally in the number of TB cases among the top 10 countries. These countries with the highest TB cases are India (2,7 million), China (889 thousand), Indonesia (581 thousand), Pakistan (525 thousand), Nigeria (418 thousand), Bangladesh (364 thousand), South Africa (322 thousand), Republic of Congo (262 thousand), and Myanmar (191 thousand). Meanwhile, Timor-Leste has demonstrated a decline in the incidence of tuberculosis (TB) in 2021, according to the World Health Organization's newly released Global TB Report. The TB incidence rate in the country has been stagnant at 498 per 100,000

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population for several years, but in 2021, the incidence rate decreased by 2,4% to 486 per 100,000 population (TB-Global Report, WHO, 2022). According to data from SSM (Servisu Saude Municipiu) Dili's incidence of pulmonary TB for the Dili district from 2014 to 2017 was 915 patients. Additionally, data at Centru Saude Comoro from January to July 2018 mentioned 167 patients with pulmonary TB, with the number increasing to 178 patients by the end of 2018 (Owa & Rochmawati, 2020).

One of the factors affecting the recovery of TB disease is treatment compliance. This treatment is influenced by several things, including age, occupation, supervision of taking medication, type of drug, drug dose, counseling from officers, knowledge, and attitudes (Ratnasari et al., 2020). To ensure the medication regularity, a PMO (Pengawas Minum Obat/Supervisor of Taking Medicine) is required. The best PMOs come from health workers, nurses, or village midwives. However, if they are unavailable, they can come from other parties, such as community leaders, health cadres, or family members. Considering TB control, treatment compliance is defined as the level of adherence of patients with a history of taking therapeutic drugs to treatment prescriptions (Ratnasari, 2018). The incidence of drug side effects in TB patients can be one of the factors of treatment failure as it has an impact on the non-compliance of TB patients in taking medication. Non-compliance caused by the side effects of TB drugs can lead to treatment resistance, which results in low treatment success rates (Musfirah et al., 2022). The problem faced today is the high rate of morbidity and mortality caused by side effects of Anti-Tuberculosis Drugs (OAT), and one of the serious side effects is hepatotoxic. It is certainly an obstacle in the eradication of TB disease. Furthermore, discontinuation of therapy due to drug side effects will lead to TB germ resistance, which will ultimately aggravate the patient's condition (Sari et al., 2011). With the low rate of drug adherence and the impact of drug withdrawal in TB patients, the researchers are interested in analyzing this matter.

Trends in the estimated incidence of tuberculosis and the number of deaths from the disease remained consistent between 2015 and 2021. Findings from the 2019 and 2023 epidemiological reviews indicate that the high incidence of tuberculosis in Timor-Leste is primarily due to several factors: the high prevalence of TB-specific risk factors (such as malnutrition and smoking), a significant number of undiagnozed patients in the community, delays in diagnosis, and challenges within the health system regarding early and comprehensive TB diagnosis. These factors contribute to high rates of TB transmission within the community. Data from a previous study conducted in Timor-Leste in 2016 and 2017 revealed that nearly 84% of TB patients and their families incurred significant costs related to the disease (WHO 2023). The number of relapses has also increased, with 70 cases reported in 2020, 75 cases in 2021, and 121 cases in 2022. Additionally, there was a significant increase in TB patients, with 3,139 cases in 2021 (1,786 male and 1,407 female patients). This number surged to 5,249 patients in 2022, comprising 2,912 male and 2,337 female patients (WHO, 2023). This situation has prompted researchers to focus on TB cases in Timor-Leste for further analysis.

METHOD

This research method is an observational analytic study using a cross sectional design. The Cross Sectional method is conducted with a face-to-face meeting, or the patient filled out a questionnaire directly. The target population of this study were all patients with Pulmonary TB who completed the intensive stage of treatment and participated in the DOTS program at selected health centers during the three months, namely patients diagnosed with Tuberculosis and registered as outpatients at the Hospital Nacional Guido Valadares (HNGV) Dili, Klibur Domin Tibar, Liquiça and at the Hospital Sentru Saúde Bairro Pite, Dili, Timor-Leste. The inclusion criteria in this study involved tuberculosis patients receiving anti-tuberculosis drug therapy for at least four weeks since the initial stage of treatment, aged more or equal to 17 years and able to understand oral and written instructions. Samples unused were patients with tuberculosis who could not communicate or whose condition did not allow them to be interviewed.

Sampling was conducted at several treatment locations, namely at the Hospital Nacional Guido Valadares (HNGV) Dili, Timor-Leste with 25 patients; at Klibur Domin Tibar, Liquiça, Timor-Leste with 22 patients; at Sentru Saúde Bairro Pite, Dili, Timor-Leste with 22 patients. Thus, the total number of patients with pulmonary TB who sought treatment at the selected health facilities was 69 patients. The research was conducted from September to November 2023. The sampling method was consecutive sampling derived from subjects who came to the health center and met the inclusion and exclusion criteria. The independent variables of this study were treatment compliance and respondent characteristics. This study had passed a series of ethical tests and received a letter of recommendation from the Ethics Committee of Timor Leste with No. Ref: 43/INSP-TL/UEPD/X/23. The research instruments used 1) Morysky Medication Adherence Report Scale (MMAS) questionnaire, used to determine the level of patient adherence to treatment. The questionnaire used has been tested for validity and reliability by previous researchers which contains five questions with five statement answers and accompanied by an Informed Consent sheet. 2) Medical Records used to determine medical data on laboratory results, treatment therapy, and the final results of patients. The steps of data processing were checking the completeness and clarity of the data, coding each variable data, entering data in a computer program, and checking again to ensure that the data was free from errors. Data analysis consisted of univariate and bivariate analysis. In bivariate analysis, the correlation between two variables was analyzed using the Chi-square formula. Data collection was carried out by researchers using the observation method and giving questionnaires to research respondents filled in directly, and data collection was carried out at the Public Health Center/Puskesmas according to the procedures created.

RESULTS AND DISCUSSIONS

Based on table 1 above, the research results on the description of treatment compliance for pulmonary TB patients show the following characteristics of respondents: 26 people (37%) are between 20 and 30 years old. Most respondents are male, as many as 35 people (51%). The level of education possessed by respondents is quite high,

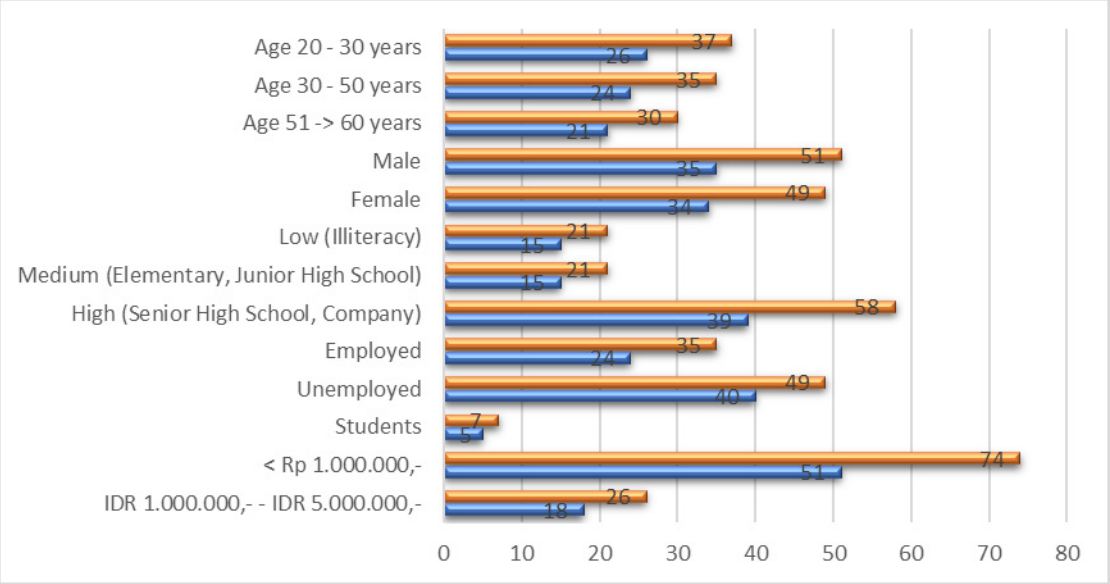

Figure 1: Respondents' Characteristics

with 39 people (58%) having a high school or college education. Regarding monthly income, most respondents, as many as 51 people (74%), have an income of less than 1 million rupiah. In addition, the respondents' occupation also showed that 33 people (49%) are unemployed. These results provide an overview of respondent characteristics that are significant in analyzing treatment adherence in patients with pulmonary TB. The results of the OAT adherence study shows the distribution of drug adherence assessment scores of adult pulmonary TB patients in the Timor Leste region, as presented in the following figure.

The results regarding the description of treatment compliance for patients with pulmonary TB indicate that of the 69 respondents, 67 patients (97%) have moderate compliance with medication. Meanwhile, only 2 respondents (3%) have a medication adherence score in the high category. This data indicates that most patients with pulmonary TB show moderate compliance, but still need improvement to achieve optimal levels of compliance. This study shows that the highest age level of tuberculosis patients is 23 people (33%) aged 21-30 years. It is in accordance with the results of a study that the highest age of tuberculosis patients was in the range of 20-30 years (Shrestha et al., 2023), while other results stated that the average age of patients was 29 years old (Adhikari et al., 2022). The high number of tuberculosis patients in the productive age range is due to high productivity and mobility, so this age group is very vulnerable to airborne transmission of tuberculosis germs (Resta et al., 2021). A rapid diagnosis will help patients get the right treatment (Sundaram, Vajravelu, and Paulraj 2024). Other studies reveal that the characteristics of Tuberculosis patients include age, gender, education level, marital status, place of residence, and socioeconomic status (Musfirah et al., 2022)

Gender was almost equal between 35 male patients (51%) and 34 female patients (49%). It is in line with the results, which state that age and gender are predictor variables that are proven to be significant to the incidence of tuberculosis cases in Brazil (Fernandes et al., 2018). Besides age and gender, the high incidence of tuberculosis is also caused by immigration from TB-endemic countries. It occurs especially during the early stages of the migration process in the host country (Godoy et al., 2024). Other results suggest that TB treatment non-adherence is higher among female patients than male patients (Krishnamoorthy et al., 2024). The age of TB patients varies from country to country. For instance, in India, as many as 2/3 of cases are found in males, while in Ukraine, females are 2,5 times more likely to develop the disease (Adhikari et al. 2022).

A total of 39 respondents (58%) had a high educational level status, high school or college. The topic of tuberculosis knowledge continues to be the most compelling variable for researchers. A study found that knowledge was the most frequently addressed variable, followed by self-efficacy, health cadres, TB transmission, and social support (Ratnasari & Handayani, 2023). A study shows that sociodemographic data on education as many as 64.7% (66) of TB patients have a high education status (Kumari

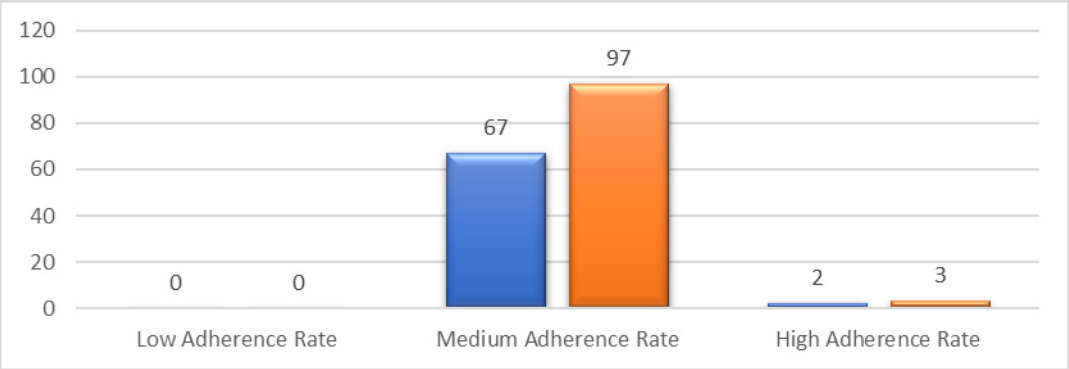

Figure 2 Medication adherence rate of TB patients

Indira & Mathew, 2023). Educational factors will affect the family's ability to modify the home environment suitable for people with TB, including lighting in the house, cleanliness, and ventilation, which are the most relevant factors related to the development of TB germs (Honorio and Zavaleta 2023). The results of this study revealed that in terms of monthly income, the majority of respondents, 51 people (74%), had an income of less than 1 million rupiah. This condition will indirectly affect the treatment process of TB patients. The cost of treatment is often a barrier to seeking health services, as WHO data states that 60% of deaths from TB are caused by low income (Davis et al., 2024). Adherence to treatment for TB patients is influenced by several factors, one of which is socioeconomic (Sapar et al., 2020). Although TB is treatable, preventable, and curable, it has emerged as the leading killer of infectious diseases, surpassing COVID-19 in 2022. This condition is supported by poor access to treatment facilities, usually experienced by people in low-income countries (Oppong, Lester, and Sadeghi Naieni Fard 2024).

Tuberculosis is a contagious disease caused by infection with the Mycobacterium tuberculosis germ, usually affecting not only the lungs but also other organs. Its incidence increases through the air when the patient coughs (Zainal S. et al., 2020). Adherence is closely related to failure. In the case of pulmonary TB treatment, both are closely related, where if the level of compliance is low, the risk of treatment failure is higher. A study stated that the failure of treatment of this disease was due to the lack of motivation of health workers in providing the services needed by patients with pulmonary TB. It happened because officers felt that if they wanted to recover, it should be the patient who was more active in seeking treatment, even though not all patients knew correctly about TB disease and existing treatment programs. Therefore, the officers' role is also needed to disseminate information related to TB disease and treatment management, as well as the impact of drugs on these disorders (Asriwati et al. 2021).In addition, the motivation from officers for TB patients to follow the treatment schedule was found to be significant for patient adherence to treatment (Zaidi et al. 2023). Wrong treatment procedures, a relatively long treatment period, and infection cause patients to avoid medication (Manurung, 2023). To obtain maximum treatment results, several items must be considered, namely patient treatment compliance, side effects and drug interactions must receive appropriate treatment from the doctor (Gupta et al., 2020).

CONCLUSIONS

Tuberculosis is a contagious disease caused by infection with the Mycobacterium tuberculosis germ. Usually it affects not only the lungs but also other organs. Adherence is closely related to failure. In the case of pulmonary TB treatment, both are closely related. If the level of compliance is low, the risk of treatment failure is higher. The results indicated that 97% of respondents had a moderate level of compliance in taking medication. It shows that improvements are still necessary in handling. Thus, expected optimal level of compliance in medication is obtained.

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Impact Sanitation, Childbearing Age, Number of Children, Mother's Age with the Risk of Stunting in Children

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Abstract

Sanitation, childbearing age, number of children, and the mother's age are still the main challenges that affect on increasing the risk of stunting. This study aims to identify factors that affect the risk of stunting in children in Semarang City, Central Java Province, Indonesia, with a special focus on sanitation, childbearing age, number of children, and mother's age. The study used a linear regression research design with a sample of 383 mothers and their children in 2022. Data analysis was carried out using the ANOVA technique to evaluate the influence of independent variables on stunting risk. The results showed that sanitation (B = 1,060, p < 0.001), age of delivery (B = 0.149, p = 0.018), and number of children (B = 1,027, p < 0.001) had a significant positive relationship with stunting risk. In contrast, maternal age (B = -0.511, p < 0.001) showed a significant negative association with stunting risk. These findings have important implications for the development of public health policies and practices, particularly in improving sanitation and nutritional interventions in young mothers and families with many children. This study makes a unique contribution by identifying specific variables that affect stunting risk in Indonesia, which can be used to develop more effective prevention strategies.

