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**RESEARCH**

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## Side Effect, Husband Support and Level of Knowledge on the Incidence of Contraceptive Acceptors Dropout

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### Abstract

Family planning program is an effort made by the Indonesian government to decrease the birth rate and control the population. The success of family planning program in decreasing the birth rate is influenced by several factors, including the incidence of dropout (DO) regarding the use of contraceptive methods. The high contraceptive acceptors DO rate indicates a problem regarding the use of contraceptive methods. DO cases in Kupang Regency, East Nusa Tenggara (NTT) Province, increased from 1.1% in 2018 to 9.1% in 2021. Therefore, it is necessary to study the factors that cause the increase in the incidence of Contraceptive Acceptors DO. This study aims to determine the factors related to the incidence of Contraceptive Acceptors DO in East Penfui Village, the work area of Tarus Community Health Center, Kupang Regency. This was an analytical survey study with cross-sectional approach. The population involved was family planning acceptors in the village from March to October 2020, as many as 163 acceptors. The samples of 69 acceptors were selected using simple random sampling technique. Data were collected through interviews and documentation. Data were analyzed using Chi-square test. The results revealed that there were three factors which influenced the incidence of contraceptive acceptors DO, namely maternal level of knowledge ( $p=0.006$ , husband support for his wife ( $p=0.003$ ), and side effects regarding contraceptive methods ( $p=0.014$ ). It can be concluded that a personal approach was needed. Counseling on the side effects of contraception and door to door education can be solutions to be performed by CHC officers as well as existing health cadres.

**Keywords:** Risk Factors, Contraceptive Acceptors Dropout.

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## 1. INTRODUCTION

Family planning program is a method made by the government to regulate the birth rate, birth spacing and appropriate age for giving birth (Idris et al., 2021), (Sari, Maringga, & Astuti, 2019). Family planning is a way to increase awareness, and role in society by maturing or raising the age of marriage, regulating birth spacing, fostering family resilience, and increasing welfare to create a happy and prosperous family (Liufeto, Wahab & Emilia, 2017), (Jidar, 2018), (Paulus & Lette, 2019).

The Indonesian family won a population award from the United Nations (UN) or the United Nations Population Award (UNPA). Indonesia was considered to have made an extraordinary contribution and awareness of population issues along with the solutions that had been carried out (Ludji, 2013), (Aryanty et al., 2021). Such award was given institutionally to the National Population and Family Planning Agency (BKKBN), (Nurjaeni et al., 2021). The success of the BKKBN in getting the award proves that the development and implementation of the family planning and population program in Indonesia by the BKKBN and all the partners involved are still getting support from the international community (Lino, Jedo, & Adam, 2021), (Gusman, Notoatmodjo, & Aprilia, 2021).

The national birth rate was reduced sharply, from 5.6 to 2.2 births per woman from 1970 to 2000. Such decline in the birth rate slowed the population growth rate and affected the quality of public services such as education, health, and infrastructure, thereby increasing standards community life (Rujianto, Sudarso, & Setiawan, 2009), (Hartoyo, Latifah, & Mulyani, 2011). According to Central Bureau of Statistics data in 2022, participants in the family planning program in NTT Province reached 451,733 in 2018 and increased by 497,774 in 2021. The same thing could also be observed in Kupang Regency that there were 21.369 participants in 2018 which increased by 32.264 participants in 2021. This increase was also followed by an increase in the dropout rate, namely as many as 52.803 people (11.7%) in NTT Province in 2018, which rose to 71.829 people (14.4%) in 2021. In addition, dropout rate in Kupang Regency in 2018 was 236 people (1.1%) which rose to 2,949 people (9%) in 2021. It was reported that the types of contraceptive methods experienced the most dropout cases in Kupang Regency were pills (19.7%), female sterilization (19.4%), and injection (17.3%) (Badan Pusat Statistik NTT, 2022), (Burstein et al., 2019).

Several previous studies reported factors that influenced the incidence of dropout, including knowledge level (Kuntalawati et al., 2020), (Amru, 2019), (Rujianto et al., 2009), age (Lubis JA, 2020), side effects (Saleh, Ashriady, & Akbar, 2019), (Qonitun, 2018), (Septalia & Puspitasari, 2017), education level (Widyawati, Siswanto, & Najib, 2020), (Saleh, Ashriady, & Akbar, 2019), parity (Nurjannah & Susanti, 2017), (Lubis & Barus, 2020), contraceptive method (Nurjannah & Susanti, 2017), attitudes (Amru, 2019), affordability of health service distance (Amru, 2019), quality of family planning services (Saleh, Ashriady, & Akbar, 2019), husband support (Saleh, Ashriady, & Akbar, 2019), cost of using contraception (Septalia & Puspitasari, 2017), and reasons for having another children (Septalia & Puspitasari, 2017).

Factors that had no effect on the incidence of dropout included education (Kuntalawati et al., 2020), (Lubis & Barus, 2020), employment status (Kuntalawati et al., 2020), (Nurjannah & Susanti, 2017), (Saleh, Ashriady, & Akbar, 2019), parity (Kuntalawati et al., 2020), education level, (Nurjannah & Susanti, 2017), income (Nurjannah & Susanti, 2017), (Aini, Mawarni, & Dharminto, 2016), service quality, health insurance, husband support, socio-cultural, welfare level (Widyawati, Siswanto & Najib, 2020), age (Nurjannah & Susanti, 2017), (Saleh, Ashriady, & Akbar, 2019), type of service (Nurjannah & Susanti, 2017), knowledge (Nurjannah & Susanti, 2017), family planning counseling (Nurjannah & Susanti, 2017), quality of health services (Nurjannah & Susanti, 2017), parity (Saleh, Ashriady, & Akbar, 2019), perception of quality of family planning services (Aini, Mawarni, & Dharminto, 2016), side effects (Aini, Mawarni, & Dharminto, 2016), barriers to cultural norms (Septalia & Puspitasari,

2017), barriers to social adjustment (Septalia & Puspitasari, 2017), barriers to physical and mental health (Septalia & Puspitasari, 2017), and barriers to accessibility (Septalia & Puspitasari, 2017).

The high rate of contraceptive acceptors dropout in Kupang Regency by 1.1% in 2018 which rose to 9.1% in 2021 has led to a question regarding the contributing factors, “why most of the participants chose to stop using contraceptives?”. So far, we have not found any study that addresses such issue. This study aims to determine the factors related to the incidence of Contraceptive Acceptors DO in East Penfui Village, the work area of Tarus Community Health Center, Kupang Regency, NTT.

## 2. RESEARCH METHOD

This was an analytical survey study with a cross-sectional approach. The population involved here was all active contraceptive acceptors in East Penfui Village, the work area of Tarus CHC, for the last 6 (six) months (March to August 2020) as many as 163 acceptors. Based on the Slovin formula, the number of samples required was 61.9 women, so the number of subjects was 62 respondents. The independent variables were maternal age, parity, education level, knowledge level about family planning and contraceptives, employment status, family income, husband support and level of compatibility of contraceptive use (complaints of side effects). On the other hand, the dependent variable was the incidence of contraceptive acceptors drop out. Primary data were obtained through interviews with questionnaires, and secondary data were obtained from documentation in the form of notes, books, newspapers, and magazines. Data processing included editing, coding, entry, and tabulating.

Data were analyzed through univariate analysis in the form of distribution and percentage of each variable in the form of a frequency table, and bivariate analysis to determine the relationship between one independent variable and the dependent variable using the Chi square test. If the p value was < 0.05, then the null hypothesis (Ho) was rejected, and vice versa if the p value was >0.05, then Ho was accepted (Wibowo, 2017). Ho meant that there was no relationship between age, parity, education level, employment status, income, knowledge level, husband support, contraceptive side effects and the incidence of Drop out. The strength level of the relationship between the independent and the dependent variables was tested using Contingency Coefficient (CC). This study has been registered by the ethics committee of the Health Polytechnic of the Ministry of Health of Kupang and received an ethical license number LB.02.03/1/0052/2020. All respondents signed an informed concern as an agreement to be involved in the study.

## 3. RESULTS AND DISCUSSION

Interviews were conducted with 62 respondents. The researcher’s further collected data and answers to each question in the questionnaire. The characteristics of the respondents are described in table 1, and the tabulation of responses are described in table 2.

**Table 1.** Distribution of characteristics by age, parity, education, employment status, income, husband support, contraceptive side effects and incidence of dropout.

Variable		n (percentage)
Age	20-35 years	43 (69.4%)
	>35 years	19 (30.6%)
Parity	1-2	47 (75.8%)
	>2	15 (24.2%)
Education Level	High	51 (82.3%)
	Low	11 (17.7%)

Employment Status	Employed	13 (21%)
	Unemployed	49 (79%)
Income	>1,950,000	16 (25.8%)
	<1,950,000	46 (74.2%)
Knowledge Level	Good	40 (60.5%)
	Poor	22 (35.5%)
Husband Support	Yes	49 (79%)
	No	13 (21%)
Contraceptive Side Effect	Yes	25 (40.3%)
	No	37 (57.9%)
Dropout	Yes	7 (11.3%)
	No	55 (88.7%)

Based on table 1, it was revealed that most of respondents had an age range of 20-35 as many as 43 women (69,4%), had parity of 1-2 as many as 47 women (75,8%), had high level of education as many as 51 women (82,3%), were unemployed (Housewives) as many as 49 women (79,0%), had income of < 1.950.000 as many as 46 women (74,2%), had a good knowledge level as many as 40 women (64,5%), received husband support as many as 49 women (79,0%), did not experience side effects as many as 37 women (57,9%) and did not dropout as many as 55 women (88,7%). Furthermore, a bivariate test was conducted to determine the relationship between age, parity, education level, employment status, income, knowledge level, husband support, and side effects on the incidence of dropout, as described in table 2 below.

**Table 2.** Cross-relationship between age, parity, education level, employment status, income, knowledge level, husband support, side effects of contraception and the incidence of dropout.

Variable		Dropout				p-value
		Yes		No		
		N	%	N	%	
Age	20-35 years	0	0	0	0	0.187
	>35 years	3	7.0	40	93.0	
		4	21.1	15	78.9	
Parity	1-2	3	8.5	43	91.5	0.345
	>2	4	20.0	12	80.0	
Education Level	High	3	6.3	45	93.8	0.365
	Low	4	28.6	10	71.4	
Employment Status	Employed	4	23.5	13	76.5	0.328
	Unemployed	3	6.7	42	93.3	
Income	>1,950,000	3	17.6	14	82.4	0.456
	<1,950,000	4	8.9	41	91.1	
Knowledge Level	Good	1	2.5	3	97.5	0.006
	Poor	6	27.3	16	72.7	
Husband Support	Yes	2	4.1	47	95.9	0.003
	No	5	38.5	8	61.5	
Contraceptive Side Effect	Yes	6	24.0	19	76.0	0.014
	No	1	2.7	36	97.3	

Based on table 2, it was revealed that the incidence of drop out mainly occurred among respondents aged >35 years as many as 4 women (21.1%), with parity of >2 as many as 4 women (20.0%), with high education as many as 6 women (11.8%), who were unemployed as many as 7 women (14.3%), with income of < 1.950,000 as many as 5 women (10.9%), with

poor knowledge as many as 6 women (27.3%), who did not have husband support as many as 5 women (38.5%), who experienced side effects of contraception as many as 6 women (24.0%).

The key to the success of the family planning program is the continuity of family planning participants in using contraceptive methods. Dropout problem was found as the most significant factor for the failure of family planning programs in the community (Palinggi et al., 2021). In particular, during this pandemic, it is inevitable that the dropout rate has increased and has an impact on the high birth rate (Amran et al., 2019). It is triggered by the public's concern about health service access during the Covid-19 pandemic. People usually look for the nearest CHC, clinic, and hospital. The National Population and Family Planning Board launched a program of family planning services for a million acceptors by making family planning services accessible in all service units (CHCs, midwives, hospitals, and clinics) (Mandira et al., 2020), (Purwanti, 2021), (Handayani et al., 2021).

Dropout rate is also still a problem found in *Kupang* Regency. DO cases in *Kupang* Regency, East *Nusa Tenggara* (NTT) Province, increased from 1.1% in 2018 to 9.1% in 2021. Such increase was also influenced by the Covid-19 pandemic condition, especially people's fear of visiting health facilities due to the rise in cases of Covid-19. In addition, there was a limitation of the number of patients served by obstetricians, midwives, and CHCs. The results of this study showed that the factors that did not affect the incidence of DO in the work area of *Tarus* CHC were maternal age, parity, education level, employment status, and income. There were similarities in the number of respondents who dropped out regarding age, parity, education level, employment status, and income.

Several studies reported different findings that age (Lubis & Barus, 2020), parity (Nurjannah & Susanti, 2017), (Lubis & Barus, 2020), and education level (Widyawati, Siswanto, & Najib, 2020), (Saleh, Ashriady, & Akbar, 2019) had a significant effect on the incidence of contraceptive acceptors DO. These different results can be influenced by several things, including the location of the study, the number of respondents, homogeneity/variable distribution, and the number of DO cases among the population and samples (Utomo et al., 2021).

The current study found that the influential factors for the incidence of DO at the *Tarus* CHC were the level of knowledge, husband support, and the incidence of side effects. Such finding indicated that there was still a problem with the level of expertise among family planning acceptors in the work area of *Tarus* CHC, as evidenced by the lack of understanding that led them to choose to DO. Husband support was also a problem found here. There were still husbands who did not support and even prohibited their wives from using contraceptive methods so that their wives decided to stop. Fear of side effects that arose also became a significant problem, and women were afraid of the rumors in the community that contraceptive methods would lead to obesity, black spots, bleeding during menstruation, cessation of menstruation, pain during menstruation, interfering with husband-and-wife relationships, etc. The lack of information on how to deal with side effects was the main cause of the high DO rate.

Several studies showed different findings that education level (Nurjannah & Susanti, 2017), husband support, knowledge level (Nurjannah & Susanti, 2017), and contraceptive side effects (Aini, Mawarni & Dharminto, 2016) did not affect the incidence of DO. Such different results could be influenced by certain factors such as the location of the study, the distribution of respondents, the number of respondents, and the number of DO cases among the population and samples.

There was a limitation in our study namely the small size of the DO case samples that was only 7 people, and 62 cases were not DO. Such number of cases is not sufficient to provide a statistically significant assessment. Furthermore, the study site was only one namely *Tarus*

CHC. Further study should involve several CHCs.

Our study showed there were still cases of contraceptive acceptors DO in the work area of *Tarus* CHC. The main factors were poor level of knowledge, no husband support, and fear of contraceptive side effects. As the final result of this study, we provide a recommendation for the government, in this case, the CHC as the closest health facility service to the community. Socialization and education should not only be held when women visit the CHC or integrated service center, but the door-to-door approach model can be a solution. House-to-house visits will educate not only housewives but also husbands and families so that the level of knowledge can be improved and further decrease the incidence of DO. In addition, the approach performed by Integrated Healthcare Post (Posyandu) cadres is one of the methods we recommend. People in rural areas usually trust and are easy to approach by integrated healthcare post cadres. Therefore, involving cadres as the extension of healthcare workers will facilitate information delivery. The existence of genuine efforts from the CHC that can answer the main problems in the community is expected to decrease the incidence of DO and ultimately improve the community's welfare.

#### 4. CONCLUSION

Factors related to the incidence of contraceptive acceptors DO in the work area of *Tarus* CHC were knowledge level, husband support and side effects. Efforts to approach, counsel, and educate from house to house are our recommendation to be performed by CHC officers as well as existing health cadres. Public campaign is considered as a good method to decrease the incidence of contraceptive acceptors DO. Problems to be further studied in-depth are the reason why knowledge, husband support and the incidence of side effects can be the causal factors of DO.

#### REFERENCES

- Aini, A. N., Mawarni, A., & Dharminto. (2016). Faktor-Faktor Yang Berhubungan Dengan Kejadian Drop Out Akseptor KB Di Kec. Tembalang Kota Semarang. *Jurnal Kesehatan Masyarakat (e-Journal)*, 4(4), 169–177. Retrieved from <https://ejournal3.undip.ac.id/index.php/jkm/article/view/13985>
- Amran, Y., Nasir, N. M., Dachlia, D., Yelda, F., Utomo, B., Ariawan, I., & Damayanti, R. (2019). Perceptions of contraception and patterns of switching contraceptive methods among family-planning acceptors in west nusa tenggara, indonesia. *Journal of Preventive Medicine and Public Health*, 52(4), 258–264. <https://doi.org/10.3961/JPMPH.18.198>
- Amru, D. E. (2019). Hubungan Tingkat Pengetahuan, Sikap dan Keterjangkauan Jarak Pelayanan Kesehatan terhadap Kejadian Drop Out Alat Kontrasepsi Suntik pada Pasangan Usia Subur (PUS) di Wilayah Kerja Puskesmas Sekupang Kota Batam. *Jurnal Bidan Komunitas*, 2(2), 117-125. <https://doi.org/10.33085/jbk.v2i2.4341>
- Aryanty, R. I., Romadlona, N. A., Besral, B., Panggabean, E. D. P., Utomo, B., Makalew, R., & Magnani, R. J. (2021). Contraceptive use and maternal mortality in Indonesia: a community-level ecological analysis. *Reproductive Health*, 18(1), 1–9. <https://doi.org/10.1186/s12978-020-01022-6>
- Badan Pusat Statistik NTT. (2022). *Jumlah Peserta KB Drop Out (DO) Per Mix Kontrasepsi 2018-2021*. Badan Pusat Statistik NTT. Retrieved from <https://ntt.bps.go.id/indicator/30/232/1/jumlah-peserta-kb-drop-out-do-per-mix-kontrasepsi.html>
- Burstein, R., Henry, N. J., Collison, M. L., Marczak, L. B., Sligar, A., Watson, S., ... & Filip, I. (2019). Mapping 123 million neonatal, infant and child deaths between 2000 and 2017. *Nature*, 574(7778), 353–358. Retrieved from <https://doi.org/10.1038/s41586-019-1545-0>

- Gusman, A. P., Notoatmodjo, S., & Aprilia, Y. T. (2021). Hubungan Pengetahuan Dan Sikap Terhadap Pemilihan Alat Kontrasepsi Jangka Panjang Pada Wanita Usia Subur (WUS) di Wilayah Kerja Polindes Kefa Utara Kab. TTU PROV. NTT Tahun 2021. *Jurnal Untuk Masyarakat Sehat (JUKMAS)*, 5(2), 120–127. <https://doi.org/10.52643/jukmas.v5i2.1553>
- Handayani, S., Damayanti, R., Ariawan, I., Yelda, F., Harlan, S., Wahyuningrum, Y., & Storey, D. (2021). Improving Communication Messages by Using Perceptual Mapping: Family Planning Survey in East Java and West Nusa Tenggara, Indonesia. *SAGE Open Medicine*, 9, 205031212199328. <https://doi.org/10.1177/2050312121993288>
- Hartoyo, H., Latifah, M., & Mulyani, S. R. (2011). Studi Nilai Anak, Jumlah Anak yang diinginkan, dan Keikutsertaan Orang Tua dalam Program KB. *Jurnal Ilmu Keluarga dan Konsumen. Jurnal Ilmu Keluarga Dan Konsumen*, 4(1), 37–45. <https://doi.org/10.24156/jikk.2011.4.1.37>
- Idris, U., Frank, S. A. K., Hindom, R. F., & Nurung, J. (2021). Family planning (KB) practices and the impact on Papuan women reproductive health. *Gaceta Sanitaria*, 35, S479–S482. <https://doi.org/10.1016/j.gaceta.2021.10.076>
- Jidar, M. (2018). Determinan Kejadian Unmet Need KB Pada Pasangan Usia Subur (PUS) di Sulawesi Selatan (Perbandingan Antara Wilayah Urban dan Rural). *Skripsi*. Fakultas Kesehatan Masyarakat, Universitas Hasanuddin Makassar
- Kuntalawati, T. C., Purnami, C. T., Nugroho, R. D., & Agushyvana, F. (2020). Kejadian Drop Out Alat Kontrasepsi Hormonal Pada Wanita PUS di Wilayah Kec Semarang Timur Kota Semarang Tahun 2018. *Jurnal Kesehatan Masyarakat*, 8(2), 196–200. Retrieved from <https://ejournal3.undip.ac.id/index.php/jkm/article/view/26288>
- Liufeto, K. G., Wahab, A., & Emilia, O. (2017). Penggunaan intra uterin device (IUD) dan pola aktivitas seksual pada perempuan di Kupang. *Berita Kedokteran Masyarakat*, 33(5), 243-248. <https://doi.org/10.22146/bkm.17803>
- Lino, M., Jedo, A., & Adam, C. V. (2021). Identifikasi Faktor-Faktor Yang Mempengaruhi Pengambilan Keputusan Pasangan Usia Subur Dalam Mengikuti Program KB (Studi Kasus Di Desa Leraboleng Kecamatan Titehena Kabupaten Flores Timur). *Jurnal Administrasi dan Demokrasi*, 1(2), 100–123.
- Lubis, J. A., & Barus, L. (2020). Faktor-Faktor Yang Berhubungan Dengan Kejadian Drop Out Alat Kontrasepsi Suntik Di Poskesdes Sion Timur II Tahun 2020. *Journal Of Midwifery Senior*, 3(1), 97-102.
- Ludji, I. D. R.. (2013). Pengaruh Faktor Intra Personal “Social Ecological Model of Health Behaviour” Terhadap Penurunan Angka Kematian Ibu (AKI) di Kabupaten Kupang, NTT. *Jurnal Info Kesehatan*, 12(1), 649-660.
- Mandira, T. M., Fitriani, D., bodro Ardi, N., Veri, V., & Selvia, A. (2020). Edukasi Program Keluarga Berencana (KB) Pada Wanita Usia Subur Selama Masa Pandemi Covid 19. *JAM: Jurnal Abdi Masyarakat*, 1(1), 108–112. Retrieved from <http://openjournal.wdh.ac.id/index.php/JAM/article/view/83>
- Nurjaeni, N., Sawangdee, Y., Pattaravanich, U., Holumyong, C., & Chamrathirong, A. (2021). The role of structural and process quality of family planning Care in Modern Contraceptive use in Indonesia: a multilevel analysis. *BMC Public Health*, 21(1), 1–15. <https://doi.org/10.1186/s12889-021-11858-7>
- Nurjannah, S. N., & Susanti, E. (2017). Determinan kejadian drop out penggunaan kontrasepsi pada pasangan usia subur (pus) di kabupaten kuningan. *Jurnal Ilmu Kesehatan Bhakti Hiusada Kuningan*, 6(2), 1–10. Retrieved from <https://ejournal.stikku.ac.id/index.php/stikku/article/view/45>
- Palinggi, R. S., Moedjiono, A. I., Suarayasa, K., Masni, Seweng, A., Amqam, H., ... Syam, A.

- (2021). The effect of balanced counseling strategy family planning against attitude, subjective norm, and intentions on the use of modern contraception behavior in the Singgani Public Health Center work area of Palu city. *Gaceta Sanitaria*, 35, S140–S144. <https://doi.org/10.1016/j.gaceta.2021.10.013>
- Paulus, A. Y., & Lette, A. R. (2019). The Effect of Physical and Socio-cultural Environments on the Access of Family Planning Service in Poor Couples of Reproductive Age in Sabu Raijua Regency. *Jurnal Kesehatan Masyarakat*, 15(2), 258–268. <https://doi.org/10.15294/kemas.v15i2.20964>
- Purwanti, S. (2021). Dampak Penurunan Jumlah Kunjungan KB Terhadap Ancaman Baby Room di Era COVID-19. *Jurnal Bina Cipta Husada*, 16(2), 105–118. Retrieved from <http://jurnal.stikesbch.ac.id/index.php/jurnal/article/view/19>
- Qonitun, U. (2018). Hubungan Antara Efek Samping Kontrasepsi Dmpa Dengan Kejadian Drop Out Pada Pasangan Usia Subur (Pus) Di Desa Mandirejo Kecamatan Merakurak Kabupaten Tuban. *Jurnal Midpro*, 9(2), 30-34. <https://doi.org/10.30736/midpro.v9i2.23>
- Rujianto, W., Sudarso, & Didik Setiawan. (2009). HUBungan Tingkat Pengetahuan Terhadap Kejadian Drop Out Kontrasepsi Suntikan di Kab Cilacap. *Pharmacy*, 06(03), 73–81.
- Saleh, S., Ashriady, A., & Akbar, F. (2019). Analisis faktor yang Berhubungan dengan Kejadian Efek Samping pada Akseptor Putus Pakai IUD/Implant di Kabupaten Mamuju Tengah. *Jurnal Kebidanan*, 9(1), 43–50. <https://doi.org/10.31983/jkb.v9i1.3979>
- Sari, N. I. Y., Maringga, E. G., & Astuti, W. W. (2019). Path Analysis of the Effect of Biological and Social Factors on the Case of Breast Cancer. *Jurnal Info Kesehatan*, 17(2), 88–100. <https://doi.org/10.31965/infokes.Vol17.Iss2.292>
- Septalia, R., & Puspitasari, N. (2017). Faktor yang Memengaruhi Pemilihan Metode Kontrasepsi. *Jurnal Biometrika Dan Kependudukan (Journal of Biometrics and Population)*, 5(2), 91–98. <https://doi.org/10.20473/jbk.v5i2.2016.91-98>
- Utomo, B., Suchaya, P. K., Romadlona, N. A., Robertson, A. S., Aryanty, R. I., & Magnani, R. J. (2021). The impact of family planning on maternal mortality in Indonesia: what future contribution can be expected? *Population Health Metrics*, 19(1), 1–13. <https://doi.org/10.1186/s12963-020-00245-w>
- Wibowo, A. (2017). Uji Chi-Square pada Statistika dan SPSS. *Jurnal Ilmiah SINUS*, 4(2), 37-46.
- Widyawati, S., Siswanto, Y., & Najib, N. (2020). Determinan Kejadian Berhenti Pakai (Drop Out) Alat Kontrasepsi. *HIGEIA (Journal of Public Health Research and Development)*, 4(1), 122-132. <https://doi.org/10.15294/higeia.v4i1.32124>

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**RESEARCH**

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## Work Fatigue Due to the Use of High Heels on Promotion Girls Workers

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### Abstract

During working hours, Sales Promotion Girl (SPG) is standing in a shopping center, which can cause work fatigue. The objective of this study was to examine the work fatigue of SPG who wore high heels in various variations. The research design was cross-sectional, with the research subjects being 60 employees from the SPG in Pontianak Indonesia Mall. The L 77 reaction timer was employed to measure fatigue before and after work. The findings revealed that workers who wore 7 cm heels experienced higher levels of fatigue than those who wore 5 cm or 3 cm heels. The study results revealed no significant difference in fatigue before and after working various variations of high heels ( $p \leq 0.001$ ). When wearing high heels, the average level of fatigue increases. However, there was no statistically significant difference in heel height variation on fatigue level ( $p=0.173$ ). When working in a standing position, wearing shoes with low heels increases comfort and reduces worker fatigue. The results of this study can be used as a starting point for future research by other researchers. Moreover, the findings of this study can also serve as a starting point for other researchers to conduct additional research.

**Keywords:** Variation, Shoe Heel, Work Fatigue, Sales Promotion Girl.

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## 1. INTRODUCTION

Workers must pay close attention to Occupational Health and Safety (OSH). Occupational Safety and Health Efforts aim to keep workers' health, welfare, and safety in the workplace, both in the formal and informal sectors. Its goal is to create healthy and productive workers by providing a safe and healthy industrial work environment (International Labor Organization, 2011), (Khan, et al., 2014). Malls are one of the trade sectors where certain standards and occupational health and safety requirements must be met. According to observations at the Pontianak mall trade centre, many SPGs work standing and walking in high heels. Standing for an extended period of time causes leg pain (Hughes, et al., 2011). Standing too long is also associated with chronic venous insufficiency, discomfort and fatigue, particularly in the back and legs, high risk for Chronic Venous Disorders (CVD) (Sudol-Szopinska, et al., 2011; Bae, et al., 2015; Mahbubi, et al., 2016; Edwards, et al., 2008).

The use of high heels may cause knee pain (Filho, et al., 2012). The ammeter venous pressure is higher than those who apply low heels (Xiong & Hapsari, 2014). Instability of the balance system in its use results in falls and injuries (Emmanouil, & Rousanoglu, 2018; Silva, et al., 2013).

When walking and standing for an extended period of time, wearing high heels can cause changes in posture, body balance, and pressure in the metatarsal area of the foot, which can affect abnormal gait patterns, footsteps, and walking speed (Ebell, et al., 1994; Afzal & Manzoor, 2017). Heels can interfere with balance and increase the likelihood of musculoskeletal injuries. Its effect on balance can cause a woman to trip and fall. Thus, women should avoid using it indefinitely (Mika, et al., 2016), as high heels also impair the effectiveness of muscle pumps (Filho, et al., 2012).

Based on the foregoing, efforts should be made to prevent and overcome fatigue and accidents caused by the use of high heels. Control efforts are performed by wearing shoes with high heels that have been adjusted to meet applicable standards. In connection with this, the authors conducted an experimental study on SPG workers, in which they used three different heel heights (3 cm, 5 cm, and 7 cm). The objective of this study was to examine work fatigue among SPGs who wore shoes with varying heel heights.

## 2. RESEARCH METHOD

This type of research was experimental which was an activity used to determine the treatment of research subjects (Tanner, 2018). Determining the research subjects in this research design was chosen at simple randomness. The research was conducted at the Pontianak Mall Shopping Centre, West Kalimantan Province, Indonesia. The research population was 60 female employees there. Each group consists of 20 people. The criteria for research subjects were women who have worked for at least a year, use work shoes and were present at research activities as indicated by the willingness of the subject or respondent (informed consent). All research procedures were carried out in accordance with the Helsinki Declaration guidelines and were approved by the Poltekkes Kemenkes Pontianak Ethics Commission (No. 136/KEPK-PK/IV/2019).

Data collection began with fatigue before work to determine the initial state of the research subject. Then the research subjects were treated with the use of work shoes with 3 kinds of heel height variations, namely group A (3 cm), group B (5 cm) and group C (7 cm). After work, research done in overcoming fatigue in groups A, B and C, so that the differences in fatigue before and after working in the 3 groups of fatigue can be known.

The procedural activities were carried out through a preparatory stage which consisted of collecting secondary data, field observations, obtaining research permits, meeting the research team and field officers to share tasks and equalize perceptions. The implementation phase consists of; 1) survey and inventory of the types of work shoes used by SPG, 2) field

activities consisting of meetings with companies to explain the aims and objectives of the research, 3) making research subjects, 4) providing the shoes used, 5) work fatigue (pre-test) namely measurement before work, 6) intervention of shoes used with various heights (3cm, 5cm, 7cm), intervention carried out for 2 weeks, 7) measurement of final work fatigue (post-test), after work. Work fatigue data used a reaction timer L 77. The working principle of the tool measures the reaction speed to a given light or sound stimulus. In this research activity used measurements with light stimulation. The unit of measurement was milliseconds (ms). The measurement officer was a standardized Occupational Safety and Health functional examiner, originating from the Occupational Safety and Health Unit (OSH) of West Kalimantan Province. The tools used have been calibrated, so that the validity and reliability of the measuring instruments can be justified. The data on the use of shoes based on the heel variation were obtained by means of observation using a checklist. Its characteristics obtained by interview using a questionnaire.

Data analysis was carried out by descriptive analysis (univariate analysis) to see the distribution characteristics of each dependent variable and independent variable. The description of the data is presented in tables and graphs, the calculation results are presented in the form of percentages, averages and ratios. Inferential analysis was performed using statistics to test hypotheses. The Anova test was conducted to test the hypothesis, to test the average difference of more than two treatments (heel height, 3 cm, 5 cm and 7 cm). The test was carried out at the significance level ( $\alpha = 5\%$ ), if  $p < 0.05$  then the results were significant.

### 3. RESULTS AND DISCUSSION

**Table 1.** Respondents Characteristics Based on Age and Working Period.

Respondent Characteristics	Category	N	%
Age	<20 years	13	21.7
	20-25 years	33	55.0
	>25 years	14	23.3
Working Period	1-3 years	41	68.3
	4-6 years	12	20.0
	>6 years	7	11.7
Total		60	100.0

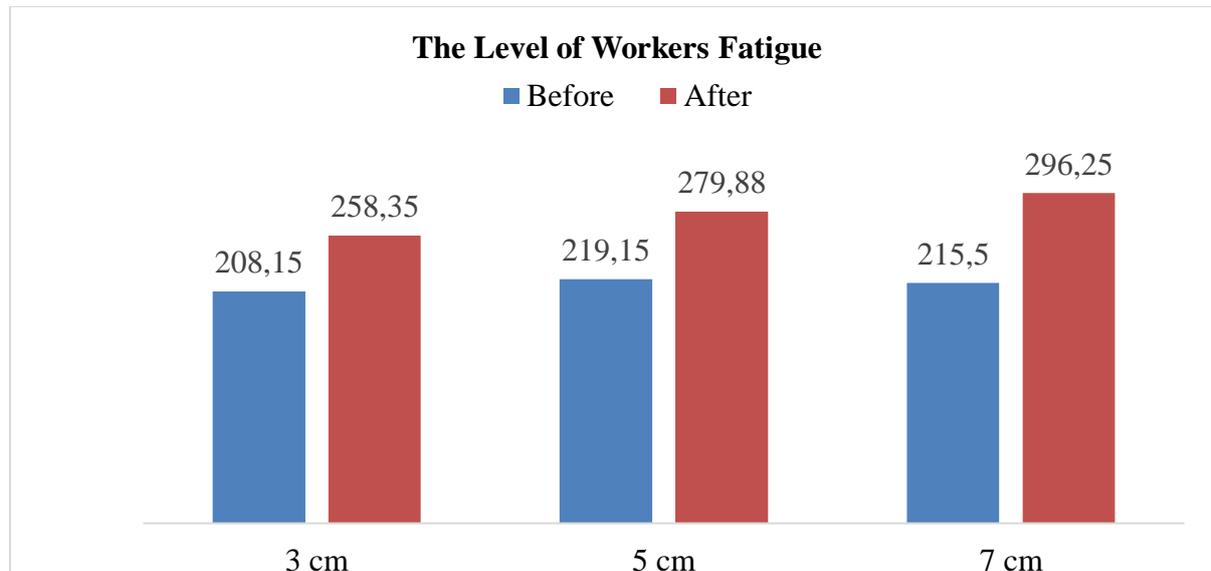
Table 1 demonstrates that respondents were mostly aged 20-25 years as many as 33 people (55%) and a maximum of 1-3 years of service as many as 41 people (68.3%).

**Table 2.** Age and Working Period Factors toward Work Fatigue.

Respondent Characteristics	Category	Min ± Max	Mean ± Sd	p-value
Age	< 20 years	6±118	47.31±36.47	0.195
	20-25 years	12±152	65.79±39.35	
	>25 years	3±171	74.71±47.32	
Working Period	1-3 years	6±171	62.20±39.88	0.701
	4-6 years	24±135	71.42±43.32	
	>6 years	3±152	60.71±49.71	

Table 2 illustrates that work fatigue in SPG increased in respondents who were getting older and have 8 working hours, but statistically, there was no significant difference between work fatigue in the age group  $p=0.195$ . The working period of respondents to the increase in SPG fatigue revealed a difference, with 4-6 years being longer than 1-3 years. There was no

statistically significant difference in the level of work fatigue based on years of service  $p = 0.701$ .



**Figure 1.** The Level of Workers Fatigue Before and After Work Height on Variations Shoes

Figure 1 shows that the increase in work fatigue before and after working in shoes with 3 cm high heels was 50.20 ms, 5 cm was 60.73 milliseconds/ms, and 7 cm was 80.75 milliseconds/ms. With increasing heel height, the level of fatigue increased.

**Table 3.** Work Fatigue Level Before and After Work

Category	Min ± Max	Mean ± Sd	p <sup>a</sup>
Before	150±325	214.28±33.164	0.000*
After	200±371	278.15±39.73	

Table 3 demonstrates that the level of fatigue before and after work, the difference was significant,  $p=0.000$ .

**Table 4.** An Analysis of Shoes Height toward Work Fatigue.

Height Heels	Min ± Max	Mean ± Sd	p <sup>a</sup>
3 cm Heels	12±94	50.20±25.28	0.173
5 cm Heels	3±132	60.15±39.07	
7 cm Heels	6±171	81.25±50.66	

Table 4 evidences that workers who wore 7 cm heels had a higher fatigue level. Workers who wore it experienced greater fatigue than those who wore 5 cm or 3 cm heels. However, statistical analysis revealed no significant difference ( $p = 0.173$ ) between the increase in work fatigue and variations in heel height.

Work fatigue can be affected by environmental and work factors. In the long term, work fatigue that occurred due to continuous working effects on the health of workers. Moreover, the use of shoes with higher heels owns a risk of work fatigue (Gefen, et al., 2002). The use of high heels can cause ankle pain, which can lead to an increase in worker fatigue (Tojo, et al., 2018). This was due to an abnormality in the heel position. The use of high heels when SPG works will result in an increase in heel height, as well as tibial anterior EMG, lower back EMG vertical movement from the center of body mass increases significantly when walking with high heels (Lee, et al., 2001). The use of high heels can also cause changes in the kinematics of the foot's joints (Ng, et al., 2014).

Fatigue was influenced by age factors. As time passes, the function of body organs and muscles begins to deteriorate. Users of high heels may overwork their muscles due to an increase in the lumbar erector spinae muscles and a decrease in stride length due to decreased ankle joint strength (Kerrigan, et al., 1998; Hageman & Blanke, 1986). When compared to adults, older people were more likely to fall due to decreased mobility, suboptimal postural changes, and decreased responsiveness (Freitas, et al., 2005). Young people can adapt postural changes to the lumbar spine when wearing high heels, whereas older people react to changes in the thoracic spine with age, which may result in an increased risk of falling (Afzal & Manzoor, 2017; Schroder, et al., 2019). The findings revealed that there was no significant relationship between age and an increase in work fatigue because the majority of participants (76.6%) were between the ages of 18 and 25.

There was no significant difference between the length of work and the level of fatigue after work, as most (96.6%) of the participants had a recent tenure of less than 6 years. The working period was associated with the length of the workforce in performing work activities. The working period for SPG workers had to receive more attention, as at work required a standing position for a long time in providing services to consumers. Hence, it caused discomfort, pain and muscle fatigue (Halim & Omar, 2012). Working period and hours were associated with the amount of time the worker was standing and the use of high heels. The longer the working hours, the more time the worker spent standing and wearing high heels. Prolonged standing was correlated with adverse health outcomes such as muscle fatigue and discomfort (Halim, et al., 2014). The Center for Occupational Health for Workers of Ontario recommends limiting working standing, pregnant women to a maximum of 2 hours of standing work (Caw Health & Safety Department, 1993). Standing for 2 hours is recommended in the perioperative setting (Association of PeriOpeative Registered Nurses, 2007).

There was a significant difference ( $p= 0.000$ ) on work fatigue using high heels with various variations in heel height before and after work. The use of high heels caused the tissue in the lumbo pelvic area to become more rigid (Mika, et al., 2012) and the kinetic function of the extremity joints (Esenyel, et al., 2003). It indicates that the longer the worker used high heels, the longer the duration of stiff tissue in that area. The use of high heels for a long time also reduced the strength of the ankle joint (Kim, et al., 2015; Cronin, et al., 2012). Increasing the load on the toes, changing foot shape and gait patterns, cause lordosis and back pain (Silva, et al., 2013). The use of high heels on a regular basis can cause muscle fatigue and injury (Mika, 2012).

Preventing injury and fatigue can be accomplished by focusing on the comfort of wearing shoes with cushioning materials and stability (Nigg, et al., 2015). High heels were recognized to influence the biomechanics of human movement and cause work fatigue, particularly by increasing forefoot plantar pressure. Because of the influence of fashion to show femininity without considering the impact on health, SPG frequently used high-heeled shoes in the cosmetic sales department (Burcar, 2019). Efforts to overcome the clinical problem of using high heels can be performed by using pads to redistribute the plantar load on the top of the forefoot and improve comfort (Mercieca, 2017) and utilize good supportive footwear 3. According to the Canadian Centre for Occupational Health and Safety (CCOHS), the requirements for comfortable shoes were those that did not pose a risk when standing for long periods of time; has a strong heel grip, so there was no slip; more stable and comfy to wear shape according to the user's natural foot or shape according to the user's foot Shoes with closed toes that were not too narrow so that there was enough room for the toes; soft shoe soles with arches (Canadian Centre for Occupational Health and Safety, 2022). The use of shoes with various sizes of heels must be adjusted to the type of work and duration of work activities as

well as the characteristics of the user. The use of high heels can be applied if the heel height was proportional to the shoe.

The use of high heels at work was adjusted to the type of work being performed. SPG workers should use shoes with low heels (< 3 cm), in their work to reduce work fatigue, as they stand and walk to serve buyers during work. Working time was setting just 8 hours as it was in accordance with government regulations.

#### 4. CONCLUSION

Variations in shoe heel height have an effect on the level of worker fatigue. The greater the worker's heel, the greater the level of fatigue. Selecting an ergonomic shoe height is highly recommended for workplace comfort. High heels cause fatigue, particularly when used in jobs that require workers to stand for long periods of time. As a result, when working in a long-standing position, it is critical to wear low heels to increase comfort and reduce worker fatigue.

#### REFERENCES

- Afzal, F., & Manzoor, S. (2017). Prolong wearing of high heeled shoes can cause low back pain. *J Nov Physiother*, 7(4), 1-2. <http://doi.org/10.4172/2165-7025.1000356>
- Association of PeriOperative Registered Nurses. (2007). *AORN Guidance Statement : Safe Patient Handling and Movement in the Perioperative Setting*. Association of Perioperative Registered Nurses. Retrieved from <https://professionals.wrha.mb.ca/old/professionals/safety/files/SafePatientHandling/AORNGuidanceStatement.pdf>
- Bae, Y. H., Ko, M., & Lee, S. M. (2015). The influence of revised high-heeled shoes on foot pressure and center of pressure during standing in young women. *Journal of Physical Therapy Science*, 27(12), 3745-3747. <https://doi.org/10.1589/jpts.27.3745>
- Burcar, L. (2019). High heels as a disciplinary practice of femininity in Sandra Cisneros's *The House on Mango Street*. *Journal of Gender Studies*, 28(3), 353-362. <https://doi.org/10.1080/09589236.2018.1472556>
- Canadian Centre for Occupational Health & Safety. (2022). *Working in a Standing Position- Basic Information*. Canada: Canadian Centre for Occupational Health and Safety.
- Caw Health & Safety Department. (1993). *Ergonomics in The Work Environment A manual for Workers*. Canada: Toronto Ontario: CAWTCA.
- Cronin, N. J., Barrett, R. S., & Carty, C. P. (2012). Long-term use of high-heeled shoes alters the neuromechanics of human walking. *Journal of applied physiology*, 112(6), 1054-1058. <https://doi.org/10.1152/jappphysiol.01402.2011>
- Ebbeling, C. J., Hamill, J., & Crusemeyer, J. A. (1994). Lower extremity mechanics and energy cost of walking in high-heeled shoes. *Journal of Orthopaedic & Sports Physical Therapy*, 19(4), 190-196. <https://www.jospt.org/doi/10.2519/jospt.1994.19.4.190>
- Edwards, L., Dixon, J., Kent, J. R., Hodgson, D., & Whittaker, V. J. (2008). Effect of shoe heel height on vastus medialis and vastus lateralis electromyographic activity during sit to stand. *Journal of orthopaedic surgery and research*, 3(1), 1-7. <https://doi.org/10.1186/1749-799X-3-2>
- Emmanouil, A. A., & Rousanoglou, E. N. (2018). Effect of high-heeled shoes on postural control in the upright and the leaning body stance. *Phys Med Rehabil Res*, 3(5), 1-5. <http://doi.org/10.15761/PMRR.1000184>
- Esenyel, M., Walsh, K., Walden, J. G., & Gitter, A. (2003). Kinetics of high-heeled gait. *Journal of the American Podiatric Medical Association*, 93(1), 27-32. <https://doi.org/10.7547/87507315-93-1-27>
- Filho, W. T., Dezzotti, N. R., Joviliano, E. E., Moriya, T., & Piccinato, C. E. (2012). Influence

- of high-heeled shoes on venous function in young women. *Journal of vascular surgery*, 56(4), 1039-1044. <https://doi.org/10.1016/j.jvs.2012.01.039>
- Freitas, S. M., Wieczorek, S. A., Marchetti, P. H., & Duarte, M. (2005). Age-related changes in human postural control of prolonged standing. *Gait & posture*, 22(4), 322-330. <https://doi.org/10.1016/j.gaitpost.2004.11.001>
- Gefen, A., Megido-Ravid, M., Itzhak, Y., & Arcan, M. (2002). Analysis of muscular fatigue and foot stability during high-heeled gait. *Gait & posture*, 15(1), 56-63. [https://doi.org/10.1016/S0966-6362\(01\)00180-1](https://doi.org/10.1016/S0966-6362(01)00180-1)
- Hageman, P. A., & Blanke, D. J. (1986). Comparison of gait of young women and elderly women. *Physical therapy*, 66(9), 1382-1387. <https://doi.org/10.1093/ptj/66.9.1382>
- Halim, I., & Omar, A. R. (2012). Development of prolonged standing strain index to quantify risk levels of standing jobs. *International journal of occupational safety and ergonomics*, 18(1), 85-96. <https://doi.org/10.1080/10803548.2012.11076917>
- Halim, I., Arep, H., Kamat, S. R., Abdullah, R., Omar, A. R., & Ismail, A. R. (2014). Development of a decision support system for analysis and solutions of prolonged standing in the workplace. *Safety and health at work*, 5(2), 97-105. <https://doi.org/10.1016/j.shaw.2014.04.002>
- Hughes, N. L., Nelson, A., Matz, M. W., & Lloyd, J. (2011). AORN Ergonomic Tool 4: Solutions for prolonged standing in perioperative settings. *AORN journal*, 93(6), 767-774. <https://doi.org/10.1016/j.aorn.2010.08.029>
- International Labour Organization. (2011). *What is Occupational Safety and Health?*. Switzerland: International Labour Organization.
- Kerrigan, D. C., Todd, M. K., Della Croce, U., Lipsitz, L. A., & Collins, J. J. (1998). Biomechanical gait alterations independent of speed in the healthy elderly: evidence for specific limiting impairments. *Archives of physical medicine and rehabilitation*, 79(3), 317-322. [https://doi.org/10.1016/S0003-9993\(98\)90013-2](https://doi.org/10.1016/S0003-9993(98)90013-2)
- Khan, W. A., Mustaq, T., & Tabassum, A. (2014). Occupational health, safety and risk analysis. *International Journal of Science, Environment and Technology*, 3(4), 1336-1346.
- Kim, M. H., Choi, Y. T., Jee, Y. S., Eun, D., Ko, I. G., Kim, S. E., ... & Yoo, J. (2015). Reducing the frequency of wearing high-heeled shoes and increasing ankle strength can prevent ankle injury in women. *International journal of clinical practice*, 69(8), 909-910. <https://doi.org/10.1111/ijcp.12684>
- Lee, C. M., Jeong, E. H., & Freivalds, A. (2001). Biomechanical effects of wearing high-heeled shoes. *International journal of industrial ergonomics*, 28(6), 321-326. [https://doi.org/10.1016/S0169-8141\(01\)00038-5](https://doi.org/10.1016/S0169-8141(01)00038-5)
- Mahbubi, M., Ismail, M. T., Maharani, E., & Hariawan, H. (2016) Chronic Venous Insufficiency in a Woman with Standing Profession. *ACI (Acta Cardiologia Indonesiana)*, 2(1), 31-37.
- Mercieca, L. A. S., Formosa, C., Grima, J. N., Chockalingam, N., Gatt, R., & Gatt, A. (2017). On the use of auxetics in footwear: investigating the effect of padding and padding material on forefoot pressure in high heels. *Physica Status Solidi (b)*, 254(12), 1700528. <https://doi.org/10.1002/pssb.201700528>
- Mika, A., Oleksy, Ł., Mika, P., Marchewka, A., & Clark, B. C. (2012). The influence of heel height on lower extremity kinematics and leg muscle activity during gait in young and middle-aged women. *Gait & posture*, 35(4), 677-680. <https://doi.org/10.1016/j.gaitpost.2011.12.001>
- Mika, A., Kielnar, R., & Świerczek, M. (2016). The influence of high-and low-heeled shoes on balance in young women. *Acta of bioengineering and biomechanics*, 18(3), 97-103.

- <http://doi.org/10.5277/ABB-00483-2015-02>
- Ng, E. X., Monkhouse, C., Wong, P., Meyer, G., Aloni, Y., & Chong, D. Y. R. (2014). Assessment of the Impact of Positive Heels (Plantarflexion) and Negative Heels (Dorsiflexion) Shoes on Human Walking Gait. In *The 15th International Conference on Biomedical Engineering* (pp. 379-382). *Springer, Cham*. [http://doi.org/10.1007/978-3-319-02913-9\\_97](http://doi.org/10.1007/978-3-319-02913-9_97)
- Nigg, B. M., Baltich, J., Hoerzer, S., & Enders, H. (2015). Running shoes and running injuries: mythbusting and a proposal for two new paradigms: ‘preferred movement path’ and ‘comfort filter’. *British journal of sports medicine*, 49(20), 1290-1294. <http://doi.org/10.1136/bjsports-2015-095054>
- Schröder, G., Dahms, C., Boldt, R., Schulze, M., Hornung, A., Blaas, V., ... & Schober, H. C. (2019). Influence of wearing personalized high heels on the posture of women of different ages: A clinical cross-sectional study. *Int. Med. Care*, 3, 1-8. <http://doi.org/10.15761/IMC.1000127>
- Silva, A. M., de Siqueira, G. R., & da Silva, G. A. (2013). Implications of high-heeled shoes on body posture of adolescents. *Revista paulista de pediatria : orgao oficial da Sociedade de Pediatria de Sao Paulo*, 31(2), 265–271. <https://doi.org/10.1590/s0103-05822013000200020>
- Sudoł-Szopińska, I., Bogdan, A., Szopiński, T., Panorska, A. K., & Kołodziejczak, M. (2011). Prevalence of chronic venous disorders among employees working in prolonged sitting and standing postures. *International journal of occupational safety and ergonomics*, 17(2), 165-173. <https://doi.org/10.1080/10803548.2011.11076887>
- Tanner, K. (2018). *Research Methods (Second Edition): Information, Systems, and Contexts*. Elsevier Ltd. <https://doi.org/10.1016/B978-0-08-102220-7.00014-5>
- Tojo, M., Yamaguchi, S., Amano, N., Ito, A., Futono, M., Sato, Y., ... & Ohtori, S. (2018). Prevalence and associated factors of foot and ankle pain among nurses at a university hospital in Japan: A cross-sectional study. *Journal of occupational health*, 60(2), 132-139. <https://doi.org/10.1539/joh.17-0174-OA>
- Xiong, S., & Hapsari, V. D. (2014). Effects of heel height and wearing experience on human standing balance. *Journal of foot and ankle research*, 7(1), A97. <https://doi.org/10.1186/1757-1146-7-S1-A97>

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**RESEARCH**

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## Implementation of Telemedicine through "Apoteker Keluarga Online" Application as an Effort for Rational Headache Self-Medication

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### Abstract

People who seek self-medication for acute headaches in pharmacies are not properly diagnosed and treated. Irrational drug use has a high potential for causing medication errors. The AKO application is one of the digital counseling service apps managed by a pharmacist who has a strategic role in educating patients on self-medication behavior in telemedicine services. The objective of this study is to identify the benefits of AKO use in increasing rational self-medication behavior in headache complaints. It is a descriptive analysis study with a case-control design. The population is the Lamongan community who have had headache self-medication. Samples were taken by purposive sampling technique. A total of 130 participants were divided into two groups: the intervention group and the control group. A headache self-medication questionnaire was employed as the instrument. The collected data was then analyzed using the Mann Whitney test to determine the value of the AKO application in increasing knowledge of the rationality of self-medication in headache complaints. The data from the measurement of the level of knowledge of the rationality of headache self-medication revealed that the majority of the intervention group (92.3%) had good knowledge and none had poor knowledge. While there are still respondents with less knowledge (15.3%) in the control group. The statistical test results for the benefits of AKO application assistance on the level of knowledge of the rationality of headache self-medication revealed a p value = 0.000, indicating a significant difference between the intervention and treatment groups. The use of telemedicine via the AKO application can increase public awareness of the rational use of headache medications. Digital health services can be used as a medium for counseling and remote patient health monitoring.

**Keywords:** "Apoteker Keluarga Online", Headache, Self-Medication, Telemedicine.

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## 1. INTRODUCTION

Self-medication is an essential concern at the global level, and is a crucial issue in the health sector. Self-medication is implemented every day in the form of self-care for our health (Mathias et al., 2020). In practice, inappropriate self-medication not only places a burden on the patient, but it also leads to unfavorable health outcomes such as drug resistance, side effects, drug interactions, and even death (Octavia et al., 2019).

According to reports, more than 90% of the population suffers from headache disorders. Approximately half of all headache sufferers and one-third of migraine sufferers believe their condition does not necessitate medical attention. For acute headaches that have not been properly diagnosed and treated, people frequently seek self-medication in pharmacies (Brusa et al., 2019). Research in Arabia reported that almost all of the respondents 98.7% practiced self-medication, encompassing headaches, which was 75.9% (Alshahrani et al., 2019). (Mehuys et al., 2012) revealed a high prevalence of medication errors for headaches. Irrational drug use has a high potential for increasing the incidence of medication errors, intensifying the patient's burden and budget expenditures, as well as side effects and drug use interactions that increase the risk (Octavia, 2019). Migraines affect more than a billion people worldwide and require critical health care resources. The COVID-19 pandemic has prompted a rapid transition to virtual care (Noutsios et al., 2021). Therefore, telemedicine can be a solution for treating patients who experience headaches during the Covid-19 pandemic (Spina et al., 2022).

Telemedicine has the potential to provide affordable, high-quality healthcare. Several factors are considered to contribute to the success of telemedicine programs, encompassing financial sustainability, ease of use, and utilization of existing resources (Jha et al., 2021). Telemedicine reduces the use of personal protective equipment and prevents the spread of COVID-19 by implementing social distancing (Chiang et al., 2021). The *Apoteker Keluarga Online* (AKO) application is one of the digital counseling service applications managed by Pharmacist Agent of Change (Octavia & Susanti., 2022). Community pharmacists possess a strategic position in educating patients on self-medication behavior in telemedicine services (Mehuys et al., 2012). Pharmacists are one of the health professionals who can provide information about drug use (Octavia & Aisyah, 2019). The AKO application will allow the public to connect directly with pharmacists as drug service providers, as well as establish two-way communication. The objective of this study is to identify the advantages of AKO application in increasing rational self-medication behavior in headache patients.

## 2. RESEARCH METHOD

This research is survey research with descriptive analysis method with case-control design. The population in this study was the Dinoyo village community, Lamongan district who had performed self-medication for headache as many as 379. From the population data, the minimum sample size was calculated by employing the Slovin formula and the minimum sample was 120. Then, an additional 10% was added to anticipate sample drop outs or the data obtained in the research process is incomplete. Thus, the minimum number of respondents is 130 respondents. Purposive sampling was employed for gathering samples. People who had self-medicate for headache, were 18-64 years old, able to operate a smartphone, and willing to be a research participant as evidenced by informed consent were eligible for this study. The total sample of 130 participants was divided into two groups of 65 participants each. As the intervention group, the group that received education and assistance with digital counseling via the AKO application media, and the control group that did not receive assistance.

The instrument used was the Headache Self-medication questionnaire, which was filled out directly by the respondents online and contained 14 validated questions. Statistical analysis was administered on each question item by correlating the question item score with the total score. If the calculated  $r$  value  $>$   $r$  table value with  $\alpha = 5\%$ , the questions in the questionnaire are

declared valid. The value of  $r$  table for 30 respondents is 0.361. Based on the results obtained, it demonstrates that each item of the headache self-medication question has an  $r$  value that is greater than the  $r$  table, which is 0.4, hence, the question item is declared valid and can be employed for research. Each correct answer is provided a score of 1 and the correct answer is provided, incorrectly given a value of 0. The collected data was then analyzed using the Mann Whitney test to determine the value of the AKO application in increasing knowledge of the rationality of self-medication in headache complaints. The limitation of this study is that it does not assess the effectiveness of AKO application in increasing public awareness of rational headache self-medication. This research has gone through an ethical test and was declared ethically feasible with the ethical number 088/EC/KEPK-S2/06/2021 issued by the Health Research Ethics Commission of the University of Muhammadiyah Lamongan.

### 3. RESULTS AND DISCUSSION

The distribution of respondents (Table 1) shows that the total number of participants (N) who participated in this study was 130, divided into two groups of 65 participants each. The control group received no assistance with the AKO application, whereas the intervention group received digital counselling assistance with the AKO application. This study took place between June and October of 2021. The majority of the women in both groups were between the ages of 36 and 45.

**Table 1.** Characteristic of Respondent.

Demography	Intervention Group		Control Group	
	n	%	n	%
<b>Gender</b>				
Male	13	20%	15	23%
Female	52	80%	50	77%
Total	65	100%	65	100%
<b>Age (year)</b>				
18-25				
26-35	14	21.5%	12	18.4%
36-45	35	53.8%	29	44.6%
46-55	14	21.5%	21	32.3%
56-65	2	3%	3	4%
Total	65	100%	65	100%

The findings of the measurement of the level of knowledge of the rationality of headache self-medication (Table 2) reveal that the data are quite different, with the majority of the intervention group (92.3%) having good knowledge and none having poor knowledge. Meanwhile, there are still respondents with less knowledge (15.3%) in the control group.

**Table 2.** The Level of Knowledge of Headache Self-Medication.

Level of Knowledge	Intervention Group		Control Group	
	n	%	n	%
Good	60	92.3%	41	63%
Fair	5	7.6%	14	21.5%
Poor	0	0	10	15.3%
Total	65	100%	65	100%

**Table 3.** A Comparison of Headache Self-Medication between Intervention and Control Groups.

<b>Groups</b>	<b>Mean Rank</b>	<b>z</b>	<b>p</b>
Intervention (n=65)	75.38	-4.119	0.000
Control (n=65)	55.62		

The statistical test of the benefits of AKO application assistance on the level of knowledge of the rationality of headache self-medication (Table 3) revealed a p value = 0.000, indicating a significant difference between the intervention and control groups.

Headache disorders are regarded as common complaints among the general public. According to statistics, 90% of people have a headache episode at least once a year (Brusa et al., 2019). However, only 2.7% of migraine patients consulted a medical facility, and 59.4% of primary headache patients never consulted a doctor about their headaches (Suzuki et al., 2014). Therefore, most headache patients may cope with the pain by having over-the-counter medications (Mizusawa et al., 2013).

