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Supports and Barriers Regarding The Iron-Folic Acid Supplementation Adherence Level in Anemic Pregnant Women: Indonesian's Perspective

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ABSTRACT
Anemia is a worldwide public health issue that affects various groups in low, middle, and high-income nations. Anemia is linked to pregnancy and is influencing poor cognitive and motor development outcomes in children. A recommended intervention to reduce anemia prevalence during pregnancy is the universal administration of Iron-Folic Acid (IFA) supplements. This study investigated supports and barriers regarding iron-folic acid supplementation adherence levels in pregnant women recorded in public health centers in Malang, Indonesia. This research was conducted using qualitative methods with in-depth interviews using semi-structured open-ended questions from July to September 2023. Twenty-five participants from four public health centers was included. The interview guide's content was developed using World Health Organization's framework as well as other pertinent themes. Data analysis was processed from verbal record transcription, generating the codes into the outcomes. Five main themes with a total of eleven subthemes were highlighted from interview process. These themes was further classified into barriers and supports. Side effect, forgetfulness, boredom, laziness, and insufficient understanding of disease recorded as barriers. In contrast, husband and family support, health care team motivation, affordability of access, knowledge and education background included in supports. These findings enlighten the barriers encountered by the pregnant women in IFA supplementation adherence. However, the effectiveness of treating anemia during pregnancy might be influenced by fundamental elements that support IFA supplementation adherence. Therefore, to tackle the this issue, the pregnant women requires a proper therapy and all key points mentioned in support group must be applied.

INTRODUCTION

Anemia is a worldwide public health issue that affects variable groups, such as children under five (especially toddlers under two), women between the ages of 15 to 49, and pregnant women in low- and middle-income nations.[1] One of the Sustainable Development Goals and a Global Nutrition Target set by the World Health Assembly for 2025 is the reduction of anemia cases.[2]

The widespread delivery of Iron and Folic Acid (IFA) to prevent anemia in pregnant women is a highly recommended technique to improve the mother's survival and fetus development.[8] Anemia can bring exhaustion that leads to less productivity, which is further linked to poor conditions during pregnancy and causes poor cognitive and motor development in babies (including low birth weight and prematurity).[3] Thus, in low, middle, and high-income countries, anemia has a substantial impact on human health and the country's social and economic development. Anemia is characterized by a decrease in the blood's concentration of hemoglobin (Hb) and has impacted one-third of the global population[4–6] with more than 800 million recorded as children and women.[7] The Indonesian government has made efforts to prevent and control anemia by recommending the consumption of a minimum of ninety iron supplement pills containing ferrous (Fe) fumarate or Fe sulfate during pregnancy. Fe fumarate is more effective in increasing the amount of hemoglobin (Hb) and has a lower side effect compared to administering Fe sulfate for 30-90 days in anemic pregnant women.[9,10] Fe fumarate is also useful in increasing serum ferritin levels compared to Fe bi-glycinate and iron carbonyl.[11] Apart from that, Fe fumarate is a free supplement provided by the government through the Health Social Security Administering Agency (Indonesian: *Badan Penyelenggara Jaminan Sosial, or BPJS)* and is routinely given to pregnant women at every Community Health Center. Unfortunately, many nations' national IFA supplementation programs have struggled to reach the high coverage and adherence levels required to significantly lower anemia cases.[12]

A mixed-method study conducted in seven countries during 2012-2013 has reported the barriers and enablers in the IFA supplementation programs among pregnant women. The barrier is related to the specific cultural beliefs and practices. Meanwhile, rationale family and community support or reminders from the family are found to be a supportive factor towards adherence level.[13] A study in Yaoundé, Cameroon, concluded that pregnant women were not interested in daily consuming the supplement. Another study reported that pregnant women age 25 years old or older and pregnant women who don't encounter the side effects from IFA supplementation are more likely to adhere to the IFA supplementation program than those who are younger than 25 years old and experiencing the side effects.[14] A study in North Wollo Zone, Ethiopia, reported the low compliance status of pregnant women.[15]

This present study aims to gain a deeper understanding of support and barrier factors in practices of the IFA supplementation program to provide information to the government to help meet the needs of pregnant women and raise the standard of prenatal care in the nation. Therefore, the supplementation program implementation will be better in the future.

MATERIAL AND METHOD

This research was done using qualitative data collection with semi-structured interviews from July to September 2023. Qualitative research was distinguished by its flexibility and was grounded in a different research paradigm than quantitative research.[16] This study was carried out at four primary healthcare services in Malang City, Indonesia, namely at Kedungkandang, Polowijen, Janti, and Mulyorejo regions. This research included a total of 25 participants. The number of participants in this research was determined by theoretical, qualitative research.[17] The inclusion criteria in this research were pregnant women with anemia (Hemoglobin ≤ 11 g/dL) who had received IFA supplementation from primary health care services. A purposive sampling technique was performed in this study to gather information from participants who received the supplementation program from healthcare services to overcome the anemia problem.

The researcher conducted in-depth face-to-face interviews with semi-structured instruments to explore the phenomena directly with the participants. The data regarding

Hemoglobin was collected from a health care laboratory under permission and supervision from midwives and the head of the primary health care services. The interviews were done by two interviewers accompanied by community health center cadres beside the participants. The entire interview was recorded on audio using audio recording and transcribed verbatim. The interview guide, including an interview checklist, was used as the instrument to collect the data. To establish the credibility of the interviewers, the team's seasoned researchers conducted training to guarantee that each investigator had the necessary abilities and knowledge to fulfill their roles. All participants in the study were given information regarding the meaning and the purpose of this study, and before conducting the interview, the participants signed an informed consent form. The participants were also rewarded with compensation for their participation.

The following procedures were used to analyze qualitative data: (1) transcribe the recordings into a narrative; (2) carry out a data reduction procedure, such as picking data and removing terms that aren't needed; (3) generating codes—words or phrases—from the narration's outcomes before categorized them. The interview guide's content was developed using the WHO framework[18] as well as other pertinent themes that surfaced from participant narratives to classify variables affecting long-term therapy adherence into five dimensions.

This study has received ethical clearance approval from The Ethics Committee of the Faculty of Medicine, University of Muhammadiyah Malang, with the code number No.E.5.a/209/KEPKUMM/VII/2023.

RESULTS

All 25 participants have met the inclusion criteria set for this research. Table 1 lists the demographic and gestational characteristics of the study participants. The majority of the total participants were aged 27 to 37 years old (48%), had attended high school (40%), were a housewife (72%), and were in their last trimester of pregnancy (56%).

According to the data analysis result, this study identified four main themes among the perception of the participants, namely: 1) Socioeconomic-related factors; 2) Health care team/health system-related factors; 3) Therapy-related factors; 4) Patient-related factors. For each of the themes, the factors were then classified into two classifications: support and barrier. Table 2 shows the detailed analytical framework of this research.

Figure 1 explains the graphic of Table 2 regarding the classification of support and barrier factors linked with IFA supplementation adherence level. The figure shows subthemes of support and barrier individually and then connected to the IFA supplementation adherence level.

Table 1. Characteristics of Participants Based on Several Parameters

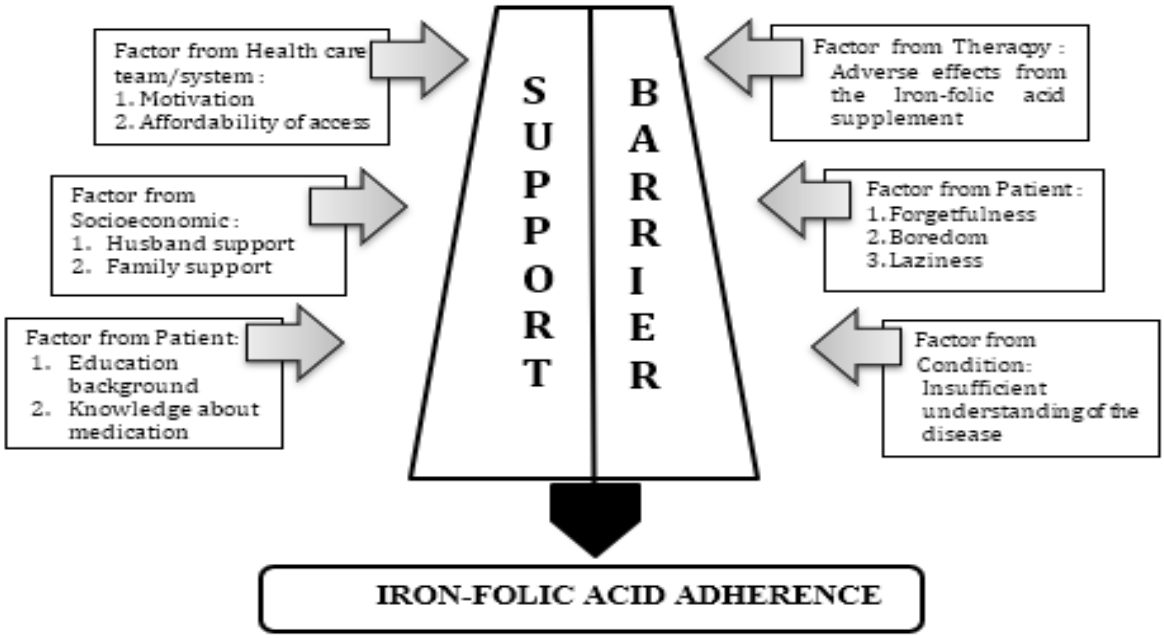
Parameters	n = 25	%
Age (Year)		
16-26	11	44
27-37	12	48
38-48	3	12
Education		
Elementary School	3	12
Junior High School	5	20
Senior High School	10	40
University Education	7	28
Employment status		
Housewife	18	72
Merchant	1	4
Government Employee	1	2
Self-Employed	2	8
Private Employee	3	12
Gestational Week		
First Trimester	3	12
Second Trimester	8	32
Third Trimester	14	56

Source: Primary Data, 2023

Table 2. Analytical Framework

Theme	Classification	Subthemes
Socioeconomic-related factors	Support	1. Husband support 2. Family support
Healthcare team/health system-related factors	Support	1. Motivation from the healthcare team 2. Affordability of access to community healthcare service
Therapy-related factors	Barrier	Adverse effects from the Iron-folic acid supplement
Patient-related factors	Barrier and Support	**Barrier** 1. Forgetfulness 2. Boredom 3. Laziness **Support** 1. Education background 2. Knowledge about medication
Condition-related factors	Barrier	3. Insufficient understanding of the disease

Source: Primary Data, 2023



Source: Primary Data, 2023

Figure 1. Support and Barrier Perspective Framework Related to IFA Supplementation Adherence Level

Theme 1: Socioeconomic-Related Factors

Support: Husband Support

In an effort to ensure that the majority of participants adhere to their iron-folic acid supplement regimen, the husband's role is crucial. Based on the interview's findings, the participants stated that they only had their husbands beside them to support them because some were far from their parents. Husband support is a very fundamental support for anemic mothers.

"Usually, my husband reminds me to take the tablet if it is time to have the supplement" (Participant 1).

"My husband supports me and insists I take the supplement every day because my other families live separately from me." (Participant 6).

"Yes, my husband always reminds me about the tablet because I feel lazy if I remember the taste from the supplement, but he always reminds me to

take it. I have no other families, just me and my husband here." (Participant 7).

Support: Family Support

The results of the in-depth interviews revealed that family support, besides husband support, also motivated them to take the supplement. One way that parents and families can encourage pregnant women is by providing meals. Mostly, the role of the participant's mother and siblings is very important in supporting them directly and indirectly.

"My mom also checks on my supplement, not only remind me to take the tablet. She always checks my supplement is still there or whether it has run out" (Participant 8)

"My sister always reminds me to take the tablet" (Participant 9)

"…Yes, my family also asked me to eat fruits more..." (Participant 12)

"…Every day they (family member) always reminded me whether I have drunk it (Iron-folic acid supplement) or not" (Participant 22)

Theme 2: Healthcare Team/Health System-Related Factors

Support: Motivation from the Healthcare Team

The role played by health workers is to provide information, communication, and motivation to pregnant women about the dangers of anemia, the benefits of iron and food that contain iron, the importance of Antenatal Care (ANC), and the importance of improving health during the pregnancy. In this study, the participants stated that they had always been motivated, monitored, and reminded again about their anemia condition and the importance of IFA supplementation.

"...Every time I visit healthcare services, the midwife always asks about my supplements (Iron-folic acid)" (Participant 1)

"They advise to always take the IFA tablets and do not miss the tablets." (Participant 11)

"Yes, I was advised that I had to keep taking iron-folic acid supplement tablets because my hemoglobin was below normal, 10.8" (Participant 14)

"Yes, remind me to take the supplement tablets" (Participant 16)

"They give support and give input to me." (Participant 23)

Support: Affordability of Access to Community Healthcare Service

Ease of affordability of access to the health center (Indonesian: *Pusat Kesehatan Masyarakat*, or Puskesmas) is always an enabling factor for patients to achieve healthiness and get treatments for their illnesses. The interview reveals that most participants live near Puskesmas and have no worries or obstacles regarding access to healthcare services. This factor was found to be the support factor in achieving affordability of the IFA supplementation program.

"…but it's not so far from my home. I go to the Puskesmas usually by online driver service" (Participant 6)

"I go by myself because it's near; I have no problem about that, it's a convenience to me" (Participant 11)

"I go to ANC check with my husband, he drives me and accompany me there." (Participant 24)

Theme 3: Therapy-Related Factors

Barrier: Adverse effects from the IFA Supplementation

There are adverse effects associated with all medications; IFA supplement tablets are no exception. Based on the responses provided, it was observed that fourteen participants reported nausea symptoms after taking the IFA supplement tablet.

"I feel nausea, but I don't get tired easily" (Participant 5)

"I just feel nauseous" (Participant 8)

"When I take iron-folic acid supplement tablets, it sometimes makes me feel nauseous since the tablet is larger than usual; other times, it stops in the middle, which is uncomfortable to me; nevertheless, if there are other issues, they don't seem to be present" (Participant 13)

"…Yes, I feel nauseous after taking the tablet; however, if I don't drink it, I don't feel nauseous as much" (Participant 9)

Theme 4: Patient-Related Factors

Barrier: Forgetfulness

The most frequent cause from the patient's perspective is forgetting to take supplements because they lose track of time. In this study, the participants stated that they always forget to take the supplement because they overslept due

to work and frequent traveling.

"Yes, I often forget to take the tablets" (Participant 9)

"It only happened 1-2 times... because I left town and didn't bring my medicine because I forgot it" (Participant 10)

"Yes, I forget, but sometimes I switch to foods that I think contain iron, like milk, I switch to real food, not just medicines, I also eat spinach and vegetables" (Participant 12)

"Sometimes I forget for one day and then remember the next day" (Participant 19)

Barrier: Boredom

The response given by pregnant women during interviews regarding their experience of feeling bored when consuming IFA supplements was that they take it every day and they have no other way to reduce the boredom.

"Yes, sometimes I get bored because I have to drink it every day…" (Participant 11)

"If you're bored, of course you'll get bored every day, taking medicine every day..." (Participant 15)

Barrier: Laziness

According to the responses provided, fourteen participants claimed to feel lazy, and the other participants supported this claim. This occurs because pregnant women who take IFA supplement tablets may feel lethargic as a result of its side effects.

"…I feel lazy to take the tablets because the taste is not good" (Participant 8)

"…incredibly lazy when it comes to taking the medications" (Participant 23)

Support: Education Background

The level of education is related to compliance with the use of IFA supplement tablets in pregnant women. Education can increase awareness of pregnant women in taking the supplement tablets. Education influences a person's logical thinking process. For the answers obtained, all twenty-five participants answered that education had an influence on compliance with supplement use. Based on the participant's answers in this study, there are supporting factors influencing the IFA supplementation adherence level in the education category.

"A good educational background for pregnant women is very important..." (Participant 10)

"Yes, nowadays, because the times are advanced, we don't have to see a doctor face to face so that we can get it now. This is all self-awareness, how important it is for us to understand our own condition, and like health workers, they only help; it is their responsibility, right? To ourselves, what do we know about iron-folic acid tablets? Especially if we have education, we should know more about how important taking the tablets is" (Participant 12)

"Yes, that's what's really important for Indonesia, right now, stunting is happening. I think practitioners and health workers are doing a lot of this to provide education, especially for pregnant women and those who are planning to get pregnant. Again, education levels in Indonesia are also very varied. There are so many different levels of education, so yes, we must catch up" (Participant 19)

Support: Knowledge of Disease and Medication

Pregnant women's knowledge impacts the anemia treatment procedure when it comes to utilizing IFA supplement tablets. Based on the participants' answers in this study, there are supporting factors for IFA supplementation adherence level in terms of knowledge, especially regarding the disease and the benefits of using IFA.

"In my opinion, it's definitely important because it's a necessity too" (Participant 16)

"…crucial information, from ignorance to comprehension at first" (Participant 21)

"It's very important that the baby is healthy too" (Participant 24)

"Family members are aware of the importance of knowledge" (Participant 25)

Theme 5: Condition-Related Factors

Barrier: Insufficient Understanding of the Disease

Principally, patients' lack of knowledge regarding their conditions affects their medicine intake. When asked about their conditions, most patients stated that they had no idea about their condition.

"Well, if that's very important, yes, many of them don't know about this disease. I don't know why I was told to drink Iron-folic acid, that's why health workers need to have access to this" (Participant 19)

"Yes, actually, it's very important. Maybe if we don't know the facts, we can ignore it I found out about it (anemia) from my friend, to asked me to check my hemoglobin in laboratory because I immediately checked at the hospital, and the doctor didn't get

me any advice, maybe because so far my symptoms have been non-existent" (Participant 13)

DISCUSSION

The study aimed to determine the barriers and support factors to IFA supplementation adherence levels according to the WHO's five dimensions. Based on the five dimensions of adherence level, we found socioeconomic factors, healthcare team/health system-related factors, therapy-related, patient-related, and condition-related factors dimensions to be barriers and support aspects affecting adherence. This study has highlighted the complex factors of administering IFA supplements in a community. In this study, the identified support to IFA supplementation adherence level was husband support, family support, motivation from the healthcare team, affordability of access to community healthcare service, educational background, and knowledge about medication. The barriers to IFA supplementation adherence level were adverse effects of the supplement, forgetfulness, boredom, laziness, and insufficient understanding of the disease that may occur due to anemia condition.

According to Ramayanti & Sulistyoningtyas, family support is a condition that influences health improvement through prevention and treatment obtained from people who are trusted, especially in the role of the husband, which makes a pregnant woman feel that other people care for and love her.[19] So far, participants have received support from their families in using IFA tablets. The most influential family support is from the husband. Family support influences pregnant women's adherence to consuming IFA tablets. Based on qualitative research conducted in Johannesburg, South Africa,[22] family support facilitates multiple micronutrient supplementation. This shows that the family is important in pregnant women's compliance with IFA supplementation. If the family's role is good in helping maintain the health of pregnant women, it will make them agree to consume IFA tablets. Family support was a significant enabler overall: as family members learned about the supplements' aim, they were supportive and crucial in reminding women to take their IFA supplements.[20] Numerous other research studies have emphasized how crucial family support is to promote supplement adherence.

Good health services influence pregnant women to take IFA supplementation. If the behavior of health workers is positive, it will result in good health services. Research by Namchar Kautsar shows a relationship between the role of health workers and the adherence level with IFA supplementation. According to Yanti et al., the role of health workers can influence pregnant women's adherence to the use of IFA supplementation. The role played by health workers is to provide information, communication, and motivation to pregnant women about the dangers of anemia, the benefits of iron and food factors that contain iron, the importance of ANC, and the importance of improving health.[21] Health workers play a role in every visit to pregnant women, such as educating pregnant women about health and providing information that must be recommended to patients. The majority of participants stated that they had good communication with their medical team and easy access to the primary health care center. The healthcare team's information and assistance were seen as encouraging and beneficial.[22] Despite the common belief that patients are to blame for non-adherence rather than healthcare providers, research shows that aspects of the healthcare system significantly impact the adherence level. Patients' adherence to treatment plans may be lowered by inadequate follow-up, poor provider-patient relationships, inadequate drug supply, ambiguous information regarding drug administration, and poor follow-up.[20]

When using Iron-folic acid tablets, the knowledge possessed by pregnant women influences the anemia treatment process itself. Based on research by Lutfita, there is a relationship between the level of knowledge and compliance of anemic pregnant women in taking IFA supplementation.[23] In contrast, with lower knowledge about anemia, pregnant women with better knowledge were more likely to adhere to IFA supplementation. Similar findings have also been reported previously elsewhere.[24,25] A woman with knowledge of anemia may likely be able to comprehend the condition's causes, pre-

ventative strategies, and potentially harmful effects on both the mother and her unborn child. Pregnant women with good knowledge indicate that they know the importance of IFA tablets for pregnancy and maintaining normal HB levels. The level of education is related to the adherence to the use of IFA supplementations in pregnant women. Education can increase pregnant women's awareness of the use of IFA supplementations. Education influences a person's logical thinking process. According to Sasono[26], the level of education can influence a person's level of knowledge; namely, the higher the level of education, the easier it will be for someone to receive information. The level of education underlies the attitude of pregnant women in accepting health information. Based on research by Yanti et al.[27] There is a relationship between education level and adherence to the IFA supplementation. The higher a person's level of education makes a person have the ability to understand input and information from health workers better.

Barrier factors such as side effects, forgetfulness, and boredom were found in this study. Based on research conducted by Bakhtiar et al, the most common side effect is nausea. The most common side effects experienced by pregnant women are discomfort in the pit of the stomach or above the navel, nausea, vomiting, and blackish stools.[28] Based on research conducted by Maryam, the reason for not liking taking IFA supplement tablets is boredom. The response given by pregnant women during interviews regarding their experience of feeling bored when consuming the IFA supplement was that they drank it every day, and they had no other way to reduce the boredom.[29] Another common cause is forgetting to take medication because pregnant women lose track of time, such as frequently falling asleep due to extensive work and frequent travel. Similar reasons for non-adherence have also been reported among pregnant women in India and Kenya.[30,25] Incorporating instruction on IFA supplementation-related adverse effects management within ANC counseling is imperative for healthcare practitioners.[33-35]

There has been evidence that certain behaviors, such as taking IFA tablets right before bed or with meals while consuming an abundance of fruits and vegetables, can lessen the side effects of IFA.[31] Encouraging women to utilize modern technology to remind them to take their supplements or at specified times, including after meals, every morning, or before bed, could help prevent forgetfulness among iron-folic acid users.