Introduction

Decreased prevalence of global stunting and identify factors such as an increase in the asset index as the main drivers of stunting reduction (Najib et al., 2023; Vaivada et al., 2020). The nutritional status of toddlers is an important indicator of public health, especially in assessing the quality of nutritional intake and the children health in an area (Nasution et al., 2024; Prasetyo et al., 2023). The 2023 national health survey revealed the prevalence of nutritional status of toddlers in Semarang City, showing various nutritional problems that must be addressed immediately. The prevalence of stunting in Semarang City is 15.7%, with a 95% Confidence Interval (CI) range between 12.9-19%. The prevalence of wasting in Semarang City is 6.2%, with a 95% CI range between 4.4-8.7%. The prevalence of underweight in Semarang City is 11.8%, with a 95% CI range between 9.3-14.8%. Meanwhile, the prevalence of overweight in Semarang City is 6.2%, with a 95% CI range between 4.6-8.3%. Overweight in toddlers is an early sign of overnutrition problems that can lead to obesity. This condition risks leading to various health problems such as diabetes, hypertension, and heart disease in the future. The high prevalence of nutritional problems in toddlers in Semarang City shows the need for immediate and comprehensive

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intervention to improve the nutritional status of children. Local governments and various stakeholders must work together to provide targeted nutrition programs, educate the public about the importance of healthy diets, and ensure access to adequate health services. These efforts are not only important for the health of today's children, but also for their future and the well-being of society.

Scientific attention to stunting leads to variations, such as Stunting and Anemia in Ethiopia. Geda et al. (2021) identifying risk factors for stunting and anemia in Ethiopia, including poor sanitation and malnutrition. Geospatial Inequalities in Afghanistan (Akseer et al., 2018) highlights geographical disparities in the prevalence of stunting in Afghanistan, with factors such as maternal education and access to sanitation playing a significant role. Child Growth Factors in Guatemala by Wren-Atilola et al. (2019) found that subclinical mastitis and poor sanitation contribute to stunting in Guatemala. Inequality in India in the study of Singh et al., (2020) shows that socio-economic inequality has a major effect on the prevalence of stunting among the urban poor in India. The Combination of Anemia and Stunting by Gosdin et al. (2018) examined the coexistence of anemia and stunting in India and Peru, highlighting the importance of integrated interventions. Predictor factors in Indonesia in the study of Togatorop et al. (2023) identified factors that affect stunting in children in Indonesia, such as feeding practices and household conditions. The Prediction Model in Jambi was researched by Kalsum et al. (2023) analyzing the stunting prediction model in Jambi province, and finding that socioeconomic factors are the main root of stunting. As mentioned in the literature, this study highlights the factors of maternal age, number of children, childbearing age, and sanitation conditions in Semarang City, Central Java Province, Indonesia. Stunting in toddlers in Semarang City is assumed to be influenced by various factors, as the literature mentioned earlier. But, this study focused on the factors of maternal age, number of children, childbearing age, and sanitation conditions. This study aims to identify factors that affect the risk of stunting in children in Semarang City, Central Java Province, Indonesia, with a special focus on sanitation, childbearing age, number of children, and mother's age.

The literature study starts with the risk of stunting, stunting is a condition of failure to grow in children due to chronic malnutrition that occurs during growth and usually occurs in the early stages of life, especially before the age of two. This can result in children having a shorter height than the healthy average for their age. Sanitation and Stunting in Indonesia, Hasanah & Susanti (2018) found that access to clean water and good sanitation is significantly related to the risk of stunting in children in Indonesia. Risk Factors in Bali, Indonesia, a study by Pradnyawati et al. (2021) identified various risk factors for stunting in Kedisan Village, Gianyar, including sanitation and inadequate feeding practices. Sociodemography and Stunting in West Java by Permatasari et al. (2023) examines the relationship between sociodemographic, nutritional, and sanitation characteristics and stunting in rural areas in West Java, Indonesia. Environmental Factors researched Vilcins et al. (2018) examined environmental risk factors such as food toxins and poor sanitation as the cause of stunting in children. Long-Term Effects of Stunting, Alam et al. (2020) showed that early stunting is associated with lower cognitive development at 5 years old, especially in low- and middle-income countries. WASH and Nutrition, by Momberg et al. (2021) highlights the relationship between water, sanitation, and hygiene (WASH) conditions and nutritional status of children in Sub-Saharan Africa. CIAF in Bogor, Permatasari & Chadirin (2022) using the Combined Anthropometric Failure Index (CIAF) to assess malnutrition among children in Bogor, Indonesia, found a close relationship between sociodemographic factors and children's nutritional status. The Impact of Malnutrition on Child Development by Ramokolo et al. (2018) emphasizes the long-term effects of malnutrition on childhood, including an increased risk of chronic disease in adulthood.

Furthermore, sanitation refers to environmental conditions that affect human health, especially in terms of access to and management of clean water, waste management, and cleanliness of the surrounding environment.

A Nutrition Meta-Analysis, through research from (Dewey et al., 2021), showed that lipid-based nutritional supplementation can reduce the prevalence of stunting and wasting in children, highlighting the importance of nutritional interventions at an early age. Stunting in slums Das et al. (2020) examined the factors influencing stunting in children in informal settlements in Mumbai, India, and found that higher maternal education and longer birth intervals were associated with a reduced risk of stunting. Stunting and Environmental Factors by Siti Novianti et al. (2023) identified that safe access to drinking water and maternal hygiene practices are associated with a reduced risk of stunting in West Java, Indonesia. Maternal Age Factors and Stunting, researched by Hashmi et al. (2019), showed that maternal height and suboptimal feeding practices are associated with stunting in migrant and refugee children on the Thailand-Myanmar border. Interventions for Nutrition and Sanitation, by Urgell-Lahuerta et al. (2021) reviewed interventions that address food security, water quality, and hygiene to improve nutritional status in children in low- and middle-income countries.

Meanwhile, the number of children in a family can affect the family quality of life, including health, education, and economic aspects, and also can affect the risk of stunting. The COVID-19 Pandemic and Stunting by Arini et al. (2022) found that changes in socioeconomic and sanitation conditions during the pandemic increased the risk of stunting in children in coastal areas in Surabaya, Indonesia. Child Nutritional Status in Sri Lanka in Sathiadas et al. (2021) examined the nutritional status of school children in Northern Sri Lanka and found that socio-demographic factors such as maternal education and the number of family members are related to the prevalence of stunting. Early Childhood Nutrition Education, researched by Sukmawati et al. (2023), shows that nutrition education for parents and early childhood caregivers is effective in reducing the prevalence of stunting, emphasizing the importance of a holistic approach that considers social and economic factors. The Influence of Family and Environment in Medan through Rukmana et al. (2022) found that the age of the child, birth weight, and family income are related to the nutritional status of children in Medan, Indonesia.

Meanwhile, maternal age during childbirth significantly impacts the risk of stunting in children, with adolescent mothers becoming particularly vulnerable to inadequate nutritional knowledge and care during pregnancy, leading to a higher incidence of stunting in their children (Maulana et al., 2024; Najib et al., 2023; Sulistyawati et al., 2024). In addition, the age of young mothers has been associated with a higher likelihood of stunting in toddlers, emphasizing the importance of raising awareness about early marriage to prevent stunting (Sulistyawati et al., 2024). Conversely, older maternal age can also pose a risk, as highlighted in a study in which the age of pregnant women was found to be a significant factor influencing the incidence of stunting in toddlers (Oktaviani et al., 2023). Therefore, addressing maternal age through targeted health education programs for young and older mothers is essential in preventing stunting and promoting optimal child growth and development.

The literature evaluation, referring to research by Pitoyo et al. (2022), identified that maternal education, parental work, and household environmental conditions have a significant effect on the prevalence of stunting in Indonesia. Nugroho et al. (2023) added that social support and access to health services are important determinants in overcoming stunting. However, these two studies did not pay attention to childbearing age and the number of children as independent variables. Research by Nguyen et al. (2019) in India shows that teenage pregnancy is associated with malnutrition in early childhood, with social, biological, and programmatic factors playing an important role. Similar findings were also found in Bangladesh by Nguyen et al. (2021), which showed that children of adolescent mothers had a higher risk of stunting. Jones et al. (2016) showed that urbanization in Sub-Saharan Africa is associated with a double burden of malnutrition at the household and individual levels, including stunting in children and overweight in women of childbearing age. From the literature review above, it can be synthesized that maternal age factors,

number of children, childbearing age, and sanitation conditions all have a significant impact on stunting risk. However, research that comprehensively combines all these variables is still limited. Therefore, this study aims to fill the gap by identifying and analyzing the interaction between these variables. Overall, factors such as poor sanitation, maternal age at birth, the number of children in the family, and maternal age are social and environmental factors that can interact and affect the risk of stunting in children. Efforts to reduce the risk of stunting need to pay attention to these aspects holistically, including increased access to adequate nutrition, good maternal health care, and improved sanitation and environmental hygiene. This literature review will evaluate and synthesize previous research to build the foundation of this research, focusing on the influence of maternal age, number of children, age of childbirth, and sanitary conditions on stunting risk.

Method

This study uses a quantitative research design with a linear regression approach (Nasution et al., 2024) to analyze factors that affect the risk of stunting in children in Semarang City. The methodology of this study includes sample selection, data collection methods, and data analysis techniques used. The research sample consisted of 383 mothers and their children randomly selected from the population of mothers with children under five in Semarang City. Primary data was obtained based on the Decree on Research Ethics in the Field of Social Humanities, number 305/KE.01/SK/9/2022 in September 2022 and the Approval Letter of the Ethics Commission of Gajah Mada University, number KE/UGM/045/EC/2022. The sampling strategy was by stratified random sampling techniques to ensure the proper representation of various socio-economic and geographical groups. The inclusion criteria include mothers with children under five years old, while the exclusion criteria include mothers who are not willing to participate or have incomplete data. Data were collected through structured interviews and questionnaires tested for validity and reliability. The questionnaire instrument includes questions regarding the age of the mother, the number of children, the age of childbirth, and household sanitation conditions. Data analysis was carried out using multiple linear regression to evaluate the influence of independent variables (maternal age, number of children, childbearing age, and sanitary conditions) on dependent variables (stunting risk). The regression equation model used in this study is as follows:

$$\text{Risk of Stunting} = \beta 0 + \beta 1\ (\text{MA}) + \beta 2\ (\text{NC}) + \beta 3\ (\text{CA}) + \beta 4\ (\text{Sa}) + \epsilon \quad (1$$

Where:

$\beta 0$ is a constant.

$\beta 1$, $\beta 2$, $\beta 3$, $\beta 4$ are the regression coefficient for each independent variable.

MA is Mother's Age

NC is Number of Children

CA is Childbearing Age

Sa is Sanitation

ϵ is an error term.

To ensure internal validity, all data collection instruments have gone through content and construct validity tests. Reliability is measured using Cronbach's Alpha coefficient, indicating that the instrument has high internal consistency. External validity is achieved through representative sampling techniques and rigorous data collection procedures. The study stage begins with planning, compiling questionnaire instruments, and conducting trials to ensure validity and reliability, then collecting data from respondents through interviews and filling out questionnaires. The next stage is data analysis by entering data into statistical analysis software (SPSS) and performing multiple linear regression equipped with interpretation to interpret the results to answer the research objectives.

Result and Discussion

This regression analysis model showed a strong relationship between maternal age, number of children, age of childbirth, and sanitation with measured outcomes, with an R Square of 0.718 and an adjusted R Square of 0.715. It means 71.8% of the variation in the results can be explained by this predictor variable, with a standard estimated error of 0.40075. Alderman et al. (2019) in their study found that teenage pregnancy is associated with malnutrition in children in India. Social,

TABLE 1. ANOVA[a] Risk of Stunting

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	154.623	4	38.656	240.698	.000[b]
	Residual	60.867	379	.161		
	Total	215.490	383			

a. Dependent Variable: Risk of Stunting
b. Predictors: (Constant), sanitation, childbearing age, number of children, mother's age
Source: Analysis Results, 2024

biological, and programmatic variables play an important role in this link. Kabir et al. (2021) and Migang et al. (2020) examined the demographic and environmental risk factors associated with the loss of children under the age of five in Bangladesh. These factors include the mother's age when the time of childbirth and household sanitation conditions. Sinha et al. (2016) showed that maternal age at childbirth correlates with perinatal mortality and children under the age of five in Delhi. Mothers who are younger or older than 20-24 years show an increased risk of child mortality. Kempton et al. (2021) studied methylmercury exposure and its impact on the health of women of childbearing age and their children in Munduruku, Brazil. This environmental exposure has an impact on child and maternal health outcomes. The variables of maternal age, number of children, age of delivery, and sanitary conditions have a significant influence on various indicators of child and maternal health and nutrition. The ANOVA model (Table 1) shows that independent variables, namely maternal age, number of children, age of delivery, and sanitation, significantly affected the risk of stunting in children with an F of 240,698 and a significance value of 0.000. The total sum of squares is 215,490, with a regression sum of 154,623 and a residual of 60,867. Here are the results based on 10 relevant scientific articles/ books.

Research by Nugroho et al. (2023) revealed that social factors such as maternal education, parental work, income, environment, family social support, and health services are related to the incidence of stunting in Indonesia. Jones et al. (2016) found that urbanization is related to the double burden of malnutrition, where women of childbearing age are overweight and anemic while preschool children are stunted in Sub-Saharan Africa. Das et al. (2020) reported that higher maternal education, a minimum birth interval of 2 years, and a desired pregnancy were associated with a reduced risk of stunting in children in Mumbai slums. Migang et al. (2020) and Setiawan & Machsus (2023) highlight the role of families in providing nutritious food, creating a healthy environment as education about good nutrition and disease prevention to prevent and reduce stunting in Bekasi Regency. Kempton et al. (2021) examined the impact of methylmercury exposure on the health of

TABLE 3. Coefficientsa

Model B		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		Std.	Beta			Tolerance	VIF	
1	(Constant)	1.822	.122		14.931	.000		
	Sanitation	1.060	.096	.307	11.014	.000	.960	1.042
	Childbearing Age	.149	.063	.066	2.371	.018	.974	1.027
	Number of Children	1.027	.044	.644	23.308	.000	.977	1.024
	Mother's Age	-.511	.041	-.349	-12.526	.000	.959	1.042

a. Dependent Variable: Risk of Stunting
Source: Analysis Results, 2024

women of childbearing age and their children in the community of Munduruku, Brazil, and found that poor environmental exposure affects child health outcomes. Haider et al. (2023) found that pregnancy at a young age has an impact on growth retardation and long-term health in women in Bangladesh. They found that women who became pregnant at an early age experienced growth retardation compared to those who became pregnant at an older age. Nguyen et al. (2021) reported that adolescent births are associated with child malnutrition in Bangladesh. Children of adolescent mothers are more susceptible to malnutrition compared to children of adult mothers. This regression model (Table 2) shows a significant relationship between sanitation, childbearing age, number of children, and maternal age with stunting risk. The non-standardized coefficient for sanitation is 1,060, for the childbearing age is 0.149, for the number of children is 1,027, and for the mother's age is -0.511.