According to the findings, the majority of respondents were female. Migraine is more common in women and people with lower levels of education (Brusa et al., 2019). It is similar to the results of previous studies that the epidemiology of headaches occurs in the age range of 15-64 years and is common in middle-aged women in the range of 36-49 years. It is directly associated with daily life and socio-economic activities (Katsuki et al., 2022).

Self-medication behavior is frequently performed in cases of mild disease, one of which is headache. According to the study's findings, women were more dominant in self-medication for headaches because women paid more attention to their health conditions, so they would be cautious when doing self-medication and consuming the types of over-the-counter medicines used for self-medication. This is consistent with the findings of Karimy et al. (2019), who discovered that 76% of women had used self-medication in the past. Many of the reasons for self-medication stem from the belief that self-medication is considered harmless (41%), and that the symptoms experienced are not severe enough to necessitate special medical treatment (Karimy et al., 2019). It is different, in accordance with Tesfamariam et al., (2019) that the ease of accessibility factor underlies the behavior of people's self-medication in India (21.55%) (Tesfamariam et al., 2019). Age can also influence drug selection in the community for self-medication. The majority of respondents are over the age of 18. Adults use self-medication drugs more frequently because of the influence of activity-intensive factors that cause symptoms such as headaches to appear, necessitating the use of self-medication drugs to treat the disease they are experiencing, as opposed to adolescents who are physiologically stronger and thus use drugs less frequently.

Tesfamariam et al. (2019) explained that when people first started self-medication, pharmacists were the most sought after for information or instructions on how to use drugs (34.8%), followed by those who needed medical consultation from doctors (27.1%), others (21%) sought advice from friends and relatives, and the rest (3.4%) used the internet or mobile applications as a source of information. The level of knowledge of the intervention group who received assistance from pharmacists had a higher percentage of 'good' knowledge than the control group, indicating that public trust in the role of pharmacists is still quite high. Pharmacists who work in a variety of settings and health care facilities interact with patients either directly or indirectly. They can respond quickly to public health emergencies by developing professional service guidelines for pharmacists working in various health facilities, ensuring an effective drug supply system, monitoring and resolving drug shortage issues, establishing and promoting remote pharmacy services, counseling communities on basic infection prevention, and educating patients about proper use of personal protective equipment (Octavia & Utami, 2022). When people do not understand the role of pharmacists, the purpose of providing drug information may be incomplete and unclear, increasing the risk of medication

errors and reducing therapeutic goals achievement (Pratiwi et al., 2020). Provision of drug information can increase rationality in treatment (Inayatillah et al., 2023). At all levels of healthcare delivery, patients, healthcare professionals, regulators, and the pharmaceutical industry must work together to reduce the risk of medication errors (Octavia et al., 2021).

Self-medication for headaches necessitates the pharmacist's involvement in the selection of the appropriate self-medication. Research from Mourya et al., (2019), the most common symptoms experienced by the community are fever (31.55%) and headache (30%), so the use of over-the-counter drugs and over-the-counter drugs, including analgesics, which are the drug choices most frequently purchased by the public, is limited. In Pharmacies in India (Mourya et al., 2019) The level of public knowledge in general about the indications and how to use analgesics such as NSAIDs (Non Steroid Anti-Inflammatory Drugs) possesses a good level of knowledge, this also still requires pharmacist monitoring in the duration of analgesic use, to prevent risk of drug-related problems (Utami et al., 2020). Most people choose self-medication only to suppress disease symptoms, but research in the control group shows that there are still respondents who lack sufficient knowledge and understanding of the proper use of self-medication. Based on this, pharmacists are desperately needed in drug information and counseling services as in the research of Mourya et al., (2019). Almost 51.55% of respondents require counseling with pharmacists before deciding which self-medication drug to use.

Pharmacists have a professional responsibility to provide logical advice in the selection of rational self-medication so that it can have a positive impact on improving the patient's quality of life, which is supported by the provision of information on safe and appropriate drug use, such as drug indications, how long is the ideal time to use it, what is the dosing regimen, and when to stop the drug. Community pharmacists must also stay involved in coordinated and adaptive efforts to the necessary changes in pharmaceutical practice. It is critical to be aware of potential emergencies at the pharmacy at all times (Utami et al., 2021).

The AKO application was developed with the goal of educating the public on the benefits of rational self-medication. The AKO application facilitates two-way communication between pharmacists, agents of change, and members of the public who are connected to the WhatsApp application, allowing respondents to consult about drug-related issues. The availability of direct communication between pharmacists and respondents will make it easier for people to obtain appropriate drug use solutions from pharmacists. The study's findings show that the intervention group, which received treatment with education and assistance through applications, had a higher level of knowledge than the control group. The use of the AKO application is an online pharmacy service innovation that is implemented directly by pharmacists and is easily accessible at any time through the playstore. As is the case with mobile e-health which contains online medical services (telemedicine). E-health is an information and communication technology in the health sector. People will more easily understand and recognize various types of drugs, encompassing how to use drugs properly and correctly. Mobile applications make it easier for people to identify or access various information on their own medicines (Muzakir, 2018). Telemedicine has proven to be beneficial to the community because it reduces travel time and costs when compared to in-person consultations, particularly during the COVID-19 pandemic, which forces people to confine themselves to their homes or visit health facilities (Calton, Abedini & Fratkin, 2020), (Bashshur et al., 2020).

Telemedicine is already employed in most countries as a tool to enhance health services. There are shortcomings in the use of telemedicine such as technological barriers, it becomes a big problem when the application is implemented by people who are less savvy about technology (Scott Kruse et al., 2018). Telemedicine is now a modern health-care delivery system thanks to advancements in telecommunications technology. Telemedicine improves

services such as specialized care, patient consultation, remote patient monitoring, and health education without requiring patients to leave their homes. Telemedicine benefits include increased compliance, decreased anxiety, improved quality of life, and patient empowerment through active participation in their own illness management (Chen, 2017).

The importance of a pharmacist will be highlighted because this application includes self-medication educational materials that are useful in everyday life. Educational materials are packaged in a simple and straightforward manner, with categories for self-medication use at various ages ranging from child to elderly self-medication. DAGUSIBU provides basic drug education through its materials (how to get, use, store, and dispose of drugs). The community requires health information and education about drugs and how to choose the right drugs so that individuals and the community can participate in therapy and drug use decisions in order to achieve optimal results, improve quality of life, be more responsible for health, independent, and capable of rational and safe self-medication. Pharmacists can help to close current population health gaps, which can have a direct impact on patients' medication adherence and overall health status (Livet et al., 2021). The education will keep the community from promoting commercial drugs, which are widely disseminated on social media. In today's digital technology era, the community desperately needs education and assistance through applications. People will become more aware of the existence of pharmacists. Tele-pharmacy has the potential to improve pharmaceutical care service delivery by lowering medication errors, increasing access to health professionals and facilities in remote and rural areas, and reducing adverse drug events (Tegegne et al., 2023).

This study has limitations in conducting research, specifically limitations when testing information (assessment) from pharmacists to respondents; respondents frequently encounter obstacles in responding to assessment data needed by a pharmacist, so several assessments are required. To complete patient assessment data, it should take several form options and access options, such as video calls on the application page.

#### 4. CONCLUSION

The use of telemedicine via the AKO application can increase public awareness of the rational use of headache medications. Digital health services can be used as a medium for counseling and remote patient health monitoring.

#### REFERENCES

- Alshahrani, S. M., Alavudeen, S. S., Alakhali, K. M., Al-Worafi, Y. M., Bahamdan, A. K., & Vigneshwaran, E. (2019). Self-Medication Among King Khalid University Students, Saudi Arabia. *Risk Management and Healthcare Policy*, 12, 243–249. <https://doi.org/10.2147/RMHP.S230257>
- Bashshur, R., Doarn, C. R., Frenk, J. M., Kvedar, J. C., & Woolliscroft, J. O. (2020). Telemedicine and the COVID-19 pandemic, lessons for the future. *Telemedicine and E-Health*, 26(5), 571–573. <https://doi.org/10.1089/tmj.2020.29040.rb>
- Brusa, P., Allais, G., Scarinzi, C., Baratta, F., Parente, M., Rolando, S., Gnavi, R., Spadea, T., Costa, G., Benedetto, C., Mana, M., Giaccone, M., Mandelli, A., Manzoni, G. C., & Bussone, G. (2019). Self-medication for migraine: A nationwide cross-sectional study in Italy. *PloS One*, 14(1), e0211191. <https://doi.org/10.1371/journal.pone.0211191>
- Calton, B., Abedini, N., & Fratkin, M. (2020). Telemedicine in the Time of Coronavirus. *Journal of Pain and Symptom Management*, 60(1), e12–e14. <https://doi.org/10.1016/j.jpainsymman.2020.03.019>
- Chen, E. T. (2017). Considerations of Telemedicine in the Delivery of Modern Healthcare. *American Journal of Management*, 17(3), 20–28.
- Chiang, C.-C., Halker Singh, R., Lalvani, N., Shubin Stein, K., Henscheid Lorenz, D., Lay, C.,

- Dodick, D. W., & Newman, L. C. (2021). Patient experience of telemedicine for headache care during the COVID-19 pandemic: An American Migraine Foundation survey study. *Headache*, 61(5), 734–739. <https://doi.org/10.1111/head.14110>
- Inayatillah, F., Octavia, D. R., & Rahman, A. A. (2023). Profil Pemberian Informasi Obat Swamedikasi Di Apotek Wilayah Kecamatan Lamongan (Studi Dengan Metode Simulasi Pasien). *Medical Sains Jurnal Ilmiah Kefarmasian*, 8(1), 33–40. <https://doi.org/10.37874/ms.v8i1.454>
- Jha, A. K., Sawka, E., Tiwari, B., Dong, H., Oh, C. C., Ghaemi, S., Zhang, X., & Jha, A. K. (2021). Telemedicine and Community Health Projects in Asia. *Dermatologic Clinics*, 39(1), 23–32. <https://doi.org/10.1016/j.det.2020.08.003>
- Karimy, M., Rezaee-Momtaz, M., Tavousi, M., Montazeri, A., & Araban, M. (2019). Risk factors associated with self-medication among women in Iran. *BMC Public Health*, 19, 1033. <https://doi.org/10.1186/s12889-019-7302-3>
- Katsuki, M., Yamagishi, C., Matsumori, Y., Koh, A., Kawamura, S., Kashiwagi, K., Kito, T., Entani, A., Yamamoto, T., Ikeda, T., & Yamagishi, F. (2022). Questionnaire-based survey on the prevalence of medication-overuse headache in Japanese one city-Itoigawa study. *Neurological Sciences : Official Journal of the Italian Neurological Society and of the Italian Society of Clinical Neurophysiology*, 43, 381-3822. <https://doi.org/10.1007/s10072-021-05831-w>
- Livet, M., Levitt, J. M., Lee, A., & Easter, J. (2021). The pharmacist as a public health resource: Expanding telepharmacy services to address social determinants of health during the COVID-19 pandemic. *Exploratory Research in Clinical and Social Pharmacy*, 2, 100032. <https://doi.org/10.1016/j.rcsop.2021.100032>
- Mathias, E. G., D'souza, A., & Prabhu, S. (2020). Self-Medication Practices among the Adolescent Population of South Karnataka, India. *Journal of Environmental and Public Health*, 2020, 9021819. <https://doi.org/10.1155/2020/9021819>
- Mehuys, E., Paemeleire, K., Van Hees, T., Christiaens, T., Van Bortel, L. M., Van Tongelen, I., De Bolle, L., Remon, J.-P., & Boussery, K. (2012). Self-medication of regular headache: a community pharmacy-based survey. *European Journal of Neurology*, 19(8), 1093–1099. <https://doi.org/10.1111/j.1468-1331.2012.03681.x>
- Mizusawa, H., Sakai, F., & Tsuji, S. (2013). *Clinical Practice Guideline for Chronic Headache 2013 On Publication of Clinical Practice Guideline*. 284.
- Mourya, A., Mary, C., James, C., Jose, J., & Srinivasan, R. (2019). A Survey on Over The Counter Drug usage in the Community. *Journal of Drug Delivery & Therapeutics*, 9(2-s), 406–416.
- Muzakir, A. (2018). Prototyping Aplikasi E-Health sebagai Bagian Pengenalan Obat-Obatan Dengan Teknologi Cross-Platform. *Jurnal Informatika: Jurnal Pengembangan IT (JPIT)*, 03(01), 61–66.
- Noutsios, C. D., Boisvert-Plante, V., Perez, J., Hudon, J., & Ingelmo, P. (2021). Telemedicine Applications for the Evaluation of Patients with Non-Acute Headache: A Narrative Review. *Journal of Pain Research*, 14, 1533–1542. <https://doi.org/10.2147/JPR.S309542>
- Octavia, D. R., Purwandini, S. N. ., Hilaria, M. ., & Pangestu, D. P. . (2021). Medication Error at the Prescribing Phase . *JURNAL INFO KESEHATAN*, 19(1), 12–19. <https://doi.org/10.31965/infokes.Vol19.Iss1.417>
- Octavia, D. R. (2019). Tingkat pengetahuan masyarakat tentang swamedikasi yang rasional di Lamongan. *Surya: Jurnal Media Komunikasi Ilmu Kesehatan*, 11(03), 1-8. <https://doi.org/10.38040/js.v11i03.54>
- Octavia, D. R., & Aisyah, M. (2019). Pelatihan Apoteker Cilik Siswa Sekolah Dasar Dalam Upaya Penggunaan Obat Yang Tepat Di Lamongan. *JCES (Journal of Character*

- Education Society*), 2(2), 1-10. Retrieved from <https://journal.ummat.ac.id/index.php/JCES/article/view/1482>
- Octavia, D. R., & Susanti, I. (2022). Aplikasi AKO (Apoteker Keluarga Online) sebagai Media Digital Counseling dalam Upaya Penggunaan Obat yang Rasional di Masyarakat. *PUNDIMAS: Publikasi Kegiatan Abdimas*, 1(1), 1-6. <https://doi.org/10.37010/pnd.v1i1.553>
- Octavia, D. R., & Utami, P. R. (2022). The Role of Community Pharmacists in Drug Information Services in Lamongan During the COVID-19 Pandemic. *KnE Medicine*, 341–349. <https://doi.org/10.18502/kme.v2i3.11885>
- Pratiwi, H., Mustikaningtiyas, I., Widyartika, F. R., Setiawan, D., Nasrudin, K., & Julietta, L. (2020). Analisis Persepsi Masyarakat Terhadap Peran Apoteker Pada Layanan Kefarmasian Di Apotek Kecamatan Sokaraja, Baturraden, Sumbang, Dan Kedungbanteng. *JPSCR: Journal of Pharmaceutical Science and Clinical Research*, 5(1), 33. <https://doi.org/10.20961/jpscr.v5i1.39273>
- Scott Kruse, C., Karem, P., Shifflett, K., Vegi, L., Ravi, K., & Brooks, M. (2018). Evaluating barriers to adopting telemedicine worldwide: A systematic review. *Journal of Telemedicine and Telecare*, 24(1), 4–12. <https://doi.org/10.1177/1357633X16674087>
- Spina, E., Tedeschi, G., Russo, A., Trojsi, F., Iodice, R., Tozza, S., Iovino, A., Iodice, F., Abbadessa, G., di Lorenzo, F., Miele, G., Maida, E., Cerullo, G., Sparaco, M., Silvestro, M., Leocani, L., Bonavita, S., Manganelli, F., & Lavorgna, L. (2022). Telemedicine application to headache: a critical review. *Neurological Sciences*, 43, 3795-3801. <https://doi.org/10.1007/s10072-022-05910-6>
- Suzuki, N., Ishikawa, Y., Gomi, S., Ito, N., Watanabe, S., Yokoyama, M., Funatsu, K., Miyake, H., Yokoyama, H., Shimizu, T., & Shibata, M. (2014). Prevalence and characteristics of headaches in a socially active population working in the Tokyo metropolitan area - surveillance by an industrial health consortium. *Internal Medicine*, 53(7), 683–689. <https://doi.org/10.2169/internalmedicine.53.1700>
- Tegegne, M. D., Wubante, S. M., Melaku, M. S., Mengiste, N. D., Fentahun, A., Zemene, W., Zeleke, T., Walle, A. D., Lakew, G. T., Tareke, Y. T., Abdi, M. S., Alemayehu, H. M., Girma, E. M., Tilahun, G. G., Demsash, A. W., & Dessie, H. S. (2023). Tele-pharmacy perception, knowledge and associated factors among pharmacy students in northwest Ethiopia: an input for implementers. *BMC Medical Education*, 23, 130. <https://doi.org/10.1186/s12909-023-04111-9>
- Tesfamariam, S., Anand, I. S., Kaleab, G., Berhane, S., Woldai, B., Habte, E., & Russom, M. (2019). Self-medication with over the counter drugs, prevalence of risky practice and its associated factors in pharmacy outlets of Asmara, Eritrea. *BMC Public Health*, 19, 159. <https://doi.org/10.1186/s12889-019-6470-5>
- Utami, P. R., Octavia, D. R., & Fandinata, S. S. (2020). The Level Of Knowledge on the Use Of NSAIDs As Analgesic For Dysmenorrhea Case In Faculty of Health Universitas Muhammadiyah Lamongan. *Jurnal Midpro*, 12(2), 287. <https://doi.org/10.30736/md.v12i2.245>
- Utami, P. R., Sholikhah, S., Putri, A. K., Octavia, D. R., & Rahmawati, E. (2021). Pharmacists Efforts in Community Pharmacy to Achieve Health Protocol Compliance During the Covid- 19 Pandemic in Lamongan. *STRADA Jurnal Ilmiah Kesehatan*, 10(1), 310–317. <https://doi.org/10.30994/sjik.v10i1.628>

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**RESEARCH**

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## The Role of the Family in Preventing the Transmission of COVID-19 in Children

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### Abstract

COVID-19 is a disease that is highly communicable from infected individuals to others who are susceptible to infection. The family is the first line of defense against the spread of the COVID-19 epidemic among youngsters. There is transmission of the COVID-19 virus to children notwithstanding the inadequacy of parental efforts to prevent such transmission. The effect of COVID-19 infection on unfit parents will result in the transmission of the virus to offspring. The incidence of COVID-19 in children is influenced by the level of parental knowledge and conduct to avoid the transfer of the virus. The purpose of this study is to examine the relationship between parents' activities and attitudes regarding COVID-19 prevention, the detection of COVID-19 symptoms in children, and the level of information regarding the prevalence of COVID-19 in children. The research design employs a cross-sectional observational analysis. This study's demographic and sample consisted of proportional samples from 12 Community Health Centers, with 550 family respondents in total. The results of this study indicate that delivering the COVID-19 vaccination to the family considerably reduces the risk of COVID-19 transmission to children. The level of family knowledge correlates strongly with the transmission of COVID-19 to children (a symp=0.001, with a correlation p-value of 0.669). There is a correlation between the administration of the COVID-19 vaccine to parents and the transmission of the virus to children (symp=0.001, p=0.660). Based on the results of the study, there was a significant influence between the level of parental knowledge on the behavior of preventing COVID-19 in children in Kupang City. In addition, there is a significant relationship between the behavior and attitudes of parents who are disobedient in preventing COVID-19 in children and the incidence of COVID-19 in children. Families or parents who carry out the COVID-19 vaccination in the family also have a significant relationship with the transmission of the COVID-19 virus to children. To reduce the transmission of COVID-19 to children, efforts from the family are needed, such as implementing health protocols and carrying out vaccinations.

**Keywords:** COVID-19, Children, Level of family knowledge, Preventive behavior.

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## 1. INTRODUCTION

The rapid spread of COVID-19 is one of the characteristics that sets it apart from other diseases that have evolved that are similar in nature. This virus's behaviour is extremely infectious to other people. This virus is rapidly spreading, and the number of people infected with it is steadily increasing. According to information obtained by The World Health Organization (WHO) on June 9, 2020 from local and national authorities, there have been more than 7 million cases of COVID-19 and more than 400,000 fatalities as a result of the disease (WHO, 2020), (Blumberg, et al., 2020), (Dong, et al, 2020).

As of 2 April, 2020, the COVID-19 pandemic has resulted in >890,000 cases and >45,000 deaths worldwide. In the United States, infants, children, and older teenagers make up 22% of the population (CDC, 2020), (CDC, 2020). According to data from China, pediatric instances of COVID-19 may not be as severe as adult cases, and children may exhibit different symptoms than adults. The China Pneumonia Emergency Response Epidemiology Team conducted research with 72,314 individuals and determined that approximately 2% of the 44,672 confirmed cases of COVID-19 were children aged 0-19, with 0.9% of these cases occurring in children under the age of 10. This outbreak has been labelled a pandemic by the WHO (WHO, 2020), (She, Liu , & Liu, 2020).

In contrast to the situation in other nations, Indonesia has had a high rate of COVID-19 transmission. This has been the case since the disease was discovered there. The cross-infection that can occur between children and their parents is the primary mode of disease transmission (Anantyo et al., 2020). Because parents do not comply with health norms and do not vaccinate their children against COVID-19, the virus is able to be passed on to their children (Anantyo et al., 2020). The family is the basic structural unit that should serve as the foundation for any efforts made by the government to stop the spread of COVID-19. It is critical to have an accurate understanding of the factors that have a role in the spread of the COVID-19 virus to children such as the level of knowledge, attitudes to prevent transmission, health protocols, and the COVID-19 vaccination support preventing transmission to children (Ernawati et al., 2020; Adeyinka et al., 2021; She, Liu , & Liu, 2020).

The biggest risk in this pandemic is that someone who is infected will make it difficult to manage relationships with those who are already infected or waiting for the results of diagnostic tests (Shelmerdine et al., 2020), (Shen et al. (2020)). This study will look into the family's roles and activities in stopping the spread of the COVID-19 viral infection. The goal of this study was to examine the association between the level of family awareness in avoiding COVID-19, family attitudes and behavior, and parents' COVID-19 vaccination behaviour on COVID-19 transmission to children.

## 2. RESEARCH METHOD

A method for doing research based on observational analytics and a cross-sectional design. This research was conducted from March 28 to May 30, 2022 in a total of 12 health sites, with 550 individuals who met the inclusion criteria volunteering their responses. The family dynamic and the children's development are the foci of this investigation. There is a level of validity and reliability in the study instrument that is equal to 91%. Interviews and a questionnaire were used to compile the data collected for this study. The interviews focused on gathering demographic information and determinants on transmission of COVID-19 virus to children. In addition, other data were collected by analyzing particular antigens and swabs taken from children who had a history of acute respiratory infections in their family. Utilizing various software programs, an analysis of the data was performed. Due to the fact that the acquired data do not follow a normal distribution, a bivariate analysis will be performed using the Spearman test and the Mann-Whitney test (with a significance level of = 0.05). In addition, the Section Kupang Ministry of Health Poltekkes Research Ethics Committee gave their stamp

of approval to this study (their number is LB.02.03/1/0075/2022, and the date is March 25th, 2022) in order to ensure that it adheres to ethical standards.

In this study, the selected respondents were families discovered in 12 Kupang Health Centers after their children had treatment for respiratory infections or coughs. The family was then informed and informed consent was obtained. Children who meet the requirements for exposure to upper respiratory tract infections are followed with a pap smear antigen test by Puskesmas health professionals to determine if they have been exposed to COVID-19. A questionnaire is utilized to assess the amount of family knowledge, attitudes, and behaviour towards the prevention of COVID-19 in children. Individuals who are at risk for COVID-19 and who have had COVID-19 immunizations can demonstrate their status using a COVID-19 vaccination card.

### 3. RESULTS AND DISCUSSION

**Table 1.** Distribution of Families respondents based on age, level of education level, and homestay status (n = 550).

Variable	Category	Total	Percentage (%)
Age	25-30	106	19,27
	30-35	129	23,45
	35-40	150	27,27
	40-45	165	30,01
Level of education	Elementary school/equivalent	155	28,18
	Junior high school/equivalent	145	26,33
	Senior high school/equivalent	160	29,09
	University/Higher education	90	16,37
Home stay status	Live with nuclear family	425	77,27
	Own house	125	22,73

Table 1 illustrates the characteristics of the respondents, which demonstrate that the majority of respondents were aged 40-45 years (30.01%) and had the highest education level, namely SMA, with 160 respondents (29.09%). According to population status, the vast majority of respondents (77.27%) lived with their nuclear family.

**Table 2.** Family behavior in preventing transmission of COVID-19 in children by vaccinating (n=550).

Variable	Category	Total	Percentage (%)
Administering COVID-19 vaccinations to families	The family has been given the COVID-19 vaccine	242	44
	The family has not been given the COVID-19 vaccine	308	56
	Total	550	100

According to the data shown in Table 2, which can be found above, greater than half of the respondents who had the status of parent did not be vaccinated against COVID-19. This amounts to 308 families, or 56% of the total.

**Table 3.** The attitude of the family in prevention the transmission of COVID-19 in children (n=550).

Variable	Category	Total	Percentage (%)
The attitude of the family in efforts to prevent the transmission of COVID-19 in children	Good for prevention	100	18,18
	Enough prevention efforts	125	22,73
	Lacking in prevention	325	59,09
	Total	550	100

Based on table 3, more than half of the respondents, 325 respondents (59.09%), displayed poor attitudes and behaviours regarding the prevention of COVID-19 virus transmission.

**Table 4.** The level of family knowledge and preventing preventive behavior COVID-19 in children in Kupang City in 2022 ( n=550).

Variable	Category	Total	Percentage (%)
The level of family knowledge and preventing preventive behavior COVID-19 in children	The knowledge level is good	68	12,04
	An adequate level of knowledge	237	43,09
	Lack of knowledge level	245	45,00
Total		550	100

According to table 4, it is possible to infer that just 68 (12.04%) of the total respondents had strong knowledge. This is fewer than one-eighth of the total respondents. Although the majority of respondents (245) had inadequate knowledge and 237 (43.09%) had sufficient knowledge, the majority of respondents had inadequate knowledge (43.09%).

**Table 5.** The transmission rate in children from pap smear examination results in children who have upper respiratory infections with antigen swabs (n = 100).

Variable	Category	Total	Percentage (%)	Category	Total	Percentage (%)	
Age	5 years	Reactive (positive for covid 19)	20	20	non-reactive (negative for covid 19)	13	13
	6-10 years	Reactive (poistive for covid 19)	12	12	non-reactive (negative for covid 19)	15	15
	11-16 years	Reactive (positive for COVID-19)	10	10	non-reactive (negative for covid 19)	30	30
Total		42	100		58	100	

Table 5 displays the findings of the Pap smear for 100 children with symptoms of acute respiratory infection. There were 42 (42%) children with reactive nasal and throat smear results, while there were 58 (58%) children with non-reactive results.

**Table 6.** The relationship between age, level of family knowledge, and family behavior to prevent COVID-19 in children and to give vaccines to parents of children in against transmission of COVID-19 in children.

Variable	Asymp. Sig. (2-sided)	p = value Correlation
The relationship between the age of parents and the transmission of COVID-19 in children	0,100	0,261
The relationship between the level of family knowledge and transmission of COVID-19 in children	0,001	0,669
Relationship between family transmission prevention behavior and COVID-19 transmission in children	0,001	0,561
The relationship between the administration of the COVID-19 vaccine to parents and the transmission of COVID-19 to children	0,001	0,660

*Spearman test*

\*p-value > 0.05 (0.00 to 0.20 means: there is almost no correlation 0.21 to 0.40, meaning: low correlation 0.41 to 0.60, meaning: moderate correlation 0.61 to 0.80, meaning: high correlation 0.81 to 1.00, meaning: perfect correlation)

On the basis of the data shown in table 6, it is possible to draw the conclusion that the administration of the COVID-19 vaccine to children is the factor that has the most significant impact on the rate at which COVID-19 is passed on to children. According to the information in the table that was just presented, there is a significant correlation between the level of knowledge that children have and the transmission of COVID-19 (a sym=0.001, with a correlation p=value of 0.669). Vaccination of parents is protective against the passing on of COVID-19 to their offspring (symp=0.001, p=0.660); this protective effect is statistically significant.

In terms of family involvement in COVID-19 prevention in children, the findings of this study indicate that families have implemented COVID-19 prevention in children. The majority of the 550 heads of households (64.50%) have implemented methods for preventing COVID-19 in children based on their attitudes and level of knowledge about the topic. For instance, if a family member has respiratory tract infection symptoms, the family maintains physical distance, washes hands after handling objects, and wears a mask when coughing and facing patients to prevent droplet transmission. Aerosolized COVID-19 infections are the norm (Ernawati et al, 2020), (Sinha et al., 2020). There is a substantial risk of COVID-19 transmission in non-circulating settings, such as houses, for all variants of COVID-19 with genetically engineered MRa viruses (Assaker et al., 2020), (Bandi, Nevid, & Mahdavinia, 2020). The extent to which families adopt this preventive relies on their level of perception, individual experience, access to adequate information, and prior exposure to COVID-19. In families with a high level of education, this preventive behaviour is typically performed naturally and without education from the outside environment or health professionals. In contrast, a lack of education will influence preventative behaviour (Syadidurrahmah et al, 2020), (Ashidiqie, 2020).

Researchers identify children with acute respiratory infections symptoms by using nose and throat swabs with the COVID-19 antigen test. This allows the researchers to determine whether or not children are exposed to COVID-19. Children who are exposed to the virus exhibit a variety of symptoms, including coughing, difficulty breathing, fever, and runny or stuffy nose (rhinorrhea) (Liu et al., 2020). The level of perception, individual experience, proper information, and previous experience of suffering from COVID-19 all have a role in

determining the amount of family implementation in the carrying out of this preventive. This preventative behaviour is instinctive and frequently carried out without any education from the outside environment or health workers in homes where the family members have received an acceptable education.

On the other hand, preventative behaviours will be impacted by a low degree of education. In 2019, the Ministry of Health reported that those who had been exposed to COVID-19 as well as those who had not been exposed had followed the preventative practises. The prevention of COVID-19 can be enhanced by regulating and improving individual and community health by maintaining patterns of behaviour and lifestyle that can effect health improvement. This can be done by keeping healthy patterns of behaviour and lifestyle (Huang, et al., 2020). A New Normal Adaptation Behavior for the Prevention of COVID-19 (Syadidurrahmah et al, 2020). Understanding what a person can do about health problems, using the resources that are already available, and making decisions that are most appropriate to improve health are the three primary goals of giving health education in order to enable the individual to determine the problems and needs the person goals.

During the time of the COVID-19 pandemic, the immune system plays a very essential role as the entry site for the onset of COVID-19 symptoms. This is because the immune system is the entry point for the virus. COVID-19 symptoms will appear rapidly in those with a compromised immune system. Vaccination against COVID-19, as well as subsequent vaccinations, is required of all families and households that contain children as part of the efforts to reduce the risk of transmission (Sari, Agata & Patria, 2020). An individual's decision to get vaccinated may be influenced by factors such as anxiety and a lack of adequate family knowledge. The development of unpleasant symptoms in response to vaccination is a physiological marker that indicates that immunity has been established in the body (Graff, et al, 2021). This results in psychological anguish for families with a limited level of awareness, which ultimately results in their refusal to participate in re-vaccination. When making a decision about whether or not to vaccinate or take preventative measures, the level of knowledge that a family possesses is a crucial factor to consider. The higher the level of perception and cognition, the more it will effect the behaviour of the family in terms of taking preventive actions (Ernawati, et al, 2021). The primary vehicle for the transmission of COVID-19 in children is the household setting. Families with a high occupancy rate who live in a house with a narrow room space may put their children at risk of contracting COVID-19 and other diseases related to aerosol or droplet infections (Graff, et al, 2021).

Living at home with respiratory infections or isolated at home with inadequate family attitudes like a separate isolation room will have a significant risk of passing the infection on to children (Lu et al, 2020), (Natera-de Benito, et al., 2021). This is also true of isolating at home with respiratory infections. The transmission of the Corona virus is comparable to that of an acute pneumonia infection that has a high rate of transmission. The relationship between the horizons of increasing the distribution of COVID-19 in children is the relationship between the horizons of the interaction between knowledge, attitudes, and behaviour. When it comes to selecting the appropriate behaviour in the interest of prevention, one's level of knowledge will have an effect on one's attitudes; subsequent behaviour will be improved if family comprehension and attitudes are sufficient (Graff, et al, 2021).

Adjustments to new routines are made by individuals no matter where they are, including at home, in the office, at school, and at their places of worship. People who are health conscious and who have the knowledge and awareness to live a life that maintains cleanliness and satisfies health standards are created when clean and healthy behaviour is maintained in public areas. This highlights the necessity of keeping clean and healthy behaviour in public spaces (Naja, Wedderburn, & Ciurtin, 2020). Lately, we have been hearing a lot about something called the "New Normal," which refers to returning to a life that is clean and healthy and living according

to the standards established by the health sector in order to stop the spread of COVID-19. Therefore, maintaining a safe distance, wearing protective masks, and often washing one's hands are all important components of clean and healthy living behaviours that will be incorporated into everyday life.

The family is the source of all COVID-19 transmission in children. The risk of spreading COVID-19 to children and other diseases associated to aerosol or droplet infections is increased among low-occupancy families living in houses with a small room area. Individuals who suffer from Acute Respiratory Illness or self-isolation by staying at home with their family are provided with insufficient isolation rooms that provide a high risk of transmission to children. Yuliana, (2020), stated that the spread of the corona virus is comparable to a highly transmissible acute pneumonia infection. The link between knowledge, attitudes, and behaviour relates to the likelihood of increasing COVID-19 transmission among offspring (Assaker et al, 2020). When choosing the correct behaviour in prevention, the level of information will influence attitudes, therefore behaviour will be better if family comprehension and attitudes are adequate (Han et al., 2021), (Wajdi et al., 2020). Knowledge, attitudes, and proactive activities to maintain and prevent the risk of disease, protect oneself from the threat of disease, and participate actively in the public health movement constitute healthy behaviour. Maintaining a safe distance, using a mask, and washing one's hands will be part of clean and healthy everyday habits (Yuliana, 2020), (Ashididie, 2020).

Concerning the spread of COVID-19 in children, the findings of pap smears performed on discharge from the nose and throat of 100 children diagnosed with Acute Respiratory Infection showed that 42 children, or 42%, were reactive, whereas 58 children, or 58%, were non-reactive. The droplet infection or saliva splashes that are inhaled through the air or aerosols can transfer the corona virus to other persons (Ho et al., 2020), (Ludvigsson, 2020), (Woodruff, et al., 2022). The use of masks, avoiding staying in closed rooms or living in the same house with persons who are considered carriers of the corona virus, and avoiding close contact with other people who have the virus are all highly important preventative measures (Mustajab et al., 2020). Individual immunity to the Corona 19 virus does not rule out the possibility of transmission to others, even in families that have been certified cured of the virus. In order to stop the spread of the COVID-19 virus, members of the family need to create an area for isolation by paying attention to the room ventilation, using separate bathrooms and dining addresses, and remembering to wear masks when interacting with one another (WHO, 2020), (Pavone et al., 2020), (Sari, Agata & Patria, 2020), (Zimmermann, Pittet, & Curtis, 2021).

#### **4. CONCLUSION**

According to the findings of the research, there was a substantial relationship between the level of parental understanding and the behaviour of preventing COVID-19 in children living in the city of Kupang. In addition, there is a substantial correlation between the rebellious actions and attitudes exhibited by parents in regard to the prevention of COVID-19 in children and the prevalence of COVID-19 in children. Families or parents who provide the COVID-19 vaccination to other members of the family also have a substantial association with the virus's transmission to children. It is necessary for families to make steps, such as putting in place health procedures and ensuring that children are vaccinated, in order to limit the risk of COVID-19 being passed on to their children.

#### **REFERENCES**

Adeyinka, A., Bailey, K., Pierre, L., & Kondamudi, N. (2021). COVID 19 infection: pediatric perspectives. *Journal of the American College of Emergency Physicians Open*, 2(1),

- e12375. <https://doi.org/10.1002/emp2.12375>
- Anantyo, D. T., Kusumaningrum, A. A., Rini, A. E., Radityo, A. N., Rahardjani, K. B., & Sarosa, G. I. (2020). Coronavirus Disease 2019 (COVID-19) Pada Anak (Studi Literatur). *Medica Hospitalia: Journal of Clinical Medicine*, 7(1A), 344-360. <https://doi.org/10.36408/mhjcm.v7i1A.479>
- Assaker, R., Colas, A. E., Julien-Marsollier, F., Bruneau, B., Marsac, L., Greff, B., ... & Dahmani, S. (2020). Presenting symptoms of COVID-19 in children: a meta-analysis of published studies. *British journal of anaesthesia*, 125(3), e330-e332. <https://doi.org/10.1016/j.bja.2020.05.026>
- Ashidiqie, M. L. I. I. (2020). Peran Keluarga Dalam Mencegah Coronavirus Disease 2019. *SALAM: Jurnal Sosial Dan Budaya Syar-I*, 7(8), 911-922.
- Bandi, S., Nevid, M. Z., & Mahdavinia, M. (2020). African American children are at higher risk for COVID-19 infection. *Pediatric Allergy and Immunology*. 31(7): 861-864. <https://publons.com/publon/10.1111/PAI.13298>
- Blumberg, T. J., Adler, A. C., Lin, E. E., Fazal, F. Z., Talwar, D., Ellingsen, K., ... & Shah, A. S. (2020). Universal screening for COVID-19 in children undergoing orthopaedic surgery: a multicenter report. *Journal of Pediatric Orthopaedics*, 40(10), e990-e993. <https://doi.org/10.1097/BPO.0000000000001657>
- CDC. (2020). *Bridged race population estimates*. Atlanta, GA: US Department of Health and Human Services, CDC.
- CDC. (2020). *Coronavirus disease 2019 (COVID-19): cases in U.S.* Atlanta, GA: US Department of Health and Human Services, CDC.
- Dong, Y., Mo, X., Hu, Y., Qi, X., Jiang, F., Jiang, Z., & Tong, S. (2020). Epidemiology of COVID-19 Among Children in China. *Pediatrics*, 145(6), e20200702. <https://doi.org/10.1542/peds.2020-0702>
- Ernawati, K., Cantika, I. B., Isaputri, R. R., Andari, A. W., Ramadhan, M. F., Nathasia, S. K., ... & Ismail10, Y. (2021). Community knowledge, attitudes and behaviors in prevention of covid-19 transmission: A systematic review. *International Journal of Public Health Science*, 10(1), 16-26. <http://doi.org/10.11591/ijphs.v10i1.20664>
- Graff, K., Smith, C., Silveira, L., Jung, S., Curran-Hays, S., Jarjour, J., ... & Abuogi, L. (2021). Risk factors for severe COVID-19 in children. *The Pediatric Infectious Disease Journal*, 40(4), e137-e145. <https://doi.org/10.1097/INF.0000000000003043>
- Han, X., Li, X., Xiao, Y., Yang, R., Wang, Y., & Wei, X. (2021). Distinct characteristics of COVID-19 infection in children. *Frontiers in Pediatrics*, 9, 619738. <https://doi.org/10.3389/fped.2021.619738>
- Ho, C. L. T., Oligbu, P., Ojubolamo, O., Pervaiz, M., & Oligbu, G. (2020). Clinical characteristics of children with COVID-19. *AIMS Public Health*, 7(2), 258-273. <https://doi.org/10.3934/publichealth.2020022>
- Huang, X., Wei, F., Hu, L., Wen, L., & Chen, K. (2020). Epidemiology and clinical characteristics of COVID-19. *Archives of Iranian medicine*, 23(4), 268-271. <http://doi.org/10.34172/aim.2020.09>
- Liu, W., Zhang, Q. I., Chen, J., Xiang, R., Song, H., Shu, S., ... & Liu, Y. (2020). Detection of Covid-19 in children in early January 2020 in Wuhan, China. *New England Journal of Medicine*, 382(14), 1370-1371. <https://doi.org/10.1056/NEJMc2003717>
- Lu, X., Zhang, L., Du, H., Zhang, J., Li, Y. Y., Qu, J., ... & Wong, G. W. (2020). SARS-CoV-2 infection in children. *New England Journal of Medicine*, 382(17), 1663-1665. <https://doi.org/10.1056/NEJMc2005073>
- Ludvigsson, J. F. (2020). Systematic review of COVID-19 in children shows milder cases and a better prognosis than adults. *Acta paediatrica*, 109(6), 1088-1095. <https://doi.org/10.1111/apa.15270>

- Mustajab, D., Bauw, A., Rasyid, A., Irawan, A., Akbar, M. A., & Hamid, M. A. (2020). Working from home phenomenon as an effort to prevent COVID-19 attacks and its impacts on work productivity. *TIJAB (The International Journal of Applied Business)*, 4(1), 13-21.
- Naja, M., Wedderburn, L., & Ciurtin, C. (2020). COVID-19 infection in children and adolescents. *British Journal of Hospital Medicine*, 81(8), 1-10. <https://doi.org/10.12968/hmed.2020.0321>
- Natera-de Benito, D., Aguilera-Albesa, S., Costa-Comellas, L., García-Romero, M., Miranda-Herrero, M. C., Rúbies Olives, J., ... & Nascimento, A. (2021). COVID-19 in children with neuromuscular disorders. *Journal of Neurology*, 268(9), 3081-3085. <https://doi.org/10.1007/s00415-020-10339-y>
- Pavone, P., Ceccarelli, M., Taibi, R., La Rocca, G., & Nunnari, G. (2020). Outbreak of COVID-19 infection in children: fear and serenity. *Eur Rev Med Pharmacol Sci*, 24(8), 4572-4575.
- Sari, N. N., Agata, A., & Patria, A. (2020). Factors Affecting Covid-19 Disease Prevention Behavior in Bandar Lampung, Indonesia. *Journal for Quality in Public Health*, 4(1), 140-146. <https://doi.org/10.30994/jqph.v4i1.129>
- She, J., Liu, L., & Liu, W. (2020). COVID-19 epidemic: disease characteristics in children. *Journal of medical virology*, 92(7), 747-754. <https://doi.org/10.1002/jmv.25807>
- Shelmerdine, S. C., Lovrenski, J., Caro-Domínguez, P., & Toso, S. (2020). Coronavirus disease 2019 (COVID-19) in children: a systematic review of imaging findings. *Pediatric radiology*, 50, 1217-1230. <https://doi.org/10.1007/s00247-020-04726-w>
- Shen, K., Yang, Y., Wang, T., Zhao, D., Jiang, Y., Jin, R., ... & Gao, L. (2020). Diagnosis, treatment, and prevention of 2019 novel coronavirus infection in children: experts' consensus statement. *World journal of pediatrics*, 16(3), 223-231. <https://doi.org/10.1007/s12519-020-00343-7>
- Sinha, I. P., Harwood, R., Semple, M. G., Hawcutt, D. B., Thursfield, R., Narayan, O., ... & Southern, K. W. (2020). COVID-19 infection in children. *The Lancet Respiratory Medicine*, 8(5), 446-447.
- Syadidurrahmah, F., Muntahaya, F., Islamiyah, S. Z., Fitriani, T. A., & Nisa, H. (2020). Perilaku physical distancing mahasiswa UIN Syarif Hidayatullah Jakarta pada masa pandemi covid-19. *Perilaku dan Promosi Kesehatan: Indonesian Journal of Health Promotion and Behavior*, 2(1), 29-37. <http://dx.doi.org/10.47034/ppk.v2i1.4004>
- Wajdi, M. B. N., Kuswandi, I., Al Faruq, U., Zuhijra, Z., Khairudin, K., & Khoiriyah, K. (2020). Education policy overcome coronavirus, a study of Indonesians. *EDUTECH: Journal of Education And Technology*, 3(2), 96-106.
- WHO. (2020). Coronavirus disease (COVID-2019) situation reports. WHO . Retrieved from <https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200620-covid-19-sitrep-152.pdf>
- Woodruff, R. C., Campbell, A. P., Taylor, C. A., Chai, S. J., Kawasaki, B., Meek, J., ... & Havers, F. (2022). Risk factors for severe COVID-19 in children. *Pediatrics*, 149(1), e2021053418.
- Yuliana, Y. (2020). Corona virus diseases (Covid-19): Sebuah tinjauan literatur. *Wellness And Healthy Magazine*, 2(1), 187-192.
- Zimmermann, P., Pittet, L. F., & Curtis, N. (2021). How common is long COVID in children and adolescents?. *The Pediatric infectious disease journal*, 40(12), e482. <https://doi.org/10.1097/INF.0000000000003328>

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DOI: [10.31965/infokes.Vol21Iss1.977](https://doi.org/10.31965/infokes.Vol21Iss1.977)Journal homepage: <http://jurnal.poltekkeskupang.ac.id/index.php/infokes>**RESEARCH****Open Access****Qualitative Study and Antioxidant Activity Herbal Tea Bag of Moringa Leaves (*Moringa oleifera* Lam.) and Red Ginger (*Zingiber officinale* var. *Rubrum*)****Priska Ernestina Tenda<sup>1a\*</sup>, Maria Hilaria<sup>1b</sup>, Faizal R. Soeharto<sup>1c</sup>, Mohd Nadzri Bin Mohd Najib<sup>2d</sup>**<sup>1</sup> Department of Pharmacy, Poltekkes Kemenkes Kupang, Kupang City, East Nusa Tenggara, Indonesia<sup>2</sup> Faculty of Pharmacy, Universiti Teknologi MARA (UiTM), Cawangan Pulau Pinang, Kampus Bertam, Malaysia<sup>a</sup> Email address: [priskafarmasikupang@gmail.com](mailto:priskafarmasikupang@gmail.com)<sup>b</sup> Email address: [mariahilariamanehat@gmail.com](mailto:mariahilariamanehat@gmail.com)<sup>c</sup> Email address: [faizalrizasoearto19473@gmail.com](mailto:faizalrizasoearto19473@gmail.com)<sup>d</sup> Email address: [mohdna2857@uitm.edu.my](mailto:mohdna2857@uitm.edu.my)

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**Abstract**

Moringa (MO) leaves contain several chemical substances of high value, including vitamin C, flavonoids, phenolic compounds, carotenoids, tannins, and triterpenoids, among which one functions as an antioxidant. Previous research observed that MO leaves have already been developed into various formulations; unfortunately, these formulas could not completely obscure the aroma and taste problems that rendered MO leaves less acceptable to consumers. In this research, Moringa leaf powder (MLP) and red ginger (RG) are combined to cover the unpleasant taste and aroma of MO leaves. The purpose of this study assess the quality of three tea bag formulations, including their water content, ash content, hedonic and antioxidant activities, by quantitative tests; F0 (3 Gr of MLP), F1 (2.25 Gr of MLP, and 0.75 Gr of RG), and F2 (the amount of MLP and RG is equal to 1.5 Gr). This experimental study employs a completely randomized design, three special treatments, and three repetitions. Statistical analysis of quality test results and antioxidant activity uses One-Way ANOVA followed by a post hoc test utilizing the Least Significant Difference (LSD). The water content tests revealed that all three formulations qualified the Indonesian National Standard (SNI), ranging from 3.86% to 4.29%. Adding ginger did not influence the water content ( $p > 0.05$ ). Otherwise, it increases the ash level from 8.65% to 9.98%. Based on the results of the hedonic test, the panelists preferred F0 over F1 and F2 concerning color by a score of 86%. In contrast, they preferred F2 regarding aroma and taste by a score of 82%. The addition of RG in F1 and F2 was significant to the preference level of panelists ( $p < 0.05$ ). The IC50 value for the antioxidant activity test was highest for F2 at  $59.31 \pm 0.13$  ppm. The addition of RG boosted the antioxidant activity of MO tea products considerably ( $\text{sig} < 0.05$ ). Consequently, developing MO tea products containing RG in F2 could be potentially produced as herbal tea beverages with antioxidant properties.

**Keywords:** Antioxidants, Moringa Leaves, Red ginger, Tea bags.**\*Corresponding Author:**

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## 1. INTRODUCTION

Free radicals and Reactive Oxidative Stress (ROS) are frequently discussed as causes of various human chronic diseases (Ghezzi et al., 2017). Stroke, diabetic nephropathy, cancer, hypertension, cardiovascular disease, acute lung inflammation, neurological illnesses, cataracts, obesity, hyperglycemia, and aging are triggered by reactive oxygen species (ROS), which are produced due to exposure to radiation, pollutants, and drug metabolites (Davies et al., 2017). Antioxidants are one of the available solutions for preventing the development of endogenous and exogenous ROS and free radicals through a variety of mechanisms of action. In addition, antioxidants are frequently implemented in cancer therapy to reduce the side effects of anticancer therapy (Casas et al., 2020).

Synthetic drugs can function as antioxidants. However, their high costs provide an incredible opportunity for herbal medicines to be employed as an affordable source in antioxidant development. Furthermore, antioxidants generated from synthetic materials, such as butylated hydroxyl anisol (BHA; 320), butylated hydroxyl toluene (BHT; E321), tert-butylhydroquinone (E-319), and propyl gallate (E-311), have unidentified side effects. Therefore, natural antioxidants may be employed as a source for the development of antioxidants (Malekmohammad et al., 2019). Natural ingredients with chemical compounds such as alkaloids, terpenoids, tannins (Pisoschi et al., 2016), flavonoids, anthocyanins, carotenoids, and vitamins C and E (Xu et al., 2017) are proven to have antioxidant potential with various mechanisms of action that are influenced by geographical conditions or location where the medicinal plants are grown or processed (Cardoso, 2019).

MO leaves contain many active compounds, such as vitamins A and C, flavonoids, phenolic compounds, and triterpenoids (Farooq et al., 2021). The high content of phenolic bioactive compounds in MO leaves contributes to their ability to scavenge free radicals strongly (Kou et al., 2018). Previous studies have proven that MO leaf extract has antioxidant activity using the DPPH method with an IC<sub>50</sub> value of 87.54 ppm (Muna, 2022).

People usually consume MO leaves as *lalapan* (raw vegetables) by boiling them. Modification of MO leaves is produced in the development, manifested in dry powder as a nutritional addition to children's food (Singh et al., 2018). Additional formulations have also been implemented in food products to increase their nutritional value such as soy meatballs (Evivie et al., 2016), and candy MO served in the form of tea (Darna et al., 2019). Despite their unpleasant taste, MO leaves in tea provide certain health benefits, particularly antioxidant properties. To solve that problem, it is necessary to include other ingredients for the product to be accepted by people and provide more health benefits (Fatima et al., 2020). Moringa leaves tea bags are formulated by adding red ginger (*Zingiber officinale* var. *rubrum*) to increase its antioxidant potential due to the high chemical composition of gingerols, oleoresin, and essential oils in red ginger and to provide a distinctive taste (Suhendy, 2021).

The widespread use of MO in the community encourages researchers to develop MO into other products so that consumers have a wide range of options for consuming MO. Moreover, in Kupang-East Nusa Tenggara, MO is widely available, and the provided technology is relatively simple to implement in the community. This research intends to produce a tea bag containing MO leaves and RG to reduce the unpleasant aroma. The current study did a qualitative test to measure phytochemical screening, water content, ash content, hedonic and in vitro antioxidant activity. In this study, Moringa leaves are produced as a product packaged in bags made of filter paper as tea bags. Moringa tea preparations are then carried out with qualitative tests, including phytochemical screening, water content test, ash content test, hedonic tests, and in vitro antioxidant activity tests using the 2,2-diphenyl-2-picrylhydrazil (DPPH) method as a quantitative aspect of testing. Then, Moringa tea preparations are carried out with qualitative tests, including phytochemical screening, water content test, ash content

test, hedonic tests, and in vitro antioxidant activity tests using the 2,2-diphenyl-2 picrylhydrazil (DPPH) method as a quantitative aspect of testing.

## 2. RESEARCH METHOD

The research design is completely randomized design (CRD), consisting of three treatments and three replications with variations in ginger addition. The first formula is F0, with the composition of 3 Gr of MLP without the addition of red ginger (0%). The second formula is F1, with the composition of 2.25 Gr of MLP and 0.75 grams of red ginger. The third formula is F2, with the composition of MLP 1.5 Gr and red ginger 1.5 Gr (50%). This study aims to assess the herbal tea bags of MO leaves in qualitative and quantitative aspects. Numerous procedures are performed to achieve this aim; a) determination of MO and red ginger plants, b) manufacture of MO leaves and red ginger powder, c) manufacture of herbal tea combined with MO leaves and red ginger as well as quality tests including water content, ash content, hedonic test and antioxidant activity test of tea bag products using DPPH method. The ANOVA test analyzes statistical data on water content, ash content, and antioxidant activity. If the findings indicated a significant or very significant impact, a post hoc test using the LSD technique would be performed.

### a. Plants determination and MO leaves and red ginger powder preparation.

In May 2022, MO leaves, and red ginger were produced at Penfui, Kupang, East Nusa Tenggara. The collected MO leaves were green, not old or too young, fresh, and intact. The certification of plant identification was achieved from the Jatinangor Herbarium, Laboratory of Plant Taxonomy, Department of Biology, Mathematics and Natural Science Faculty, Padjajaran University, following the letter of determination No.47/HB/02/2022.

The MO leaves and red ginger that is to be dried are carefully cleaned and drained in running water. The MO leaves are dried properly by aerating them at room temperature while flipping them over continuously. The drying process is continued until the water content is reduced which is indicated by the fragility of the leaves when it is held. MO leaves *Simplicia* are powdered using a grinder with a 60-mesh powder particle size (Irwan, 2020). The ginger rhizome is chopped longitudinally (split), then dried by airing it for seven days (Siampa & Jayanto, 2020). The dried *Simplicia* is then mashed using a blender and sifted using a 60-mesh sieve (Ngatirah & Dewi, 2020). The *simplicial* is then formulated into tea bags.

### b. Herbal tea bags made from a combination of MO leaves and red ginger.

The tea bags are formulated into three formulas weighing 3 Gr each. MO tea formula 1 (F0) is made by weighing 3 Gr of MO powder, formula 2 (F2) consists of 2.25 Gr of MO powder and 0.75 Gr of red ginger, formula 3 (F3) consists of MO and red ginger in equal amount, namely 1.5 Gr Each material that is weighed is then mixed until homogeneous, and put into a tea bag (Santi et al., 2022). Then, quality tests are carried out including phytochemical screening, water content test, ash content test, hedonic organoleptic test, and antioxidant activity as quantitative test parameters.

### c. Phytochemical screening

The material used to analyze chemical content is brewed from tea bags. The tea bags of each formula are dipped up and down with 200 mL of warm water at 40 °C for 5 minutes. The tea bags are removed from the solute ion (Nikmah et al., 2022), cooled to room temperature, and then analyzed for their chemical content (Sucianti et al., 2021).

#### 1). Flavonoids identification.

The flavonoid test was carried out using the Wilstater test. A sample dissolved in 2 mL of warm water was added to a spatula of Mg powder and four drops of HCl 2% (Nikmah et al., 2022).

2). Steroids and triterpenoids identification.

1 mL of sample was added with 3 mL of 70% ethanol and 2 mL of concentrated H<sub>2</sub>SO<sub>4</sub> and 2 mL of acetic acid anhydrous (Liebermann-Burchard reagent). A color change from purple to blue or green indicated the presence of steroids. In contrast, the formation of a brownish-red color at the interface showed the presence of triterpenoids (Purwoko et al., 2022).

3). Tannins identification.

2 mL of sample was taken and put into a test tube, and added 2-3 drops of 1% FeCl<sub>3</sub>. The formation of a green-black or dark-blue solution indicated that the sample contained tannin (Ruwandha et al., 2021).

4). Alkaloids identification.

The identification of alkaloids was accomplished by reacting 1 mL of chloroform and ammonia with each sample. The results of the reaction were then warmed over a Bunsen flame, instead shaken, and filtered. The filtrate was divided into three equal parts. In each portion, three drops of 2N H<sub>2</sub>SO<sub>4</sub> were added, shaken, and allowed to stand separately. The supernatant was taken to be reacted with several reagents, and the color of the precipitate was observed. A positive sample contained alkaloids if the Meyer reagent identified an orange precipitate, a brown precipitate formed in the Wagner reagent, and a white precipitate formed in the Dragendorf reagent (Khanifah, Puspitasari, & Awwaluddin, 2021).

5). Saponins.

The sample was heated to boiling using 5 mL of distilled water and filtered. The filtered results were shaken and then allowed to stand for 15 minutes. Samples that positively contained saponin were indicated by the formation of stable foam (Dena et al., 2021).

d. Water content test.

The test was carried out employing the gravimetric method. A total of approximately 2 g of tea product samples were weighed carefully and placed into a container that had been sterilized. The sample was then cooked in the oven at +/- 105 °C for 5 hours and weighed. Drying and weighing were performed at 1-hour intervals until the difference between 2 consecutive weighings did not exceed 0.25% (Tuapattinaya et al., 2021).

e. Ash content test

Samples of tea products in each formula were weighed accurately as much as 2-3 grams; then the samples were put into a silicate crucible that had been ignited and tared. The sample was ignited slowly until the charcoal ran out, cooled in a desiccator then weighed until the weight remains constant (Widanti & Wahyudi, 2019).

$$\text{Ash content} = \frac{W_1}{W_2} \times 100\% \dots\dots\dots (1)$$

Description :

W1 = sample weight after ashing (grams)

W2 = sample weight before ashing (grams)

f. Hedonic organoleptic test

The hedonic test was assessed using a hedonic or preference-level scale. In this study, the panelists consisted of 50 people from the community surrounding the city of Kupang. The panelists were selected using the Simple random sampling technique with inclusion criteria including tea and MO consumption. The method was based on observations utilizing the five senses or organoleptic (Tiyani, Suharti, and Andriani, 2020). Panelists were given samples to be tested along with a form to write down the results of the hedonic test, which was carried out

independently with directions from the researcher. In this study, a hedonic scale of 5 was used, a relatively simple scale but with good sensitivity in assessment (Wangiyana et al., 2021). Ratings were expressed in numbers: 1 (dislike highly), 2 (dislike slightly), 3 (neither like nor dislike), 4 (like slightly), and 5 (like significantly) to assess the level of panelists' preference for the color, taste, and aroma of tea products (Wangiyana et al., 2021).