Meanwhile, an insufficient understanding of the disease is a condition-related factor that affects participants' IFA supplementation adherence level. One key contributing element to bad health is ignorance. In addition to causing individuals—especially the impoverished—to waste scarce resources on unnecessary care, it also causes people to put off obtaining care when necessary, even without financial impediments.[32]

The strength of this study was that it focused on interviewing 25 pregnant women diagnosed with anemia in depth to determine barriers and support factors for IFA supplementation adherence in the community setting from a primary healthcare center. The limitation of this study was that it focused only on the perspectives of the patients. Future studies should include perspectives from healthcare practitioners, especially from the side of pharmacists and midwives. As the participants were only 25, the findings of this study could not be generalizable to the population.

CONCLUSION AND RECOMMENDATION

These findings shed light on the barriers encountered by pregnant women in iron-folic acid adherence, such as forgetfulness, boredom, and laziness. However, the effectiveness of treating anemia during pregnancy might be influenced by fundamental elements that support the adherence level, such as family support, husband support, and knowledge regarding the disease and the medication. Thus, to tackle the anemia cases and provide pregnant women with the optimal therapy, all relevant parties mentioned in this study must collaborate. The implication of this research is the need for advanced counseling by the health provider to direct the right practice of the patients.

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AUTHOR CONTRIBUTIONS

Conceived and designed the qualitative study by RNA; A contributed designed the instrument and interview guide; DA performed the collection data process; LYS analyzed the data; AAP performed final data analytic including tables and graphic; SU contributed final check for the manuscript. The authors read and approved the final manuscript. RNA = Rizka Novia Atmadani; A = Akrom, DA = Dhea Ananda; LYS = Laila Yoga Saputri; AAP = Alvina Arum Puspitasari; SU = Siti Urbayatun.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. WHO. Global Nutrition Targets 2025: Anaemia Policy Brief. Geneva, Switzerland: World Health Organization 2022. https://apps.who.int/iris/handle/10665/148556
2. WHO. Global Anemia Reduction Efforts among Women of Reproductive Age: Impact, Achievement of Targets, and the Way Forward for Optimizing Efforts. Geneva, Switzerland: World Health Organization. 2020. https:%0A//www.who.int/publications/i/item/9789240012202
3. Balarajan Y, Ramakrishnan U, Ozaltin E, Shankar AH, Subramanian S V. Anaemia in Low-Income and Middle-Income Countries. *Lancet (London, England)*. 2011;378(9809): 2123–2135. https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(10)62304-5/abstract
4. Kassebaum NJ, Collaborators GBD 2013 A. The Global Burden of Anemia. *Hematology/Oncology Clinics of North America*. 2016;30(2):247–308. https://observatorio.fm.usp.br/handle/OPI/26259
5. Khani Jeihooni A, Rakhshani T, Harsini PA, Layeghiasl M. Effect of Educational Program Based on Theory of Planned Behavior on Promoting Nutritional Behaviors Preventing Anemia in A Sample of Iranian Pregnant Women. *BMC Public Health.* 2021;21:1–9. https://link.springer.com/article/10.1186/s12889-021-12270-x
6. Kapil U, Kapil R, Gupta A. Prevention and Control of Anemia Amongst Children and Adolescents: Theory and Practice in India. *Indian Journal of Pediatrics*. 2019;86:523–531. https://link.springer.com/article/10.1007/s12098-019-02932-5
7. Birhanu TM, Birarra MK, Mekonnen FA. Compliance To Iron and Folic Acid Supplementation in Pregnancy, Northwest Ethiopia. *BMC Research Notes* 2018;11:1–5. https://link.springer.com/article/10.1186/s13104-018-3433-3
8. Abd Rahman R, Idris IB, Md Isa Z, Abd Rahman R. The Effectiveness of A Theory-Based Intervention Program For Pregnant Women With Anemia: A Randomized Control Trial. *PLoS One*. 2022;17(12). https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0278192
9. Kusumawardani N, Darmawan E, Suprapti S, Dwinta E, Estiningsih D. Pharmacist Counselling Can Change Adherence to Iron Supplementation and Physical Activity Lifestyle of Anaemic Pregnant Women in Yogyakarta. In: *2nd International Conference on Contemporary Science and Clinical Pharmacy 2021 (ICCSCP 2021)*. Atlantis Press; 2021:157–170.
10. Atmadani RN, Irham LM, Perwitasari DA, Akrom A, Urbayatun S. Adherence to Iron Supplementation Among Anemic Pregnant Women During 1964-2022: A Bibliometric Analysis. *Public Health of Indonesia*. 2023;9(1):1–12. https://doi.org/10.36685/phi.v9i1.647
11. Dalal M, Goyal R, Nanda S, Dahiya P, Dahiya K, Madan S. Oral Versus Intravenous Iron for Treatment of Iron Deficiency Anaemia in Pregnancy: A Randomized Controlled Trial. *Indian Journal of Public Health Research & Development*. 2018;9(6):1–6. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85048969659&doi=10.5958%2F0976-

5506.2018.00513.2&partnerID=40&md5=db500b49f7e03e339b286d8a6b2486a3

12. Smitha MV, Indumathi P, Parichha S, Kullu S, Roy S, Gurjar S, et al. Compliance with Iron-Folic Acid Supplementation, Associated Factors, and Barriers Among Postpartum Women in Eastern India. *Human Nutrition & Metabolism*. 2024;35:200237. https://www.sciencedirect.com/science/article/pii/S2666149723000543
13. Siekmans K, Roche M, Kung'u JK, Desrochers RE, De-Regil LM. Barriers and Enablers For Iron Folic Acid (IFA) Supplementation in Pregnant Women. *Maternal & Child Nutrition*. 2018;14:e12532. https://onlinelibrary.wiley.com/doi/full/10.1111/mcn.12532
14. Fouelifack FY, Sama JD, Sone CE. Assessment of Adherence to Iron Supplementation among Pregnant Women in the Yaounde Gynaeco-Obstetric and Paediatric Hospital. *The Pan African Medical Journal.* 2019;34. https://www.ajol.info/index.php/pamj/article/view/212238
15. Demis A, Geda B, Alemayehu T, Abebe H. Iron and Folic Acid Supplementation Adherence Among Pregnant Women Attending Antenatal Care in North Wollo Zone Northern Ethiopia: Institution Based Cross-Sectional Study. *BMC Research Notes*. 2019;12(1):1–7. https://link.springer.com/article/10.1186/s13104-019-4142-2
16. Busetto L, Wick W, Gumbinger C. How To Use and Assess Qualitative Research Methods. *Neurological Research and Practice*. 2020;2:1–10. https://link.springer.com/article/10.1186/s42466-020-00059-z
17. Wahyuni S. *Qualitative Research Method: Theory and Practice*. Third. Jakarta: Salemba Empat; 2019. 278
18. WHO. Adherence to long-term therapies: evidence for action: 2003. Geneva, Switzerland: World Health Organization.
19. Ramayanti E, Sulistyoningtyas S. The Factors Affecting the Behavior of Pregnant Women in Conducting Triple Elimination Examinations During the Pandemic at Nani Rusnani Maternity Clinic. *Menara Journal of Health Science.* 2022;1(4):324–336. https://doi:10.35335/midwifery.v10i5.93
20. Molla T, Guadu T, Muhammad EA, Hunegnaw MT. Factors Associated with Adherence to Iron Folate Supplementation Among Pregnant Women in West Dembia District, Northwest Ethiopia: A Cross Sectional Study. *BMC Research Notes*. 2019;12(1):1–6. https://bmcresnotes.biomedcentral.com/articles/10.1186/s13104-019-4045-2
21. Turawa E, Awotiwon O, Dhansay MA, Cois A, Labadarios D, Bradshaw D, et al. Prevalence of Anaemia, Iron Deficiency, and Iron Deficiency Anaemia in Women of Reproductive Age and Children Under 5 Years of Age In South Africa (1997–2021): A Systematic Review. *International Journal of Environmental Research and Public Health*. 2021;18(23):12799. https://www.mdpi.com/1660-4601/18/23/12799
22. Silubonde TM, Draper CE, Baumgartner J, Ware LJ, Smuts CM, Norris SA. Barriers and Facilitators of Micronutrient Supplementation Among Non-Pregnant Women of Reproductive Age in Johannesburg, South Africa. *PLOS Global Public Health*. 2022;2(11). https://journals.plos.org/globalpublichealth/article?id=10.1371/journal.pgph.0001310
23. Lutfita SM, Pratiwi PY. The Relationship Between Knowledge with Compliance of Fe Tablet Consumption in Third Trimester Pregnant Women at The Jambukulon Public Health Center. *Medical Journal of Nusantara* 2023;2(1):32–37. https://doi.org/10.55080/mjn.v2i1.126
24. Desta M, Kassie B, Chanie H, Mulugeta H, Yirga T, Temesgen H, et al. Adherence of Iron and Folic Acid Supplementation and Determinants among Pregnant Women in Ethiopia: A Systematic Review and Meta-Analysis. *Reproductive Health*. 2019;16(1). https://reproductive-health-journal.biomedcentral.com/articles/10.1186/s12978-019-0848-9
25. Bahati F, Kairu-Wanyoike S, Nzioki JM.

Adherence to Iron and Folic Acid Supplementation During Pregnancy among Postnatal Mothers Seeking Maternal and Child Healthcare at Kakamega Level 5 Hospital in Kenya: A Cross-Sectional Study. *Wellcome Open Research*. 2021;6. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8366300/

26. Sasono HA, Husna I, Zulfian Z, Mulyani W. Relationship of Education Level and Anemia Events in Pregnant Women in Some Regions of Indonesia. *Jurnal Medika Malahayati.* 2021;5(1):59–66. https://doi.org/10.33024/jmm.v5i1.3891
27. Yanti LM, Mahardita MU, Hidayati L, Firmansyah F, Warajati S, Isnaeni I. Hubungan Tingkat Pendidikan, Pengetahuan Tentang Anemia, Dukungan Keluarga dengan Kepatuhan Ibu Hamil Minum TTD. In: *Prosiding University Research Colloquium*. 2023. 974–982. http://repository.urecol.org/index.php/proceeding/article/view/2527
28. Bakhtiar R, Muladi Y, Tamaya A, Utari A, Yuliana R, Ariyanti W. Hubungan Pengetahuan dan Kepatuhan Ibu Hamil Anemia dalam Mengkonsumsi Tablet Tambah Darah di Wilayah Kerja Puskesmas Lempake Kota Samarinda. *Jurnal Kedokteran Mulawarman*. 2021;8(3):78–88. https://e-journals.unmul.ac.id/index.php/JKM/article/view/6514
29. Maryam S. Analisis Riwayat Tablet Tambah Darah pada Ibu Hamil dengan Anemia di Indonesia (Data Riskesdas 2018). *Kebidanan*. 2020;10(2):1–8. https://journal.unita.ac.id/index.php/bidan/article/view/404
30. Lavanya P, Jayalakshmy R, Rajaa S, Mahalakshmy T. Adherence to Iron and Folic Acid Supplementation among Antenatal Mothers Attending a Tertiary Care Center, Puducherry: A Mixed-Methods Study. *J Fam Med Prim CARE*. 2020;9(10):5205–5211. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7773120/
31. Kamau MW, Mirie W, Kimani S. Compliance with Iron and Folic Acid Supplementation (IFAS) and Associated Factors Among Pregnant Women: Results from A Cross-Sectional Study in Kiambu County, Kenya. *BMC Public Health*. 2018;18. https://link.springer.com/article/10.1186/s12889-018-5437-2
32. Claeson M, Folger P. *Health Issues of the UN Millennium Development Goals*. In: Heggenhougen HK (Kris) BT-IE of PH, editor. Oxford: Academic Press; 2008. 197–204.
33. Solomon Y, Sema A, Menberu T. Adherence and Associated Factors to Iron and Folic Acid Supplementation Among Pregnant Women Attending Antenatal Care in Public Hospitals of Dire Dawa, Eastern Ethiopia. European *Journal of Midwifery*. 2021;5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8386124/
34. Gebremariam AD, Tiruneh SA, Abate BA, Engidaw MT, Asnakew DT. Adherence to Iron with Folic Acid Supplementation And its Associated Factors among Pregnant Women Attending Antenatal Care Follow Up at Debre Tabor General Hospital, Ethiopia, 2017. *PLoS One*. 2019;14(1). https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0210086
35. Agegnehu G, Atenafu A, Dagne H, Dagnew B. Adherence to Iron and Folic Acid Supplement and Its Associated Factors among Antenatal Care Attendant Mothers in Lay Armachiho Health Centers, Northwest, Ethiopia, 2017. Nottola SA, editor. *International Journal of Reproductive Medicine*. 2019;2019:5863737. https://www.hindawi.com/journals/ijrmed/2019/5863737/

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Problems Scanning Related to Stunting Using Iceberg Theory Model in Salakbrojo Village Central Java

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ABSTRACT
The prevalence of stunting to date is 21,6%, which is far from target which is 14%. Research aimed to elaborate on problem of stunting using iceberg method model analysis. The research is a qualitative study with a phenomenological approach to obtain idea of stunting occurrence pattern as well as the root of problem. Data was collected by assigning focused group discussion. Correspondents were ten mothers of toddlers, five health cadres, a secretary of rural, and a rural midwife. Validity test was done by doing data source triangulation during focused group discussions. Mental model analysis was taken using directly elicited mental model technique by doing content analysis. Result of iceberg analysis found that occurrence of stunting was 3,42%. Patterns and trends include wasting 2,92%, normal nutrition 84,39%, risk of overnutrition 5,85%, overnutrition 1,95%, and obesity 1,46%. Systemic structure has shown there are relation between direct cause include lack of food intake, exclusive breastfeeding, complementary food, infectious diseases and incomplete basic immunization. Indirect causes for stunting include lack of knowledge of stunting, access of health services, house condition triggers infectious diseases and poor sanitation. The mothers' analysis on mentality who are confident about their children being healthy and active despite nutritional problems. Mental model of health cadres, rural midwives, rural government and public health centers believe that collaboration in solving stunting problems is needed. It can be concluded that iceberg model can be applied in analyzing stunting problem and results of it can be considered in the implementation of stunting treatment.

INTRODUCTION

The prevalence of stunting to date is still high which is 21,6% and it is far from the target expected by the government which is 14%. The number indicates that two out of ten children are experiencing stunting.[1] This condition fails children's growth due to chronic malnutrition. Besides malnutrition during the first 1000 days of life, lack of primary health service access also becomes the causal factor of stunting. This problem of growth is irreversible and can hamper the development of children's intelligence and learning capacity to reach their maximum potential. Stunting also has been a factor of health disorder risks due to several chronic illnesses such as diabetes mellitus and heart disease.[2] Based on Mustafa et al (2015), a child who is suffering from stunting tends to have lower intelligence, a higher risk of getting obese, and is prone to various degenerative diseases.

Stunting which is possessed by children in the age of 9-24 months, if continuing, can lead to psychological development disruption which might appear at the age of 17. The symptoms which appear in teenagers who have stunting such as anxiety disorder, depression, and low self-esteem.[3] In line with a South Asian study by Saif and Anwar (2023), malnutrition is a hidden iceberg phenomenon in child anthropometric failure. The research using the ECIAF (a composite index of anthropometric failure) model, this study looks at the variety of malnutrition in South Asia throughout some periods.[4]

The efforts in decreasing stunting numbers have shown a positive trend, at the national level, it was 24,4% in 2021. This means that the number of stunting needs to be decreased by as much as 3,8% every year to reach that goal in 2024. Based on data from the Nutritional Status Survey of Indonesia *(Survei Status Gizi Indonesia or SSGI)* in 2022, the decreasing number of stunting in Central Java was insignificant which was 0,1% from 20,9% in 2021, so it became 20,8% in 2022. Pekalongan Regency's stunting rate is 23.1% higher than Central Java its 20.1%. Based on the group age, the stunting number in children aged 24-35 months was 25,29%, which was the highest among the other age groups.[5]

Based on the national acceleration scheme, there are 12 provinces selected as guided regions from the program. In the 2023 first semester, only two out of nine specific intervention indicators reached the target, that was pregnant women had iron supplements at least 9 tablets throughout the pregnancy period and children in the age of 6-23 months had weaning food.[6] These facts have shown a more comprehensive effort and strategy to reach the set target. Therefore, it is deemed necessary to investigate more deeply and comprehensively stunting problems that are related to intervention aspects, target indicators, and determinants.

Referring to data from Pekalongan District Health Service for 2022, the stunting rate in Salakbrojo Village is 12 cases and is quite high compared to other areas. Results of the initial study in Salakbrojo Village showed that problems of stunting were related to the mother's parenting in providing nutrition. Babies aged ≤6 months are generally given formula milk, honey and other additional foods. Babies aged ≥6 months do not receive adequate nutritional intake because mothers are not competent in serving a varied menu according to the child's needs. Menu variations are very necessary to meet nutritional needs, especially for children who have difficulty eating and are picky eaters. Apart from nutritional adequacy factors, stunting is a multidimensional problem. It takes a framework iceberg thinking approach to visualize stunting problem in three descriptions: problems that are above surface of sea, problems which is below surface line of seawater and issues that are at bottom of sea.[7] The iceberg model includes event variables, event patterns, problem structure that causes stunting and a mental model that is the root of problems.

MATERIAL AND METHOD

This study is a qualitative-quantitative study with a phenomenological approach to obtaining an overview of stunting patterns and the roots of the problem.[8,9] The analysis of problems and roots in stages using the iceberg theory model (iceberg theory). The data was collected through a focused group discussion in Salakbrojo Village Hall in August 2023. Correspondents selected in the focused group discussion included 10 mothers who have under five kids which were selected by using predetermined criteria. Namely, mothers who have children who are

indicated to be stunted, mothers who have children with wasting nutritional status mothers who have children with under nutritional status mothers who have children with normal nutritional status mothers who have children with overweight/obese. Each criterion consists of two informants. Other informants consist of 5 health cadres, 1 secretary, and 1 rural midwife.[9] Total number of informants was 17.

The aspects that were deeply delved into in the focus group discussion are nutrition issues, tendency patterns, causal factors, root problems, and strategic interventions that have been carried out in the decline of stunting in the village of Salakbrojo. Validity and reliability testing using source triangulation techniques was carried out directly in the focus group discussion. Source triangulation to obtain data from various sources in a single method of data collection namely focus group discussion so that data is complete from various perspectives.[10,11]

Iceberg theory approach is used to scan problems based on the structure of the iceberg. The part where the tip is above sea level is a visible problem; part that is below the sea surface is an invisible problem. The phenomena seen above the surface of the sea surface are only symptoms of problems that arise and are perceived by society. The phenomenon below the surface size and depth of the problem is much more massive than the symptoms seen.[12]

According to iceberg theory, the scanning phase of a problem consists of events that are related to context of problem. The second stage is patterns and trends, that is, patterns of trend That are formed about problem context and indicate the existence of factors that play a role as cause and effect. Scanning problems at this stage unravel the root problems associated with stunting. The fourth stage is the mental model (Figure 1), which is the study of beliefs and assumptions that form problems and problem-solving.[13] The mental model analysis uses the technique of direct-elicited mental models with a content analysis approach. Data analysis is done descriptively using open qualitative data obtained from focused group discussions.[14] This research has received ethical approval by the Health Research Ethics Committee of the Faculty of Health University of Pekalongan which is recorded in the ethical clearance numbered 166/B.02.01/KEPK/VII/2023.

RESULTS

The results were presented following the structure of the iceberg: scanning events, scanning patterns and trends, scanning systemic structure, and scanning mental models.

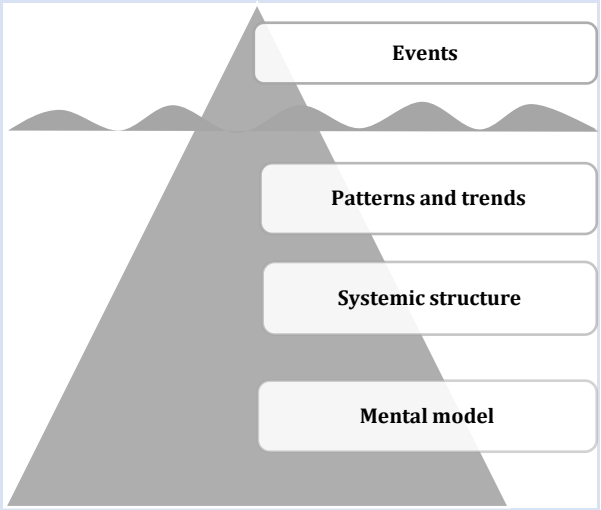
Analysis Avents

Events obtained include stunting data and other data such as exclusive breastfeeding, complete basic immunization, weaning food giving (MPASI), sanitation, infectious diseases, food intake, access to health services, as well as the knowledge of mothers-in-law against stunting. Table 1 shows the results of scanning against the stunting event:

Table 1. Stunting Events Based on Toddlers' Nutritional Status

Characteristics	n = 205	%
Exclusive Breastfeeding		
Given exclusive breastfeeding	132	84.39
Not given exclusive breastfeeding	73	15.61
Food Intake		
Carbohydrate	49	24
Plant-based protein	31	15
Animal-based protein	37	18
Vegetables	27	13
Fruits	39	19
Fat and milk	22	11
Basic Immunization		
Complete	185	90.25
Incomplete	20	9.75
Weaning Food		
≥ 6 months	153	74.63
≤ 6 months	52	25.37
Environment Sanitation		
Toilet Availability		
Have toilet	199	97.70
Do not have a toilet	6	2.30
Drink Water Sources		
Dug well	152	74.14
Boreholes	41	20
PDAM (Regional Corporation of Drink Water)	12	5.86
Knowledge about Stunting		
Sufficient	133	65
Insufficient	72	35
Infectious Diseases		
Suffering from it	6	2.93
Not suffering from it	199	97.07

Source: Primary Data, 2023



Source: Monat & Gannon, 2023

Figure 1. Iceberg Model[12]

Analysis Patterns and Trends

The second stage of scanning stunting problems is an analysis of patterns and trends. Analysis of patterns and trends displayed in Table 2. Table 2 shows that 7 cases (3.42%) are included in indicated case of stunting. Stunting events in the village of Salakbrojo Central Java are accompanied by other problems of nutritional status, such as malnutrition, risk of overnutrition, overnutrition, and obesity.