Sanitation has an unstandardized coefficient of 1.060 ($p < 0.001$), indicating that better sanitation conditions significantly reduce the risk of stunting. This is in line with research by Jones et al. (2016) which found that good sanitation is associated with a decrease in the prevalence of malnutrition in children in Sub-Saharan Africa (Jones, 2016). The age of childbirth showed a coefficient of 0.149 ($p = 0.018$), indicating that the older age of childbirth was slightly associated with an increased risk of stunting. These results contrast with the findings of Nguyen et al. (2019) which show that teenage pregnancy is more at risk of stunting. The number of children has a coefficient of 1,027 ($p < 0.001$), indicating that the more children a mother has, the higher the risk of stunting. This is supported by research by Pitoyo et al. (2022) which shows that families with more children are more prone to malnutrition problems. The mother's age had a negative coefficient of -0.511 ($p < 0.001$), indicating that the older mother's age was associated with a reduced risk of stunting. This is in line with research in Bangladesh by Haider et al. (2023) which shows that older mothers tend to have more nutritionally healthy children. The results of this study show that sanitary conditions, childbearing age, number of children, and maternal age significantly affect the risk of stunting in children in Indonesia. These findings provide important insights for the development of more effective public health policies, in reducing the prevalence of stunting. Taking these findings into account, targeted interventions on improving sanitation conditions, health education for young mothers, and family support can contribute significantly to reducing the risk of stunting in Semarang City.

The age of older mothers is negatively related to the risk of stunting is proven to be true. The negative coefficient (-0.511) indicates that children of older mothers tend to have a lower risk of stunting. It aligns with previous research by Haider et al. (2023) in Bangladesh. It showed that older mothers tend to have better knowledge about nutrition and access to better resources to support children's health. The number of children more positively related to the risk of stunting has also been proven true. A coefficient of 1,027 indicates that each additional child increases the risk of stunting. Research by Pitoyo et al. (2022) supports these findings, where families with more children are more susceptible to malnutrition due to limited resources. Younger childbearing age is also positively related to stunting risk, with a coefficient of 0.149. However, these results are slightly different from the findings of Alderman et al. (2019) which shows that teenage pregnancy significantly increases the risk of stunting higher than older childbearing age. Poor sanitation conditions are positively related to stunting risk as evidenced by a coefficient of 1,060.

These findings are consistent with research about risk factors in Myanmar by Khaing et al. (2019) identified regional risk factors associated with malnutrition in children in Myanmar, including socioeconomic status and household conditions. Feeding Strategies (Jeyakumar et al., 2022) show that infant and young children feeding strategies (IYCF) potentially reduce the double burden of malnutrition in urban slums in India. Nutritional status in Indonesia (Rafisa et al., 2023) evaluated the nutritional status of children with cleft lip and/or palate in Indonesia and found a significant prevalence of malnutrition in this population. Socioeconomic inequalities

in Sub-Saharan Africa, Ekholuenetale et al. (2020) examined socioeconomic inequalities in hidden malnutrition and malnutrition in children in 35 Sub-Saharan African countries. The Impact of Seasons in Uganda (Nahalomo et al., 2022), research assessed the influence of seasonal variations and related factors on child malnutrition in landslide-affected areas in Uganda. Causative Factors in Pakistan by (iddiqa et al. (2023) examined the determinants of stunting, wasting, and underweight in children in Pakistan, highlighting the importance of size at birth as a major risk factor. The findings of this study have important implications for theory and practice. Theoretically, these results confirm the importance of considering various demographic and environmental factors in the study. Practically, these findings suggest that targeted interventions on improved sanitation, maternal health education, and family support can help reduce the risk of stunting. Policies encouraging increased access to proper sanitation facilities and educational programs for young mothers can contribute significantly to stunting prevention efforts.

Conclusion

This study aims to identify factors that affect the risk of stunting in children in Indonesia, focusing on maternal age, number of children, childbearing age, and sanitation conditions. Key findings suggest that older maternal age reduces the risk of stunting, while a higher number of children and poor sanitation conditions increase the risk. Younger childbearing age also slightly increases the risk of stunting. The theoretical implications of the findings are that the results of this study strengthen the theoretical understanding of stunting determinants by emphasizing the importance of demographic and environmental factors. This study adds to the existing literature by showing the interaction between variables such as maternal age, number of children, and sanitation conditions in the context of stunting in Indonesia. Practically, these findings show that interventions that focus on improving sanitation conditions and maternal health education are very important in reducing the risk of stunting in Semarang City. Public health policies that support mothers in planning their families and improve access to proper sanitation facilities can contribute significantly to stunting prevention efforts.

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Climate Factors with the Incidence of Dengue Hemorrhagic Fever in Semarang, Indonesia

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Abstract

In Indonesia, Dengue Hemorrhagic Fever (DHF) remains a public health issue that can lead to extraordinary events. Indonesia ranks fourth in the world for the highest incidence of DHF. This is evident from the fluctuating morbidity and mortality rates due to DHF in Indonesia, including in Semarang. The purpose of this study is to determine the relationship between climatic factors and the incidence of DHF in Semarang from 2018 to 2022. This type of research is descriptive observational with an ecological study design. The data sources for the study are secondary data from the Semarang City Health Office and the Semarang City Meteorology, Climatology, and Geophysics Agency (BMKG) from 2018 to 2022. Data analysis was conducted using the Spearman Rank test. The results showed that rainfall (p= 0,004; r= 0,37), air humidity (p= 0,0001; r= 0,47), temperature (p= 0,016; r= -0,31), wind speed (p= 0,0001; r= -0,48), and duration of sunshine (p= 0,015; r= -0,31) were associated with the incidence of DHF. The conclusion of this study indicates a correlation between climatic factors, such as rainfall, air humidity, temperature, wind speed, and duration of sunshine, and the incidence of DHF in Semarang from 2018 to 2022.

INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is one of the infectious diseases caused by the Dengue virus, which belongs to the Flaviviridae family and the Flavivirus genus. This virus has four main serotypes: DENV-1, DENV-2, DENV-3, and DENV-4. DHF is transmitted by vector mosquitoes, with the main vector species being Aedes aegypti and Aedes albopictus (Wang et al., 2020). According to WHO, the incidence of dengue fever has increased rapidly worldwide in recent decades. In 2000, there were 505,430 reported cases, which sharply increased to 5.2 million reported cases in 2019. This disease is endemic in more than 100 countries, including regions in Africa, America, the Eastern Mediterranean, Southeast Asia, and the Western Pacific (World Health Organization, 2023). The European Centre for Disease Prevention and Control (ECDC) stated that in 2022, there were 4,110,465 cases of dengue fever worldwide. The countries with the highest number of cases were Brazil (2,363,490 cases), Vietnam (367,729 cases), Philippines (220,705 cases), Indonesia (125,888 cases), and India (110,473 cases) (World Health Organization, 2023). In Indonesia, DHF remains a public health issue that can lead to extraordinary events (Susilowati & Cahyati, 2021). It is evident from the fluctuating morbidity and mortality rates due to DHF in Indonesia. In 2022, the number of dengue cases in Indonesia reached 143,000, with the highest incidence occurring in three provinces, namely West Java, East Java, and

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Central Java (Kementerian Kesehatan Republik Indonesia, 2022).

DHF situation in Semarang shows a fluctuating trend in cases. According to the Semarang City Health Office, there were 103 cases of DHF in Semarang in 2018 (IR = 6.17; CFR = 0.97%). In 2019, the incidence of DHF increased to 441 cases (IR= 26.37; CFR= 3.18%). In 2020, the incidence of DHF decreased to 320 cases (IR= 19.16; CFR= 1.25%). In 2021, the incidence of DHF increased to 322 cases (IR= 19.88; CFR= 2.71%). In 2022, the incidence of DHF increased to 864 cases (IR= 51.7; CFR= 3.82%) (Kementerian Kesehatan Republik Indonesia, 2022). Based on the epidemiological triangle, Dengue Hemorrhagic Fever (DHF) is associated with three main factors. They are agent, host, and environment. The vector requires a suitable environment to breed (Ghaisani et al., 2021). The vector that causes DHF is closely related to climate change. Climate change can affect the increased risk of disease transmission and cause the mosquito population to rise.

The spread of the DHF virus is closely related to climate change patterns. Several studies indicate that climatic factors such as temperature, rainfall, humidity, wind speed, and sunshine duration are associated with the incidence of DHF in a region. A study conducted in Sleman, Indonesia, found that humidity, temperature, rainfall, and the number of rainy days are the climatic factors that most significantly influence DHF incidence (Kesetyaningsih & Fauzan, 2021). Research conducted in Dhaka, Bangladesh, indicated that wind speed has a positive relationship with dengue fever (Hossain et al., 2023). A study conducted in Hanoi found a correlation between monthly relative humidity and total sunshine hours with DHF incidence (Thi Tuyet-Hanh et al., 2018). Rainfall contributes to the incidence of DHF because high rainfall can increase the potential breeding places for Aedes aegypti and Aedes albopictus mosquitoes, thereby increasing the mosquito vector population (Ghaisani et al., 2021). Temperature can affect virus replication and mosquito breeding (Arsin et al., 2020). Humidity also contributes to the incidence of DHF, as it influences mosquito breeding, resting, lifespan, and biting habits (Kesetyaningsih & Fauzan, 2021).

Sunshine significantly affects mosquitoes when resting and biting (Minarti et al., 2021). Aedes aegypti mosquitoes look for shaded places to rest, have adequate humidity, and protected from the sun. Abundance of sunshine increase air temperature, which can heat water temperature and reduce humidity, thereby disrupting mosquito survival. Wind speed can affect the range of mosquito flight. A wider flight range increases the possibilities of contact with humans (Arsin et al., 2020). Based on the above explanation, the researcher considers it important to study the data related to climatic factors and the incidence of DHF in Semarang from 2018 to 2022. Therefore, this study is conducted to determine the correlation between climatic factors and the incidence of DHF in Semarang from 2018 to 2022. Understanding the relationship between climatic factors and DHF incidence is expected to help take preventive measures to reduce the incidence of DHF.

METHOD

The type of research used in this study is descriptive observational with an ecological study design. An ecological study examines the relationship between independent and dependent variables, along with the strength and direction of the relationship. The population in this study consists of the total number of DHF cases in Semarang from 2018 to 2022. Data collection for DHF and climate used secondary ones. DHF data was obtained from the Semarang City Health Office recorded in the TUNGGAL DARA application from January 2018 to December 2022. Climate data was sourced from the Central Java Province BMKG Station in Semarang recorded in BMKG's official central database application from January 2018 to December 2022.

In this study, the dependent variable is the incidence of DHF. The independent variables include rainfall, air humidity, temperature, wind speed, and duration of sunshine. The units for the independent variables are as follows: rainfall (mm), air humidity (%), temperature (°C), wind speed (m/s), and duration of sunshine (hours). The measurement of distribution is conducted to

describe the mean, median, standard deviation, and min-max of the incidence of DHF, rainfall, air humidity, temperature, wind speed, and duration of sunshine. In this study, the bivariate analysis uses the Pearson Product Moment test if the requirements are met, such as the measurement scale being numerical and the data being normally distributed. Alternatively, the Rank Spearman test is used if the data is not normally distributed. The correlation strength parameter (r) is as follows: 0.0 - < 0.2 very weak; 0.2 - < 0.4 weak; 0.4 - < 0.6 moderate; 0.6 - < 0.8 strong; and 0.8 - 1 very strong. The direction of correlation can be positive or negative. The p-value parameter is > 0.05 for non-significant and < 0.05 for significant correlation. Ethical approval for this research was obtained from the Health Research Ethics Committee (KEPK) of the Faculty of Medicine, Universitas Negeri Semarang, with No. 018/KEPK/FK/KLE/2024.

RESULTS AND DISCUSSION

Based on Table 1, the average monthly incidence of DHF in Semarang from 2018 to 2022 was 35 cases, with a minimum of 2 cases and a maximum of 94 cases. The monthly rainfall in Semarang from 2018 to 2022 ranged from 0 to 694.2 mm, with an average monthly rainfall of 181.7 mm. The monthly air humidity in Semarang from 2018 to 2022 ranged from 66.2% to 91.4%, with an average monthly humidity of 79.5%. The monthly temperature in Semarang from 2018 to 2022 ranged from 26.7°C to 30.1°C, with an average monthly temperature of 28.3°C. The monthly wind speed in Semarang from 2018 to 2022 ranged from 1.5 to 3.2 m/s, with an average monthly wind speed of 2.2 m/s. The duration of sunshine per month in Semarang from 2018 to 2022 ranged from 3 to 9.9 hours, with an average of 6.6 hours.

Based on Table 2, the bivariate results indicate that rainfall has a significant relationship with the incidence of DHF, with a weak correlation strength and a positive correlation direction (r= 0.37; p= 0.004). Air humidity also has a significant relationship with the incidence of DHF, with a moderate correlation strength and a positive correlation direction (r= 0.47; p= 0.0001). Temperature has a significant relationship with the incidence of DHF, with a weak correlation strength and a negative correlation direction (r= -0.31; p= 0.016). Wind speed has a significant relationship with the incidence of DHF, with a moderate correlation strength and a negative correlation direction (r= -0.48; p=0.0001). The duration of sunshine also has a significant relationship with the incidence of DHF, with a weak correlation strength and a negative correlation direction (r= -0.31; p= 0.015).

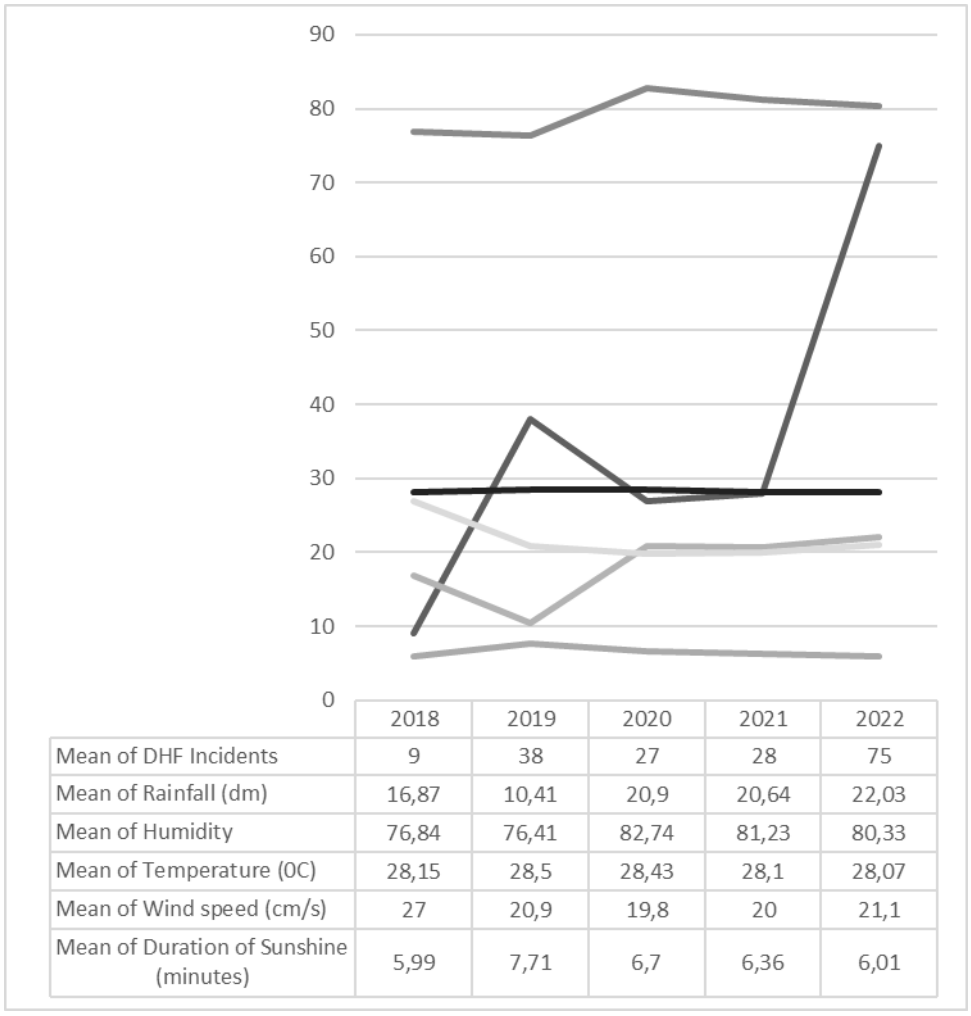
Based on the diagram 1, the increase in rainfall is also accompanied by an increase in the incidence of dengue fever. The incidence of dengue fever also follows trends in other variables. Thus, it can be concluded that the incidence of dengue fever can be influenced by several climate variables, including rainfall, humidity, temperature, wind speed, and duration of sunshine.