Formula 0, 1, and 2 of tea bags were made in 5 pouches each (5 tea bags) put in a glass, and then dipped up and down with 200 ml of warm water at 40 °C for 5 minutes. The test was carried out in stages, namely every 10 people per day over 5 days. Clearwater was provided to rinse the mouth to become neutral, and a 3-minute interval was offered after attempting each formula. The data obtained were calculated by means and standard deviation to get the percentage level of preference for the tea bag product (Yusfiani et al., 2021). The research was conducted after obtaining approvals from the health research ethics committee at the Health Polytechnic of the Ministry of Health Kupang (Reference LB.02.03/1/0148/2022).

g. Antioxidant activity test

The antioxidant activity of MO tea products was measured using the 2,2-diphenyl-2-picrylhydrazyl (DPPH) method. The principle of this method is based on the ability of the sample to inhibit the DPPH free radical by donating an H atom to form a non-radical compound (Zela & Diah, 2021). This test was preceded by preparing a 0.2 mM DPPH solution and determining the maximum  $\lambda$ . The ethanol extracts of F0, F1, and F2 were made at concentrations of 10, 50, 100, 150, and 200 ppm, respectively. 4 mL of the solution was taken, then 1 mL of DPPH reagent was added. Then put it in a vial and vortex. The solution mixture was allowed to stand for 30 minutes in a room without light. The absorbance was read using a UV-Vis spectrophotometer at a maximum wavelength of 519 nm. The measurements were repeated three times. This procedure was also carried out for vitamin C blanks and control solutions (Aryanti et al., 2021). The percentage of DPPH free radical scavenging was calculated based on its absorbance value with the formula:

$$\% \text{ Scavenging} = [(\text{blank abs} - \text{sample abs}) / (\text{blank abs})] \times 100\% \dots \dots \dots (2)$$

Description:

Abs blank = absorbance blank

Abs of sample = absorbance of the sample

The DPPH free radical scavenging effect (percent of reduction) of MO tea was shown by  $IC_{50}$  value and calculated using linear regression analysis  $y = ax + b$  which was the relationship between  $x$  (log concentration) and  $y$  (probit). The  $IC_{50}$  value as the effective concentration of the sample in absorbing 50% of total DPPH was obtained from the linear regression equation by substituting the  $y$  value as the percent scavenging of 50% (Aulyawati et al., 2021).

### 3. RESULTS AND DISCUSSION

The assessment of MO leaves tea bags combined with red ginger quality was established according to the characteristics of the material used to evaluate the degree of quality of the ingredients. It implements standards based on two parameters, namely particular parameters, including plant identity, organoleptic, and chemical content of *Simplicia*, and non-specific parameters: moisture/water content, ash content, and hedonic or preference level (Yana et al., 2022). The assessment for the specific parameters of the simplicial material is shown in Table 1.

**Table 1.** Specific parameters of Moringa leaf and red ginger *Simplicia* powder

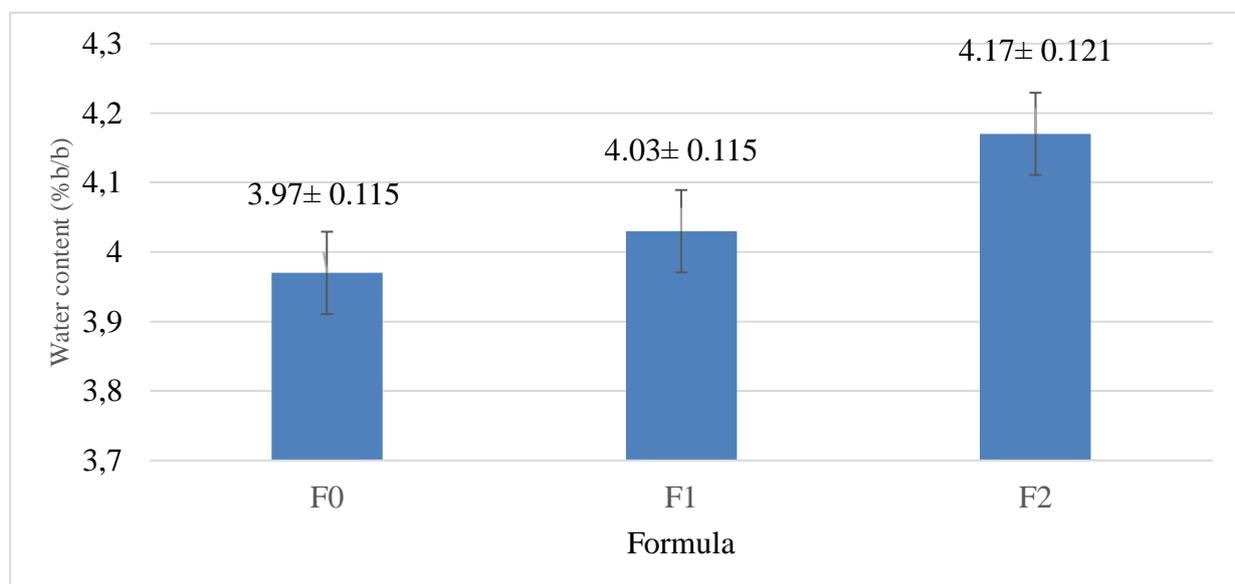
No	Evaluation parameters	Result			
		Moringa	Picture	Ret Ginger	Picture
1	Plants Identity	<i>Moringa oleifera</i> Lam.		<i>Zingiber officinale</i> Roscoe	
	Scientific Name	<i>Moringa zeylanica</i>		<i>Zingiber officinale</i> var. <i>Rubrum</i>	
	Sinonim	Burmann		Theilade	
	Local name	Kelor		Jahe Merah	
	Family	Moringaceae		Zingiberaceae	
2	Organoleptic <i>Simplicia</i> powder	Green color, typical smell, tasteless		Brownish-yellow color, typical smell of ginger, spicy taste	
3	Chemical content of moringa powder and red gingers: flavonoids, tannins, terpenoids, alkaloids, saponins				
		Orange color in the Wilstater test: positively contains flavonoids		Green color with ferric chloride reagent 1%: positively contains tannins	
		Brownish-red color with Liebermann-Burchard reagent: positively contains terpenoids		Brown precipitate with Wagner reagent: positively contains alkaloids	
	Stable foam: Negative saponins				

Determination of plants was the first procedure implemented in this research to identify plants accurately. MO leaves and red ginger were determined at the Jatinangor Herbarium, Plant Taxonomy Laboratory, Department of Biology, Mathematics and Nature Science Faculty, Padjajaran University. The determination results showed that the plants used were MO from the Moringaceae family and red ginger (*Zingiber officinale* Roscoe) from the Zingiberaceae family.

MO leaves, and red ginger rhizome became the sample plant components. Each *Simplicia* powder was screened for phytochemicals with a color reaction to determine the active compound's content. The results of the phytochemical screening showed that both *Simplicia* positively contained flavonoids, tannins, terpenoids, and alkaloids, which were supported by the results of previous studies. Research by Isyraqi et al., (2020) proved that MO leaves positively contained flavonoids, tannins, and terpenoids and that they also contained alkaloids (Yulianto, 2020). Red ginger contains phenol compounds, including gingerol, shogaol, and paradol (Mao et al., 2019) which give it a spicy taste (Zhang et al., 2022), and volatile terpenoids, which give ginger a distinctive aroma (Mao et al., 2019). Besides that, it also contained tannins with an astringent taste which was indicated by the formation of a brown color in the color reaction (Szczyrek, 2021). Phenols, flavonoids, tannins, and alkaloids were phenolic groups proven to have high antioxidant activity (Widiastini et al., 2021). MO leaves and red ginger powder the chemical content had been identified and then formulated into tea bags and then non-specific parameters were measured, including moisture content, ash content, and hedonic test.

a. Water content

The purpose of determining water content was to identify the amount of water left after drying. It was one of the most important factors in establishing a product's quality. The results of the water content test for tea bags are shown in Figure 1.



Description: F0, F1, F2, = Concentration of RG: 0%, 25% and 50%

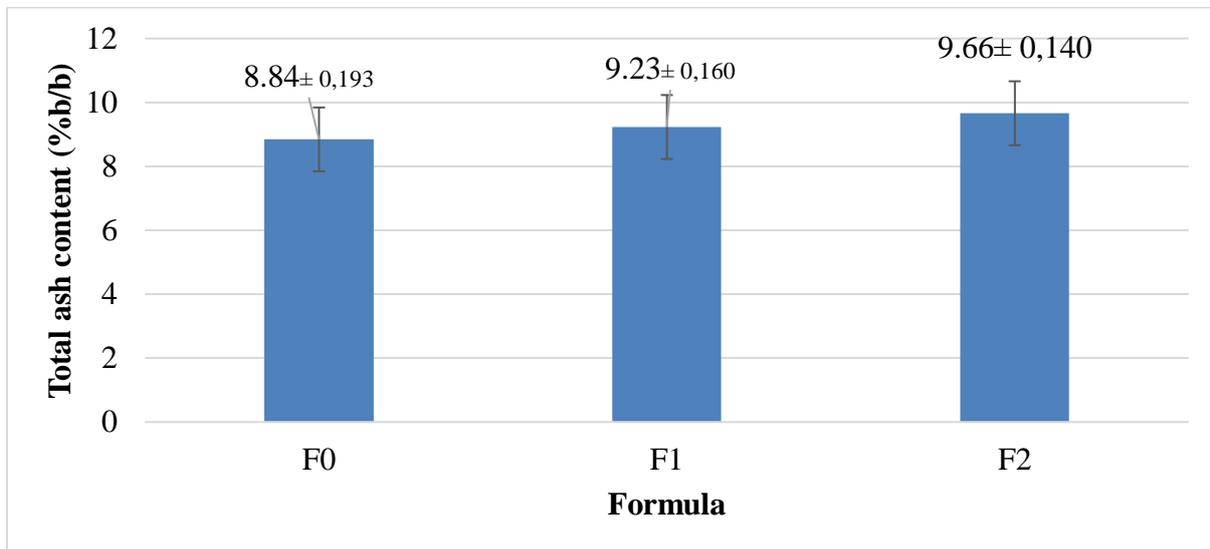
**Figure 1.** The results of the water content test of tea bag products

According to the findings of the water content analysis that are presented in Figure 1, the average water content of Moringa tea with the addition of red ginger in the three different formulas ranges from 3.86% to 4.29%. This water content successfully met the requirements of the water content standard for tea products that was established by the INS; the maximum

water content standard was 8% (Prawira-Atmaja et al., 2021). This is in line with the research conducted by Sinulingga et al (2021), which stated that the water content of tea bags was 2.3%-7.1%. The water content in tea could affect its durability, where the high water content could be a medium for the growth of microorganisms, such as fungi and bacteria, that could damage its biological activities (Palupi et al., 2020). Adding ginger to MO tea products did not significantly affect the water content ( $p > 0.05$ ); this indicated that the MO leaves tea bag combination with red ginger in each formula did not exceed the specified water content quality requirements.

b. Total ash content

The total ash content was another parameter that determined the quality of the tea. This test aimed to acquire a general overview of all inorganic and mineral components used in the manufacturing process. In Figure 2, the results of the ash content test for MO tea products are displayed.



Description: F0, F1, F2, = Concentration of RG: 0%, 25% and 50%

**Figure 2.** The results of the total ash content of tea bag products.

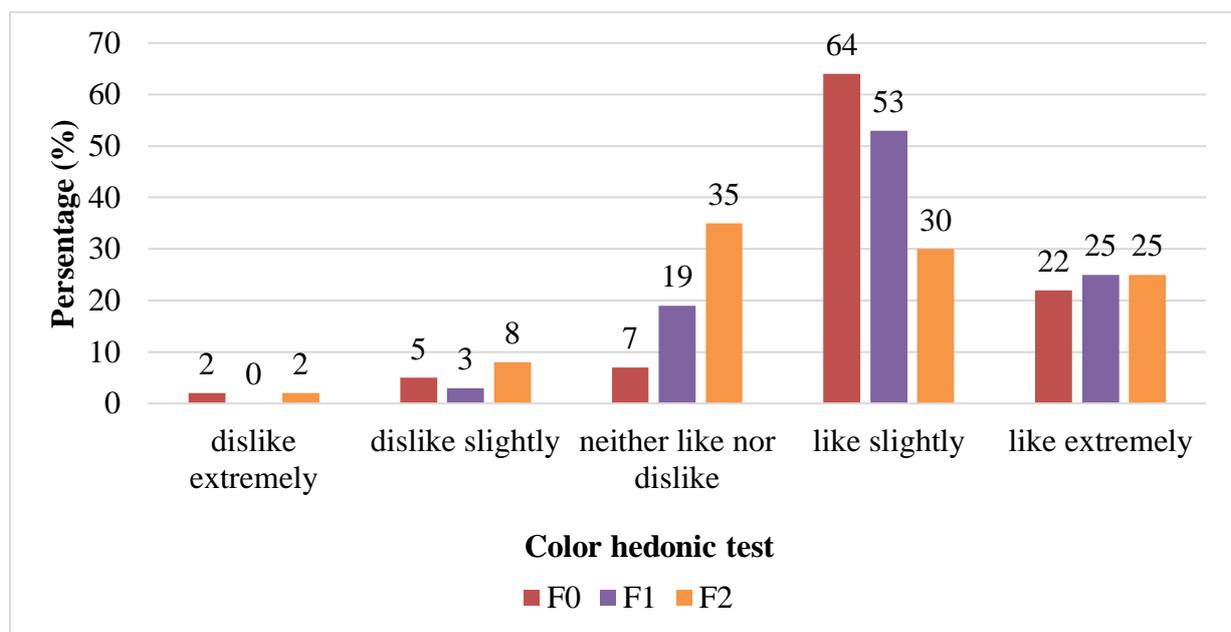
In this study, the total ash content of MO leaves tea bags with the addition of red ginger ranged from 8.65% -9.98%, it was exceeding the INS standard for tea bags which was set at 8% (Prawira-Atmaja et al., 2021). The high ash content of the tea bags illustrated the high mineral components in the MO leaves and red ginger. This result was in line with Bata et al., (2018) research, proving that the total ash content of MO leaves *Simplicia* was 9.221% ± 0.002. There are 15 mineral components found in MO leaves *Simplicia*, including Phosphorus, Sulfur, Potassium, Calcium, Titanium, Chromium, Manganese, Iron, Nickel, Copper, Zinc, Molybdenum, Strontium, Barium, and Rhenium which the highest components were calcium and potassium. These minerals could be developed as a mineral supplement (Manggara & Shofi, 2018). Ginger also contains macro and micro minerals such as Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sodium, Manganese, Iron, Zinc, and copper (Jaborova et al., 2021). The statistical analysis results also showed a significant difference in the ash content of the tea bags ( $p < 0.05$ ). This result showed that the addition of red ginger in the manufacture of tea bags significantly affected the ash content of the tea bags produced.

c. Hedonic organoleptic test

Tea bag products were also subjected to a hedonic test to determine the preference level and consumer acceptance (Su et al., 2021). The standard was based on the sensory characteristics of the observer, namely the assessment of aspects of color, taste, and aroma (Siow et al., 2022).

1). Color hedonic test

In F0, the tea was green, which was the color of MO leaves without the addition of ginger, while F1 and F2 were yellowish green which was the color of a mixture of MO leaves and red ginger. The results of the color hedonic test of the tea bag product of MO leaves and red ginger combination for each formula were shown in Figure 3.



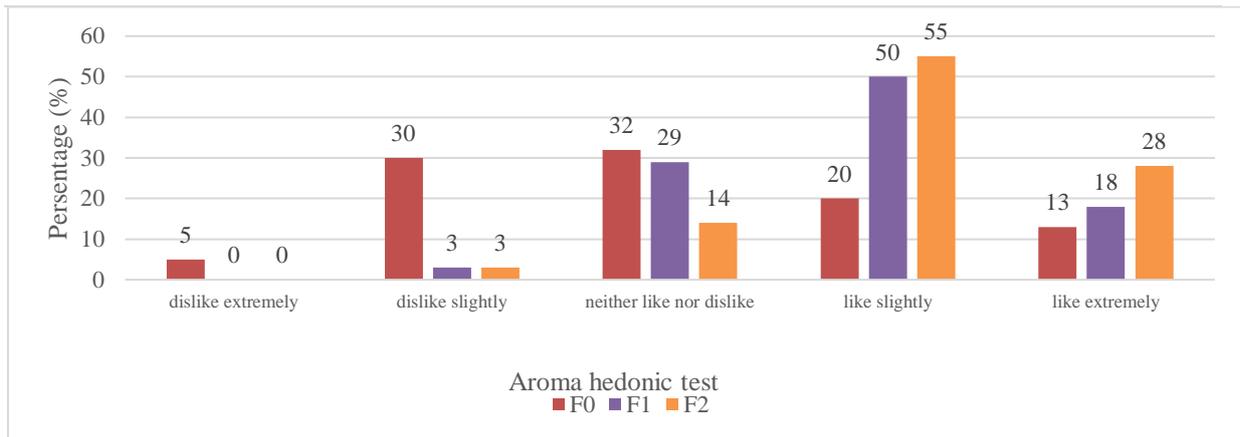
Description: F0, F1, F2, = Concentration of RG: 0%, 25% and 50%

**Figure 3.** Result of color hedonic test

Based on Figure 3, the color of the tea bag product showed the color of F0 with a composition of 3 Gr MO occupying the highest percentage with a category of like extremely (22%) and like slightly (64%), followed by F1 with a weight of 2.25 Gr of MO and F2 with a weight of 1.5 Gr of MO. MO leaves contained chlorophyll or a natural green leaves dye with high concentrations. The bright dark green color of F1 was due to the high weight of MO and was associated with the chlorophyll content extracted from the brewed water of tea bags (Farooq et al., 2021). The ANOVA results also showed a significant difference between each formula on color organoleptic parameters with a significant value of  $<0.05$ .

2). Aroma hedonic test

The role aroma of a product is essential because it will determine consumer acceptance of the product (Arumsari & Aminah, 2019). The aroma produced from the F0 tea bag product was a typical aroma of MO leaves. At the same time, F1 and F2 were the typical aromas of MO leaves and RG.



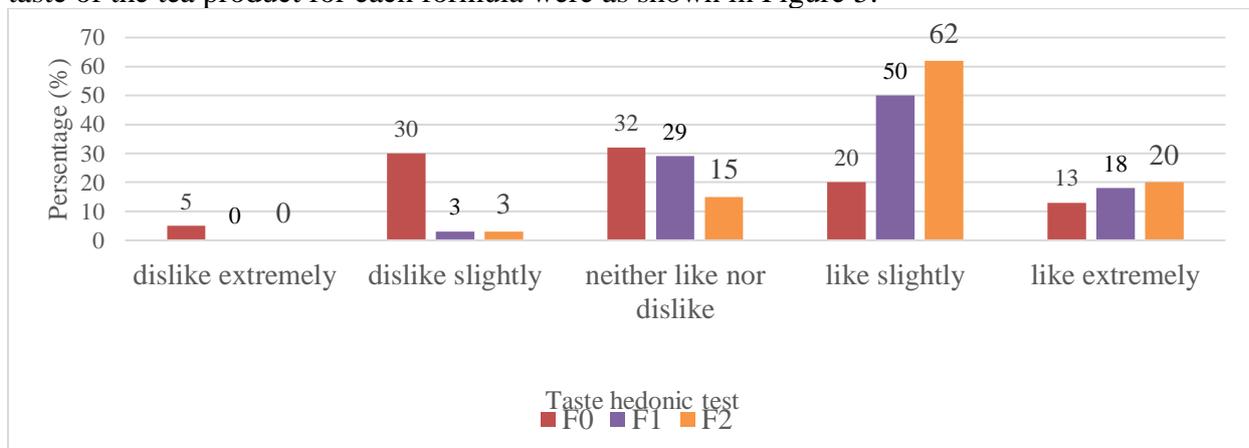
Description: F0, F1, F2, = Concentration of RG: 0%, 25% and 50%

**Figure 4.** Results of aroma hedonic test

The tea formula with ginger tends to be preferred by the panelists. F2, with a composition of 1.5 Gr of ginger as much as MO was the most preferred by the panelists with the category of like extremely as much as 24% and like slightly (58%) followed by F1 and F0. The higher concentration of MO in F1 (2.25 Gr) and F0 (3 Gr) was less favored by the panelists because of the unpleasant odor of MO. The addition of red ginger aimed to cover the unpleasant odor from MO leaves. Red ginger contains volatile terpenoid compounds that give ginger its distinctive aroma (Mao et al., 2019). The unpleasant smell was more pronounced if the concentration of MO leaves was added more than red ginger. Otherwise, it decreased with increasing concentration of red ginger. This was in line with the research of Fatima et al., (2020) that red ginger could cover the unpleasant odor of MO leaves. The ANOVA results also showed a significant effect between the addition of red ginger to the aroma organoleptic parameters with a significant value <math><0.05</math>.

### 3). Taste hedonic test

Taste is one factor that is important for consumers in considering product selection. Although other parameters have good values, consumers will reject the product if the taste is not good (Setiyani et al., 2022). The results of the test of the researcher's preference for the taste of the tea product for each formula were as shown in Figure 5.



Description: F0, F1, F2, = Concentration of RG: 0%, 25% and 50%

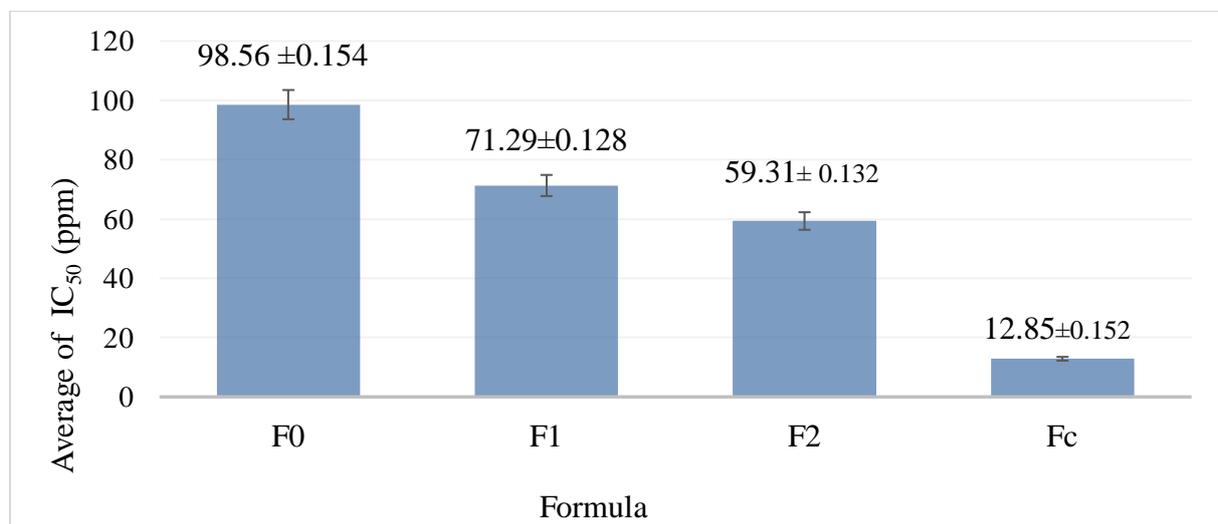
**Figure 5.** Results of the hedonic taste test

Based on the test results of panelist's preference for the taste of tea bag products in Figure 5, the tea product that obtained the highest level of taste preference was F2 (composition of 1.5 Gr of MO leaves to powder and 1.5 Gr of red ginger) product with a category of 62% like slightly and 20% like extremely. The F1 (composition of 2.25 Gr of MO leaves to powder and 0.75 Gr of RG) product and F0 (composition of 3 Gr of MO leaves powder) product were not liked by panelists because the concentration of MO leaves used was higher than ginger so that the unpleasant and bitter taste of MO leaves tends to be felt. The taste produced by MO leaves tends to be bitter and unpleasant comes from the saponins and tannins it contains. Fatima et al's research (2020) proved that adding red ginger to MO leaf powder could reduce the unpleasant taste of MO leaves. This was associated with phenolic compounds, including gingerol, shogaol, and paradol (Mao et al., 2019), which gave ginger a distinctive taste (Zhang et al., 2022). The ANOVA results also showed a significant effect between the addition of red ginger on the organoleptic parameters of aroma with a significance value of  $<0.05$ .

d). Antioxidant activity of tea bags.

The antioxidant activity of tea bags using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) method with the principle that reducing compounds donate H atoms caused DPPH to be reduced to form diphenylpicrihydrazine which was characterized by a reduction or loss of purple to a pale yellow color. The intensity of the purple color was measured using visible spectrophotometry at the maximum wavelength of the DPPH (Yang et al., 2020). In this study, the maximum DPPH wavelength was obtained at 519.0 nm. This was in line with the study of Asbabu, (2019), the full wavelength range for sample measurements using the DPPH method was around 400-550 nm.

The ability of Moringa tea products as antioxidants was assessed based on the reduced purple color of the DPPH solution which was read as absorbance on a spectrophotometer and was then quantified and expressed by the  $IC_{50}$  value (Muna, 2022). A small  $IC_{50}$  value indicated that the antioxidant activity was getting stronger and vice versa, as shown in Figure 6.



Description: F0, F1, F2, Fc = Concentration of RG: 0%, 25%, 50%, Control Vitamins C

**Figure 6.** The average  $IC_{50}$  value for tea bags.

Based on the data above, F2, with a composition of 1.5 grams of MO leaves to powder and 1.5 grams of red ginger, had the highest antioxidant activity with  $IC_{50}$  of  $59.31 \pm 0.132$  ppm, followed by F1 of  $71.29 \pm 0.128$  ppm and F0 of  $98.56 \pm 0.154$  ppm. These values indicated that the three formulas have moderate category antioxidant activity with a range of

IC<sub>50</sub> values between 50-100 ppm (Muna, 2022). This study used pure vitamin C to compare, and IC<sub>50</sub> of 12.849 ± 0.152 was obtained. Vitamin C was proven to have the potential for extreme antioxidant activity due to oxidative stress (Dotulong et al., 2021).

The ability of antioxidant activity of tea bag products was associated with the contribution of several compounds found in MO leaves and red ginger, including flavonoids, phenols, and tannins. These compounds release H<sup>+</sup> atoms and form stable DPPH molecules. Dillak, Kristiani, & Kasmiyati, (2019) said that the presence of the OH<sup>-</sup> group in flavonoids, a phenol group, played a role in donating H<sup>+</sup> atoms to stabilize the DPPH radical. In a study by Rachmatiah et al., (2022), who tested the antioxidant activity of ileum (*Clerodendrum minahassae* Teijsm. & Binn) leaves it was shown that leilem leaves had antioxidant activity in a very strong category because of their flavonoid and phenolic content. In addition, according to Szczurek (2021), tannins have aromatic rings with hydroxyl groups, which also play a role in reducing DPPH free radicals. Adding red ginger to F1 and F2 increased antioxidant activity even though they were in the same range of IC<sub>50</sub> values. According to Mao et al., (2019), the shogaol content belongs to the phenol group due to the conversion of gingerol, which also has antioxidant activity besides giving ginger a distinctive taste. This was supported by the research of Septiana et al., (2019), which proves ginger could increase antioxidant activity in honey combined with *temulawak*. The results of the statistical analysis of the tea bag products' antioxidant activity showed a significant effect (p <0.05) on the proportion of added RG.

Another parameter related to the quality of tea bag products is the shelf life. It can be determined through several approaches, including distribution turnover, distribution abuse test, consumer complaints, and accelerated shelf-life testing. However, it cannot be undertaken because of the limited time.

#### 4. CONCLUSION

Based on the results of this study, it could be concluded that the tea bag products F0, F1, and F2 qualified the quality requirements for water content yet failed to satisfy ash content. The three formulas had an antioxidant activity with IC<sub>50</sub> of 59.30 ± 0.132 ppm to 98.56 ± 0.154 ppm. The addition of red ginger to F2 contributed to the preference level of the panelists from the aspect of aroma and taste compared to F1 and F0 so it has the potential to be further developed as an antioxidant herbal drink. For further research, it is possible to conduct a comprehensive life-saving parameter test to determine the life-saving product.

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#### REFERENCES

- Aryanti, A., Febrina, L., Annisa, N., & Rusli, R. (2021). Antioxidant Activity of Coffee and Tea Products in Samarinda City. *Jurnal Sains Dan Kesehatan*, 3(3), 488–491. <https://doi.org/10.25026/jsk.v3i3.510>
- Arumsari, K., Aminah, S. N. (2019). Total Phenol, Antioxidant Activity And Sensory Characteristic Of Kecombrang Flower, Mint Leaves, And Stevia Leaves Tea Bags. *Jurnal Pangan Dan Gizi*, 9(2), 128–140. <https://doi.org/10.26714/jpg.9.2.2019.79-93>
- Asbanu, Y. W. A., Wijayati, N., & Kusumo, E. (2019). Identifikasi Senyawa Kimia Ekstrak Daun Sirsak (*Annona muricata* L.) dan Uji Aktivitas Antioksidannya dengan Metode DPPH (2, 2-Difenil-1-

- Pikrihidrasil). *Indonesian Journal of Chemical Science*, 8(3), 153-160.
- Aulyawati, N., Yahdi, & Suryani, N. (2021). Skrining Fitokimia Dan Aktivitas Antioksidan Ekstrak Etanol Rambut Jagung Manis (*Zea Mays* Ssaccharata Strurf) Menggunakan Metode DPPH. *Jurnal Kimia & Pendidikan Kimia*, 3(2), 132–142.
- Bata, M. H., Wijaya, S., & Setiawan, H. K. (2018). Standarisasi Simplisia Kering Daun Kelor (*Moringa oleifera*) Dari Tiga Daerah Berbeda. *Jurnal Farmasi Sains dan Terapan*, 5(1), 45-52.
- Cardoso, S. M., & Fazio, A. (2020). The Antioxidant Capacities of Natural Products 2019. *Molecules*, 25(23), 5676. <https://doi.org/10.3390/molecules25235676>
- Casas, A. I., Nogales, C., Mucke, H. A. M., Petraina, A., Cuadrado, A., Rojo, A. I., Ghezzi, P., Jaquet, V., Augsburg, F., Dufresne, F., Soubhye, J., Deshwal, S., Di Sante, M., Kaludercic, N., Di Lisa, F., & Schmidt, H. H. H. W. (2020). On the clinical pharmacology of reactive oxygen species. *Pharmacological Reviews*, 72(4), 801–828. <https://doi.org/10.1124/pr.120.019422>
- Darna, A. R. P., M.L.M Timbuleng, E. M. L. M. T., Azzahroh, N., Khasanah, P. U., Arofah, G. E., & Kartikasari, M. N. D. (2019). PERI DALOR (Permen Jeli Daun Kelor) : Inovasi Permen Kaya Antioksidan Sebagai Solusi Kesehatan. *SEMAR (Jurnal Ilmu Pengetahuan, Teknologi, Dan Seni Bagi Masyarakat)*, 8(1), 35–39. <https://doi.org/10.20961/semar.v8i1.22062>
- Davies, J. M. S., Cillard, J., Friguet, B., Cadenas, E., Cadet, J., Cayce, R., Fishmann, A., Liao, D., Bulteau, A. L., Derbré, F., Rébillard, A., Burstein, S., Hirsch, E., Kloner, R. A., Jakowec, M., Petzinger, G., Sauce, D., Sennlaub, F., Limon, I., ... Davies, K. J. A. (2017). The Oxygen Paradox, the French Paradox, and age-related diseases. *GeroScience*, 39(5–6), 499–550. <https://doi.org/10.1007/s11357-017-0002-y>
- Dena, A., Restiani, R., & Aditiyarini, D. (2021). Peningkatan Produksi Saponin pada Kultur Kalus Ginseng Jawa (*Talinum paniculatum* Gaertn) dengan Penambahan Ekstrak Yeast. *Sciscitatio*, 2(1), 35–44. <https://doi.org/10.21460/sciscitatio.2021.21.48>
- Dillak, H. I., Kristiani, E. B. E. K., & Kasmiyati, S. (2019). Secondary Metabolites and Antioxidant Activity of Ethanolic Extract of Faloak (*Sterculia quadrifida*). *Biosaintifika Journal of Biology & Biology Education*, 5, 11(3), 296–303.
- Dotulong, V., Wonggo, D., & Montolalu, L. A. D. Y. (2021). Evaluation of Secondary Metabolites and Antioxidant Activity of Water, Ethyl Acetate and Hexane Fractions from the Mangrove Young Leaves *Sonneratia alba*. *Chemical Science International Journal*, 30(2), 23–32. <https://doi.org/10.9734/csji/2021/v30i230215>
- Evivie, S., Ebahamiegbebho, P., Imaren, J., & Igene, J. (2016). Evaluating the Organoleptic Properties of Soy Meatballs (BEEF) with varying Levels of *Moringa oleifera* Leaves Powder. *Journal of Applied Sciences and Environmental Management*, 19(4), 649-656. <https://doi.org/10.4314/jasem.v19i4.12>
- Farooq, B., Koul, B., Mahant, D., & Yadav, D. (2021). Phytochemical analyses, antioxidant and anticancer activities of ethanolic leaf extracts of *Moringa oleifera* lam varieties. *Plants*, 10(11), 2348. <https://doi.org/10.3390/plants10112348>
- Fatima, S., Masriani., & Idrus. (2020). Pengaruh Penambahan Bubuk Jahe Merah Terhadap Organoleptik Teh Celup Daun Kelor (*Moringa oleifera*). *Jurnal Pengelolaan Pangan*, 5(2), 42–47. <https://doi.org/10.31970/pangan.v5i2.40>
- Fuel, M., Mesas, C., Martínez, R., Ortiz, R., Quiñero, F., Prados, J., Porres, J. M., & Melguizo, C. (2021). Antioxidant and antiproliferative potential of ethanolic extracts from *Moringa oleifera*, *Tropaeolum tuberosum* and *Annona cherimola* in colorectal cancer cells. *Biomedicine and Pharmacotherapy*, 143, 112248. <https://doi.org/10.1016/j.biopha.2021.112248>
- Ghezzi, P., Jaquet, V., Marcucci, F., & Schmidt, H. H. H. W. (2017). The oxidative stress

- theory of disease: levels of evidence and epistemological aspects. *British Journal of Pharmacology*, 174(12), 1784–1796. <https://doi.org/10.1111/bph.13544>
- Irwan, Z. (2020). Kandungan Zat Gizi Daun Kelor (*Moringa Oleifera*) Berdasarkan Metode Pengeringan. *Jurnal Kesehatan Manarang*, 6(1), 69–77. <https://doi.org/10.33490/jkm.v6i1.231>
- Isyraqi, N. A., Rahmawati, D., & Sastyarina, Y. (2020, December). Studi Literatur: Skrining Fitokimia dan Aktivitas Farmakologi Tanaman Kelor (*Moringa oleifera* Lam.). In *Proceeding of Mulawarman Pharmaceuticals Conferences*, 12: 202-210. <https://doi.org/10.25026/mpc.v12i1.426>
- Jabborova, D., Sayyed, R. Z., Azimov, A., Jabbarov, Z., Matchanov, A., Enakiev, Y., Baazeem, A., EL Sabagh, A., Danish, S., & Datta, R. (2021). Impact of mineral fertilizers on mineral nutrients in the ginger rhizome and on soil enzymes activities and soil properties. *Saudi Journal of Biological Sciences*, 28(9), 5268–5274. <https://doi.org/10.1016/j.sjbs.2021.05.037>
- Khanifah, F., Puspitasari, E., & Awwaludin, S. (2021). Uji Kualitatif Flavonoid, Alkaloid, Tanin pada Kombinasi Kunyit (*Curcuma Longa*) dan Coklat (*Theobroma cacao* L.). *Jurnal Sains Dan Terapan Kimia*, 15(1). <http://dx.doi.org/10.20527/jstk.v15i1.9415>
- Kou, X., Li, B., Olayanju, J. B., Drake, J. M., & Chen, N. (2018). Nutraceutical or pharmacological potential of *Moringa oleifera* Lam. *Nutrients*, 10(3), 343. <https://doi.org/10.3390/nu10030343>
- Lindawati, N. Y., & Ma'ruf, S. H. (2020). Penetapan Kadar Total Flavonoid Ekstrak Etanol Kacang Merah (*Phaseolus vulgaris* L.) Secara Spektrofotometri Visibel. *Jurnal Ilmiah Manuntung*, 6(1), 83-91. <https://doi.org/10.51352/jim.v6i1.312>
- Malekmohammad, K., Sewell, R. D. E., & Rafieian-Kopaei, M. (2019). Antioxidants and atherosclerosis: Mechanistic aspects. *Biomolecules*, 9(8), 1–19. <https://doi.org/10.3390/biom9080301>
- Manggara, A. B., & Shofi, M. (2018). Analisis Kandungan Mineral Daun Kelor (*Moringa oleifera* Lamk.) Menggunakan Spektrometer XRF (X-Ray Fluorescence). *Akta Kimia Indonesia*, 3(1), 104-111. <https://doi.org/10.12962/j25493736.v3i1.3095>
- Mao, Q. Q., Xu, X. Y., Cao, S. Y., Gan, R. Y., Corke, H., Beta, T., & Li, H. Bin. (2019). Bioactive compounds and bioactivities of ginger (*zingiber officinale* roscoe). *Foods*, 8(6), 1–21. <https://doi.org/10.3390/foods8060185>
- Mareta, D. T. (2019). Hedonic Test Method for Measuring Instant Pindang Seasoning Powder Preferences. *Journal of Science and Applicative Technology*, 3(1), 34-36. <https://doi.org/10.35472/jsat.v3i1.195>
- Muna, L. N. (2022). Aktivitas antioksidan ekstrak air daun kelor (*Moringa oleifera*) dengan metode DPPH serta analisis kualitatif kandungan metabolit sekunder. *Sasambo Journal of Pharmacy*, 3(2), 91-96. <https://doi.org/10.29303/sjp.v3i2.182>
- Ngatirah, N., & Dewi, C. W. A. (2020). Pelatihan Penggunaan Mesin Penggiling Jahe Dan Pengolahan Limbah Ampas Jahe Menjadi Bubuk Jahe. *SELAPARANG Jurnal Pengabdian Masyarakat Berkemajuan*, 4(1), 589-593. <https://doi.org/10.31764/jpmb.v4i1.3355>
- Nikmah, Majid, A., & Paulus, A. Y. (2022). Identifikasi Golongan Senyawa Tanin, Flavonoid, Alkaloid dan Saponin Sebagai Senyawa Antibakteri Pada Ekstrak Daun Kelor (*Moringa oleifera* L.) Asal Kota Kupang. *CHM-K Applied Scientific Journal*, 5(1), 1–7.
- Palupi, C., Nugraha, P. S. A., & Ernawaningtyas, E. (2020). Uji Mutu Sediaan Celup Daun Bunga Kertas (*Bougainvillea glabra* Choisy). *MEDFARM: Jurnal Farmasi Dan Kesehatan*, 9(1), 22–28. <https://doi.org/10.48191/medfarm.v9i1.28>
- Pisoschi, A. M., Pop, A., Cimpeanu, C., & Predoi, G. (2016). Antioxidant capacity

- determination in plants and plant-derived products: A review. *Oxidative Medicine and Cellular Longevity*, 2016, 9130976. <https://doi.org/10.1155/2016/9130976>
- Prawira-Atmaja, M. I., Maulana, H., Shabri, S., Riski, G. P., Fauziah, A., Harianto, S., & Rohdiana, D. (2021). Evaluasi Kesesuaian Mutu Produk Teh Dengan Persyaratan Standar Nasional Indonesia. *Jurnal Standardisasi*, 23(1), 43-52. <https://doi.org/10.31153/js.v23i1.845>
- Purwoko, M. L. Y., Syamsudin, S., & Simanjuntak, P. (2022). Kombinasi Ekstrak Herba Pegagan dan Daun Kelor terhadap Kerusakan Otak dengan Metode Radial Eight-Arm Test. *PHARMACY: Jurnal Farmasi Indonesia (Pharmaceutical Journal of Indonesia)*, 19(1), 142-150. <https://doi.org/10.30595/pharmacy.v19i1.13490>
- Rachmatiah, T., Daud, J. J., & Artanti, N. (2022). Aktivitas Antioksidan, Toksisitas, Kandungan Senyawa Fenol dan Flavonoid Total dari Daun Leilem (*Clerodendrum minahassae* Teijsm. & Binn). *Sainstech Farma*, 15(1), 35-43. <https://doi.org/10.37277/sfj.v15i1.1103>
- Ruwandha, D., Fitriyani, D., & Iskandar, D. (2021). Uji Aktivitas Tanin Daun Mimba (*Azadirachta indica*) Terhadap Bakteri *Salmonella typhi*. *Jurnal Kimia Riset*, 6(1), 77-85. <https://doi.org/10.20473/jkr.v6i1.24848>
- Santi, I., Amirah, S., & Andriani, I. (2022). Sosialisasi Pembuatan Teh Herbal Dalam Kemasan Teh Celup Pada Kelompok Pkk Kalabbirang, Kabupaten Takalar. *Dharmakarya*, 11(1), 22. <https://doi.org/10.24198/dharmakarya.v11i1.32667>
- Septiana, A. T., Handayani, I., & Winarsi, H. (2019). Aktivitas Antioksidan dan Sifat Fisikokimia Madu Temulawak (*Curcuma zanthorrhiza roxb*) yang Ditambah Ekstrak Jahe (*Zingiber officinale* Rosc). *Jurnal Aplikasi Teknologi Pangan*, 8(4), 155-160. <https://doi.org/10.17728/jatp.4849>
- Setiyani, R., Fitria, A. V., Asfarida, T., & Lestari, R. D. Analisis Tipe Perilaku Konsumen dalam Membeli Teh Celup. *Agricultural Socio-Economic Empowerment and Agribusiness Journal*, 1(2), 49-58. <https://doi.org/10.20961/agrisema.v1i2.61897>
- Siampa, J. P., & Jayanto, I. (2020). PKM Pemberdayaan Guru SLB Khusus Autis Permata Hati Dan SLB YPAC Manado Melalui Pelatihan Produksi Minuman Kesehatan Granul Instan Jahe Merah (*Zingiber Officinale*) Sebagai Upaya Peningkatan Kemandirian Ekonomi dan Terapi Supportif Siswa SLB. *VIVABIO: Jurnal Pengabdian Multidisiplin*, 2(2), 8. <https://doi.org/10.35799/vivabio.2.2.2020.30280>
- Singh, V., Arulanantham, A., Parisipogula, V., Arulanantham, S., & Biswas, A. (2018). Moringa olifera: Nutrient Dense Food Source and World's Most Useful Plant to Ensure Nutritional Security, Good Health and Eradication of Malnutrition. *European Journal of Nutrition & Food Safety*, 8(4), 204-214. <https://doi.org/10.9734/ejnfs/2018/42468>
- Sinulingga, S. E., Sebayang, L. B., & Sihotang, S. (2021). Inovasi Pembuatan Teh Herbal dari Jantung Pisang dengan Tambahan Daun Stevia Sebagai Pemanis Alami. *Jurnal Bios Logos*, 11(2), 147-154. <https://doi.org/10.35799/jbl.v11i2.35677>
- Siow, C. S., Chan, E. W. C., Wong, C. W., & Ng, C. W. (2022). Antioxidant and sensory evaluation of cocoa (*Theobroma cacao* L.) tea formulated with cocoa bean hull of different origins. *Future Foods*, 5(October 2021), 100108. <https://doi.org/10.1016/j.fufo.2021.100108>
- Su, T. C., Yang, M. J., Huang, H. H., Kuo, C. C., & Chen, L. Y. (2021). Using sensory wheels to characterize consumers' perception for authentication of taiwan specialty teas. *Foods*, 10(4), 1-17. <https://doi.org/10.3390/foods10040836>
- Sucianti, A., Yusa, N. M., & Sughita, I. M. (2021). Pengaruh Suhu Pengeringan Terhadap Aktivitas Antioksidan Dan Karakteristik Teh Celup Herbal Daun Mint (*Mentha piperita* L.). *Jurnal Ilmu Dan Teknologi Pangan (ITEPA)*, 10(3), 378-388. <https://doi.org/10.24843/itepa.2021.v10.i03.p06>

- Suhendy, H. (2021). Formulasi dan Evaluasi Minuman Herbal Antioksidan Jahe Merah (*Zingiber officinale* Rosc. var. *rubrum*). *Jurnal Ilmiah Farmasi Farmasyifa*, 4(2), 79–86. <https://doi.org/10.29313/jiff.v4i2.7617>
- Szczurek, A. (2021). Perspectives on tannins. *Biomolecules*, 11(3), 1–3. <https://doi.org/10.3390/biom11030442>
- Triandini, I.G.A.A.H., Wangiyana, I. G. A. . (2022). Mini-Review Uji Hedonik Pada Produk Teh Herbal Hutan. *Jurnal Silva Samalas Journal of Forestry and Plant Science*, 5(1), 12–19.
- Tuapattinaya, P. M., Simal, R., & Warella, J. C. (2021). Analisis Kadar Air dan Kadar Abu Teh Berbahan Dasar Daun Lamun (*Enhalus acoroides*). *Jurnal Biologi Pendidikan Dan Terapan*, 8(1), 16–21.
- Tiyani, U., Suharti, S., & Andriani, S. (2020). Formulasi Dan Uji Organoleptik Teh Celup Daun Kersen (*Muntingia Calabura* L.) Untuk Memelihara Kadar Gula Darah Dan Penambahan Rimpang Jahe (*Zingiber Officinale*) Sebagai Pehangat Tubuh. *Journal of Holistic and Health Sciences (Jurnal Ilmu Holistik dan Kesehatan)*, 4(1), 43-49. <https://doi.org/10.51873/jhhs.v4i1.75>
- Wangiyana, I. G. A. S., Triandini, I. G. A. A. H., & Nugraheni, Y. M. M. A. (2021). Hedonic test of agarwood tea from *Gyrinops versteegii* with different leaves processing method. *Jurnal Riset Industri Hasil Hutan*, 13(2), 99-110. <http://dx.doi.org/10.24111/jrihh.v13i2.6939>
- Widiastini, L. P., Karuniadi, I. G. A. M., & Tangkas, M. (2021). Senyawa Antioksidan Ekstrak Etanol Daun Kelor (*Moringa Oleifera*) Di Denpasar Selatan Bali. *Media Kesehatan Politeknik Kesehatan Makassar*, 16(1), 135-139. <https://doi.org/10.32382/medkes.v16i1.2038>
- Widanti, Y.A., Wahyudi, H. (2019). Aktivitas Antioksidan Teh Daun Kelor (*Moringa oliefera*) -Rosela (*Hibiscus sabdariffa* L) Dengan Variasi Lama Pengeringan. *Jurnal Teknologi Dan Industri Pangan*, 3(2), 106-112. <https://doi.org/10.33061/jitipari.v3i2.2692>
- Xu, D. P., Li, Y., Meng, X., Zhou, T., Zhou, Y., Zheng, J., Zhang, J. J., & Li, H. Bin. (2017). Natural antioxidants in foods and medicinal plants: Extraction, assessment and resources. *International Journal of Molecular Sciences*, 18(1),96. <https://doi.org/10.3390/ijms18010096>
- Yana, N. D., Marpaung, M. P., & Gummy, B. (2022). Analisis Parameter Spesifik dan Nonspesifik Simplisia Daun Bawang Merah (*Allium cepa* L.). *KOVALEN: Jurnal Riset Kimia*, 8(1), 45–52. <https://doi.org/10.22487/kovalen.2022.v8.i1.15741>
- Yang, L., Liu, H., Xia, D., & Wang, S. (2020). Antioxidant properties of camphene-based thiosemicarbazones: Experimental and theoretical evaluation. *Molecules*, 25(5), 1192. <https://doi.org/10.3390/molecules25051192>
- Yulianto, S. (2020). Identifikasi Alkaloid Daun Kelor (*Moringa oleifera* L). *Jurnal Kebidanan Dan Kesehatan Tradisional*, 5(1), 55–57. <https://doi.org/10.37341/jkkt.v5i1.136>
- Yusfiani, M., Diana, A., Harahap, M., & Syakura, A. (2021). Studi Marinasi Udang Kecap Asin: Uji Hedonik. *Jurnal Pengolahan Pangan*, 6(1), 35–41. <https://doi.org/10.31970/pangan.v6i1.48>
- Zela, Z., & Diah, A. W. M. (2021). Uji Aktivitas Antioksidan Ekstrak Buah Kersen (*Muntingia calabura* L.) Menggunakan 1,1-Difenil-2-Pikrilhidrazil. *Media Eksakta*, 17(2), 85–90. <https://doi.org/10.22487/me.v17i2.1108>
- Zhang, S., Kou, X., Zhao, H., Mak, K. K., Balijepalli, M. K., & Pichika, M. R. (2022). *Zingiber officinale* var. *rubrum*: Red Ginger’s Medicinal Uses. *Molecules*, 27(3), 775. <https://doi.org/10.3390/molecules27030775>

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DOI: [10.31965/infokes.Vol21Iss1.878](https://doi.org/10.31965/infokes.Vol21Iss1.878)Journal homepage: <http://jurnal.poltekkeskupang.ac.id/index.php/infokes>**RESEARCH****Open Access****Abdominal Circumference as A Predictor of Type II Diabetes Mellitus in Young Women**Siti Choirul Dwi Astuti<sup>1a\*</sup>, Yohana Putri Apryanti<sup>1b</sup><sup>1</sup> Department of Midwifery, Politeknik Kesehatan Kementerian Kesehatan Gorontalo, Gorontalo City, Gorontalo Province, Indonesia<sup>2</sup> Department of Midwifery, Institut Kesehatan Sumatera Utara, Medan City, North Sumatera, Indonesia<sup>a</sup> Email address: [sitichoirul13@yahoo.co.id](mailto:sitichoirul13@yahoo.co.id)<sup>b</sup> Email address: [yohanasembiring2804@gmail.com](mailto:yohanasembiring2804@gmail.com)

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**Abstract**

Obesity is becoming one of the main factors in the increase in non-communicable diseases globally. In Indonesia, the prevalence of central obesity at 15 years and over continues to increase. The increase in visceral fat is related to abnormal metabolisms, such as a decrease in glucose tolerance and insulin sensitivity, causing an increase in blood sugar levels, a risk factor for diabetes. To predict the incidence of type 2 diabetes mellitus, the abdominal circumference is a better predictor than BMI against type 2 diabetes mellitus. This study aims to determine the relationship between abdominal circumference to blood sugar levels in young women. This research is an observational analytical study using the cross-section method. Sampling in this study used a consecutive sample, which was taken based on inclusion and exclusion criteria in the population. The overall subjects of the study amounted to 70 respondents. The results showed a meaningful relationship between the abdominal circumference and fasting blood sugar levels ( $p = 0.000$ ) with a moderate correlation ( $r = 0.440$ ) and a significant relationship between abdominal circumference to blood sugar levels 2 hours after glucose loading ( $p = 0.030$ ) with a weak correlation ( $r = 0.259$ ). This study concluded that there is a relationship between abdominal circumference and blood sugar levels using an oral glucose tolerance test in young women. As a recommendation, young women should maintain their lifestyle and keep their abdominal circumference not exceeding 80 centimeters to prevent diabetes.

**Keywords:** Abdominal Circumference, Diabetes Mellitus, Young Women.**\*Corresponding Author:**

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## 1. INTRODUCTION

Globally, obesity has been a major contributor to the growth of noncommunicable diseases (Adnyana et al., 2020). Obesity develops when the accumulation of extra fat increases health hazards. The body mass index (BMI) and abdominal circumference are two of the body fat measurement methods (Alves et al., 2021). According to the *World Health Organization* (WHO), individuals are obese if their BMI is more than or equal to 27 kg/m<sup>2</sup> Indonesia (Angullo-Martínez et al., 2021).

The threshold values for abdominal circumference measurements vary by area. In Indonesia, a person is considered obese if his or her belly circumference is larger than 90 centimeters for men and 80 centimeters for women (Asiah, 2016). Obesity is one of the most prominent problems in the world today. In Indonesia, the prevalence of obesity continues to rise, particularly obesity in adults aged 18 and older (Bolla et al., 2020). Obesity can raise a person's risk of morbidity and death. Increased visceral fat is associated with aberrant metabolisms, including decreased glucose tolerance and insulin sensitivity, which is a risk factor for the development of diabetes (Bonora et al., 2021b).

It is known that abdominal circumference is a better predictor than body mass index (BMI) on the incidence of type 2 diabetes mellitus (Bonora et al., 2021a). Compared to body mass index (BMI), abdominal circumference tends to be more accurate for diagnosing central obesity. Central obesity is a condition of excess fat in the abdomen. Therefore, it is crucial to measure the waist circumference occasionally. Diabetes mellitus is a metabolic disorder with various etiologies (Ametembun, 2017). It is characterized by hyperglycemia resulting from the pancreas not producing enough insulin or the insulin produced cannot be used by the body effectively (Carrasco-Sánchez et al., 2021). Hyperglycemia can be defined as a condition in which blood sugar levels exceed normal limits (Arise et al., 2021). If this situation occurs continuously, it can result in diabetes mellitus. One way that can be used to establish diabetes mellitus is through oral glucose (GDO), which is more sensitive and specific than fasting plasma glucose testing (Burda et al., 2013). Diabetes mellitus has a long-term effect, damaging the heart, blood vessels, eyes, kidneys, and nerves. These complications are the result of uncontrolled diabetes. (Chan et al., 2021) The long course of the disease to become a complication causes diabetes mellitus to often go undiagnosed at the beginning; therefore, blood sugar checks need to be done to diagnose diabetes (Cheng et al., 2021).

In 2020, the number of Indonesians aged 15 and older with diabetes is projected to reach 12,191,564, with an estimated 8,485,334 individuals undiagnosed (Chikowore et al., 2021). In 2021, the prevalence of diabetes in the population aged 15 and older rose from 1.1% in 2020 to 2.1% (Burda et al., 2012). Genetics, a family history of diabetes, being overweight or obese, a poor diet, a lack of physical activity, and smoking are all risk factors for diabetes. The greatest risk factor for type 2 diabetes mellitus is excess body fat caused by a healthy diet and regular exercise (Cuschieri et al., 2022).

The prevalence of obesity and diabetes mellitus continues to rise, along with the association between obesity, particularly central obesity, and diabetes mellitus (Chen et al., 2020). Gorontalo is one of the regions with the greatest prevalence of obesity. The prevalence of obesity in adult males is 25.5%, whereas in females it is greater at 47.5%. Obesity occurs not just in metropolitan regions but also in rural ones. It is crucial to recognize the initial rise in blood sugar levels in young women as the onset of insulin resistance (Das et al., 2017). Hence, researchers wish to determine if belly circumference may be utilized as an alternative predictor of type II diabetes in young women.

## 2. RESEARCH METHOD

This is an analytical cross-sectional study in which both constrained and unconstrained variables are observed at a single time. The investigation was conducted at the Kabila Health Center between February and June 2022. This study collected primary data by measuring participants' blood sugar and belly circumference. Blood sugar is sugar or glucose in the blood that comes from eating and is transported to all body cells through blood vessels.

Blood glucose (blood sugar) is an indispensable health indicator. Consistently high blood sugar levels (hyperglycemia) will cause disorders such as diabetes and vice versa. In addition to causing a person to faint, hypoglycemia (low blood sugar) can also lead to low blood sugar levels. The target population consists of young women in good health at the Kabila Health Center in Gorontalo Province. In December 2021, 70 young women between the ages of 10 and 18 were surveyed at the Kabila Health Center to compile the sample population. The sampling method employs the sequential sampling methodology, in which samples are drawn from a population based on inclusion and exclusion criteria. The inclusion criteria are being willing to participate in research and signing informed consent. Exclusion criteria include research participants who are ill, using medications that impact blood glucose levels (metformin/glibenclamide), or participating in a diet program, abdominal circumference can be affected by disease (tumors, hepatomegaly). Data analysis was carried out with the SPSS program. Following the collection of data, the information is processed. This research already has a permit by the Research Ethics Commission of the Health Polytechnic of the Ministry of Gorontalo, numbered LB.01.01/KEPK /177/2022.

## 3. RESULTS AND DISCUSSION

**Table 1.** Displays the findings of the study, which illustrates the age distribution, family history of diabetes, and education levels of the 70 young women who participated in the study as respondents.

**Table 1.** Respondent Characteristics (n=70).

Characteristics	Frequency Distribution		p-value
	n	%	
<b>Age</b>			0,001
10 Years Old	16	23	
11 Years Old	4	6	
12 Years Old	12	17	
13 Years Old	9	13	
14 Years Old	3	4	
15 Years Old	7	10	
16 Years Old	9	13	
17 Years Old	6	9	
18 Years Old	4	5	
<b>Family History of Diabetes Mellitus</b>			0,013
Yes	30	42,9	
No	40	57,1	
<b>Education</b>			0,804
Primary School	44	63	
High School	26	37	

According to table 1, the number and percentage of respondents were the highest in ten years, with 16 respondents (23%) receiving the most responses. In contrast, only three respondents (4%) were aged 14 years or younger. According to table 1, the number and percentage of respondents with a junior high school education were 44 (63%) and the number and percentage of respondents with a high school education was 26 (37%). The number and proportion of respondents without a family history of diabetes mellitus, namely 40 respondents (57.1%), are also presented. The number and proportion of respondents with a family history of diabetes mellitus were 30 (42.9%), as shown in Table 1. The number and proportion of respondents without a family history of diabetes mellitus, namely 40 respondents (57.1%), are also presented.

**Table 2.** Respondents' blood sugar (n=70).

Numeric Variables	Blood Sugar			
	Median	Min-Max	Mean±SD	p-value
Fasting Blood Sugar	87	74-112	86,97-8,45	0,001
Oral Blood Sugar	111	66-358	115,71-37,02	

According to table 2, the average level of fasting blood sugar among the 70 people who participated in this research was 86.97, and the standard deviation was 8.45. The minimal level of sugar in the blood during fasting is 74, and the maximum level of sugar in the blood while fasting is 112. In this particular investigation, the figure of 87 was determined to be the median for the participants' fasting blood sugar values. The average glucose level in the blood two hours after eating 70 grams was 115.71, with a standard deviation of 37.02 among the 70 people who participated in this study. Two hours after ingesting 70 grams of glucose orally, the lowest possible value for blood sugar is 66, and the highest possible value for blood sugar is 358. Both of these values are reached via glucose loading. In this particular investigation, the figure of 111 was determined to be the median for the respondents' fasting blood sugar values.

**Table 3.** Respondent's abdominal circumference (n=70).

Numeric Variables	Abdominal Circumference			
	Median	Min-Max	Mean±SD	p-value
Fasting Blood Sugar	79	63-111	82,23-12,711	0,008
Oral Blood Sugar	90	66-127	90,13-15,38	

According to table 3, the average abdomen circumference of participants at the time of fasting blood sugar was 82.23 with a standard deviation of 12,711, the minimum abdominal circumference was 63 and the highest abdominal circumference was 111, with a median abdominal circumference of 79. The average abdomen circumference of respondents following oral administration of 70 grams of glucose was 90,13 with a standard deviation of 15.38, the lowest abdominal circumference being 66 and the highest abdominal circumference being 127, with an average abdominal circumference of 90.