Systemic Structure

The third stage of the scanning problem is an analysis of the systemic structure that affects stunting incidents as well as other nutritional problems in the village of Salakbrojo, Pekalongan Regency. Figure 2 shows the results of the systemic structure analysis. Systemic structure model that describes the causes of stunting which are direct causes and indirect causes. The direct causes include lack of food intake, exclusive breastfeeding, complementary food, infectious diseases and incomplete basic immunization. Indirect causes for stunting include lack of knowledge of stunting, access to health services, house condition triggers infectious diseases and poor sanitation. The figure 2 shows that direct cause is the most dominant factor causing stunting in the village of Salakbrojo, Central Java. Indirect causes is triggering the emergence of direct causes.

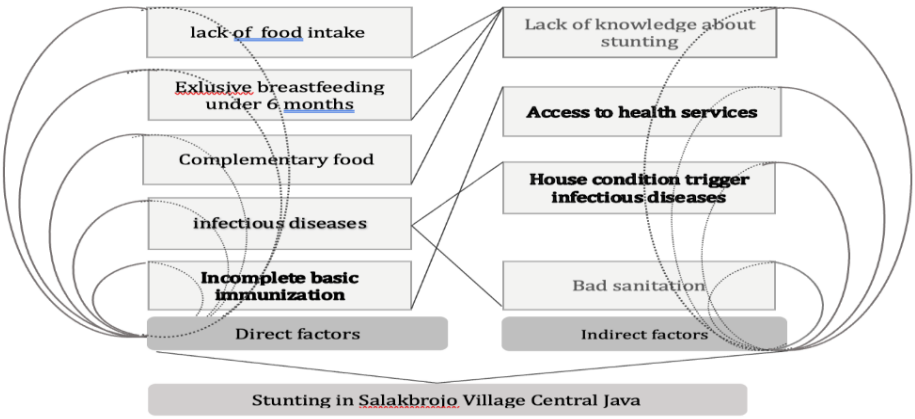
Mental Models

The fourth phase is the mental analysis of the model and the final phase of the iceberg analysis. The analysis presented in Table 3 is the result of focus group discussions by all correspondents, including the health cadres, rural midwives, village leaders, and mothers. The analysis of mental models aims to summarize the broad understanding into more specific ones. The model mental analysis is based on an in-depth investigation of information to understand the root of the problem.

Table 2. The Patterns and Trends of The Toddlers' Nutritional Status

Characteristics	n = 205	%
Nutritional Status		
Indicated stunting	7	3.42
Malnutrition	6	2.92
Normal	173	84.39
At risk of overnutrition	12	5.85
Overnutrition	4	1.95
Obese	3	1.46

Source: Primary Data, 2023



Source: Primary Data, 2023

Figure 2. Stunting Systemical Structure in Salakbrojo Village

Tabel 3. Mental Models Stunting in Desa Salakbrojo

Subject Category	The Mental Models Issues of Stunting
Toddlers' Mother	The mothers think that stunting is not a big problem to worry about. They do not feel anxious as long as the child is not sick and can carry out activities appropriate for his age. They also have confidence that their children will grow and develop normally when they enter the school.
Health Cadres	The cadres have sufficient knowledge about stunting and it is the main government program at the moment. They support the efforts to reduce stunting through the Integrated Services Post *(Pos Pelayanan Terpadu/Posyandu)* activities. They play an important role to prevent and reduce stunting in Salakbrojo Village.
Salakbrojo Village Head	The Salakbrojo Village Government supports the program to accelerate stunting reduction. The village government also provides funds for a program related to stunting through the Integrated Services Post *(Pos Pelayanan Terpadu/Posyandu)* and other activities. The municipality of Salakbrojo also facilitates the Puskesmas activities organized in the village. Regularly, the municipality coordinates with the health cadres to monitor the implementation of the stunting reduction program.
Rural Midwife	The rural midwife has the view that reducing stunting is not an easy effort to implement. The effort to reduce stunting requires a consistent and intensive effort. However, if the program is successful a role model for the community.

Source: Primary Data, 2023

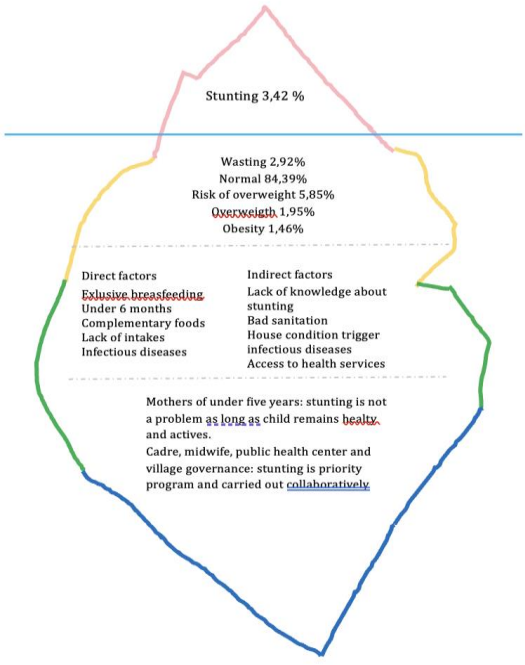
Table 3 informs us of the existence of two different mental models. The villagers, villagers, and cadres have a mental models that stunting is a problems that must be tackled together in collaboration with various parties. The mental models of mothers believes that mothers do not consider stunting as a serious problem.

DISCUSSION

The study uses the iceberg phenomenon theory model as a tool to analyze stunting problems in the village of Salakbrojo, Central Java. Some studies have used iceberg theory as a methodological approach as well as an analysis tool.[15,16,17,18] Iceberg theory model is a method for mapping research problems transparently. This theory also provides a comprehensive overview of the field of problems being studied. As an analytical tool, iceberg theory can dig deeper into understanding while identifying problem-prevention interventions.[17]

The iceberg construction is built from patterns that form structures systematically.[12] The iceberg model is a structure that is interrelated and describes a causal and consequential relationship.[12] It can be seen in Figure 2 that there is a cause-and-effect relationship in the dimensions of direct cause and indirect cause. Some studies use iceberg models for epidemiological modelling of new and ongoing cases. Epidemiological iceberg models can be used to plan troubleshooting. This model is relevant for applications in disease surveillance and screening, disease burden calculation, health services, and program planning.[15]

Iceberg phenomenon in stunting is described in two layers, namely upper layer above surface and lower layer underneath the surface. Scanning stunting problems in village of Salakbrojo as a whole can be seen in the figure 3:



Source: Primary Data, 2023

Figure 3. Results of Problem Scanning Using Iceberg Phenomenon Model

The events of stunting are at peak of the iceberg as visible and quantitatively measurable. There are seven cases indicating that there is a case of stunting from village of Salakbrojo. Stunting is closely linked to economic capacity of people to meet their nutritional food needs. A total of 131 families have income of less than Rp. 2,500,000, out of 205 families in Salakbrojo Village. This number is higher than the minimum wage figure in Central Java in 2023 of Rp. 2,247,346,00.[19] Results of the Indonesian Nutrition Status Survey in 2022 showed a decline in stunting trend from 24.4% in 2021 to 21.6% in 2022. Overweight cases have dropped from 3.8% in 2021 to 3.5% in 2022, but the prevalence of wasting and underweight has increased by 2022.[1]

The prevalence of stunting is declining globally but not evenly in every country, especially in rural areas in countries with severe poverty rates. Based on socio-economic status, there is a significant gap in the rate of decline between urban and rural areas.[20] This follows Permatasari and Chadirin study (2022), which states that stunting incidents in Bogor district are related to family income. Stunting children come from families with a monthly income of Rs. 3,800,000 and live in rural areas.[21] A study by Win and Shafique et al. (2020) revealed a relationship between working mothers and stunting cases in Dhaka, Bangladesh. Working mothers come from low-income families with extended family characteristics.[22]

The second layer of iceberg is patterns and trends, indicating a pattern of events that has similarities with stunts. Figure 3 shows patterns and trends of undernourishment, normal nutrition, higher nutritional risk, more nutrition, and obesity. The findings are interesting because they show a double burden of malnutrition, namely, overnourishment and obesity. Stunting is generally accompanied by other malnutrition problems such as wasting, underweight, and anemia.[23] These four problems are double burden of global undernourishment problem. Percentage of children between ages of 2 and 19 at risk of being overweight increased significantly by 18% in South Africa by 2020.[24] Stunting study in Timor Leste found almost same condition that prevalence of stunting in young people (44.4%) was followed by underweight (37.5%) and wasting (24.3%).[25] Increasing mother's education has a significant impact on reducing stunting. however, changes in behaviours towards mother's education did not show a significant relationship reducing stunting.[26]

Systemic structures form causality structures between indirect and direct causes. The larger systemic structure, more causal and consequential relationships are described. The wider complexity analysis, easier it is to find a solution to problem.[27] Systemic structures with a high degree of complexity make problem more difficult to understand. A flow diagram can retrospectively deduce a cause-and-effect relationship or even the absence of a factor-to-factor relationship.[12] Based on systematic structural analysis, direct causes of stunting include exclusive breastfeeding, weaning food giving, food intake, and infectious diseases. These factors arise from indirect causes such as a mother's knowledge, sanitation of environment, home characteristics, and access to basic health care. 0–6-month exclusive breastfeeding is believed to not only perfectly meet baby's nutritional needs but can also boost infant's immunity against the threat of infectious diseases. Exclusive breastfeeding is equivalent to three times the intake that must be met in children who consume energy and protein sources.[21]

Research by Rachmawati (2019) states that improper health practices early in life cause babies to be 1.15 times more likely to suffer from stunting. One of the mistakes in health practice is giving weaning food before age of six months.[28] Food intake calculation is used in this study using the FFQ method (Food Frequency Questionnaires). This method contains a list of choices, food combinations, frequency of consumption, size of servings, and duration of intake (in months and years). This FFQ method is suitable for research with large population numbers.[29] Nindyaningrum, in her research (2023), mentioned that children who consumed animal-based protein proved to have 33.3% better nutritional status.[30] Minimum energy intake <1400 kcal/capita/day significantly influenced the prevalence of stunting in babies under 2 years old in Indonesia.[31]

Stunting is closely related to environmental sanitation and home characteristics. Prevalence

of stunting in households drinking untreated water was 38.2% compared to those treated at 27.3%.[32] This is consistent with research in South Ethiopia showing that unavailability of toilets was improper and insufficient, water sources were inadequate, and the non-use of soap for hand washing significantly increased the stunting prevalence.[33] WHO Conceptual Framework identifies health care as one of the factors affecting stunting.[34] Children who suffer from malnutrition are affected by poverty and limited access to health care.[35]

Based on figure 2, it is known that mothers of toddlers have a mental model that tends not to worry about stunting child's condition. Mother believes there is no need to question stunting condition of their children as long as they look healthy and active. A mother's knowledge of stunting is closely related to her educational level. Adequate education of the mother increases good knowledge and skills in caring for children, including fulfilling their nutrition.[36] A study by Win (2020) in Bangladesh showed slightly different results; low-educated mothers were not closely associated with stunting events, and the results matched an OR figure of 0.94.[22] Stunting reduction program is one of the priorities of government through specific and sensitive intervention. Both interventions are carried out in an integrated way from the central level to village government.[37]

CONCLUSION AND RECOMMENDATION

The iceberg model is a comprehensive problem analysis that describes stunting problems both quantitatively and qualitatively Knowledge contributes to the emergence of other factors, both direct and indirect. Knowledge contributes to exclusive breastfeeding, the provision of MPASI ≤6 months, fulfilment of the child's food needs, as well as sanitary conditions of environment and home. The mother's knowledge also shapes the mental model; they believe stunting is not a big deal to worry about.

The recommendation of this study reveals that convergence efforts to reduce stunting involving village government, district government, public health center, public health office and other related sectors are needed. Convergence efforts focused on specific and sensitive interventions, especially in improving the mother's knowledge of stunting.

AUTHOR CONTRIBUTIONS

Y carried out data collection with focus group discussion, drafted the framework of the concept of an iceberg model and described it as an analysis instrument, conducted an analysis of systemic structures and mental models, wrote manuscripts, and became a corresponding author. R and DNRM collected data using focus group discussions, analyzed systemic structures and mental models and wrote the manuscript. MF performs nutritional status measurements based on data in the KMS Book and presents the measurement results in the form of tables. Y = Yuniarti; R = Ristiawati; DNRM = Dewi Nugraheni Restu Mastuti; MF = Muhammad Fatih.

CONFLICTS OF INTEREST

The author declares that there is no conflict of interest.

REFERENCES

1. Badan Kebijakan Pembangunan Kesehatan. Hasil Survei Status Gizi Indonesia (SSGI) 2022.
2. BKKBN. Laporan Pelaksanaan Percepatan Penurunan Stunting Semester Pertama Tahun 2023.
3. Migang, Y. W., Rarome, M. J., Heriteluna, M. & Dawam, M. Intervention of Specific Nutrition and Sensitive Nutrition with Nutritional Status of Under Two-Year Infants in Family Planning Village as Efforts to Face the Demographic Bonus. *Jurnal Kesehatan Masyarakat*.2020; 16(1): 101–110. https://journal.unnes.ac.id/nju/index.php/kemas/article/view/23172
4. Saif, S. & Anwar, S. Unraveling The South Asian Enigma : Concurrent Manifestations of Child Anthropometric Failures and Their Determinants in Selected South Asian Countries. *BMC Nutrition*.2023;9(120):1-13. https://bmcnutr.biomedcentral.com/articles/10.1186/s40795-023-00771-4

5. Badan Kebijakan Pembangunan Kesehatan. Hasil Survei Status Gizi Indonesia (SSGI) 2022.
6. BKKBN. Laporan Pelaksanaan Percepatan Penurunan Stunting Semester Pertama Tahun 2023.
7. Thordal-Christensen, H. A Holistic View on Plant Effector-Triggered Immunity Presented as an Iceberg Model. *Cellular and Molecular Life Sciences*.2020;77(20): 3963–3976. https://link.springer.com/10.1007/s00018-020-03515-w
8. Maxwell, J. A. & Reybold, L. E. Qualitative Research. in *International Encyclopedia of the Social & Behavioral Sciences: Second Edition*.2015; (Elsevier Inc.):685–689. https://linkinghub.elsevier.com/retrieve/pii/B9780080970868105586
9. Moen, K. & Middelthon, A.-L. Qualitative Research Methods. in *Research in Medical and Biological Sciences* 321–378 (Elsevier, 2015). https://linkinghub.elsevier.com/retrieve/pii/B9780127999432000100
10. Moon, M. D. Triangulation: A Method to Increase Validity, Reliability, and Legitimation in Clinical Research. *Journal of Emergency Nursing. 2019;*45(1):103–105. https://linkinghub.elsevier.com/retrieve/pii/S0099176718305889
11. Carter, N., Bryant-Lukosius, D., Dicenso, A., Blythe, J. & Neville, A. J. The Use of Triangulation in *Qualitative Research. Oncology Nursing Forum*. 2014;41(5):545-547. http://onf.ons.org/onf/41/5/use-triangulation-qualitative-research
12. Monat, J. P. & Gannon, T. F. The Meaning of "Structure" in Systems Thinking. *Systems*. 2023;11(2). https://www.mdpi.com/2079-8954/11/2/92
13. Doyle, E. E. H. *et al.* Eliciting Mental Models of Science and Risk for Disaster Communication: A Scoping Review of Methodologies. *International Journal of Disaster Risk Reduction*. 2022:77. https://linkinghub.elsevier.com/retrieve/pii/S221242092200303X
14. Holtrop, J. S., Scherer, L. D., Matlock, D. D., Glasgow, R. E. & Green, L. A. The Importance of Mental Models in Implementation Science. *Frontier in Public Health*. 2021;9 https://www.frontiersin.org/articles/10.3389/fpubh.2021.680316/full
15. Moradi, Gholami, et al. How Is the Iceberg of COVID-19? Results From a Rapid Literature Review. *Medical Journal of The Islamic of The Republic of Iran*. 2021;35(77). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8285553/
16. Leitao, S. *et al.* Maternal Morbidity and Mortality: An Iceberg Phenomenon. *BJOG: An International Journal of Obstetrics and Gynaecology*. 2022; 129(3):402–411. https://obgyn.onlinelibrary.wiley.com/doi/10.1111/1471-0528.16880
17. Geulayov, G. *et al.* Incidence of Suicide, Hospital-presenting Non-fatal Self-harm, and Community-occurring Non-fatal Self-harm in Adolescents in England (The Iceberg Model of Self-harm): A Retrospective Study. *Lancet Psychiatry*. 2018: 2018;5(2):167-174. https://linkinghub.elsevier.com/retrieve/pii/S2215036617304789
18. Thordal-Christensen, H. A Holistic View on Plant Effector-triggered Immunity Presented as An Iceberg Model. *Cellular and Molecular Life Sciences*. 2020;77(20): 3963–3976. https://link.springer.com/10.1007/s00018-020-03515-w
19. BPS Provinsi Jawa Tengah. Upah Minimum Kabupaten/Kota di Provinsi Jawa Tengah 2021-2023.
20. Baye, K., Laillou, A. & Chitweke, S. Socio-Economic Inequalities in Child Stunting Reduction in Sub-Saharan Africa. *Nutrients*.2020; 12:1–11. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7019538/pdf/nutrients-12-00253.pdf
21. Permatasari, T. A. E. & Chadirin, Y. Assessment of Undernutrition Using The Composite Index of Anthropometric Failure (CIAF) and Its Determinants: A Cross-sectional Study in The Rural Area of The

Bogor District in Indonesia. *BMC Nutrition*. 2022;8(1). https://bmcnutr.biomedcentral.com/articles/10.1186/s40795-022-00627-3

22. Win, H. *et al.* Association Between Mother's Work Status and Child Stunting in Urban Slums: S Cross-sectional Assessment of 346 Child-mother Dyads in Dhaka, Bangladesh. *Archives of Public Health*. 2022;80(1). https://archpublichealth.biomedcentral.com/articles/10.1186/s13690-022-00948-6
23. Kim, J. *et al.* Estimating the Burden of Child Undernutrition for Smaller Electoral Units in India. *JAMA Network Open*. 2021;4(10). https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2785600
24. Gwelo, N. B., Sumankuuro, J., Akintola, O. & Brieger, W. R. Factors Associated with Underweight, Overweight, Stunting and Wasting Among Primary School-going Children Participating in A School Health Initiative in South Africa. *BMC Nutrition*. 2023;9(1). https://bmcnutr.biomedcentral.com/articles/10.1186/s40795-023-00778-x
25. Maulina, R., Qomaruddin, M. B., Kurniawan, A. W., Fernandes, A. & Astuti, E. Prevalence and Predictor Stunting, Wasting and Underweight in Timor Leste Children Under Five Years: An Analysis of DHS Data in 2016. *Journal of Public Health in Africa*. 2022;13 (2166). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9425938/pdf/jpha-13-22-2116.pdf
26. Dessie, G., Tsegaye, G. W., Mekonnen, B. A., Bayih, M. T. & Nigussie, Z. M. Change in Stunting and Its Associated Factors Among Children Aged Less Than 5 Years In Ethiopia Using Ethiopia Demographic and Health Survey Data From 2005 To 2019: A Multivariate Decomposition Analysis. *BMJ Open*. 2022;12(11). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9660614/pdf/bmjopen-2022-061707.pdf
27. Lissack, M. Understanding Is a Design Problem: Cognizing from a Designerly Thinking Perspective. Part 2. *She Ji: The Journal of Economics, Design, and Innovation*. 2019; 5(4):327–342. https://linkinghub.elsevier.com/retrieve/pii/S2405872619300929
28. Rachmawati, S., Machmud, P. B. & Hatma, R. D. Early Life Health Practice and Stunting Among Children Under-Five Years Old. *Media Kesehatan Masyarakat Indonesia*. 2019;15(2):120–127. http://journal.unhas.ac.id/index.php/mkmi/article/view/6334
29. Neuhouser, M. L., Prentice, R. L., Tinker, L. F. & Lampe, J. W. Enhancing Capacity for Food and Nutrient Intake Assessment in Population Sciences Research. *Annual Reviews of Public Health.* 2023;44: 37–54. https://pubmed.ncbi.nlm.nih.gov/36525959/
30. Nindyaningrum, S. F., Muniroh, L. & Rifqi, M. A. Relation of Three Basic Needs by Mother with Growth and Development of Children Age 3-5 Years in Mulyorejo Surabaya. *Indonesian Journal of Public Health*.2023;18(1): 93–105. https://ejournal.unair.ac.id/IJPH/article/view/24312
31. Wardani, Z., Sukandar, D., Baliwati, Y. F. & Riyadi, H. Access to Sanitation, Smoking and Annual Parasite Incidence of Malaria as Stunting Predictors of Children Under-2 Years in Indonesia. *Media Kesehatan Masyarakat Indonesia*. 2020;16(1):127–139. http://journal.unhas.ac.id/index.php/mkmi/article/view/9070
32. Das, S. et al. Not Water, Sanitation and Hygiene Practice, but Timing of Stunting is Associated with Recovery from Stunting At 24 Months: Results from A Multi-Country Birth Cohort Study. *Public Health Nutrition*. 2021;24(6):1428–1437. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8025093/pdf/S136898002000004Xa.pdf
33. Woldesenbet, B., Tolcha, A. & Tsegaye, B. Water, Hygiene and Sanitation Practices are Associated with Stunting among Children of Age 24-59 Months in Lemo District, South Ethiopia, In 2021: Community Based Cross Sectional Study. *BMC Nutrition*. 2023;9(17). https://bmcnutr.biomedcentral.com/articles/10.1186/s40795-023-00677-1

34. Botero-Tovar, N., Arocha Zuluaga, G. P. & Ramírez Varela, A. Factors Influencing Delivery of Intersectoral Actions to Address Infant Stunting in Bogotá, Colombia – a Mixed Methods Case Study. *BMC Public Health*.2020;20(925). https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-020-09057-x
35. Singh, S. K., Srivastava, S. & Chauhan, S. Inequality in Child Undernutrition Among Urban Population in India: a Decomposition Analysis. *BMC Public Health.* 2020; 20(1852). https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-020-09864-2
36. Siddiqa, M., Zubair, A., Kamal, A., Ijaz, M. & Abushal, T. Prevalence and Associated Factors of Stunting, Wasting and Underweight of Children Below Five Using Quintile Regression Analysis (PDHS 2017–2018). *Scientific Reports.*2022;12(20326). https://www.nature.com/articles/s41598-022-24063-2
37. Peraturan Presiden (Perpres). Peraturan Presiden RI Nomor 72 Tahun 2021 Tentang Percepatan Penurunan Stunting. 2021; Jakarta.