The results of this study indicate that rainfall, air humidity, temperature, wind speed, and duration of sunshine are related to the incidence of DHF. These findings are consistent with a study conducted in Sleman, Indonesia, from 2008 to 2015, which showed that rainfall is significantly related to the incidence of DHF (Kesetyaningsih & Fauzan, 2021). A study in Bangkok stated that a 1% increase in rainfall would result in a 3.3% increase in monthly dengue fever incidence (Polwiang, 2020). Research in Lampung, Indonesia, from 2007 to 2018 found that rainfall had a 19% impact on the incidence of DHF (Rusli & Yushananta, 2020). Rainfall is a crucial factor in the transmission of DHF. High rainfall intensity leads to increased

Table 1 Distribution of DHF Incidence and Climatic Factors in Semarang from 2018 to 2022

Variables	n (Months)	Mean	Minimum	Maximum
DHF Incidence	60	35	2	94
Rainfall	60	181,7	0	694,2
Air Humidity	60	79,5	66,2	91,4
Temperature	60	28,3	26,7	30,1
Wind Speed	60	2,2	1,5	3,2
Duration of Sunshine	60	6,6	3	9,9

Sources: Tunggal Dara Application (Kementerian Kesehatan Republik Indonesia, 2022)



	2018	2019	2020	2021	2022
Mean of DHF Incidents	9	38	27	28	75
Mean of Rainfall (dm)	16,87	10,41	20,9	20,64	22,03
Mean of Humidity	76,84	76,41	82,74	81,23	80,33
Mean of Temperature (0C)	28,15	28,5	28,43	28,1	28,07
Mean of Wind speed (cm/s)	27	20,9	19,8	20	21,1
Mean of Duration of Sunshine (minutes)	5,99	7,71	6,7	6,36	6,01

Diagram 1. Climatic Factors and DHF Incidence in Semarang from 2018 to 2022 (Kementerian Kesehatan Republik Indonesia, 2022)

water puddles, which become breeding grounds for adult mosquitoes, facilitating their egg-laying and increasing mosquito populations. Rainfall can also affect air humidity, and increased humidity can extend the lifespan of adult mosquitoes (Wulandari et al.,2023). However, a study conducted in Surabaya from 2007 to 2017 showed contrasting results, indicating that there is no relationship between rainfall and the incidence of DHF. This is due to the possibility of heavy rains being detrimental to mosquitoes, as they can destroy mosquito eggs and larvae (Ghaisani et al., 2021).

Dengue fever cases are more frequent during the rainy season when humidity is relatively higher. High humidity during the rainy season supports mosquito breeding, which can lead to an increase in the number of infected mosquitoes (Sutriyawan et al., 2023). The average air humidity based on the study results was 79.5%, which is consistent with research conducted in Hanoi from 2008 to 2015, indicating that air humidity is related to the incidence of DHF, with an average air humidity of 80.1% (Thi Tuyet-Hanh et al., 2018). A study conducted in Manado also stated that there is a relationship between air humidity and the incidence of DHF (r=0.873; p= 0.0001) (Monintja et al., 2021). Air humidity can affect the respiratory system and physiological processes of Aedes aegypti mosquitoes. The optimal air humidity for mosquito survival is more than 60%, while low air humidity, less than 60%, can shorten the mosquito's lifespan due to body fluid evaporation. Conversely, high air humidity, more than 85%, can extend the mosquito's lifespan (Wulandari et al., 2023). Additionally,

Table 2 Correlation Analysis Results between Climatic Factors and DHF Incidence in Semarang from 2018 to 2022

Variables	Dengue Hemorrhagic Fever (DHF) Incidence		
	Correlation Coefficient (r)		Description
Rainfall	0,37	0,004	Weak correlation strength, positive correlation direction, and significant correlation
Air Humidity	0,47	0,0001	Moderate correlation strength, positive correlation direction, and significant correlation
Temperature	-0,31	0,016	Weak correlation strength, negative correlation direction, and significant correlation
Wind Speed	-0,48	0,0001	Moderate correlation strength, negative correlation direction, and significant correlation
Duration of Sunshine	-0,31	0,015	Weak correlation strength, negative correlation direction, and significant correlation

Source: Primary data

mosquitoes prefer to lay eggs in humid places, so increased air humidity can potentially increase Aedes aegypti larvae (Kesetyaningsih & Fauzan, 2021). The relationship between air humidity one month prior and the incidence of DHF is very strong. It is because high air humidity causes mosquitoes to lay more eggs, leading to an increased mosquito population and faster DHF transmission (Amelinda et al., 2022). However, a study conducted at RSUD Palembang Bari, Indonesia showed contrasting results, indicating no relationship between air humidity and the incidence of DHF (Indawati et al., 2021).

Based on this study, temperature correlates with the incidence of DHF, with an average temperature of 28.3°C. This is in line with research conducted in Surabaya, Indonesia, which found a statistical relationship between average temperature and the incidence of DHF (r= -0.603; p= 0.01) (Tang et al., 2020). A study in Central Java, Indonesia observed that the temperature with the lowest risk of dengue fever is around 27°C. The risk of dengue fever decreases as the temperature increases (Wibawa et al., 2024). Research conducted in Kelantan, Malaysia, stated that dengue fever cases increase when the average temperature ranges between 26°C and 28°C. The dengue fever cases are predicted to decrease when the average daily temperature rises above 28°C (Masrani et al., 2021). Temperature is a climatic factor that can affect the life cycle of mosquito vectors and virus replication. The optimal temperature for mosquito vectors is around 26-30°C. Therefore, dengue transmission is higher in tropical and subtropical regions. It is because extremely high or low temperatures can disrupt mosquito growth and can be fatal to them (Amelinda et al., 2022). Temperature can also affect the biting activity of female mosquitoes, with optimal temperatures potentially increasing the spread of DHF (Minarti et al., 2021). Research conducted in Surabaya, Indonesia, showed contrasting results, indicating no relationship between temperature and the incidence of DHF (Ghaisani et al., 2021).

Based on the results, wind speed is related to the incidence of DHF, with an average wind speed of 2.2 m/s. This study aligns with research conducted in Makassar, Indonesia, which found a relationship between wind speed and the incidence of dengue fever, with a negative correlation. The research in Makassar indicated that strong winds could reduce mosquito density, making it difficult for mosquitoes to find their hosts (Susilawaty et al., 2021). Wind speed can affect mosquito flight and dispersion. When the wind speed is 11-14 m/s or 25-31 mph, it can hinder mosquito flight. Wind speed when mosquitoes fly in and out of houses is one of the factors that determines the amount of contact between mosquitoes and humans (Amelinda et al., 2022).

Aedes aegypti mosquitoes fly about 30-50 meters per day, but this distance depends on the availability of breeding places. When the breeding site is in or around the house, they will not fly far. Female mosquitoes have an average flying capability of 40 meters and a maximum

of 100 meters. Wind speed influences the range of Aedes aegypti mosquitoes while flying. The wider the range of the mosquitoes, the greater the chances of contact with humans. If the wind speed is faster, mosquitoes find it more difficult to fly. Therefore, mosquitoes find it hard to move long distances, which can reduce the chance of DHF transmission (Arsin et al., 2020). Research conducted in Kendari, Indonesia, showed a contrasting result, indicating no correlation between wind speed and the incidence of DHF (Arsin et al., 2020).

Research results indicate a relationship between the duration of sunshine exposure and the incidence of dengue hemorrhagic fever (DHF), with an average sunshine duration of 6.6 hours. This study aligns with research conducted in Hanoi, which found a relationship between the average monthly sunshine duration and the incidence of DHF (Thi Tuyet-Hanh et al., 2018). Research in Bangladesh stated that shorter sunshine duration is more conducive to the transmission of dengue fever, as mosquitoes are more active in dark environments, increasing the frequency of mosquito bites (Hossain et al., 2023). When resting, Aedes aegypti mosquitoes tend to seek shaded areas with adequate humidity, protected from sunshine (Kementerian Kesehatan Republik Indonesia, 2022). The mosquito movement in searching for food or resting places is greatly influenced by sunshine (Minarti et al., 2021). Research conducted in Palembang, Indonesia, showed a contrasting result, indicating no correlation between sunshine duration and the incidence of DHF (Minarti et al., 2021).

This study has limitations due to the ecological study design, resulting in aggregate data analysis. In this research, bias cannot be controlled as the validity and reliability of the data are unknown, given the use of secondary data. Additionally, this study cannot accurately measure the risk impact and predictive value of DHF incidence because the analysis is only bivariate when the data is not normally distributed. Moreover, this study is limited by its focus solely on climatic factors, suggesting a need for further research on other potential factors related to the incidence of DHF.

CONCLUSION

Based on the results of bivariate analysis using the Rank Spearman correlation analysis, climatic factors that have a relationship with the incidence of DHF in Semarang from 2018 to 2022 include rainfall (r= 0,37; p= 0,004), air humidity (r= 0,47; p= 0,0001), temperature (r= -0,31; p= 0,016), wind speed (r= -0,48; p= 0,0001), and duration of sunshine (r= -0,31; p= 0,015). This study has shown that climatic factors are important elements that can influence the incidence of DHF in Semarang. It is expected that the Semarang City Health Office implements an early warning system regarding the risk of increasing DHF incidence related to climatic factors by using data from the Meteorology, Climatology, and Geophysics Agency (BMKG) at the Semarang City Climatology Station. It would allow for timely intervention in monitoring DHF. Additionally, it is hoped that this research can strengthen environmental management and raise awareness of DHF in society.

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Wisdom of Local Food Ingredients as an Enhancer to Food Supply for Diabetes Mellitus Prevention

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Abstract

The increase in cases and prevalence of children with DM increased 70 times (2010 – January 2023). The dominant factor is the consumption of unhealthy food, which is exacerbated by the limited diversity of healthy foods on the market. The objectives of this research are: 1) obtaining local food ingredients and food products to be used, 2) obtaining product prototypes, and 3) obtaining selected products for DM prevention. The activities consist of: 1) Determining local food ingredients with a qualitative approach, 2) Getting selected product formulas for limited environmental tests, with formula tests through expert design, selected formula production tests, proximate tests, and organoleptic tests, 3) getting products to be ready for field tests, with hedonic tests, Anova tests, and Post Hoc tests. The results obtained: 1) the local food that will be used is a large white sweet potato (Ipomoea Batatas) with food products in the form of sweet potato pie. The selected products were F5 (45% sweet potato, 20% wheat, and 5% tapioca), based on the laboratory results of the lowest carbohydrate, total fat, and total energy content (average 47.82%, 21.23%, 397.89) and the highest fiber content (9.64%). In addition, there were differences in overall value (F:6.033, sig 0.003), color value (F:4.252, sig 0.016), aroma value (F:6.247, sig 0.002), and taste value (F:1.841, sig 0.162). Furthermore, the results of the Post Hoc test concluded that there were differences related to the overall value, color, aroma and taste between F5 and F6 products.

INTRODUCTION

Diabetes Mellitus (Diabetes) belongs to the group of non-communicable diseases (NCDs) and is also classified as a group of degenerative diseases, caused by impaired carbohydrate metabolism, due to insulin hormone insufficiency. In 2030, approximately 366 million adults will suffer from diabetes and by 2040 the number is estimated to reach 642 million, of which 75% are in developing countries (International Diabetes Federation, 2021). Indonesia ranks 6th with the highest number of diabetes cases, which is 10.3 million cases per year in 2017. Center for Indonesia's Strategic Development Initiative (CISDI) stated that the number of children with diabetes is increasing rapidly, this is reinforced by the Indonesian Pediatrician Association (IDAI), which states that the prevalence of children with diabetes has increased 70 times (2010 – January 2023).

The loss of Gross Domestic Product

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(GDP) in the world due to diabetes from 2010 to 2030 is estimated at around 1.7 trillion dollars. Treatment is carried out throughout life, which results in an economic burden on the family, which can increase the severity of symptoms and complications in patients (Patil et al., 2017; Tol et al., 2013). Diabetes can also attack all organ systems of the body, reduce human resource performance, and cause premature death.

Unhealthy lifestyle behaviors, overweight, abdominal obesity, lack of physical activity, and unhealthy diet, are risk factors for Diabetes that can arise due to the socio-cultural environment, which can be improved (Harding et al., 2004; Hu et al., 2012; Teixeira-lemos et al., 2011; Handayani et al., 2021). Unhealthy lifestyles formed by habits, low knowledge, environment, and lack of healthy food offered, including lack of facilities and policy support are important factors in the increase in Diabetes cases in the community (Al-sejari, 2017; Aye et al., 2014; Handayani et al., 2020; Silva, 2012). The availability of low-sugar foods and drinks is still limited at the hawker level and receives little serious attention (it is mixed with others, making it difficult to find, with a limited number of types) (Raharjo et al., 2016; Nugroho et al., 2023). Results of other research obtained local food wisdom, including the existence of several foods with a low Glycemic Index (IG), such as bran flour (Bran), sweet potato (Ipomoea batatas), Arrowroot (Maranta arudinacea), and kidney beans (Phaseolus vulgaris) (Al-sejari, 2017; Patil et al., 2017; Silva, 2012; Tol et al., 2013). The content of the resulting product is influenced by the formula of the staples and the cooking process (Handayani, Kurnia, et al., 2021; Handayani, Mardiana, et al., 2021; Handayani, Nugroho, et al., 2021).

One of the solutions to improve behavior related to healthy eating consumption is the environment related to the availability of healthy food in the environment, in terms of the type or variety and quantity. This activity will also utilize the wisdom of existing food ingredients into functional food for DM prevention and collaborate with MSMEs from the research process to the production process to be marketed later, as well as collaborate with vendors/shops for marketing. The purpose of the research is to: 1) obtain local food ingredients and food products to be used, 2) obtain product prototypes 3) obtain selected food enrichment products for diabetes prevention.