**Table 4.** Test Results of Spearman's Rank Correlation of Abdominal Circumference to blood sugar (n=70).

Numeric Variables	Significance	Correlation Coefficient R
Fasting Blood Sugar	0,0001	0,440
Oral Blood Sugar	0,030	0,259

In table 4, based on the findings of the Spearman's rank correlation test between abdomen circumference and fasting blood sugar, a significant value (p-value) of 0.0001 was achieved, indicating that the value was less than (0.05). This result demonstrates that the obtained data

yielded substantial results. In addition, the correlation coefficient  $R$  has a value of 0.440. It also reveals a modest association between stomach circumference and fasting blood sugar. In table 4, based on the findings of the Spearman's rank correlation test to the variables of belly circumference and blood sugar 2 hours after receiving 70 grams of glucose, a significant value (p-value) of 0.030 was obtained, indicating that the deal was less than (0.05). This score indicates that the obtained data has produced substantial results. In addition, the correlation coefficient  $R$  has a value of 0.259. It demonstrates a slight association between belly circumference and blood sugar 2 hours after 70 grams of glucose ingestion.

This study's conclusions are based on a bivariate analysis utilizing Spearman's Rank correlation. It was determined that abdomen circumference and fasting blood sugar showed a significant relationship (p-value = 0.000) and moderate correlation (correlation coefficient  $r$ , which is 0.440). It was also shown that the abdominal circumference and blood sugar 2 hours after receiving 70 grams of glucose showed a weak but significant relationship (p-value = 0.030) (correlation coefficient  $r$ , 0.259). On the basis of the two obtained outcomes, it is possible to infer that the null hypothesis ( $H_0$ ) was rejected and the alternative hypothesis ( $H_a$ ) was accepted. Thus, the oral glucose tolerance test revealed a correlation between young women's abdomen circumference and blood sugar levels.

Obese individuals are known to decrease the function of  $\beta$  in the pancreas (Dom et al., 2021). The  $\beta$  have an essential role in regulating insulin production. Decreased function of  $\beta$  due to obesity can result in inflammation of the pancreas, which causes the proliferation of macrophages in the pancreas (Dubey et al., 2022). These macrophages will interact with  $\beta$ , where it is known that direct contact between the macrophages and the  $\beta$  results in damage to the  $\beta$  (Engel, 2014). The occurrence of damage to this  $\beta$  can result in abnormal tolerance of fasting glucose can occur.

The study on the association between BMI (body mass index), abdominal circumference, and RLPP (the ratio of pelvic waist circumference) and blood sugar levels revealed that BMI was associated with blood sugar levels (p=0.007; r=0.345), abdominal circumference was associated with blood sugar levels (p=0.001; r=0.424), and RLPP was associated with blood sugar levels (p=0.002; r=0.392) (Grimes et al., 2015). It indicates a connection between anthropometrics and blood sugar levels, particularly belly circumference, which has the highest correlation with blood sugar levels compared to other factors (Harbuwono et al., 2021).

Because gluconeogenesis can stop insulin from working, a bigger waistline can make it harder to control blood sugar (Kargar et al., 2021). Fatty acids are released into the port vein of the liver as a waste product of the fat in the abdomen (Kh. Albashr et al., 2022). When there are too many free fatty acids in the liver, they oxidize and make Acetyl CoA. This turns on the liver enzyme pyruvate carboxylase, which turns pyruvic acid into glucose. Gluconeogenesis is the name for this process (Kuok et al., 2016). Also, having more free fatty acids circulating in the liver can make muscle cells less sensitive to insulin, which can lead to insulin resistance (Kushwaha et al., 2022). Therefore, muscle cells require more insulin for blood glucose into the muscles (Lu et al., 2018). In a study entitled the relationship between the abdominal circumference and the ratio of pelvic abdominal circumference to fasting blood sugar levels in soldiers, a sample of 73 respondents was obtained (Lukito et al., 2020). The results of this study's correlation test between waist circumference and fasting blood sugar were p = 0.000 and r = 0.525. This showed that waist circumference and fasting blood sugar have a meaningful relationship and a moderate correlation (Ninomiya et al., 2022). In the chi-square test, men with an abdominal circumference of 90 cm or less and women with an abdominal circumference of 80 cm or less were labeled as having central obesity. Men and women with abdominal circumference of more than 90 cm and 80 cm were labeled as having non-central obesity (Pathiranage et al., 2022). Fasting blood sugar levels are categorized into regular blood sugar (<90 mg/dL) and rise ( $\geq$ 90 mg/dL) (Pressman et al., 2021). The value of p = 0.038 for the chi-

square test between the abdominal circumference and fasting blood sugar showed that there was a meaningful relationship between the abdominal circumference and fasting blood sugar, and OR = 3.167 showed that people with central obesity were three times more likely to have fasting blood sugar than people who were not obese (Purnami et al., 2015).

The insulin sensitivity of fat persons will be diminished. There is an increase in the release of Nonesterified Fatty Acid (NEFA) in obese persons, which can lead to insulin resistance (Sarvazad et al., 2020). Based on studies on the relationship between diabetes and insulin resistance (Sheehan et al., 2019), this study used a cross-sectional research design, with one method of measuring the distribution of adiposity using abdominal circumference (Sukkriang et al., 2021) and in the analysis using *Pearson's* correlation between the abdominal circumference and blood sugar levels 2 hours after glucose loading, a  $p < 0.0001$  value was obtained with a value of  $r = 0.20$  to show that abdominal circumference has a meaningful relationship with sugar levels 2 hours after glucose loading with correlation strength, which is weakly correlated (Seibert et al., 2018).

#### 4. CONCLUSION

It is possible to classify women as having central obesity based on their average abdomen circumference. The intermediate fasting blood sugar level is the same as the regular one. The intermediate blood sugar level two hours after eating can be the same as the blood sugar level two hours after a typical glucose loading. A correlation was found, according to a bivariate study's results, between young women's abdominal circumference and blood sugar levels. It is advised that more studies be carried out to investigate further potential risk factors that might induce alterations in blood sugar levels in young women. It is suggested that members of the community, particularly young ladies, always keep their posture to prevent developing central obesity. One of the ways this can be accomplished is by leading a healthy lifestyle, which will also help reduce the risk of developing diabetes mellitus.

#### REFERENCES

- Adnyana, A. A. N. K., Surudarma, W., Made Wihandani, D., Wayan, S. G., & Wandu, N. (2021). Hubungan lingkaran perut terhadap kadar gula darah menggunakan tes toleransi glukosa oral pada remaja akhir. *J Med Udayana [Internet]*, 9(12), 14-20.
- Alves, V. P., de Oliveira, R. C., & Gregori, D. (2021). Non-communicable chronic diseases: Mortality of older adult citizens in Brazil and Italy before the Covid-19 pandemic. *Health Policy Open*, 2(December), 100041. <https://doi.org/10.1016/j.hpopen.2021.100041>
- Ametembun, M. G. (2017). Pancreas Ultrasound among Young Adult Diabetes Melitus Type II with Abdominal Tuberculosis. *Ultrasound in Medicine & Biology*, 43, S160–S161. <https://doi.org/10.1016/j.ultrasmedbio.2017.08.1529>
- Angullo-Martínez, E., Carretero-Anibarro, E., Sánchez Barrancos, I. M., Cos Claramunt, X., Orozco Beltrán, D., Torres Baile, J. L., Ezkurra Loiola, P., Álvarez Guisasola, F., Arrieta Blanco, F. J., Ávila Lachica, L., Belinchón Sánchez-Somoza, B. M., Caride Miana, E., María Cebrián Cuenca, A., García Soidán, F. J., Martín Manzano, J. L., Navarro Pérez, J., Ortega Millán, C., Sagredo Pérez, J., Ruiz Quintero, M., ... Benito Badorrey, B. (2021). Checklist for patients with type 2 diabetes mellitus for remote consultation. *Atencion Primaria*, 53(4), 101983. <https://doi.org/10.1016/j.aprim.2021.101983>
- Arise, R. O., Taofeek, O. O., Babaita, K., Adeoye, R. I., & Osemwegie, O. (2021). Blood pressure and sugar regulating potentials of *Anarcadium occidentale* nut globulin and albumin hydrolysates. *Heliyon*, 7(3), e06384. <https://doi.org/10.1016/j.heliyon.2021.e06384>

- Asiah, N. (2016). Pengaruh Penyuluhan Dalam Peningkatan Pengetahuan Kesehatan Reproduksi Remaja Pada Pengurus Pusat Informasi dan Konseling Mahasiswa UHAMKA. *Arkesmas*, 1(2), 97–101.
- Bolla, A. M., Dozio, N., Scavini, M., Succurro, E., Tumminia, A., Torlone, E., Sasso, F. C., & Vitacolonna, E. (2020). Awareness about diabetes and pregnancy among diabetes specialists and fellows: The YoSID diabetes and pregnancy project. *Nutrition, Metabolism and Cardiovascular Diseases*, 30(9), 1520–1524. <https://doi.org/10.1016/j.numecd.2020.04.019>
- Bonora, E., Cataudella, S., Marchesini, G., Miccoli, R., Vaccaro, O., Fadini, G. P., Martini, N., & Rossi, E. (2021a). Incidence of diabetes mellitus in Italy in year 2018. A nationwide population-based study of the ARNO Diabetes Observatory. *Nutrition, Metabolism and Cardiovascular Diseases*, 31(8), 2338–2344. <https://doi.org/10.1016/j.numecd.2021.04.017>
- Bonora, E., Cataudella, S., Marchesini, G., Miccoli, R., Vaccaro, O., Fadini, G. P., Martini, N., & Rossi, E. (2021b). Initial treatment of diabetes in Italy. A nationwide population-based study from of the ARNO Diabetes Observatory. *Nutrition, Metabolism and Cardiovascular Diseases*, 31(9), 2661–2668. <https://doi.org/10.1016/j.numecd.2021.06.006>
- Burda, N., Mema, V., Mahmudi, E., Selimi, B., Zhugli, S., Lenajni, B., & Bunjaku, I. (2013). Prevalence of dry eye syndrome at patients with diabetes melitus TIP 2. *Journal of Acute Disease*, 2(1), 48–51. [https://doi.org/10.1016/s2221-6189\(13\)60095-5](https://doi.org/10.1016/s2221-6189(13)60095-5)
- Burda, N., Mema, V., Md, E. M., Selimi, B., Zhugli, S., Lenajni, B., & Bunjaku, I. (2012). Prevalence of dry eye syndrome at patients with diabetes melitus tip 2, one year retrospective study May 2011-June 2012. *Journal of Acute Disease*, 1(2), 110–114. [https://doi.org/10.1016/s2221-6189\(13\)60026-8](https://doi.org/10.1016/s2221-6189(13)60026-8)
- Carrasco-Sánchez, F. J., Fernández-Rodríguez, J. M., Ena, J., Gómez-Huelgas, R., & Carretero-Gómez, J. (2021). Medical treatment of type 2 diabetes mellitus: Recommendations of the Diabetes, Obesity and Nutrition Group of the Spanish Society of Internal Medicine. *Revista Clínica Española (English Edition)*, 221(2), 101–108. <https://doi.org/10.1016/j.rceng.2020.06.009>
- Chan, J. C. N., Lim, L. L., Shaw, J. E., Aguilar-Salinas, C. A., & Gregg, E. W. (2021). Data on diabetes-specific distress are needed to improve the quality of diabetes care – Authors’ reply. *The Lancet*, 397(10290), 2150. [https://doi.org/10.1016/S0140-6736\(21\)00664-4](https://doi.org/10.1016/S0140-6736(21)00664-4)
- Chen, Y., Lin, Y., Wang, J., Guo, X., Guo, Y., Dong, F., Gao, F., & Liu, Q. (2020). The serum concentration of  $\beta$ CGRP is novel marker for type 1 diabetes. *Heliyon*, 6(1), e03223. <https://doi.org/10.1016/j.heliyon.2020.e03223>
- Cheng, A. Y. Y., Feig, D. S., Ho, J., Siemens, R., Bajaj, H., Gilbert, J., Houlden, R., Kim, J., Mackay, D., Rabi, D. M., Senior, P., & Sherifali, D. (2021). Blood Glucose Monitoring in Adults and Children with Diabetes: Update 2021. *Canadian Journal of Diabetes*, 45(7), 580–587. <https://doi.org/10.1016/j.cjcd.2021.07.003>
- Chikowore, T., Kamiza, A. B., Oduaran, O. H., Machipisa, T., & Fatumo, S. (2021). Non-communicable diseases pandemic and precision medicine: Is Africa ready? *EBioMedicine*, 65, 103260. <https://doi.org/10.1016/j.ebiom.2021.103260>
- Cuschieri, S., Pallari, E., Hatziyianni, A., Sigurvinsdottir, R., Sigfusdottir, I. D., & Sigurðardóttir, K. (2022). Mortality comparisons of COVID-19 with all-cause and non-communicable diseases in Cyprus, Iceland and Malta: lessons learned and forward planning. *Public Health*, 202, 52–57. <https://doi.org/10.1016/j.puhe.2021.03.025>
- Das, S., Minz, N., & Sahu, M. C. (2017). The relationship of abdominal girth with blood pressure, blood sugar and lipid profile among cardiac patients. *Journal of Taibah University Medical Sciences*, 12(2), 178–182.

- <https://doi.org/10.1016/j.jtumed.2016.10.007>
- Dom, A., Gray, L., Liew, Z. Q., Glantz, J. C., Rogg, K., Mather, A., Olson-Chen, C., & Malshe, A. (2021). 407 Accelerated fetal abdominal circumference growth velocity (ACGV): a predictor of adverse outcomes in diabetic pregnancies. *American Journal of Obstetrics and Gynecology*, 224(2), S263. <https://doi.org/10.1016/j.ajog.2020.12.428>
- Dubey, S., Yadalla, S., Prabu, N., Dubey, A., & Ramakrishnan, V. (2022). IDF21-0421 High blood sugar as a risk factor for post COVID-19 rhino-orbital-cerebral mucormycosis. *Diabetes Research and Clinical Practice*, 186, 109354. <https://doi.org/10.1016/j.diabres.2022.109354>
- Engel. (2014). Pengertian Tentang Pengaruh Pada Masa Remaja. *Paper Knowledge . Toward a Media History of Documents*, 6–19.
- Grimes, R., Bennett, K., & Henman, M. (2015). The Impact Of Self-Monitoring Of Blood Glucose (Smbg) On Prescription Costs In Newly Treated Type 2 Diabetes Melitus (T2dm): A Retrospective Cohort Analysis. *Value in Health*, 18(7), A367. <https://doi.org/10.1016/j.jval.2015.09.733>
- Harbuwono, D. S., Sazli, B. I., Kurniawan, F., Darmowidjojo, B., Koesnoe, S., & Tahapary, D. L. (2021). The impact of Ramadan fasting on Fetuin-A level in type 2 diabetes mellitus. *Heliyon*, 7(5), e06773. <https://doi.org/10.1016/j.heliyon.2021.e06773>
- Kargar, S., Kowsar, Z., Poorhamdollah, M., Kanani, M., Asasi, K., & Ghaffari, M. H. (2021). Effects of replacing steam-flaked corn with shredded sugar beet pulp on feed sorting, behavior, blood metabolites, and growth performance of dairy calves. *Animal Nutrition*, 7(4), 917–926. <https://doi.org/10.1016/j.aninu.2021.07.003>
- Kh. Albashr, T., Kh. Khidhir, Z., Namiq, K., Hamadamin, A., Alhabib, F., & Khalaf, W. (2022). Study on chemical composition and physical properties of the Hamri (*Barbus luteus*) and Balaout (*Chondrostoma regium*) fish meat, oil and impact of its oils on cholesterol, triglyceride, HDL and blood sugar of laboratory rats. *Saudi Journal of Biological Sciences*, 29(1), 261–265. <https://doi.org/10.1016/j.sjbs.2021.08.089>
- Kuok, C. H., Huang, C. H., Tsai, P. S., Ko, Y. P., Lee, W. S., Hsu, Y. W., & Hung, F. Y. (2016). Preoperative measurement of maternal abdominal circumference relates the initial sensory block level of spinal anesthesia for cesarean section: An observational study. *Taiwanese Journal of Obstetrics and Gynecology*, 55(6), 810–814. <https://doi.org/10.1016/j.tjog.2015.04.009>
- Kushwaha, J. S., Gupta, V. K., Singh, A., & Giri, R. (2022). Authors : *Diabetes Epidemiology and Management*, 100092. <https://doi.org/10.1016/j.deman.2022.100092>
- Lu, S. C., Chang, C. H., Yu, C. H., Kang, L., Tsai, P. Y., & Chang, F. M. (2008). Reappraisal of fetal abdominal circumference in an Asian population: Analysis of 50,131 records. *Taiwanese Journal of Obstetrics and Gynecology*, 47(1), 49–56. [https://doi.org/10.1016/S1028-4559\(08\)60054-6](https://doi.org/10.1016/S1028-4559(08)60054-6)
- Lukito, A. A., Pranata, R., Henrina, J., Lim, M. A., Lawrensia, S., & Suastika, K. (2020). The Effect of Metformin Consumption on Mortality in Hospitalized COVID-19 patients: a systematic review and meta-analysis. *Diabetes and Metabolic Syndrome: Clinical Research and Reviews*, 14(6), 2177–2183. <https://doi.org/10.1016/j.dsx.2020.11.006>
- Ninomiya, Y., Kawasoe, S., Kubozono, T., Tokushige, A., Ichiki, H., Ikeda, Y., Miyahara, H., Tokushige, K., & Ohishi, M. (2022). Sex Differences in Future Hypertension Caused By Increased Abdominal Circumference in Mildly Obese Middle-Aged Participants. *Journal of the American College of Cardiology*, 79(9), 1576. [https://doi.org/10.1016/s0735-1097\(22\)02567-0](https://doi.org/10.1016/s0735-1097(22)02567-0)
- Pathirana, H., Thilanka, D., Pathirana, H., Wijesekara, I., Liyana, L., Chandi, W.,

- Garusinghe, C., Jayasinghe, M. A., & Waidyarathne, K. P. (2022). Contents of lists Future Comparison of blood glucose responses by cane sugar ( *S accharum offi* Comparison of blood glucose responses by cane sugar ( *S accharum offi* versus coconut jaggery ( *Cocos nucifera* ) a in type 2 diabetes patients. *Journal of Future Foods*, 2(3), 261–265. <https://doi.org/10.1016/j.jfutfo.2022.06.007>
- Pressman, K., Odibo, L., Duncan, J. R., & Odibo, A. (2021). 725 Impact of using abdominal circumference independently in the diagnosis of fetal growth restriction. *American Journal of Obstetrics and Gynecology*, 224(2), S454–S455. <https://doi.org/10.1016/j.ajog.2020.12.748>
- Purnami, M. D., Arimbawa, M., Bikin, W., Bagian, S., Smf, /, Kesehatan, I., Fakultas, A., Universitas, K., / U., Sanglah, R., & Suryawan, W. B. (2015). Prevalensi dan Faktor Risiko Glikosuria pada Remaja Sekolah Menengah Pertama Swasta di Kota Denpasar Prevalence and Risk Factors for Glycosuria among Private Junior High School Adolescents in Denpasar. *Sari Pediatri*, 17(2), 129–135.
- Sarvazad, H., Cahngaripour, S. H., Eskandari Roozbahani, N., & Izadi, B. (2020). Evaluation of electrolyte status of sodium, potassium and magnesium, and fasting blood sugar at the initial admission of individuals with COVID-19 without underlying disease in Golestan Hospital, Kermanshah. *New Microbes and New Infections*, 38, 100807. <https://doi.org/10.1016/j.nmni.2020.100807>
- Seibert, H., Pereira, A. M. L., Ajzen, S. A., & Koch Nogueira, P. C. (2013). Abdominal circumference measurement by ultrasound does not enhance estimating the association of visceral fat with cardiovascular risk. *Nutrition*, 29(2), 393–398. <https://doi.org/10.1016/j.nut.2012.06.014>
- Sheehan, J., Moorthy, V., Colilla, S., & Kalsekar, I. (2014). Charges and health care resource use in patients with type 2 diabetes melitus after treatment initiation with saxagliptin or sitagliptin. *Value in Health*, 17(3), PA245. <https://doi.org/10.1016/j.jval.2014.03.1430>
- Sukkriang, N., Chanprasertpinyo, W., Wattanapisit, A., Punsawad, C., Thamrongrat, N., & Sangpoom, S. (2021). Correlation of body visceral fat rating with serum lipid profile and fasting blood sugar in obese adults using a noninvasive machine. *Heliyon*, 7(2), e06264. <https://doi.org/10.1016/j.heliyon.2021.e06264>

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**RESEARCH**

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## The Effect of Knowledge of Mothers Assisted by Cadres during Pregnancy on the Incidence of Low Birth Weight

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### Abstract

Every pregnancy carries risks to the quality of birth outcomes, such as low birth weight (LBW). Interventions such as increased maternal knowledge, supervision, and intensive assistance are required, which can be performed by health cadres. The study aimed to examine the impact of knowledge on the incidence of LBW in pregnant women accompanied/assisted by cadres during pregnancy. This method combines descriptive research with a quasi-experiment. The study included 30 pregnant women who fulfilled the following criteria: single pregnancy, 30 weeks gestation, not a high-risk pregnancy, and no comorbidities. The study lasted three months, and the independent variable was the knowledge of pregnant women assisted by cadres, while the dependent variable was the incidence of LBW. Pregnant women's questionnaires and observation sheets were employed as instruments. T-Test and Yates' Correction were utilized during data analysis. The findings revealed a p-value of 0.031 increase in knowledge of pregnant women before and after being assisted by cadres during pregnancy, and the incidence of LBW was 3 cases (10%). With a p-value of 0.041, the results of Yates' Correction statistical test revealed that knowledge of pregnant women assisted by cadres is one of the determinants of the occurrence of LBW. It is critical to increase cadre involvement and role in assisting pregnant women.

**Keywords:** Knowledge, Cadres, Pregnancy, Low Birth Weight.

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## 1. INTRODUCTION

Low birth weight (LBW) is a major public health concern worldwide, as it is associated with increased infant morbidity and mortality rates, as well as long-term health effects such as developmental delays and chronic diseases (Bianchi & Restrepo, 2022). A high-risk pregnancy is one that deviates from normal conditions in which mothers face a variety of issues that can disrupt their pregnancy and increase the risk of adverse pregnancy outcomes such as low birth weight (LBW) (Lowe, 2020). LBW conditions are the leading cause of neonatal death in Indonesia. In Indonesia, 25 of 34 provinces reported around 3.4% of babies with LBW, while the results of the 2018 Basic Health Research (RISKESDAS) implementation demonstrate 6.2% of 56% of children under five with a birth weight record were born with LBW conditions (Badan Penelitian dan Pengembangan Kesehatan, 2019).

Among the risk approaches developed in Indonesia to prevent maternal death is factor 4 being late, which includes being late in detecting danger signs, being late in making a decision to refer, being late at the referral site, and being late in receiving help at the referral site. Delays in detecting problems can be avoided by educating pregnant women and their families so that they recognize danger signs and make the referral process easier, resulting in faster treatment and better final results. Early detection of maternal health problems is advantageous in lowering the risk of complications and death during pregnancy because prompt, precise, and effective treatment can be administered immediately (Patriajati & Hadijono, 2021).

Maternal knowledge and attitude during pregnancy have been identified as important factors in preventing LBW (Esposito et al., 2015). Pregnant women's ability to recognize danger and high-risk signs of pregnancy has an effect on the growth of the fetus in the womb. Pregnant women who recognize the danger signs of pregnancy will take immediate action to seek medical attention (Esposito et al., 2015), (Mwilike et al., 2018). While previous research has looked into the efficacy of community health worker interventions, such as health education programs delivered by cadres, the specific impact of the cadres' assistance to mothers during pregnancy on LBW has not been thoroughly investigated. Community health cadres can play an important role in educating and supporting pregnant women. Cadres have important jobs, especially when it comes to problems involving pregnant women's health, such as identifying pregnant women, providing health education, and conducting early detection of health conditions that require referral to a higher level of care that a pregnant mother may be experiencing (Olaniran et al., 2019). The focus of this study on the specific intervention of cadres accompanying/assisting mothers during pregnancy on the incidence of LBW offers a unique perspective and fills a critical gap in the existing literature. The findings of this study may help to guide the development of targeted maternal and child health interventions that leverage the role of community health workers, including cadres, to reduce the incidence of LBW in developing countries.

## 2. RESEARCH METHOD

This research is descriptive research with a Quasi Experiment One Group Pre-Post Design. This method will be employed in order to determine whether the knowledge of pregnant women who are assisted by cadres has an effect on the incidence of LBW. From August to October 2019, the research was conducted in three primary health center areas in Gorontalo City, where cadre assistance activities for pregnant women were carried out five times using a guidebook. The participants in this study were all pregnant women in their third trimester. Purposive sampling was utilized, and all pregnant women in their third trimester were in the working areas of Duingingi Health Center, Sipatana Health Center, and East City Health Center during the study period. The inclusion criteria for this study are single pregnancy, 30 weeks gestation, not a high-risk pregnancy, and not with comorbidities. The 30 cadres chosen to assist pregnant women have worked as cadres for more than 5 years, are under

50 years old, and are always active. A questionnaire with 22 questions on anemia in pregnant women (1 question), danger signs in pregnancy (9 questions), use of Blood Add Tablets (2 questions), personal hygiene and maternal health (1 question), nutrition and a balanced diet (1 question), physical activity and exercise (1 question), examination to a health facility (1 question), and preparation for delivery (1 question) (6 questions). Data analysis used T-Test to measure knowledge of pregnant women before and after being assisted by cadres and *Yates's Correction* to calculate the effect of knowledge of pregnant women assisted by cadres on the incidence of LBW (<2500 gr). This research has received approval from the ethics commission for health research, Poltekkes Kemenkes Gorontalo, Number: LB.01.01/KEPK/031/2019.

### 3. RESULTS AND DISCUSSION

**Table 1.** General Characteristics of Respondents

<i>Characteristic</i>	<i>n=30</i>	<i>%</i>
<b>Age (years)</b>		
< 30	18	60
≥ 30	12	40
<b>Parity</b>		
Primipara	10	66,7
Multipara	20	33,3
<b>Education</b>		
High	22	73,3
Low	8	26,7
<b>Job Status</b>		
Working	7	23,3
Not working	23	76,7

Source: *Primary Data 2019*

Table 1 show that the age of the respondents revealed that most of the respondents were <30 years old as many as 18 people, which was 60.0%, and most of the respondents were multiparous as many as 20 people, which was 33.3%. Most of the respondents possess a higher education level of 22 people, which is 73.3%, and most of the respondents own a non-employment status of 23 people, which is 76.7%.

**Table 2.** Average Knowledge Score of Respondents Before and After Cadre Mentoring

<b>Knowledge Score</b>	<i>Mean</i>	<i>N</i>	<i>Standard Deviation</i>	$\Delta$	<i>p-value</i>
Pretest	18,80	30	2,235	0,97	0,031
Posttest	19,77	30	1,832		

Source: *Primary Data 2019*

Table 2 show that the respondent's knowledge before mentoring was 18.80 with a standard deviation of 2.2, and the respondent's knowledge after mentoring was 19.77 with a standard deviation of 1.8. With a delta of 0.97, the respondent's knowledge score after mentoring was higher than before mentoring. With a p-value of 0.031, statistical tests show that there are differences in the knowledge scores of respondents before and after mentoring by cadres using manuals.

**Table 3.** The Effect of Knowledge of Pregnant Women Assisted by Cadres on the Incidence of BBLR.

Variable	Birth Weight Incident				p-value
	Normal		Low		
	n	%	n	%	
Knowledge					
Good	19	100,0	0	0,0	0,041
Insufficient	8	72,7	3	27,3	

Source: *Primary Data 2019*

Table 3 show that a p-value of 0.041 is obtained, smaller than 0.05, thus,  $H_0$  is rejected and  $H_a$  is accepted which indicates that there is an effect of cadre assistance to pregnant women on preventing the incidence of LBW.

Assistance for pregnant women is a risk screening step that allows for the early identification or detection of risks, potential disturbances, and abnormalities in pregnant women's health so that they can receive the appropriate treatment, and this activity is one of the efforts to reduce the Maternal Mortality Rate (MMR) and Infant Mortality Rate (IMR) (IMR) (WHO, 2019). The delay in seeking obstetric treatment is caused by the mother's lack of awareness and knowledge of obstetric danger signs (Nkamba et al., 2021). To reduce MMR, the involvement of many parties is required, including community involvement through empowerment, which is the right step so that the community has responsibility according to their respective roles. One example of community empowerment is the formation of health cadres with extensive knowledge and a strong commitment to improving the health of mothers and children (Nurfazriah et al., 2021).

In this study, cadres' activities of assisting pregnant women were preceded by a day of refreshing cadres. Cadres are provided information on a variety of topics related to the task of assisting pregnant women, such as monitoring of anemia, monitoring of danger signs in pregnancy, monitoring of blood-supplementing tablet consumption, monitoring of personal hygiene and maternal health, monitoring of nutrient and balanced food consumption, monitoring of physical activity and exercise, monitoring of examinations to health facilities, and monitoring of childbirth preparation. Increasing cadre knowledge and skills through refreshing cadres aims to provide new information that is a substitute for previously obtained knowledge or is a refinement of previously obtained information and increases active participation of health cadres (Profita, 2018).

Cadres are health workers' extensions; they serve as a link between the community and health workers. Cadres are responsible for identifying pregnant women at risk, encouraging pregnant women to have their pregnancies checked at healthcare facilities, informing the public, and coordinating the types of services provided with health workers (Krieger et al., 2021).

The respondents in this study ranged in age from 20 to 35 years. This age is part of the productive period, during which pregnant women are expected to understand and comprehend pregnancy information conveyed by cadres. Prior to the mentoring activity, pregnant women were given questionnaires to assess their knowledge levels. Knowledge is obtained through cognitive processes, and in order to know that knowledge, a person must understand or recognize science. A sensory experience is an important tool for knowing the occurrence of knowledge. The majority of human knowledge is acquired through the eyes and ears (Darsini et al., 2019).

In this study, it was discovered that the knowledge score of the respondents after the mentoring increased compared to the knowledge score of the respondents before the mentoring. All forms of information provided by cadres during mentoring will increase the mother's knowledge about detecting pregnancy risk factors and complications that may occur, allowing

the mother to maintain her health independently and make visits to check her pregnancy in order to have a good quality delivery.

The respondents' education level is mostly high school education level/equivalent, which is 80.0%, where that level of education is included in the higher education level so that pregnant women are considered to be able to receive and understand well the information obtained and have the motivation to behave in a way that has a positive impact on pregnancy. Furthermore, information has a significant impact on a person's knowledge (Pipitcahyani, 2018). Education is one of the factors that determines a person's breadth of insight and knowledge (Fatimah & Kania, 2019). Education is one of the factors that determines a person's breadth of insight and knowledge. Education is required to obtain information, such as things that support health, in order to improve a person's quality of life. A high level of education greatly influences a person's ability to receive information, making it easier to change the mother's mindset (Nurzeza et al., 2017), (Chowdhury et al., 2017). With the majority of respondents having completed high school, it will affect mothers' knowledge and attitudes toward pregnancy. The more education a person has, the easier it is for him to absorb the knowledge he has gained (Fatimah & Kania, 2019).

The weight of the baby born to the mother can be used to assess labor outcomes. According to the study's findings, three respondents gave birth to babies with LBW, two of whom gave birth at the age of >30 years and one at the age of 22 years, all of whom were with a third party. Maternal parity is one of the factors that contribute to the prevalence of LBW (Rasyid & Yulianingsih, 2021). High parity above three causes the function and workings of uterine muscle cells to weaken, which has an effect on the inhibition of the supply of nutrients transported from the mother's body through the placenta to the fetus, resulting in an increase in the incidence of LBW. The incidence of LBW is associated to maternal parity (Khoiriah, 2017), (Mahayana et al., 2015), (Setiati & Rahayu, 2017), (Putri, 2019).

During mentoring, cadres solicit complaints about the mother's condition, use manuals to provide counseling and monitoring, involve families in providing support to pregnant women, and make pregnant women feel comfortable. Family support in pregnant women is important in lowering the incidence of low birth weight (Tessema et al., 2021). Cadres also carry out monitoring using a manual which contains materials, namely: 1) anemia status of pregnant women through examination of the face and eyelids and maternal nails; 2) Danger signs in pregnancy in the form of monitoring of birth canal bleeding, swelling of the feet, hands and face or headache assisted by seizures, high fever, premature discharge of amniotic fluid, reduced or immobile fetal movements, continuous vomiting and refusal to eat; 3) Consumption of Blood Add Tablets; 4) personal hygiene and maternal health; 5) Consumption of balanced nutrition and food; 6) Physical activity and sports; 7) Examination to health facilities; 8) Preparation for labor (Rasyid & Claudia, 2019).

Based on the results of *Yates's Correction*, it was revealed that there was an effect of respondent's knowledge after mentoring on the incidence of LBW with a p-value of 0.041 below the value of 0.05. The better pregnant women's knowledge after being assisted, the less likely the occurrence of Low Birth Weight. It indicates that cadres' assistance to pregnant women is effective in reducing the incidence of LBW in Gorontalo City's working area.

A total of 19 respondents had good knowledge and had babies with normal birth weight, while 8 had poor knowledge and had babies with LBW. Pregnant women who are well-informed about a healthy pregnancy can alter their behavior in order to maintain and care for their pregnancy so that the baby is born healthy and at a normal weight (Chowdhury et al., 2017), (Aji et al., 2019). Changes in pregnant women's behavior are a description of the learning process obtained from stimulation in the form of pregnancy monitoring assistance by cadres, which is well received by pregnant women in the form of paying attention and carrying

out what the cadres suggest, ensuring that the stimulation or form of assistance is effective. If the organism's attention is drawn to or receives the stimulus, it is understood and will be carried forward in the next process (Notoatmodjo, 2014). In this case, pregnant women who receive stimulation in the form of assistance from cadres will follow the recommendations made by cadres because they understand the purpose of mentoring activities that benefit their pregnancy.

The impact of maternal health conditions during pregnancy is reflected in birth weight. Pregnant women's physical activity has an effect on the incidence of LBW, which is exacerbated by stressful events. Walking in the morning, assisted by light body movements, breathing techniques, and muscle stretching, will improve blood circulation to support the supply of oxygen from the mother to the fetus through the placenta can be fulfilled and has a positive influence on the fetus, fetal development and fetal brain development (Díaz-Burrucco et al., 2021) (Kubler et al., 2022).

Early detection of pregnancy with risk factors is an activity performed to identify pregnant women who possess risk factors and obstetric complications. Detection of risk factors in mothers both by health workers and the community is one of the efforts to prevent death and illness (Diana et al., 2020), (Damayanti et al., 2019). Counseling and health information about obstetric complications as well as early detection and management of complications performed by cadres when conducting pregnancy assistance owns a positive impact on the knowledge of pregnant women (Wachamo et al., 2019). Therefore, the detection of risk factors in mothers by both health workers and the public is one of the efforts to prevent death and pain (Khadijah & Arneti, 2018). The findings of this study indicate that the role of cadres as members of the community in assisting pregnant women by directly monitoring their health conditions has a positive impact on increasing pregnant women's knowledge as well as their willingness to behave in maintaining their health conditions so that the expected quality of delivery in the form of prevention of the incidence of LBW can be achieved.

Overcoming pregnant women's health problems requires more than just promotional and preventive efforts from health workers; the role of the community, particularly health cadres and family empowerment, is critical to success in assisting pregnant women (Aisyah, 2018). In addition to the knowledge of respondents, the knowledge of cadres must be ensured to be good as it affects success in increasing the knowledge of pregnant women (Mediani et al., 2022). The better the respondent's knowledge, the better the respondent's acceptance understanding and be willing to conduct the cadre's recommendations (Parmawati et al., 2020). One of the researcher's assumptions is that pregnant women's exposure to the media in the form of guidance manuals used by cadres, which contain pictures, simple language, instructions, and ways to behave in a healthy life, recognizing danger signs, is the most effective factor in preventing LBW incidents.

Cadres' mentoring activities to pregnant women five times in the third trimester are a form of receiving external stimuli and responses in order to form pregnant women's perceptions and knowledge about the importance of monitoring anemia, danger signs in pregnancy, consumption of blood-added tablets, and personal hygiene. and maternal health, balanced nutrition and food consumption, physical activity and sports, examinations at health facilities, and childbirth preparation. It is a good habit to have close sources of information and regular interactive activities so that the mother's knowledge is more mutually reinforcing with the knowledge she already has. Mothers will be more aware of the significance of avoiding low birth weight.

When there are interactive activities between cadres and pregnant women that pioneer the creation of a source of information that is closer and easier to understand as well as motivation or triggering the mother's interest to perform her pregnancy well, mothers' understanding enhances. This can result in a mutually reinforcing relationship in which the mother is more willing to deal with any pregnancy discomforts that may arise. The researcher

did not administer the control group as a comparison in this study, so it was not optimal for demonstrating the representativeness of the research results.

#### 4. CONCLUSION

Most pregnant women possess good knowledge after cadre mentoring, thus, mother's ability to perform cadre recommendations encourages the formation of healthy living behavior and good pregnancy care. This condition affects maternal delivery outcomes, specifically the birth of babies with normal birth weights. It indicates that the knowledge of pregnant women who are assisted by cadres influences the prevention of LBW in Gorontalo City's working area. Direct cadre assistance to mothers during pregnancy must be optimized in order to detect and prevent pregnancy complications as early as possible.

#### REFERENCES

- Aisyah, S. (2018). Pendampingan Ibu Hamil Anemia Dan Kekurangan Energi Kronis (Kek) Di Desa Jarak Kecamatan Plosoklaten Kabupaten Kediri. *at-tamkin: Jurnal Pengabdian kepada Masyarakat*, 1(1), 67-78.
- Aji, A. S. H., Awg-Manan, F., Abdullah, Y. R., Kisut, R., Abdul Rahman, H., & Abdul-Mumin, K. H. (2019). Antenatal education for pregnant women attending maternal and child health clinics in Brunei Darussalam. *Women and Birth*, 32(6), 564–569. <https://doi.org/10.1016/j.wombi.2018.11.005>
- Badan Penelitian dan Pengembangan Kesehatan. (2019). *Laporan Nasional RISKESDAS 2018*. Jakarta: Badan Penelitian dan Pengembangan Kesehatan, Kementerian Kesehatan Republik Indonesia.
- Bianchi, M. E., & Restrepo, J. M. (2022). Low Birthweight as a Risk Factor for Non-communicable Diseases in Adults. *Frontiers in Medicine*, 8(January), 6–11. <https://doi.org/10.3389/fmed.2021.793990>
- Chowdhury, A. A., Halder, K. R., Haque, M. I., Muhammad, F., Hasan, M. M., & Chowdhury, M. (2017). Status of Knowledge on the Risk Factors of Low Birth Weight among the Women of Reproductive Age in Rural Bangladesh. *Epidemiology: Open Access*, 7(1), 292. <https://doi.org/10.4172/2161-1165.1000292>
- Damayanti, N. A., Setijanto, D., Hargono, A., Wulandari, R. D., Santi, M. W., Tjahjono, B., & Ramadhani, A. (2019). Integrated information system for early detection of maternal risk factors based on the continuum of care approach of mother and toddler cohorts. *Healthcare Informatics Research*, 25(3), 153–160. <https://doi.org/10.4258/hir.2019.25.3.153>
- Darsini, Fahrurrozi, F., & Cahyono, E. A. (2019). Pengetahuan; Artikel Review. *Jurnal Keperawatan*, 12(1), 95-107. <https://ejournal.lppmdianhusada.ac.id/index.php/jk/article/view/96>
- Diana, S., Wahyuni, C. U., & Prasetyo, B. (2020). Maternal complications and risk factors for mortality. *Journal of Public Health Research*, 9(2), 195–198. <https://doi.org/10.4081/jphr.2020.1842>
- Díaz-Burrucco, J. R., Cano-Ibáñez, N., Martín-Peláez, S., Khan, K. S., & Amezcua-Prieto, C. (2021). Effects on the maternal-fetal health outcomes of various physical activity types in healthy pregnant women. A systematic review and meta-analysis. *European Journal of Obstetrics and Gynecology and Reproductive Biology*, 262(July), 203–215. <https://doi.org/10.1016/j.ejogrb.2021.05.030>
- Esposito, G., Ambrosio, R., Napolitano, F., & Di Giuseppe, G. (2015). Women's knowledge, attitudes, and behavior about maternal risk factors in pregnancy. *PLoS ONE*, 10(12) : e0145873. <https://doi.org/10.1371/journal.pone.0145873>

- Fatimah, S., & Kania, N. D. (2019). Hubungan Tingkat Pengetahuan Ibu Hamil Tentang Anemia Dengan Risiko Kejadian BBLR. *Journal of Midwifery and Public Health*, 1(1), 1-8. <https://doi.org/10.25157/jmph.v1i1.1998>
- Khadijah, S. (2018). Upaya deteksi dini resiko tinggi kehamilan ditentukan oleh pengetahuan dan dukungan tenaga kesehatan. *Jurnal Sehat Mandiri*, 13(1), 27-34. <https://doi.org/10.33761/jsm.v13i1.2>
- Khoiriah, A. (2017). Hubungan antara usia dan paritas ibu bersalin dengan bayi berat lahir rendah (BBLR) di rumah sakit islam Siti Khadijah Palembang. *Jurnal Kesehatan*, 8(2), 310-314. <http://dx.doi.org/10.26630/jk.v8i2.508>
- Krieger, M. G. M., Wenham, C., Nacif Pimenta, D., Nkya, T. E., Schall, B., Nunes, A. C., ... & Lotta, G. (2022). How do community health workers institutionalise: An analysis of Brazil's CHW programme. *Global Public Health*, 17(8), 1507-1524. <https://doi.org/10.1080/17441692.2021.1940236>
- Kubler, J. M., Clifton, V. L., Moholdt, T., & Beetham, K. S. (2022). The effects of exercise during pregnancy on placental composition: a systematic review and meta-analysis. *Placenta*, 117, 39-46. <https://doi.org/10.1016/j.placenta.2021.10.008>
- Lowe, N. K. (2020). Birth settings in America: Outcomes, quality, access, and choice. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*, 49(4), 331.-335. <https://doi.org/10.1016/j.jogn.2020.06.001>
- Mahayana, S. A. S., Chundrayetti, E., & Yulistini, Y. (2015). Faktor Risiko yang Berpengaruh terhadap Kejadian Berat Badan Lahir Rendah di RSUP Dr. M. Djamil Padang. *Jurnal Kesehatan Andalas*, 4(3), 664-673. <https://doi.org/10.25077/jka.v4i3.345>
- Mediani, H. S., Hendrawati, S., Pahria, T., Mediawati, A. S., & Suryani, M. (2022). Factors affecting the knowledge and motivation of health cadres in stunting prevention among children in Indonesia. *Journal of Multidisciplinary Healthcare*, 1069-1082. <https://doi.org/10.2147/jmdh.s356736>
- Mwilike, B., Nalwadda, G., Kagawa, M., Malima, K., Mselle, L., & Horiuchi, S. (2018). Knowledge of danger signs during pregnancy and subsequent healthcare seeking actions among women in Urban Tanzania: A cross-sectional study. *BMC Pregnancy and Childbirth*, 18(1), 1-8. <https://doi.org/10.1186/s12884-017-1628-6>
- Nkamba, D. M., Wembodinga, G., Bernard, P., Ditekemena, J., & Robert, A. (2021). Awareness of obstetric danger signs among pregnant women in the Democratic Republic of Congo: evidence from a nationwide cross-sectional study. *BMC Women's Health*, 21(1), 1-12. <https://doi.org/10.1186/s12905-021-01234-3>
- Notoatmodjo, S. (2014). *Promosi Kesehatan & Ilmu Perilaku*. Jakarta: Rineka Cipta.
- Nurfazriah, I., Hidayat, A. N., Kartikasari, R., & Yusuffina, D. (2021). Peningkatan Pengetahuan Kader Tentang Kesehatan Ibu dan Anak dalam Upaya Pencegahan AKI Dan AKB di Desa Citaman. *International Journal of Community Service Learning*, 5(4), 324-332. <https://doi.org/10.23887/ijcsl.v5i4.40588>
- Nurzeza, A., Larasati, T., & SRW, D. W. (2017). Hubungan Tingkat Pendidikan, Pengetahuan dan Kepercayaan Ibu terhadap Pemberian Makanan Pendamping ASI (MP-ASI) pada Kabupaten Lampung Timur. *J Agromedicine*, 4(2), 211-217.
- Olaniran, A., Madaj, B., Bar-Zev, S., & van den Broek, N. (2019). The roles of community health workers who provide maternal and newborn health services: case studies from Africa and Asia. *BMJ global health*, 4(4), e001388. <https://doi.org/10.1136/bmjgh-2019-001388>
- Parmawati, I., Sandhi, A., Nisman, W. A., Lismidiati, W., Rustiyaningsih, A., & Kholisa, I. L. (2020). Knowledge enhancement about pregnancy complications: Optimizing the role of high risk pregnancy prepared cadres. *Journal of Community Empowerment for Health*, 3(1), 18-27. <https://doi.org/10.22146/jcoemph.47317>

- Patriajati, A., & Hadijono, S. (2021). Differences in The Number of Maternal References In Semarang Public Health Center Based on MEOWS Scoring System. *Diponegoro International Medical Journal*, 2(2), 54–62. <https://doi.org/10.14710/dimj.v2i2.11120>
- Pipitcahyani, T. I. (2018). Sumber informasi dan pengetahuan ibu hamil tentang tanda bahaya kehamilan, persalinan dan nifas. *Jurnal Pendidikan Kesehatan*, 7(1), 47–52.
- Profita, A. C. (2018). Beberapa Faktor Yang Berhubungan Dengan Keaktifan Kader Posyandu Di Desa Pengadegan Kabupaten Banyumas. *Jurnal Administrasi Kesehatan Indonesia*, 6(2), 68-74. <https://doi.org/10.20473/jaki.v6i2.2018.68-74>
- Putri, A. W., Pratitis, A., Luthfiya, L., Wahyuni, S., & Tarmali, A. (2019). Faktor Ibu terhadap Kejadian Bayi Berat Lahir Rendah. *HIGEIA (Journal of Public Health Research and Development)*, 3(1), 55-62.
- Rasyid, P. S., & Claudia, J. G. (2019). *Pedoman Pendampingan Kader Pada Ibu Hamil* (N. Oliy (ed.)). Ideas Publishing.
- Rasyid, P. S., & Yulianingsih, E. (2021). Effect of Maternal Age, Parity and Placental Weight on Birth Weight in Otanaha Hospital, Gorontalo City. *Jurnal Ners Dan Kebidanan Indonesia*, 8(4), 253-260. [https://doi.org/10.21927/jnki.2020.8\(4\).253-260](https://doi.org/10.21927/jnki.2020.8(4).253-260)
- Setiati, A. R., & Rahayu, S. R. S. (2017). Faktor yang mempengaruhi kejadian BBLR (Berat Badan Lahir Rendah) di ruang perawatan intensif neonatus RSUD dr Moewardi di Surakarta. (*JKG*) *Jurnal Keperawatan Global*, 2(1), 9–20. <https://doi.org/10.37341/jkg.v2i1.27>
- Tessema, Z. T., Tamirat, K. S., Teshale, A. B., & Tesema, G. A. (2021). Prevalence of low birth weight and its associated factor at birth in Sub-Saharan Africa: A generalized linear mixed model. *PLoS ONE*, 16(3 March), 1–13. <https://doi.org/10.1371/journal.pone.0248417>
- Wachamo, T. M., Bililign Yimer, N., & Bizuneh, A. D. (2019). Risk factors for low birth weight in hospitals of North Wello zone, Ethiopia: A case-control study. *PloS one*, 14(3), e0213054. <https://doi.org/10.1371/journal.pone.0213054>
- WHO. (2019). *Maternal mortality Evidence brief*. Geneva: World Health Organization

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**RESEARCH**

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## The Effect of Sombere Education on Stress Levels in Primigravida Pregnant Women

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### Abstract

Mental health problems during pregnancy are major public health issues that require immediate attention. Anxiety and stress can have an impact on pregnancy and childbirth. This study examines the impact of Sombere education on the stress levels of pregnant women. A quasi-experimental design with a pre-test and post-test design and a control group was employed in this study. This study's sample consisted of 80 primigravida pregnant women who met the sample criteria. Purposive sampling was utilized in this study. The chi-square test and the Wilcoxon rank test were implemented to analyze the data. The findings of this study revealed that there was a difference in stress in the intervention group after treatment ( $p=0.000<0.005$ ), as well as a difference in stress in the control group during the post-test ( $p=0.001<0.005$ ). Sombere education has an effect on stress levels in primigravida pregnant women ( $p=0.016<0.005$ ). The requirement Midwives provide education on maternal mental health, particularly the stress of pregnancy. In addition, midwives must conduct stress assessments or collaborate with psychologists to ensure pregnant women's mental health.

**Keywords:** Sombere, Emphasize, Primigravida.

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## 1. INTRODUCTION

Mental health issues during pregnancy are major public health issues that require immediate attention. During pregnancy and postpartum, 10% to 20% of women worldwide experience mental disorders. The prevalence of mental health problems during pregnancy is still quite high in low- and middle-income countries, with an average prevalence of 15.6% (Spedding et al., 2020). Among mental problems during pregnancy, stress, depression, and anxiety are the most frequently reported problems during pregnancy. Other mental disorders with a fairly high prevalence are pregnancy stress at 92.8% and anxiety at 32.6% (Usami et al., 2016). This condition is primarily caused by low self-esteem as a result of changes in body shape during pregnancy, excessive fear of pain, childbirth, and congenital disabilities in babies, all of which contribute to anxiety, particularly in nulliparous mothers (Khoshkerdar & Raeisi, 2020).

The tendency to fear giving birth is 33% greater in nulliparous mothers than in multiparous mothers. Approximately 22% of mothers are afraid of childbirth, which leads nulliparous pregnant women to choose caesarean section delivery at the mother's request (Biaggi et al., 2016). Moreover, stress escalates the risk of experiencing labor complications 8,229 times (Amidu et al., 2018). The results of research conducted by (Ningtiyasari, 2019) explain that stress in pregnancy possesses the potential to cause low birth weight and small head circumference ( $p$ -value $<0.01$ ). Furthermore, stress during pregnancy has been demonstrated to affect neonatal neurobehavioral development, ACTH, cortisol, norepinephrine, and epinephrine levels ( $p<0.001$ ) (Togher et al., 2017).

Mental health education and training programs reduce anxiety and stress while improving mental function. As a result, research on Mindfulness-Based Childbirth Education (MBCE) indicates that psychological awareness programs can enhance interpersonal relationships as well as effectiveness in dealing with stress, anxiety, and fear in pregnant women (Frank et al., 2014). Sombere education is based on the Mindfulness-Based Childbirth Education (MBCE) model, which combines education with skills and relaxation techniques to alleviate anxiety and fear during normal childbirth. Although the MBCE meditation program is a relaxation technique, relaxation techniques such as foot soak and Therapy Murottal have been studied. Researchers will develop an educational model to achieve the mental well-being of mothers by involving families, particularly husbands, in an education that provides services to reduce stress on mothers through skills and evaluation of programs that will pay attention to maternal health through the adaptation of the chair theory shake balance. Mental aspects, such as stress, are in the form of module development. This research aims to develop Education Sombere in order to reduce stress on pregnant mothers.

## 2. RESEARCH METHOD

The Quasy experimental design with pre-test and post-test design with the control group was employed in this study. This research employed participants who were divided into two groups:

1. Intervention group: pregnant women are given education through education Sombere shaped by Maternal Mental Health counselling and an intervention-shaped foot soak and therapy murottal al-Qur'an.
2. Control group: pregnant women as the control group received counselling through the Maternal and Child Health Book

This study was conducted in the Makassar area, specifically at four Community Health Centers and two hospitals in the Makassar City Region that were randomly selected: Bara-Baraya Health Center, Patingalloang Health Center, Antang Perumnas Health Center, Kaluku Boddoo

Health Center, Rumah sick mother and child Siti Fatimah, and Homesick Mashita gave birth. It is a facility that is frequently visited by Mother. The sample was selected using the purposive sampling method, specifically the sample that fulfilled the requirements for inclusion. Sample inclusion criteria were primigravida, normal pregnant women third trimester UK, gestational age 28 weeks, willing to sign informed consent, willing to take part in educational activities 3 (three) times for the intervention group, family/husband willing to participate in educational activities for the intervention group and experienced mild to severe stress that was calculated with Prenatal Distress Questionnaire (PDQ). Exclusion criteria include experiencing mother complications, a history of the disease, and depression. This study's sample size was 80 people (39 mothers in the intervention group and 41 mothers in the control group). The Prenatal Distress Questionnaire (PDQ) was used, with 12 statements using an alternative Likert scale with four choices (weight 0-3), notably 0 = Never, 1 = Sometimes, 2 = Quite often, and 3 = Very often. The chi-square test was utilized for contrasting stress levels in the control and intervention groups. The Wilcoxon test was employed for assessing stress levels before and after intervention in each group.

### 3. RESULTS AND DISCUSSION

This study was performed between January and October 2022, with up to 80 respondents required to meet criteria. The following are the results of the data study processed and analyzed using the application SPSS version 16:

**Table 1.** Distribution of Respondent Characteristics in the Intervention Group and the Control Group.

Variable	Intervention (n=39)	Control (n=41)
	n (%) / Mean $\pm$ SD	n (%) / Mean $\pm$ SD
Mother's age (years)	23.48 $\pm$ 4.15	21.97 $\pm$ 3.517
Length of Marriage (month)	17.33 $\pm$ 11.6	18.95 $\pm$ 19.97
<b>Income (Rupiah/) month</b>		
According to UMR (Minimum wages)	6 (15.4)	14 (34.1)
Under UMR	2,217 33 (84.6)	3,545,000272 27 (65.9)
<b>Mother's job</b>		
Working as an IRT (Housewife)	36 (91.7)	38 (92.7)
Work is not IRT	3 (8.3)	3 (7.3)
<b>Education</b>		
Elementary school	3 (7.7)	2 (4.9)
Junior High School	8 (20.5)	6 (14.6)
Senior High School	20 (51.3)	26 (63.4)
College	8 (20.5)	7 (17.1)
<b>Pregnancy status</b>		
Planned	24 (61.5)	31 (75.6)
Unplanned	15 (38.5)	10 (24.4)
<b>Resident status</b>		
With family	31 (79.5)	26 (63.4)
Own	8 (20.5)	15 (36.6)

Table 1 illustrates that the Mean  $\pm$  SD of the mothers in the control group was 21.97  $\pm$  3.517 years, and the Mean  $\pm$  SD of the intervention group was 23.48  $\pm$  4.15 years. The intervention group's highest income was held by 33 respondents (55%). The majority of respondents worked as housemaids, with 38 (92.7%) in the control group and 36 (91.7%) in the intervention group. The most common pregnancy status in the two groups was planned pregnancies, with 31

respondents (75.6%). In terms of residence status, the intervention group with family had 31 respondents (79.5%), while the control group had 26 respondents (63.4%).

**Table 2.** Analysis of Changes in Stress and Self-Efficacy in the Intervention and Control Groups.

Variable	N	Rating Average	Number of Ranks	p-value
<b>Deep Stress of Group Intervention</b>				
Negative rating	21	13.21	277.50	0.000*
Positive rating	3	7.5	10:50 p.m	
Ties	15			
<b>Group stress control</b>				
Negative rating	22	12.77	281.00	0.001*
Positive ratings	3	14.67	44.00	
Ties	16			

*p = Wilcoxon signed rating test*

The differences in stress and self-efficacy in the intervention group are displayed in Table 2. After the intervention, 21 respondents reported a decrease in stress, three stated a rise in stress, and 15 reported a constant stress level. In 21 respondents, the average value of ratings on a negative rating reveals 13.21 differences in pregnancy stress before and after treatment. The difference in stress reduction is calculated by adding the rank values. In comparison, the average positive rating is 7.5, an increase from the previous average of 3 respondents, for a total positive rating of 22.50.

Control 22 respondents reported lower stress levels, 3 reported higher stress levels, and 16 reported survivals. In the negative rank, the mean rank value was 12.77, indicating differences in pregnancy stress before and after treatment in 22 respondents. The difference in stress reduction is 281.00, which is the sum of the rank values. At the same time, the average positive rating is 14.67, representing an increase of 3 respondents, for a total positive rating of 44.00.

The results of the different tests with the Wilcoxon rank obtained the stress in pregnancy at the intervention  $p$  value = 0.000 < 0.005. Similarly, in groups control happen, it is changed the stress on the post-test with  $p$ -value = 0.001 < 0.05.

**Table 3.** Analysis of the Effect of Sombere Education on Pregnancy Stress in the Intervention and Control Groups.

Variable	Intervention (n=39)	Control (n=41)	p-value
<b>Pregnancy stress</b>			
<b>Pre-test</b>			
Without stress	0	0	0.273
Light	8 (20.5)	10 (24.4)	
Currently	27 (69.2)	25 (61)	
Heavy	4 (10.3)	6 (14.6)	
<b>Post-test</b>			
Without stress	13 (33.3)	1(2,4)	0.016*
Light	16 (41.1)	16 (39.1)	
Currently	10 (25.6)	19 (46.3)	
Heavy	0	5 (12.2)	

*p = Chi Squared*

Table 3 demonstrates that Pregnancy stress before treatment was most prevalent in the intervention group, with 27 respondents (69.2%) falling into this category. Similarly, the majority of respondents in the control group, that is 25 (61%), were in the currently category. Following the intervention, the majority of the treatment group, particularly regarding 16 respondents (41.1%), included in the light category. In contrast, the majority of the control group, 19 respondents (46.3%), are currently employed.

The analysis results employing the test *chi-square*,  $p$  is the stress of pregnancy, before treatment, the value of  $p = 0.273 > 0.05$ , which illustrates no significant difference. However, after the treatment,  $p = 0.016 < 0.05$  indicated a difference between the two groups. In the intervention group, 33.3% of the respondents experienced a decrease in stress to no stress, and 41.1% experienced mild stress. This intervention is being implemented because mental health-based education for pregnant women has discovered that mindfulness training can also help with self-management. Individuals can use various coping strategies when they are more aware of their physical and psychological experiences (Jebena et al., 2015). While relaxation is not the intended outcome of mindfulness practice, it is a common side effect that may help with stress-related symptoms and physical distractions. Acceptance (or non-judgment) is a fundamental point in mindfulness practice, and people are encouraged to accept all aspects of their experience, including their thoughts, emotions, and physical sensations (Kartini et al., 2019)

Furthermore, relaxation therapy administered to the intervention group can reduce stress in the respondents. Relaxation techniques such as soaking feet in warm water and murottal therapy can help mothers reduce the symptoms of stress (Sudirman et al., 2022). Anxiety during pregnancy can be brought on by negative thoughts that continue to grow. As a result, anxiety rises as a result of the brain's decision to fight or flee. This intervention increases the supply of oxygen to the body's tissues, resulting in an imbalance of O<sub>2</sub> and CO<sub>2</sub> levels in the brain. Body shaking, difficulty breathing, weakness, visual disturbances, increased muscle strength, neck and head pain, and chest pain are all symptoms of a O<sub>2</sub> and CO<sub>2</sub> imbalance (Septianingrum, 2018).