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Navigating the Storm: Unraveling the Factors Shaping Adolescent Anxiety Amid the COVID-19 Pandemic

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ABSTRACT
The COVID-19 epidemic has significantly impacted adolescent mental health, particularly in cases of anxiety. The underlying causes, though, are yet unknown. The goal of this study is to identify any potential influences on adolescent anxiety during the COVID-19 epidemic. Cross-sectional time series analysis is the method used in this investigation. The 188 teenagers who made up the study's samples ranged in age from 15 to 18 years old. The sampling method made use of the probability sampling. The Generalized Anxiety Disorder-7 (GAD-7) questionnaire was used as the instrument for gathering the data. Then, univariate, bivariate, and multivariate were used in the statistical test. Most of the respondents, namely 143 respondents (76.1%) experienced anxiety. The most influential factor in anxiety is the source of information (p value 0.020). The factors related to anxiety were sources of information, resilience, loneliness, social support, and having positive COVID-19 patients within the family or around the family environment. During the COVID-19, the source of information variable was found to be the most important variable related to the anxiety. Lack of clear information makes thingking worse and increases adolescent anxiety. It is recommended for healthcare services and community health centers to provide accurate information about COVID-19 in educational institutions to reduce adolescent anxiety.

INTRODUCTION

The COVID-19 pandemic has altered social connections all across the world. The regulations to stay at home and to do social distancing are established to prevent the transmission of COVID-19. The enactment of these regulations has an influence on the daily life of all age groups, one of which is the youth group.[1] The lack of external support and support from the family can increase the anxiety. Anxiety because of the COVID-19 pandemic can also be caused by the deteriorating economic conditions so that unemployment rates are high and increasing in all countries. This impact puts a lot of pressure on teenagers.[2]

The findings of the research carried out by the United Nations International Children's Emergency Fund (UNICEF) in 2021, state that as many as 27% of adolescents experienced anxiety, 15% are depressed during the pandemic, 46% of adolescents are not motivated to do activities they usually like, 36% are not motivated to do homework, and 43% of female adolescents feel pessimistic about their future. Meanwhile, male adolescents feel pessimistic, namely around 31%.[3] According to the previous research, the COVID-19 pandemic resulted in a twofold increase in the prevalence of depression and anxiety among children and adolescents worldwide. The study also stated that globally 1 out of 4 adolescents experienced an increase in depressive symptoms and 1 out of 5 adolescents experienced an increase in anxiety.[4]

The data on adolescent mental health in Indonesia in 2013 reached around 6.1% of the total population of Indonesia or the equivalent of 11 million people. Whereas in 2018, there were 9.8% of adolescents aged over 15 years experiencing mental-emotional disorders with the symptoms of depression and anxiety. The data shows that for 5 years mental disorders in adolescents have increased by around 3.7%.[5] In Central Java, there are 95,460 people (15-24 years old) with a prevalence of mental-emotional illnesses in 2018, and there are 95,461 (15-24 years old) with a prevalence of depression in Central Java.[5] Before the pandemic, the problem with adolescent mental health was also quite large. The research conducted by the Litbangkes Agency shows that 60.17% of junior high school students experience symptoms of mental-emotional disorders with the symptoms of 44.54% feeling lonely, 40.75% feeling anxious, and 7.33% of adolescents having attempted suicide.[5]

Adolescent anxiety during the COVID-19 pandemic was influenced by a variety of elements, including loneliness, decreased resilience, and a lack of social support.[6] Anxiety in adolescents is also influenced by information sources owned by positive COVID-19 patients in or around the family.[7] High loneliness and a low tolerance for pressure can increase the anxiety that occurs in adolescents.[6] However, mental disorders can be prevented by having resilience and feeling supported by others. Psychological resilience can be used to adapt positively when facing difficulties during a pandemic.[8] The results of the previous studies stated that there were 898 (61.5%) adolescents who experienced high loneliness, 72.0% of adolescents had low resilience, and from the data we obtained, teenagers during the COVID-19 pandemic stated that 88.2% of the majority received information and developments on the COVID-19 disease through television. Most of the respondents have a high level of social support.[6] Adolescents' anxiety levels can increase 3.81 times when they live in a family or environment with positive COVID-19 patients.[7]

Excessive anxiety can affect the physical condition of adolescents because anxiety can indirectly increase the heart rate in the body and affect a person's physical condition in the form of dizziness, headaches and affect a person's performance and immunity. During the pandemic, problems with sleep, denial, anger, fear, and eating disorders affect adolescents.[9] In earlier research, 34.4% of high school students reported having anxiety symptoms, 42.9% of the students said they had depression symptoms, and 44.8% said they had insomnia symptoms. [10] If anxiety is allowed to develop, it can result in risky behavior, inappropriate sexual involvement, drug abuse, and isolation from family and friends. It may also have an effect on academic performance and outcomes at school, which may have repercussions for choices regarding careers or fields of study in the future.[11]

Mental health problems need to be identified and treated. The World Health Organization (WHO) has identified a gap in handling mental health problems including Indonesia, which reaches more than 85%, meaning that less than

15% of people with mental health problems get the health services they need. Mental health conditions are still an issue that has not received optimal attention and the number of people with mental disorders continues to increase.[5] Anxiety experienced by adolescents can have an emotional and physical impact. Excessive anxiety can affect adolescents in the educational process because excessive fear can affect clarity of thinking and memory for learning. Anxiety can also affect a adolescent physical condition because anxiety can indirectly increase the heart rate in the body and affect a person's physical condition in the form of dizziness, headaches and affect a person's performance and immunity. Poor sleep patterns, denial, anger, fear and eating disorders cause mental problems in adolescents during the pandemic.[12] If depression and anxiety are allowed to develop, it can lead to adolescent isolation from family and friends, risky behavior, inappropriate sexual involvement and drug abuse. It can also impact school performance and studies which can have downstream effects on career or study choices in the future.[12]

The coronavirus pandemic and the aftermath of the pandemic can affect the emotional health of the adolescents and their parents. Inadequate management of mental health issues connected to COVID-19 in teenagers can result in post-traumatic stress disorder, mental disorders, and other psychosocial issues. So that in the future it will have an impact on the quality and productivity of human resources. In this manner, it is important to complete the endeavors to help the emotional wellness of the youths during the Coronavirus pandemic. The health office and Public Health Centers (PHC) must work together with various parties in the community, which include health workers (doctors and midwives), social workers, community organizations, parents, and other elements of the society to build networks in promotive efforts. preventive measures through early detection and effective and efficient handling. This network can be integrated into Community Based Health Efforts integrated service post-service activities, health service facilities both government and private, educational institutions, and social institutions (social homes) as part of the efforts to deal with the COVID-19 pandemic. This study differs from the earlier research in that it is known, based on the results of the previous journal reviews, that a variety of factors, including social isolation, lack of social support, information sources, and having a positive patient with COVID-19 in or around the family, can contribute to anxiety in adolescents. Based on the aforementioned information, this study intends to examine variables that affect adolescent anxiety during the coronavirus pandemic.

MATERIAL AND METHOD

This study employs a survey-based research design and a quantitative approach. The time approach used is cross-sectional, namely identifying the independent variables and the dependent variable at one time.[13] The cross-sectional approach in this study is that the anxiety data and the influencing factors are taken at the same time at the current time only. The subjects in this study were high school teenagers. The respondents' inclusion criteria were: male and female adolescents, aged 15-18 years old and willing to become respondents. The instrument in this study used the GAD-7 questionnaire. The data collection techniques were carried out by collecting the questionnaires. The data analysis using univariate, bivariate, and multivariate. Univariate analysis was performed on each variable from the research results in the form of distribution and percentage of each variable. The chi-square bivariate test examines the associations between information sources, isolation, adaptability, social support, and having positive COVID-19 patients in or in the home context with anxiety. Then multiple logistic regression was used to run a multivariate test. The variables utilized in the logistic regression test had a p-value of less than 0.25 and were included in the multiple logistic regression analysis used to find the predictors of the anxiety symptoms. The ethical commission has approved this study (No. 2099/KEP-UNISA/VI/2022).

RESULTS

Based on Table 1 of the characteristics in this study, it was found that the majority of the respondents were female, 134 (71.3%). Based on the age characteristics, it was found that most of the respondents were 17-18 years old with 121 respondents (64.4%). Univariate analysis

was used to describe the frequency and percentage distribution of the independent variables (sources of information, resilience, loneliness, social support, having positive COVID-19 patients in or around the family), dependent variables (anxiety, depression), and confounding variables (age, gender) that has been obtained from the research results (Table 1).

From Table 2, it can be seen that during the pandemic, it was found that the majority of the respondents obtained sources of information about COVID-19 from electronic and printing media, as many as 112 respondents (59.6%). The respondents who have low resilience were 94 respondents (50%). Most of the respondents experienced loneliness as many as 153 students (81.4%). The respondents mostly had low social support as many as 99 respondents (52.7%). Most of the respondents also had family members who tested positive for COVID-19 as many as 148 respondents (78.7%).

The relationship between independent and dependent variables can be determined using bivariate analysis. The chi-square test was used to look at the data to see if there was a relationship and what the next step should be namely multivariate analysis. The variables that will be tested bivariate in this study are the independent variables (sources of information, resilience, loneliness, social support, and having positive COVID-19 patients in or around the family) with the dependent variables (anxiety and depression).

Based on the data findings, it was found that the proportion of anxiety in adolescents mostly obtained information sources through electronic and print media, had low resilience, during the C Coronavirus pandemic, the majority of adolescents experienced loneliness and lacked social support, and most adolescents have positive COVID-19 patients in or around the family. The chi-square calculation's findings demonstrated that there was a significant relationship between sources of information, resilience, loneliness, social support, and having positive COVID-19 patients in or around the family with anxiety during the Coronavirus pandemic (Table 3).

Table 1. Characteristics of Respondents

Characteristics	n = 188	%
Gender		
Man	54	28,7
Woman	134	71.3
Age		
Early Teenagers (15-16 years)	67	35,6
Late Teenagers (17-18 years)	121	64,4
Worry		
Not Worried	45	23.9
Worried	143	76.1

Source: Primary Data, 2022

Table 2. The Frequency Distribution of the Factors Influencing Anxiety During the COVID-19 Pandemic

Variable	n = 188	%
Resources		
Electronic and printing media	112	59.6
Oral Media	76	40.4
Resilience		
High Durability	94	50
Low Resistance	94	50
Lonely		
Lonely	153	81.4
Not Lonely	35	18.6
Social Support		
High Social Support	89	47.3
Low Social Support	99	52.7
Have a positive COVID-19 patient in or in the family environment		
There is	148	78.7
There aren't any	40	21.3

Source: Primary Data, 2022

To ascertain whether the external variables have an impact on the dependent variable, multivariate analysis is utilized. The logistic regression is the multivariate analysis method employed. The multivariate analysis includes the variables having a p-value of less than 0.25.

The results of Table 4 explain the effect of each variable in the multivariate test through the Odds Ratio (OR) or Exp (B) value. From the multivariate analysis, it was found that the source of information variable was the most dominant factor in adolescent anxiety during the Coronavirus pandemic with OR = 1.891.

Table 3. The Results of Analysis of Factors Influencing Anxiety

Variable	No worries	Worri-ed	Total	p-*value*
	n (%)	n (%)	n (%)	
Resources				
Electronic and Printing Media	34 (18.1)	78 (41.5)	112 (59.6)	0.020
Oral Media	11 (18.2)	65 (34.6)	76 (40.4)	
Resilience				
High Durability	41 (21.8)	53 (28.2)	94 (50)	0.000
Low Resistance	4 (2.1)	90 (71.5)	94 (50)	
Lonely				
Lonely	15 (8)	138 (73.4)	153 (81.4)	0.000
Not Lonely	30 (16)	5 (2.7)	35 (18.6)	
Social Support				
High Social Support	37 (19.7)	52 (27.7)	89 (47.3)	0.000
Low Social Support	8 (4.3)	91 (48.4)	99 (52.7)	
Having a COVID-19 Positive Patient in or Around the Family				
There is	22 (11.7)	126 (67)	148 (78.7)	0.000
There aren't any	23 (12.2)	17 (9)	40 (21.3)	

Source: Primary Data, 2022

DISCUSSION

The Effect of Loneliness on Adolescent Anxiety During the COVID-19 Pandemic

Based totally on the outcomes of the cross-tabulation of loneliness and anxiety, it was observed that the general public of respondents who experienced loneliness skilled tension, particularly 138 respondents (73.4%), and based totally on the Chi-square which obtained an importance value of 0.000 < 0.05, that means there may be a courting among loneliness and anxiety. This finding supports the earlier studies that explain how adolescent loneliness contributes to high levels of stress.

Loneliness is a risk factor for mental health experienced by adolescents, thus making adolescents feel vulnerable and pessimistic about their situation and resulting in negative moods and increased anxiety and depression during the pandemic.[14] According to the other study, adolescents who experience significant degrees of loneliness during a pandemic may experience symptoms of anxiety, sadness, and Post-Traumatic Stress Disorder (PTSD), as well as other mental health issues.[15]

Table 4 Multivariate Analysis of Factors Influencing Anxiety During the COVID-19 Pandemic by Considering Confounding Variables

Worry	Model 1	Model 2
Resources		
Print media	1891 [0.553, 6.474]	
Oral Media	1 [1, 1]	
Covid		
There aren't any	0.351 [0.089, 1.380]	
There is	1 [1, 1]	
Lonely		
Not Lonely	0.006*** [0.001, 0.046]	0.009*** [0.002, 0.053]
Lonely	1 [1, 1]	1 [1, 1]
Resilience		
High Durability	0.149* [0.034, 0.660]	0.102*** [0.024, 0.426]
Low Resistance	1 [1, 1]	1 [1, 1]
Social Support		
High Social Support	0.062*** [0.012, 0.317]	0.091*** [0.019, 0.431]
Low Social Support	1 [1, 1]	1 [1, 1]
Gender		
Man	3.496 [0.899, 13.597]	
Woman	1 [1, 1]	
Age		
Early Teens	1715 [0.483, 6.087]	
Late Teens	1 [1, 1]	

Source: Primary Data, 2022

Data are exponential coefficients; 95% confidence interval in brackets, $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$

The Effect of Resilience on Adolescent Anxiety during the COVID-19 Pandemic

Based on the cross-tabulation results, it was found that 90 respondents (47.9%) had low resilience to experience anxiety. A significance value of 0.001 < 0.05 as determined by the chi-square test indicates that resilience and anxiety are related. These findings support the previous research6 that adolescent resilience affects high anxiety, however not PTSD levels. Adolescent resilience, which comprises personal competence and trust in one's intuition, has been associated to the increased rates of depression, anxiety, and Post-Traumatic Stress Disorder (PTSD) symptoms during the pandemic. A person's ability to control emotions both physically and mentally is more effective in protecting individuals than characteristics that involve flexibility of mind, especially for adolescents who experience symptoms and side effects of PTSD in general during a pandemic. A pandemic is a source of worldwide pressure that has no predefined endpoint; therefore, it cannot be controlled by a single person. In addition, the pandemic has also simultaneously affected several aspects of life (health, relationships, and finances), which can exacerbate the symptoms of Post-Traumatic Stress Disorder (PTSD).

Therefore, the mental resilience typically associated with overcoming setbacks isn't sufficient to defend and protect against PTSD symptoms during a pandemic.6 This is also in line with the research16 which shows that in managing mental health, both emotional and stress, good skills are needed through effective coping mechanisms so no problems will arise in psychological health such as sleep disturbances, anxiety, depression, and panic. A research conducted by Cao, et al.17 shows that the increase in symptoms of depression and anxiety in adolescents is due to online learning difficulties, conflicts with parents and peers, and stress over notifications about COVID-19.

The Effect of Social Support on Adolescent Anxiety during the COVID-19 Pandemic

According to the cross-tabulation results, 91 individuals (48.4%) with low social support were reported having anxiety. Based on the results of the chi-square test, a significance value of 0.000 < 0.05 means that there is a relationship between social support and anxiety. This research confirmed the previous findings that adolescents experience low levels of social support; around (37%) of adolescents reported to have low support from their families, which affected the level of anxiety in adolescents.6 In this study, people who provided social support included friends, family, and significant others. Additionally, the prior research has demonstrated that the importance of parental support during the adolescent years varies across life stages.[16]

According to the previous research, more than half of adolescents with low social support also show symptoms of depression and anxiety, with a 4.2-fold increased risk of anxiety and depression compared to adolescents with high social support.[18] The results of this study indicate that social support is an important component of mental health among adolescents. Adolescents' mental health improves when they get more social support. Empathizing with teens, friends, and family can reduce their levels of anxiety and depression. An individual's sense of self-efficacy and capacities for understanding, respect, encouragement, courage, and self-fulfillment are all enhanced by social support, which can also assist individuals in maintaining relatively stable emotions even during stressful situations.[16]

The Influence of Information Sources on Anxiety during the COVID-19 Pandemic

Based on the research result, it is known that most of the respondents who obtained information from digital and print media experienced anxiety, specifically seventy-eight respondents (41.5%). Based on the results of the analytic test using chi-square, there is a relationship between sources of information and anxiety. The dissemination of worry and dread in relation to the COVID-19 epidemic is significantly influenced by social media.7. Since the issues that are raised by the constant exposure to material gained through social media cannot be answered, it can lead to worry, anxiety, and terror.[19] Based on the research conducted, it mentioned that the rise of news via the internet related to COVID-19 made teenagers unconsciously read information that could create panic. The dissemination of incorrect information will trigger fear and anxiety in teenagers. Therefore, it is said that

improper electronic media can trigger greater anxiety than the use of oral media as a source of information in adolescents.

The Effect of Having a Positive COVID-19 patient in or in the Family Environment on Adolescent Anxiety during the COVID-19 Pandemic

Based on the outcomes, cross-tabulations of having positive COVID-19 patients in or around the family, it was found that respondents who had families who tested positive for COVID-19 experienced more anxiety, with 126 respondents (67%). There is a correlation between anxiety and having positive COVID-19 patients in or around the family, according to the chi-square test results, and an OR value of 7.749 is obtained, meaning that respondents who have positive COVID-19 patients have a risk of experiencing anxiety 7.749 times compared to respondents who do not have families who test positive for COVID-19. This is in line with earlier studies, which discovered that the presence of those adolescents' family or relatives had an effect on the mental health of adolescents with COVID-19.[20] Grief over the loss of a family can exacerbate mental distress in adolescents.9 Having a family member who is hospitalized due to COVID-19 infection is a significant risk factor for the worsening of anxiety and sadness.[21]

The Most Dominant Factor Affecting Adolescent Anxiety during COVID-19

According to the findings of the multivariate analysis, the information source with the highest OR value (1.891), had the greatest influence on adolescent anxiety during the COVID-19 pandemic. This indicated that the source of information is the main factor influencing anxiety. This is in accordance with previous research by Garfin, et al.[22] that exposure to the mass media increases the fear of COVID-19 which has an impact on increasing anxiety and attitudes. As many as 88.2% of adolescents follow the development of the disease COVID-19 and most obtain information through electronic media.[7]

One of the primary routes for updating information about COVID-19 is social media.23 During the pandemic youth agendas changed rapidly and television and social media were mostly news about COVID-19. Exposing adolescents to excessive information causes an increase in anxiety, lack of clear information makes the public think the worst thereby increasing their anxiety.[23] Other studies also show that factors that affect confusion among adolescents stem from differences in style, approach, and content of government messages, because many adolescents use electronic social media as a source of information that triggers fear and confuses adolescents so that it can endanger their mental health, so it is necessary for the authorities to cooperate and coordinate properly and provide accurate and easy-to-understand information about prevention strategies.[24]

The internet and social media are also useful resources for learning about the COVID-19 epidemic. The availability of knowledge regarding the coronavirus has resulted in an infodemic, which can affect teenagers' mental health. This is because, during the epidemic, many activities are carried out remotely, beginning with school, and social media has helped preserve social links with families and friends. However, excessive internet use can negatively impact the well-being of children and adolescents.[7] A good parent-child relationship can be an important protective factor for health adolescent mentality when facing the COVID-19 pandemic.[25]

CONCLUSION AND RECOMMENDATION

This research found that the majority of adolescents experience anxiety during the COVID-19 pandemic. There is a correlation between sources of information, resilience, loneliness, social support, and having positive COVID-19 patients in or around families with adolescent anxiety during the pandemic. Sources of information as the most important factor causing adolescent anxiety during a pandemic (OR 1.891). Exposing adolescent to information overload causes an increase in anxiety. Efforts need to be made to support mental and psychosocial health for adolescents in situations of adapting to the new habits of the COVID-19 pandemic. The health service and community health centers must collaborate with various parties including health workers, parents and social organizations to built promotive and preventive networks such as early detection and effective and efficient

treatment by providing outreach in educational institutions as an effort to handle teenage anxiety during the COVID-19 pandemic. Providing guidelines related to factors that influence teenage anxiety during the pandemic so that it can reduce teenage anxiety rates.