METHOD

The research was conducted in Semarang City, considering that the number of Diabetes cases increased from 2016 – 2019 (Semarang City Health Department), which is an area for the development of food availability in the market and policy development as a pilot that can be carried out. The stages of the research carried out are: Determine the potential profile of local food ingredients for the prevention of diabetes and food preference trends in the community in the research area. Carried out with qualitative approaches, the informants were the health resources of the Semarang DKK, health center nutrition officers, posyandu heads, chairmen, and members of the PKK, the target community was determined by purposive techniques, with an initial number of 22 people. Then additional informants from the target community were added with the snowball technique so that the total number of informants was 32 people. The data was obtained by in-depth interviews and FGD, and analyzed with the Miles and Huberman model.

Get product prototypes and get selected food enrichment products for diabetes prevention, based on the results of the activity: (1) Test the Formula through expert design. (2) Test the production of selected formulas (7 formulas) carried out with MSMEs. (3) Chemical assessment and analysis (proximate analysis) to obtain moisture and ash content (oven method), protein content (Mikro Kjeldahl), fat content (method Soxhlet), carbohydrate content (Carbohydrates by Difference), Analysis of dietary fiber content (Asp et al., 1983). (4) Organoleptic test in the trained panelists aged 25-40 years, as many as 5 men and 5 women, using a quality scale of 9 points. (5) Products for limited environmental testing (3 formulas) with improvements based on input from organoleptic test results. (6) Hedonic test to get the preferred product. The assessment by consumer panelists was 50 people, provided that the panelists were 20-40 years old, healthy, and willing to be panelists.

Techniques for determining informants Quota Sampling, with an acceptability test on a scale of 1 – 9 (Lamusu, 2007). The different tests were carried out with the Anova test and the Post Hoc test.

RESULTS AND DISCUSSION

Qualitative data obtained through FGD, and filling out questionnaires concluded that the food to be developed is large white sweet potatoes (Ipomoea Batatas), this is based on the results of taking questionnaire data to the target target of 30 people (15 adolescents and 15 young adults) and FGD conducted to 12 people (1 from DKK Semarang, 1 Nutrition Officer of the Health Center, 2 Posyandu Cadres, 3 representatives from PKK, 3 target communities, 2 representatives of partner MSMEs), and by considering the results of research that has been carried out previously where large white sweet potatoes are a food ingredient with low IG and are preferred by the community and used as a DM Preventive Support (International Diabetes Federation, 2021; Patil et al., 2017).

In addition, the election also considers the results of other research that has obtained local food wisdom including the existence of several foods with a low Glycemic Index (IG), which can be an option such as bran flour (Bran), sweet potato (Ipomoea batatas), Arrowroot (Maranta arudinacea), and kidney beans (Phaseolus vulgaris) (Harding et al., 2004; Teixeira-lemos et al., 2011; Tol et al., 2013). The results obtained related to the data of food products to be developed were concluded to be sweet potato pie with considerations based on the most proposals and the level of feasibility by MSME partners. Based on the Formula Test through expert design, with variables consisting of large white sweet potato staples, wheat, tapioca flour, and fixed variables consisting of eggs, honey, baking powder, and margarine (Table 1), so that 15 formula designs are produced, and the top 7 formulas will be used for further processed selected formula production tests. Product processing is carried out in collaboration with MSMEs by 1) preparing ingredients and weighing the ingredients to be used, 2) white sweet potatoes are steamed, crushed until smooth, and filtered, so that they form a pulp, 3) mixing all ingredients according to the formula into one dough that can be formed, 4) making fla which is a mixture

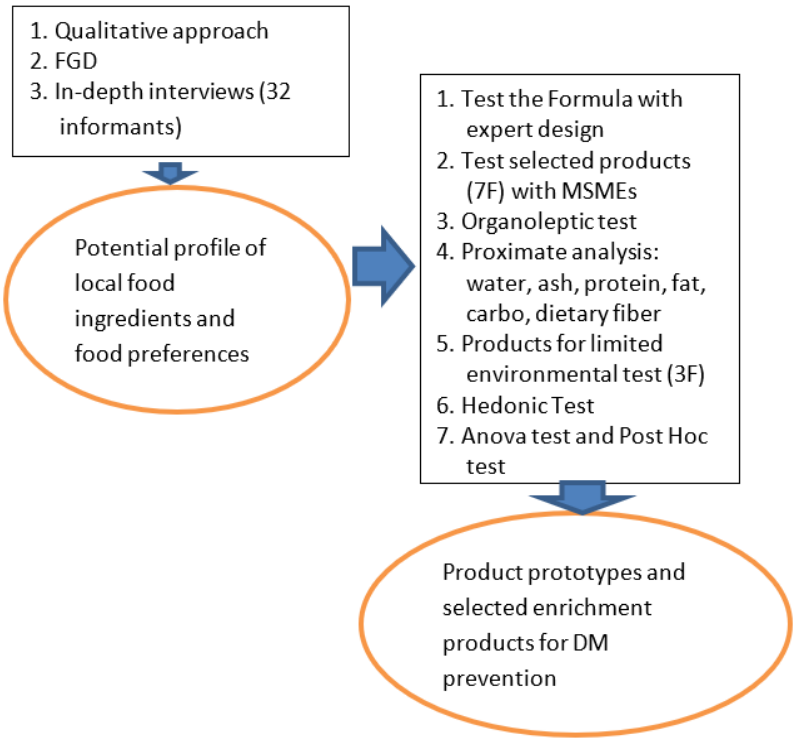

Figure 1. Research flow

Figure 2. White Sweet Potato, Ingredients, and Sweet Potato Pie Products.

Table 1. Basic Formula

Changed Variable: 70%		
Sample (Material)	Upper limit	Lower limit
Large White Sweet Potato	30	60
Wheat	10	20
Tapioca	5	15

Fixed variable: 30%	
Material	Amount (%)
Margarine	15
Honey	7
Egg	7
Backing Powder	1

of 300 ml sweetened condensed milk, 30 gr cornstarch, 8 bh egg yolk, 400 ml water and 1 tsp liquid vanilla. 5) Then it is formed in a pie mold, at the top of the fla pie filling, 6) baked over medium heat for 40 minutes.

Organoleptic analysis was carried out to determine the best product based on color, texture, taste, and aroma carried out by trained panelists, and obtained the 4 highest orders, namely F6, F5, F4, F3, then a proximate test was carried out and the results obtained were as illustrated in Table 2.

Based on the results of the proximate test, it was concluded that the product selected for the limited environmental test was in F3, F5, and F6 based on the consideration of carbohydrate content, total fat, total energy, and dietary fiber content with an improvement note that it is necessary to add a cornstarch mixture to the custard to get even lower carb content and add Emplex to get the crispiness of the product. This conclusion considers the results of previous research which stated that the content of the products produced is influenced by the formula of the staples and the cooking process (Aye et al., 2014). The data from the hedonic test in a limited scale test was conducted on 50 respondents and tested on 3 selected formulas (F3, F5, and F6) with aspects assessed related to color, aroma, texture, taste, and overall.

The conclusion based on the number of hedonic test assessments is that the superior is in F5 with the highest total score (1455) and superior in the overall aspect, aroma, and taste. The results of testing local food ingredients based on color, aroma, texture, taste, and overall in formula 3, formula 5, and formula 6 with the F test obtained the following results:

1)The assessment of the respondents based on the overall F value was obtained with

Table 2. Proximate test results F3, F4, F5, and F6.

Formula	Total energy (Kcal/100g)	Energy from fat (Kcal/100g)	Ash content (%)	Moisture content (%)	Carbohydrates (%)	Total fat content (%)	Protein content (%)	Dietary fiber (%)
F3								
Simplo	409.72	193.68	1.17	23.30	49.87	21.52	4.14	8.26
Duplo	413.76	200.88	1.21	23.25	48.95	22.32	4.27	8.08
F4								
Simplo	407.58	189.18	1.19	23.19	50.53	21.02	4.07	5.79
Duplo	401.32	181.08	1.23	23.59	50.83	20.12	4.23	5.94
F5								
Simplo	396.44	187.56	1.16	25.78	48.26	20.84	3.96	9.42
Duplo	399.34	194.58	1.20	25.99	47.38	21.62	3.81	9.86
F6								
Simplo	433.78	219.42	1.19	20.84	49.44	24.38	4.15	7.11
Duplo	440.05	226.89	1.15	20.35	49.00	25.21	4.29	7.02

Table 3. Results of the Number of Hedonic Test Assessments.

Product	VALUE					
	Overall	Color	Aroma	Texture	Flavor	Total
Formula 3	272	269	290	255	283	1369
Formula 5	301	286	303	267	298	1455
Formula 6	293	289	274	270	293	1419

a calculated F value of 6.033 with sig = 0.003. So it can be concluded that there are differences in local food products based on the overall formula 3, 5, and 6.

2)The assessment of respondents based on color obtained an F value of 4.252 with sig = 0.016. So it can be concluded that there are differences in local food products based on color in Formula 3, 5, and 6.

3)The assessment of respondents based on aroma obtained an F value of 6.247 with sig = 0.002. So it can be concluded that there are differences in local food products based on the aroma of Formula 3, 5, and 6.

4)The assessment of respondents based on texture obtained an F value of 2.161 with sig = 0.119. So it can be concluded that there is no difference in local food products based on the texture of Formula 3, 5, and 6.

5)The respondent's assessment based on the feeling obtained an F value calculated at 1.841 with sig = 0.162. So it can be concluded that there is no difference in local food ingredients based on taste in Formula 3, 5, and 6.

Table 4. Results of Post Hoc Tests of Local Food Ingredients Based on Overall Value, Color, Aroma.

The results of the post hoc test of local food products based on the overall in formula 3 with formula 5 and formula 3 with formula 6 have a significance value of < 0.05 so it can be concluded that there are differences in local food products in formula 3 with formula 5 and formula 3 with formula 6 based on the whole. Local food products in formula 5 and formula 6 have a significance value of > 0.05 so it can be interpreted that there is no difference in local food products in formula 5 and formula 6 based on the whole. The results of the post hoc test of local food products based on color in formula 3 with formula 5 and formula 3 with formula 6 have a significance value of < 0.05 so it can be concluded that there are differences in local food products in formula 3 with formula 5 and formula 3 with formula 6 based on color. Local food products in formula 5 and formula 6 have a significance value of > 0.05 so it can be

Table 4. Results of Post Hoc Tests of Local Food Ingredients Based on Overall Value, Color, Aroma.

Multiple Comparisons

Overall						
		Mean Difference		Sig.	95% Confidence Interval	
(I) Formula	(J) Formula	(I-J)	Std. Error		Lower Boun	Upper Bound
Formula 3	Formula 5	-.58000*	.17247	.001	-.9208	-.2392
	Formula 6	-.42000*	.17247	.016	-.7608	-.0792
Formula 5	Formula 3	.58000*	.17247	.001	.2392	.9208
	Formula 6	.16000	.17247	.355	-.1808	.5008
Formula 6	Formula 3	.42000*	.17247	.016	.0792	.7608
	Formula 5	-.16000	.17247	.355	-.5008	.1808
Color						
		Mean Difference		Sig.	95% Confidence Interval	
(I) Formula	(J) Formula	(I-J)	Std. Error		Lower Bound	Upper Bound
Formula 3	Formula 5	-.34000*	.14795	.023	-.6324	-.0476
	Formula 6	-.40000*	.14795	.008	-.6924	-.1076
Formula 5	Formula 3	.34000*	.14795	.023	.0476	.6324
	Formula 6	-.06000	.14795	.686	-.3524	.2324
Formula 6	Formula 3	.40000*	.14795	.008	.1076	.6924
	Formula 5	.06000	.14795	.686	-.2324	.3524
Aroma						
		Mean Difference	Std. Error	Sig.	95% Confidence Interval	
(I) Formula	(J) Formula	(I-J)			Lower Bound	Upper Bound
Formula 3	Formula 5	-.26000	.16438	.116	-.5849	.0649
	Formula 6	.32000	.16438	.053	-.0049	.6449
Formula 5	Formula 3	.26000	.16438	.116	-.0649	.5849
	Formula 6	.58000*	.16438	.001	.2551	.9049
Formula 6	Formula 3	-.32000	.16438	.053	-.6449	.0049
	Formula 5	-.58000*	.16438	.001	-.9049	-.2551

*. The mean difference is significant at the 0.05 level.

interpreted that there is no difference between local food products in formula 5 and formula 6 based on color.

The results of the post hoc test of local food products based on aroma in formula 3 with formula 5, and formula 3 with formula 6 have a significance value of > 0.05 so it can be concluded that there is no difference in local food products in formula 3 with formula 5 and formula 3 with formula 6 based on aroma. Local food products in formula 5 and formula 6 have a significance value of < 0.05 so it can be interpreted that there is a difference in local food products in formula 5 and formula 6 based on aroma. Data analysis concluded that there were differences in local food products F3, F5 and F6 from the overall assessment (F calculated as 6.033 with sig = 0.003), color (F calculated as 4.252 with sig = 0.016) and aroma ((F calculated as 6.247 with sig = 0.002)), but there was no difference in terms of texture and taste. If analyzed in more detail, it is concluded that there is a difference in local food products between F3, F5, and F6 related to the overall assessment and color, but there is no difference between F5 and F6 regarding the overall assessment and color.

In the aroma assessment, it was concluded that there was no difference between F3, F5, and F6 local food products, but there was a difference between F5 and F6. Products from F5 and F6 are competing products in terms of overall assessment, color, and aroma. This can be caused by the content of staples or fixed ingredients in the form of sweet potatoes, wheat flour, and tapioca from the three formulas tested, namely F3 (40%, 20%, and 10%), F5 (45%, 20%, and 5%), and F6 (35%, 20%, and 15%). The content of the sweet potato used will affect its crude fiber levels, affecting the speed of the glucose metabolism process in the digestive system. The selected products from the limited environmental test will be continued for large-scale testing in the

second year of this series of research activities, namely in Formula 5 (F5) based on laboratory results from the nutritional content in the form of carbohydrate content, total fat, and total energy content are the lowest (average 47.82%, 21.23%, 397.89) and with the highest dietary fiber content which is an average of 9.64%. In addition, based on the hedonic test with the highest scores on the overall aspect, aroma and taste as well as conclusions from the results of statistical tests. The statistical conclusion states that there is a difference in the overall value (F: 6.033, sig 0.003), values based on color (F 4.252, sig 0.016), values based on aroma (F 6.247, sig 0.002) and values based on taste (F 1.841, sig 0.162). Furthermore, the results of the Post Hoc test concluded that there were differences related to the overall value, color, aroma, and taste of F5 or F6 products with F3, and there was no difference between F5 and F6 products.

The conclusion of the selected formula is also based on the consideration of the results of previous studies that the content of nutrients in processed foods from sweet potatoes (Ipomoea Batatas) has an impact on the Glycemic Index (GI) with a low category, so it is eligible for blood sugar level control. GI is the progression of an increase in blood sugar levels after consuming food equivalent to 50 g of carbohydrates (Wezel et al., 2016). Based on the GI, food ingredients are classified into three categories, namely food ingredients with a low GI of <55, medium GI of 55-70, and high GI of >70 (Taiwo Betty et al., 2016). The effect of lowering blood glucose levels in sweet potatoes is related to an increase in adiponectin, an adiposity hormone that functions in the process of insulin metabolism (Taiwo Betty et al., 2016; Rahati et al., 2014). The carbohydrate content of sweet potatoes has a Low Glycemic Index (LGI 51) value, so Consumption of boiled sweet potatoes can minimize postprandial blood glucose spikes, therefore it can be utilized in the management of type 2 diabetes (Asp et al., 1983). This is due to the formation of AGEs (Dietary advanced glycation end products), which are part of normal metabolism, but if the levels of AGEs are too high it can become a pathogen that will bind to the surface of receptor cells or cross-link with body proteins, altering their structure and function.