Soaking the feet in warm water for therapy causes vasodilation and reduces tension by transferring heat from the water to the feet and then to the body. Muscles promote blood circulation. The venous flexus in the feet contains many nerves, which are delivered to the body when the feet come into contact with warm water. In addition, the stimulus will be transmitted to the posterior horn and then to the spinal cord. This process continues to the dorsal root of the lamina I, II, and III and ends in the raphe area below the pons and medulla, inducing sleep. The mother will become more relaxed as a result of this condition (Septianingrum, 2018).

The sound vibrations of reading the Qur'an will be captured by the earlobe, which will be diverted to the ear canal and hit the eardrum so that it vibrates. This vibration will be transmitted to the ossicles, which are fused and pass it on to the cochlea. Auditory cells vibrate inside the cochlea in response to sound, and these vibrations produce electrical vibrations that are transmitted to the thalamus via the VIII (vestibule cochlear). The thalamus sends signals to the amygdala and the hippocampus. The hippocampus is responsible for motivation, which is a drive in the brain to recall pleasant experiences and thoughts. The amiglada is also transmitted to the hypothalamus, in addition to the hippocampus. The hypothalamus induces negative feedback from the thyroid gland, resulting in a decrease in stress hormones and an increase in relaxation hormones (Anita, 2017).

Furthermore, stress and anxiety during pregnancy can be overcome if a person has strong mental health self-efficacy. According to previous research (Nagle & Farrelly, 2018), self-efficacy in mental health is thought to be an influential factor in reducing stress and depression levels that originate within a person. As a result, it is critical to focus on increasing the person's mental health self-efficacy during the mental health intervention process (MacKinnon et al., 2017).

This research is in accordance with research (Khoshkerdar & Raeisi, 2020) (Mindfulness-based programs on the psychological health of pregnant women) that mindfulness-based programs underlie decision-making; self-management; relaxation; and acceptance, indicating that this approach may possess essential benefits for human health (Sullivan et al., 2019).

During the post-test, ten respondents (25.6%) in the intervention group experienced moderate stress. Age, education, living status, and family income are all potential risk factors for prenatal stress exacerbations, as are stressors that persist in the mother. There were 7 people (17.07%) in the control group <20 years and in the intervention group there were 6 people (15.38%). Aside from the development of maturity, age has an impact on emotional and social aspects. Age has a significant impact on a woman's ability to fulfill her role as a mother. A pregnancy occurs during a woman's psychological development at a healthy reproductive age. A woman at this age will easily adapt to her role as a mother (Martins, 2019).

Several issues will confront pregnant mothers during their adolescent years, including puberty, when adolescents have lofty goals that are frequently unrealistic, and their thoughts are overly grandiose. Sensitivity to the opinions of others is extremely high. Furthermore, the psychological problems of teenage mothers are conflicts that are not properly resolved in childhood, so the adolescent phase fails to undergo a mental development process, which has an impact on the mother's stress condition (Isir et al., 2021). Traumatic experiences in childhood or the past, such as being abused or others, can cause disruptions in the growth phase. Similarly, they are subjected to environmental or socioeconomic pressures, which can lead to feelings of inferiority. This condition occurs because teenagers are not yet emotionally stable (Triwahyuningsih & Prayugi, 2018).

In addition to age, highly educated people will respond more rationally than uneducated people who are unable to face challenges rationally. According to the findings of the study, pregnant women with primary and secondary education have higher levels of anxiety than mothers with a higher level of education. This condition exists because the higher a person's level of education, the better he can think rationally and control his emotions, thereby reducing anxiety (Sūdžiūtė et al., 2020).

Status of residence in the control group with a family of 26 mothers (63.4%) and the intervention group 31 mothers (79.5%). Status of residence most of the respondents live with their families. This research is in accordance with research conducted by (Field et al., 2019) entitled Psychosocial Stress During Pregnancy. Research results illustrate that psychosocial stress during pregnancy in pregnant women living with family is higher with OR 3.1 and to calculate their level of psychosocial stress by employing the Prenatal Psychosocial Profile Scale. Meanwhile, on research revealed that 38% of mothers experience stress living with family, particularly family husband (Prihandini & Primana, 2020).

Internal family conflicts are signs of psychosocial stressors. Internal family problems are one of the negative life events that physically and psychologically immature people experience. As a result, it will be involved in the activation of stress signals at the locus cereus and the HPA axis (Aatsinki et al., 2020).

Thus, women in the intervention group may have better relationships with their husbands and mothers-in-law, as presented in our previous study (Arinda & Herdayati, 2021). Better interpersonal relationships can help women receive more practical assistance from their families with baby care, household chores, and emotional support. This condition could explain why study groups had higher levels of perceived social support.

In Six respondents (30%) in the intervention group had family income based on the minimum wage, while 14 respondents (70% in the control group) did not. The intervention group had 33 respondents (55%) and the control group had 27 (45%). Adequate family income

prepares pregnant women for pregnancy because pregnancy necessitates a special budget for ANC, nutritious food for the mother and fetus, maternity clothes, childbirth costs, and the baby's needs after birth (Telaumbanua & Absah, 2021).

The results of this study (Said et al., 2015) revealed a relationship between family income and anxiety for primigravida mothers at the Tuminting Health Center, where the  $p$ -value = 0.000 is less than = 0.05. Research conducted by (Rahmawati, 2020) discovered that the correlation coefficient ( $r$ ) obtained between economic status and the level of maternal anxiety in dealing with normal delivery during the Covid-19 pandemic had a relationship with a significance value ( $p$ ) of  $0.000 < 0.05$ . The results demonstrated that the higher the economic status, the lower the anxiety level; the lower the economic status, the higher the anxiety level.

Pregnant women with good socioeconomic status have better physical and psychological health, which reduces anxiety before childbirth because the mother has reached an emotional maturity stage. Low socioeconomic status also causes pregnant women to be irregular in their antenatal care, increasing the risk of pathological births (Bledsoe et al., 2017). Pregnant women can benefit from mental health education provided by their mothers. Furthermore, it aids in the relief of symptoms associated with stress and physical disorders. Pregnant women have improved coping mechanisms and are encouraged to accept all aspects of their experience, including their thoughts, emotions, and physical sensations. However, the presence of determinant factors such as living status and socioeconomic conditions resulted in none of the three responses experiencing a reduction in anxiety after receiving the intervention (Alipour et al., 2018).

Anxiety can impair pregnant women's ability to concentrate and cause them to lose confidence. The effects of mothers' anxiety during childbirth will manifest as excessive pain or pain. Fear will impede the birth process because the human body will activate the center of alertness and defense when it receives a signal of fear (Stocker et al., 2020).

#### 4. CONCLUSION

In this study, there was a change in the stress of pregnant women in both the intervention and control groups after the intervention was performed during the post-test. Sombere education has an effect on stress levels in primigravida pregnant women. The importance of paying attention to pregnant women's mental or psychological conditions by developing mental health-based education to ensure the mother's and fetus's health. To ensure the mental health of pregnant women, health workers, particularly midwives, must conduct stress assessments or collaborate with psychologists.

#### REFERENCES

- Aatsinki, A.-K., Keskitalo, A., Laitinen, V., Munukka, E., Uusitupa, H.-M., Lahti, L., Kortelnuoma, S., Mustonen, P., Rodrigues, AJ, Coimbra, B., Huovinen, P., Karlsson, H., & Karlsson, L. (2020). Maternal prenatal psychological distress and hair cortisol levels associated with infant faecal microbiota composition at 2.5 months of age. *Psychoneuroendocrinology*, *119*, 104754. <https://doi.org/10.1016/j.psyneuen.2020.104754>
- Alipour, Z., Kheirabadi, G. R., Kazemi, A., & Fooladi, M. (2018). The most important risk factors affecting mental health during pregnancy: a systematic review. *Eastern Mediterranean health journal*, *24*(6), 549-559. <https://doi.org/10.26719/2018.24.6.549>
- Amidu, N., Alhassan, M., Issah, H., Yakong, V., Yahaya, W., Adams, Y., & Dapare, P. (2018). Perceived Stress and Anxiety in Women during Labor: A Case of Tamale West Hospital, Tamale, Ghana. *Asian Journal of Medicine and Health*, *11* (2), 1–10. <https://doi.org/10.9734/ajmah/2018/40373>
- Anita, W. (2017). Techniques of pain reduction in the normal labor process: systematic

- review. *Jurnal Endurance*, 2(3), 362-375. <https://doi.org/10.22216/jen.v2i3.2357>
- Arinda, Y. D., & Herdayati, M. (2021). Masalah kesehatan mental pada wanita hamil selama pandemi COVID-19. *Jurnal Kesehatan Vokasional*, 6(1), 32-41. <https://doi.org/10.22146/jkesvo.62784>
- Biaggi, A., Conroy, S., Pawlby, S., & Pariante, CM (2016). Identifying the women at risk of antenatal anxiety and depression: A systematic review. *Journal of Affective Disorders*, 191, 62–77. <https://doi.org/10.1016/j.jad.2015.11.014>
- Bledsoe, SE, Rizo, CF, Wike, TL, Killian-Farrell, C., Wessel, J., Bellows, A.-M., & Doernberg, A. (2017). Pregnant adolescent women's perceptions of depression and psychiatric services in the United States. *Women and Birth*, 30 (5), e248–e257. <https://doi.org/10.1016/j.wombi.2017.02.006>
- Field, S., Abrahams, Z., Woods, DL, Turner, R., Onah, MN, Kaura, DK, & Honikman, S. (2019). Accessible continued professional development for maternal mental health. *African Journal of Primary Health Care & Family Medicine*, 11 (1), 1-7. <https://doi.org/10.4102/phcfm.v11i1.1902>
- Frank, G. D., Fox, D., Njue, C., & Dawson, A. (2021). The maternity experiences of women seeking asylum in high-income countries: a meta-ethnography. *Women and birth : journal of the Australian College of Midwives*, 34(6), 531–539. <https://doi.org/10.1016/j.wombi.2020.12.012>
- Isir, M., Egam, A., & Mustamu, AC (2021). Factors Predictors of Survival Rate in Early Adolescent Pregnancy. *Journal of Nursing*, 13 (3), 519–528. <https://doi.org/10.32583/keperawatan.v13i3.1424>
- Jebena, M. G., Taha, M., Nakajima, M., Lemieux, A., Lemessa, F., Hoffman, R., ... & al'Absi, M. (2015). Household food insecurity and mental distress among pregnant women in Southwestern Ethiopia: a cross sectional study design. *BMC pregnancy and childbirth*, 15, 250. <https://doi.org/10.1186/s12884-015-0699-5>
- Kartini, F., Emilia, O., Dasuki, D., & Prabandari, YS (2019). Developing Indonesian version of childbirth self-efficacy inventory (Cbsei)-C32. *Bali Medical Journal*, 8 (3), 679-686. <https://doi.org/10.15562/bmj.v8i3.1538>
- MacKinnon, AL, Naguib, M., Barr, HJ, Levinsson, A., Robins, S., Feeley, N., Hayton, B., Zekowitz, P., & Gold, I. (2017). Delusional ideation during the perinatal period in a community sample. *Schizophrenia Research*, 179, 17–22. <https://doi.org/10.1016/j.schres.2016.09.027>
- Martins, CA (2019). Transition to parenthood: consequences on health and well-being. A qualitative study. *Enfermería Clínica*, 29 (4), 225–233. <https://doi.org/10.1016/j.enfcli.2018.04.005>
- Nagle, U., & Farrelly, M. (2018). Women's views and experiences of having their mental health needs considered in the perinatal period. *Midwifery*, 66, 79–87. <https://doi.org/10.1016/j.midw.2018.07.015>
- Ningtiyasari, N. (2019). The Relationship between the Nutritional Status of Pregnant Women and the Incidence of LBW in PMB Johana Widijati, Tulungagung Regency, Sidorejo Village, Kauman District, Tulungagung Regency. *Journal of Midwifery, University of Tulungagung*, 1–6.
- Khoshkerdar, P., & Raeisi, Z. (2020). The Effect of Mindfulness-Based Stress Reduction on Affective Control Dimensions in Adolescent Girls with Dysfunctional Eating Attitudes. *Journal of Child and Family Studies*, 29, 1992-1999. <https://doi.org/10.1007/s10826-020-01721-5>
- Prihandini, S., & Primana, L. (2020). Efikasi Diri Kesehatan Mental sebagai Mediator antara

- Dukungan Suami dengan Kelekatan Ibu-Janin. *INSAN Jurnal Psikologi Dan Kesehatan Mental*, 5(2), 112–124. <https://doi.org/10.20473/jpkm.V5I22020.112-124>
- Rahmawati, W. R. (2019). Pengaruh Stres pada Ibu Hamil Trimester III terhadap Aktivitas Janin yang Dikandung di Wilayah Puskesmas Grabag 1 Kabupaten Magelang. *JURNAL KEPERAWATAN MERSI*, 8(2), 37-42.
- Said, N., Kanine, E., & Bidjuni, H. (2015). Hubungan faktor sosial ekonomi dengan kecemasan ibu primigravida di puskesmas tuminting. *Jurnal Keperawatan*, 3(2),1-8.
- Septianingrum, Y. (2018). The Effectiveness of Relaxation During Pregnancy on Reducing Stress, Anxiety in Pregnant Women and the Response of the Fetus in the Womb. *Journal of Health Sciences* , 8 (2), 206–212. <https://doi.org/10.33086/jhs.v8i2.206>
- Spedding, M., Stein, DJ, Naledi, T., Myers, B., Cuijpers, P., & Sorsdahl, KR (2020). A task-sharing intervention for prepartum common mental disorders: Feasibility, acceptability and responses in a South African sample. *African Journal of Primary Health Care & Family Medicine* , 12 (1), a2378. <https://doi.org/10.4102/phcfm.v12i1.2378>
- Stocker, R., Nguyen, T., Tran, T., Tran, H., Tran, T., Hanieh, S., Biggs, B.-A., & Fisher, J. (2020). Social and economic development and pregnancy mental health: secondary analysis of data from rural Vietnam. *BMC Public Health* , 20 , 1001. <https://doi.org/10.1186/s12889-020-09067-9>
- Sudirman, J., Bachri, N., Syafar, M., Jusuf, EC, Syamsuddin, S., Mappaware, NA, & Saleng, H. (2022). Foot Hydrotherapy: Non-pharmacology Treatment for Reducing Anxiety in Third Trimester Pregnancy. *Open Access Macedonian Journal of Medical Sciences* , 10 , 320–323. <https://doi.org/10.3889/oamjms.2022.8271>
- Sūdžiūtė, K., Murauskienė, G., Jarienė, K., Jaras, A., Minkauskienė, M., Adomaitienė, V., & Nedzelskienė, I. (2020). Pre-existing mental health disorders affecting pregnancy and neonatal outcomes: a retrospective cohort study. *BMC Pregnancy and Childbirth* , 20, 419. <https://doi.org/10.1186/s12884-020-03094-5>
- Sullivan, J., Thorn, N., Amin, M., Mason, K., Lue, N., & Nawzir, M. (2019). Using simple acupressure and breathing techniques to improve mood, sleep and pain management in refugees: a peer-to-peer approach in a Rohingya refugee camp. *Intervention* , 17 (2), 252–258. [https://doi.org/10.4103/INTV.INTV\\_13\\_19](https://doi.org/10.4103/INTV.INTV_13_19)
- Telaumbanua, AS, & Absah, Y. (2021). The Influence of Education and Training on Performance Through Midwifery Competence: A Quantitative Study. *Journal of Education, Psychology and Health Research (J-P3K)* , 2 (2), 142–147. <https://doi.org/10.51849/j-p3k.v2i2.103>
- Togher, K., Treacy, E., O'Keeffe, G., & Kenny, LC (2017). Maternal distress in late pregnancy alters obstetric outcomes and the expression of genes important for placental glucocorticoid signaling. *Psychiatry Research* , 255 , 17–26. <https://doi.org/10.1016/j.psychres.2017.05.013>
- Triwahyuningsih, R. Y., & Prayugi, A. N. (2018). Analisis Faktor-Faktor Yang Berhubungan Dengan Kejadian Kekurangan Energi Kronik (Kek) Pada Ibu Hamil. *Jurnal Kebidanan*, 8(2), 116-121.
- Usami, M., Iwadare, Y., Watanabe, K., Kodaira, M., Ushijima, H., Tanaka, T., & Saito, K. (2016). Long-term fluctuations in traumatic symptoms of high school girls who survived from the 2011 Japan tsunami: series of questionnaire-based cross-sectional surveys. *Child Psychiatry & Human Development*, 47, 1002-1008. <https://doi.org/10.1007/s10578-016-0631-x>

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**RESEARCH**

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## Compliance Level of PAUD Students in Brushing with the Interactive Calendar Guide

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### Abstract

Brushing teeth properly and correctly must be instilled in children from an early age so that they become accustomed to living a clean and healthy lifestyle. Dental health education can help people develop good brushing habits. Brushing your teeth in the morning and evening for 21 days is an interactive calendar designed to control the implementation of brushing your teeth in the morning and evening. The objective of this study was to assess PAUD (Pre-School) students' compliance with morning and night toothbrushing using an interactive calendar guide to brushing their teeth in the morning and evening for 21 days. The research method used is pre-experimental. Simple random sampling method was also administered. The research intervention was conducted on 32 PAUD Bahagia Sukapura and Al Abror students. A questionnaire and an interactive calendar sheet were used as research instruments. The results showed that before the intervention, the average score of PAUD children's compliance with brushing their teeth in the morning and evening was 46.9063, but after the intervention, it increased to 79.0313. Before the intervention, the level of adherence to brushing teeth in the morning and evening was in the less compliant category (40.6%), but after the intervention with an interactive calendar, it increased to (96.9%). The Wilcoxon Sign Rank Test analysis revealed a difference in pre- and post-intervention scores on children's compliance data in brushing their teeth using the morning and evening brushing calendar for 21 days, with a p-value (0.000) < 0.05. Brushing their teeth twice a day in the morning and evening for 21 days is effective in increasing PAUD children's adherence to brushing their teeth twice a day in the morning and evening.

**Keywords:** Compliance, Morning and Evening Brushing, Interactive Calendar.

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## 1. INTRODUCTION

Efforts to maintain oral health in children are associated with oral hygiene status that impacts children's quality of life. The research results by Nuraini, Raharjo & Maharani, (2021) explained that most Indonesian children possess poor oral health. Good dental and oral health conditions influence children's overall health and well-being (Melo et al., 2021; Wijayanti & Rahayu, 2018). Dental and oral hygiene status in pre-school-age children can be enhanced through excellent and correct brushing habits (Wijayanti & Rahayu, 2018).

Basic Health Research, 2018 demonstrated that 1.1% of 86.7% of children aged 3-4 years brushed their teeth properly every day, and 1.4% of 93.2% of children aged 5-9 years brushed their teeth properly every day (Kementerian Kesehatan Republik Indonesia, 2019). Lousy brushing habits can affect potential dental caries in children. The best time to brush teeth is in the morning, after breakfast, and before bed (Melo et al., 2018; Wijayanti & Rahayu, 2018). Parents play an important role in instilling the habit of brushing teeth at a young age because, in general, parents have sufficient knowledge to brush their own teeth. (De Jong-Lenters et al., 2019; Abadi & Suparno, 2019; Wanti et al., 2021). Based on their research results, George et al., (2019) recommend that parents should assist their children in brushing their teeth and supervise brushing until the child is ten years old. The manner of parenting also affects how the children accept the direction of behavior conveyed by parents (Mahmoud et al., 2017). Ineffective parenting is characterized by inconsistent and demanding discipline practices, which result in child disobedience and resistance. It may have a negative impact on children's compliance with brushing their teeth twice a day (Seeberger & Sampietro, 2021). Good parent-child relationships positively impact children's behavior (Kell et al., 2018).

In everyday life, children must brush their teeth in the morning and at night without feeling compelled to do so. Motivating children can assist them in achieving their goals actively and without coercion. Parents may choose to use educational media to instill discipline or obedience in their children (Ceyhan et al., 2018). An interactive calendar of brushing teeth morning and evening for 21 days may guide parents to generate children's habits to brush their teeth morning and night (Heriyanto et al., 2018; Pawarti & Abrial, 2019).

The calendar for brushing the teeth in the morning and evening for 21 days is one of the programs designed by FDI (World Dental Federation) based on the theory of behavior change. Its objective is to establish the habit of brushing your teeth in the morning and evening (Melo et al., 2020). The results of previous studies also demonstrated that the morning and evening brushing calendar could enhance the habit of brushing teeth in the morning and evening in elementary school-age children (Heriyanto et al., 2018; Melo et al., 2018; Rahina et al., 2021). The difference in this study is that the respondents are PAUD students, and the interactive calendar type for brushing teeth in the morning and evening is adjusted for early childhood. The objective of this study is to examine PAUD students' compliance with brushing their teeth in the morning and evening using an interactive calendar guide that can be utilized as study material to enhance the habit of brushing teeth in the morning after breakfast and at night before bed in early childhood.

## 2. RESEARCH METHOD

This research is a pre-experimental study. In April - May 2022, the study sample consisted of PAUD Bahagia Sukapura and Al Abror students was conducted. The sample in this study consisted of all members of the population who met the criteria for research subjects. The sample size was determined using Isaac and Michael's formula, with a 5% margin of error (Sugiyono, 2020). The calculation of the sample obtained as many as 32 PAUD students.

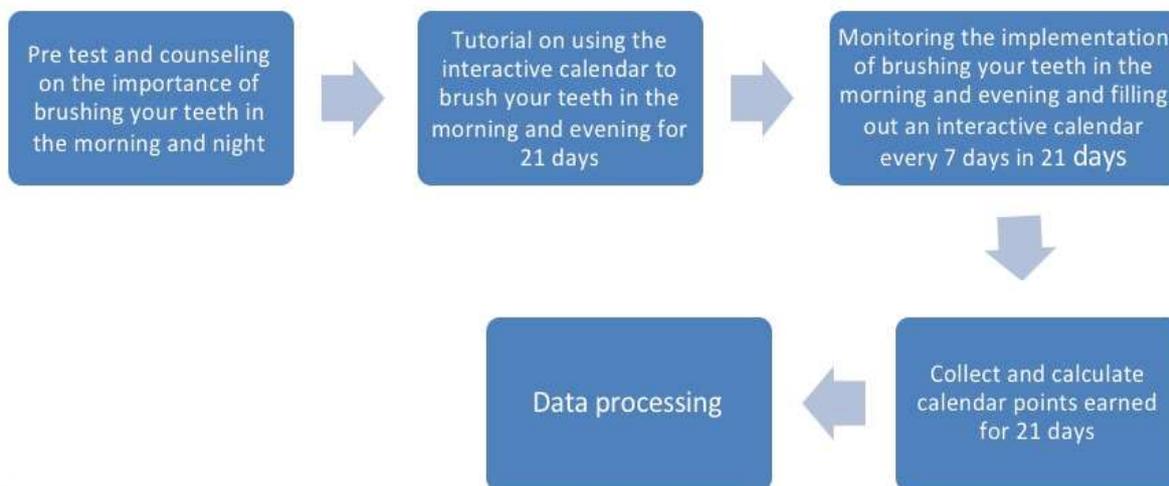
Primary data were collected using research instruments such as questionnaires and interactive calendar sheets (figure 1). PAUD children's compliance is measured as follows: if

the child brushes his teeth twice a day on time, points = 4, only brushes his teeth once, points = 2, does not brush his teeth at all, points = 0. The interactive calendar sheet was filled out, and the scores were calculated and categorized as follows: 1) disobedient score (1-41), 2) moderately obedient score (42-63), and 3) compliant score (64-84).



**Figure 1.** Interactive Calendar of Brushing Your Teeth Morning and Night 21 Days.

The research is conducted in a hybrid mode, that is, both offline and online. In the early stages, a pretest on the importance of brushing teeth morning and evening was administered, followed by an interactive calendar tutorial and offline counseling on the importance of brushing teeth morning and evening for parents of PAUD children. For 21 days, observations of children's teeth brushing activities in the morning and evening were conducted online via the WhatsApp group. The number of morning and evening toothbrushes was counted on the 21st day of the intervention to determine the level of obedience of PAUD children.



**Figure 2.** Research flow

Hypothesis testing in this study employed the *Wilcoxon Sign Rank Test* to perceive the effect of the intervention by employing an interactive calendar of brushing your teeth in the morning and evening for 21 days on adherence to brushing your teeth in the morning and evening. This research has received ethical clearance from the KEPK Poltekkes team at the Ministry of Health Bandung by 55/KEPK/EC/III/2022.

### 3. RESULTS AND DISCUSSION

This study observed the impact of morning and night brushing calendar guidelines on early childhood compliance with morning and night toothbrushing activities. The study included 32 PAUD children from PAUD Bahagia Sukapura and Al Abror, as well as their parents, who participated in the morning and night brushing of their teeth for 21 days. Table 1 demonstrates the demographic characteristics of respondents in PAUD Bahagia Sukapura and Al Abror based on age, with 21 children (65.6%) being children aged 3-4 years. There are 17 female students (53.1%) in the class. The education level of middle-class parents (SMA/SMK) is 19 (59.4%). The majority of parents' occupations (71.9%) are as private employees.

**Table 1.** Characteristics of respondents incorporate the age of the child, the gender of the child, the last education of the parents, and the occupation of the parents.

Categorical	Frequency	Percentage (%)
Child's age		
< 3 years	2	6.3
3 – 4 years	21	65.6
> 4 years	9	28.1
Child gender		
Male	15	46.9
Female	17	53.1
Parents' last education		
Elementary School	7	21.9
Secondary School	19	59.4
High School	6	18.8
Parents' occupation		
Civil servant	5	15.6
Private employee/self-employed	23	71.9
Housewife	4	12.5

**Table 2.** The level of children's adherence to the practice of brushing their teeth in the morning before and after the intervention.

Variable	Compliance level						Total Pre/post
	Less Obedient		Obedient enough		Obey		
	Pre	Post	Pre	Post	Pre	Post	
Child gender							
Male	7 (46.7%)	0 (0.0%)	8 (53.3%)	1 (6.7%)	0 (0.0%)	14 (93.3%)	100/100
Female	6 (35.3%)	0 (0.0%)	8 (47.1%)	0 (0.0%)	3 (17.6%)	17 (100%)	100/100
Parent's education							
Elementary	5 (71.4%)	0 (0.0%)	2 (28.6%)	1 (14.3%)	0 (0.0%)	6 (85.7%)	100/100
Secondary	7 (36.8%)	0 (0.0%)	12 (63.2%)	0 (0.0%)	0 (0.0%)	19 (100%)	100/100
High	1 (16.7%)	0 (0.0%)	2 (33.3%)	0 (0.0%)	3 (50.0%)	6 (100%)	100/100

Table 2 demonstrates the percentage level of adherence to the implementation of early morning toothbrushing before utilizing the interactive calendar in boys who are less compliant by 46.7% and girls who are as many as 35.3%. After receiving an interactive calendar guide, boys' compliance increased nearly twofold to 93.3%. The majority of PAUD children with parents with a basic education level (71.4%) belonged to the category of children who were less obedient prior to the intervention using an interactive calendar. The achievement level of children's compliance after being given a guide to brushing their teeth in the morning and night

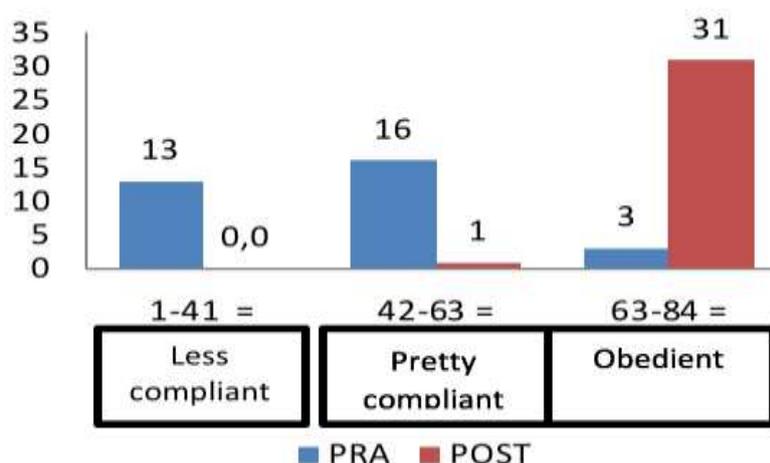
after the intervention appeared to have increased. There were no longer seen to be less obedient children, increased compliance following the intervention with the interactive calendar.

The following is a descriptive statistical value of the average and standard deviation of the measurement data for data on compliance with PAUD children in the implementation of toothbrushing using a calendar of brushing teeth in the morning and evening for 21 days:

**Table 3.** The results of the average score of children's compliance in brushing their teeth in the morning and at night.

	N	Minimum	Maximum	mean	Std. Deviation
Pre-Score	32	28.00	71.00	46.9063	11.23175
Post-Score	32	52.00	84.00	79.0313	6.96296

Table 3 illustrates as many as 32 samples of data on children's compliance scores in brushing their teeth. The results of the adherence score to brushing teeth in the morning and evening after being given the interactive calendar guide treatment for brushing varied between a minimum value of 28 to a maximum value of 71. The pre-adherence score data had an average score of 46.9063 and a standard deviation of 11.23175. The adherence score to brushing teeth in the morning and evening after treatment (interactive calendar of brushing teeth) ranged from 52 to 84. The pre-adherence score data had an average of 79.0313 and a standard deviation of 6.96296. The standard deviation value, which is less than the average in both groups of data, indicates that the data from the measurements taken is good because it is relatively uniform.



**Figure 2.** Students' Compliance with Brushing their Teeth Morning and Night.

Figure 2 illustrates that, for pre-data, 13 (40.6%) students are less compliant, while 16 (50%) students are fairly compliant. Meanwhile, the data after being treated (post) in the form of intervention using an interactive calendar of brushing teeth in the morning and evening revealed that as many as 31 students (96.9%) were compliant.

For 21 days, the Wilcoxon Signed Ranks Test was employed to compare pre-score and post-score data for children's compliance in brushing their teeth using the morning and evening brushing calendar.

**Table 4.** The Effect of Intervention Using an Interactive Calendar of Brushing Your Teeth Morning and Evening on Toothbrushing Habits in Bahagia Sukapura and Al Abror PAUD Students.

	<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>Z</b>	<b>P</b>	<b>Information</b>
Pre-Score	32	46.9063	11.23175	-4,939	0.000	Significant Test (Different)
Post-Score	32	79.0313	6,96296			

The Wilcoxon Sign Rank Test analysis test was employed to perceive the effect of the intervention utilizing an interactive calendar of brushing your teeth in the morning and evening for 21 days on adherence to brushing your teeth in the morning and evening. Table 4 illustrates the p-value ( $0.000 < 0.05$ ), thus, it is possible to conclude that there is a difference in the pre-scores and post-scores of children's compliance data in brushing their teeth for 21 days using the morning and evening brushing calendar. According to the data scores, there is an increase in children's compliance scores in brushing their teeth using the morning and evening brushing calendar for 21 days.

The implementation of preschool (PAUD), according to the Regulation of the Minister of Education and Culture, should apply several levels of achievement of child development, incorporating maintaining a clean and healthy lifestyle for children and their environment. The development of character in early childhood is a thing parents has to pay attention (Mahat & Bowen, 2017; Mahmoud et al., 2017). Excellent and correct education shapes the character of early childhood. Auto activity education can be applied to early childhood health education to encourage children to be active and productive in their growth and development (Aulina, 2018).

This study's participants were children aged 3-5 years who attended early childhood education (table 1). Because children are still in the process of rapid growth and development at this age, it is referred to as the "golden age" (Aulina, 2018). Early childhood is a distinct person, a stage of life with distinct characteristics. Young children are quick to obey and have excellent memories. They are vulnerable to events in their environment, particularly children aged 0 to 5 years who attend preschool (Angelica et al., 2019). Dental health in early childhood requires attention as it is one part of a child's growth and development, emphasizing on prevention precedes treatment (Abadi & Suparno, 2019). Dental health should be practiced as early as possible so that it becomes a habit for children and adults alike. Brushing teeth on a regular and timely basis is typical of early childhood dental health behavior (Khan et al., 2021; Muhtar et al., 2020).

Table 2 illustrates that after the intervention, children's adherence to brushing their teeth in the morning and evening increased depending on the gender of the child and the level of education of the parents. Enhancing dental and oral health education, anticipatory guidance, and parental motivation can all influence children's dental health behavior (Manton, 2018). Educational factors, knowledge, attitudes, and behavior of mothers affect children's dental health (Mahat & Bowen, 2017; Mahmoud et al., 2017). Research by Khan et al., (2021) demonstrates that the mother's knowledge and attitudes can also influence children's understanding on the importance of brushing their teeth in the morning and at night. Research by Seeberger & Sampietro, (2021) demonstrates that the mother's knowledge of children's oral health is quite good and can affect the child's dental and oral health. This research is in accordance with the results of this study, in which 59.4% of the mothers of PAUD students owned the latest secondary education (SMA/SMK). The study by Angelica et al., (2019) demonstrated that a mother with higher education owns more knowledge about dental and oral health and is more aware of employing dental health services for children.

Research result Bramantoro et al., (2021) demonstrated that dental health education for early and pre-school children is crucial for further dental growth. The role of parents at home cannot be separated from children's obedience and discipline in brushing their teeth in the

morning and evening. Children who grow up in a healthy family environment with supportive parents, where each family member's role is present and harmonious, have better brushing habits than children who grow up in a less favorable family environment (Chandio et al., 2022; Soldani et al., 2018). Children at home can also obtain external motivation to brush their teeth in the morning and evening through parental support (Arora et al., 2021). Motivating children can also affect their tooth brushing behavior, with children who are motivated having better tooth brushing behavior. Children who lack motivation, on the other hand, are less likely to brush their teeth (Khan et al., 2021; Sumangando et al., 2022). The motivation to brush teeth can come from within a person (intrinsic) or from outside a person (extrinsic). The external motivation children obtain from parents and teachers to brush their teeth in a study conducted by Wanti et al., (2021) can affect the habit of brushing children's teeth.

According to the study's results presented in table 3, there is an increase in the average daily and evening tooth brushing compliance of PAUD students after a 21-day intervention involving an interactive calendar of brushing their teeth in the morning and evening. Before the intervention, PAUD students' average tooth brushing compliance was 46.9; after the intervention, it increased to 79.03. Figure 2 in this study indicates that after being given a guide to brushing their teeth in the morning and evening using an interactive calendar, as many as 31 (96.9%) children became obedient. The findings of this study are consistent with the findings of Melo et al., (2018), which demonstrated an increase in knowledge and changes in brushing behavior after using a toothbrush calendar for 21 days in elementary school-age children. The World Dental Federation (FDI) has also created an educational tool in the form of a calendar to help people brush their teeth in the morning and evening. The World Dental Federation (FDI) collaborated on the 21 Days Brush Day & Night program to implement dental and oral health education programs around the world. The 21 Days Brush Day & Night program is the third phase of a collaboration between the World Dental Federation (FDI) that focuses on education about brushing teeth twice a day with fluoridated toothpaste, with schools as the primary target (Melo et al., 2020).

Hypothesis testing using the Wilcoxon Sign Rank Test ( $p\text{-value}=0.000<0.05$ ) demonstrated a significant difference before and after the intervention for the Bahagia Sukapura and Al Abror PAUD children. This final result is corroborated by a similar study conducted by Pawarti & Abral, (2019) that utilizes a toothbrushing calendar to influence the frequency of brushing teeth and dental and oral hygiene. Study by Heriyanto et al., (2018) regarding the interactive calendar of brushing teeth in the morning and evening for 21 days provides changes in brushing behavior in elementary school-age children. Brushing teeth in the morning and at night is something that children must do without being forced. Brushing your teeth not only means brushing them twice a day, but also brushing them at the appropriate time. Brushing your teeth is best performed each morning, after breakfast, and before bed. Based on the survey by Wijayanti & Rahayu, (2018), the research discovered that 55% of preschool and school-age children did not brush their teeth correctly.

Early childhood is still interested in visually exciting things. In several studies, it has also been proven that the use of visual media can escalate the effectiveness of children's education (Lestari et al., 2017). The morning and evening tooth brushing calendar has visually appealing features to attract children's attention. This calendar is intended to stimulate children so that they can appreciate their daily activities. Sticking stickers every time they brush their teeth in the morning and evening helps children feel responsible for brushing their teeth twice a day. Throughout the 21-day charging period, children will notice how the brushing calendar fills up with stickers every time they brush their teeth in the morning and evening, and they will look

forward to the rewards they will receive if they can fill all of the calendars. A small reward like this can help children develop the habit of brushing their teeth every morning and night from an early age (Abadi & Suparno, 2019).

Health education is identical to health education as both are oriented to behavior change. The success of dental health education efforts is inextricably linked to the educational methods and media employed (Lestari et al., 2017; Pawarti & Abral, 2019). Parents or teachers can utilize educational media to attract children's interest in dental and oral health (Belinda & Surya, 2021). Many educational media have been developed during this time period to support learning, whether it is to increase knowledge or form a behavior (Asyhar, 2012). One of the educational media that can be employed to shape the behavior of brushing your teeth in the morning and evening is this interactive calendar of brushing your teeth in the morning and evening for 21 days. The study by Rahina et al., (2021) revealed that after utilizing a calendar of brushing teeth in the morning and evening for 21 days, elementary school children became more diligent in brushing their teeth at the correct time, which is in the morning after breakfast and at night before going to bed. According to the findings of the researchers with PAUD children, an interactive calendar had an effect on improving teeth brushing skills.

Following the completion of the intervention, the results of interviews with parents of PAUD children received a positive response. Parents reported that their children were more disciplined about brushing their teeth twice daily, in the morning and at night. Parents also reported that their child's behavior had changed from not wanting to brush their teeth in the morning and at night. Everyday behaviors are recognized to be easier to develop into habits, and daily habits are more difficult to break or forget (De Vries, 2017). School-based interventions utilize behavioral theory can increase knowledge about dental and oral health in children (Zhou et al., 2019). Childhood is an excellent time, frequency, and method of tooth brushing to introduce the good habit of brushing teeth because children are more receptive, and their personality develops alongside mental maturation, increasing the likelihood of the habit being maintained for life.

#### 4. CONCLUSION

Brushing teeth in the morning and evening for 21 days using an interactive calendar guide can increase adherence to brushing teeth in the morning and evening in Bahagia Sukapura and Al Abror PAUD students. Our findings revealed a significant increase in adherence to brushing teeth in the morning and at night.

#### REFERENCES

- Abadi, N. Y. W. P., & Suparno, S. (2019). Perspektif orang tua pada kesehatan gigi anak usia dini. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 3(1), 161-169. <https://doi.org/10.31004/obsesi.v3i1.161>
- Angelica, C., Sembiring, L. S., & Suwindere, W. (2019). Pengaruh tingkat pendidikan tinggi dan perilaku ibu terhadap indeks def-t pada anak usia 4–5 tahun. The influence of higher education level and maternal behaviour on the def-t index in children aged 4–5 years old. *Padjadjaran Journal of Dental Researchers and Students*, 3(1), 20-25 <https://doi.org/10.24198/pjdrs.v3i1.22484>
- Arora, A., Lucas, D., To, M., Chimoriya, R., Bhole, S., Tadakamadla, S. K., & Crall, J. J. (2021). How Do Mothers Living in Socially Deprived Communities Perceive Oral Health of Young Children? A Qualitative Study. *International Journal of Environmental Research and Public Health*, 18(7), 3521. <https://doi.org/10.3390/ijerph18073521>
- Asyhar, R. (2012). *Kreatif Mengembangkan Media Pembelajaran*. Jakarta: Referensi.

- Aulina, C. N. (2018). Penerapan Metode Whole Brain Teaching dalam Meningkatkan Motivasi Belajar Anak Usia Dini. *Research & Learning in Early Childhood Education. Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 2(1), 1–12. <https://doi.org/10.31004/obsesi.v2i1.1>
- Belinda, N., & Surya, L. (2021). Media Edukasi dalam Pendidikan Kesehatan Gigi dan Mulut pada Anak-anak. *Jurnal Riset Intervensi Pendidikan (JRIP)*, 3(1), 55–60. Retrieved from <http://journal.rekarta.co.id/index.php/jrip/article/view/22>
- Bramantoro, T., Santoso, C. M. A., Hariyani, N., Setyowati, D., Zulfiana, A. A., Nor, N. A. M., Nagy, A., Pratamawari, D. N. P., & Irmalia, W. R. (2021). Effectiveness of the school-based oral health promotion programmes from preschool to high school: A systematic review. *PLOS ONE*, 16(8), e0256007. <https://doi.org/10.1371/journal.pone.0256007>
- Ceyhan, D., Akdik, C., & Kirzioglu, Z. (2018). An educational programme designed for the evaluation of effectiveness of two tooth brushing techniques in preschool children. *European Journal of Paediatric Dentistry*, 19(3), 181–186. <https://doi.org/10.23804/ejpd.2018.19.03.3>
- Chandio, N., Micheal, S., Tadakmadla, S. K., Sohn, W., Cartwright, S., White, R., Sanagavarapu, P., Parmar, J. S., & Arora, A. (2022). Barriers and enablers in the implementation and sustainability of toothbrushing programs in early childhood settings and primary schools: a systematic review. *BMC Oral Health*, 22, 242. <https://doi.org/10.1186/s12903-022-02270-7>
- De Jong-Lenters, M., L’Hoir, M., Polak, E., & Duijster, D. (2019). Promoting parenting strategies to improve tooth brushing in children: design of a non-randomised cluster-controlled trial. *BMC Oral Health*, 19, 210. <https://doi.org/10.1186/s12903-019-0902-6>
- De Vries, H. (2017). An Integrated Approach for Understanding Health Behavior; The I-Change Model as an Example. *Psychology and Behavioral Science International Journal*, 2(2), 555585. <https://doi.org/10.19080/PBSIJ.2017.02.555585>
- George, A., Sousa, M. S., Kong, A. C., Blinkhorn, A., Patterson Norrie, T., Foster, J., Dahlen, H. G., Ajwani, S., & Johnson, M. (2019). Effectiveness of preventive dental programs offered to mothers by non-dental professionals to control early childhood dental caries: a review. *BMC Oral Health*, 19, 172. <https://doi.org/10.1186/s12903-019-0862-x>
- Heriyanto, Y., Laela, S. D., & Mulyanti, S. (2018). Relationship Between School Dental Health Education Program Through Video and Interactive Calendar Against Changes in Tooth Brushing Behavior in Elementary School-aged Children at SDN Arcamanik Endah and SDN Mekarjaya in Bandung City and Their Families. *Proceeding of The 1st International Conference on Interprofessional Health Collaboration and Community Empowerment*, 1(1), 399–401. <https://conference.juriskes.com/index.php/IC/article/view/49>
- Kell, K., Aymerich, M.-A., & Horn, V. (2018). FDI–Unilever Brush Day & Night partnership: 12 years of improving behaviour for better oral health. *International Dental Journal*, 68 (Supplement 1), 3–6. <https://doi.org/10.1111/idj.12404>
- Kementerian Kesehatan Republik Indonesia. (2019). *Hasil Riset Kesehatan Dasar (Riskesdas) 2018*. Jakarta: Kementerian Kesehatan Republik Indonesia.
- Khan, I. M., Mani, S. A., Doss, J. G., Danaee, M., & Kong, L. Y. L. (2021). Pre-schoolers’

- tooth brushing behaviour and association with their oral health: a cross sectional study. *BMC Oral Health*, 21, 283. <https://doi.org/10.1186/s12903-021-01643-8>
- Lestari, R. D., Irawati, N., & Murniwati, M. (2017). Efektivitas Media pop-up card terhadap pengetahuan kesehatan gigi dan mulut anak usia 8-9 tahun. *Andalas Dental Journal*, 5(1), 31-39. <https://doi.org/10.25077/adj.v5i1.68>
- Mahat, G., & Bowen, F. (2017). Parental Knowledge about Urban Preschool Children's Oral Health Risk. *Pediatric Nursing*, 43(1), 30-34. <http://www.ncbi.nlm.nih.gov/pubmed/29406664>
- Mahmoud, N., Kowash, M., Hussein, I., Hassan, A., & Al Halabi, M. (2017). Oral health knowledge, attitude, and practices of Sharjah mothers of preschool children, United Arab Emirates. *Journal of International Society of Preventive and Community Dentistry*, 7(6), 308-314. [https://doi.org/10.4103/jispcd.JISPCD\\_310\\_17](https://doi.org/10.4103/jispcd.JISPCD_310_17)
- Manton, D. J. (2018). E Clinical Medicine Child Dental Caries – A Global Problem of Inequality. *E Clinical Medicine*, 1, 3-4. <https://doi.org/10.1016/j.eclinm.2018.06.006>
- Melo, P., Fine, C., Malone, S., Frencken, J. E., & Horn, V. (2018). The effectiveness of the Brush Day and Night programme in improving children's toothbrushing knowledge and behaviour. *International Dental Journal*, 68, 7-16. <https://doi.org/10.1111/idj.12410>
- Melo, P., Fine, C., Malone, S., & Taylor, S. (2021). Impact of the Brush Day & Night Programme on Well-Being, Plaque, and Dental Caries in Children. *International Dental Journal*, 71(Supplement 1), S15-S30. <https://doi.org/10.1016/j.identj.2021.01.018>
- Melo, P., Malone, S., Rao, A., & Fine, C. (2020). A 21-Day School-Based Toothbrushing Intervention in Children Aged 6 to 9 Years in Indonesia and Nigeria: Protocol for a Two-Arm Superiority Randomized Controlled Trial. *JMIR Research Protocols*, 9(2), e14156. <https://doi.org/10.2196/14156>
- Muhtar, S., Hatta, I., & Wardani, I. K. (2020). Hubungan Tingkat Pengetahuan Ibu Tentang Kesehatan Gigi Dengan Tingkat Kebersihan Gigi Dan Mulut Pada Anak Di Kabupaten Barito Kuala (Tinjauan Anak Usia 4-5 Tahun di TK Nusa Indah Berangas Kecamatan Alalak). *Dentin*, 4(1), 16-20. Retrieved from <https://ppjp.ulm.ac.id/journals/index.php/dnt/article/view/2243>
- Nuraini, S. L., Rahardjo, A., & Maharani, D. A. (2021). An Indonesian Version of Child Oral Health Impact Profile-Short Form 19 (COHIP-SF19): Assessing Validity and Reliability. *Journal of Dentistry Indonesia*, 28(1), 45-53. <https://doi.org/10.14693/jdi.v28i1.1247>
- Pawarti, P., & Abrial, A. (2019). Penggunaan Kalender Sikat Gigi Dalam Meningkatkan Motivasi Siswa Terhadap Perilaku Menyikat Gigi. *Jurnal Vokasi Kesehatan*, 5(2), 103-106. Retrieved from <http://ejournal.poltekkes-pontianak.ac.id/index.php/JVK/article/view/251>
- Rahina, Y., DIGAA, C. I., Elang, P., & Waliyanto, S. (2021). School Program Brush Day And Night 21 Day To Increase Awareness About Oral Health: A Qualitative Study: Program Sekolah 21 Hari Menyikat Gigi Pagi Dan Malam Untuk Meningkatkan Kesadaran Tentang Kesehatan Mulut: Studi Kualitatif. *Interdental Jurnal Kedokteran Gigi (IJKG)*, 17(2), 110-116. <https://doi.org/10.46862/interdental.v17i2.2942>
- Seeberger, G., & Sampietro, M. (2021). Brush Day & Night: a review of a landmark partnership for children's oral health. *International Dental Journal*, 71(Supplement 1), S2-S3. <https://doi.org/10.1016/j.identj.2021.01.019>
- Soldani, F. A., Lamont, T., Jones, K., Young, L., Walsh, T., Lala, R., & Clarkson, J. E. (2018). One-to-one oral hygiene advice provided in a dental setting for oral health. *Cochrane*

- 
- Database of Systematic Reviews*, 10(10), CD007447.  
<https://doi.org/10.1002/14651858.CD007447.pub2>
- Sugiyono. (2020). *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Bandung: CV. Alfabeta.
- Sumangando, F. F., Mintjelungan, C. N., & Pangemanan, D. H. C. (2022). Level of Parental Knowledge about Maintenance of Dental and Oral Hygiene in Early Childhood. *E-GiGi*, 10(2), 197–203. <https://doi.org/10.35790/eg.v10i2.40534>
- Wanti, M., Mintjelungan, C. N., & Wowor, V. N. S. (2021). Pengaruh Motivasi Ekstrinsik terhadap Perilaku Menyikat Gigi pada Anak. *E-GiGi*, 9(1), 15-20. <https://doi.org/10.35790/eg.9.1.2021.32365>
- Wijayanti, H. N., & Rahayu, P. P. (2018). Membiasakan Diri Menyikat Gigi Sebagai Tindakan Utama Dalam Upaya Peningkatan Kesehatan Gigi Dan Mulut Pada Anak. *Jurnal Pemberdayaan Masyarakat Mandiri Indonesia (Indonesian Journal of Independent Community Empowerment)*, 1(1), 7–12. <https://doi.org/10.35473/jpmmi.v1i1.19>
- Zhou, N., Wong, H. M., & McGrath, C. (2019). Oral health and associated factors among preschool children with special healthcare needs. *Oral Diseases*, 25(4), 1221–1228. <https://doi.org/10.1111/odi.13057>

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DOI: [10.31965/infokes.Vol21Iss1.986](https://doi.org/10.31965/infokes.Vol21Iss1.986)Journal homepage: <http://jurnal.poltekkeskupang.ac.id/index.php/infokes>**RESEARCH****Open Access****The Density of Aedes aegypti Larvae Density and the Incidence of Dengue Hemorrhagic Fever in the Pesinggahan Environment, Pagesangan Barat Village, Mataram**Urip<sup>1a\*</sup>, Kurnia Rizki<sup>1b</sup>, Erlin Yustin Tatontos<sup>1c</sup>, Gunarti<sup>1d</sup>, Kholik<sup>2e</sup><sup>1</sup> Department of Medical Laboratory Technology, Poltekkes Kemenkes Mataram, Mataram, West Nusa Tenggara, Indonesia<sup>2</sup> Department of Veterinary Public Health, Faculty of Veterinary Medicine, Universitas Pendidikan Mandalika, Mataram, West Nusa Tenggara Indonesia<sup>a</sup> Email address: [uriprama64@gmail.com](mailto:uriprama64@gmail.com)<sup>b</sup> Email address: [kurniarizki2103@gmail.com](mailto:kurniarizki2103@gmail.com)<sup>c</sup> Email address: [erlintantos64@gmail.com](mailto:erlintantos64@gmail.com)<sup>d</sup> Email address: [gunarti\\_04@yahoo.com](mailto:gunarti_04@yahoo.com)<sup>e</sup> Email address: [kholiqvet@gmail.com](mailto:kholiqvet@gmail.com)

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**Abstract**

Dengue hemorrhagic fever remains a public health concern in West Nusa Tenggara Province, with the majority of cases occurring in Mataram City and the Pesinggahan Environment of West Pagesangan Village. The density of *Aedes aegypti* larvae as disease vectors has a strong influence on the high incidence of cases and the spread of dengue hemorrhagic fever. The objective of this study was to identify if there was a relation between the density of *Aedes aegypti* larvae and the rate of dengue hemorrhagic fever in the Pesinggahan Environment of Pagesangan Barat Village. This study is an analytic observational study with a cross-sectional design. This study's sample size was 56 houses. The data collected included information on the density of *Aedes aegypti* larvae and the incidence rate of dengue hemorrhagic fever in the Pesinggahan Environment of Pagesangan Barat Village over the previous year. Descriptive analysis was used to examine data on the density of *Aedes aegypti* larvae and the incidence rate of dengue hemorrhagic fever in the Pesinggahan environment. The findings revealed that the density of *Aedes aegypti* larvae was high (Density Figure (DF) = 6), as was the incidence rate of dengue hemorrhagic fever (0.39%). The statistical analysis between the density of *A. aegypti* larvae and the incidence rate of dengue hemorrhagic fever in the Pesinggahan Environment with the chi square test demonstrated indicate that  $p\text{-value} = 0.000 < \alpha = 0.05$ . Based on the results of the study, there was a relationship between the density of *A. aegypti* larvae and the incidence rate of dengue hemorrhagic fever in Pesinggahan, Pagesangan Barat Village. Further research is required regarding the detection of the dengue virus transmitted by *A. aegypti* mosquitoes to their offspring (transovarial).

**Keywords:** Dengue Hemorrhagic Fever, Density of *A. aegypti* Larvae, Incidence Rate.**\*Corresponding Author:**

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## 1. INTRODUCTION

Dengue hemorrhagic fever is an infectious disease that is still a public health concern in the West Nusa Tenggara (NTB) province, with the majority of cases occurring in the city of Mataram. In 2015, there were 481 cases of dengue hemorrhagic fever in Mataram City, with a morbidity rate (IR) of 0.12% and a mortality rate (CFR) of 0%, and this increased to 917 cases in 2016, with a morbidity rate (IR) of 0.23% and a mortality rate (CFR) of 0.76% (Dinas Kesehatan NTB, 2015), (Dinas Kesehatan NTB, 2016), (Dinas Kesehatan Kota Mataram, 2015), (Dinas Kesehatan Kota Mataram, 2016).

Pagesangan Village is one of Mataram City's sub-districts with the highest number of dengue hemorrhagic fever cases. In 2015, there were 58 cases of dengue hemorrhagic fever with a morbidity rate (IR) of 0.62% and a mortality rate (CFR) of 0%, which increased to 172 cases in 2016 with an IR of 1.84% and a mortality rate (CFR) of 0.58% (Dinas Kesehatan NTB, 2015), (Dinas Kesehatan NTB, 2016), (Dinas Kesehatan Kota Mataram, 2015), (Dinas Kesehatan Kota Mataram, 2016).

Pesinggahan is an environment in Pagesangan Barat Village that has a high incidence of dengue fever (Kelurahan Pagesangan Barat, 2016).

The density of disease vectors has a strong influence on the high incidence of cases and the spread of dengue hemorrhagic fever (Sambel, 2009). The observation of the *Aedes aegypti* (*A. aegypti*) vector is critical, particularly in determining the distribution, density, and primary habitat of the larvae, the potential risk of transmission, the level of sensitivity of mosquitoes to insecticides, and prioritizing the location and timing of eradication (Sunaryo & Pramestuti, 2014). The presence of *Aedes aegypti* larvae in a location indicates the presence of *Aedes aegypti* mosquito populations in that location (Purnama & Baskoro, 2012). In comparison to egg and adult mosquito surveys, the larval survey is the most commonly used. The larval survey employs three indices: the House Index (HI), Container Index (CI), and Breteau Index (BI) (World Health Organization, 2002).

Based on data from the Pagesangan Health Center in November 2016, the value of the larvae-free rate in the Pesinggahan Environment was 86.81%, where this figure was still below the National Standard, which is > 95%, while the HI value: of 13.18% and CI: 8.74%, which is based on WHO standards, that is if  $HI \geq 10\%$  and  $CI \geq 5\%$ , it indicates you are at high risk of transmitting dengue hemorrhagic fever, but no research has been conducted on the *Aedes aegypti* larvae density and dengue fever incidence in the Pesinggahan Environment as data that can be used in taking dengue hemorrhagic fever preventive actions (Data Puskesmas Pagesangan, 2016), (World Health Organization, 2016). Dengue hemorrhagic fever prevention is critical because there are currently no available vaccines or drugs to treat the disease. According to Kusriastuti & Sutomo (2005), the lack of vaccines and medicines made vector control the best option for community prevention and control of dengue hemorrhagic fever. According to Zuhriyah, Habibie, & Baskoro, (2012), vector density, vector identification, and vector breeding site are all necessary for effective vector control. The objective of this study was to determine the relationship between the density of *A. aegypti* larvae and the incidence rate of dengue hemorrhagic fever in the Pesinggahan Environment of West Pagesangan Barat Village.

## 2. RESEARCH METHOD

This research is an analytic observational study with a cross-sectional research design. The sample size in this study was 56 houses, with the sampling technique in this study employing a proportionate random sampling technique, in which the number of samples in RT 1 Pesinggahan was 14 houses, in RT 2 was 16 houses, in RT 3 was 14 houses and RT 4 is 12

houses. Meanwhile, the morbidity rate of dengue hemorrhagic fever in Pesinggahan administers secondary data obtained from the Pagesangan Health Center.

The tools and materials employed in this study were bowls, glass containers, glass objects, cover glasses, pipettes, tissue, microscopes, and water. The *Aedes aegypti* larvae survey was conducted using the single larva method, and larvae samples collected from the Pesinggahan community water reservoir were identified utilizing the direct method using a microscope to determine the type of *Aedes aegypti* larvae. Following identification, the density of *Aedes aegypti* larvae was measured by calculating the values of the House Index, Container Index, and Bereteu Index, which were then adjusted to the Density Figure value based on WHO guidelines.

Meanwhile, the morbidity rate for dengue hemorrhagic fever was calculated using data from the Pagesangan Health Center on the number of dengue hemorrhagic fever incidents in the Pesinggahan area. The morbidity rate for dengue hemorrhagic fever was then calculated and adjusted for high, medium, and low categories using data from the Indonesian Ministry of Health's Data Center and Epidemiological Surveillance.

### 3. RESULTS AND DISCUSSION

**Table 1.** The House Index (HI) in Pesinggahan Environment.

Environment	Number of houses	Number of Houses that Positive Larvae	House Index (HI) (%)
RT 1	14	6	43%
RT 2	16	7	44%
RT 3	14	6	43%
RT 4	12	5	42%
Pesinggahan	56	24	43%

RT= Rukun Tetangga

House Index (HI) was employed as an indicator for dengue transmission by The Pan American Health Organization (Sanchez et al., 2006). Based on Table 1, the House Index (HI) was revealed that in RT 1 of the 14 houses examined 6 houses were positive for *Aedes aegypti* (*A. aegypti*) larvae, thus, the House Index (HI) value at RT 1 was 43%, in RT 2 of the 16 houses examined, 7 houses were positive *A. aegypti* larvae, the HI value in RT 2 was 44%, in RT 3 of the 14 houses examined, 6 houses were positive for *A. aegypti* larvae, the HI value in RT 3 was 43% and in RT 4 of 12 of the houses examined, 5 houses were positive for *A. aegypti* larvae, hence, the HI value in RT 4 was 42%, thus, overall in the Intersection environment of the 56 houses examined, 24 houses were positive for *A. aegypti* larvae, hence, the HI value in the Environment The stopover is 43%. The HI in this study is nearly identical to the results of a study conducted by Sudarmaja et al., (2022), who obtained an HI of 40% in 10 DHF patient houses equipped with ovitraps in Denpasar, Bali.