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AUTHOR CONTRIBUTIONS

Study conception and design RND and MN; Data collection RND; Data analysis and interpretation RND, MN, and DE; Drafting of the article RND, MN, and DE; Critical revision of the article MN. RND = Rini Nur Diana; MN = Mamnuah; DE = Dwi Ernawati.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Omari O Al, Sabei S Al, Rawajfah O Al, Sharour LA, Aljohani K, Alomari K, et al. Prevalence and Predictors of Depression, Anxiety, and Stress among Youth at the Time of COVID-19: An Online Cross-Sectional Multicountry Study. *Depression Research and Treatment.* 2020. https://doi.org/10.1155/2020/8887727
2. Fegert JM, Vitiello B, Plener PL, Clemens V. Challenges and Burden of the Coronavirus 2019 (COVID-19) Pandemic For Child and Adolescent Mental Health: A Narrative Review To Highlight Clinical and Research Needs in The Acute Phase and The Long Return To Normality. *Child and Adolescent Psychiatry and Mental Health*. 2020;14(1):1–11. https://doi.org/10.1186/s13034-020-00329-3
3. Lestari NE. Adolescent Mental Development during the Pandemic Unicef Survey on Adolescents during the Pandemic. Stik-SintcarolusAcId. 2020;1–34.
4. Mandigan S. Since January 2020 Elsevier Has Created A COVID-19 Resource Centre with Free Information in English and Mandarin on the Novel Coronavirus COVID-19. The COVID-19 Resource Centre is Hosted on Elsevier Connect, the company's Public News and Information. 2020;(January).
5. Kementerian Kesehatan RI. Protokol Layanan DKJPS Anak dan Remaja Pda Masa Adaptasi Kebiasaan Baru Pandemi COVID-19. 2020;41. https://www.kemkes.go.id/resources/download/info-terkini/COVID-19/Buku-Protokol-Dukungan-Kesehatan-Jiwa-Dan-Psikologi-DKJPS-AR-2020.pdf
6. Liu CH, Zhang E, Tin G, Ba W, Hyun S, Chris H. Factors Associated With Depression, Anxiety, and PTSD Symptomatology During the COVID-19 Pandemic : Clinical Implications for U.S Young Adult Mental Health. *Psychiatry Research.* 2020;290. https://doi.org/10.1016/j.psychres.2020.113172
7. Bar M, Usta MD. Factors Affecting the Anxiety Levels of Adolescents in Home-Quarantine during COVID-19 Pandemic in Turkey. *Asia Pacific Psychiatry.* 2020;1–7. https://doi.org/10.1111%2Fappy.12406
8. Varma P, Junge M, Meaklim H, Jackson ML. Younger People Are More Vulnerable To Stress, Anxiety and Depression During COVID-19 Pandemic: A Global Cross-Sectional Survey. *Progress in Neuro-Psychopharmacology & Biological Psychiatry*. 2021;109:110236. https://doi.org/10.1016/j.pnpbp.2020.110236
9. Selçuk EB, Demir AÇ, Erbay LG, Özcan ÖÖ, Gürer H, Dönmez YE. Anxiety, Depression and Post-Traumatic Stress Disorder Symptoms in Adolescents during the COVID-19 Outbreak and Associated Factors. *International Journal of Clinical Practice*. 2021;75(11):1–7. https://doi.org/10.1111/ijcp.14880
10. Zhou SJ, Wang LL, Yang R, Yang XJ, Zhang LG, Guo ZC, et al. Sleep Problems Among Chinese Adolescents and Young Adults during the Coronavirus-2019 Pandemic. *Sleep Medicine*. 2020;74:39–47. https://doi.org/10.1016/j.sleep.2020.06.001

11. Impact D. Depression in Adolescents. Depress A Prim Pract. 2012;51–65.
12. Kementerian Kesehatan RI. Rencana Aksi Kegiatan 2020-2024. Ditjen P2P Kemenkes. 2020;29. https://p2pm.kemkes.go.id/storage/informasi-publik/content/laporan_1616944172.pdf
13. Sugiyono. Metode Penelitian Kualitatif Kuantitatif dan R&D. Bandung: Alfabeta; 2013.
14. Jiao WY, Wang LN, Liu J, Fang SF, Jiao FY, Pettoello-Mantovani M, et al. Behavioral and Emotional Disorders in Children during the COVID-19 Epidemic. *The Journal of Pediatrics*. 2020;221:264-266. https://doi.org/10.1016/j.jpeds.2020.03.013
15. Chen X, Qi H, Liu R, Feng Y, Li W, Xiang M, et al. Depression, Anxiety and Associated Factors among Chinese Adolescents during the COVID-19 Outbreak: A Comparison of Two Cross-Sectional Studies. *Translational Psychiatry*. 2021;11(1). https://doi.org/10.1038/s41398-021-01271-4
16. Qi M, Zhou SJ, Guo ZC, Zhang LG, Min HJ, Li XM, et al. The Effect of Social Support on Mental Health in Chinese Adolescents During the Outbreak of COVID-19. *Journal of Adolescent Health*. 2020;67(4):514–518. https://doi.org/10.1016/j.jadohealth.2020.07.001
17. Cao C, Wang L, Fang R, Liu P, Bi Y, Luo S, et al. Anxiety, Depression, and PTSD Symptoms among High School Students In China in Response to the COVID-19 Pandemic and Lockdown. *Journal of Affective Disorders*. 2022;296:126–129. https://doi.org/10.1016/j.jad.2021.09.052
18. Wang ZH, Yang HL, Yang YQ, Liu D, Li ZH, Zhang XR, et al. Prevalence of Anxiety and Depression Symptom, and The Demands For Psychological Knowledge And Interventions in College Students During COVID-19 Epidemic: A Large Cross-Sectional Study. *Journal of Affective Disorders*. 2020;275(1023):188–193. https://doi.org/10.1016/j.jad.2020.06.034
19. Rini Nur Diana, Mamnuah, Yekti Satriyandari, Andari Wuri Astuti, Dwi Ernawati. Anxiety and Depression in Adolescents Before and During Covid-19. *International Journal of Public Health Excellence (IJPHE)*. 2023;2(2):536–540. https://doi.org/10.55299/ijphe.v2i2.280
20. Zengin M, Yayan EH, Vicnelioğlu E. The Effects of The COVID-19 Pandemic on Children's Lifestyles and Anxiety Levels. *Journal of Child and Adolescent Psychiatric Nursing*. 2021;34(3):236–242. https://doi.org/10.1111/jcap.12316
21. Jean S, Lee P, Hsueh P. Treatment options for COVID-19 : The reality and challenges. *Journal of Microbiology, Immunology and Infection*. 2020;53(3):436–443. https://doi.org/10.1016/j.jmii.2020.03.034
22. Ozbaran B, Turer F, Yilancioglu HY, Kose S, Senturk Pilan B, Guzel O, et al. COVID-19–Related Stigma and Mental Health of Children and Adolescents During Pandemic. *Clinical Child Psychology and Psychiatry*. 2022;27(1):185–200. https://doi.org/10.1177%2F13591045211059408
23. Garfin DR, Silver RC, Holman EA. The Novel Coronavirus (COVID-2019) Outbreak: Amplification of Public Health Consequences By Media Exposure. *Health Psychology*. 2020;39(5):355–357. https://doi.org/10.1037%2Fhea0000875
24. Gao J, Zheng P, Jia Y, Chen H, Mao Y, Chen S, et al. Mental Health Problems and Social Media Exposure during COVID-19 Outbreak. *PLoS One*. 2020;15(4):1–10. https://doi.org/10.1371/journal.pone.0231924
25. Batterham PJ, Calear AL, McCallum SM, Morse AR, Banfield M, Farrer LM, et al. Trajectories of Depression and Anxiety Symptoms During the COVID-19 Pandemic in A Representative Australian Adult Cohort. *Medical Journal of Australia*. 2021;214(10):462–468. https://doi.org/10.5694/mja2.51043

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Factors Affecting The Success of Exclusive Breastfeeding Among Mothers Recovered From Covid-19

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ABSTRACT
Exclusive breastfeeding for the first 6 months and continued breastfeeding with complementary foods up to 2 years are emphasized by the World Health Organization. Amid the COVID-19 pandemic, maternal concerns about virus transmission through breastfeeding have surfaced. Despite these concerns, breastfeeding remains the primary recommendation due to its manifold health benefits. This research, conducted in Tegal City's Margadana sub-district, investigates factors influencing exclusive breastfeeding success among mothers recovered from COVID-19. Using an analytical observational design with a cross-sectional approach, the study explores the link between COVID-19 symptoms in infants and exclusive breastfeeding success, revealing a significant correlation (p-value=0.042). Conversely, breast milk production shows no significant association with exclusive breastfeeding success (p-value=0.144). Notably, spousal and family support emerges as pivotal, exhibiting a significant association with exclusive breastfeeding success (p-value=0.003). However, there is no significant relationship between healthcare provider support during breastfeeding and adherence to 6-month exclusive breastfeeding (p-value=0.456). The findings underscore the importance of breastfeeding during post-COVID-19, balancing potential virus transmission risks against the established breastfeeding health benefits. The study concludes by advocating for further research to comprehensively understand and address complexities of exclusive breastfeeding in the post-COVID-19 context, offering insights for healthcare practitioners and policymakers.

INTRODUCTION

COVID-19 is a highly contagious disease. As of November 24, 2021, the total confirmed cases worldwide reached 258,164,425 with 5,166,192 deaths (CFR 2.0%) in 204 affected countries and 151 countries experiencing community transmission. In Indonesia, there have been 4,254,443 confirmed cases of COVID-19, resulting in 143,766 deaths (CFR: 3.4%), and 4,102,700 patients have recovered from the disease.[1,2] COVID-19 is primarily transmitted through respiratory droplets. Transmission occurs when an individual is in close proximity (less than 1 meter) to a person with respiratory symptoms (e.g., coughing or sneezing), allowing droplets to potentially contact mucous membranes (mouth and nose) or conjunctiva (eyes). Additionally, the virus can be transmitted through contact with surfaces and objects contaminated by droplets from an infected person. Consequently, COVID-19 transmission can occur through both direct and indirect routes, either via close contact with an infected person or through contact with objects of surfaces used by an infected person.[3,4]

The World Health Organization (WHO) emphasizes the recommendation of exclusive breastfeeding for the first six months of an infant's life, followed by continued breastfeeding along with complementary foods until two years of age. The current situation raises concerns among mothers due to the perception that SARS-CoV-2 may be transmitted to infants through breastfeeding, even though active SARS-CoV-2 has not been detected in breast milk. This fear has led to policies promoting mother-child isolation. However, there is no evidence of vertical transmission, and the risk of horizontal transmission to infants is comparable to that of the general population. For infants with COVID-19, breastfeeding may positively influence the disease's clinical course.[10] Despite these circumstances, breastfeeding remains the primary recommendation, considering not only the potential risk of infection and infant mortality due to COVID-19 but also the health risks to infants from not receiving breast milk or inappropriate formula feeding. SARS-CoV-2 presents exceptional challenges, particularly in maternity care settings. Prevention strategies and appropriate treatment are crucial to minimize transmission from breastfeeding mothers with acute respiratory symptoms or comfirmed SARS-CoV-2 infection.[5,6,7]

Despite the fact that mothers with a coronavirus infection can still breastfeed their infants, the risk of the baby contracting the coronavirus from the mother still exists if the mother does not use Personal Protective Equipment (PPE). When a mother infected by coronavirus breastfeeding, coughs or sneezes near the baby or contact with unwashed hands can transmit the viruses to her baby. Therefore, the implementation of health protocols is crucial for breastfeeding mothers, including washing hands with soap for 20 seconds or using hand sanitizer, wearing personal protective tools (cloth masks), maintain body condition with regular exercise and sufficient rest, consuming a balanced diet, and practicing proper coughing and sneezing etiquette.[12,13]

According to Indonesian health research, *Riset Kesehatan Dasar (RISKESDAS)* 2021 data, only 52.5% - or half of the 2.3 million infants under six months old - receive exclusive breastfeeding in Indonesia, a 12% decline from the 2019 figures. The number of early initiation of breastfeeding (IMDhas also decreased, from 58.2% in 2019 to 48.6% in 2021. Early and exclusive breastfeeding is crucial for infant survival and protection against various potentially fatal diseases, such as diarrhea and pneumonia. Increasing evidence suggests that children who receive breast milk demonstrate higher intelligence test scores.[8] Additionally, they have a lower likelihood of obesity or excess weight, as well as a reduced vulnerability to future diabetes.[9] Globally, increased breastfeeding could potentially save more than 820,000 children annually and prevent an additional 20,000 cases of breast cancer in women each year.[8,9]

Women who gave birth during the pandemic faced limited access to postnatal care. Pregnant and lactating women who contract SARS-CoV-2 are more susceptible to adverse health outcomes and face an elevated risk of mental health challenges due to restricted support systems. Continued breastfeeding can offer passive immunity to infants against SARS-CoV-2, and COVID-19 vaccination has been demonstrated to be safe and effective for pregnant and lactating women. To support breastfeeding during future disease outbreaks,

the implementation of innovative and adaptable lactation care, including holistic perinatal, mental health, and social support services, both digital and in-person, will be crucial.[11]

This research, conducted in Tegal City's Margadana area, investigates factors influencing the adherence to 6-month exclusive breastfeeding among mothers recovered from COVID-19.

MATERIAL AND METHOD

This research is an observational research with a cross-sectional approach. The study objective is to identify factors influencing the adherence to 6-month exclusive breastfeeding among mothers who are COVID-19 survivors. The collection of the data used an online questionnaire by Google form. The population for this research are breastfeeding mothers recovered from COVID-19 in the Margadana subdistrict of Kota Tegal. The study sample comprised 20 breastfeeding mothers diagnosed with COVID-19 who had infants aged six months or younger in the Margadana area of Kota Tegal. Participants were selected using purposive sampling.[14]

In this study, univariate analysis is used to generate the frequency distribution and presentation of each variable. the Chi-Square analysis test is used to compare the cross-distribution between two relevant variables. The study received ethical approval (reference number: 0329/EA/KEPK/2022) from the Research Ethics Commission of Poltekkes Kemenkes Semarang.[15]

RESULTS

There were 20 respondents in this study consisting of breastfeeding mothers who were COVID-19 survivors who had infants aged ≤ 6 months with the characteristics of the respondents in Table 1.

Based on the research findings in Table 1, the characteristics of respondents regarding the adherence to 6-month exclusive breastfeeding indicate that most of mothers are ≤ 35 years old, with total of 17 (85%) mothers and 15 (88.2%) successfully adherence to exclusive breastfeeding. In contrast, among mothers aged <20th or >35th, all 3 mothers (100%) successfully breastfed exclusively. The majority of participants (n=10, 50%) had completed secondary education (junior to senior high school). Among this subgroup, 9 participants (90%) successfully practiced exclusive breastfeeding. Additionally, among those with higher education, 7 (100%) mothers successfully breastfed exclusively.

Regarding working status, half of the mothers were employed, and the other half were not, each accounting for 10 (50%). In both working and non-working mothers groups, 9 (90%) successfully breastfed exclusively. In terms of parity, the majority (n=12, 60%) had given birth once, with 11 (91.7%) mothers successfully breastfeeding exclusively. For parity of 2-3 times, 6 (85%) mothers successfully breastfed exclusively. Mothers who are unable to breastfeed their babies cited stress and fear of COVID-19 transmission to their babies as primary reasons.

Based on the research findings in Table 2, most infants did not exhibit symptoms of COVID-19, with 13 (65%), and all 13 (100%) mothers in this category successfully breastfed exclusively. The analysis indicates a significant relationship between the symptoms of COVID-19 in infants and the success of exclusive breastfeeding, with a p-value of 0.042.

Regarding lactation, the majority of participants (n=17, 85%) reported no reduction in breast milk production. Among these mothers, 16 (94.1%) successfully practiced exclusive breastfeeding. However, statistical analysis revealed no significant association between breast milk production and exclusive breastfeeding success (p=0.144). Support from husbands/family showed a significant impact, with 16 (80%) cases of sufficient support resulting in 16 (100%) successful cases of exclusive breastfeeding. The analysis indicates a significant relationship with a p-value of 0.003.

On the other hand, support from healthcare professionals did not show a significant relationship with exclusive breastfeeding success, as indicated by a p-value of 0.456.

Tabel. 1 Characteristics of Respondents

Variable	Adherence to 6-Month Exclusive Breasfeeding					
	No		Yes		Total	
	n = 2	%	n = 18	%	n = 20	%
Age (Years)						
< 20th or > 35th	0	0	3	100	3	15
≤ 35th	2	11.80	15	88.20	17	85
Education						
Primary/No formal education	1	33.30	2	66.70	3	15
Secondary (SMP/SMA)	1	10	9	90	10	50
Higher Education	0	0	7	100	7	35
Working status						
Working	1	10	9	90	10	50
Not working	1	10	9	90	10	50
Parity						
1 time	1	8.30	11	91.70	12	60
2-3 times	1	14.30	6	85.70	7	35
4 times or more	0	0	1	100	1	5

Source: Primary Data, 2022

Table 2. Factors Influencing the Adherence to 6-Month Exclusive Breasfeeding Among COVID-19 Survivor Mothers

Variable	Breastfeeding Adherence						*p-value*
	No		Yes		Total		
	n = 2	%	n = 18	%	n = 20	%	
Symptoms of Covid in Infant							
No	0	0	13	100	13	65	0.042
Yes	2	28.60	5	71.40	7	35	
Breast Milk Production							
Not Reduced	1	5.90	16	94.10	17	85	0.144
Reduced	1	33.30	2	66.70	3	15	
Support from Husband/Family							
Insufficient	2	50	2	50	4	20	0.003
Sufficient	0	0	16	100	16	80	
Support from Healthcare Professionals							
Insufficient	2	12.50	14	87.5	16	80	0.456
Sufficient	0	0	4	100	4	20	

Source: Primary Data, 2022

DISCUSSION

The result of a study by Chertok Azulay Ilana, et al, 2022 indicates a decline in exclusive breastfeeding rates in the WHO European Region during the COVID-19 pandemic. Employing the socio-ecological model to identify factors linked with breastfeeding outcomes enables a comprehensive and holistic approach to addressing breastfeeding needs among women across the region. These findings highlight the need to enhance breastfeeding support and protect exclusive breastfeeding among mother-infant to counteract the decreasing exclusive breastfeeding rates. Breastfeeding mothers had limited access to support systems throughout the pandemic. Although emotional, instrumental, and appraisal support regarding exclusive breastfeeding practices were found to be statistically insignificant, mothers who practiced exclusive

breastfeedingreceived higher levels of informational support. During the COVID-19 pandemic, informational support was a crucial factor in achieving successful exclusive breastfeeding practice.[17]

The COVID-19 pandemic has had a significant psychological impact on breastfeeding mothers. According to a research survey by Ceulemans et al 48.9% of breastfeeding mothers showed signs of depressive disorders, while 54% exhibited symptoms of anxiety disorders. Factors inhibiting exclusive breastfeeding, apart from maternal psychological issues, incluse lack of maternal self-confidence, insufficient knowledge, inappropriate breastfeeding techniques, and maternal health problems. hese factors can result in decreased production of oxytocin, the hormone responsible for breast milk secretion, potentially leading to insufficient milk supply. When infants younger than six months experience inadequate breast milk intake, they may cry more frequently. This situation often prompts mothers to introduce supplementary foods such as porridge, bananas, honey, or other solid foods, contrary to exclusive breastfeeding recommendations. Maternal breastfeeding behaviors are frequently influenced by existing habits or sociocultural beliefs trusted by the mother.[18]

The analysis reveals a correlation between the presence of COVID-19 symptoms in infants and the adherence to 6-month exclusive breastfeeding, with a p-value of 0.042. In cases where mothers are confirmed positive for COVID-19, their infants are categorized as high-risk. Consequently, these infants undergo SARS-CoV-2 RT-PCR testing on days 1 and 14 postpartum. If the infant's test results are negative or pending, isolation protocols are implemented and maintained until the mother's recovery is confirmed..[19,20] Lactation is maintained through expressed breast milk, with the mother using a mask during expression. Stringent hygiene measures for hands, containers, and breast pumps are emphasized. The expressed breast milk is administered by a healthy caregiver following proper protocols. Post recovery from COVID-19, breastfeeding continues with consistenly, adhering to health protocols. In the event of a positive confirmation of COVID-19 in the infant, both the infant and mother undergo isolation procedures until recovery, with the infant receiving separate or combined care. Emotional support, instrumental, appraisal and information regarding exclusive breastfeeding must be provided as associated supports to continue breastfeeding. Notably, mothers who practice exclusive breastfeeding report receiving higher levels of informational support. The informational support factor during the pandemic period has been identified as crucial for achieving successful exclusive breastfeeding practices.[21]

The analysis indicates that most mothers show no reduction in breast milk production, with 17 (85%) indicating no reduction, and 16 (94.1%) successfully practicing exclusive breastfeeding. The analysis, however, suggests no significant correlation between breast milk production and the success of exclusive breastfeeding, with a p-value of 0.144. Mothers with infants and toddlers generally focus on ensuring sufficient breast milk production for their children, recognizing it as a primary builder of antibodies. Strategies for enhancing lactation include the consumption of specialized nursing supplements and maintenance of balanced nutrition. Addressing concerns perceived by breastfeeding mothers constitutes a primary focus, emphasizing the need for clear communication regarding lactation practices during the pandemic. Consequently, targeted education and problem-solving support are essential for breastfeeding mothers facing the challenges associated with the COVID-19 pandemic.[22,23] Recent research indicates that breastfeeding duration of most woman was not infuenced by the pandemic. However, the same studies found that a minority of subjects experienced either shortened or extended breastfeeding periods.[24,25]

Results from the present research affirm a significant correlation between support from husbands/family in exclusive breastfeeding, with p-value of 0.003. The breastfeeding mothers in this study reported benefiting from spousal support, which encompasses emotional backing, visible expressions of joy from the partner during breastfeeding sessions, comfort provision when the mother experiences fatigue, and the maintenance of a positive atmosphere by the partner. Furthermore, informative and instrumental support from the partner, including assertions of the superiority and

practicality of breastfeeding over formula feeding, and ensuring the provision of nutritious food for the lactating mother, significantly contribute to the success of exclusive breastfeeding practices. Family support, particularly from the husband, emerges as a crucial factor in the success of exclusive breastfeeding.