The pathological effects of AGEs are related to their ability to increase oxidative stress, which is linked to the epidemic of DM and cardiovascular disease. Sweet potato contains high antioxidants to neutralize the malignancy of free radicals that cause various degenerative diseases such as cancer and heart. Other nutrients that are abundant in sweet potatoes are energy, vitamin C, and vitamin B6 which play an important role in maintaining immunity. The mineral content in sweet potatoes such as phosphorus, calcium, manganese, iron, and fiber is soluble to absorb excess fat in the blood (Handayani, Mardiana, et al., 2021).

CONCLUSION

The food to be developed is a large white sweet potato (Ipomoea Batatas), in the form of a sweet potato pie. The selected products from the limited environmental test will be continued for large-scale testing in the second year of this series of research activities, namely in F5 (45% sweet potato, 20% wheat flour and 5% tapioca flour), based on laboratory results from the nutrient content in the form of the lowest carbohydrate, total fat and total energy content (average 47.82%, 21.23%, 397.89) and with the highest dietary fiber content which is an average of 9.64%. In addition, based on the hedonic test with the highest score in the overall aspect, aroma, and taste as well as the conclusion of the statistical test results.

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Urban-rural Gaps in Early Initiation of Breastfeeding (IEBF) Practices: Evidence from Thailand

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Abstract

Evidence that several factors can play a role as risk factors for breastfeeding initiation. This study aimed to examine the risk factors of early breastfeeding initiation in Thailand which are differentiated by place of residence. This study used secondary data from the Thailand MICS (Multiple Indicators Cluster Survey) in 2022. The total sample lived in an urban area is 1226, and those living in rural areas is 1,430. The analysis of this study has differentiated to urban areas. The statistical test used is STATA. The prevalence of EIBF in urban. The findings of both places of residence revealed that delivery by cesarean section was a risk factor in the urban and rural areas, with AOR 2.5 and 1.93 times, respectively. Another risk factor in an urban is formal marriage, while in a rural area is delivery with a practical nurse and low birth weight. The factors supporting EIBF implementation are the wealth index with AOR 0.48 and 1.46, respectively. Government and stockholders can focus on supporting the financial issues in the households to decrease the probability of not EIBF. Future studies can include more variables at household and community levels and add a qualitative approach.

INTRODUCTION

The World Health Organization (WHO) recommends exclusive breastfeeding for the first 6 months of life, followed by continued breastfeeding with complementary foods until two years (Pérez-Escamilla et al., 2019). The duration of lactation has been widely associated with significant health benefits for both the child and the mother. Longer breastfeeding duration is linked to a reduced risk of obesity, infectious diseases, morbidity, and mortality (North et al., 2022). However, global breastfeeding rates remain suboptimal. From 2015 to 2020, only 44% of infants worldwide were exclusively breastfed, falling short of the WHO global target of 70% by 2030 (World Health Organization, 2021). In the context of Thailand, several supportive initiatives

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have been implemented, such as promoting baby-friendly hospitals, enforcing the Code of Marketing of Breast-milk Substitutes, and introducing maternity leave policies (Topothai & Tangcharoensathien, 2021). Despite these efforts, exclusive breastfeeding rates up to one year remain low. National surveys revealed a breastfeeding rate of 32.4% in 2012, 33.3% in 2015, and a further decline to 24.6% in 2019, indicating that more targeted strategies are needed to reach the national and global targets.

Exclusive breastfeeding is influenced by multiple factors, as demonstrated by various studies. These include maternal knowledge of breastfeeding, workplace conditions such as the length of maternity leave and available support, social support, and the balance between family and work life (Maponya & Matlala, 2022; Purvis et al., 2022). Early initiation of breastfeeding, particularly within the first hour of birth, is crucial for extending the duration of exclusive breastfeeding, highlighting the importance of immediate postpartum care (Dhakal & Thapa, 2021). Moreover, maternal education, marital status, socioeconomic status, and the child age have all been shown to impact exclusive breastfeeding practices (Saputra, 2022). It is also important to consider the impact of psychosocial factors, such as breastfeeding-related self-efficacy, stress levels, and family support, on exclusive breastfeeding practice (Shiraishi et al., 2020). Psychosocial factors, including breastfeeding self-efficacy, stress levels, and family support, are important determinants (Shiraishi et al., 2020). Medical factors, such as the use of oxytocin, vacuum extraction delivery, and low birth weight, further influence breastfeeding initiation (Hirai et al., 2022).

A deeper focus on early breastfeeding initiation reveals additional factors acting as predictors. For instance, in South Asia, socioeconomic status, access to media, and the lack of breastfeeding education programs present significant barriers to timely initiation. Studies have shown that mothers assisted by traditional birth attendants, those delivering via cesarean section, and mothers from disadvantaged ethnic groups were less likely to initiate breastfeeding early (Islam et al., 2024). Cultural factors, such as food taboos in the Dayak tribe, further contribute to reluctance towards early breastfeeding (Suyitno et al., 2023). In rural West Ethiopia, access to health information was identified as vital in promoting early breastfeeding initiation (D. D. Ayalew et al., 2022). Moreover, evidence from Vietnam highlights that the Baby-Friendly Hospital Initiative significantly improved breastfeeding support and early initiation rates (Joyce et al., 2021).

Comparative insights from rural and urban contexts emphasize the need to tailor breastfeeding promotion strategies based on place of residence. In Ethiopia, rural mothers, who often have limited access to information sources, were identified as a key group needing special attention for improving breastfeeding practices. Contrastingly, while pre-lacteal and bottle feeding were more common in urban areas, overall feeding practices were poorer in rural settings (Lokesh et al., 2023). These findings underscore the influence of socioeconomic and cultural factors on breastfeeding behaviors. This study aims to examine the risk factors affecting breastfeeding initiation in Thailand, with a particular focus on how these factors vary by place of residence, providing valuable insights for region-specific interventions.

METHOD

This study used cross-sectional secondary data. The Thailand Multiple Indicator Cluster Survey (MICS) was carried out in 2022 by the National Statistical Office of Thailand (NSO) in collaboration with UNICEF as part of the Global MICS Programme. Technical support was provided by the United Nations Children's Fund (UNICEF), with government funding and financial support from UNICEF. The Global MICS Programme was developed by UNICEF in the 1990s as an international multi-purpose household survey program to support countries in collecting internationally comparable data on a wide range of indicators on the situation of children and women. MICS surveys measure key indicators that allow countries to generate data for use in policies, programs, and national development plans, and to monitor progress towards the Sustainable Development Goals (SDGs) and other internationally agreed-

upon commitments. The original survey MICS Thailand 2022 took time from June to October 2022. The interviewer training was done in two batches. The first batch was from 9 – 17 June 2022, and the second was from 30 June – 8 July 2022. MICS Thailand 2022 has been done in all regions, including Bangkok, Central, North, Northeast, and South. This current study only focuses on the Southern part of Thailand, which takes 12.8% of the total population. The Southern region of Thailand in this study consists of 14 Province: Nakhon Si Thammarat, Krabi, Phangnga, Phuket, Surat Thani, Ranong, Chumpon, Songkhla, Satun, Trang, Phatthalung, Pattani, Yala, and Narathiwat.

The sample frame of this study was carried out from the original survey, which was the 2022 Household Basic Information Survey (HBIS). The total number of households interviewed was 30,008 of the 34,540 sampled (94.7% response rate). The total number of children under five that mothers/caretakers interviewed was 10,502 from eligible 10,638 (98.7% response rate). The urban and rural areas by province were identified as the primary sampling strata, and the sample was selected in two stages. Within each stratum, a specified number of 2022 Household Basic Information Survey enumeration areas (EAs) were selected systematically with Probability Proportional to Size (PPS) at the first stage. After a household listing was carried out within the selected enumeration areas, households with and without children under 5 years were identified. A systematic sample of households was selected separately from each group within the sample EA at the second stage. A total of 1,727 sample EAs and 34,540 households were selected at the national level. As the sample is not self-weighted, sample weights are used for the survey results report.

There were five questionnaires in the original survey MICS Thailand 2022, including household, women (age 15 – 49), men (age 15 – 49), children under five, and children aged 5-14. The questionnaires were based on the MICS6 standard questionnaires.2 From the MICS6 model English version, the questionnaires were customized and translated into Thai and were pre-tested in Pathum Thani province from April 5-7, 2022. Based on the pre-test results, modifications were made to the wording and translation of the questionnaires. The dependent variable in this study was whether children ever breastfeed or not. The definition of this indicator is the percentage of most recent live-born children to women with a live birth in the last 2 years who were ever breastfed. MICS surveys utilize Computer-Assisted Personal Interviewing (CAPI). The data collection application was based on the CSPro (Census and Survey Processing System) software, Version 7.6, including a MICS-dedicated data management platform. Procedures and standard programs3 developed under the global MICS program were adapted to the Thailand MICS 2022 final questionnaires and used throughout. The data were collected by 98 teams. Each was comprised of two to four interviewers and a supervisor. In some areas in which non-Thai households are prevalent, the team also had a translator. Fieldwork began in June 2022 and concluded in October 2022. Data was collected using tablet computers running the Windows 10 operating system, utilizing a Bluetooth application for field operations, enabling the transfer of assignments, and completed questionnaires between supervisor and interviewer tablets.

Data were received at the National Statistical Office's central office via the CSWeb System integrated into the management application on the supervisors' tablets. Whenever logistically possible, synchronization was done daily. The central office communicated application updates to field teams through this system. During data collection and following the completion of fieldwork, data were edited according to the editing process described in detail in the Guidelines for Secondary Editing, a customized version of the standard MICS6 documentation. Data were analyzed using the Statistical Package for Social Sciences (SPSS) software, Version 24. Model syntax and tabulation plan developed by UNICEF were customized and used for this purpose. However, this study used the STAT version 17 software for univariate, bivariate, and multivariate analysis (UNICEF, 2023). Verbal consent was obtained for each respondent participating, and for children aged 15-17 years individually interviewed, adult consent was

Table 1. The General Characteristics of Respondents and Bivariate Analysis of Factors Associated with EIBF

Variables	Urban			Rural		
	EIBF			EIBF		
	Yes (%)	No (%)	p-value	Yes (%)	No (%)	p-value
EIBF	**845 (67.12)**	**414 (32.88)**		**962 (66.21)**	**491 (33.79)**	
Age	Mean = 30.03, Std dev = 6.43		0.946	Mean = 29.86, Std dev = 6.44		0.175
Education level			0.980			0.050
Uneducated	30 (71.43)	12 (28.57)		24 (75.00)	8 (25.00)	
Primary	82 (67.21)	40 (32.79)		116 (64.80)	63 (35.20)	
Lower secondary	180 (66.42)	91 (33.58)		266 (68.03)	125 (31.97)	
Upper secondary	221 (67.38)	107 (32.62)		242 (60.65)	157 (39.25)	
Higher	332 (66.94)	164 (33.06)		314 (69.47)	138 (30.53)	
Times of prenatal care			0.141			0.548
8 times or more	563 (66.08)	289 (33.92)		648 (65.79)	337 (34.21)	
7 times or less	279 (70.28)	118 (29.72)		310 (67.39)	150 (32.61)	
Place of delivery			0.899			0.328
Public hospital	761 (66.93)	376 (33.07)		912 (65.80)	474 (34.20)	
Private hospital	76 (69.09)	34 (30.91)		35 (74.47)	12 (25.53)	
Others	8 (66.67)	4 (33.33)		15 (75.00)	5 (25.00)	
Assistance of delivery			0.486			**0.044**
Medical doctor	76 (72.38)	29 (27.62)		97 (69.78)	42 (30.22)	
Nurse/midwife	534 (66.58)	268 (33.42)		656 (67.63)	314 (32.37)	
Practical nurse	235 (66.76)	117 (33.24)		209 (60.76)	135 (39.24)	
Delivery by caesarean section			**0.000**			**0.000**
No	562 (73.46)	203 (26.54)		668 (70.39)	281 (29.61)	
Yes	283 (57.29)	211 (42.71)		294 (58.33)	210 (41.67)	
Marital status			**0.048**			0.814
Currently married/in union	818 (67.66)	391 (32.34)		913 (66.35)	463 (33.65)	
Formerly married/in union	25 (52.08)	23 (47.92)		48 (64.00)	27 (36.00)	
Never married/in union	2 (100.00)	0 (0.00)		1 (50.00)	1 (50.00)	
Children ever born	Mean = 1.91, Std dev = 1.06		0.888	Mean = 2.01, Std dev = 1.04		0.667
Wealth index			0.108			0.100
First	131 (65.17)	70 (34.83)		215 (62.50)	129 (37.50)	
Second	157 (62.80)	93 (37.20)		208 (65.00)	112 (35.00)	
Middle	193 (66.32)	98 (33.68)		218 (64.50)	120 (35.50)	
Fourth	176 (67.18)	86 (32.82)		196 (71.53)	78 (28.47)	
Richest	188 (73.73)	67 (26.27)		125 (70.62)	52 (29.38)	
Baby has low birth weight			0.113			0.057
No	761 (68.31)	353 (31.69)		869 (67.57)	417 (32.43)	
Yes	76 (61.29)	48 (38.71)		91 (59.87)	61 (40.13)	

obtained in advance of the child's assent. All respondents were informed of the voluntary nature of participation and the confidentiality and anonymity of information. Additionally, respondents were informed of their right to refuse to answer all or particular questions, as well as to stop the interview at any time.

RESULT AND DISCUSSION

Paragraph The result of this study consisted of univariate, bivariate, and multivariate. Table 1 below describes the general characteristics of the informants between urban and rural. It shows that, in urban and rural areas, around 33% and 34%, respectively, women of reproductive age did not practice the early initiation of breastfeeding (EIBF). According to age, the mean women's age in urban and rural was 30 on average. The table below also described the bivariate findings that examined the correlation between each independent and dependent variable. In an urban setting, several variables, including marital status and delivery by cesarean section, correlate with unpracticed IEBF. Additionally, in rural settings, the assistance of delivery and delivery by cesarean section correlated with unpracticed IEBF. However, other independent variables, including age, educational level, times of prenatal care, place of delivery, children ever born (CEB), wealth index, and baby has low birth weight found no correlation to IEBF.