**Table 2.** The Container Index (CI) in Pesinggahan Environment.

Environment	Number of Containers	Number of Containers that Positive larvae	Container Index (CI) (%)
RT 1	29	7	24%
RT 2	35	9	26%
RT 3	29	7	24%
RT 4	25	5	24%
Total	118	29	24%

RT= Rukun Tetangga

Based on Table 2, the Container Index (CI) was revealed that at RT 1 of the 29 containers examined, there were 7 containers positive for *Aedes aegypti* (*A. aegypti*) larvae,

thus, the Container Index (CI) value at RT 1 was 24%. At RT 2 of the 35 containers investigated, there were 9 containers positive for larvae *A. aegypti*, the CI value at RT 2 was 26%. At RT 3 of the 29 containers observed, there were 7 containers positive for *A. aegypti* larvae, hence, the CI value at RT 3 was 24% and at RT 4 of 25 containers examined, there were 5 containers positive for *A. aegypti* larvae. Meanwhile, the CI value at RT 4 was 24%, hence, overall in the stopover environment of the 118 containers calculated, 29 containers were positive for *A. aegypti* larvae, thus, the CI value in the stopover environment was 24%.

**Table 3.** The Breteau Index (BI) in Pesinggahan Environment.

Environment	Number of Containers	Number of Containers that Positive larvae	Breteau Index (BI) (%)
RT 1	14	7	50%
RT 2	16	9	56%
RT 3	14	7	50%
RT 4	12	5	50%
Total	56	29	50%

RT= Rukun Tetangga

According to Table 3, the Breteau Index (BI) in Pesinggahan Environment revealed that in RT 1 of the 14 houses examined, 7 containers were positive for *Aedes aegypti* larvae, thus, the Breteau Index (BI) value at RT 1 was 50%. At RT 2 of the 16 houses investigated, there were 9 containers positive for *A. aegypti* larvae, the BI value at RT 2 was 56%. At RT 3 out of 14 houses observed, there were 7 containers positive for *A. aegypti* larvae. Meanwhile, the BI value at RT 3 was 50% and at RT 4 out of 12 houses measured, there were 5 containers which were positive for *A. aegypti* larvae. Meanwhile, the BI value at RT 4 was 50%, hence, overall in the Intersection environment of the 56 houses calculated, there were 29 containers positive for *A. aegypti* larvae, thus, the BI value at RT 4 was 50 %.

Based on the House Index (HI), Container Index (CI), and Breteau Index (BI) values of *A. aegypti* larvae Density at RT 1 were 43%, 24%, and 50%, at RT 2 the HI, CI, and BI values were 44%, 26%, 56%, at RT 3 the HI, CI, BI is 43%, 24%, 50%, and in RT 4 the values HI, CI, BI were 42%, 24%, 50%. Hence, in the Intersection Environment the values HI, CI, BI were 43%, 24%, 50%. The HI, CI, and BI values in this stopover environment are adjusted to the WHO Density Figure table to determine density, and the HI, CI, and BI values have a Density Figure (DF) = 6 (House Index = 43%, Container Index = 23%, Breteau Index = 50%), indicating a high density of *Aedes aegypti* larvae. *Aedes aegypti* larvae were abundant (Density Figure (DF)). After determining the density of *Aedes aegypti* larvae, the study proceeded by analyzing the incidence rate of dengue hemorrhagic fever to provide an overview of the disease's transmission, which was associated with the density of *Aedes aegypti* larvae.

**Table 4.** The Incidence Rate of Dengue hemorrhagic fever in Pesinggahan Environment.

Year	RT	Population	Number of Incidences (person)	Incidence Rate (%)
2016	RT1	645	1	0, 16%
	RT2	700	4	0, 57%
	RT3	670	2	0, 30%
	RT4	561	3	0, 53%
	Total	2576	10	0, 39%

RT= Rukun Tetangga

According to Table 4, the incidence rate of dengue hemorrhagic fever in RT 1 was 0.16%, RT 2 was 0.57%, RT 3 was 0.30%, and RT 4 was 0.53%, and the total of the incidence rate of dengue hemorrhagic fever in the Pesinggahan Environment was 0.39%, indicating that the incidence rate of dengue hemorrhagic fever in the Pesinggahan District is high. The high density of *Aedes aegypti* larvae is directly proportional to the high incidence rate of dengue hemorrhagic fever in the Pesinggahan Environment of Pagesangan Barat Village, implying that the density of *Aedes aegypti* larvae has a close relationship with dengue fever incidence rate in the Pesipihan Environment of Pagesangan Barat Village. This is noteworthy because, contrary to research, free larva index value high incidence rate cases of dengue fever should be low. According to the result of a study conducted in Jember Regency, the index of free larvae was inversely proportional to dengue fever cases (Kurniawati et al., 2015). The findings of this study were also corroborated by Widyanto (2007), who discovered that the presence of the dengue vector *Aedes aegypti* influenced the incidence of dengue hemorrhagic fever.

The statistical analysis of the density of *Aedes aegypti* larvae and the incidence rate of dengue hemorrhagic fever (Table 5) in the Pesinggahan Environment with the chi square test revealed that  $p = 0.000 < \alpha = 0.05$ , indicating that there is a relationship. There is a relationship between the density of *Aedes aegypti* larvae and the incidence rate of dengue hemorrhagic fever in the Pesinggahan Environment, thus, the density of *Aedes aegypti* larvae has a relationship with the morbidity rate of dengue hemorrhagic fever. Widyanto, (2007) conducted research which revealed that the presence of the dengue vector *Aedes aegypti* influenced the incidence of dengue hemorrhagic fever.

**Table 5.** Statistical Analysis between Density of *A.aegypti* Larvae and Incidence Rate of Dengue Hemorrhagic Fever.

Chi Square	X <sup>2</sup>	2 Tailed P
Uncorrected (MH)	18.1988	0.0000199006
Corrected (MH)	16.6422	0.0000451351

The high density of *Aedes aegypti* larvae in the Pesinggahan environment can be attributed to several factors, one of which is the climate, as this research was conducted during the rainy season, which caused an increase in mosquito breeding sites such as previously dry water reservoirs to be filled with rainwater and become mosquito breeding grounds, thereby increasing the population of dengue hemorrhagic fever vectors. This is consistent with Wirayoga (2014)'s research in the city of Semarang, which discovered that high rainfall can increase mosquito breeding sites, increasing the density of their larvae.

The high density of *Aedes aegypti* larvae is also influenced by the knowledge factor of the people in the area, where the people in this stopover have less knowledge about dengue hemorrhagic fever, causing the environment to become a breeding ground for *Aedes aegypti* mosquitos as dengue hemorrhagic fever vectors. The fact that there are still many places where the disease's vector can develop, such as stagnant water and garbage, demonstrates the low level of public knowledge about DHF in the Pagesangan area. According to the description of dengue cases in Mataram, they are closely related to settlement conditions that provide vector breeding places, such as standing water and plastic waste (Sazali & Astuti., 2018). Low public awareness of DHF will increase DHF, as stated in the statement that knowledge influences the incidence of dengue hemorrhagic fever (Shanti et al. 2012).

The Pesinggahan environment incorporates 4 RTs (Neighborhood Association), in which each RT owns a high density of *A. aegypti* larvae. The highest density of *A. aegypti* larvae is discovered in RT 2 with a HI value of 43%, a CI of 26%, and a BI of 56%. The high HI, CI, and BI scores were obtained as RT 2 is an area in the Pesinggahan that possesses the most number of houses compared to other RT in the Pesinggahan. The home environment in the Pagesangan area is not good, such as the presence of piles of garbage and standing water which

enhances the development of *A. aegypti*. Sazali & Astuti., (2018) mentioned that the Pagesangan environment owns a lot of standing water and garbage dumps which allow for the development of *A. aegypti*. According to the findings of Masruroh, Wahyuningsih & Dina., (2016), there is a relationship between the presence of breeding places, such as places that can hold water, and the occurrence of DHF. A lot of standing water and garbage dumps in the Pagesangan environment can be affected by people who do not follow the 3M plus program, such as people who do not routinely clean their water reservoirs, resulting in a high number of *Aedes aegypti* mosquito larvae. This is supported by Yudhastuti & Vidiyani., (2005) research, which discovered a relationship between community behavior and the presence of *Aedes aegypti* larvae.

Due to the high density of *Aedes aegypti* larvae, the larvae reproduce into pupae, which develop into adult mosquitoes, with the adult *Aedes aegypti* mosquito serving as the primary vector of dengue hemorrhagic fever transmission. Infection with *Aedes aegypti* mosquitos by the dengue virus can occur through biting people whose bodies contain the virus or through transovarial transmission (Frida, 2006). This study supports the findings of Purnama & Baskoro (2012), who discovered a relationship between the House Index and the incidence of Dengue Hemorrhagic Fever (DHF), indicating that houses with positive *Aedes aegypti* larvae are more likely to contract DHF than those without *Aedes aegypti* larvae. The results of this study were corroborated by research which stated that the larvae of the *Aedes aegypti* mosquito were a risk factor for transmission of dengue hemorrhagic fever in Bali (Leri et al., 2021).

The infection of the *A. aegypti* mosquito by the dengue virus then infects healthy people resulting in an increase in the incidence of dengue hemorrhagic fever in an area as was the case in a study conducted in the Pesinggahan Environment where high incidence of dengue fever was obtained, where in every RT in the Pesinggahan, there is one person or more who suffers from dengue hemorrhagic fever, the highest incidence of dengue hemorrhagic fever occurs in RT 2 where in this RT there are as many as 4 people who have experienced dengue hemorrhagic fever, this high incidence of dengue hemorrhagic fever results in high morbidity rates of dengue fever dengue in the Pesinggahan environment because the morbidity rate is obtained from the incidence rate divided by the number of residents multiplied by one hundred percent, this is in accordance with the theory stated by Widoyono, (2011) which states that the morbidity rate is obtained from the number of dengue hemorrhagic fever incidents divided by the number of people at risk multiplied by 100%. The results of other studies also show a significant relationship between water reservoirs containing larvae and the incidence of DHF, with the risk is 8.8 times greater than that of respondents whose water reservoirs do not have larvae (Sucipto et al., 2015).

The Pesinggahan environment of Pagesangan Barat Subdistrict has a high incidence rate of dengue hemorrhagic fever, which is caused by the proximity of residents' houses and the high population density in the Pesinggahan, resulting in *Aedes aegypti* larvae that have grown into adult mosquitoes and are infected with the virus. Due to the short flight distance of the *Aedes aegypti* mosquito, which is 100 meters, this dengue easily spreads dengue virus from one person to another, increasing the risk of transmission of dengue hemorrhagic fever. Because a house with positive larvae and many positive larvae water reservoirs increases the risk of contracting Dengue Hemorrhagic Fever, the house index variable has a significant relationship (DHF) (Cahyani et al., 2018). Sari, (2005) asserts that higher population density and closer distances between houses in an environment will result in easier transmission of dengue hemorrhagic fever due to the mosquito's short flight distance of 100 meters (Sari, 2005), (Candra, 2010). According to statistical analysis, there is a significant relationship between population density and the number of dengue cases in both Sawah and Gambir sub-districts (Afira & Mansyur, 2013). A study conducted by Komaling, Sumampouw & Sondakh, (2020)

discovered a positive relationship between population density and the incidence of DHF in South Minahasa Regency, in which the higher the population density, the higher the DHF cases or vice versa.

#### 4. CONCLUSION

The density of *Aedes aegypti* larvae in the Pesinggahan environment had a House index of 43%, a Container Index of 24%, and a Breteau Index of 50%. The incidence rate of Dengue hemorrhagic fever in Pesinggahan is high, at 0.39%. There is a correlation between the density of *Aedes aegypti* larvae and the incidence rate of dengue hemorrhagic fever in the Pesinggahan Environment, Pagesangan Barat Village ( $p = 0.000 < \alpha = 0.05$ ). The high density of *Aedes aegypti* larvae can be a risk factor in the incidence of dengue hemorrhagic fever in the Pesinggahan Environment of West Pagesangan Village, so it is necessary to take preventive measures to reduce the density of *Aedes aegypti* larvae, such as implementing the 3 M action.

The Public Health Center and the Mataram City Health Office are hoped to increase periodic larvae inspection activities and promote the 3M plus program in the surrounding environment so that it can be used for monitoring. More research is required to detect the dengue virus transmitted by *Aedes aegypti* mosquitos to their offspring (transovarial).

#### REFERENCES

- Afira, F., & Mansyur, M. (2013). Gambaran Kejadian Demam Berdarah Dengue di Kecamatan Gambir dan Kecamatan Sawah Besar, Jakarta Pusat, Tahun 2005-2009. *eJournal Kedokteran Indonesia*, 1(1), 23-29. <https://doi.org/10.23886/ejki.1.1592.23-29>
- Cahyani, I. P. (2019). *Hubungan Kepadatan Jentik Aedes sp. Dengan Kejadian Demam Berdarah Dengue (DBD) Di Kecamatan Magetan, Kabupaten Magetan Tahun 2019. Diploma thesis*. Poltekkes Kemenkes Surabaya.
- Candra, A. (2010). Demam Berdarah Dengue: Epidemiologi, Patogenesis, dan Faktor Risiko Penularan. *ASPIRATOR - Journal of Vector-Borne Disease Studies*, 2(2), 110-119. Retrieved from <http://ejournal2.litbang.kemkes.go.id/index.php/aspirator/article/view/1787>
- Data Puskesmas Pagesangan. (2016). *Survei Larva Aedes di Lingkungan Pesinggahan*. Mataram: Puskesmas Pagesangan.
- Dinas Kesehatan Kota Mataram. (2015). *Profil Kesehatan Kota Mataram Tahun 2015*. Mataram: Dinas Kesehatan Kota Mataram.
- Dinas Kesehatan Kota Mataram. (2016). *Profil Kesehatan Kota Mataram Tahun 2016*. Mataram: Dinas Kesehatan Kota Mataram.
- Dinas Kesehatan NTB. (2015). *Profil Kesehatan NTB Tahun 2015*. Mataram: Dinas Kesehatan NTB.
- Dinas Kesehatan NTB. (2016). *Profil Kesehatan NTB Tahun 2016*. Mataram: Dinas Kesehatan NTB.
- Frida, N. (2008). *Mengenal Demam Berdarah Dengue* (Edisi I). Jakarta Barat: CV. Pamularsih.
- Kelurahan Pagesangan Barat. (2016). *Profil Kelurahan Pagesangan Barat. Tahun 2016*. Mataram: Kelurahan Pagesangan Barat.
- Komaling, D., Sumampouw, O. J., & Sondakh, R. C. (2020). Determinan Kejadian Demam Berdarah Dengue di Kabupaten Minahasa Selatan Tahun 2016-2018. *Indonesian Journal of Public Health and Community Medicine*, 1(1), 57-64.
- Kurniawati, R., Wati, D.M., Ariyanto, Y. (2015). Analisis Spasial Sebaran Kasus Demam Berdarah Dengue (DBD) di Kabupaten Jember Tahun 2014. *Artikel Ilmiah Hasil Penelitian Mahasiswa*, 1-7. Retrieved from <https://repository.unej.ac.id/bitstream/handle/123456789/75300/Rika%20Kurniawati.pdf?sequence=1&isAllowed=y>

- Kusriastuti, R., & Sutomo, S. (2005). Evolution of dengue Prevention and control programme in Indonesia. *Dengue Bulletin*, 29, 1-7
- Leri, C. Y. A. P., Setyobudi, A., & Ndoen, E. M. (2021). Density figure of *Aedes aegypti* larvae and community participation in prevention of dengue hemorrhagic fever (DHF). *Lontar: Journal of Community Health*, 3(3), 123-132. <https://doi.org/10.35508/ljch.v3i3.4329>
- Masruroh, L., Wahyuningsih, N. E., & Dina, R. A. (2016). Hubungan faktor lingkungan dan praktik pemberantasan sarang nyamuk (PSN) dengan kejadian demam berdarah dengue (DBD) di Kecamatan Ngawi. *Jurnal Kesehatan Masyarakat (Undip)*, 4(4), 992-1001.
- Purnama, S. G., & Baskoro, T. (2012). Maya index dan kepadatan larva *Aedes aegypti* terhadap infeksi dengue. *Makara Kesehatan*, 16(2), 57-64.
- Sambel, D. T. (2009). *Entomologi Kedokteran*. Yogyakarta: Andi.
- Sanchez, L., Vanlerberghe, V., Alfonso, L., Marquetti, M.delC., Guzman, M. G., Bisset, J., & van der Stuyft, P. (2006). *Aedes aegypti* larval indices and risk for dengue epidemics. *Emerging infectious diseases*, 12(5), 800–806. <https://doi.org/10.3201/eid1205.050866>
- Santhi, N. M. M., WD, I. G., & Aryasih, I. G. A. M. (2014). Pengaruh Pengetahuan dan Sikap Masyarakat Tentang DBD Terhadap Aktivitas Pemberantasan Sarang Nyamuk di Desa Dalung Kecamatan Kuta Utara Tahun 2012. *Jurnal Kesehatan Lingkungan*, 4(2), 152-155.
- Sari, C. I. N. (2005). Pengaruh Lingkungan Terhadap Perkembangan Penyakit Malaria dan Demam Berdarah Dengue. *Doktoral dissertation*. Institute Pertanian Bogor. Retrieved from [https://rudycr.com/PPS702-ipb/09145/cut\\_irsanya\\_ns.pdf](https://rudycr.com/PPS702-ipb/09145/cut_irsanya_ns.pdf)
- Sazali, M., & Astuti, R. R. U. N. W. (2018). Pengendalian Vektor Demam Berdarah Menggunakan Lethal Mosquito Trap Modification (LMM) Di Kelurahan Pagutan Induk, Kota Mataram. *JBIO: jurnal biosains (the journal of biosciences)*, 4(3), 124-130. Retrieved from <https://jurnal.unimed.ac.id/2012/index.php/biosains/article/view/11320>
- Sucipto, P. T., Raharjo, M., & Nurjazuli, N. (2016). Faktor – Faktor Yang Mempengaruhi Kejadian Penyakit Demam Berdarah Dengue (DBD) Dan Jenis Serotipe Virus Dengue Di Kabupaten Semarang. *Jurnal Kesehatan Lingkungan Indonesia*, 14(2), 51-56. <https://doi.org/10.14710/jkli.14.2.51-56>
- Sudarmaja, I. M., Swastika, I. K., Diarthini, L. P. E., Prasetya, I. P. D., & Wirawan, I. M. A. (2022). Dengue virus transovarial transmission detection in *Aedes aegypti* from dengue hemorrhagic fever patients' residences in Denpasar, Bali. *Veterinary world*, 15(4), 1149–1153. <https://doi.org/10.14202/vetworld.2022.1149-1153>
- Sunaryo, S., & Pramestuti, N. (2014). Surveilans *Aedes aegypti* di daerah endemis demam berdarah dengue. *Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)*, 8(8), 423-429. <http://dx.doi.org/10.21109/kesmas.v8i8.415>
- World Health Organization. (2002). *Panduan Lengkap Pencegahan dan Pengendalian Dengue dan Demam Berdarah*. Jakarta. Penerbit EGC.
- World Health Organization. (2016). Dengue and Severe Dengue. World Health Organization. Retrieved from <http://www.who.int/mediacentre/factsheets/fs117/en/>
- Widiyanto, T. (2007). Kajian manajemen lingkungan terhadap kejadian demam berdarah dengue (DBD) di kota purwokerto jawa tengah. *Thesis*. Universitas Diponegoro Semarang.
- Widoyono, M. P. H. (2011). *Penyakit Tropis Epidemiologi, Penularan, Pencegahan & Pemberantasan*. Jakarta: Penerbit Erlangga Indonesia.
- Wirayoga, M. (2014). Hubungan Kejadian Demam Berdarah Dengue Dengan Iklim Di Kota Semarang Tahun 2006-2011. *Unnes Journal of Public Health*, 2(4), 1-9. <https://doi.org/10.15294/ujph.v2i4.3055>

- Yudhastuti, R., & Vidiyani, A. (2005). Hubungan kondisi lingkungan, kontainer, dan perilaku masyarakat dengan keberadaan jentik nyamuk *Aedes aegypti* di daerah endemis demam berdarah dengue Surabaya. *Jurnal Kesehatan Lingkungan*, *1*(2), 170-182.
- Zuhriyah, L., Habibie, I., & Baskoro, A. (2012). The key container of *Aedes aegypti* in rural and urban Malang, East Java, Indonesia. *Health and The Environment Journal (HEJ): Mission Statement*, *3*(3), 51-58.

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**RESEARCH**

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## The Impact of Mental Health on the Job Performance of Medical and Non-Medical Workers

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### Abstract

In terms of their impact on the workforce, mental disorders in the workplace are a major concern. Poor mental health and stress can have a negative impact on worker performance and productivity, job attachment, collegial communication, physical performance, and daily functioning. The objective of this study is to investigate the relationship between mental health and job performance in medical and non-medical workers at general region hospital X. A quantitative cross-sectional study was conducted on 222 respondents, two of whom were medical and two of whom were non-medical workers, using a DASS-21 questionnaire and a job performance questionnaire. The findings show a relationship between age and job performance among medical and non-medical employees at General Region Hospital X. There is no significant relationship between mental health and job performance among medical workers. Gender, age, employment status, and work period all had a significant relationship with non-medical workers' job performance. Anxiety, gender, and age all have a significant relationship in non-medical workers. The conclusions is 44.1% reported poor job performance, 14.5% reported depression, 30.7% reported anxiety, and 11.3% reported stress. In both medical and non-medical workers, there was a significant interaction between anxiety and gender on job performance. Anxiety, gender, and age all had an impact on non-medical workers' job performance. It is critical to develop new health policies to prevent and treat mental health issues while also improving job performance. Intervene and assist workers suffering from mental illnesses. Training and management on mental health, a conducive workplace, and social support can enhance productivity and decrease mental problems.

**Keywords:** Anxiety, Depression, Health Care, Hospital, Job Performance, Medical Workers, Mental Health, Non-Medical Workers, Performance, Stress.

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## 1. INTRODUCTION

Mental disorders affect approximately 450 million people worldwide, according to estimates. According to a 2017 study conducted by the Institute for Health Metrics and Evaluation (IHME), mental disorders ranked fifth among the conditions causing stress in people living with disabilities, with a rate of 14.4%. According to IHME, mental disorders ranked fifth in Indonesia in 2017 with 13.4%. Depressive disorder, anxiety disorder, schizophrenia, bipolar disorder, conduct disorder, autism, eating behavior disorder, intellectual disability, and ADHD are the ten most common mental disorders (Attention Deficit Hyperactivity Disorder) (Tennant, 2001), (Institute for Health Metric and Evaluation, 2019).

In accordance with the 2018 Basic Health Research, over 19 million people over the age of 15 suffer from emotional psychiatric disorders, with over 12 million suffering from depression. Psychiatric disorders affect one in every five Indonesians, or roughly 20% of the country's 250 million people (Rokom, 2021). Psycho-affective disorders affect 4.7% of Central Java's population (Pusat Data dan Informasi, Kementerian Kesehatan Republik Indonesia, 2019). Work stressors that influence mental well-being are the root causes, and they are classified as off-work stressors such as family issues and a person's inner components, and on-work stressors such as corporate connections between colleagues, superior-subordinate or organizational connections, career connections improvement, and work inspiration (Wardhani, 2021).

Mental disorders in the workplace are a major problem in terms of their impact on the workforce. Poor mental health and stress can have a negative impact on worker performance and productivity, work attachment, collegial communication, and worker physical performance and daily functioning (Division of Population Health, National Center for Chronic Disease Prevention and Health Promotion, 2018), (Tennant, 2001). The most common mental disorders in the work environment are depression, anxiety, stress, bipolar disorder, and PTSD (*Post Traumatic Stress Disorder*) (Wisnubrata, 2019), (Thomas & Hersen, 2002). Anxiety, restlessness, depression, loss of interest in work, sleep disturbances, dizziness, difficulty concentrating, muscle tension, indigestion, and withdrawal from social activities are the most common symptoms of mental disorders at work. These include withdrawal, libido loss, and alcoholism (Stranks, 2005), (Segal, Smith, & Robinson, 2021).

A hospital is a work environment with a high workload that has an impact on physical and social health as well as workplace interaction. Headaches, abdominal pain, sleep disturbances, difficulty breathing, trembling, and an increased heart rate are symptoms of mental disorders, which increase the risk of errors and accidents in patients (Maslim, 2003), (Ribanszki et al., 2022). High levels of depression, stress, and anxiety may cause work accidents that endanger patient safety; employees can even cause material losses to the institution (Twistiandayani, Prameswari & Lestari, 2022), (Tennant, 2001). Mental health issues can impair hospital workers' ability to focus and concentrate, resulting in decreased productivity and efficiency. People with mental health issues may miss work or take more sick days, disrupting workflow and affecting patient care. Poor care quality can make it difficult to communicate effectively with patients or provide compassionate care, which can be costly for hospitals and result in staffing shortages (Chou et al., 2014), (Khamisa et al., 2016).

Researchers discovered that 28% of medical personnel experienced depression, 32% experienced anxiety, and 8% experienced stress in a preliminary study of 25 medical personnel and 25 non-medical personnel at General Region Hospital X, while 12% of non-medical personnel experienced depression, 16% experienced anxiety, and 8% experienced stress. The preliminary study revealed a 22.2% decrease in job performance for medical workers and a 25.4% decrease for non-medical workers. Health protocols are complicated by fatigue, increased workload, long working hours, and local culture. The objective of this study is to

investigate the relationship between mental health and job performance among medical and non-medical workers at General Region Hospital X in Central Java.

## 2. RESEARCH METHOD

A quantitative cross-sectional study in which the research tools were the DASS-21 (Depression and Anxiety Stress Scale-21) mental health questionnaire encompassing 21 items, seven of each of the depression, anxiety, and stress statements. Based on the performance theories of Robbins, Konopaske, and Matteson, researchers developed a job performance questionnaire (Robbins, & Judge, 2013), (Van Leeuwen et al., 2018). The job performance questionnaire contains 40 items drawn from four quality of work indicators: punctuality, independence, and commitment. Medical and non-medical workers who agree to be respondents and work for at least one year are eligible. Respondents with any type of mental disorder are excluded. SPSS data analysis with Chi-square and logistic regression (Kurniawan, 2016). The DASS-21 validity test demonstrated valid results when  $r$  calculate >  $r$  table, and reliability tests by administering Cronbach's alpha with depression at 0.80, anxiety at 0.89, and stress at 0.81 illustrated realistic results. The job performance questionnaire also reveals that all the item was valid are reliable at 0.8 using Cronbach's alpha test.

The samples comprise of 222 respondents, 126 medical workers and 96 non-medical workers from General Region Hospital X Central Java. The location was chosen for the study because it discovered mental health disorders in both medical and non-medical workers and had a large enough population to conduct the research. A stratified random sample of 126 medical workers (general practitioners, specialists, dentists, nurses, and midwives) and 96 non-medical workers (clerks, pharmacists, radiologists, administrative staff, physiotherapists, and structural staff) was used.

For all analyses, the SPSS for Windows results were employed. The frequency of each variable was investigated using one-way analysis. The relationship between each variable and job performance was examined using bivariate analysis with Chi-square. A variable with a p-value less than 0.25 was tested using logistic regression testing to determine the impact of each variable on job performance. Three indicators (depression, anxiety, and stress) value mental health as an independent variable, while job performance is a dependent variable.

## 3. RESULTS AND DISCUSSION

**Table 1.** Characteristics of the Study Population and Prevalence

Variables	Medical and non-medical workers		Medical workers		Non-medical workers	
	N	%	N	%	N	%
<b>Gender</b>						
Man	64	28.8	34	27	30	31.3
Women	158	71.2	92	73	66	68.8
<b>Age</b>						
< 20 yr.	3	1.4	0	0	3	3.1
20-25 yr.	29	13.1	19	15.1	10	10.4
26-30 yr.	50	22.5	31	24.6	19	19.8
31-35 yr.	47	21.2	29	23	18	18.8
36-40 yr.	29	13.1	20	15.9	9	9.4
41-45 yr.	36	16.2	20	15.9	16	16.7
46-50 yr.	12	5.4	3	2.4	9	9.4

>50 yr.	16	7.2	4	3.2	12	12.5
<b>Marital Status</b>						
Unmarried	52	23.4	29	23	23	24
Married	170	76.6	97	77	73	76
<b>Education</b>						
High School	12	5.4	0	0	12	12.5
Diploma (D1/D2/D3)	92	41.4	52	41.3	41	42.7
Bachelor (S1/S2/S3)	118	53.2	74	58.7	43	44.8
<b>Employment Status</b>						
Permanent / Civil Servants	176	79.3	98	77.8	78	81.3
Contract / Partners	46	20.7	28	22.2	18	18.8
<b>Service period</b>						
< 5 yr.	96	43.2	60	47.6	36	37.5
>5 yr.	126	56.8	66	52.4	60	62.5
<b>Mental Health</b>						
Depression	32	14.5	12	9.6	20	20.9
Anxiety	68	30.7	24	19	44	45.8
Stress	25	11.3	10	8	15	15.6
<b>Job Performance</b>						
Good	85	38.3	50	39.7	35	36.5
Bad	137	61.7	76	60.3	61	63.5

Table 1 demonstrates the characteristics of the total population, medical workers, and non-medical workers. The age range of respondents ranged from under 20 to over 50 years old, 76.6% were married, 53.2% had a bachelor's degree, 79.3% were civil servants, and 56.8% had worked for more than 5 years.

**Table 2.** Relations between Job Performance and Other Variables for the Entire Population

Variable		Job Performance				p-Value	OR	CI 95 %
		Good		Bad				
		Σ	%	Σ	%			
Depression	Normal	110	49.5	80	36	0.194	1.768	0.831-3.763
	Depression	14	6.3	18	8.1			
Anxiety	Normal	92	41.4	62	27.9	0.108	1.669	0.939-2.966
	Anxiety	32	14.4	36	16.2			
Stress	Normal	110	49.5	87	39.2	1.000	0.993	0.430-2.297
	Stress	14	6.3	11	5.0			
Gender	Men	29	13.1	35	15.8	0.062	0.549	0.306-0.987
	Women	95	42.8	63	28.4			
Age	< 20-25 yr.	18	8.1	14	6.3	0.987		
	26-30 yr.	26	11.7	24	10.8			
	31-35 yr.	26	11.7	21	9.5			
	36-40 yr.	15	6.8	14	6.3			
	41-45 yr.	17	7.7	19	8.6			
	46-50 yr.	7	3.2	5	2.3			
	>50 yr.	9	4.1	7	3.2			
Marital Status	Unmarried	28	12.6	24	10.8	0.862	0.899	0.482-1.678
	Married	96	43.2	74	33.3			
Education	High school	6	2.7	7	3.2	0.713		
	Diploma	50	22.5	41	18.5			

	Bachelor	68	30.6	50	22.5			
Employment Status	Permanent	102	45.9	74	33.3			
	Contract	22	9.9	24	10.8	0.287	1.504	0.784-2.884
Service period	< 5 yr.	49	22.1	47	21.2	0.261	0.709	0.415-1.211
	>5 yr.	75	33.8	51	23			

The full population chi-square test results for determining the relationship between independent and dependent variables are displayed in Table 2. According to the table above, no variable has a significant relationship with job performance for medical and non-medical workers at General Region Hospital X in Central Java. Data with a p-value of 0.25 will be tested further using logistic regression.

**Table 3.** Results of Logistic Regression Tests on the Relationship between Depression, Anxiety, and Gender on Job Performance in the Entire Population.

Variable	Sig	Exp (B)	95% C. I. for Exp (B)		Nagelkerke R Square
			Lower	upper	
Depression	0.338	1.327	0.744	2.368	0.056
Anxiety	0.024	1.360	1.042	1.775	
Gender	0.034	0.526	0.290	0.953	

According to table 3, depression has a p-value of 0.338, indicating that it has no significant effect on the job performance of the entire population in X regional hospitals in Central Java. Anxiety and gender had significant effects on overall population job performance; Nagelkerke's R-squared value was 0.056, indicating that anxiety and gender affect job performance by 5.6%.

**Table 4.** Relations between Job Performance and Other Variables for Medical Workers.

Variable		Job Performance				p-Value	OR	CI 95 %
		Good		Bad				
		Σ	%	Σ	%			
Depression	Normal	72	57.1	42	33.3	0.562	1.714	0.520-5.657
	Depression	6	4.8	6	4.8			
Anxiety	Normal	63	50	39	31	1.000	0.969	0.387-2.427
	Anxiety	15	11.9	9	7.1			
Stress	Normal	72	57.1	44	34.9	1.000	1.091	0.292-4.082
	Stress	6	4.8	4	3.2			
Gender	Man	20	15.9	14	11.1	0.821	0.837	0.375-1870
	Women	58	46	34	27			
Age	20-25 yr.	14	11.1	5	4	0.543		
	26-30 yr.	19	15.1	12	9.4			
	31-35 yr.	20	15.9	9	7.1			
	36-40 yr.	12	9.5	8	6.3			
	41-45 yr.	10	7.9	10	7.9			
	>46 yr.	3	2.4	4	3.2			
Marital Status	Unmarried	20	15.9	9	7.1	0.500	1.494	0.617-3.621
	Married	58	46	39	31			
Education	Diploma	34	27	18	14.3	0.626	1.288	0.671-2.689
	Bachelor	44	34.9	30	23.8			
Employment Status	Permanent	61	48.4	37	29.4	1.000	1.067	0.451-2.524
	Contract	17	13.5	11	8.7			

Service period	< 5 yr.	37	29.4	23	18.3	1.000	0.981	0.478-2.015
	>5 yr.	41	32.5	25	19.8			

The table 4 illustrates the relationship between the independent variables and the job performance of the medical workers at General Region Hospital X in Central Java. We can conclude from the above table that there is no significant relationship between all independent variables and job performance.

**Table 5.** Relations between Job Performance and Other Variables for Non-Medical Workers,

Variable		Job Performance				p-Value	OR	CI 95 %
		Good		Bad				
		Σ	%	Σ	%			
Depression	Normal	38	39.6	38	39.6	0.586	1.500	0.551-4.082
	Depression	8	8.3	12	12.5			
Anxiety	Normal	29	30.2	23	24	0.142	2.003	0.885-4.534
	Anxiety	17	17.7	27	28.1			
Stress	Normal	38	39.6	43	44.8	0.860	0.773	0.256-2.333
	Stress	8	8.3	7	7.3			
Gender	Man	9	9.4	21	21.9	0.032	0.336	0.134-0.843
	Women	37	38.5	29	30.2			
Age	< 20-30 yr.	10	10.4	21	21.9	0.006		
	31-40 yr.	10	10.4	18	18.8			
	41-50 yr.	17	17.7	8	8.3			
	>50 yr.	9	9.4	3	3.1			
Marital status	Unmarried	8	8.3	15	15.6	0.228	0.491	0.186-1.300
	Married	38	39.6	35	36.5			
Education	High school	5	5.2	7	7.3	0.815		
	Diploma	19	19.8	22	22.9			
	Bachelor	22	22.9	21	21.9			
Employment Status	Permanent	42	43.8	36	37.5	0.031	4.083	1.234-23.517
	Contract	4	4.2	14	14.6			
Service period	< 5 yr.	11	11.5	25	26	0.015	0.314	0.131-0.754
	>5 yr.	35	36.5	25	26			

Table 5 demonstrates that gender, age, employment status, and service period are significantly related to non-medical workers' job performance at general region hospital X in Central Java. Anxiety, age, gender, marital status, employment status, and service period can all be examined using logistic regression.

**Table 6.** Results of Logistic Regression Tests on the Relationship between Anxiety, Gender, Age, Marital Status, and Service Period toward Job Performance in Non-Medical Workers

Variable	Sig	Exp (B)	95% C. I. for Exp (B)		Nagelkerke R Square
			Lower	upper	
Anxiety	0.008	4.118	1.442	11.763	0.308
Gender	0.006	0.215	0.071	0.645	
Age	0.000	0.388	0.230	0.652	
Marital Status	0.282	2.148	0.534	8.646	
Employment Status	0.305	2.338	0.461	11.847	
Service Period	0.801	0.829	0.193	3.559	

The table 6 illustrates that anxiety (p-value 0.008< 0.05), gender (p-value 0.006<0.05), and age (p-value 0.000<0.05) significantly affect the job performance of non-medical workers

in general region hospital X, Central Java. A Nagelkerke R-squared value of 0.308 indicates that anxiety, gender, and age affect the job performance of non-medical workers at a general region hospital in Central Java by 30.8%.

Mental health in the workplace is critical, especially in hospitals, because it can affect performance as well as both mental and physical health. According to the study, 14.5% of her respondents were depressed, 30.7% were anxious, and 11.3% were stressed. Poor concentration, irritability, anxiety, insomnia, decreased productivity, and interpersonal conflict can result from mental health disorders, which can lead to more severe mental illness and separation from family members in the long run (Pusat Data dan Informasi, Kementerian Kesehatan Republik Indonesia, 2019). Furthermore, mental illness can negatively impact self-perceived job performance in the form of reduced work quality, slower measures, and increased errors (Hennekam et al., 2020), (Amagasa, Nakayama, & Takahashi, 2005).

Participants in the survey were 71.2% female, mostly between the ages of 26 and 30, 76.6% married, 53.2% undergraduates, 79.3% civil servants, and 56.8% had worked for more than 5 years. Although many studies on the mental health of healthcare workers have been conducted, this is the first study to assess the mental health of a non-medical group. According to the study, 9.6% of the medical group suffered from depression, 19% from anxiety, and 8% from stress. Non-medical workers had worse mental health, with 20.9% experiencing depression, 45.8% experiencing anxiety, and 15.6% experiencing stress.

In this study, job performance was similar across populations. The overall rate of poor performance was 44.1%, compared to 38.1% in the medical group and 52.1% in the non-medical group. This study reveals a significant gender relationship in the entire workforce. Anxiety and gender have a large impact on the entire workforce. In addition, this study discovered a relationship between gender, age, employment status, work period, and job performance in non-medical workers. Anxiety, gender, and age all have a 30.8% impact on non-medical job performance. A study conducted by Brolin et al. revealed a positive and significant effect of mental health on job performance among North Tanapuli District Office employees for Tanapuli Health Department employees (Otnie et al., 2021). Another study by William van Gorden et al. examined the work-related mental health and job performance which revealed a significant relationship between mental health and performance (Van Gordon et al., 2014), (Dubey et al., 2020). Novika's essay, "The Role of Work Stress on Individual Work Performance," investigated the effects of job stress on individual performance (Grasiaswaty, 2020).

Factors associated with mental illness for doctors, nurses, or other health care professionals encompass long working hours, a high workload and pressure, a lack of role clarity, a lack of peer support, a lack of commitment to work, and organizational culture (Tennant, 2001), (Karakurt et al., 2023)). For other hospital workers, job overload and pressure, unclear roles, a lack of job control, and a lack of participation have been uncovered to be associated with stress (Chaabouni, 2021), (Weinberg & Creed, 2000), (Michie & Williams, 2003).

The study's limitation is that it is the first to perceive mental health in a large and representative sample of hospital workers from various professional groups and contract terms. Thus, previous research on medical staff morale has mostly concerned on individual groups of professionals, and this represents a significant advance in this area of study. Non-professional factors (personal factors, global problems, etc.; socioeconomic environments, labor market pressures) contributed to the high level of mental health exposure. There were no factors influencing job performance in this study.

A critical need to develop new health policies for strategies to prevent and manage mental illness, as well as improve job performance is highly required. Intervene and support workers who are suffering from mental disorders in order to manage psychological conditions. Conducting mental health education and managing depression, anxiety, and depression can help workers understand the importance of mental health and learn effective coping strategies. Workers' symptoms of mental disorders can be reduced by training and development of coping skills such as relaxation, meditation, and breathing techniques (Baqutayan, 2015), (Maryam, 2017). Cognitive-behavioral therapy (CBT) is employed to help workers understand their own thoughts, feelings, and behaviors in order to reduce the symptoms of mental illnesses (Suwanto, 2020). When necessary, psychologists and psychiatrists provide counseling and therapy. Management, superiors, and coworkers can all contribute to a reduction in workload and an increase in social support in the workplace. Making the workplace a safe, comfortable, and supportive environment can help to reduce mental disorders and increase productivity. Time management, effective communication, and interpersonal skills training can increase workplace productivity while reducing the impact of mental disorders (Abdullah, 2014), (Rad, 2006). Recognizing and appreciating medical and non-medical personnel who work can boost motivation and morale.

#### 4. CONCLUSION

Workers' mental health is a serious problem that affects many aspects of their lives, including their professional, interpersonal, and social lives. Anxiety was reported by 30.7% of respondents, compared to 19% of medical workers and 45.8% of non-medical workers. Anxiety has a negative impact on both medical and non-medical workers' job performance. Anxiety reduces job performance by 30.8% regardless of gender or age. Young age, a lack of work experience, being female, a heavy workload, working in hazardous environments, and a lack of education and social support were all identified as risk factors. Poor job performance can jeopardize patient and worker safety, according to 44.1% of respondents. To control and treat mental health and improve worker productivity, management support, training, and treatment are required.

#### REFERENCES

- Abdullah H. M.S. M. (2014). *Manajemen dan Evaluasi Kinerja Karyawan*. Yogyakarta: Aswaja Pressindo.
- Amagasa, T., Nakayama, T., & Takahashi, Y. (2005). Karojisatsu in Japan: Characteristics of 22 cases of work-related suicide. *Journal of Occupational Health*, 47(2), 157–164. <https://doi.org/10.1539/joh.47.157>
- Baqutayan, S. M. S. (2015). Stress and coping mechanisms: A historical overview. *Mediterranean Journal of Social Sciences*, 6(2 S1), 479. <https://doi.org/10.5901/mjss.2015.v6n2s1p479>
- Chaabouni, A. (2021). The effect of job stress appraisals on mental health among health professionals: The mediating role of work engagement. *European Psychiatry*, 64(Suppl 1), S466. <https://doi.org/10.1192/J.EURPSY.2021.1244>
- Chou, L. P., Li, C. Y., & Hu, S. C. (2014). Job stress and burnout in hospital employees: Comparisons of different medical professions in a regional hospital in Taiwan. *BMJ Open*, 4(2), 1–7. <https://doi.org/10.1136/bmjopen-2013-004185>
- Division of Population Health, National Center for Chronic Disease Prevention and Health Promotion. C. for C. D. P. and H. P. (2018). *Mental Health Disorders and Stress Affect Working-Age Americans*. Division of Population Health, National Center for Chronic Disease Prevention and Health Promotion. Retrieved from <https://www.cdc.gov/workplacehealthpromotion/tools-resources/workplace->

health/mental-health/index.html

- Dubey, S., Biswas, P., Ghosh, R., Chatterjee, S., Dubey, M. J., Chatterjee, S., Lahiri, D., & Lavie, C. J. (2020). Psychosocial impact of COVID-19. *Diabetes and Metabolic Syndrome: Clinical Research and Reviews*, 14(5), 779–788. <https://doi.org/10.1016/J.DSX.2020.05.035>
- Grasiaswaty, N. (2020). The role of work stress on individual work performance: Study in civil servants. *Jurnal Manajemen dan Pemasaran Jasa*, 13(1), 111-126. <https://doi.org/10.25105/jmpj.v13i1.5051>
- Hennekam, S., Richard, S., & Grima, F. (2020). Coping with mental health conditions at work and its impact on self-perceived job performance. *Employee Relations*, 42(3), 626–645. <https://doi.org/10.1108/ER-05-2019-0211>
- Institute for Health Metric and Evaluation. (2019). *Global Burden of Disease “Mental Health” Compare*. The Institute for Health Metrics and Evaluation. Retrieved from <https://vizhub.healthdata.org/gbd-compare/>
- Karakurt, N., Erden, Y., & Sis Çelik, A. (2023). The relationship between nurses’ work stress levels and work-family conflict during the COVID-19 pandemic and the affecting factors: A study from Turkey. *Archives of Psychiatric Nursing*, 42(January 2022), 61–67. <https://doi.org/10.1016/j.apnu.2022.12.015>
- Khamisa, N., Peltzer, K., Ilic, D., & Oldenburg, B. (2016). Work related stress, burnout, job satisfaction and general health of nurses: A follow-up study. *International Journal of Nursing Practice*, 22(6), 538–545. <https://doi.org/10.1111/IJN.12455>
- Kurniawan, A. W. & Puspitaningtyas, Z. (2016). *Metode Penelitian Kuantitatif*. Yogyakarta: Pandiva Buku.
- Maryam, S. (2017). Strategi coping: Teori dan sumberdayanya. *Jurnal konseling andi matappa*, 1(2), 101-107.
- Maslim, R. (2003). *Buku Saku Diagnosis Gangguan Jiwa Rujukkan dari PPDGJ III*. Jakarta: PPDGJ-III
- Michie, S., & Williams, S. (2003). Reducing work related psychological ill health and sickness absence: A systematic literature review. *Occupational and Environmental Medicine*, 60(1), 3–9. <https://doi.org/10.1136/oem.60.1.3>
- Otnie, B. M., Sitompul, R. S., Sihombing, D. R. W., & Damanik, J. B. (2021). Pengaruh Kesehatan Mental Terhadap Kinerja Pegawai Pada Dinas Kesehatan Kabupaten Tapanuli Utara. *JURNAL GLOBAL MANAJEMEN*, 10(2), 8-13. Retrieved from <http://jurnal.darmaagung.ac.id/index.php/global/article/view/1329>
- Pusat Data dan Informasi, Kementerian Kesehatan Republik Indonesia. (2019). *Situasi Kesehatan Jiwa Di Indonesia*. Jakarta: Pusat Data dan Informasi, Kementerian Kesehatan Republik Indonesia .
- Rad, A. M. M. (2006). The impact of organizational culture on the successful implementation of total quality management. *TQM Magazine*, 18(6), 606–625. <https://doi.org/10.1108/09544780610707101>
- Ribanszki, R., S Taylor, K., Scheutzow, J., Saez Fonseca, J. A., & Ponzio, S. (2022). Welfare systems and mental health in OECD and EEA countries: a scoping review. *Humanities and Social Sciences Communications*, 9(1), 1–10. <https://doi.org/10.1057/s41599-022-01391-2>
- Robbins, S.P. and Judge, T.A. (2013). *Organisational Behavior*. 15th edition, Pearson, Boston.
- Rokom. (2021). *Kemenkes Beberkan Masalah Permasalahan Kesehatan Jiwa di Indonesia – Sehat Negeriku*. Kementerian Kesehatan Republik Indonesia.
- Segal, J., Smith, M., & Robinson, L. (2021). *Stress at Work*. HelpGuide.org. Retrieved from

- <https://www.helpguide.org/articles/stress/stress-in-the-workplace.htm>
- Stranks, J. (2005). *Stress at Work Management and Prevention*. Elsevier Butterworth-Heinemann.
- Suwanto, I. (2020). Pendekatan Cognitive Behavior Therapy (Cbt) Teknik Bibliotherapy Sebagai Intervensi Dalam Konseling Kelompok. *JURKAM: Jurnal Konseling Andi Matappa*, 4(1), 7–8. <https://doi.org/10.31100/jurkam.v4i1.479>
- Tennant, C. (2001). Work-related stress and depressive disorders. *Journal of Psychosomatic Research*, 51(5), 697–704. [https://doi.org/10.1016/S0022-3999\(01\)00255-0](https://doi.org/10.1016/S0022-3999(01)00255-0)
- Thomas, J. C. & Hersen, M. (2002). *Handbook of Mental Health in the Workplace*. London: Sage Publications.
- Twistiandayani, R., Prameswari, R. D., & Lestari, N. (2022). Hubungan Dampak Psikologis (Stress Dan Kecemasan) Dengan Kinerja Perawat Di RS Surabaya. *Journals of Ners Community*, 13(1), 89-96. <https://doi.org/10.55129/jnerscommunity.v13i1.1688>
- Van Gordon, W., Shonin, E., Zangeneh, M., & Griffiths, M. D. (2014). Work-Related Mental Health and Job Performance: Can Mindfulness Help? *International Journal of Mental Health and Addiction*, 12(2), 129–137. <https://doi.org/10.1007/s11469-014-9484-3>
- Van Leeuwen, M., Husson, O., Alberti, P., Arraras, J. I., Chinot, O. L., Costantini, A., ... & van de Poll-Franse, L. V. (2018). Understanding the quality of life (QOL) issues in survivors of cancer: towards the development of an EORTC QOL cancer survivorship questionnaire. *Health and quality of life outcomes*, 16, 114. <https://doi.org/10.1186/s12955-018-0920-0>
- Wardhani, M. N. (2021). *Kesehatan Jiwa dalam Dunia Kerja*. Rumah Sakit Dr. H. Marzoeki Mahdi. Retrieved from <https://www.rsmmbogor.com/apps-rsmm/news-detail.do?id=954>
- Weinberg, A., & Creed, F. (2000). Stress and psychiatric disorder in healthcare professionals and hospital staff. *The Lancet*, 355(9203), 533–537. [https://doi.org/10.1016/S0140-6736\(99\)07366-3](https://doi.org/10.1016/S0140-6736(99)07366-3)
- Wisnubrata. (2019). *Waspadai 4 Masalah Mental yang Rentan Terjadi pada Pekerja Kantor*. Kompas.Com. Retrieved from <https://lifestyle.kompas.com/read/2019/01/24/130144920/waspadai-4-masalah-mental-yang-rentan-terjadi-pada-pekerja-kantor>

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**RESEARCH**

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## Factors Affecting Willingness to Pay for National Health Insurance Program among Informal Workers in Indonesia

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### Abstract

The effort to achieve universal health coverage for all people under a single-payer national health insurance in Indonesia still experiences a substantial challenge particularly related to informal workers. This population faces a number of challenges, including income irregularity, a lack of educational variety, the fact that the majority of workers live in rural areas, and a lack of health insurance literacy. The objective of this study was to examine the factors that influence informal workers' willingness to pay for a national health insurance program in Indonesia. This cross-sectional study was conducted in the Banyumas district of Central Java, Indonesia. Employing a multistage random sampling technique, 316 workers in the informal sector were recruited as study participants. Logistic regression was employed to investigate the factors that influence willingness to pay for national health insurance premiums. According to the study findings, urban, national health insurance information, and uneducated factors were related to informal workers' willingness to pay for national health insurance. Workers who lived in urban area ( $p < 0.05$ , OR = 3.922) were more willing to pay for insurance premium. Workers who received better exposure of national health insurance information ( $p < 0.05$ , OR = 2.330) were more willing to pay for premium. Furthermore, workers who uneducated ( $p < 0.05$ , OR = 14.847) were more willing to pay for premium. The national health insurance campaign serves as a catalyst for increasing public awareness of this program. Adequate and widespread national health insurance program information dissemination would aid in the effectiveness of Indonesia's efforts to achieve the goal of universal health insurance coverage.

**Keywords:** Informal Sector, National Health Insurance, Premium, Universal Health Coverage, Willingness to Pay.

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## 1. INTRODUCTION

The effort to provide health care for all has been recommended by the World Health Organization and the World Bank by establishing universal health coverage (UHC) (Barber, et al., 2020), (Meara et al., 2015), (The Lancet Global Health, 2017). The UHC has the ability to protect citizens' financial interests while providing access to health care (Aji et al., 2017). Like other countries, Indonesia has initiated UHC by introducing national health insurance program, administered by *BPJS Kesehatan* since 2014. *BPJS Kesehatan* becomes a single payer insurer that attempts to cover the entire Indonesian population under its scheme. By July 2020, it is expected that 220 million people, or approximately 82% of Indonesia's total population, will be covered by *BPJS Kesehatan* (Pratiwi et al., 2021). During the first year of operation, the number of enrollments was gradually increased. However, a large number of workers, approximately 32.5 million people, or 60.14% of all jobs in Indonesia, who work primarily in the informal sector, have not enrolled in the *BPJS Kesehatan* program.

There are several challenges to covering informal workers under national health insurance because of their working characteristics such as own-account, unpaid family workers with non-standardized working hours, and less than 10 employees and employers working establishments (Andria, 2019), (Deranti, Hartini, & Andria, 2019). As a result, extending health insurance coverage to informal sector workers is one of the most difficult challenges in developing countries, including Indonesia (Lavers, 2019), (Muttaqien et al., 2021), (Okungu et al., 2018). In developing countries, informal workforce accounted for 70% of the employment, and it produced about 35% of the gross domestic product (GDP) (Loayza, 2016). Informality has become a significant issue to address because it is associated with poverty, low productivity, and a lack of social protection. Furthermore, informality contributed to issues such as low health insurance coverage, insufficient access to high-quality health care, and a higher burden of out-of-pocket expenses (Aji, Intiasari, & Masfiah, 2019), (Dartanto, et al., 2020), (Nakamura et al., 2020). According to evidence from other countries, the major challenges encountered in providing health insurance to informal workers include premium collection issues, low enrollment rates, and adverse selection (Dartanto, et al., 2020), (Dartanto et al., 2016). The irregularity of their income was one of several factors that hampered the expansion of health insurance coverage among informal workers (Minyihun, Gebregziabher, & Gelaw, 2019), (Miti et al., 2021).

The initial step in extending health insurance coverage to informal workers is to determine their willingness to pay (WTP) for insurance premiums. Individual willingness to join the insurance scheme with its hypothetical package is reflected in WTP (Basaza et al., 2019), (Garedew et al., 2020). It can be measured using contingent valuation methods (CVM), an open-ended valuation in which people are asked to specify the maximum amount of their WTP for insurance benefits, also known as a "bidding game" (Kim, Lee, & An, 2018). Evidence from other developing countries revealed that informal workers' willingness to pay for health insurance schemes was lower than the premium rate (Ahmed et al., 2016); (Donfouet, et al., 2011), (Jain, 2014). However, few studies have been conducted in Indonesia to investigate the willingness of the informal sector to pay for health insurance. The objectives of this study were to measure WTP for informal sector workers and to identify the factors that influence WTP among selected groups of informal workers.

## 2. RESEARCH METHOD

This study was quantitative study employing cross sectional study design. Data was collected among 316 informal sector workers encompassing drivers, cow-breeder and fish breeder in the district of Banyumas. The study's minimal sample was examined using multi-stage random sampling, but the sample was obtained using an accidental sampling approach because there was no clear sample frame prior to the study's conduct. As inclusion criteria for

this study, a structured questionnaire was administered by a trained enumerator to informal workers who are eligible, i.e., have worked for at least one year in their field and agree to participate voluntarily in research.

WTP was calculated by employing CVM approach. This method has previously been employed elsewhere (Asgary et al., 2004), (Entele & Emodi, 2016), (Gyldmark & Morrison, 2001) Kim, e & An, 2018), (Mohsin, Islam, & Ahmed, 2021). CVM questions were composed either open-ended or discrete questions. In an open-ended valuation questionnaire, the respondents were requested to mention their maximum amount of WTP for the health insurance benefit, frequently understood as “bidding game”. In the first step, a bidding was made to ask the respondents to accept or reject it. Then, depending on the answer, further bidding was adjusted to reach the maximum amount of WTP. The results of the bidding were applied for estimating WTP for national health insurance program premium. The questionnaire also asked about gender, age, educational level, household size, information exposure about health insurance, household income, which was then decomposed using quintiles (quintiles 1 to 5), work duration, health behavior regarding smoking, health condition, and willingness to pay for health insurance premiums as predicted and outcome variables of this study.

Informed consent was employed in order to solicit participation in the study. To ensure clarity, the nature of the survey and the right to participate in the study were also explained in Bahasa or local languages. The data was analyzed using logistic regression. The ethical clearance of this study was approved by the Faculty of Medicine, Jenderal Soedirman University, Indonesia (Letter No. 221/KEPK/VII/2018).

### 3. RESULTS AND DISCUSSION

Out of 316 informal sector workers, 45% had completed junior high school, and almost all of them (96.2%) had a small family (1-4 household members). Only one-quarter (25.6%) have previously been exposed to health insurance (*BPJS Kesehatan*) information. More than half (67.7%) of them work more than 8 hours per day. More than two-thirds of them (78.8%) had a chronic illness condition in the year preceding the study.

**Table 1.** Demographic Characteristic of informal workers.

Characteristics	Frequency (n)	Percentage (%)
Gender		
Male	313	99.1
Female	3	0.9
Age (years old)		
25 - 34	23	7.3
35 - 44	80	25.3
45 - 54	132	41.8
55 - 64	69	21.8
> 65	12	3.8
Education		
No education	17	5.4
Primary school	143	45.3
Junior high school	106	33.5
Senior high school	47	14.9
Diploma and above	3	0.9
Household size		
Small (1 – 4 household member)	304	96.2

Big (> 5 household member)	12	3.8
<i>BPJS Kesehatan</i> information exposure		
Yes	81	25.6
No	235	74.4
Monthly income		
1st Quintile (lowest)	71	22.5
2nd Quintile (lower)	93	29.4
3rd Quintile (middle)	40	12.7
4th Quintile (higher)	55	17.4
4th Quintile (highest)	57	18.0
Work duration (hour/day)		
< 8	97	30.7
> 8	214	67.7
Smoking behavior		
Yes	221	69.9
No	95	30.1
Chronical illness status		
Yes	67	78.8
No	249	21.2

Source: primary data

Informal workers were asked whether they were willing to pay for the health insurance scheme or not. If they are willing to pay, the question about how much money they are willing to pay per member of their family to register for health insurance will be asked. According to Table 2, more than half of informal workers are willing to pay for insurance. The average amount of money they are willing to pay (Table 3) is approximately Rp 24.740, - (1.65 US\$).

**Table 2.** Willingness to pay for the national health insurance among informal workers.

Willingness to pay (WTP)	Frequency (n)	Percentage (%)
Yes	213	67.4
No	103	32.6

**Table 3.** The average amount of WTP among informal workers

WTP	IDR	USD
Minimum	0	0
Maximum	80,000	5.33
Mean	24,740	1.65
Median	25,500	1.70
Standard Deviation	13,217	0.88

Among 316 informal workers, 67.4% are willing to pay for health insurance premium. Using logistic regression (Table 4), it was discovered that rural and urban status, *BPJS Kesehatan* information exposure, and education all had a significant impact on the WTP of informal sector workers in the Banyumas District. Workers who live in cities are three times more willing to pay for insurance than workers who live in rural areas. Informal workers who were exposed to *BPJS Kesehatan* information prior to the study were about two times more willing to pay for health insurance than workers who had not been exposed to *BPJS Kesehatan* information previously. Interestingly, this study also revealed that informal workers who do not have education are 14 times more willing to pay the insurance compare to informal workers who graduated from diploma (colleges).