The role of family support, especially from the husband, is highlighted as pivotal in transforming the mother's attitude towards positive changes.[26] The results of other research state the COVID-19 pandemic has had a discernible impact on the decision-making processes concerning infant and young child feeding practices within Mexican households. This impact is typified by the irregularity in governmental communication and the widespread prevalence of misconceptions within the community, particularly among socioeconomically disadvantaged families. These circumstances heighten the risk of families refraining from initiating or sustaining breastfeeding during the pandemic. The amelioration of these social inequities necessitates targeted interventions designed to enhance breastfeeding practices and attain the long-term health benefits associated with breastfeeding.[27] Family support encompasses attitudes and actions taken by supportive family members who accept the conditions of other family members and are prepared to provide assistance when needed. Forms of family support include informational, appraisal, instrumental, and emotional support. The majority of mothers who successfully practice exclusive breastfeeding report receiving good family support.[17]

Conversely, in the present study, the analysis of support from healthcare professionals during breastfeeding shows limited support, with 16 (80%) indicating insufficient support and 14 (87.5%) successfully practicing exclusive breastfeeding. The analysis suggests no significant correlation between support from healthcare professionals during breastfeeding and the success of exclusive breastfeeding, with a p-value of 0.456. Common reasons for discontinuing breastfeeding include inadequate healthcare support, physical challenges such as fatigue, insufficient milk supply, and pain.[28] The pandemic of COVID-19 has influenced decisions to discontinue breastfeeding, with respondents expressing concerns about inadequate face-to-face support, pprehensions regarding the safety of breastfeeding during the pandemic, and misinformation from some healthcare professionals suggesting that breastfeeding may not be safe in the context of COVID-19. The lack of accurate informationfrom healthcare providers during prenatal check-ups or upon discharge about breastfeeding contributes to the misconception that formula feeding is equivalent to or superior to breastfeeding. This insufficient guidance from healthcare professionals during pregnancy check-ups or at the time of discharge is a significant factor influencing the decision to cease breastfeeding.[29,30]

CONCLUSION AND RECOMMENDATION

Based on the research findings, it has been determined that there are factors influencing the success of exclusive breastfeeding among mothers recovering from COVID-19. The analysis results indicate a relationship between COVID-19 symptoms in infants and the success of exclusive breastfeeding with a p-value of 0.042. Regarding breast milk production, the analysis results indicate no significant relationship between breast milk production and the success of exclusive breastfeeding, with a p-value of 0.144. As for the support factor, the analysis results reveal a relationship between spousal/family support and the success of exclusive breastfeeding, with a p-value of 0.003. However, in the case of support from healthcare professionals (nurses), the analysis results show no significant relationship with the adherence of exclusive breastfeeding, with a p-value of 0.456.

For future researchers, investigating other factors that may influence the adherence of exclusive breastfeeding among mothers who have recovered from COVID-19 is recommended. Infant protection against SARS-CoV-2 infection may be conferred by vaccination and continued breastfeeding. It is imperative that the isolation of new mothers, as experienced during the current pandemic, is not repeated in future public health crises. Optimizing breastfeeding during COVID-19 can be achieved by prioritizing lactation support and perinatal care, including the maintenance of in-person services where possible. High levels of support from various

stakeholders, including healthcare professionals, family members, and social networks, are crucial for mothers practicing exclusive breastfeeding. However, maternal and infant health issues, as well as sociocultural factors, have been identified as potential barriers to exclusive breastfeeding practices.[31]

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AUTHOR CONTRIBUTIONS

UL (Author and Content Development): UL is responsible for conceiving the manuscript, designing it, defining the intellectual content, conducting literature research, clinical studies, data analysis, statistical analysis, and manuscript review.

NR (Manuscript Preparation): NR is responsible for preparing the manuscript, editing the manuscript, and reviewing the manuscript for accuracy and coherence.

AHK (Data Acquisition and Analysis): AHK is tasked with data acquisition, data analysis, and reviewing the manuscript. UL = Ulfatul Latifah; NR = Nora Rahmanindar; AHK = Ardhi Henda Karmandika.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. WHO dan PHEOC Kemenkes. Situasi Terkini Perkembangan Coronaviris Diseasea (COVID-19) 25 November 2021. (2021).
2. Al-Awadhi AM, Alsaifi K, Al-Awadhi A, Alhammadi S. Death and Contagious Infectious Diseases: Impact of the COVID-19 Virus on Stock Market Returns. *Journal of Behavioral and Experimental Finance.* 2020;27:100326. https://doi.org/10.1016/j.jbef.2020.100326
3. Anas Ma'ruf, yoeyen aryanti, wardah, marlina indah, *et al*. Indonesia Health Profile 2020. Kementerian Kesehatan RI; 2021.https://media.neliti.com/media/publications/554203-efektivitas-penerapan-vidio-dan-leaflet-c9aab682.pdf
4. Bhadra A, Mukherjee A, Sarkar K. Impact of population density on Covid-19 Infected and Mortality Rate in India. *Modeling Earth Systems And Environment.* 2021;7(1):623–629. https://doi.org/10.1007/s40808-020-00984-7
5. UNICEF, WHO. World Breastfeeding Week. WHO; 2022. https://www.who.int/indonesia/news/detail/01-08-2022-world-breastfeeding-week--unicef-and-who-urge-greater-support-for-breastfeeding-in-indonesia-as-rates-decline-during-covid-19
6. Perl SH, Uzan-Yulzari A, Klainer H, et al. SARS-CoV-2–Specific Antibodies in Breast Milk After COVID-19 Vaccination of Breastfeeding Women. *JAMA*. 2021;325(19):2013–2014. https://jamanetwork.com/journals/jama/fullarticle/2778766
7. Kumar, R. *et al.* SARS-CoV-2 Infection During Pregnancy And Pregnancy-Related Conditions: Concerns, Challenges, Management and Mitigation Strategies–A Narrative Review. *Journal of Infection and Public Health.* 2021;14(1):863–875. https://doi.org/10.1016/j.jiph.2021.04.005
8. World Health Organization. Scientific Brief: Breastfeeding and COVID-19. WHO; 2020. https://reliefweb.int/report/world/scientific-brief-breastfeeding-and-covid-19-23-june-2020
9. Mohamed BY, and Kissimova-Skarbek, K. Economic Evaluation of Home-Based Counselling to Promote Exclusive Breastfeeding in Egypt. 2022:1–49. https://doi.org/10.21203/rs.3.rs-

1450911/v1

10. Galindo-Sevilla NDC, Contreras-Carreto NA, Rojas-Bernabé A, Mancilla-Ramírez J. Breastfeeding and COVID-19. *Gaceta Medica De Mexico.* 2021;152(2):201–208. https://doi.org/10.24875/gmm.20000665
11. Vassilopoulou, E. *et al.* Breastfeeding and COVID-19: From Nutrition to Immunity. *Frontiers in. Immunology.* 2021; 12:661806. https://doi.org/10.3389%2Ffimmu.2021.661806
12. Purnama Y, Dewiani K, Yusanti L. Pemutusan Rantai Penularan Covid-19 Pada Ibu Hamil, Nifas dan Menyusui di Kecamatan Ratu Agung Kota Bengkulu. *Dharma Raflesia: Jurnal Ilmiah Pengembangan Dan Penerapan IPTEKS.* 2020;18(2):190–198. https://doi.org/10.33369/dr.v18i2.13170
13. Avsar G, Kasikci M, Yagci N. Hand Washing of Nursing Students: An Observational Study. *International Journal of Caring Sciences.* 2015;8:618–624. https://www.proquest.com/scholarly-journals/hand-washing-nursing-students-observational-study/docview/1732805688/se-2.
14. Levin, K. A. Study Design III: Cross-Sectional Studies. *Evidence-based Dentistry.* 2006;7(1):24–25. https://doi.org/10.1038/sj.ebd.6400375
15. Qian, X. *et al.* Changes in Distributions of Waist Circumference, Waist-To-Hip Ratio and Waist-To-Height Ratio Over an 18-Year Period Among Chinese Adults: A Longitudinal Study Using Quantile Regression. *BMC Public Health.* 2019;19(1):700. https://doi.org/10.1186/s12889-019-6927-6
16. Chertok, I. A. *et al.* Factors Associated with Exclusive Breastfeeding at Discharge During The COVID-19 Pandemic in 17 WHO European Region Countries. *International Breastfeeding Journal.* 2022; 17(1):83 https://doi.org/10.1186/s13006-022-00517-1
17. Agrina A, Afandi D, Suyanto S, et al. Analysis of Supporting Factors Associated with Exclusive Breastfeeding Practice in the Urban Setting during the COVID-19 Pandemic. *Children (Basel).* 2022; 2022;9(7):1074. https://doi.org/10.3390/children9071074
18. Ceulemans M, Foulon V, Ngo E, et al. Mental Health Status of Pregnant and Breastfeeding Women During the COVID-19 Pandemic-A Multinational Cross-Sectional Study. *Acta Obstetricia Et Gynecologica.* 2021;100(7):1219-1229. https://doi.org/10.1111/aogs.14092
19. Masruroh, N., Rizki, L. K., Ashari, N. A. & Irma, I. Analisis Perilaku Ibu Menyusui dalam Memberikan ASI Eksklusif di Masa Pandemi Covid 19 di Surabaya (Mix Method). *Muhammadiyah Journal of Midwifery.* 2022;3(1):1-10. https://jurnal.umj.ac.id/index.php/MyJM/article/view/10443
20. Safitri, M. G. & Citra, A. F. Perceived Social Support Dan Breastfeeding Self Efficacy Pada Ibu Menyusui Asi Eksklusif. *Jurnal Psikologi.* 2019;12(2);108–111. http://dx.doi.org/10.35760/psi.2019.v12i2.2436
21. Felicia, F. V. Manajemen Laktasi di Masa Pandemi COVID-19. *Cermin Dunia Kedokteran.* 2020;47(9):691-693. https://cdkjournal.com/index.php/cdk/article/view/568
22. Selfy Rosida Bakker, Utami TA, Paramitha Wirdhani Ningsih. Hubungan Karakteristik dan Pengetahuan Ibu dengan Keberhasilan Menyusui Eksklusif pada Masa Pandemi Covid-19 di Puskesmas Alak Kupang. *Media Publikasi Promosi Kesehatan Indonesia.* 2023;6(3):482-489. https://doi.org/10.56338/mppki.v6i3.2969
23. Fitria, A., Pa, M. & Wahyuni, S. Efektifitas Perawatan Payudara terhadap Produksi ASI pada Ibu Nifas. Proceeding Book Seminar Nasional Interaktif dan Publikasi Ilmiah. *Prosiding Kebidanan: Seminar Nasional "Bidan Kuat Bidan Maju"*.2022:1(2). https://journal.umtas.ac.id/index.php/prosidingkeperawatan/article/view/1987
24. Dewi, Dewa A. D. K., and Dinar Lubis Tingkat Pengetahuan dan Sikap Remaja Putri Tentang Kehamilan Usia Dini di Kota

Denpasar. *Archive of Community Health* 2012;1(1):63–68. https://media.neliti.com/media/publications/43784-ID-tingkat-pengetahuan-dan-sikap-remaja-putri-tentang-kehamilan-usia-dini-di-kota-d.pdf

25. Magnazi, M.B., Sartena, G., Goldberg, M. et al. Impact of The COVID-19 Pandemic on Breastfeeding in Israel: A Cross- Sectional, Observational Survey. *International Breastfeeding Journal* 2022:17(16): 1–7 (2022). https://doi.org/10.1186/s13006-022-00505-5
26. Zulaida, I. P., Nawangsari, H. & Arham, A. H. Identification of Factors that Influence Exclusive Breastfeeding During the Covid-19 Pandemic. *Midwiferia: Jurnal Kebidanan.* 2022;8(1):22–32. https://doi.org/10.21070/midwiferia.v8i1.1635
27. Vilar-Compte, M., Gaitán-Rossi, P., Rhodes, E.C. et al. Breastfeeding Media Coverage and Beliefs During the COVID-19 Pandemic In Mexico: Implications For Breastfeeding Equity. *International Journal for Equity in Health*. 2021;20:1–12. https://doi.org/10.1186/s12939-021-01588-y
28. Amir, F. Hubungan Sikap Ibu Tentang Pemberian ASI Ekslusif Pada Bayi pada Masa Covid-19 Di Puskesama Cendrawasih Makassar. *Jurnal Delima Kesehatan Pelamonia.* 2021;5(1):40–46. https://doi.org/10.37337/jkdp.v5i1.215
29. Sari, F., Aprillia, Y. T. & Mawarni, E. S. Analisis Tindakan untuk Ibu Menyusui Terkait Sikap dan Social Distancing pada Masa Pandemi COVID-19. *Muhammadiyah Journal of Midwifery.* 2023;3(2):80. https://doi.org/10.24853/myjm.3.2.80-88
30. Wanjohi, M., Griffiths, P., Wekesah, F. et al. Sociocultural Factors Influencing Breastfeeding Practices in Two Slums in Nairobi, Kenya. *International Breastfeeding Journal.* 2017;12(5):1–8. https://doi.org/10.1186/s13006-016-0092-7
31. Winda Gaolis Putri Br. Manurung, Yulia Irvani Dewi & Erika. Gambaran Faktor Pendukung dan Penghambat dalam Pemberian Asi Eksklusif Di Klinik Laktasi Masa Pandemi Covid-19. *Health Care: Jurnal Kesehatan.* 2023:12(1);56-67. https://doi.org/10.36763/healthcare.v12i1.284

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Risk of Vitamin D Deficiency in Smokers: Mix-Method

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ABSTRACT
Cigarettes are one of the leading causes of death in the world and Indonesia. Cigarettes emit cigarette smoke, which contains toxins and has pro-inflammatory properties that interfere the metabolism of vitamin D in the lungs. The study aimed to determine the risk of vitamin D deficiency in active smokers in Rungkut Village, Surabaya City. This research method is a mix-method with a Convergent Parallel Design type strategy, which is a way of collecting quantitative (cross-sectional) and qualitative data (interpretative phenomenological analysis) simultaneously, with purposive sampling technique. The variable was the risk of vitamin D deficiency and vitamin D level. Subjects were active smokers aged ≥19 years in the Rungkut Subdistrict. The number of samples involved in this research was 125 samples in the quantitative phase, and 15 people in the qualitative phase. The highest level of smoking severity was light smokers (45.60%). Most of respondents had normal vitamin D levels (≥20 μg/mL) of 73.33%, averaging of 37.66 ± 5.89 μg/mL. Most active smokers are at risk of vitamin D deficiency. Risk factors for deficiency in heavy smokers are not consuming foods containing vitamin D (such as fish, eggs, and milk), not consuming fish oil supplements and vitamins, and not sunbathing. However, the level of physical activity tended to be moderate-heavy. The conclusion is that smokers must pay attention to their intake of foods containing vitamin D and exposure to sunlight to achieve sufficient vitamin D levels.

INTRODUCTION

Indonesia is in third place with the most significant number of smokers in the world after the People's Republic of China (PRC) and India. It is estimated that by 2030 the number of smokers in the world and the death rate will reach up to 10 million, of which 70% will come from developing countries. Currently, 50% of the death rate among smokers in the world has come from developing countries.[1] The number of deaths due to smoking is predicted to continue to increase every year because the main ingredient in cigarettes is tobacco.[2] The main substance in tobacco, namely nicotine, has a relaxing effect, making it addictive for users. The chemical poisons contained in cigarette smoke can be easily transferred from the lungs to the bloodstream and even spread to almost every organ of the human body.[3]

Systemically, exposure to cigarette smoke can disrupt vitamin D metabolism and damage tubules in the kidneys and liver. Cigarette exposure reduces 25(OH)D and 1,25(OH)2D levels by 10%.4 Cigarettes can also cause dryness and shrinkage of the skin, where skin synthesis is the primary source of vitamin D in humans.[4] Cigarette smoke contains toxic aldehydes that can influence the inflammatory response by increasing the production of pro-inflammatory cytokines.[5] Additionally, it has pro-inflammatory properties that can weaken host cells in the human body and disrupt the metabolism of vitamin D in the lungs,[6,7] leading to an accelerated decline in lung function.[8]

In recent years, research has shown an increase in the prevalence of vitamin D deficiency in countries near the equator, where there is abundant exposure to sunlight.[9]

Sun exposure is the most sustainable solution to the widespread issue of vitamin D deficiency, particularly in tropical regions. Despite the abundant sunlight in countries considered a paradox,[9] like Indonesia, there is a high prevalence of vitamin D deficiency.[10,11] A Hartung-Knapp-Sidik-Jonkman method meta-analysis revealed that vitamin D deficiency is a significant public health concern in Indonesia.[12] Research by Suryadinata and Lorensia in Indonesia demonstrated a link between vitamin D deficiency and smoking habits.[13] Respiratory diseases are commonly associated with vitamin D deficiency. This study aimed to assess the risk of vitamin D deficiency among active smokers in the Rungkut District of Surabaya City, located in the eastern part of Surabaya, with a large population of 833,426 people. Rungkut District is densely populated and includes worker residential areas, such as cigarette factories.[14]

MATERIAL AND METHOD

This research is a mixed-methods study that combines quantitative and qualitative data. The design strategy employed is convergent parallel design. The quantitative aspect involves descriptive analysis using a Cross-Sectional Study approach, while the qualitative aspect utilizes Interpretative Phenomenological Analysis (IPA) techniques for data analysis. The study was conducted in Rungkut Village, Surabaya City, from April to July 2023. The research adhered to the code of ethics with No. 160/KE/VI/2023 by Universitas Surabaya, Surabaya.

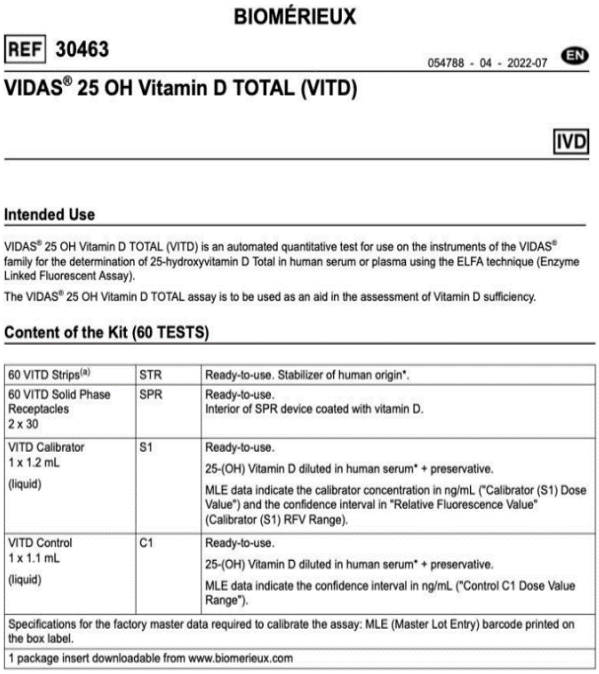
Smokers are adults who have smoked at least 100 cigarettes in their lifetime and currently smoke every day.[15] Smoking classification based on the Brinkman Index is divided into three categories: light smokers (0-199), moderate smokers (200-599), and heavy smokers (≥600). The Brinkman index formula is calculated by multiplying the number of cigarettes smoked daily (sticks) by the number of years of smoking (years).[16,17] Vitamin D deficiency occurs when the body lacks sufficient vitamin D intake. Most experts consider a 25(OH)D concentration below 25 or 30 nmol/L indicating an increased risk of vitamin D deficiency. A concentration of 50 nmol/L or higher is considered within the normal health range.[18,19] The study population was adult male active smokers in Rungkut Subdistrict, Surabaya City. The sample included male active smokers aged 19-60 years, with no chronic lung disease, who had been smoking for the last 5 years, and were willing to participate in the research. The total number of active adult smokers in the Rungkut Subdistrict was 125 respondents. Data was collected from residents who attended a health education session at the RW hall facilitated by the local RT head in April 2023. For this quantitative study, the minimum sample size was calculated using the Slovin formula, n=N/[1+Ne2] with a sampling error (e) of 5%. The minimum sample size (n) for this research was 95 respondents. The sampling method used was purposive sampling. In the

qualitative phase, data collection continued until data saturation was achieved.

The method used in this research is Mixed-Method, which can simultaneously collect quantitative and qualitative data. The qualitative phase of the mix-method aims to produce a more complete and in-depth picture of the phenomenon. In the initial stage, quantitative methods were used to measure active smokers' vitamin D deficiency risk. These risk factors were described from domains, including smoking history, diet, vitamin/supplement intake, sun exposure, frequency of gadget screens, and physical activity. Data collection began based on adapting the Vitamin D Deficiency Risk Questionnaire.[4,10,20,21] This research used a questionnaire consisting of 12 closed questions and several open questions. Questions in the vitamin D deficiency risk questionnaire included cigarette use, consumption of foods containing vitamin D (consumption of food from fish, eggs, and milk, which was assessed from the question points in the questionnaire, including the frequency and method of serving food), vitamin D supplements, exposure to sunlight, exposure to gadget radiation, and physical activity. The validity test in this questionnaire only extends to the development of sentences and language because each question item only contains short (closed) questions. In filling out the questionnaire in this study, respondents can fill in each question that has been provided.

Measurement of Vitamin D (25(OH)D) levels in human serum uses VIDAS® 25 OH Vitamin D TOTAL (VIT D), an automated quantitative test employing the ELFA (Enzyme-Linked Fluorescent Assay) technique (Figure 1). VIDAS® 25 OH Vitamin D TOTAL is employed to evaluate Vitamin D sufficiency. A certified laboratory collected 3 ml blood samples from respondents, followed by a blood sample taken at a standardized laboratory in Surabaya.

Quantitative methods are used to obtain measurable data that can be descriptive. The quantitative data in this research is for descriptive analysis. Measuring the percentage value of respondents regarding the risk of deficiency involves using simple statistical data, with the resulting percentage value calculated using the Statistical Package for Social Science (SPSS) program. After the quantitative data collection is complete, qualitative data is gathered in the form of an in-depth examination of the risk factors for vitamin D deficiency in various domains, including cigarette smoking, intake of foods containing vitamin D (such as fish, eggs, milk, and fish oil supplements), vitamin intake, skin exposure to sunlight, screen time on gadgets, and physical activity. Qualitative data is obtained through interviews conducted with the help of an interview guide instrument.



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VIDAS® 25 OH Vitamin D TOTAL (VITD)

IVD

Intended Use

VIDAS® 25 OH Vitamin D TOTAL (VITD) is an automated quantitative test for use on the instruments of the VIDAS® family for the determination of 25-hydroxyvitamin D Total in human serum or plasma using the ELFA technique (Enzyme Linked Fluorescent Assay).