Table 2 below shows the result of binary logistic regression comparing urban and rural setting. In urban settings, marital status, delivered by cesarean section, and wealth index were significantly associated with IEBF. In more detail, women who delivered by cesarean section were 2.54 times more likely to not practice IEBF compared to women who delivery by vaginal, after adjusting to other independent variables. Women who were formerly married/ in a union were 1.89 times more likely to not practice IEBF compared to women who were currently married/in union, after controlling to other independent variables. Compared to

Table 2. The Multivariate Analysis Results of Factors Associated with Initiation of Breastfeeding

Variables	Urban (n=1,226)			Rural (n=1,430)		
	AOR	95% Confidence Interval		AOR	95% Confidence Interval	p-value
Age	0.99	0.97 – 1.01	0.649	0.98	0.97 – 1.01	0.257
Education level						
Uneducated (ref)						
Primary	1.10	0.49 – 2.46	0.814	1.46	0.60 – 3.52	0.403
Lower secondary	1.17	0.55 – 2.49	0.673	1.27	0.54 – 3.01	0.586
Upper secondary	1.19	0.57 – 2.52	0.635	1.89	0.79 – 4.50	0.149
Higher	1.22	0.58 – 2.59	0.600	1.35	0.56 – 3.25	0.504
Times of prenatal care						
8 times or more (ref)						
7 times or less	0.84	0.64 – 1.10	0.206	0.90	0.70 – 1.15	0.398
Place of delivery						
Public hospital (ref)						
Private hospital	0.91	0.57 – 1.44	0.681	0.59	0.29 – 1.18	0.137
Others	1.24	0.36 – 4.28	0.735	0.70	0.25 – 1.99	0.510
Assistance of delivery						
Medical doctor (ref)						
Nurse/midwife	1.21	0.75 – 1.96	0.428	1.25	0.83 – 1.89	0.288
Practical nurse	1.27	0.76 – 2.11	0.362	1.73	1.10 – 2.71	0.016
Delivery by caesarean section						
No (ref)						
Yes	2.54	1.94 – 3.32	0.000	1.93	1.51 – 2.47	0.000
Marital status						
Currently married/in union (ref)						
Formerly married/in union	1.89	1.03 – 3.46	0.039	0.97	0.58 – 1.62	0.922
Never married/in union	N/A			1.72	0.10 – 29.90	0.709
Children ever born	1.03	0.90 – 1.19	0.615	1.03	0.90 – 1.17	0.691
Wealth index						
First (ref)						
Second	0.93	0.62 – 1.40	0.734	0.88	0.63 – 1.23	0.462
Middle	0.79	0.53 – 1.20	0.276	0.87	0.61 – 1.23	0.439
Fourth	0.72	0.47 – 1.21	0.148	0.63	0.42 – 0.93	0.022
Richest	0.48	0.29 – 0.78	0.003	0.65	0.41 – 1.03	0.066
Baby has low birth weight						
No (ref)						
Yes	1.32	0.88 – 1.98	0.179	1.46	1.02 – 2.09	0.036
Pseudo R2						

poorest women, richest women had decrease 52% probability to not practice IEBF after adjusting to other independent variables.

In the rural setting, it shows that assistance of delivery, delivery by cesarean section, wealth index, and low birth weight are significantly associated with unpracticed IEBF. In particular, women assisted by a practical nurse were 1.73 times more likely to not practice IEBF than those assisted by a medical doctor after adjusting to all independent variables. Women who delivered by cesarean section had 1.93 times more likely to not practice IEBF compared to those who delivered by vaginal after adjusting to other independent variables. Compared to the poor, rich women have a 37% lower probability of unpracticed IEBF after controlling for other independent variables. Women who delivered babies with low birth weight were 1.46 times more likely to not practice IEBF compared to women who delivered babies with normal birth weight after adjusting to all independent variables. However, the variables of women's age, education level, times of prenatal care, place of delivery, and number of children ever born were not significantly associated with IEBF practice in urban or rural settings. There are some gaps between urban and rural areas to define the factors associated with IEBF. In rural settings, the factors correlated are more complex than urban settings.

The findings of this study showed the rate of initiation of early breastfeeding in urban areas is higher than in rural. In urban areas, the risk factors found are formerly being married. This finding supports the current study in Ethiopia that found marital status is significantly associated with breastfeeding practice (Muluneh, 2023). Wealth indexes are significantly associated with breastfeeding practice based on research in Ethiopia, Indonesia, and Bangladesh (Kabir & Islam, 2022; Muluneh, 2023; Nurokhmah et al., 2022). In rural areas, the risk factors found are assistance of delivery, wealth index, and infant low birth weight. The risk factors in urban and rural areas are delivery by cesarean section and wealth index. Other risk factors of IEBF in urban areas are being married and a rich household index. Other risk factors of IEBF in rural areas are delivery assistance by practical nurses, fourth wealth index, and low birth weight of the baby. In more detail about delivery by SC, the adjusted odd ratio is higher in urban areas compared to rural areas (2.54 and 1.93 times more likely, respectively).

Existing studies revealed similar findings. Only 50% of newborns in Bangladesh initiated breastfeeding within 1 hour of birth (Raihana et al., 2019). Studies in other developing countries' communities have found pre-lacteal feeding and discarding of colostrum to be common (T. Ayalew & Asmare, 2021). In a study from rural Niger, poverty was found to be negatively associated with early breastfeeding initiation (Goyal, 2019). Descriptive statistics were used to demonstrate the prevalence of early breastfeeding initiation (John et al., 2019). Rates and factors associated with early breastfeeding initiation in rural and urban Nigeria were assessed (Shobo et al., 2020). Closer surveillance of changes in breastfeeding practices alongside appropriate intervention strategies is recommended for emerging economies (Darboe et al., 2023). The practice of breastfeeding among urban respondents was found to be low in a comparative study of mothers in urban and rural communities of Lagos, Southwest Nigeria (Adebayo & Oluwaseyi, 2020).

Cesarean section delivery has been consistently identified as a factor associated with delayed initiation of breastfeeding in various studies. Cesarean section delivery was linked to decreased odds of timely initiation of breastfeeding (Getaneh et al., 2021). Emphasized the importance of establishing practices that enable timely breastfeeding, especially after caesarean sections (Belachew, 2019). Furthermore, the cesarean section was associated with a lower prevalence of early initiation of breastfeeding (Yisma et al., 2019). This negative association between cesarean section and early breastfeeding initiation was also supported by the study in Tanzania and Sub-Saharan Africa (Appiah et al., 2021). Moreover, the impact of cesarean section on breastfeeding initiation has been observed in various settings. Studies in Kuwait and Scandinavia indicated that breastfeeding initiation rates were lower

among mothers delivering by cesarean section compared to those delivering vaginally (Dashti et al., 2010; Lagerberg et al., 2020). Lower breastfeeding initiation and increased difficulties in breastfeeding among women who had caesarean sections could be influenced by physiological factors affecting lactogenesis (Hussain et al., 2022).

Early breastfeeding initiation is a crucial practice associated with improved neonatal and child survival outcomes. In Thailand, similar to many other countries, the rate of early initiation of breastfeeding significantly impacts infant health. Research has indicated that factors such as cesarean section deliveries can present challenges to timely breastfeeding initiation (Shakya & Shakya, 2021). Cesarean section births have been linked to delayed initiation of breastfeeding, potentially affecting breastfeeding establishment and leading to breastfeeding difficulties (Li et al., 2021). Additionally, maternal health service utilization, including delivering at health facilities, has been found to positively influence early initiation of breastfeeding among mothers (Ghimire, 2019).

Early breastfeeding initiation in Asia is a critical aspect of infant health and well-being. Despite the recognized benefits of immediate breastfeeding initiation, rates in South Asia have been reported as low, with variations among countries (Mallick & Shenassa, 2024). Factors influencing early breastfeeding initiation in South Asia include socioeconomic status, access to media, and lack of breastfeeding education programs (Ekholuenetale et al., 2021). Addressing these barriers is crucial to promoting timely breastfeeding initiation.

Studies have highlighted the importance of proper support and guidance from healthcare professionals, especially during cesarean section deliveries, to encourage early breastfeeding initiation (Hobbs et al., 2016). Additionally, socioeconomic inequalities have been observed in early initiation and exclusive breastfeeding practices (Rowe-Murray & Fisher, 2002). Efforts to enhance skin-to-skin contact and breastfeeding practices have been identified as essential in addressing disparities in early breastfeeding initiation (Bartick et al., 2020).

The association between cesarean section deliveries and delayed breastfeeding initiation has been noted in various studies (Erbaydar & Erbaydar, 2020). Women undergoing cesarean sections are at higher risk of late breastfeeding initiation, emphasizing the need for targeted interventions to support breastfeeding after surgical deliveries. Furthermore, factors such as rural residence, educational status, and place of delivery have been identified as predictors of early breastfeeding initiation in Ethiopia (Birhan et al., 2021).

Early initiation of breastfeeding in Southeast Asia is influenced by various factors. Studies have shown that mothers assisted by traditional attendants during childbirth, those delivered by cesarean section, and those from ethnically disadvantaged families were less likely to initiate breastfeeding early (Syam et al., 2021). In rural parts of West Ethiopia, appropriate health information was identified as vital in promoting early initiation of breastfeeding (T. Ayalew & Asmare, 2021). Additionally, research has highlighted the association between early essential newborn care and positive breastfeeding outcomes (Zhao et al., 2020). In Vietnam, the implementation of a Baby-Friendly Hospital Program was linked to improved support for breastfeeding, addressing the low rates of early initiation in the region (Joyce et al., 2021).

The studies cited provide valuable insights into the differences in early breastfeeding initiation between rural and urban areas. The study in the United States highlights that associations observed for rural-urban breastfeeding initiation differ based on maternal race/ethnicity and poverty status (Trinh et al., 2023). Moreover, the study in India identified education as a key determinant of early breastfeeding initiation, with slight variations between rural and urban areas in India (Senanayake et al., 2019). Additionally, one study suggests that rural mothers in Saudi Arabia are more likely to initiate breastfeeding early compared to urban mothers (A. E. Ahmed & Salih, 2019). Another study stresses the importance of targeting interventions for women in rural areas to enhance early breastfeeding initiation (Mbuya et al., 2019). One study found that poverty was negatively

associated with early breastfeeding initiation in rural Niger (Kazmi et al., 2021). Another study reported that in Ethiopia, mothers in urban areas had the highest proportion of early initiation of breastfeeding but the lowest prevalence of exclusive breastfeeding compared to rural areas (K. Y. Ahmed et al., 2019). These findings collectively underscore the influence of factors such as education, poverty, and location on breastfeeding practices.

Insights into the determinants of early initiation of breastfeeding in rural and urban settings can be gained from several studies (A. Ahmed, 2023). The importance of providing special attention to rural mothers due to their limited access to information sources, which may impact breastfeeding practices. These findings suggest a high prevalence of early breastfeeding initiation in both settings. Understanding the factors influencing early initiation of breastfeeding in rural and urban contexts, as discussed in these studies, can provide valuable insights that may be relevant for examining similar patterns in Thailand.

CONCLUSION

The prevalence of early breastfeeding initiation (EIBF) in urban and rural area is 67.12% and 66.21%, respectively. There are some differences in risk factors affecting the EIBF in both urban and rural areas. The risk factors of unpracticed EIBF in urban areas, such as delivery by cesarean section and formally married or currently not married. The probability of EIBF is increasing for those with a rich wealth index in urban areas. The risk factors of not practicing EIBF in rural areas, such as delivery assistance by a practical nurse, delivery by cesarean section, and having low birth weight. The odds of EIBF are increasing for those in the fourth level of the household wealth index. Government and stakeholders can focus on supporting the financial issue in the households to decrease the probability of not EIBF. Future studies can include more variables in households and community levels and add the qualitative approach.

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Health Service Seeking Behavior in Suburban Communities

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Abstract

Health problems in Indonesia today include the low health status of the community, among others, marked by high maternal mortality rates and infant mortality rates. On the other hand, health service is vital in determining health, influenced by geographical, economic, and social aspects. The study aims to analyze the relationship between health service access factors and the determination of family health services in suburban communities in Java and outside Java. The method uses a quantitative approach and is supported by qualitative data. The instrument consists of a questionnaire related to access to health services (geographic access, economic access, social access) and the choice of health services. The population is families in the suburban areas of Semarang and Gorontalo. Samples were taken using the accidental sampling technique, as many as 100 families. The data was analyzed with univariate, bivariate, and multivariate analysis. The study obtained significant differences in health services decision determination between the suburban communities of Semarang (Java) and Gorontalo (Outside Java), with a t-value of 4.284 and a sig value of 0.000. The difference lies in economic access. The health services decision determination in suburban families in Java is more oriented towards choosing medical services such as hospitals and community health centers. In other lands, many families still rely on traditional medicine as health services.

INTRODUCTION

The utilization of health services is a vital factor in determining health, which has particular relevance as a health and community development issue, especially in low-income countries. The current health problem in Indonesia is the low public health status, among others, marked by high maternal mortality rates (MMR) and infant mortality rates (IMR), which are still below the target achievement (Zahtamal et al., 2016; Laksono et al., 2013). Based on the 2007 Basic Health Survey, IMR in Indonesia is still 228 per 100,000 live births. Likewise, IMR is still in the range of 26.9 per 1,000 live births.

The utilization of health services is the use of health service facilities provided either in outpatient care, inpatient care, home visits by health workers, or other forms of activities from the utilization of these health services. Factors that influence the determination of health services by the community are factors from health service providers such as service facilities, service costs, and distance, while factors from the community using health services are education factors, socio-economic status of the community including payment methods (Hermawan et al., 2023). Cultural factors related to habits, community environment, and existing values can also

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determine health care patterns and health services chosen (Handayani et al., 2020; 2021). Independent health payments cause a heavy economic burden for families.

Access to health services is vital in improving physical and mental health and quality of life. Access to health facilities is classified into availability, accessibility, affordability, acceptability, and accommodation, which can be distinguished geographically, economically, and socially. Similar studies have concluded that several barriers to accessing health services include geographic location, travel time, availability of transportation, and access to referrals. Ease of access is often a priority in location considerations where the location convenience is viewed geographically, ease of obtaining other public facilities, and proximity to the community are vital points for ease of access to health services (Nugroho et al., 2023; Rieke Cahya et al., 2023).

According to the Indonesian Ministry of Health (2021), Indonesia has around 3,133 hospitals, with uneven distribution across regions. Most hospitals (around 1,968 or 62.8%) are on the island of Java. There are around 10,134 community health centers (Puskesmas) in Indonesia. But, remote areas such as Papua only have 372 community health centers, compared to Java, which has more than 3,000 community health centers. Additional data from research from Health Policy and Planning (2021) mentioned 53% of residents in rural areas need more than 30 minutes to reach the nearest health facility. In urban areas, this figure drops to only 22%. As many as 60% of rural residents in Indonesia have limited access to specialist services in hospitals, compared to 90% of urban residents with easier access to specialist services.

People in areas with limited resources are vulnerable to health services (Nelson et al., 2020). Social integration related to social support in the form of family ties, environmental communities, and culture can determine the decision to seek health services (Melissa et al., 2022). The choice of health services for the community is vital in determining the health of individuals and the community. Some barriers to accessing health services include geographic location, travel time, availability of transportation facilities, access to referrals, aspects of accurate diagnosis and availability of drugs, and shortage of health workers, where ease of access is often a priority in considering the health services chosen (Yilin et al., 2022; Siqin et al., 2021; Michael et al., 2022; Jean et al., 2020; Desire & Neha, 2021).

The novelty in this study is that it will analyze factors related to determining the search for health services that are typical in Indonesia with a geography that is an archipelagic country with a heterogeneous culture, namely in Java and outside Java. The geographical conditions of Indonesia, which has many regions with diverse characteristics, face its challenges in providing health services. Some public health problems that have not been solved are access problems (Mubasyiroh et al., 2016). Many studies state that the high incidence of AKI and AKB is due to one of the factors being difficult access to health services. Indonesia is also an archipelagic country with a heterogeneous society, so the problem of access to health services is vital to consider to provide quality services to the community, which will determine the decision to choose health services by the community. The purpose of this study is to analyze how the relationship between health service access factors (geographical aspects, economic and social aspects) to the determination of decisions to choose health services for their families in suburban communities in Java and outside Java, which are geographically different.