**Table 4.** Determinants of the WTP among informal workers.

Determinants related to WTP	p-value	OR	95% C.I. for OR	
			Lower	Upper
Age (years old)	0.263		0.061	4.859
25 – 34	0.585	0.543	0.065	2.941
35 – 44	0.395	0.437	0.087	3.576
45 – 54	0.537	0.557	0.186	8.701
55 – 64	0.807	1.271	0.130	2.682
Household size	0.495	0.590	0.455	1.790
Work duration (hour/day)	0.768	0.902		
Monthly income	0.076		0.348	2.190
1st Quintile (lowest)	0.772	0.873	0.861	5.528
2nd Quintile (lower)	0.100	2.182	0.816	8.847
3rd Quintile (middle)	0.104	2.686	0.736	5.765
4th Quintile (higher)	0.169	2.060	0.463	2.236
Chronical illness	0.966	1.017	1.414	10.878
Rural and urban status	0.009	3.922	1.062	5.109
<i>BPJS Kesehatan</i> information exposure	0.035	2.330	0.909	13.458
Marital status	0.069	3.497		
Education	0.301		1.179	186.992
No education	0.037	14.847	0.898	43.760
Primary school	0.064	6.267	0.900	45.427
Junior high school	0.064	6.393	0.716	41.703
Senior high school	0.102	5.464	0.061	4.859

The study unveiled that a large number of informal workers are willing to pay the national health insurance (67.4%), with the average amount of the WTP per month per member of household registered was 1,65 USD. This number was lower compared to other studies of the health insurance WTP in developing countries. Donfouet, et al.,(2011), study revealed that most of respondents who were informal workers in rural Cameroon were willing to pay for national health insurance premium about 2.15 USD (Donfouet et al., 2011). Furthermore, Jain, et al., (2014), study also discovered that WTP for health insurance in rural India was about 2.25 USD per month (Jain et al., 2014). However, a study conducted by Ahmed *et al.* in urban area of Bangladesh uncovered that 86.7% of the informal workers were only willing to pay about 0.8 USD (Ahmed et al., 2016).

This study also investigated whether *BPJS Kesehatan* information exposure and education were significantly associated with WTP of informal sector workers in both rural and urban areas. Previous research on WTP in Sierra Leone discovered that education level and geographic area were significantly related to willingness to pay among informal workers (Jofre-Bonet & Kamara, 2018). Paradoxically, this study revealed that education levels had a significant negative association with WTP. However, previously published studies in China and Bangladesh also uncovered a similar pattern of the negative association between education levels and WTP (Ahmed et al., 2016; Ying et al., 2007).

There are several limitations to this study. First, because this study is limited to informal sector workers, it cannot provide a comprehensive overview of informal sector workers'

willingness to pay for health insurance premiums in Indonesia. Second, due to limitations in describing latent health conditions and the inability to present a significant relationship between chronic disease willingness to pay, this study was unable to investigate the phenomenon of adverse selection.

Despite its limitations, this study supports the evidence of informal workers WTP and identifies its determinants. The findings would help policymakers estimate national health insurance coverage among informal workers by designing an appropriate approach for informal workers premium setting. Furthermore, an innovative premium collection and channeling system for informal workers would significantly increase their enrollment in national health insurance schemes.

#### 4. CONCLUSION

According to the findings of this study, the willingness to pay BPJS Kesehatan premiums is still low and falls below the rate of the national health insurance scheme. However, informal sector workers are quite willing to pay health insurance premiums. Furthermore, informal workers who live in cities and have more knowledge about health insurance are more willing to pay health insurance premiums. The national health insurance campaign serves as a catalyst for increasing public awareness of this program. Adequate and widespread national health insurance program information dissemination would aid in the effectiveness of Indonesia's efforts to achieve the goal of universal health insurance coverage.

#### REFERENCES

- Ahmed, S., Hoque, M. E., Sarker, A. R., Sultana, M., Islam, Z., Gazi, R., & Khan, J. A. M. (2016). Willingness-to-pay for community-based health insurance among informal workers in urban bangladesh. *PLoS ONE*, *11*(2), e0148211. <https://doi.org/10.1371/journal.pone.0148211>
- Aji, B., Intiasari, A. D., & Masfiah, S. (2019). Insights into urban informal workers in indonesia: Health insurance enrollment, adverse selection issue and access to health care. *Indian Journal of Public Health Research and Development*, *10*(3). <https://doi.org/10.5958/0976-5506.2019.00587.4>
- Aji, B., Mohammed, S., Haque, M. A., & Allegri, M. De. (2017). The Dynamics of Catastrophic and Impoverishing Health Spending in Indonesia: How Well Does the Indonesian Health Care Financing System Perform? *Asia-Pacific Journal of Public Health*, *29*(6), 505-515. <https://doi.org/10.1177/1010539517729778>
- Andria, F., Tosida, E. T., Kusnadi, N., & Andriani, S. (2019). Prediction Model of Health Insurance membership for Informal Workers. *American Journal of Humanities and Sosial Sciences Research (AJHSSR)*, *3*(4), 236-246.
- Asgary, A., Willis, K., Taghvaei, A. A., & Rafeian, M. (2004). Estimating rural households' willingness to pay for health insurance. *European Journal of Health Economics*, *5*, 209-215. <https://doi.org/10.1007/s10198-004-0233-6>
- Barber, S. L., O'dougherty, S., Torres, L. V., Tsilaajav, T., & Ong, P. (2020). Other considerations than: How much will universal health coverage cost? *Bulletin of the World Health Organization*, *98*, 95-99. <https://doi.org/10.2471/BLT.19.238915>
- Basaza, R., Kyasiimire, E. P., Namyalo, P. K., Kawooya, A., Nnamulondo, P., & Alier, K. P. (2019). Willingness to pay for community health insurance among taxi drivers in

- kampala city, uganda: A contingent evaluation. *Risk Management and Healthcare Policy*, 12, 133-143. <https://doi.org/10.2147/RMHP.S184872>
- Dartanto, T., Halimatussadiyah, A., Rezki, J. F., Nurhasana, R., Siregar, C. H., Bintara, H., ... Soeharno, R. (2020). Why Do Informal Sector Workers Not Pay the Premium Regularly? Evidence from the National Health Insurance System in Indonesia. *Applied Health Economics and Health Policy*, 18, 81-96. <https://doi.org/10.1007/s40258-019-00518-y>
- Dartanto, T., Pramono, W., Lumbanraja, A. U., Siregar, C. H., Bintara, H., Sholihah, N. K., & Usman. (2020). Enrolment of informal sector workers in the National Health Insurance System in Indonesia: A qualitative study. *Heliyon*, 6(11), E05316. <https://doi.org/10.1016/j.heliyon.2020.e05316>
- Dartanto, T., Rezki, J. F., Pramono, W., Siregar, C. H., Bintara, U., & Bintara, H. (2016). Participation of informal sector workers in Indonesia's national health insurance system. *Journal of Southeast Asian Economies*, 33(3), 317-342. <https://www.jstor.org/stable/44132409>
- Deranti, M., Hartini, S., & Andria, F. (2019). Kendala Pencapaian Target Kepesertaan Program Jaminan Kesehatan Nasional Pekerja Sektor Informal Dalam Mencapai UHC 2019 (Studi Kasus di Kota Bogor). *Jurnal Online Mahasiswa (JOM)*, 4(2), 1-16.
- Donfouet, H. P. P., Makaudze, E., Mahieu, P. A., & Malin, E. (2011). The determinants of the willingness-to-pay for community-based prepayment scheme in rural Cameroon. *International Journal of Health Care Finance and Economics*, 11, 209-220. <https://doi.org/10.1007/s10754-011-9097-3>
- Entele, B. R., & Emodi, N. V. (2016). Health insurance technology in Ethiopia: willingness to pay and its implication for health care financing. *Am J Public Health Res*, 4(3), 98-106.
- Garedew, M. G., Sinkie, S. O., Handalo, D. M., Salgado, W. B., Kehali, K. Y., Kebene, F. G., ... Mengesha, M. A. (2020). Willingness to join and pay for community-based health insurance among rural households of selected districts of jimma zone, southwest Ethiopia. *ClinicoEconomics and Outcomes Research*, 12, 45-55. <https://doi.org/10.2147/CEOR.S227934>
- Gyldmark, M., & Morrison, G. C. (2001). Demand for health care in Denmark: Results of a national sample survey using contingent valuation. *Social Science and Medicine*, 53(8), 1023-1036. [https://doi.org/10.1016/S0277-9536\(00\)00398-1](https://doi.org/10.1016/S0277-9536(00)00398-1)
- Jain, A., Swetha, S., Johar, Z., & Raghavan, R. (2014). Acceptability of, and willingness to pay for, community health insurance in rural India. *Journal of Epidemiology and Global Health*, 4(3), 159-167. <https://doi.org/10.1016/j.jegh.2013.12.004>
- Jofre-Bonet, M., & Kamara, J. (2018). Willingness to pay for health insurance in the informal sector of Sierra Leone. *PLoS ONE*, 13(5), e0189915. <https://doi.org/10.1371/journal.pone.0189915>
- Kim, A. R., Lee, S. M., & An, S. (2018). Estimating the economic value of counselling services using the contingent valuation method. *Psychotherapy Research*, 28(5), 820-828. <https://doi.org/10.1080/10503307.2017.1280197>

- Lavers, T. (2019). Towards Universal Health Coverage in Ethiopia's 'developmental state'? The political drivers of health insurance. *Social Science and Medicine*, 228, 60-67. <https://doi.org/10.1016/j.socscimed.2019.03.007>
- Loayza, N. V. (2016). Informality in the Process of Development and Growth. *World Economy*, 39(12), 1856-1916. <https://doi.org/10.1111/twec.12480>
- Meara, J. G., Leather, A. J. M., Hagander, L., Alkire, B. C., Alonso, N., Ameh, E. A., ... Yip, W. (2015). Global Surgery 2030: Evidence and solutions for achieving health, welfare, and economic development. *The Lancet*, 386(9993), P569-624. [https://doi.org/10.1016/S0140-6736\(15\)60160-X](https://doi.org/10.1016/S0140-6736(15)60160-X)
- Minyihun, A., Gebregziabher, M. G., & Gelaw, Y. A. (2019). Willingness to pay for community-based health insurance and associated factors among rural households of Bugna District, Northeast Ethiopia. *BMC Research Notes*, 12(55). <https://doi.org/10.1186/s13104-019-4091-9>
- Miti, J. J., Perkio, M., Metteri, A., & Atkins, S. (2021). Factors associated with willingness to pay for health insurance and pension scheme among informal economy workers in low- and middle-income countries: a systematic review. *International Journal of Social Economics*, 48(1), 17-37. <https://doi.org/10.1108/IJSE-03-2020-0165>
- Mohsin, M., Islam, M. Z., & Ahmed, M. U. (2021). Awareness and Willingness to Pay for Health Insurance: A Study on Selected Government and Non-Government Employees of Bangladesh. *Journal of Armed Forces Medical College, Bangladesh*, 16(2), 9-13. <https://doi.org/10.3329/jafmc.v16i2.55289>
- Muttaqien, M., Setiyaningsih, H., Aristianti, V., Selby Coleman, H. L., Hidayat, M. S., Dhanalvin, E., ... Kok, M. O. (2021). Why did informal sector workers stop paying for health insurance in Indonesia? Exploring enrollees' ability and willingness to pay. *PLoS ONE*, 16(6), e0252708. <https://doi.org/10.1371/journal.pone.0252708>
- Nakamura, H., Amimo, F., Yi, S., Tuot, S., Yoshida, T., Tobe, M., & Nomura, S. (2020). Implementing a sustainable health insurance system in Cambodia: A study protocol for developing and validating an efficient household income-level assessment model for equitable premium collection. *International Journal for Equity in Health*, 19, 17. <https://doi.org/10.1186/s12939-020-1126-8>
- Okungu, V., Chuma, J., Mulupi, S., & McIntyre, D. (2018). Extending coverage to informal sector populations in Kenya: Design preferences and implications for financing policy. *BMC Health Services Research*, 18,13. <https://doi.org/10.1186/s12913-017-2805-z>
- Pratiwi, A. B., Setiyaningsih, H., Kok, M. O., Hoekstra, T., Mukti, A. G., & Pisani, E. (2021). Is Indonesia achieving universal health coverage? Secondary analysis of national data on insurance coverage, health spending and service availability. *BMJ Open*, 11, e050565. <https://doi.org/10.1136/bmjopen-2021-050565>
- The Lancet Global Health. (2017). Gravitating towards universal health coverage in the new WHO era. *The Lancet Global Health*, 5(7), E633. [https://doi.org/10.1016/S2214-109X\(17\)30224-3](https://doi.org/10.1016/S2214-109X(17)30224-3)
- Ying, X. H., Hu, T. W., Ren, J., Chen, W., Xu, K., & Huang, J. H. (2007). Demand for private health insurance in Chinese urban areas. *Health Economics*, 16(10), 1041-1050. <https://doi.org/10.1002/hec.1206>

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DOI: [10.31965/infokes.Vol21Iss1.965](https://doi.org/10.31965/infokes.Vol21Iss1.965)Journal homepage: <http://jurnal.poltekkeskupang.ac.id/index.php/infokes>**RESEARCH****Open Access****In Silico Analysis of the NPC1L1 Inhibitor of Catechins from Green Tea****Erna Susanti<sup>1a\*</sup>, Ellyvina Setyadini<sup>1b</sup>**<sup>1</sup> Academy of Pharmacy and Food Analyst of Putra Indonesia Malang, Malang, East Java, Indonesia<sup>a</sup> Email address: [abiyatur@gmail.com](mailto:abiyatur@gmail.com)<sup>b</sup> Email address: [ellyvinasd@mail.akfarpim.ac.id](mailto:ellyvinasd@mail.akfarpim.ac.id)

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**Abstract**

The main contributor to cardiovascular disease is atherosclerosis. The Liver X Receptor is one of the unexplored signaling pathways in atherosclerosis that contributes to cholesterol efflux and inhibitory inflammation (LXR). Catechin, as an LXR agonist, influences the expression of the NPC1L1 protein transporter, which inhibits cholesterol absorption. The objective of this study is to predict the NPC1L1 inhibitor of Catechins from Green Tea. The role of NPC1L1 inhibitors is to prevent atherogenesis. Molecular docking is the research method used. Pyrx's Open Babel was used for analysis. Autodock vina in Pyrx was employed for docking, and Chimera v1.8 was administered for visualization. The result of molecular interaction was assigned. Pose view was used in this study. Catechins have the potential to be an NPC1L1 inhibitor, according to the findings. The main parameters used to predict the biological effect were energy bonds, hydrogen bonds, and hydrophobic interactions of molecules with NPC1L1. All Catechins isolates had low affinity energy and a strong affinity for NPC1L1. Epigallocatechin gallate (EGCG) is the most effective inhibitor because it has the lowest binding energy and the most active sites, including Gln 200, Tyr 192, Trp 202, Cys 189, Gly 207, Asp 217, Gly 190, Phe 205, Asp 208. There are hydrogen bonds at Thr 219, Ile 218, Asn 204, Asn 211, Arg 201, and Asn 204. The interaction energy between NPC1L1 and EGCG is -7.5 kCal/mol. Based on the results of the in-silico analysis, the researchers concluded that Catechins have the potential to be an NPC1L1 inhibitor. Further research into molecular dynamic simulation and in vivo analysis is required to demonstrate the synergistic effect of Catechins as an inhibitor of atherogenesis.

**Keywords:** In silico, Catechins, NPC1L1, Atherogenesis.**\*Corresponding Author:**

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## 1. INTRODUCTION

The development of natural products as drugs continues, particularly for degenerative diseases. Because of the high prevalence of cardiovascular disease as a degenerative disease, complementary therapy is required to supplement the main drug. The in-silico methods are one of the research approaches used to demonstrate the activity of natural substances in preventing cardiovascular disease (Suryadi et al., 2021).

The in-silico method is useful for determining the activity of natural substances with pharmacological properties such as analgesic (Suryadi et al., 2021), anticancer (Ervina et al., 2021a; Ervina et al., 2021b; Sulistyowaty et al., 2021), antidiabetic, and recently antivirus (Rendi et al., 2021; Hidayat et al., 2021; Asdaq et al., 2021). On a computational basis, this method predicts drug activity based on drug interactions with receptors. Traditional methods for investigating the activity of natural substances are prohibitively expensive (Brooijmans & Kuntz, 2003; Mukesh & Rakesh, 2011). The in-silico method is now being used more extensively in the search for new compounds for medicinal or nutraceutical ingredients. Molecular docking is commonly used in drug development. Docking is based on the formation of complex proteins and ligands. The docking principle can be used to determine ligand binding to target proteins as well as predict the properties of complex molecules (Gohlke, & Klebe, 2002). The ultimate goal of in silico is to find bioactive compounds with biological effects for drug development. In this docking method, candidate molecules are placed at various positions and suitability on the desired target protein. The pose done assessment is used to determine the exact position (scoring). A high score indicates that the molecule is the best candidate for binding to the target (Halperin et al., 2002; Meng, et al., 2011).

Catechins, as LXR agonists, can reduce the expression of NPC1L1, also known as the Niemann-Pick C1-Like 1, a protein transporter on the apical of enterocytes (Altmann, et al., 2004). NPC1L1 is involved in intestinal cholesterol absorption. Cholesterol from the diet and cholesterol synthesized by HMG CoA are transported through cell membranes by Niemann Pick C1 Like 1 (NPC1L1), and ApoB48 phospholipids, along with triglycerides, are synthesized into triglyceride-rich chylomicrons by Mycrosomal Triglyceride Transport Protein (MTP). With the help of ABCG5/G8, some of the absorbed cholesterol is excreted in the gut.

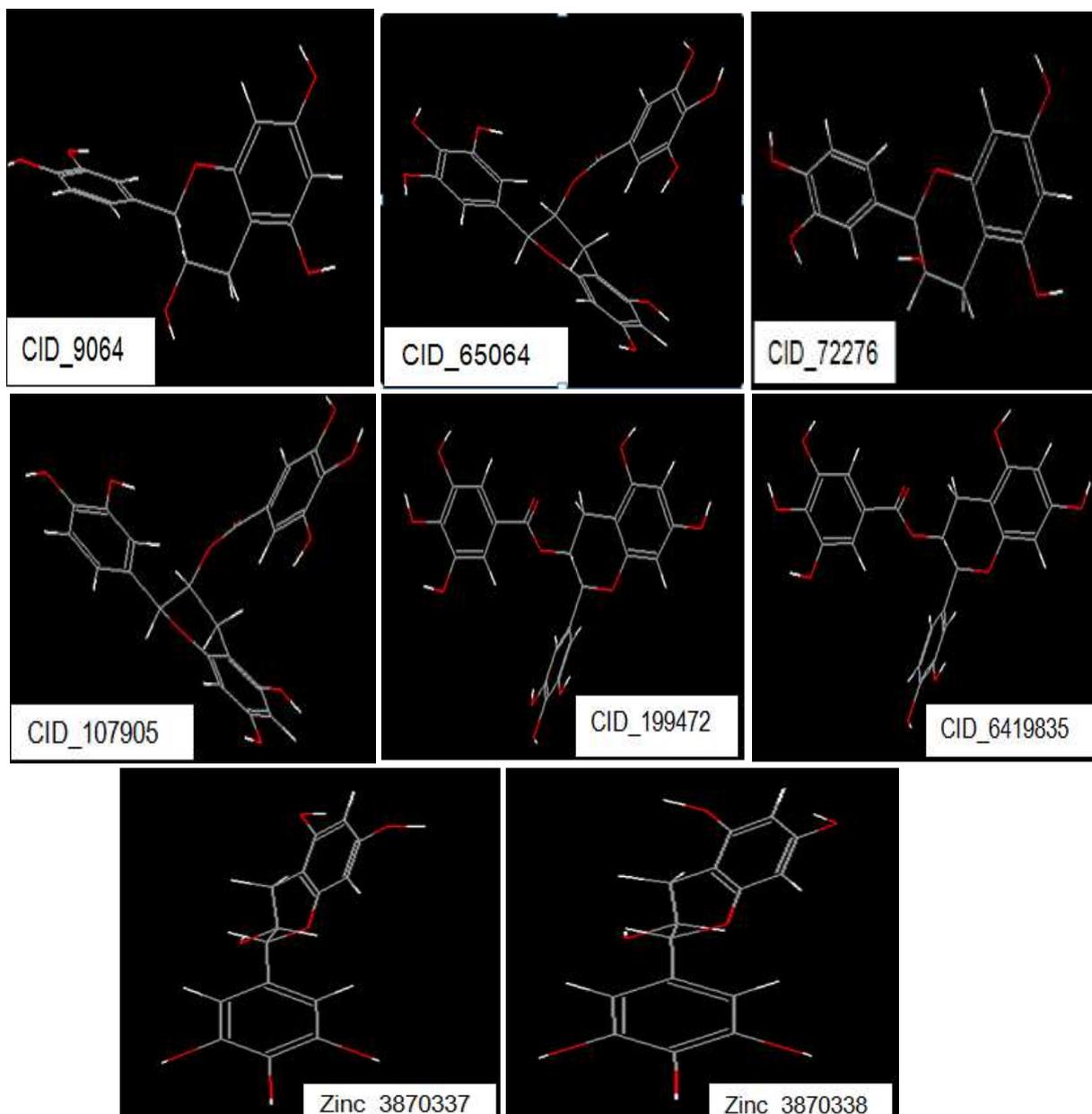
Preliminary studies prove Catechins increase efflux cholesterol macrophage, increase eNOS expression, p 110 PI3K, decrease MMP9 expression, and p 38 MAPK (Susanti, 2021; Susanti, 2012; Susanti, 2015; Susanti 2019). All these factors contribute to the inhibition of atherogenesis. Another mechanism is that NPC1L1 expression parameters inhibit intestinal cholesterol absorption. Catechins' activity as an inhibitor of NPC1L1 must be demonstrated in silico as a predictable activity before in vivo studies are conducted. The objective of this study is to predict the NPC1L1 inhibitor of Catechins from Green Tea. In silico data is required in the early stages of drug discovery to select active compounds. Natural substances as NPC1L1 inhibitors have received little attention. As a result, we will conduct research to identify interactions between NPC1L1 inhibitors and natural substances for the prevention of degenerative diseases.

## 2. RESEARCH METHOD

This research aims to predict the interaction NPC1L1 with Catechins through in silico analysis. A literature review and in silico analysis were performed to ensure the active compounds of Catechins. The Bioinformatic Laboratory Department Biology Universitas Brawijaya Malang assisted in the collection of research data.

## a. Homology modelling.

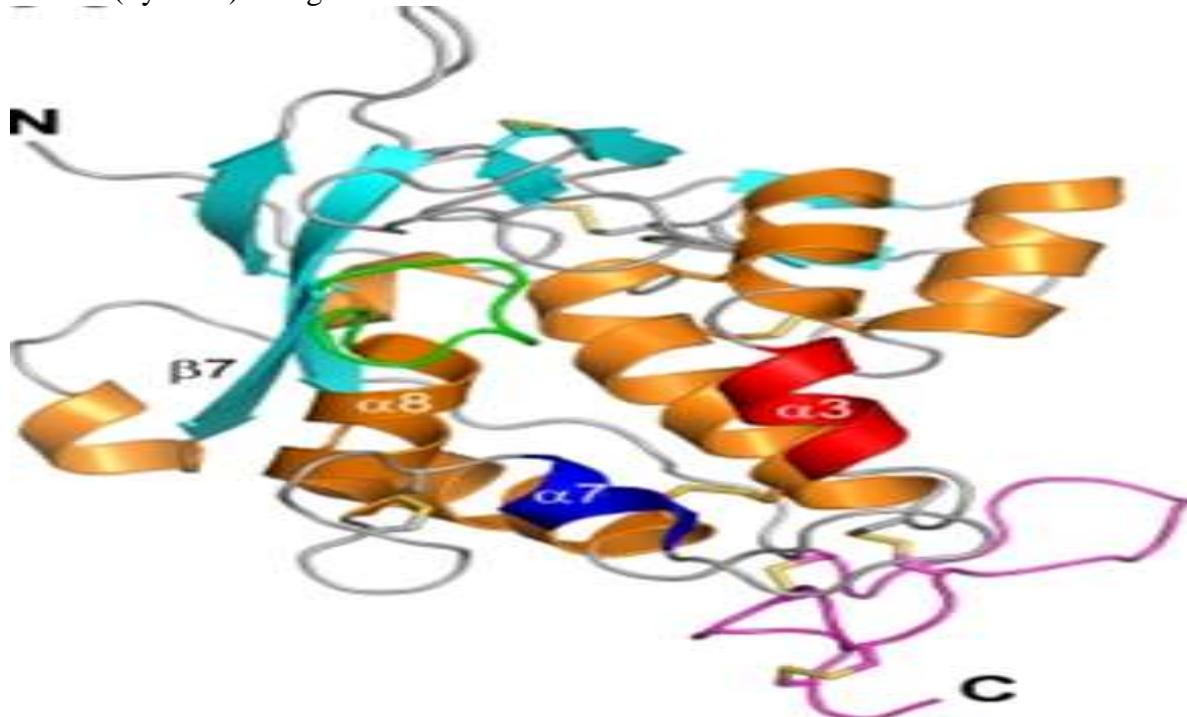
Homology modeling to generate Molecular NPC1L1 employed a web server Swiss Model (Grosdidier, Zoete, & Michielin., 2007; Guex & Peitsch, 1997). This study administered web server PROCHECK to validate 3D structures (Fradera et al., 2010). The active compounds of Catechins from PubChem Compound ZINC database in a file (sdf) (<http://pubchem.ncbi.nlm.nih.gov>).



**Figure 1.** Structure of Catechins in three dimensions; Zinc\_3870337: Gallocatechin, Zinc\_3870338: Epigallocatechin, CID\_9064: (-) Catechin, CID\_199472: Gallocatechin gallate, CID\_65064: EGCG, CID\_6419835: Catechin gallate, CID\_72276: Epicatechin, CID\_107905: Epicatechin gallate

b. The 3D structure of NPC1L1

The Swiss model was used in this study to generate a 3D structure of NPC1L1 (<http://swissmodel.expasy.org>). The 3D structures were visualized by Python Molecular Viewer (PyMOL) 3. Figure 2 demonstrates the 3D Structure of LXR.



**Figure 2.** Three-dimension structure of NPC1L1.

c. Molecular docking study.

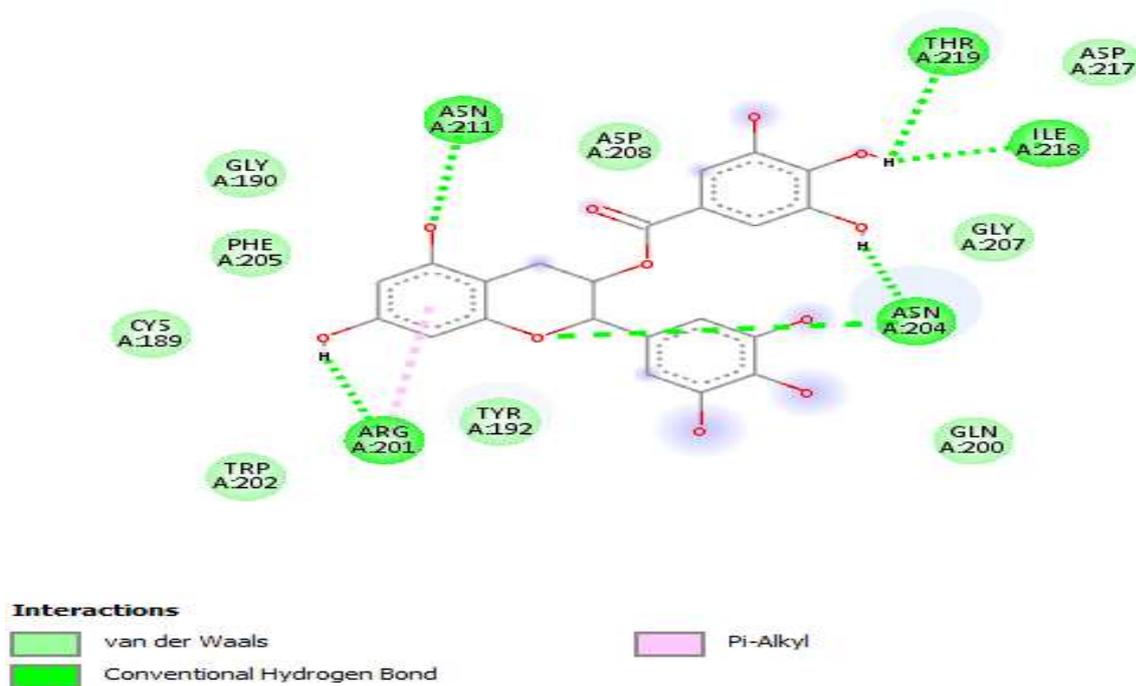
The bond energy strength, the number of hydrogen bonds, and the number of hydrophobic interactions is the three main parameters of in silico analysis. To demonstrate catechins as NPC1L1 inhibitors with the lowest binding energy and the greatest number of hydrophobic interactions and hydrogen bonding. Open Babel in Pyrx was employed for in silico analysis, and Autodock 4.0 in Pyrx was administered for docking. Docking results are determined using Pose view. To see both sides of the interaction, Chimera v 1.8 is required.

### 3. RESULTS AND DISCUSSION

**Table 1.** Binding energy (Kcal/mol) of Catechins with NPC1L1.

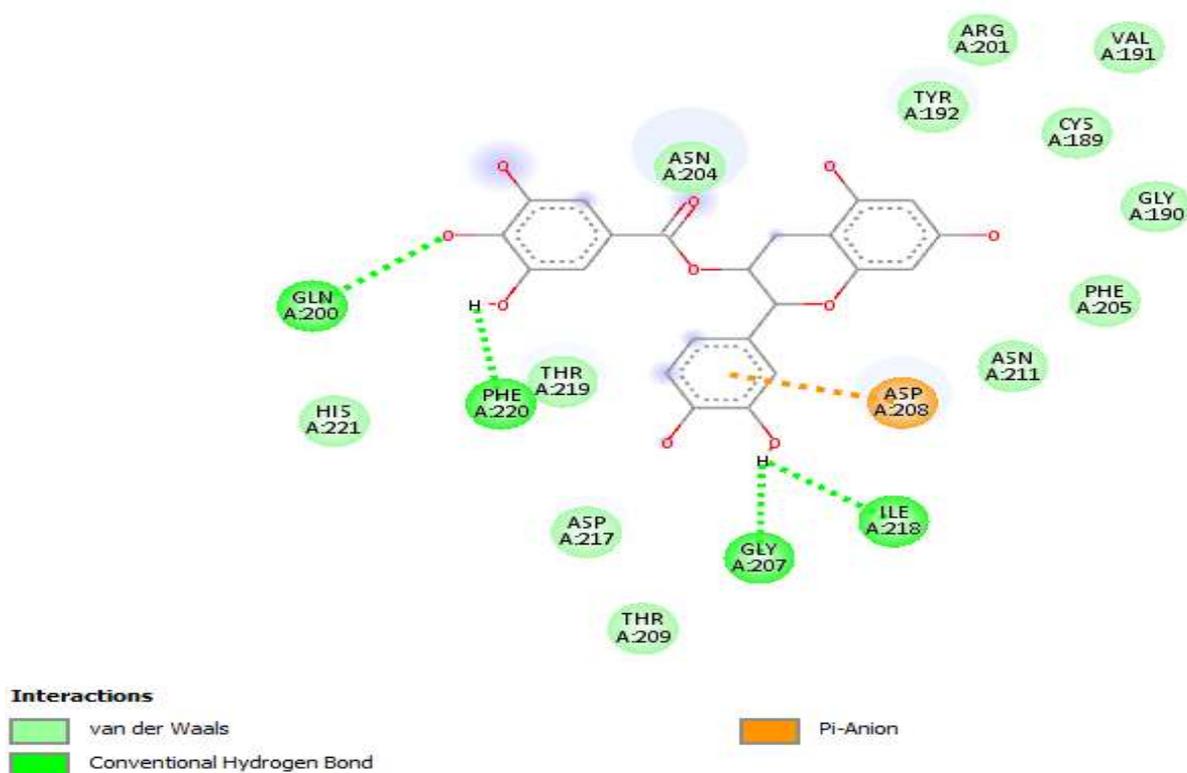
Catechins (Ligan)	NPC1L1 (Receptor)
Epigallocatechin gallate (EGCG)	-7.5
(-)-Catechin gallate (CG)	-7.4
(-)-Gallocatechin Gallate (GCG)	-7.3
(-) Catechin (C)	-6.7
Epigallocatechin (EGC)	-6.6
Epicatechin (EC)	-6.6
Gallocatechin (GC)	-6.5
Ezetimibe (control)	-6.1

Table 1 illustrates binding energy of Catechins with NPC1L1. The binding affinity of Catechins with NPC1L1 had been evaluated.



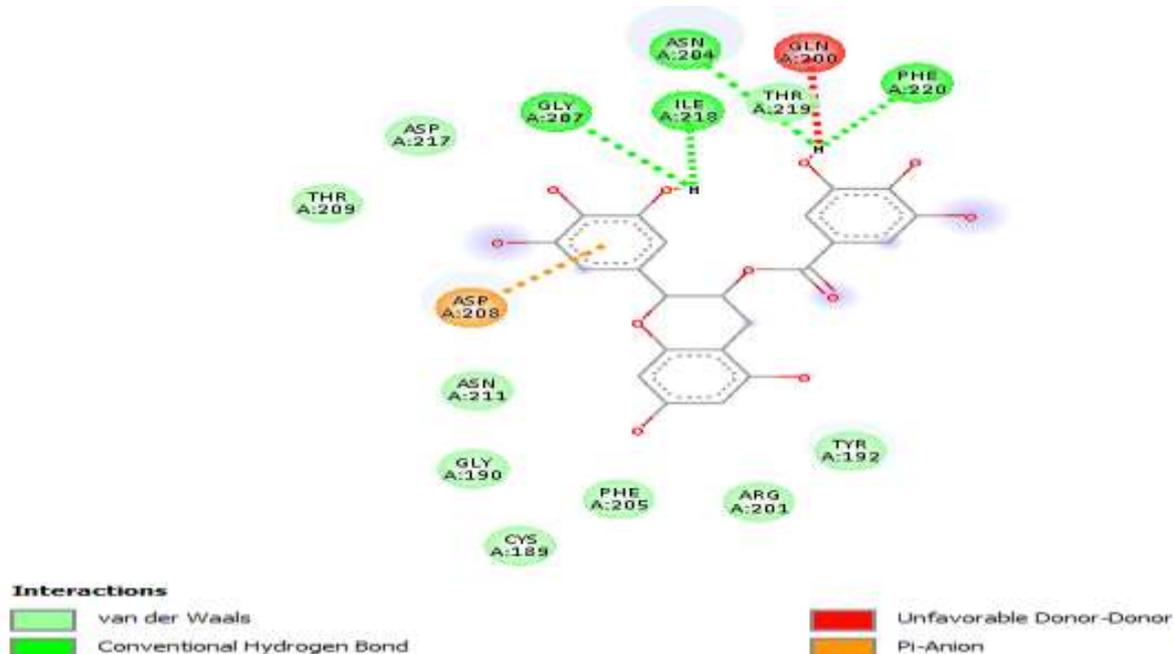
**Figure 3.** The hydrogen bonding and hydrophobic interaction of NPC1L1 with EGCG.

The binding energy of EGCG with NPC1L1 is -7,5 kcal/mol. The hydrogen bonding was at Thr 219, Ile 218, Asn 204, Asn 211, Arg 201, and hydrophobic interactions were at Gln 200, Tyr 192, Trp 202, Cys 189, Gly 207, Asp 217, Gly 190, Phe 205, and Asp 208.



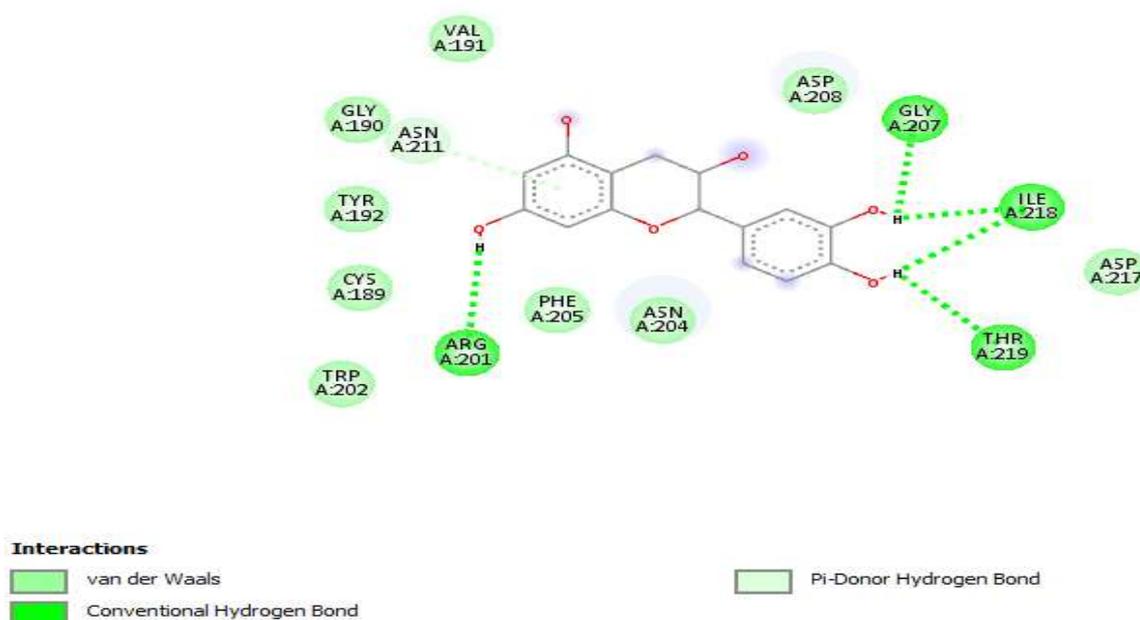
**Figure 4.** The hydrogen bonding and hydrophobic interaction of NPC1L1 with Catechin gallate.

The binding energy of Catechin gallate with NPC1L1 is -7.4 kcal/mol. The hydrogen bond at Gln 200, Phe 220, Gly 207, Ile 218, and hydrophobic interactions at Arg 201, Val 191, Gly 190, Tyr 192, Cys 189, Phe 201, Asn 211, Asn 204, Thr 219, Asp 217, Thr 209, and His 221.



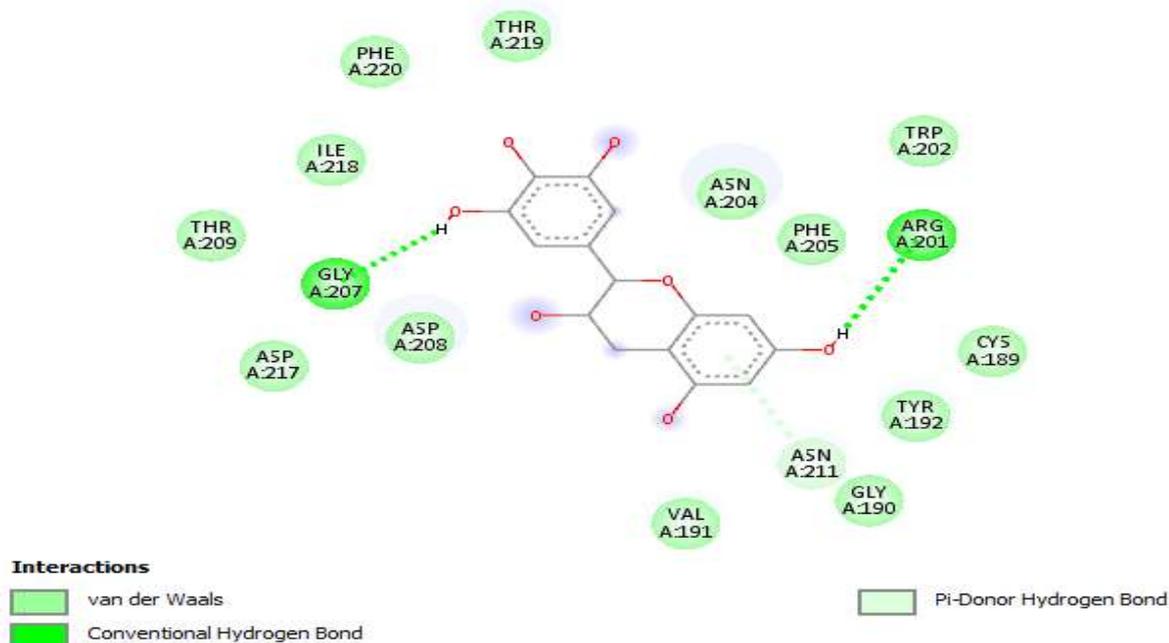
**Figure 5.** The hydrogen bonding and hydrophobic interaction of NPC1L1 with Gallocatechin gallate.

The binding energy of Gallocatechin gallate with NPC1L1 is -7.5 kcal/mol. Meanwhile, the type of bond that is generated is a hydrogen bond at Asn 204, Ile 218, Gly 207, Phe 220, and hydrophobic interactions at Thr 219, Asp 217, Thr 209, Asn 211, Gly 190, Phe 205, Arg 201, Tyr 192, and Cys 189.



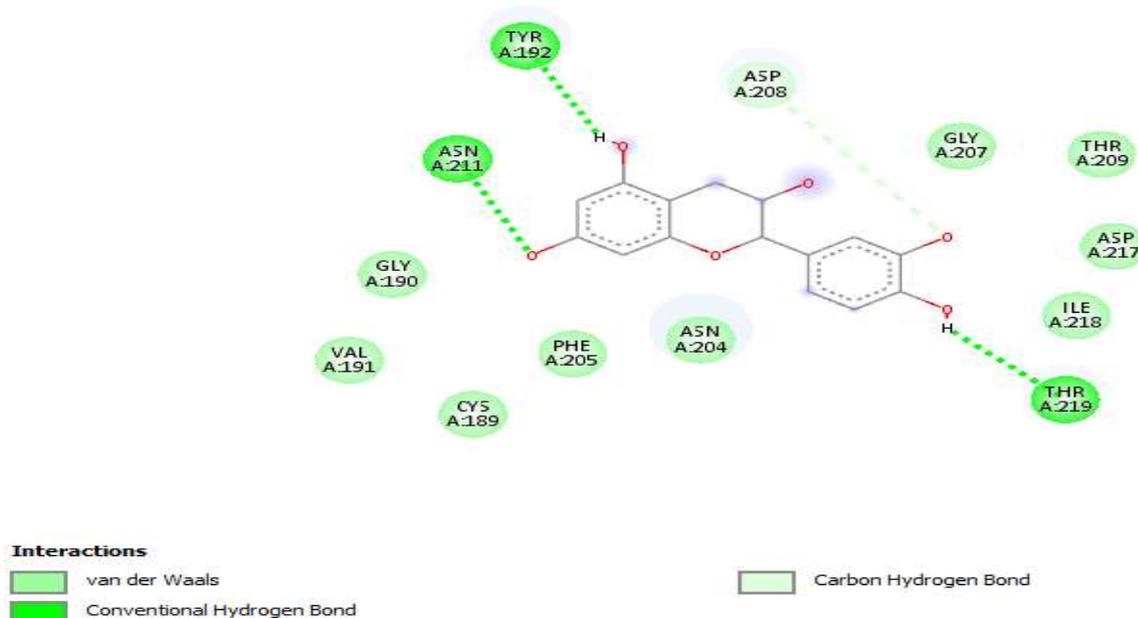
**Figure 6.** The hydrogen bonding and hydrophobic interaction of NPC1L1 with Catechin.

NPC1L1 has a binding energy of -6,7 kcal/mol with Catechin. Hydrophobic interactions at Asp 217, Asp 208, Val 191, Gly 190, Asn 211, Tyr 192, Cys 189, Trp 192, Cys 189, Trp 202, Phe 205, and Asn 204, as well as hydrogen bonds at Arg 201, Thr 219, Ile 218, Gly 207.



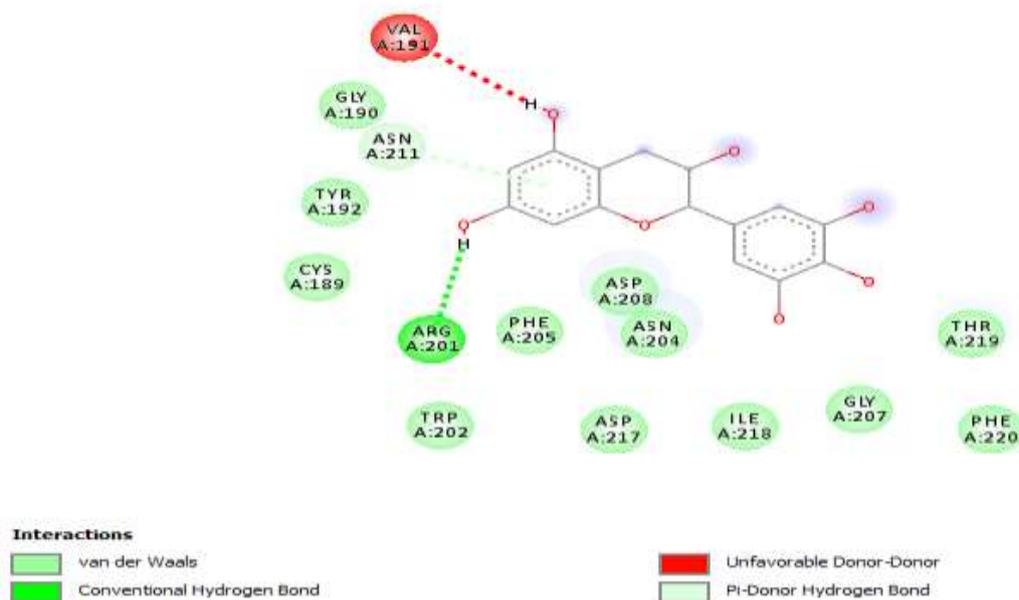
**Figure 7.** The hydrogen bonding and hydrophobic interaction of NPC1L1 with Epigallocatechin.

The binding energy of NPC1L1 with Epigallocatechin is -6,6 kcal/mol. The hydrogen bond is at Gly 207, Arg 201, and hydrophobic interactions at Thr 219, Phe 220, Ile 218, Cys 189, Tyr 192, Val 191, Thr 209, Asn 204, Phe 205, Asn 211, Gly 190, Trp 202, Asp 217, and Asp 208.



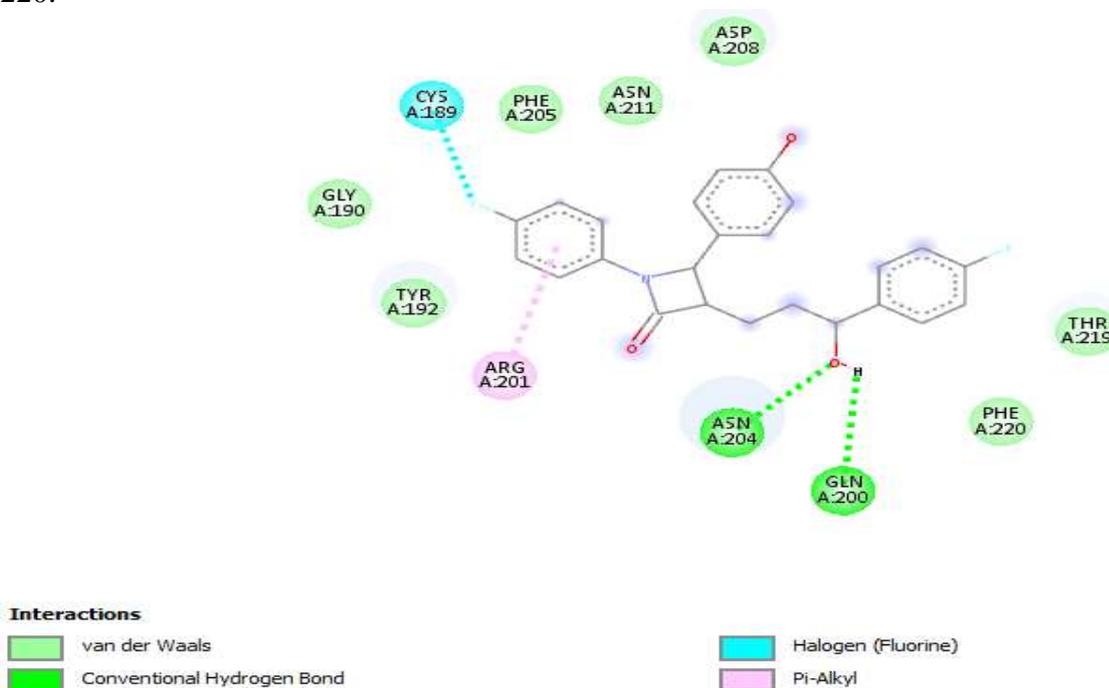
**Figure 8.** The hydrogen bonding and hydrophobic interaction of NPC1L1 with Epicatechin.

NPC1L1 has a binding energy of -6,6 kcal/mol with Epicatechin. Hydrophobic interactions are at Asp 208, Gly 207, Thr 209, Asp 217, Val 191, Ile 218, Asn 204, Phe 205, Cys 189, and Gly 190.



**Figure 9.** The hydrogen bonding and hydrophobic interaction of NPC1L1 with Gallic acid.

The binding energy of NPC1L1 with Gallic acid is -6,5 kcal/mol. The hydrogen bond is at Arg 201 and hydrophobic interactions at Gly 190, Phe 205, Asp 208, Asn 211, Asn 204, Tyr 192, Trp 202, Cys 189, Asp 217, Ile 218, Thr 219, Gly 207, Asp 217, Gly 207, and Phe 220.



**Figure 10.** The hydrogen bonding and hydrophobic interaction of NPC1L1 with Ezetimibe.

NPC1L1 has a binding energy of -6,1 kcal/mol with Ezetimibe. The hydrogen bond is at Asn 204, Gln 200 and hydrophobic interactions at Asp 208, Gly 207, Thr 209, Asp 217, Val 191, Ile 218, Asn 204, Phe 205, Cys 189, Gly 190, Phe 320, Thr 220, Tir 192, Gly 190, Phe 205, Asn 211, and Asn 208.

**Table 2.** Binding energy, hydrogen binding, and hydrophobic interaction of complex Catechins and NPC1L1.

<b>Catechins</b>	<b>Binding Energy (kcal/mol)</b>	<b>Hydrophobic Interaction van der walls</b>	<b>Hydrogen binding</b>
Epigallocatechin Gallate	-7.5	Gln 200, Tyr 192, Trp 202, Cys 189, Gly 207, Asp 217, Gly 207, Asp 217, Gly 190, Phe 205, Asp 208	Thr 219, Ile 218, Asn 204, Asn 211, Arg 201
Catechin Gallate	-7.4	Arg 201, Val 191, Gly 190, Tyr 192, Cys 189, Phe 201, Asn 211, Asn 204, Thr 219, Asp 217, Thr 209, His 221	Gln 200, Phe 220, Gly 207, Ile 218
Gallocatechin Gallate	-7.3	Thr 219, Phe 220, Ile 218, Cys 189, Tyr 192, Val 191, Thr 209, Asn 204 Phe 205, Asn 211, Gly 190, Trp 202, Asp 217, Asp 208	Gly 207, Arg 201
Catechin	-6.7	Asp 217, Asp 208, Val 191, Gly 190, Asn 211, Tyr 192, Cys 189, Trp 192, Cys 189, Trp 202, Phe 205, Asn 204	Arg 201, Thr 219, Ile 218, Gly 207
Epigallocatechin	-6.5	Gly 190, Phe 205, Asp 208, Asn 211, Asn 204, Tyr192, Trp 202, Cys 189, Asp 217, Ile 218, Thr 219, Gly207, Asp 217, Gly 207, Phe 220	Arg 201
Epicatechin	-6.6	Asp 208, Gly 207, Thr 209, Asp 217, Val 191, Ile 218, Asn 204, Phe 205, Cys 189, Gly 190	Tyr 192, Asn 211, Thr 219
Gallocatechin	-6.5	Thr 219, Asp 217, Thr 209, Asn 211, Gly 190, Phe 205, Arg 201, Tyr 192, Cys 189	Asn 204, Ile 218, Gly 207, Phe 220
Ezetimibe	-6.1	Phe 320, Thr 220, Tir 192, Gly 190, Phe 205, Asn 211, Asn 208	Asn 204, Gln 200

The binding energy results of NPC1L1 docking with Catechins were obtained. The order of the binding energy is as follows: EGCG<CG<GCG<C<EGC<EC<GC< Ezetimibe as a positive control. The minimum interaction energy indicates the maximum receptor-ligand interactions (Yu et. al, 2005). Catechins' active compounds all have a low bond energy, indicating the strength of Catechins' binding to target receptors. Previous research suggests that EGCG has the potential to lower cholesterol by inhibiting the HMGCoA reductase enzyme and its binding to LDL receptors. Because EGCG has a low Gibbs free energy, the bond reactions that occur are more spontaneous and form more stable bonds (Adelina & Kurniarti, 2018).

Another parameter used to predict the activity of natural substances is hydrogen bonds. This binding is stronger than others. However, it is weaker than any other covalent or ionic bond. Hydrogen bonds are important in biological systems (Cuff et al., 2006). The molecular structure is one of many factors that influence hydrogen bonds. Catechins contain flavonoids with numerous hydroxyl groups (Kim et al., 2010). Catechins with hydrogen bonds similar to

Azetimibe are EGCG and GC. This interaction's binding site is located at Asn 204. Meanwhile, those with hydrophobic bonds similar to ezetimibe at Asn 211 are GC, EGC, C, GCG, CG. At Gly190 are GC, C, GCG, CG, EGCG. Nonpolar substances have a proclivity to organize hydrophobic interactions by forming aggregates. These aggregates can be dispersed to form micelles in aqueous solutions. A polar carboxyl group will surround the nonpolar. The greater the number of hydrophobic interactions between the ligand and its receptor, the stronger the interaction. Because EGCG from Catechins has the lowest binding energy, it may have the potential to inhibit NPC1L1.

The NPC1L1 sterol transporter is responsible for mediating intestinal cholesterol absorption. NPC1L1 is identified in enterocytes' apical membranes and hepatocytes' canalicular membranes. The other function is hepatobiliary cholesterol excretion that is counterbalanced (Alqahtani et al, 2015). Ezetimibe, a hypercholesterolemic medication, is an NPC1L1 inhibitor. NPC1L1 was discovered through a genomics and bioinformatics approach (Davies, Levy & Ioannou, 2000). The researchers discovered mutations in Niemann-Pick disease type C1, a genetic disorder characterized by lysosomal cholesterol and other lipid accumulation (Mukesh, & Rakesh, 2011). Previous research revealed that NPC1L1 knockout mice and ezetimibe-treated mice have similar reduced intestinal cholesterol absorption, indicating that NPC1L1 is involved in the ezetimibe-sensitive pathway (Janowski et al., 1999).

NPC1L1 inhibition may reduce cholesterol-dependent LXR activation and subsequent LXR-induced hepatic lipogenesis (Weinglass et al., 2008; Pirillo, Catapano & Norata., 2016). Intestinal cholesterol absorption may be necessary for the body to maintain basal LXR activity. According to the results of an in-silico analysis, Catechins have the potential to be an NPC1L1 inhibitor. However, molecular dynamic simulation and in vivo analysis are required to demonstrate a synergistic effect of Catechins as an inhibitor of atherogenesis.

The docking method has a limitation in drug design in that it can only predict protein-ligand interactions statically (Kitchen et al., 2004). More research on molecular dynamic methods is needed to understand how the structure of protein ligands changes over time.

#### 4. CONCLUSION

The conclusion of these studies is Catechins of Green Tea are potential as NPC1L1 inhibitor be based energy bonds, hydrogen bonds and hydrophobic interactions of molecules. The GC>EC>EGC>C>GCG>CG>EGCG has the largest energy binding. Epigallocatechin Gallate (EGCG), the most potent NPC1L1 inhibitor of Catechins, binds to NPC1L1 at numerous active sites including Gln 200, Tyr 192, Trp 202, Cys 189, Gly 207, Asp 217, Gly 190, Phe 205, and Asp 208. EGCG is a potential NPC1L1 inhibitor candidate for preventing atherogenesis.