The VIDAS® 25 OH Vitamin D TOTAL assay is to be used as an aid in the assessment of Vitamin D sufficiency.

Content of the Kit (60 TESTS)

60 VITD Strips[a]	STR	Ready-to-use. Stabilizer of human origin*.
60 VITD Solid Phase Receptacles 2 x 30	SPR	Ready-to-use. Interior of SPR device coated with vitamin D.
VITD Calibrator 1 x 1.2 mL (liquid)	S1	Ready-to-use. 25-(OH) Vitamin D diluted in human serum* + preservative. MLE data indicate the calibrator concentration in ng/mL ("Calibrator (S1) Dose Value") and the confidence interval in "Relative Fluorescence Value" (Calibrator (S1) RFV Range).
VITD Control 1 x 1.1 mL (liquid)	C1	Ready-to-use. 25-(OH) Vitamin D diluted in human serum* + preservative. MLE data indicate the confidence interval in ng/mL ("Control C1 Dose Value Range").
Specifications for the factory master data required to calibrate the assay: MLE (Master Lot Entry) barcode printed on the box label.		
1 package insert downloadable from www.biomerieux.com		

Source: Primary Data, 2023

Figure 1. VIDAS® 25 OH Vitamin D TOTAL (VIT-D) Procedure

RESULTS

This research and data collection was conducted from April 2023 to July 2023 in Rungkut Village. Data were collected by filling in questionnaire questions and conducting interviews with respondents included in the research sample. The number of samples involved in this research was 125. All active smokers were willing to fill out a questionnaire and have their vitamin D levels measured (n=125). However, in the qualitative phase, only 15 respondents were able to be followed up and were willing to continue with in-depth interviews. Based on Table 1, 125 respondents were active smokers, with 65 respondents (52%) starting smoking in adulthood, 22 (40%) having an average normal body weight, and the highest percentage of respondents (92%) having no history of the disease.

Based on Table 1 it showed that 85 respondents (68%) were active smokers with an average of ≥10 years of smoking.23 The maximum number of cigarettes smoked per day was 11-24, with 69 respondents (55.20%). Additionally, 99 respondents (79.20%) smoked filter cigarettes. The Brinkman Index categorized 57 respondents (45.50%) as light smokers.

Based on Table 2, there were 21 respondents (16.80%) who smoked tobacco through direct smoking. Additionally, 108 respondents (86.40%) consumed fish, with 100 respondents (80%) frying it. Moreover, 117 respondents (93.60%) consumed eggs, out of which 115 respondents (92%) used chicken eggs and fried them, as reported by 94 respondents (75.20%). Furthermore, 79 respondents consumed milk (63.20%), and 25 respondents (20.00%) used packaged liquid milk. The highest frequency of respondents who did not consume fish oil supplements was 118 respondents (94.40%). Similarly, the highest frequency of respondents who did not consume vitamins was 73 respondents (58.40%). The main reason respondents consumed vitamins was due to the health benefits, with 45 respondents (36%) citing this reason. The highest frequency of respondents who often looked at gadget screens was 118 respondents (94.40%), with 49 respondents (39.20%) spending more than 7 hours on this activity. Additionally, 98 respondents (78%) were unaware of the ideal time to look at monitor screens (40%). The highest frequency of respondents who rarely engaged in physical activity was 96 respondents (76.80%), with 49 respondents (39.20%) spending more than 7 hours inactive and 96 respondents (76.80%) falling into the moderate activity category (Table 2).

Table 1. Frequency Distribution of Respondents Based on Age, BMI, and Smoking Profiles

Characteristics	n = 125	%
Age (Years)		
19-44 (Adult)	65	52
45-59 (Pre-elderly)	48	38.40
60 (Seniors)	12	9.60
Body Mass Index (BMI)[24]		
Underweight (<18.5)	12	9.60
Normal (18.5-22.9)	50	40
Overweight with risks (23- 24.9)	25	20
Obesity 1 (25-29.9)	31	24.80
Obesity 2 (≥30)	7	5.60
Disease History		
Hypertension	3	2.40
Dyslipidemia	3	2.40
Diabetes Mellitus Type 2	3	2.40
Rheumatoid Arthritis	1	0.80
No History of Illness	115	92
Long Time Smoking Cigarettes (Years)		
< 10	40	32
≥ 10	85	68
Number of Cigarettes Smoked		
1-10 cigarettes per day	47	37.60
11-24 cigarettes per day	69	55.20
≥24 cigarettes per day	9	7.20
Types of Cigarettes		
Filter	99	79.20
Kretek	20	16.00
Mixture	6	4.80
Brinkman Index		
Light smoker (0-199)	57	45.60
Medium smoker (200-600)	52	41.60
Heavy smoker (>600)	16	12.80

Source: Primary Data, 2023

Table 2. Distribution Profile of Respondents' Answers

Domain	Question	Respondent's Answer	n = 125	%
Cigarette	Have you ever consumed tobacco directly?	No	104	83.20
		Yes	21	16.80
	How do you use this tobacco?	No	104	83.20
		Inhale directly	21	16.80
		Chewed	0	0
	How do you know this?	Don't know	104	83.20
		Friends/family	13	10.40
		Environment	8	6.40
Fish	Have you ever consumed fish?	Consume	108	86.40
		Do not consume	17	13.60
	What fish do you usually eat?	Mackarel tuna	35	28
		Pindang fish	32	25.60
		Salted fish	25	20
		Milkfish	7	5.60
		Catfish	5	4
		Mujaer fish	4	3.20
	How do you serve the fish you eat?	Fried	100	80
		Burned	5	4
		Steamed	3	2.40
	What is your reason for consuming fish?	Kitchen dishes	40	32
		Love the taste	32	25.60
		Get health benefits	21	16.80
		Do not like	16	12.80
		Affordable prices	10	8
		Diet	5	4
		Allergy	1	0.80
Egg	Have you ever consumed eggs?	Consume	117	93.60
		Do not consume	8	6.40
	What eggs do you usually eat?	Chicken	115	92
		Duck	2	1.60
	How do you serve the eggs you consume?	Fried	94	75.20
		Boiled	23	18.40
	What is the reason you consume eggs?	Love the taste	82	65.60
		Get health benefits	23	18.40
		Kitchen dishes	9	7.20
		Don't consume	7	5.60
		Cheap/affordable prices	3	2.40
		Diet	1	0.80
Milk	Do you consume milk?	Consume	79	63.20
		Do not consume	46	36.80
	What milk do you usually consume?	Packaging (liquid)	25	20
		Condensed milk (sachet)	22	17.60
		Real milk	20	16
		Powder	12	9.60
	What is the reason you consume milk?	Health benefits	50	40
		Love the taste	29	23.20
Fish Oil Supplements	Do you take fish oil supplements?	Do not consume	118	94.40
		Consume	7	5.60
	What type and brand of fish oil supplement do you consume?	Omega-3	4	3.20
		Forgot the brand	3	2.40
	How many fish oil supplements do you consume?	Capsule	7	5.60
		Teaspoon	0	0
		Tablespoon	0	0

Table 2. Distribution Profile of Respondents' Answers

Domain	Question	Respondent's Answer	n = 125	%
	Why do you take fish oil supplements?	Not accustomed to	63	50.40
		Stench	40	32
		Expensive price	15	12
		Health benefits	7	5.60
Vitamin	Do you take vitamins?	Do not consume	73	58.40
		Consume	52	41.60
	What type and brand of vitamins do you consume?	Vitacimin®	27	21.60
		Enervon-C®	7	5.60
		Hemaviton®	5	4
		Vitamin D (1000 IU)	5	4
		Imbost®	4	3.20
	The reason you take vitamins?	Don't know	73	58.40
		Health benefits	45	36
		Recommended	4	3.20
		friend/doctor	3	2.40
Changes in Skin Color	Does your skin color change when exposed to direct sunlight?	No	68	54.40
		Yes	57	45.60
	What changes does your skin color look like when exposed to sunlight?	No	40	32
		Blackish red	20	16
		Red	8	6.40
Sunbathe	Do you take free time to sunbathe directly?	No	67	53.60
		Yes (eg, tanned)	58	46.40
	What time are you usually exposed to sunlight (sunbathing)?	07.00-09.00	60	48
		10.00-11.00	32	25.60
		12.00-14.00	26	20.80
		15.00-17.00	7	5.60
	Do you sunbathe using personal protective equipment?	Hat	58	46.40
		Jacket	40	32
		Without personal protection	19	15.20
		Sunscreen/sunscreen	6	4.80
		Umbrella	2	1.60
	Do you wear closed clothes?	Shirt and trousers	82	65.60
		Short t-shirt	43	34.40
Gadget Screen	Are you staring at a gadget screen such as a cellphone, laptop or tablet?	Often	118	94.40
		Rarely/not at all	7	5.60
	How long (per day) do you stare at a monitor screen such as a cellphone, laptop or tablet?	≥7 hours	49	39.20
		0-1.5 hours	32	25.60
		4-6 hours	20	16
		2-3 hours	17	13.60
	In your opinion, how long is the ideal time to stare at a monitor screen?	Don't know	98	78.40
		1-2 hours	18	14.40
		20-30 minutes	9	7.20
Physical Activity	Do you often do physical activity?	Seldom	96	76.80
		Often	29	23.20
	How often do you do physical activity?	Light	0	0
		Moderate	96	76.80
		Heavy	29	23.20

Source: Primary Data, 2023

Most of respondents had normal vitamin D levels (sufficiency) of 73.33%, with an average vitamin D level of 37.66±5.89 mg/mL. The results of the cross-tabulation between the description of vitamin D risk factors and vitamin D levels can be seen in Table 3.

When conducting interviews regarding the risk of vitamin D deficiency, 15 respondents out of 125 respondents were willing to conduct further interviews. The researcher then made interview transcripts and summarized them in table form as well as interview excerpts to further understand the interview themes so that they were in accordance with the research title (Table 4).

Table 3. Cross Tabulation Between the Risk of Vitamin D Deficiency and Vitamin D Levels

Risk of Vitamin D Deficiency		Vitamin D Serum Category (μg/mL)[31]			Total
	Domain	Deficiency (<12μg/mL) (n = 7)	Insufficiency (12-20 μg/mL) (n = 26)	Sufficiency (>20 μg/mL) (n = 92)	
Cigarette (Brinkman Index)[24]	Light smoker (0-199)	0	4	53	57
	Medium smoker (200-600)	2	12	38	52
	Heavy smoker (>600)	5	10	1	16
Fish	Consume fish that contain high levels of vitamin D	3	10	52	65
	Consume fish that do not contain high levels of vitamin D	2	7	34	43
	Do not consume fish	3	9	5	17
Egg	Consume egg	1	25	91	117
	Do not consume egg	6	1	1	8
Milk	Consume milk	2	9	68	79
	Do not consume milk	5	17	24	46
Fish Oil Supplements	Consume fish oil	4	24	90	118
	Do not consume fish oil	3	2	2	7
Vitamin	Vitamin C	0	1	36	37
	Vitamin D	0	0	5	5
	Immunomodulator	0	2	2	4
	Not taking any vitamins	7	23	49	79
Changes in Skin Color	Yes	3	13	41	57
	No	4	13	51	68
Sunbathe	Yes	4	11	43	58
	No	3	15	49	67
Gadget Screen	Often	4	24	90	118
	Rarely/not at all	3	2	2	7
Physical Activity	Light	0	0	0	0
	Moderate	4	14	78	96
	Heavy	3	12	14	29

Source: Primary Data, 2023

Table 4. In-depth Interview Results

Domain	Findings	Answer Findings	Quotes From The Interview	Source
Smoke	Respondents knew the severity of smoking	Frequency of cigarette use by respondents	"I've been smoking for more than 15 years, so what's strange is that I can't really stop. Just stop when you cough, then try again with one cigarette, if you cough, throw it away and change to another brand of cigarette, and so on, sis."	Respondent 7
			"Usually I use official cigarettes from factories such as salt warehouses and every day I use up more than 20 cigarettes. I've been smoking for more than 15 years."	Respondent 1
			"I use cigarettes and the brand varies depending on the price, but I usually use 1 pack of solar a day, and I smoked when I was single, around 25 years after graduating from high school, sis."	Respondent 9
			"You don't know how to smoke, sis, sometimes Surya sometimes uses DJI Samsoe. "I've been smoking since I was 18 years old, sis, and now I'm 52 years old."	Respondent 11
	Respondents' views on cigarette use	Views of cigarettes on health by respondents	"For example, if I don't smoke, sis, I'm stressed because my job is uncertain. So, if I smoke, it just feels calmer in my mind, sis."	Respondent 2
			"I don't smoke, or if I just stop for a day, I'll get a headache, but if I smoke just one cigarette, my body will immediately feel better, sis, so I think that smoking isn't completely dangerous because according to my father, cigarettes are medicine."	Respondent 4
Tobacco	Respondents know their knowledge and behavior regarding tobacco use	Tobacco use by respondents	"Previously, I used to smoke tobacco straight away, sis, because in the past tobacco was cheaper than cigarettes, and I knew how to do it when my friends told me to use tobacco."	Respondent 13
			“In the past, I used tobacco directly, sis, by smoking it. "I knew about tobacco because I was told by a friend and forced by a friend to try it. After a while, I became addicted to it and then I tried to replace it with cigarettes."	Respondent 8
			"When I'm in a crisis, I usually use tobacco, sis, because it's cheaper and the way to do it is to smoke it directly. I know that method, I was given tips from my father for using tobacco too."	Respondent 5
Fish	Respondents know the behavior and amount of fish consumed	Respondents explained their fish consumption habits	"I like fish but I don't know how to eat it, sis, sometimes once a week, often twice at most. "I like it when the fish is fried, but more often I like to eat fish steamed in banana leaves."	Respondent 6

Table 4. In-depth Interview Results

Domain	Findings	Answer Findings	Quotes From The Interview	Source
			"I like to eat fish, but I can't guarantee that it will be every day depending on my wife's business in the kitchen, sis, usually once a week."	Respondent 8
	Respondents know their views on fish consumption habits	Respondents explained the benefits of consuming fish	"Actually, there is no benefit from fish, it's just a complement to food and just increases your appetite, sis."	Respondent 15
			"I like fish, sis, because the benefits of fish are that it is delicious as a complement to food and makes you full, sis."	Respondent 13
			"Because you really like eating fish because the benefits are actually good for your health, sis."	Respondent 11
Egg	Respondents' views on behavior and habits of consuming eggs	Respondents explained their egg consumption habits and views on eggs	“I like eggs, sis, but they contain diabetes, so at my age I cut back on them, sis. So I just eat boiled egg whites and discard the yolks and I eat them often every day, usually mixed with vegetables, because my wife makes that menu, sis."	Respondent 7
			"I like eggs, but I usually eat salted eggs when they are served because I like them. Eggs are good for the strength of your voice and are good for your health."	Respondent 3
			“I also often eat fried eggs, usually twice a week, and now I've switched to salted eggs, sis. "The reason is that I like eggs and they have good health benefits, but if the portion is too big, it's not good, sis."	Respondent 11
	Respondents found out their views on the habit of consuming eggs	Respondents explained the benefits of consuming fish	"Eggs are just a food supplement, so they have no health benefits."	Respondent 2
Milk	Respondents understand the behavior and benefits of milk	Respondents explained their milk drinking habits and views on the benefits of milk	"Sometimes I drink Frisian flag milk twice a week and if I drink too much I'm afraid because it contains sugar, sis. I actually prefer whole milk but I don't buy it because it's more expensive, sis. And I think the benefits of milk are good for health and increase energy."	Respondent 5
			"I also drink Anlene milk 3x a week because of its benefits for bones and usually relieves fatigue."	Respondent 11
	Respondents' views on milk consumption behavior		“I consume milk almost every day, sis, and usually I consume canned milk. "Drinking milk is just for warming the body and the benefits are only for warming the body, sis."	Respondent 12
	Respondents understand the	Respondents explained the	"I also consume the milk from Indomaret, usually it's the Frisian flag	Respondent 9

Table 4. In-depth Interview Results

Domain	Findings	Answer Findings	Quotes From The Interview	Source
	behavior and benefits of milk	behavior and benefits of consuming milk	brand which is low fat, but that's rare, sis, especially if you want it, sis. "It has good health benefits because it contains lots of vitamins."	
Supplement oil fish	Respondents knew the behavior and benefits of fish oil supplements	Views on fish oil supplements by respondents	"I don't take supplements because I don't know the benefits and I don't have the time, sis, because I think I already get enough vitamins from vegetables and fruit."	Respondent 8
		Views on the taste and benefits of oil supplements by respondents	"I don't like drinking fish oil because it tastes fishy even though it has benefits for increasing appetite."	Respondent 1
			"I know that it is useful for stamina, but I don't like taking fish oil supplements because I don't like the fishy taste."	Respondent 5
			"I don't take fish oil supplements because I have a stomach ailment, sis, so I don't like anything strange, especially fish oil supplements because it's fishy and makes me nauseous, even though the benefits are actually good for the body, the effect is only short-lived, sis."	Respondent 7

Source: Primary Data, 2023

DISCUSSION

The results obtained from filling out a questionnaire by 125 respondents were followed by interviews with 15 respondents regarding the risk of vitamin D deficiency in active smokers. This research focuses on exploring and exploring the risk of vitamin D deficiency, starting with the domain regarding smoking, the domain regarding sources of vitamin D, the sunlight exposure domain, the radiation domain, and the physical activity domain.

Based on the data obtained, 125 respondents were active smokers, most of whom smoked for more than 10 years, with the highest number of cigarettes smoked in a day ranging from 11-24 cigarettes, so it can be seen that active smokers in Rungkut Village can be categorized as light smokers, with a respondent frequency of 57 respondents. This relatively high number of smokers is in line with previous research by Salsabila et al.25, Central Java, Yogyakarta, East Java, Bali, NTB, South Kalimantan and South Sulawesi), there were 12,591 research subjects. Based on age, smokers in Indonesia have a median of 38 years. Based on gender, the majority of smokers in Indonesia are men, namely 11,908 people (95%). The type of cigarette most frequently used is filtered kretek cigarettes with an average of 12 cigarettes/day. Indonesia is the country with the highest number of smokers in ASEAN. In South Asia, smoking tobacco (25.2%) and smokeless tobacco (24.7%) is a widespread habit among men. Data from a nationally representative cross-sectional study (Demographic and Health Survey) conducted in Afghanistan, India, Maldives, Nepal and Pakistan from 2015–2018. The subjects were men between 15 and 49 years old. Results found that higher age, lower education, lower wealth status, and involvement in any occupation were strongly associated with smoking (p-value <0.001).[26]

Cigarette smoke has pro-inflammatory properties which can weaken host cells in the body and can interfere with the metabolism of vitamin D in the lungs. This is supported by previous research which shows that cigarette smoke can disrupt the potential pathways of the endocrine system so that it can trigger vitamin D deficiency.[6] Previous research by Yang et al., shows smokers have lower vitamin D

concentrations than non-smokers. So, smokers can trigger a more significant vitamin D deficiency than non-smokers.[4] Based on interviews conducted, respondents were asked for their reasons for smoking cigarettes. As for respondents who said that cigarettes are something that can relieve and reduce pain or have a calming effect on users (Table 4). From the results of the quote above, several respondents experience stress and even dizziness if they do not smoke and think that cigarettes can relieve stress or dizziness. This is supported by previous research that cigarettes can have a positive impact by eliminating stress and dizziness and providing a sense of calm against disturbing thoughts. The nicotine content in cigarettes gives users peace of mind.[27]

In general, conventional tobacco can be used as smoked tobacco or smokeless tobacco. Apart from cigarettes, tobacco is consumed in other forms such as loosely chewed tobacco leaves, snus, naswar, gutka tobacco, and tobacco paste. Scientific analysis of these smokeless tobacco products has revealed more than 20 chemical compounds known to be cancer-causing agents, which include tobacco-specific nitrosamines, N-nitrosamine acids, volatile N-nitrosamines, polycyclic triggering hydrocarbons, and aldehydes.[28] There are several interview quotes above that the price of using tobacco is cheaper than the price of cigarettes from the factory. Based on previous research, tobacco prices are more affordable because the weather makes tobacco production in Indonesia uncertain. If the quality of the tobacco is not good, the price of the tobacco will be sold cheaper.[29] Besides the price of tobacco being cheaper than factory cigarettes, rising cigarette prices will influence the high prevalence in Indonesia. This is because cigarette consumption, especially among adults, is greatly influenced by cigarette prices. The increase in cigarette prices is a preventative effort carried out by the government to reduce cigarette consumption, which currently has the highest number of smokers in the Asian region.[22]

The results showed most respondents consumed fish such as tuna, pindang fish, salted fish, milkfish, catfish, and tilapia fish. The most common way of serving fish is by frying rather than grilling or steaming. It can be seen from the interview excerpt above that respondents 6, 8, 15, 13, and 11 mostly consume fish even though some respondents have inconsistent views regarding the benefits of consuming fish (Table 4). Fish is one of the biggest contributors to vitamin D intake, such as catfish, milkfish, and snapper, which contain around 400 IU per 85 grams of fish. The frequency of fish consumption can affect the concentration of vitamin D, so frequent fish consumption can be recommended to prevent vitamin D deficiency. The process of cooking fish does not affect the vitamin D content in food products because vitamin D is resistant to heat, such as by grilling. However, the amount of vitamin D will decrease by 50% if frying uses cooking oil due to the fat-soluble nature of vitamin D.[30] Different cooking processes (fried, boiled, grilled) will affect the contents of the fish. Changes in the amount of vitamins and protein are significantly higher when fried. The change in the amount of fat will be higher in frying fish than in boiling or grilling. It was stated in this research that the cooking method by boiling is the best for healthy food.[31] A previous study by Sridonpai et al., determined the vitamin D content of commonly consumed fish in Thailand and the effect of different cooking methods on vitamin D retention.[32] The results showed that vitamin D3 was the only form of vitamin D detected in fish. The vitamin D content of raw freshwater fish ranges from 2.42 to 48.5 μg per 100 g Edible Portion (EP), higher than that of raw sea fish (2.94 to 4.69 μg per 100 g EP).32 Previous research by Andrade et al., a cross-sectional online study, was conducted among 1,637 adults.[33] Participants were considered vitamin D deficient and consumed an average of 347.05 ± 307.8 IUs of vitamin D through foods/beverages. Overall, though, participants, on average, did not meet the vitamin D RDAs (Recommended Daily Allowances) for healthy people. This is mainly related to participants rarely or never consuming foods high in vitamin D such as fish and dairy products.