METHOD

The research was conducted on Java Island (Semarang suburban area) and outside Java Island, namely on Sulawesi Island (in Gorontalo suburban area), considering the geographical location of the region, cultural differences, the same public health problems related to MMR and IMR, and considerations of the possible reach of the Research Team. The activity is a research with a quantitative approach supported by qualitative data. The instrument consists of a questionnaire regarding access to health services (geographic access, economic access, social access) related to health service choices.

The independent variables are geographic, economic, and social access,

and the dependent variable is the choice of health services. Operational definition: 1) Geographical, can be described as the ease of reaching health services measured by distance, travel time, type of transportation, and road infrastructure. 2) Economic access is the ability of the community to allocate their financial capabilities to reaching health services. 3) Social access is related to communication, culture, friendliness, and service satisfaction (Laksono, 2016). The population is families in the Sub-urban Semarang and Sub-urban Gorontalo areas. The number of samples was taken using the accidental sampling technique. Samples were taken from as many as 100 families (50 families from the suburban Semarang area, 50 families from the suburban Gorontalo) who met the requirements, namely 1) residing in the suburban Semarang/Gorontalo area, 2) having been married for at least 5 years, 3) willing to be involved in the study. Data analysis is done by conducting univariate analysis, chi-square test, and t-test.

RESULTS AND DISCUSSIONS

Based on the data obtained in the suburban area of Semarang, the results of the frequency distribution are as follows: 1) in terms of geographic access, the most respondents gave the assessment category of supporting health services as many as 26 people or 56.5%, 2) in terms of economic access, the most respondents gave the assessment category of very supporting health services as many as 28 people or 60.9%, 3) in terms of economic access, the most respondents gave the assessment category of supporting as many as 30 people or 65.2%, 4) the frequency distribution of the habits of the community seeking health services by respondents was mostly medical as many as 44 people or 95.7%, 5) the frequency distribution of the most qualified places of treatment according to the community of respondents was mostly medical treatment as many as 25 people or 54.3%, 6) the frequency distribution of the determination of health service decisions according to respondents was mostly medical treatment as many as 41 people or 89.1%. Based on the data obtained in the suburban area of Semarang, it is concluded that the results of the frequency distribution are as follows: 1) in terms of geographic access, the most respondents gave the assessment category of supporting health services as many as 26 people or 56.5%, 2) the economic access of the respondents gave the most category of assessment that strongly supports health services as many as 28 people or 60.9%, 3) the economic access of the respondents gave the most category of assessment that supports as

Table 1. The Relationship between Geographic Access and Health Service Decision Determination

	Health Service Decision Determination						Sig.
Geographic Access	Medical	Percentage	Traditional Treatment	Percentage	Total	Percentage	
Fairly Support	1	2,20%	0	0,00%	1	2,20%	0,526
Support	22	47,80%	4	8,70%	26	56,50%	
Highly Support	18	39,10%	1	2,20%	19	41,30%	
Total	41	89,10%	5	10,90%	46	100,00%	

Table 2. The Relationship between Economic Access and Health Service Decision Determination

	Health Care Decision Determination						Sig.
Economic Aspect	Medical	Percentage	Traditional Treatment	Percentage	Total	Percentage	
Fairly Support	1	2,20%	1	2,20%	2	4,30%	0,165
Support	14	30,40%	2	4,30%	16	34,80%	
Highly Support	26	56,50%	2	4,30%	28	60,90%	
Total	41	89,10%	5	10,90%	46	100,0%	

Table 3. The Relationship between Social Access and Health Service Decision Determination

	Health Service Decision Determination						Sig.
Social Aspect	Medical	Percentage	Traditional Treatment	Percentage	Total	Percentage	
Not Support	1	2,20%	0	0,00%	1	2,20%	0,343
Fairly Support	2	4,30%	1	2,20%	3	6,50%	
Support	26	56,50%	4	8,70%	30	65,20%	
Highly Support	12	26,10%	0	0,00%	12	26,10%	
Total	41	89,10%	5	10,90%	46	100,00%	

many as 30 people or 65.2%, 4) the frequency distribution of the habits of the community seeking health services of the respondents was mostly medical as many as 44 people or 95.7%, 5) the frequency distribution of the most qualified places of treatment according to the community of respondents was mostly medical treatment as many as 25 people or 54.3%, 6) the frequency distribution of the determination of health service decisions according to respondents was mostly medical treatment as many as 41 people or 89.1%.

The results of cross-tabulation of geographic access with Health Service Decision Determination obtained the most is geographic access in the supportive category and health service decisions choose medical treatment as many as 22 people or 47.8%. The results of the chi square test obtained a sig value of 0.526> 0.05, so it was concluded that there was no significant relationship between geographic access and Health Service Decision Determination in Semarang.

The results of cross-tabulation of economic access with the Determination of Health Service Decisions obtained the most were economic access in the very supportive category, and health service decisions chose medical treatment for as many as 26 people, or 56.5%. The results of the chi-square test obtained a sig value of 0.165> 0.05, so it was concluded that there was no significant relationship between economic access and the Determination of Health Service Decisions in Semarang.

The results of cross-tabulation of social access with Health Service Decision Determination obtained the most is economic access in the very supportive category and health service decisions choose medical treatment for as many as 26 people or 56.5%. The chi-square test obtained a sig value of 0.343> 0.05, so there was no significant relationship between social access and Health Service Decision Determination in Semarang. The results of the frequency distribution show the following: 1) in terms of geographic access, most respondents gave a fairly supportive assessment category of 23 people or 38.3%, 2) economic access, most respondents gave a very supportive assessment category of 33 people or 55.0%, 3) social access, most respondents gave a very supportive assessment category of 36 people or 60.0%, 4) the frequency distribution of the community's habits in seeking health services for respondents was mostly medical, 50 people or 83.3%, 5) the frequency distribution of the most qualified places of treatment according to the community respondents was mostly traditional medicine, 33 people or 55.0%, 6) the frequency distribution of health service decision-making according to respondents was mostly medical treatment, 33 people or 55.0%.

The results of cross-tabulation of geographic access with Health Service Decision Determination obtained the most is geographic access in the fairly supportive category and health service decisions choose medical treatment for as many as 17 people or 28.3%. The results of the chi-square test obtained a sig value of 0.085> 0.05, so it was concluded that there was no significant relationship between geographic access and Health Service Decision Determination in Gorontalo.

The results of cross-tabulation of geographic access with Health Service Decision Determination obtained that economic access is the very supportive category, and health service

Table 4. The Relationship between Geographic Access and Health Service Decision Determination

	Health Service Decision Determination						Sig.
Geographic Aspect	Medical	Percentage	Traditional Treatment	Percentage	Total	Percentage	
Highly Not Support	1	1.70%	0	0.00%	1	1.70%	0,085
Not Support	2	3.30%	1	1.70%	3	5.00%	
Fairly Support	17	28.30%	6	10.00%	23	38.30%	
Support	9	15.00%	11	18.30%	20	33.30%	
Highly Support	4	6.70%	9	15.00%	13	21.70%	
Total	33	55.00%	27	45.00%	60	100.00%	

decisions chose medical treatment for as many as 22 people, or 66.7%. The results of the chi-square test obtained a sig value of 0.009 <0.05, so it is concluded that there is a significant relationship between economic access and Health Service Decision Determination in Gorontalo.

The results of cross-tabulation of social access with Health Service Decision Determination obtained the largest category of social access is very supportive, and health service decisions choose medical treatment for as many as 19 people, or 31.7%. The results of the chi-square test obtained a sig value of 0.871> 0.05, so it was concluded that there was no significant relationship between social access and Health Service Decision Determination in Gorontalo. Based on the test results, the difference in the average answer to health service decisions between Java Island and non-Java Island communities is 0.341, and the t-value is 4.284, with a sig. value of 0.000. The sig. value is 0.000 <0.05. So Ho is rejected, and Ha is accepted, meaning a significant difference in health service decisions between Java Island and non-Java Island communities.

Based on the research results, there was a significant difference in the decision to choose health services between the people of Semarang (Java) and Gorontalo (Outside Java) suburbs, with a t-value of 4.284 and a sig value of 0.000. Statistical calculations in each research area (suburban Java and suburban outside Java) concluded no relationship between access to health services in geographic and social access. In economic access, there was no relationship in the Java suburban area (Semarang), and there was a relationship in the suburban area outside Java (Gorontalo) with the determination of the decision to choose health services by the family.

This research activity in the suburban areas of Java and outside Java with access to health services on geographic access (distance, ease of getting transportation, and available road/infrastructure conditions) and social aspects (community habits in seeking health services, perspectives on the most qualified place to seek treatment, the most satisfying and trusted health service place) has no relationship with the health services decision determination by families. It is because the geographical factor is not a main obstacle or a difficulty that can be overcome because road and transportation access to the outskirts of the

Table 5. The Relationship between Economic Access and Health Service Decision Determination

	Health Service Decision Determination						Sig.
Economic Aspect	Medical	Percentage	Traditional Treatment	Percentage	Total	Percentage	
Fairly Support	6	10.00%	2	3.30%	8	13.30%	0,009
Support	5	8.30%	14	23.30%	19	31.70%	
Highly Support	22	36.70%	11	18.30%	33	55.00%	
Total	33	55.00%	27	45.00%	60	100.00%	

Table 6. The Relationship between Social Access and Health Service Decision Determination

	Health Service Decision Determination						Sig.
Social Aspect	Medical	Percentage	Traditional Treatment	Percentage	Total	Percentage	
Fairly Support	2	3.30%	1	1.70%	3	5.00%	0,871
Support	12	20.00%	9	15.00%	21	35.00%	
Highly Support	19	31.70%	17	28.30%	36	60.00%	
Total	33	55.00%	27	45.00%	60	100.00%	

city (suburban areas) both in Java and outside Java are currently relatively good. Likewise, with social and cultural access, the common habit of the community in seeking treatment is in medical health services that provide health insurance programs from the government (National Health Insurance program) because from several respondent assessments (quality, satisfaction, cost, available information) it is considered quite satisfactory. The results can be said to be in line with research that states no boundaries between supporting and inhibiting factors. Service utilization is facilitated by behavioral factors (awareness, beliefs, and behavior) possessed by individuals (pregnant women), families, communities, and those closest to them in health services for mothers and newborns in Ethiopia (Alemayehu et al., 2021).

The research area, part of Indonesia's geographical conditions with many regions and islands with diverse characteristics, faces its own challenges in providing health services. Within the region, in rural or remote areas, more complicated health service access factors will be obtained. The results of the study stated that the level of accessibility to health services is significantly lower in rural, mountainous, and coastal areas compared to metropolitan areas (Sangwan, 2022; Sangwan et al., 2024). In reality, several unresolved public health problems are access problems (Mubasyiroh, 2016). Many studies have stated that the high incidence of MMR and IMR is due to one of the factors being difficult access to health services. Similar studies have concluded that several barriers to accessing health services include geographic location, travel time, availability of transportation facilities, and referral access (Adane et al., 2022; Yan Li et al., 2023; Liknaw et al, 2021; Preety et al., 2022). Ease of access is often a priority in location considerations where location convenience is seen geographically, ease of obtaining other public facilities, and proximity to the community are important points for ease of access to health services (Rieke et al., 2023; Bandita & Nandita, 2020; Mariam & Yusuke, 2019).

In contrast to previous research results, cultural factors related to habits, community environment, and existing values can also determine healthcare patterns and health services chosen (Handayani et al., 2019). According to several research results, there are several obstacles in accessing health services, including geographic location, travel time, availability of transportation facilities, access to referrals, aspects of diagnostic accuracy and drug availability, shortage of health workers, where ease of access is often a priority in consideration (Yilin et al., 2022; Siqin et al., 2021; Michael et al., 2022; Jean et al., 2020; Desire & Neha, 2021). Other studies related to culture, state that a combination of strategies at various levels of health services is needed to ensure services are accessible, culturally appropriate, acceptable, and affordable (Resham & Yibeltal, 2022; Sara et al., 2020; Cory & Lindsey, 2021; Bryony et al., 2021). According to Vernon M et al, religious norms, sociocultural and matriarchal figures, and gender stereotypes are important influences on the acceptance and utilization of maternal health services, including childbirth in health facilities and contraception (Vermon et al., 2020). So it takes support from health workers related to the cultural competence of certain communities, such as the disabled community, the LGBTQ community, and refugees (Alexandros et al., 2022; Hathairat et al., 2020). The results of this

study are not in line with previous studies. It may be due to different research time conditions. Where nowadays, health services are more widely available through health insurance by the government called JKN (National Health Insurance).

In economic access, we concluded that there was no relationship in the suburban areas of Java (Semarang). But, there was a relationship in the suburban areas outside Java (Gorontalo) with the determination of health service decisions by families. Due to geographical access, the majority stated that it was fairly support (38.3%) from the choice of 5 criteria, namely very unsupportive, unsupportive, quite supportive, supportive, and very supportive. Population density, limited residential areas, and the number of health service facilities, especially private health services, are fewer outside Java than in Java. The conditions affect the transportation cost to seek health services. Although, the government's health insurance policy applies equally in Java and outside Java. Identical with the results of a study in Ethiopia, which provides evidence of the positive impact of community-based health insurance in Ethiopia, namely increasing the use of health services and reducing very large health expenditures (Yibeltal et al., 2023). The results of Dan Li et al's research concluded that the main determinants of inequality in determining the use of health services include marital status and economic status, including the service quality index observed in migrant worker groups in rural China (Dan Li et al., 2022; John et al., 2020).

The study results concluded there are significant differences in the decision to choose health services between the people of Semarang (Java) and Gorontalo (Outside Java). It was due to the difference in the answers of the most respondents in: 1) the habits of people seeking health services: in the Java suburban area (medical 95.7%, traditional medicine 4.3%) outside Java (medical 83.3%, traditional medicine 16.7%), 2) the most qualified place to seek treatment: in the Java suburban area (medical 54.3%, traditional medicine 45.7%) outside Java (medical 45.0%, traditional medicine 55.0%), 3) determining health service decisions: medical in the Java suburban area (medical 89.1%, traditional medicine 10.9%) outside Java (medical 55.0%, traditional medicine 45%), from this data we can conclude that the choice of health services in suburban families in Java is more oriented towards choosing medical services such as hospitals, health centers, family doctors, and doctor's practice clinics. While in areas outside Java Island, there are still quite a lot of families who choose health services in traditional medicine, such as treatment to a shaman and the like. Cultural factors may be still quite influential, including customs and traditional leaders who are followed.

CONCLUSIONS

Based on the research results, there was a significant difference in health services decision determination between the people of Semarang (Java) and Gorontalo (Outside Java) suburbs, with a t-value of 4.284 and a sig value of 0.000. From the results of statistical calculations in each research area (suburban Java and suburban outside Java), we concluded that there was no relationship in access to health services in geographic and social access. While in economic access, we concluded there was no relationship in the Java suburban area (Semarang), and there was a relationship in the outside Java suburban area (Gorontalo) with the determination of the health services decision by families. There was a significant difference in health services decision determination between the Semarang (Java) and Gorontalo (Outside Java) suburban communities. The choice of health services in suburban families in Java is more oriented towards choosing medical services such as hospitals, health centers, family doctors, and doctor's practice clinics. While in areas outside Java, there are still quite a lot of families who choose health services in traditional medicine, such as treatment to a shaman and the like. Cultural factors, in this case, may still be quite influential, including customs and traditional leaders followed.

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