The results show that most respondents consume eggs such as chicken and duck. The most common way of serving fish is frying compared to boiling (Table 4). On average, respondents consume eggs and are aware of their habits regarding egg consumption. Additionally, respondents understand the benefits of consuming eggs. Eggs are a rich source of protein containing ample amounts of

vitamin D and antioxidants, which help prevent aging by aiding in cell degradation. Vitamin D-rich eggs are found in egg yolks at 20 IU per yolk. The cooking process significantly affects the vitamin D content in eggs. According to USDA data from 2015, raw and boiled eggs contain 41 IU/50 grams of vitamin D3, while fried eggs contain 40 IU/46 grams of vitamin D3.[34] Eggs are among the few rich dietary sources of vitamin D. The results of the study by Vičič et al., revealed that fortifying eggs and milk (including yogurt) could effectively increase vitamin D intake in Slovenian women aged 44 to 65 by almost fivefold, thereby reducing the prevalence of vitamin D deficiency.[34] However, a previous study by Daly et al., evaluated the dose-response effect of consuming 2, 7, or 12 commercially available eggs per week on serum 25(OH)D concentrations. The results indicated that consuming 7 eggs per week for 12 weeks effectively reduced the decline in circulating vitamin D concentrations during winter in young Australian adults, with 12 eggs per week not providing any additional benefit.[35]

Based on the results of the questionnaire answered by respondents, it was found that 79 respondents consumed milk most frequently, using liquid packaged milk (ready to eat) and condensed milk (sachets) (Table 4). Respondents consume milk such as ready-to-eat packaged milk. Milk is a fortified product containing vitamin D. Fortified milk must contain 400 IU of vitamin D per litre, whereas pure cow's milk only has 40 IU per litre. Therefore, the best milk is milk with vitamin D fortification in the form of ready-to-eat liquid packaged milk. This research is also similar to other research by Lorensia et al., who analyzed the intake of foods containing vitamin D in 100 adults, showing that eggs and milk contain vitamin D that are most consumed almost every day (98.50%). The incidence of vitamin D deficiency is widespread worldwide, affecting individuals of all ages, including young and healthy subjects, as well as pregnant and elderly women, due to various factors such as inadequate sun exposure, skin pigmentation, adiposity, lifestyle, and low food intake.[30] To address this issue, fortification of daily consumed foods, such as milk, is highly recommended.[36] A theoretical model applied vitamin D3 fortifications of 1 µg, 1.5 µg and 2 µg/100g to simulate improvements in vitamin D intakes. Mean ± SD vitamin D3 in whole milk was 0.06 ± 0.02 µg/100g.[37] Previous research by Zhang et al., explored interaction between passive smoking and dietary undernutrition on the risk of vitamin D deficiency. The interaction between passive smoking and inadequate nutrition influences vitamin D risk D deficiency.[38] Passive smoking may amplify the effect of poor nutrition on the risk of vitamin D deficiency. The more often cigarettes one consumes, nicotine content enters CNS and CNS, putting an individual's food intake.[39] Research has been conducted on consuming foods containing vitamin D on vitamin to prevent deficiency,[30] but there has been no research linking the impact of active on the population and population, and no research no assessed that influences influencing levels through the intake of foods containing vitamin D.

Based on the results obtained, the highest frequency of respondents was found among those who did not consume fish oil supplements. Some reasons for not consuming fish oil supplements included being unaccustomed to them and disliking the fishy smell or taste associated with them (Table 4). Respondents elaborated on their reasons for not taking fish oil supplements, leading to most of respondents not taking supplements containing vitamin D. According to the results, the highest frequency of respondents was among those who did not consume vitamins (Table 4). The majority of respondents, as per the interview excerpt, do not take vitamins, despite some being aware of the benefits they offer to the body. Previous research by Lorensia and Suryadinata,[40] indicated that many individuals are hesitant to use fish oil supplements independently due to the large size of the soft capsules, which can be uncomfortable to swallow, and the fishy odor. However, this research also demonstrates that fish oil supplements are effective in enhancing lung function in smokers.[40]

The questionnaire results showed that as many as 68 respondents experienced color changes when exposed to sunlight, with the most frequent color changes occurring in blackish red. From the interview excerpts of the two respondents above, the respondents experienced changes in skin color when exposed to sunlight. This is supported by research

conducted by Carlberg,[41] skin color will change to pink or even black if the skin has received enough vitamin D. As for several other respondents who experienced something different from the previous respondents, respondents 3 and 9 did not experience changes in skin color when exposed to sunlight (Table 4). The respondent did not experience changes in skin color. The darker a person's skin color, the longer it takes to form vitamin D in the skin. According to Raymond-Lezman and Riskin,[42] in their research, they explain that someone with dark skin has large amounts of melanin in the epidermis, which will make melanin oppose vitamin D receptors in the skin. Melanin will absorb UVB light exposure, reducing the absorption of UVB light exposure for vitamin D receptors in the skin. A person with dark skin takes 10-50 times more exposure to sunlight than a person with light skin to produce the same amount of vitamin D.[42]

The results of the questionnaire showed that 67 respondents who took the time to sunbathe directly, which was mostly found at 07.00-09.00 WIB and by using personal protective equipment such as hats/jackets and long clothes (Table 4). Many respondents spend time sunbathing, but when the intensity of sun exposure is low, many respondents also use personal protective equipment and long clothing, which is at risk of experiencing a a deficiency. Respondents took time to sunbathe between 07.00-09.00 WIB and wore personal protective equipment and closed clothing. Previous research explained that the UVB intensity of sunlight is low at 07.00-08.00 WIB, while at 09.00 WIB, the intensity achieved increases, but it takes a long time of around 25 minutes to sunbathe directly. A good time to be exposed to sunlight is from 10 AM to 2 PM, because at that time UVB rays are more than UVA with a relatively stable and high intensity. However, to be able to see the adequacy of sun exposure not only at the time of exposure, the use of long clothing and personal protection also has an influence. So, it can be concluded that someone who has insufficient sun exposure and has body protection such as sunscreen, hats, jackets and long clothes will be at risk of vitamin D deficiency or vitamin D deficiency.[43]

From the results obtained, almost all respondents use gadget screens frequently (Table 4). Respondents use gadget screens for a long time, up to 7 hours or more. In the research of Shan et al.[44] the use of gadget screens is associated with physical activity on vitamin D concentrations. The time of gadget screen use has a significant relationship with a person's level of physical activity. So, screen use and physical activity are both markers of exposure to UVB rays. This is also supported by research by Rocka et al.[45] that there is a significant relationship between gadget screen use and physical activity on a person's vitamin status. A good duration of time to stare at a gadget screen is ≤2 hours/per day.

Based on the results obtained, the highest frequency of respondents was 96 respondents who carried out moderate levels of physical activity (Table 4). Respondents carried out moderate levels of physical activity such as doing housework as explained by respondents 10, 3, 13, and 14, while respondents 4 and 8 carried out heavy levels of physical activity. Vitamin D levels in the blood are related to muscles and bones and play a role in energy metabolism, oxidative stress, maintenance and increasing physical fitness.[46] The measurement of physical activity in this study only assessed physical activity from respondents' confessions but did not measure in quantitative detail the level of physical activity. Measuring physical activity quantitatively generally uses the IPAQ (International Physical Activity Questionnaire) questionnaire which was used in Indonesia by Lorensia et al.[47,48] Previous research by Lorensia et al., determine differences in lung function and levels of physical activity between smokers and non-smokers. The results show that a significant difference in lung function values was observed between smokers and non-smokers (p=0.00).[48]

CONCLUSION AND RECOMMENDATION

Most of the respondents were light smokers with normal blood levels of vitamin D. Most respondents often consume mackerel and pindang fish, even though they are served fried. Most respondents also consumed a lot of fried chicken eggs and drank bottled cow's milk. Smokers with vitamin D deficiency and insufficiency tend to have a low intake of foods containing vitamin D, such as fish, eggs and milk. Intake of fish oil and vitamin supplements is still rare. Most respondents rarely sunbathe and are

only exposed to sunlight in the morning. Respondents also use gadgets a lot and the frequency of physical activity tends to be rare and moderate.

Therefore, to reduce the risk of vitamin D deficiency, a smoker needs to improve his lifestyle by reducing the frequency of smoking, increasing his intake of foods high in vitamin D (fish, eggs, milk), increasing the frequency of exposure to sunlight, reducing the frequency of using gadgets and increasing activity physique.

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AUTHOR CONTRIBUTIONS

From the research process until the writing of this article, all authors played a role in this research. The correspondent author plays a role in compiling and designing research, the2nd acts as a data analyzer, the 3rd author acts as data collection in the field, and 4th author acts as an examiner of the clinical condition of each respondent in the field.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Tobacco Control Support Center-Ikatan Ahli Kesehatan Masyarakat Indonesia (TCSC-IAKMI). *Atlas tembakau Indonesia* 2020; 2020.
2. West R. Tobacco Smoking: Health Impact, Prevalence, Correlates and Interventions. *Psychology & Health*. 2017;32(8):1018–1036. https://doi.org/10.1080/08870446.2017.1325890
3. Varghese J, Gharde PM. A Comprehensive Review on the Impacts of Smoking on the Health of an Individual. *Cureus*. 2023;15(10):e46532. https://doi.org/10.7759/cureus.46532
4. Yang L, Zhao H, Liu K, et al. Smoking Behavior and Circulating Vitamin D Levels in Adults: A Meta-Analysis. *Food Science & Nutrition*. 2021;9(10):5820–5832. https://doi.org/10.1002/fsn3.2488
5. Dahdah A, Jaggers RM, Sreejit G, et al. Immunological Insights into Cigarette Smoking-Induced Cardiovascular Disease Risk. *Cells*. 2022;11(20):3190. https://doi.org/10.3390/cells11203190
6. Nikniaz L, Ghojazadeh M, Nateghian H, et al. The Interaction Effect of Aerobic Exercise and Vitamin D Supplementation on Inflammatory Factors, Anti-Inflammatory Proteins, and Lung Function in Male Smokers: A Randomized Controlled Trial. *BMC Sports Science, Medicine Rehabilitation*. 2021;13(1):102. https://doi.org/10.1186/s13102-021-00333-w
7. Chen YC, Sung HC, Chuang TY, et al. Vitamin D3 Decreases TNF-α-Induced Inflammation in Lung Epithelial Cells Through a Reduction in Mitochondrial Fission and Mitophagy. *Cell Biology and Toxicology*. 2022;38(3):427–450. https://doi.org/10.1007/s10565-021-09629-6
8. Tian T, Jiang X, Qin R, et al. Effect of Smoking on Lung Function Decline in a Retrospective Study of a Health Examination Population in Chinese Males. *Front Med (Lausanne)*. 2023;9:843162. https://doi.org/10.3389/fmed.2022.843162
9. Augustine LF, Nair KM, Kulkarni B. Sun Exposure as a Strategy for Acquiring Vitamin D in Developing Countries of Tropical Region: Challenges & Way Forward. *Indian J Med Res*. 2021;154(3):423–432. https://doi.org/10.4103/ijmr.IJMR_1244_18
10. Lorensia A, Suryadinata RV, Inu IA. Comparison of Vitamin D Status And Physical Activity Related With Obesity in Student. *Journal of Applied Pharmaceutical Science*. 2022;12(4):108–118. https://doi.org/10.7324/JAPS.2022.120412
11. Lorensia A, Suryadinata RV. Smoking Cessa-

tion Experience and Socioeconomic Status of Online Motorcycle Taxi Drivers in Surabaya. *Media Kesehatan Masyarakat Indonesia*. 2021;17(3):80–87. https://doi.org/10.30597/mkmi.v17i3.14059

12. Octavius GS, Shakila A, Meliani M, et al. Vitamin D Deficiency is a Public Health Emergency among Indonesian Children and Adolescents: A Systematic Review and Meta-Analysis of Prevalence. *Annals of Pediatric Endocrinology & Metabolism: apem*. 2023;28(1):10-19. https://doi.org/10.6065/apem.2244170.085
13. Suryadinata RV, Lorensia A. Frekuensi Asupan Makanan, Pengetahuan Vitamin D dan Obesitas Pada Kelompok Usia Lanjut Food Frequency, Knowledge about Vitamin D and Obesity among Elderly. *Amerta Nutrition*. 2020;4(1):43–48. https://doi.org/10.2473/amnt.v4i1.2020
14. Widyastuty AASA, Jihan JC. Tingkat Kekumuhan dan Analisis Spasial Permukiman Kumuh Perkotaan (Studi Kasus: Surabaya Timur). *Jurnal Teknik Waktu*. 2018;16(2);47–55. https://doi.org/10.36456/waktu.v16i02.1667
15. Holipah H, Sulistomo HW, Maharani A. Tobacco Smoking and Risk of All-Cause Mortality in Indonesia. *PLoS One*. 2020;15(12):e0242558. https://doi.org/10.1371/journal.pone.0242558
16. Herath P, Wimalasekera S, Amarasekara T, et al. Effect of Cigarette Smoking on Smoking Biomarkers, Blood Pressure and Blood Lipid Levels Among Sri Lankan Male Smokers. *Postgraduate Medical Journal*. 2022;98(1165):848–854. https://doi.org/10.1136/postgradmedj-2021-141016
17. Sugiura T, Dohi Y, Takagi Y, et al. Close Association between Subclinical Atherosclerosis and Pulmonary Function in Middle-Aged Male Smokers. *Journal of Atherosclerosis and Thrombosis*. 2020;27(11):1230–1242. https://doi.org/10.5551/jat.55996
18. Sutherland JP, Zhou A, Hyppönen E. Vitamin D Deficiency Increases Mortality Risk in the UK Biobank: A Nonlinear Mendelian Randomization Study. *Annals of Internal Medicine*. 2022;175(11):1552–1559. https://doi.org/10.7326/M21-3324
19. AlSubai A, Baqai MH, Agha H, et al. Vitamin D and Preeclampsia: A Systematic Review And Meta-Analysis. *SAGE Open Medicine*. 2023;11:20503121231212093. https://doi.org/10.1177/20503121231212093
20. Sherief LM, Ali A, Gaballa A, et al. Vitamin D Status and Healthy Egyptian Adolescents: Where Do We Stand?. *Medicine (Baltimore)*. 2021;100(29):e26661. https://doi.org/10.1097/MD.0000000000026661
21. Moghadasi N, Alimohammadi I, Safari Variani A, et al. The Effect of Mobile Radiation on the Oxidative Stress Biomarkers in Pregnant Mice. *Journal of Family and Reproductive Health*. 2021 Sep;15(3):172-178. https://doi.org/10.18502/jfrh.v15i3.7134
22. Nguyen CV, Le TT, Nguyen NH. The Impact of Cigarette Prices on Smoking Participation and Tobacco Expenditure in Vietnam. *PLoS One*. 2021;16(12):e0260415. https://doi.org/10.1371/journal.pone.0260415
23. Septiani R. Hubungan Lama Merokok dan Frekuensi Merokok dengan Kadar Hemoglobin (HB) Pada Perokok Aktif. *Babul Ilmi: Jurnal Ilmiah Multi Science Kesehatan*. 2022;14(1):30–40. https://jurnal.stikes-aisyiyah-palembang.ac.id/index.php/Kep/article/view/809
24. Weir CB, Jan A. *BMI Classification Percentile And Cut Off Points*. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023.
25. Salsabila NN, Indraswari N, Sujatmiko B. Gambaran Kebiasaan Merokok Di Indonesia Berdasarkan *Indonesia Family Life Survey 5* (IFLS 5). *Jurnal Ekonomi Kesehatan Indonesia*. 2022;7(1):13-22. https://journal.fkm.ui.ac.id/jurnal-eki/article/view/5394

26. Islam MS, Rashid M, Sizear MI, et al. Cigarette Smoking and Associated Factors Among Men in Five South Asian Countries: A Pooled Analysis of Nationally Representative Surveys. *PLoS One*. 2022;17(11):e0277758. https://doi.org/10.1371/journal.pone.0277758
27. Foulds J, Veldheer S, Pachas G, et al. The Effects of Reduced Nicotine Content Cigarettes on Biomarkers of Nicotine and Toxicant Exposure, Smoking Behavior and Psychiatric Symptoms in Smokers with Mood or Anxiety Disorders: A Double-Blind Randomized Trial. *PLoS One*. 2022;17(11):e0275522. https://doi.org/10.1371/journal.pone.0275522
28. Omare MO, Kibet JK, Cherutoi JK, et al. A Review of Tobacco Abuse And Its Epidemiological Consequences. *Zeitschrift Fur Gesundheitswissenschaften = Journal of Public Health*. 2022;30(6):1485-500. https://doi.org/10.1007/s10389-020-01443-4
29. Golestan YP, Kalan ME, Taleb ZB, et al. The Effect of Price on Cigarette Consumption, Distribution, and Sale In Tehran: A Qualitative Study. *BMC Public Health*. 2021;21(1):1720. https://doi.org/10.1186/s12889-021-11733-5
30. Lorensia A, Suryadinata RV, Arganitya GN. Relationship of Food Vitamin D Intake with Obesity in Adolescent in Surabaya. *Global Medical & Health Communication*. 2022;10(2):104–110. https://ejournal.unisba.ac.id/index.php/gmhc/article/view/9024
31. AlFaris NA, Alshammari GM, AlTamimi JZ, et al. Evaluating The Effects of Different Processing Methods on The Nutritional Composition of Shrimp and The Antioxidant Activity of Shrimp Powder. *Saudi Journal of Biological Sciences* 2022;29(1):640-9. https://doi.org/10.1016/j.sjbs.2021.09.029
32. Sridonpai P, Judprasong K, Tirakomonpong N, et al. Effects of Different Cooking Methods on the Vitamin D Content of Commonly Consumed Fish in Thailand. *Foods*. 2022;11(6):819. https://doi.org/10.3390/foods11060819
33. Andrade JM, Grandoff PG, Schneider ST. Vitamin D Intake and Factors Associated With Self-Reported Vitamin D Deficiency Among US Adults: A 2021 Cross-Sectional Study. *Frontiers in Nutrition*. 2022;9:899300. https://doi.org/10.3389/fnut.2022.899300
34. Vičič V, Mikuš RP, Kugler S, et al. Vitamin D Fortification of Eggs Alone and in Combination with Milk in Women Aged 44-65 Years: Fortification Model and Economic Evaluation. *Slovenian Journal of Public Health*. 2022;62(1):30-33. https://doi.org/10.2478/sjph-2023-0005
35. Daly RM, De Ross B, Gianoudis J, et al. Dose-Response Effect of Consuming Commercially Available Eggs on Wintertime Serum 25-Hydroxyvitamin D Concentrations in Young Australian Adults: a 12-Week Randomized Controlled Trial. *The Journal of Nutrition*. 2022;152(7):1702-1710. https://doi.org/10.1093/jn/nxac044
36. Pellegrino L, Marangoni F, Muscogiuri G, et al. Vitamin D Fortification of Consumption Cow's Milk: Health, Nutritional and Technological Aspects. A Multidisciplinary Lecture of the Recent Scientific Evidence. *Molecules*. 2021;26(17):5289. https://doi.org/10.3390/molecules26175289
37. Weir RR, Johnston M, Lowis C, et al. Vitamin D_3 Content of Cows' Milk Produced in Northern Ireland and Its Efficacy As A Vehicle For Vitamin D Fortification: A UK Model. *International Journal of Food Sciences and Nutrition*. 2021;72(4):447-455. https://doi.org/10.1080/09637486.2020.1837743
38. Zhang Y, Lin S, Li J, et al. Interaction of Passive Smoking and Diet Habits on Vitamin D Deficiency among Women of Reproductive Age in Rural Central China. *Nutrients*. 2022;15(1):126. https://doi.org/10.3390/nu15010126

39. Tiwari RK, Sharma V, Pandey RK, et al. Nicotine Addiction: Neurobiology and Mechanism. *Journal of Pharmacopuncture*. 2020;23(1):1–7. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7163392/

40. Lorensia A, Suryadinata RV. Profil of Omega-3 Food Intake and Its Association with Socioeconomic Status on Online Motorcycle Driver Smokers. *Healthcare in Low-resource Settings*. 2023;11(s1):11164. https://www.pagepressjournals.org/index.php/hls/article/view/11164

41. Carlberg C. Vitamin D and Pigmented Skin. *Nutrients*. 2022;14(2):325. https://doi.org/10.3390/nu14020325

42. Raymond-Lezman JR, Riskin SI. Benefits and Risks of Sun Exposure to Maintain Adequate Vitamin D Levels. *Cureus*. 2023;15(5):e38578. https://doi.org/10.7759/cureus.38578

43. Sultana N. Sun Awareness and Sun Protection Practices. *Clinical, Cosmetic and Investigational Dermatology*. 2020;13:717–730. https://doi.org/10.2147/CCID.S265477

44. Shan L, Dong H, Wang T, et al. Screen Time, Age and Sunshine Duration Rather Than Outdoor Activity Time Are Related to Nutritional Vitamin D Status in Children With ASD. *Frontiers in Pediatrics*. 2022;9:806981. https://doi.org/10.3389/fped.2021.806981

45. Rocka A, Jasielska F, Madras D, et al. The Impact of Digital Screen Time on Dietary Habits and Physical Activity in Children and Adolescents. *Nutrients*. 2022;14(14):2985. https://doi.org/10.3390/nu14142985

46. Zhang J, Cao ZB. Exercise: A Possibly Effective Way to Improve Vitamin D Nutritional Status. *Nutrients*. 2022;14(13):2652. https://doi.org/10.3390/nu14132652

47. Lorensia A, Suryadinata RV, Chandra NLMR. Profile of Vitamin D Status, Physical Activity, and Lung Health in Construction Workers. *Community Medicine and Public Health of Indonesia Journal*. 2020;1(2):117–24. http://comphi.sinergis.org/index.php/comphi/article/view/19

48. Lorensia A, Muntu CM, Suryadinata RV, et al. Effect of lung function disorders and physical activity on smoking and non-smoking students. *Journal of Preventive Medicine and Hygiene*. 2021; 62(1):89–96. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8283647