#### REFERENCES

- Adelina, R. & Kurniatri, A. A. (2018). Mekanisme Katekin Sebagai Obat Antidislipidemia (Uji In Silico). *Buletin Penelitian Kesehatan*, 46(3), 147-154. <https://doi.org/10.22435/bpk.v46i3.899>
- Alqahtani, S., Qosa, H., Primeaux, B., & Kaddoumi, A. (2015). Orlistat limits cholesterol intestinal absorption by Niemann-pick C1-like 1 (NPC1L1) inhibition. *Eur J Pharmacol.*, 762, 263-269. <https://doi.org/10.1016/j.ejphar.2015.05.060>
- Altmann, S. W., Jr Davis, H. R., Zhu, L. J., Yao, X., Hoos, L. M., Tetzloff, G., Iyer, S. P. N., Maguire, M., Golovko, A., Zeng, M., Wang, L., Murgolo, N., & Graziano, M. P. (2004). Niemann-Pick C1 Like 1 protein is critical for intestinal cholesterol absorption. *Science*, 303(5661), 1201–1204. <https://doi.org/10.1126/science.1093131>

- Asdaq, S. M. B., Ikbali, A. M. A., Sahu, R. K., Bhattacharjee, B., Paul, T., Deka, B., Fattepur, S., Widyowati, R., Vijaya, J., Mohaini, M. A., Alsalman, A. J., Imran, M., Nagaraja, S., Nair, A. B., Attimarad, M., & Venugopala, K. N. (2021). Nanotechnology Integration for SARS-CoV-2 Diagnosis and Treatment: An Approach to Preventing Pandemic. *Nanomaterials*, 11(7), 1841. <https://doi.org/10.3390/nano11071841>
- Brooijmans, N., & Kuntz, I. D. (2003). Molecular recognition and docking algorithms. *Annu. Rev. Biophys. Biomol. Struct.*, 32, 335-373. doi: <https://doi.org/10.1146/annurev.biophys.32.110601.142532>
- Cuff, A. L., Janes, R. W., & Martin, A. C. R. (2006). Analyzing the ability to retain sidechain hydrogen bonds in mutant proteins. *Bioinformatics*, 22(12), 1464-1470. <https://doi.org/10.1093/bioinformatics/btl120>
- Davies, J. P., Levy, B., Ioannou, Y. A. (2000). Evidence for a Niemann-Pick C (NPC) gene family: identification and characterization of NPC1L1. *Genomics*, 65(2), 137-145. <https://doi.org/10.1006/geno.2000.6151>
- Ervina, M., Pratama, M. R. F., Poerwono, H., Ekowati, J., Widyowati, R., Matsunami, K., & Sukardiman. (2021). In silico estrogen receptor alpha antagonist studies and toxicity prediction of *Melia azedarach* leaves bioactive ethyl acetate fraction. *Journal of Advanced Pharmaceutical Technology and Research*, 12(3), 236-241. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8300330/>
- Ervina, M., Poerwono, H., Widyowati, R., Otsuka, H., Matsunami, K., & Sukardiman, S. (2021). Pregnane steroids from the leaves of *Melia azedarach* and apoptotic activity against T47D Cells. *Asian Pacific Journal of Cancer Prevention*, 22(6), 1967-1973. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8418864/>
- Fradera, X., Vu, D., Nimz, O., Skene, R., Hosfield, D., Wynands, R., Cooke, A. J., Hauns, A., King, A., Bennett, J., McGuire, R., & Uitdehaag, J. C. M. (2010), X-ray structures of the LXR alpha in its homodimeric form and implications for heterodimer signaling. *J.Mol.Biol.*, 399(1), 120-132. <http://doi.org/10.1016/j.jmb.2010.04.005>
- Grosdidier, A., Zoete, V., & Michielin, O. (2007). EADock: Docking of small molecules into protein active sites with a multiobjective evolutionary optimization. *Proteins*, 67(4), 1010-1025. <http://doi.org/10.1002/prot.21367>
- Guex, N., & Peitsch, M. C. (1997). SWISS-MODEL and the Swiss-PdbViewer: An environment for comparative protein modeling. *Electrophoresis*, 18(15), 2714-2723. <https://doi.org/10.1002/elps.1150181505>
- Gohlke, H., & Klebe, G. (2002) Approaches to the description and prediction of the binding affinity of smallmolecule ligands to macromolecular receptors. *Angew Chem Int Ed Engl*, 41(15), 2644-2676. [https://doi.org/10.1002/1521-3773\(20020802\)41:15<2644::AID-ANIE2644>3.0.CO;2-O](https://doi.org/10.1002/1521-3773(20020802)41:15<2644::AID-ANIE2644>3.0.CO;2-O)
- Halperin, I., Ma, B., Wolfson, H., & Nussinov, R. (2002). Principles of docking: An overview of search algorithms and a guide to scoring functions. *Proteins*, 47(4), 409-443. <https://doi.org/10.1002/prot.10115>
- Hidayat, S., Cahyohartoto, A., Dewi, A. U., Mukminah, I. A., & Sigalingging, O. S. (2021). Uji Aktivitas Senyawa Bahan Alam terhadap Enzim Mpro pada SARS-CoV-2 Secara In Silico. *JURNAL FARMASI DAN ILMU KEFARMASIAN INDONESIA*, 8(3), 235-241. <https://doi.org/10.20473/jfiki.v8i32021.235-241>
- Janowski, B. A., Grogan, M. J., Jones, S. A., Wisely, G. B., Kliewer, S. A., Corey, E. J., & Mangelsdorf, G. J. (1999). Structural requirement of ligands for oxysterol liver X receptors LXR $\alpha$  and LXR $\beta$ . *Proc. Natl. Acad. Sci.*, 96(1), 266-271. <https://doi.org/10.1073/pnas.96.1.266>

- Kim, H., Kim, J. K., Kang, L., Jeong, K., & Jung, S. (2010). Docking and scoring of quercetin and quercetin glycosides against  $\alpha$ -amylase receptor. *Bull. Korean Chem. Soc.*, 31(2), 461- 463. <https://doi.org/10.5012/bkcs.2010.31.02.461>
- Kitchen, D. B., Decornez, H., Furr, J. R., & Bajorath, J. (2004). Docking and scoring in virtual screening for drug discovery: methods and applications. *Nature reviews Drug discovery*, 3(11), 935-949. <https://doi.org/10.1038/nrd1549>
- Leach, A. R. (2000). *Molecular Modelling: Principle and Applications*. 2<sup>nd</sup> ed. Pearson Education.
- Meng, X. Y., Zhang, H. X., Mezei, M., & Cui, M. (2011). Molecular docking: a powerful approach for structure-based drug discovery. *Current computer-aided drug design*, 7(2), 146-157. <https://doi.org/10.2174/157340911795677602>
- Mukesh, B., & Rakesh, K. (2011). Molecular docking: A review. *IJRAP*, 2(6), 1746-1751.
- Pirillo, A., Catapano, L.A., Norata, D.G. (2016). Niemann-Pick C1-Like 1 (NPC1L1) inhibition and cardiovascular disease. *Curr Med Chem.*, 23(10), 983-999. <https://doi.org/10.2174/0929867323666160229114111>
- Rendi, I. P., Maranata, G. J., Chaerunisa, H., Nugrahaeni, N., & Alfathonah, S. S. (2021). Molecular Docking of Compounds in Moringa oleifera Lam with Dipeptidyl Peptidase-4 Receptors as Antidiabetic Candidates. *Jurnal Farmasi dan Ilmu Kefarmasian Indonesia*, 8(3), 242–249. <https://doi.org/10.20473/jfiki.v8i32021.242-249>
- Sulistiyowaty, M. I., Widyowati, R., Putra, G. S., Budiati, T., & Matsunami, K. (2021). Synthesis, ADMET predictions, molecular docking studies, and in-vitro anticancer activity of some benzoxazines against A549 human lung cancer cells. *Journal of Basic and Clinical Physiology and Pharmacology*, 32(4), 385-392. <https://doi.org/10.1515/jbcpp-2020-0433>
- Susanti, E. (2001). Aktivitas Katekin Terhadap Stabilisasi Plak (Dalam Rangka Memperkecil Resiko Serangan Jantung). *El-Hayah*, 2(2), 78-84. <https://doi.org/10.18860/elha.v2i2.2214>
- Susanti, E. (2019, June). In silico analysis of bioactive compounds of Hibiscus sabdariffa as potential agonists of LXR to inhibit the atherogenesis process. In *AIP Conference Proceedings* (Vol. 2108, No. 1, p. 020008). AIP Publishing LLC. <https://doi.org/10.1063/1.5109983>
- Susanti, E., Rudijanto, A., & Ratnawati, R. (2012). Catechins inhibit atherosclerosis in male rats on a high fat diet. *Universa Medicina*, 31(2), 81-87. Retrieved from <https://univmed.org/ejurnal/index.php/medicina/article/view/99>
- Suryadi, A., Siswodihardjo, S., Widiandani, T., & Widyowati, R. (2021). Structure modifications of pinostrobin from Temu Kunci (*Boesenbergia pandurata* ROXB. SCHLECHT) and their analgesic activity based on in silico studies. *Research Journal of Pharmacy and Technology*, 14(4), 2089-2094. <https://doi.org/10.52711/0974-360X.2021.00370>
- Susanti, E.M., Ciptati, C., Ratnawati, R., Aulanni'am, A., & Rudijanto, A. (2015). Molecular docking of Catechins with LXR $\alpha$  and LXR $\beta$  as potensial inhibitor atherogenesis. *Int. J. Pharm. Tech. Res.*, 8(3), 340-346.
- Weinglass, A. B., Kohler, M., Schulte, U., Liu, J., Nketiah, E. O., Thomas, A., Schmalhofer, W., Wiliam, B., Bildl, W., McMasters, D. R., Dai, K., Beers, L., McCann, M. E., Kaczorowski, G. J., Garcia, M. L. (2008). Extracellular loop C of NPC1L1 is important for binding to Ezetimibe. *Proc Natl Acad Sci.*, 105(32), 11140–11145. <https://doi.org/10.1073/pnas.0800936105>

Yue, L., Ye, F., Gui, C., Luo, H., Cai, J., Shen, J., Chen, K., Shen, X., Jiang, H. (2005). Ligand-binding regulation of LXR/RXR and LXR/PPAR heterodimerizations: SPR technology-based kinetic analysis correlated with molecular dynamics simulation. *Prot. Sci.*, 14, 812–822. <https://doi.org/10.1110/ps.04951405>

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**RESEARCH**

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## The Impact of Visfatin Level Against Blood Pressure Among Pregnant Women

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### Abstract

Visfatin, a protein with a molecular weight of 52 kDa, has been demonstrated to increase in the bloodstream. Visfatin has been shown in several studies to be a potential marker of preeclampsia. The objective of this study was to describe visfatin levels in pregnant women in Gianyar, Bali. An observational design was employed in this study to describe visfatin levels in 41 pregnant women in Ubud, Gianyar regency, Bali. Visfatin levels were determined by examining EDTA blood samples using the Elisa method and reading them at 450 nm on a microplate reader. The average value of visfatin levels was 6.49 ng/ml, according to the results. The average visfatin level based on hypertension blood pressure respondents was 3.74 ng/ml. This result was lower than that of normal blood pressure respondents. This study's decrease in visfatin levels may have a smaller effect on physiological insulin resistance. The average visfatin level in second trimester respondents was 7.9 ng/ml higher than 5.7 ng/ml in third trimester respondents. The increase in visfatin levels suggests that visfatin may play a role in the pathogenesis of preeclampsia. Visfatin has the potential to be used as a biomarker to detect preeclampsia earlier, allowing pregnant women with preeclampsia to receive appropriate treatment.

**Keywords:** Preeclampsia, Pregnant Women, Visfatin.

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## 1. INTRODUCTION

Visfatin is a protein with a molecular weight of 52 kDa that is primarily discovered in visceral adipose tissue. This protein has 491 amino acids. Visfatin is also produced in the fetal, placental, and myometrium membranes (Fukuhara et al., 2005; Ihsan, Rini, & Yaswir, 2016; Marseglia et al., 2015). The visfatin/PBEF gene product was first identified as a lymphocyte-produced cytokine that promotes lymphocyte maturation and inhibits neutrophil apoptosis, hence the name pre-B-cell colony enhancing factor (PBEF). It was later discovered that nicotinamide phosphoribosyl transferase (Nampt), an intracellular form of visfatin, is a key enzyme in the biosynthesis of nicotinamide adenine dinucleotide (NAD) (Marseglia et al., 2015; Nourbakhsh et al., 2015).

Visfatin is insulin-mimetic and immunoregulatory. Visfatin has been associated with an increase in circulating blood levels in insulin-resistant conditions such as obesity, type II diabetes, and gestational diabetes (Ferreira et al., 2013; Hu et al., 2008). In pregnancies with preeclampsia, maternal circulating levels of visfatin are frequently elevated (Ferreira et al., 2013; Gorska et al., 2009).

Preeclampsia is a leading cause of maternal and fetal mortality and morbidity throughout the world. Preeclampsia is estimated to affect 2%-8% of all pregnancies worldwide, where the number of cases of hypertension caused by pregnancy (including preeclampsia) is on the rise and is the most common complication of pregnancy (ACOG Committee on Obstetric Practice, 2020). Although maternal mortality in patients with preeclampsia is very rare, the frequency of perinatal mortality is between 5%-14%. This figure escalates significantly when the patients have eclampsia (seizures). The frequency of complications that occur is associated with the gestational age at which preeclampsia began, the severity of the disease, and other medical problems (Leveno, 2018). Placental abruption, cerebrovascular injury, acute renal failure, pulmonary edema, and Hemolysis Elevated Liver Enzymes and Low Platelets (HELLP) syndrome are all examples of maternal morbidity. Preterm birth and intrauterine growth retardation (IUGR) are two short-term fetal consequences observed in nearly 25% of cases (Coban et al., 2020; Ukah et al. 2018).

In High blood pressure disorders account for 16% of maternal deaths in developing countries. In 2015, the maternal mortality rate during pregnancy, childbirth, and postpartum was 305 per 100,000 live births in Indonesia. In Indonesia, the leading causes of maternal death are bleeding, hypertension during pregnancy, and infection (ACOG Committee on Obstetric Practice, 2020; Kementerian Kesehatan Republik Indonesia, 2018). However, the etiology and pathophysiology is still unclear (ACOG Committee on Obstetric Practice, 2020). As a result, proper examination and treatment are required in cases of preeclampsia in pregnant women in order to prevent maternal mortality and childbirth

Visfatin may be a biologic marker of the metabolic syndrome in the context of preeclampsia, where circulating levels are identified to be elevated and placental disturbances occur. According to one study, visfatin levels in patients with preeclampsia were significantly higher in those with increased uterine artery impedance than in those with normal uteroplacental perfusion (Ferreira et al., 2013; Gorska et al., 2009).

The human placenta is now thought to be an active organ capable of secreting substances such as inflammatory cytokines and adipokines, which may contribute to insulin resistance. Furthermore, the placenta, a unique fetal organ during pregnancy, was found to express significant levels of visfatin in normal pregnancies (Ma et al., 2010). Visfatin is believed to have significance in the regulation of glucose balance. Type 2 diabetes, obesity, intrauterine growth retardation (IUGR), and gestational diabetes have a strong influence on its levels in blood plasma (Salan, 2017). Several studies have revealed that circulating of visfatin is

increased in pregnant women with IUGR and preeclampsia when compared to healthy pregnant women (Gorska et al., 2009).

Several studies have unveiled that visfatin possesses potential as a marker of preeclampsia. Hu et al., (2008) and Mazaki-Tovi et al., (2010) uncovered that visfatin levels in pregnant women decreased and were not much different from normal pregnant women (Hu et al., 2008; Mazaki-Tovi et al., 2010). Meanwhile, Fasshauer et al., (2008) revealed that visfatin levels were elevated in pregnant women with preeclampsia (Fasshauer et al., 2008).

Based on the 2018 Gianyar Health Agency Performance Report, the high maternal and infant mortality rates continue to be issues in carrying out activities in 2018 (Dinas Kesehatan Kabupaten Gianyar, 2020). Preeclampsia, as one of the leading causes of maternal death, necessitates the development of a widely applicable and affordable test that can diagnose asymptomatic preeclampsia and identify and monitor patients at risk. Thus, women and their children will receive the best prenatal care possible. A similar test would be useful for confirming a perplexing clinical diagnosis and for further research to determine prophylactic or temporary treatment. As a result, we selected Gianyar Regency as the research location for this study, specifically the Ubud sub-district. The objective of this study was to describe visfatin levels in pregnant women in Gianyar, Bali.

## 2. RESEARCH METHOD

An observational design was used in this study to describe visfatin levels in pregnant women with preeclampsia in Ubud sub-district, Gianyar regency, Bali. The study was conducted in the Laboratory of the Medical Laboratory Technology Department of the Health Polytechnic of the Polytechnic Ministry of Health Denpasar from June to October 2022. This research has been approved by the code of ethics with the number LB.02.03/EA/KEPK/0082/2022 from health ethics committee of the Polytechnic of health Denpasar.

The number of samples in this study was 41 women, with inclusion criteria were pregnant women. Meanwhile, the exclusion criteria were pregnant women with special pregnancy conditions (ex: congenital disease, chronic disease, inflammatory treatment). We administered informed consent, which is a consent form as a respondent, to express pregnant women's willingness to participate in this study. The research interview sheet was used as a guideline for conducting interviews and recording respondents' interview results. Direct interviews with respondents were conducted to gather information about their identities and willingness to become respondents. Blood samples were obtained from respondents who agreed to the informed consent. A molecular analysis was performed on the blood sample. The blood examination results are processed as research data. Respondents who have agreed to the informed consent were taken blood samples. Plasma was collected using EDTA as an anticoagulant. Samples were centrifuged for 15 minutes at 2000-3000 rpm at 2-8°C.

A total of 40µl of sample was added to the sample well and then 10µl of anti-Visfatin antibody was applied to the sample well, then 50µl of streptavidin-HRP was added to the sample well and wells. Mixed well. Apply sealer to the plate. Incubated at 37°C for 60 minutes. Then, washed it five times with a washing buffer. For each wash, the well is immersed in at least 0.35 ml of wash buffer for 30 seconds to 1 minute. All wells were aspirated and washed 5 times with wash buffer before being filled with wash buffer. The dish was dried on a paper towel or other absorbent material 50µl of substrate solution A was added to each well, then 50µl of substrate solution B was added to each well. The incubation plate was covered with a new sealer for 10 minutes at 37°C in the dark. Added 50µl Stop Solution to each well. Within 10 minutes of adding the stop solution, the optical density (OD value) of each well was

determined immediately using a microplate reader set to 450 nm. The data obtained were recorded, collected, processed, and presented in the form narratives, tables, and graphs.

### 3. RESULTS AND DISCUSSION

This descriptive study with an observational design encompassed 41 pregnant women in the Ubud District, Gianyar Regency, Bali. The description of the characteristics of research subjects was based on age, gestational age, and blood pressure can be seen in Table 1.

**Table 1.** The Characteristics of Research Subjects.

Characteristics	Total	
Age	20-30 years	24
	31-40 years	14
	41-50 years	3
Gestational Age	1-13 weeks	5
	14-27 weeks	18
	28-41 weeks	18
Blood Pressure	90/60 - 120/80 mm Hg	28
	121/81 – 139/89 mm Hg	12
	>140/90 mm Hg	1

The results of the examination of visfatin levels employing the Elisa method showed the average value of visfatin levels for 41 respondents was 6.49 ng/ml with the lowest level of 2.56 ng/ml and the highest level of 38.14 ng/ml. According to the findings of this study, the most age group of respondents was between the ages of 20 and 30. There were 18 respondents in the second trimester and 18 respondents in the third trimester among the 41 respondents. There are 28 people who have normal blood pressure.

**Table 2.** The Visfatin Levels Based on Blood Pressure.

Visfatin Levels (ng/ml)			Blood Pressure Category
Min	Max	Mean	
2.6	38.1	7.4	Normal
2.7	14.7	4.7	Pre-Hypertension
2.9	3.7	3.74	Hypertension

Based on the results obtained, the average visfatin level was classified into three categories based on the respondent's blood pressure, namely normal blood pressure, high blood pressure, and low blood pressure. ( $\leq 120/80$  mm Hg), prehypertension ( $121/81$  mm Hg –  $139/89$  mm Hg), and hypertension ( $\geq 140/90$  mm Hg) (National High Blood Pressure Education Program 2004).

**Table 3.** The Visfatin Levels Based on Gestational Age.

Visfatin Levels (ng/ml)			Gestational Age
Min	Max	Mean	
2.8	6.8	4.2	First Trimester
2.6	38.1	7.9	Second Trimester
2.7	14.7	5.7	Third Trimester

The visfatin level based on the respondent's gestational age, which is categorized into the first trimester (1-13 weeks), second (14-27 weeks), and third (28-41 weeks).

Visfatin is an adipokine produced by visceral tissue, but it is also expressed in the placenta and fetal membranes during pregnancy. Visfatin is insulin-mimetic and immunoregulatory. Visfatin levels in the blood have been identified as being elevated in

insulin-resistant states such as obesity, type II diabetes, and gestational diabetes (Ferreira et al. 2013; Hu et al., 2008). According to Kar, (2014) and Salan, (2017) visfatin is one of the biomarkers of preeclampsia markers. Visfatin is an adipokine secreted by adipose tissue that plays a significant role in the biosynthesis of nicotinamide adenine nucleotide by catalyzing the condensation of nicotinamide with 5-phosphoribosyl-1-pyrophosphate to produce nicotinamide mononucleotide. Visfatin is also involved in the regulation of glucose homeostasis. Changes in plasma levels have been associated with a number of disorders, including type 2 diabetes mellitus, obesity, fetal growth retardation, and gestational diabetes mellitus. Visfatin levels are also related to the severity of preeclampsia (Fasshauer et al., 2007; Kar, 2014; Salan 2017).

Preeclampsia is a common pregnancy condition characterized by edema, hypertension, and proteinuria that occurs after 28 weeks of gestation and has an unknown cause. Early preeclampsia develops between 20 and 34 weeks of gestation, while late preeclampsia develops at or after 34 weeks (Dhariwal & Lynde 2017). Preeclampsia was discovered to be a direct threat to health from hypertension, which also increased cardiovascular disorders during pregnancy and was linked to an increase in cardiovascular disease later in life. Furthermore, it is a major cause of maternal and fetal mortality and morbidity (Shaheen et al. 2016). Predicting whether or not a pregnancy will result in preeclampsia is critical to ensuring that pregnant women receive the best care possible. There is currently no preventive therapy, thus, predicting the risk of preeclampsia should lead to more optimal treatment of patient hypertension development and reduce the severity of the disease (Dhariwal & Lynde, 2017).

There has been no consistent use of a therapy to prevent the development of preeclampsia. This is most likely due to the fact that the pathogenesis of the disease occurs several weeks before the patient develops symptoms. The majority of treatment aims to reduce the effects of inflammation, which manifests in later disease (Dhariwal & Lynde, 2017). Aspirin is the only therapy that has been shown to reduce the risk of preeclampsia in high-risk women. If given before 16 weeks of gestation, aspirin is effective in lowering the risk of preeclampsia (Fox et al., 2019). Low-dose aspirin has been proposed as a therapy to reduce the occurrence of preeclampsia. Endothelial dysfunction and the resulting activation of the platelet and clotting system are thought to be crucial aspects of preeclampsia symptoms. Aspirin is thought to reduce the frequency and severity of preeclampsia by inhibiting thromboxane formation (Dhariwal & Lynde, 2017). Low-dose aspirin has been demonstrated to be beneficial in pregnant women at moderate to high risk, reducing the incidence of preeclampsia by about 15% (Askie et al., 2007; English, Kenny, & McCarthy, 2015).

One of the factors influencing the presence or absence of potential obstetric emergencies is age. Age is a risk factor for severe preeclampsia as well. Preeclampsia is said to be more prevalent in mothers over the age of 40. Adeline, Laksana, and Atika, (2018) discovered severe preeclampsia in the 17-34 age group out of 175 (73%) cases in their study (Adeline, Laksana, & Atika, 2018). Other research has demonstrated that being over 40 years old increases the risk of preeclampsia. Women over the age of 40, women with a history of preeclampsia, obesity before pregnancy, and women with donor eggs, donor embryos, or donor insemination all increase the risk of preeclampsia. Diabetes, pre-existing hypertension, and a family history of preeclampsia are all risk factors. Furthermore, various paternal factors can increase the risk of a preeclamptic pregnancy (English, Kenny, & McCarthy, 2015). This difference is probably due to the general age of mothers who experience pregnancy and childbirth at the age of 17 to 34 years, hence, the number of severe preeclampsia is also most generally discovered at that age (Adeline, Laksana, & Atika, 2018).

Visfatin levels were discovered to be lower in this study when compared to respondents with normal blood pressure. Visfatin levels decreased in respondents in the third trimester when

compared to respondents in the second trimester. These results are consistent with Hu et al., research's, (2008). Hu et al., (2008) discovered that visfatin levels in pregnant women with preeclampsia were lower than controls for pregnant women without preeclampsia and women who were not pregnant in their study. Visfatin levels in the third trimester were lower than in non-pregnant women and healthy pregnant women. Altered patterns of visfatin and other adipokines such as leptin, resistin, and adiponectin are identified to escalate insulin resistance during pregnancy and participate in the formation of physiological insulin resistance and are involved in the regulation of energy metabolism. Changes that occur at visfatin levels in this study possess a smaller effect on physiological insulin resistance (Hu et al. 2008).

In this study, the increase in visfatin levels occurred during the second trimester. Visfatin levels increased during PE beginning in the first trimester, indicating a possible role for visfatin in the pathogenesis of PE. Visfatin is abundantly expressed in adipose tissue, as well as the placenta and fetal membranes. Mean visfatin concentrations have been reported to be higher in the second and third trimesters of normal pregnancy than in the first, supporting the theory that visfatin is produced by the placenta and fetal membranes. Thus, it is possible that normal visfatin production is regulated to support fetal growth, but in PE, visfatin's supporting role is disrupted, resulting in PE (Amiri-Dashatan et al., 2020; Mastorakos et al., 2007; Ngala et al., 2016).

Fasshauer et al., (2008) discovered that serum visfatin levels in PE patients were significantly higher than in controls. According to Fasshauer et al., (2008), visfatin levels increased 1.4-fold in women with gestational diabetes mellitus when compared to controls of the same gestational age. Furthermore, visfatin levels in third trimester patients with intrauterine growth restriction (IUR) were identified to be doubled when compared to healthy pregnant women (Fasshauer et al., 2008). Increased levels of visfatin in pregnant women with PE were also revealed by Ferreira et al., (2013), Ngala et al., (2016), and Shaheen et al., (2016) (Ferreira et al., 2013; Ngala et al. 2016; Shaheen et al. 2016).

To determine normal levels of visfatin in pregnant women, the potential of visfatin as a PE marker requires to be investigated further using a larger sample size. Such studies may even provide useful information on predicting the condition of pregnant women with PE, which could aid in the development of intervention programs to reduce the effects of PE on maternal and fetal morbidity and mortality, as well as the prevalence of stunting (Dewi et al., 2022).

Ngala et al., (2016) discovered that obese women are more likely to develop PE during pregnancy. This risk multiplies by two to three. The findings of this study show that a higher BMI (>28.8 kg/m<sup>2</sup>) has a high accuracy in predicting pregnancies that are likely to develop into PE. This suggests that excessive fat accumulation in the body plays a significant role in the pathogenesis of PE (Ngala et al. 2016).

Variations in study findings can be attributed to a variety of factors, including disease severity, metabolic disorders, blood sampling timing, serum or plasma from the blood, and the study's subject. Increased levels of visfatin have been connected to the pathogenesis of PE (Shaheen et al., 2016). Visfatin levels in PE may be higher than in the control group. This suggests that visfatin levels in the placenta are essential as evidence for success in predicting PE. More research is needed, however, to investigate these medical complications during pregnancy.

#### **4. CONCLUSION**

In accordance with the research results, visfatin levels in pregnant women with pre-hypertension and hypertension have lower levels than pregnant women with normal blood pressure. Visfatin levels increased in the second trimester compared to the first and third trimesters. Visfatin has the potential to be employed as a biomarker to detect preeclampsia, allowing pregnant women with the condition to be identified early. It is recommended that

future research be conducted with a larger number of samples. And it is recommended to use controls for healthy pregnant women and non-pregnant women.

## REFERENCES

- ACOG Committee on Obstetric Practice. 2020. Gestational Hypertension and Preeclampsia: ACOG Practice Bulletin, Number 222. (2020). *Obstetrics and gynecology*, 135(6), e237–e260. <https://doi.org/10.1097/AOG.0000000000003891>
- Adeline, M. E., Laksana, M. A. C., & Atika, A. (2018). Characteristic of Referral Patients With Severe Preeclampsia In Surabaya. *Biomolecular and Health Science Journal*, 1(1), 25–28. <https://doi.org/10.20473/bhsj.v1i1.8219>
- Amiri-Dashatan, N., Koushki, M., Hosseini, H., Khodabandehloo, H., Fathi, M., Doustimotlagh, A. H., & Rezaei-Tavirani, M. (2022). Association between circulating visfatin and pre-eclampsia: a systematic review and meta-analysis. *The Journal of Maternal-Fetal & Neonatal Medicine*, 35(13), 2606-2618. <https://doi.org/10.1080/14767058.2020.1789581>
- Askie, L. M., Duley, L., Henderson-Smart, D. J., & Stewart, L. A. (2007). Antiplatelet agents for prevention of pre-eclampsia: a meta-analysis of individual patient data. *The Lancet*, 369(9575), 1791-1798. [https://doi.org/10.1016/S0140-6736\(07\)60712-0](https://doi.org/10.1016/S0140-6736(07)60712-0)
- Coban, U., Takmaz, T., Unyeli, O. D., & Ozdemir, S. (2021). Adverse outcomes of preeclampsia in previous and subsequent pregnancies and the risk of recurrence. *The Medical Bulletin of Sisli Etfal Hospital*, 55(3), 426-431. <https://doi.org/10.14744/SEMB.2020.56650>
- Dewi, N. N. A., Rinawati, L. P., Dewi, N. P. D. P., Paramartha, I. M. K., Diyanti, N. P. I. M. A., Rakhmawati, A., & Bektı, H. S. (2022). Overview of Visfatin Levels in Pregnant Women as a Stunting Biomarker. *Jurnal Kebidanan*, 12(1), 13-18. <https://doi.org/10.31983/jkb.v12i1.8018>
- Dhariwal, N. K., & Lynde, G. C. (2017). Update in the management of patients with preeclampsia. *Anesthesiology clinics*, 35(1), 95-106. <https://doi.org/10.1016/j.anclin.2016.09.009>
- Dinas Kesehatan Kabupaten Gianyar. (2020). *Profil Kesehatan Gianyar Tahun 2020*. Gianyar: Dinas Kesehatan Kabupaten Gianyar.
- English, F. A., Kenny, L. C., McCarthy, F. P. (2015). Risk factors and effective management of preeclampsia. *Integr Blood Press Control*. 8:7-12 <https://doi.org/10.2147/IBPC.S50641>
- Fasshauer, M., Blüher, M., Stumvoll, M., Tönessen, P., Faber, R., & Stepan, H. (2007). Differential Regulation of Visfatin and Adiponectin in Pregnancies with Normal and Abnormal Placental Function. *Clinical Endocrinology* 66(3), 434–39. <https://doi.org/10.1111/j.1365-2265.2007.02751.x>
- Fasshauer, M., Waldeyer, T., Seeger, J., Schrey, S., Ebert, T., Kratzsch, J., ... & Stepan, H. (2008). Serum levels of the adipokine visfatin are increased in pre-eclampsia. *Clinical endocrinology*, 69(1), 69-73. <https://doi.org/10.1111/j.1365-2265.2007.03147.x>
- Ferreira, A. F. A., Rezende, J. C., de Cassia C Oliveira, R., Akolekar, R., & Nicolaides, K. H. (2013). Maternal serum visfatin at 11–13 weeks' gestation in preeclampsia. *Journal of*

- human hypertension*, 27(4), 261-264. <https://doi.org/10.1038/jhh.2012.10>
- Fox, R., Kitt, J., Leeson, P., Aye, C. Y., & Lewandowski, A. J. (2019). Preeclampsia: risk factors, diagnosis, management, and the cardiovascular impact on the offspring. *Journal of clinical medicine*, 8(10), 1625. <https://doi.org/10.3390/jcm8101625>
- Fukuhara, A., Matsuda, M., Nishizawa, M., Segawa, K., Tanaka, M., Kishimoto, K., ... & Shimomura, I. (2005). Visfatin: a protein secreted by visceral fat that mimics the effects of insulin. *Science*, 307(5708), 426-430. <https://doi.org/10.1126/science.109724>
- Górska, M., Krętowski, A., Nikołąjuk, A., Zonenberg, A., Telejko, B., Kuźmicki, M., & Szamatowicz, J. (2009). Serum visfatin concentration is elevated in pregnant women irrespectively of the presence of gestational diabetes. *Ginekologia Polska*, 80, 14-18. Retrieved from [https://journals.viamedica.pl/ginekologia\\_polska/article/view/46652](https://journals.viamedica.pl/ginekologia_polska/article/view/46652)
- Hu, W., Wang, Z., Wang, H., Huang, H., & Dong, M. (2008). Serum visfatin levels in late pregnancy and pre-eclampsia. *Acta obstetrica et gynecologica Scandinavica*, 87(4), 413-418. <https://doi.org/10.1080/00016340801976012>
- Ihsan, I., Rini, E. A., & Yaswir, R. (2016). Visfatin levels in non-obese, obese, and insulin resistant adolescents. *Paediatrica Indonesiana*, 56(5), 291-296. <http://doi.org/10.14238/pi56.5.2016.291-6>
- Kar, M. (2014). Role of biomarkers in early detection of preeclampsia. *Journal of clinical and diagnostic research: JCDR*, 8(4), BE01-BE04. <http://doi.org/10.7860/JCDR/2014/7969.4261>
- Kementerian Kesehatan Republik Indonesia. (2018). *Profil Kesehatan Indonesia 2018*. Jakarta: Kementerian Kesehatan Republik Indonesia.
- Leveno, K. (2018). *Williams Obstetrics*. 25th ed. New York: McGraw-Hill Education.
- Ma, Y., Cheng, Y., Wang, J., Cheng, H., Zhou, S., & Li, X. (2010). The changes of visfatin in serum and its expression in fat and placental tissue in pregnant women with gestational diabetes. *Diabetes research and clinical practice*, 90(1), 60-65. <https://doi.org/10.1016/j.diabres.2010.06.010>
- Marseglia, L., Manti, S., D'Angelo, G., Cuppari, C., Salpietro, V., Filippelli, M., ... & Arrigo, T. (2015). The role of visfatin in pregnancy, complications and procreation. *Journal of Pediatric Biochemistry*, 5(01), 002-007. <https://doi.org/10.1055/s-0035-1554783>
- Mastorakos, G., Valsamakis, G., Papatheodorou, D. C., Barlas, I., Margeli, A., Boutsiadis, A., ... & Creatsas, G. (2007). The role of adipocytokines in insulin resistance in normal pregnancy: visfatin concentrations in early pregnancy predict insulin sensitivity. *Clinical chemistry*, 53(8), 1477-1483. <https://doi.org/10.1373/clinchem.2006.084731>
- Mazaki-Tovi, S., Romero, R., Kim, S. K., Vaisbuch, E., Kusanovic, J. P., Erez, O., ... & Hassan, S. S. (2010). Could alterations in maternal plasma visfatin concentration participate in the phenotype definition of preeclampsia and SGA?. *The Journal of Maternal-Fetal & Neonatal Medicine*, 23(8), 857-868. <https://doi.org/10.3109/14767050903301017>
- National High Blood Pressure Education Program. (2004). The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure. Bethesda (MD): National Heart, Lung, and Blood Institute (US). Retrieved from <https://pubmed.ncbi.nlm.nih.gov/20821851/>
- Ngala, R. A., Yeboah, F. A., Bawah, A. T., Alidu, H. & Seini, M. M. (2016). Maternal Adiposity and Serum Visfatin Levels During First Trimester Among Pregnant Women

- With Preeclampsia. *International Journal of Advanced Research*, 4(8), 960–66. <https://doi.org/10.21474/ijar01/1293>
- Nourbakhsh, M., Nourbakhsh, M., Gholinejad, Z., & Razzaghy-Azar, M. (2015). Visfatin in obese children and adolescents and its association with insulin resistance and metabolic syndrome. *Scandinavian Journal of Clinical and Laboratory Investigation*, 75(2), 183-188. <https://doi.org/10.3109/00365513.2014.1003594>
- Salan, Y. D. C. (2017). Biomarker terkini dalam usaha memprediksi preeklampsia. *Berkala Kedokteran*, 13(1), 119-128. <http://dx.doi.org/10.20527/jbk.v13i1.3448>
- Shaheen, A., Nazli, R., Fatima, S., Ali, R., Khan, I., & Khattak, S. (2016). Adipokine Serum visfatin level in pregnancy induced hypertension and uncomplicated pregnancy. *Pakistan Journal of Medical Sciences*, 32(6), 1419-1424. <https://doi.org/10.12669/pjms.326.10917>
- Ukah, U. V., De Silva, D. A., Payne, B., Magee, L. A., Hutcheon, J. A., Brown, H., ... & von Dadelszen, P. (2018). Prediction of adverse maternal outcomes from pre-eclampsia and other hypertensive disorders of pregnancy: a systematic review. *Pregnancy hypertension*, 11, 115-123. <https://doi.org/10.1016/j.preghy.2017.11.006>

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DOI: [10.31965/infokes.Vol21Iss1.629](https://doi.org/10.31965/infokes.Vol21Iss1.629)Journal homepage: <http://jurnal.poltekkeskupang.ac.id/index.php/infokes>**RESEARCH****Open Access****Effect of Sociodemographic Factors on the Risk of Postpartum Depression during the Covid-19: Evidence from Tarakan****Selvia Febrianti<sup>1a\*</sup>, Ririn Ariyanti<sup>1b</sup>, Nurul Hidayatun Jalilah<sup>1c</sup>**<sup>1</sup> Department of Midwifery, Faculty of Health, Borneo Tarakan University, Tarakan, North Kalimantan, Indonesia<sup>a</sup> Email address: [selvia.febril1@borneo.ac.id](mailto:selvia.febril1@borneo.ac.id)<sup>b</sup> Email address: [ririn\\_ariyanti@borneo.ac.id](mailto:ririn_ariyanti@borneo.ac.id)<sup>c</sup> Email address: [nurulhamzar240987@gmail.com](mailto:nurulhamzar240987@gmail.com)

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**Abstract**

Social and environmental factors can have an impact on a mother's mental health, especially during a pandemic. Financial stress and the social environment can exacerbate postpartum depression. Postpartum depression is one of the mental health consequences. Postpartum depression is similar to other types of depression, but it occurs as a result of physical and social changes caused by the process of giving birth and raising a child. The objective of this study was to identify the sociodemographic factors that influence the risk of postpartum depression in Tarakan during the Covid-19 pandemic. It was a cross-sectional study conducted in Tarakan's North Tarakan District from August to October 2021. The study included 150 postpartum mothers. In this study, simple random sampling was used. The dependent variable of this study was postpartum depression and independent variables were age, education, income, parity, occupation, and support. Data collection employed questionnaires and logistic regression data analysis with the Stata 13 program. The risk of postpartum depression increased with multiparity (95% CI: 0.11-1.78);  $p = 0.026$ ), and less income (< minimum wage) (95% CI: 0.01-1.48);  $p=0.045$ ). The risk of postpartum depression decreased with age (<35 years old) (95% CI: (-2.00) - (-0.25));  $p= 0.011$ ), occupation (95% CI: (-1.60) – (-0.07));  $p= 0.032$ ), support (95% CI: (-1.76) – (-0.10));  $p= 0.028$ ), higher education (95% CI: (-1.22) – 0.24);  $p= 0.190$ ). Postpartum depression risk increases with multiparity and lower income. With normal age, occupation, support, and education, the risk of postpartum depression decreased.

**Keywords:** Postpartum, Depression, Sociodemographic.**\*Corresponding Author:**

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## 1. INTRODUCTION

Tarakan is a coastal town where almost all of the residential areas are located. The people are descended from immigrants, with the majority earning a living as fishermen. With the availability of seaweed commodities, the economic conditions of coastal communities are improving rapidly. The promising results have made families flock to work as seaweed fishermen. Both are used as binders for seaweed seeds (*ma'betang*), as well as for sun drying and transporting seaweed products. Housewives are also involved in the seaweed production process in this case, despite the fact that a mother plays an important role in her family's and her own health (Moelyaningrum, et al., 2022).

Indonesia has been infected with the Covid-19 virus since 2020. A pandemic can have an impact on societal psychological/mental, economic, and social conditions (Maulida et al., 2020). Tarakan still had an increase in cases of positive Covid-19 patients at the beginning of 2021, with an additional 147 people. There was a total of 2,466 new positive cases. Pandemic conditions, on the other hand, have not reduced the birth rate. As a result of the pandemic, it is expected that a greater number of postpartum women will be psychologically affected. Puerperium, as we all know, is the period during which a woman recovers from giving birth. In Tarakan, research on sociodemographic factors associated with depression in postpartum women is still very limited. As a result, the authors want to look into the relationship between socio-demographic factors and the prevalence of postpartum depression in Tarakan. The objective of this study was to investigate sociodemographic factors that correlates the risk of postpartum depression during the Covid-19 pandemic in Tarakan.

Postpartum depression is a condition that develops shortly after a woman gives birth and is characterized by feelings of sadness, loss of interest in daily activities, sleep and eating disorders, feeling useless, tired, or fear of injuring herself or her baby (Nugroho, 2017). Postpartum depression is similar to other types of depression, but it is caused by a reaction to physical and social changes caused by childbirth and parenting. Postpartum depression is more common in mothers who have had complications during childbirth, unwanted pregnancies, or have a low family income (Putriarsih, Budihastuti, & Murti, 2017). In another study, the risk of postpartum depression increased with the type of delivery, delivery complications, and age  $\geq 35$  years old. Meanwhile, traditional postpartum care, higher education, adequate family income, multiparity, intended pregnancy, and marital satisfaction all reduced the risk of postpartum depression (Febrianti, Tamtomo, & Budihastuti, 2020). Researchers believe that hormonal changes associated with pregnancy may make depression more prone to recurrence (Gelaye, et al., 2016).

Postpartum depression affects the first year of growth. Children born to mothers suffering from postpartum depression are more likely to be underweight (Farías-Antúnez, Xavier, & Santos, 2018). Depression treatment can improve newborn growth and development and reduce the likelihood of diarrhea and malnutrition in children. Depression affects 19.8% of women in developing countries during their puerperium (WHO, 2017). Since 2020, the world has been hit by a covid pandemic, one of which has an impact on pregnant women, maternity, and postpartum. Anxiety and depression are the most common psychological issues (Purwaningsih, 2020). During the pandemic, postpartum care can still be provided by health workers with home visits, but with preventive measures from officers, mothers, and families. Postpartum visits can also be carried out by monitoring through online media, unless the mother exhibits danger signs, in which case she should immediately consult with health workers (Kementerian Kesehatan Republik Indonesia, 2020).

The pandemic conditions had no effect on the region's birth rate. It suggests that the number of postpartum mothers who will be affected by the pandemic may increase. As a result,

it is critical to assess the psychological impact of the pandemic on postpartum mothers, as well as the factors that influence it.

## 2. RESEARCH METHOD

This research is analytical research using a cross-sectional approach, from August to October 2021. The population used in this study were postpartum mothers located in the North Tarakan sub-district. The formula 15-20 research subjects for each independent variable are used to calculate the number of samples used in multivariate analysis (Murti, 2013). This study requires a minimum sample of 10 x (15-20) research subjects, which translates to 150 - 200 research subjects. Considering the time and cost of the study, the researchers decided on a sample size of 150 postpartum mothers. This study's sample criteria were postpartum mothers aged 2 to 6 weeks, who were not seriously ill and were willing to participate. The sociodemographic factor questionnaire was used to collect information. A list of names (initials), age, parity, education, income, occupation, family support, and the EPDS are included in this questionnaire (Edinburg Postpartum Depression Scale).

Age, parity, education, occupational status, and support family were the independent variables. Postpartum depression was the dependent variable, with two categories: at risk of depression and not at risk of depression. If the variable has a score of less than or equal to 8, it is not at risk of depression; if the variable has a score of more than 9 or 14, it is at risk of depression; the maximum value of the EPDS questionnaire is 30. Data was collected directly from respondents by completing online or offline (physical) questionnaires.

Frequency distribution was analyzed by univariate, bivariate to investigate the direct relationship between variables using Chi-Square test, and multivariate analysis by employing logistic regression analysis model with STATA 13 program. The ethical approval in this study was obtained from the Health Research Ethics Committee, Faculty of Health Sciences, University of Borneo Tarakan, Indonesia, No. 011/KEPK-FIKES UBT/VIII/2021.

## 3. RESULTS AND DISCUSSION

The categorical data sample description elaborates the continuous data on each research variable, such as age, parity, and postpartum depression. Table 1 displays the results of the continuous data analysis.

**Table 1.** Description of research variables with continuous data.

Variable	Continuous Data				
	<i>n</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Age	150	29.03	6.671	17	50
Parity	150	2.45	1.272	1	8
Postpartum Depression (>9)	150	7.08	3.586	2	19

**Table 2.** Description of research variables with dichotomous data.

Variable	Dichotomous Data	
	<i>n</i>	Percentage
<b>Age</b>		
High Risk ( $\geq 35$ )	42	28.00
Normal ( $< 35$ )	108	72.00
<b>Parity</b>		
Primipara	50	33.33
Multipara	100	66.67
<b>Education Level</b>		
Low (<High School)	67	44.6

High ( $\geq$ High School)	83	55.3
<b>Income</b>		
Normal ( $\geq$ Rp 3.761.896)	81	54.00
Low ( $<$ Rp 3.761.896)	69	46.00
<b>Occupational Status</b>		
Unemployed	89	59.33
Employed	61	40.67
<b>Support</b>		
No Support	100	66.6
Supported	50	33.3

Table 2 illustrates the majority of postpartum mothers aged  $> 35$  years (high-risk) as much as 72%. More than 30% of mothers were with primiparous status. Postpartum mothers with higher education ( $>$  SMA) were 55.3%. Postpartum mothers with lower family income earn 54% more than those with incomes above the UMK. There are more postpartum mothers who don't 59.3%. Only 33.3% of mothers received support from their husbands or family during the postpartum period.

**Table 3.** Chi-square test of the influence of sociodemographic factors on the risk of postpartum depression.

Variable	Not Depressed		Depressed		OR CI 95%	p
	n = 93	%	n = 57	%		
<b>Age</b>						
High Risk	63	58.3	45	41.6	0.56	0.138
Normal	30	71.4	12	28.5		
<b>Parity</b>						
Primipara (Children $< 2$ )	37	74.0	13	26.0	2.23	0.032
Multipara (Children $\geq 2$ )	56	56.0	44	44.0		
<b>Income</b>						
Normal ( $\geq$ Rp 3.761.896)	56	69.1	25	30.8	1.93	0.051
Low ( $<$ Rp 3.761.896)	37	53.6	32	46.3		
<b>Occupation</b>						
Unemployed	48	53.9	41	46.0	0.41	0.014
Employed	45	73.7	16	26.2		
<b>Support</b>						
Supported	55	55.00	45	45.0	0.38	0.012
Not Supported	38	76.00	12	24.0		
<b>Education Level</b>						
Low ( $<$ High school)	38	56.7	29	43.2	0.66	0.231
High ( $>$ High school)	55	66.2	28	33.7		

Table 3 demonstrates that maternal age had no effect on postpartum depression and was not statistically significant. Postpartum mothers over the age of 35 had a 0.56 times lower risk of developing postpartum depression than mothers under the age of 35 (OR CI 95% 0.56;  $p = 0.138$ ). Parity had an effect on postpartum depression. Multiparous postpartum mothers were 2.2 times more likely than primiparous mothers to experience postpartum depression (OR CI95% 2.23;  $p = 0.032$ ). Income had an effect on postpartum depression. Mothers with lower family income (3.761.896) are nearly twice as likely to experience depression as mothers with

higher income ( $\geq 3.761.896$ ) (OR CI95% 1.93;  $p=0.051$ ). There was an effect of work on postpartum depression. However, depending on the number of family members, a sufficient income may not be sufficient to meet family needs.

Postpartum mothers who worked were 0.4 times less likely than mothers who did not work to experience postpartum depression (OR CI95% 0.41;  $p = 0.014$ ). Postpartum depression was affected by husband or family support. Postpartum mothers who were not supported were 0.4 times more likely than mothers who were supported by their husbands or families to experience postpartum depression (OR CI95% 0.38;  $p=0.012$ ). The education of the mother had an effect on postpartum depression, but it was not statistically significant. Mothers with a low education are 0.6 times more likely than those with a higher education to experience postpartum depression (OR CI95% 0.66;  $p = 0.231$ ).

**Table 4.** Results of logistic regression analysis of sociodemographic factors' influence on the risk of postpartum depression.

Independent Variable	b	CI 95%		p-value
		Lower	Upper	
<b>Fixed Effect</b>				
Age (Normal)	-1.12	-2.00	-0.25	0.011
Parity (Multipara)	0.95	0.11	1.78	0.026
Income (< Minimum wage)	0.74	0.01	1.48	0.045
Occupation (Unemployed)	-0.83	-1.60	-0.07	0.032
Support (Supported)	-0.93	-1.76	-0.10	0.028
Education (High)	-0.49	-1.22	0.24	0.190

Table 4 displays postpartum mothers of normal age who had log odds for postpartum depression 1.12 units lower than mothers who have a high risk age ( $b=-1.12$ ; CI (95%)=-2.00 to -0.25;  $p=0.011$ ). Multiparous postpartum women possessed log odds for postpartum depression 0.95 units higher than primiparous women ( $b=0.95$ ; (95% CI)= 0.11 to 1.78;  $p = 0.026$ ). Postpartum mothers with less income (< minimum wage) owned log odds for postpartum depression 0.74 units higher than mothers with sufficient income ( $\geq$  Minimum wage) ( $b=0.74$ ; (95% CI)= 0.01 to 1.48;  $p = 0.045$ ). Working mothers had log odds for postpartum depression 0.83 units lower than mothers who did not work ( $b=-0.83$ ; (95% CI) = -1.60 to -0.07;  $p = 0.032$ ). Postpartum mothers who received support had log odds of postpartum depression 0.93 units lower than mothers who did not ( $b=-0.93$ ; (95% CI)= -1.76 to -0.10;  $p = 0.028$ ). There was no effect of postpartum mothers' education (> high school) on postpartum depression, but it was not statistically significant ( $b=-0.49$ ; (95% CI)= -1.22 to 0.24;  $p = 0.190$ ).

The effect of age on postpartum depression. The results revealed a statistically significant negative effect of age on postpartum depression. Postpartum mothers who were of normal pregnancy age had a lower risk of postpartum depression than women who were of high-risk pregnancy age (under 20 and over 35 years old). The findings of this study are consistent with previous research indicating that maternal age is a factor that influences postpartum depression internally; this is related to maternal age when married and pregnant of 20 years or more than 35 years (Lubis, 2016). According to other studies, pregnant teenagers are more likely to experience postpartum depression. This has an effect on them, their children, and their families (Rahmadhani, Kusumastuti, & Chamroen, 2022). Other studies suggest that postpartum depression is more common in women between the ages of 18 and 23. It is possible as young women who give birth for the first time are more exposed to emotional pressure and the additional burden of caring for the baby (Toru, Chemir, & Anand, 2018). Giving birth at a risky age is generally very susceptible to being a factor causing postpartum depression, but apart from this age factor, it is necessary to consider other factors affecting the incidence of postpartum depression, intended pregnancy, complications during delivery, and type of

delivery. Other researchers contend that there is a relationship between age and the prevalence of postpartum depression (Kim et al., 2019).

The effect of parity on postpartum depression. The results of this study indicate that there is a positive effect of parity on postpartum depression and it is statistically significant. Multiparous women are more likely than primiparous women to experience postpartum depression. Postpartum depression affects a large number of multiparous mothers. This is due to the fact that multiparous mothers already have additional responsibilities such as housework and responsibilities from their existing children. According to research, multiparous mothers do not only concern on caring for their babies, but they also have to care for or care for other children. Thus, a relationship that is not well established between mother and baby in the early stages of birth can create psychological conditions. It is definitely not good for the mother (Rahmadhani, Kusumastuti, & Chamroen, 2022).

Women who have had more than twice the number of births possess a higher risk of postpartum depression compared to women who own just had one child (Pham et al., 2017). Research in India illustrates that the chances of developing postpartum depression are three times higher in women with two or more children (Agarwala, Rao, & Narayanan, 2018). The results of this study are contrary to the results of the study of Solama, Rivanica, Effendi, & Safitri, (2023) which revealed that primiparous mothers possess no experience taking care of children so they have to adapt more than multiparas.

Income has an effect on postpartum depression. According to the findings of this study, family income has a statistically significant positive effect on postpartum depression. Postpartum mothers with low family income are more likely to experience postpartum depression than postpartum women with adequate income (Tarakan monthly minimum wage is at IDR 3,761,896). Education, wealth, and employment status can all influence a person's ability to experience depressive symptoms (Dewi, Relaksana, & Siregar, 2021). This is consistent with previous research, which concluded that economic status and individual happiness point to a potential mechanism that influences a person's income on mental health (Li, Zhou, & Hu, 2022).

One of the factors that can influence postpartum depression is postpartum mothers' fear of family financial problems (Nugroho, 2017). Mothers with higher family incomes are better able to meet their daily needs than mothers with lower incomes. Later on, this will have an effect on the mother's psychology, potentially increasing her risk of depression (Ria, Budihastuti, & Sudiyanto, 2018). On the contrary, the results of other studies explain that economic status which is elaborated by low income contributes to the incidence of postpartum depression (Yasa & Lesmana, 2019). it is in accordance with the results of the author's research.

The effect of Occupation on postpartum depression. The results uncovered that there was a negative effect of working mothers on postpartum depression and it was statistically significant. Working mothers had a higher risk of postpartum depression than nonworking mothers. Postpartum depression is more common in women who work more than 40 hours per week than in women who work less than 40 hours per week (Hahn-holbrook, Cornwell-Hinrichs, & Anaya, , 2018). Postpartum depression does not affect housewives. It could happen because working mothers receive maternity leave, lowering the social status of working mothers to that of housewives during the postpartum period (Vaezi et al., 2018). However, on the other side, it is elaborated that working mothers are more prone to experiencing postpartum depression as they have to adjust to their jobs and take care of their children (Yasa & Lesmana, 2019).

The effect of support family on postpartum depression. The results unveiled that there was a negative effect of support on postpartum depression and it was statistically significant. Mothers who receive support from their husbands and families are less likely to suffer from

postpartum depression than mothers who do not. According to previous research, a lack of social support can increase the risk of postpartum depression (Ardiani, Soemanto, & Murti, 2020). Mothers who do not receive social support are more likely to feel worthless and uncared for by their husbands and families, making them more prone to depression (Rahmadhani, Kusumastuti, & Chamroen, 2022). Research by Anggarini, (2019) states that social support is essential for mothers' physical and psychological health when they take on a new role as parents. Other perspectives argue that a lack of social support can lead to feelings of loneliness, which can exacerbate challenges in raising children and cause mothers to experience postpartum depression (Dlamini, et al., 2019). Research facts reveal, having poor social support is one of the highest contributors to poor mental health (Wubetu, Engidaw, & Gizachew, 2020).

The results of this study are in contrast to the results of Ariyanti, (2020), There is no effect of family support on the occurrence of postpartum depression. This is due to the respondents' characteristics in this study, which include age, parity, education, employment, and economic factors. However, it was also stated that postpartum mothers should be screened in order to avoid postpartum depression. This could be due to the mother's weak condition, as she still requires a lot of assistance; therefore, postpartum mothers must be supported. Social support can help to reduce stress during pregnancy and delivery. As a result, it will have an effect on the postpartum mother's mental health (Vaezi et al., 2018).

The effect of education on postpartum depression. The results of the study revealed that education had no effect on postpartum depression and was not statistically significant. Educated mothers usually have everything planned out, from getting pregnant to preparing for their baby's birth (Kurniasari & Astuti, 2015). Postpartum mothers who have a high level of education can reduce the risk of postpartum depression by 2.46 units compared to postpartum mothers who possess low education (Jannah, Budihastuti, & Murti, 2019). Another study discovered that mothers with only an elementary education had a higher risk of postpartum depression (Demirel et al., 2018). The results of this research differ from those of previous studies, which discovered that education level has no effect on the incidence of postpartum depression. The current situation enables every mother to seek information about health, particularly through social media. It was revealed by Faisal (2020) who elaborated that there was a relationship between exposure to information media and the level of knowledge of mothers about the danger signs of the puerperium.

Mothers' exposure to health workers or cadres also allows them to obtain health information during childbirth. Regardless of educational background, exposure to information can influence maternal health knowledge and behavior during the puerperium (Kusuma, 2023). It greatly assists mothers and families in providing support in order to reduce the risk of postpartum depression. On the other hand, even postpartum mothers with a high level of education are at risk for depression. Postpartum mothers with a higher education may still be at risk of depression because they often feel conflicted about their roles as mothers in caring for their children and families and their desire to advance in their careers (Kurniasari & Astuti, 2015).

#### **4. CONCLUSION**

According to the findings of this study, age, parity, income, occupation, and support are sociodemographic factors that influence the risk of postpartum depression during the Covid-19 pandemic in Tarakan. During the Covid-19 pandemic, this research may provide additional information about postpartum depression and be useful to health workers in providing comprehensive care to postpartum mothers.

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## REFERENCES

- Agarwala, A., Rao, P. A., & Narayanan, P. (2019). Prevalence and predictors of postpartum depression among mothers in the rural areas of Udipi Taluk, Karnataka, India: A cross-sectional study. *Clinical epidemiology and global health*, 7(3), 342-345. <https://doi.org/10.1016/j.cegh.2018.08.009>
- Anggarini, I. A. (2019). Factors relating of postpartum depression in independent practices of midwife misni herawati, husniyati and soraya. *Jurnal Kebidanan*, 8(2), 94-104. <https://doi.org/10.26714/jk.8.2.2019.94-104>
- Ardiani, A., Soemanto, R. B., & Murti, B. (2020). Meta-analysis: The association between social support and postpartum depression. *Journal of Maternal and Child Health*, 5(6), 641-650. <https://doi.org/10.26911/thejmch.2020.05.06.04>
- Ariyanti, R. (2020). Hubungan Dukungan Keluarga dengan Risiko Depresi Postpartum. *Jurnal Kebidanan Mutiara Mahakam*, 8(2), 94-101. <https://doi.org/10.36998/jkmm.v8i2.99>
- Demirel, G., Egri, G., Yesildag, B., & Doganer, A. (2018). Effects of traditional practices in the postpartum period on postpartum depression. *Health Care for Women International*, 39(1), 65-78. <https://doi.org/10.1080/07399332.2017.1370469>
- Dewi, Y., Relaksana, R., & Siregar, A. Y. M. (2021). Analisis Faktor Socioeconomic Status (Ses) Terhadap Kesehatan Mental: Gejala Depresi Di Indonesia. *Jurnal Ekonomi Kesehatan Indonesia*, 5(2), 29-40. <https://doi.org/10.7454/eki.v5i2.4125>
- Dlamini, L. P., Mahanya, S., Dlamini, S. D., & Shongwe, M. C. (2019). Prevalence and factors associated with postpartum depression at a primary healthcare facility in Eswatini. *South African Journal of Psychiatry*, 25, 1-7. <https://doi.org/10.4102/sajpsychiatry.v25i0.1404>
- Faisal, A. D. (2020). Hubungan Karakteristik Ibu Nifas Dengan Tingkatpengetahuan Ibu Nifas Tentang Tanda-Tanda Bahaya Pada Masa Nifas Di Wilayah Kerja Puskesmas Pauh Kota Padang. *Jurnal Amanah Kesehatan*, 2(2), 9-18. <https://doi.org/10.55866/jak.v2i2.74>
- Fariás-Antúnez, S., Xavier, M. O., & Santos, I. S. (2018). Effect of maternal postpartum depression on offspring's growth. *Journal of Affective Disorders*, 228, 143-152. <https://doi.org/10.1016/j.jad.2017.12.013>
- Febrianti, S., Tamtomo, D., & Budihastuti, U. R. (2020). The Contextual Effect of Place of Birth Delivery and Biopsychosocial Determinants on Postpartum Depression: A Multilevel Evidence from Yogyakarta. *Journal of Maternal and Child Health*, 5(1), 87-98. <https://doi.org/10.26911/thejmch.2020.05.01.10>
- Gelaye, B., Rondon, M. B., Araya, R., & Williams, M. A. (2016). Epidemiology of maternal depression, risk factors, and child outcomes in low-income and middle-income countries. *The Lancet Psychiatry*, 3(10), 973-982. [https://doi.org/10.1016/S2215-0366\(16\)30284-X](https://doi.org/10.1016/S2215-0366(16)30284-X)
- Hahn-Holbrook, J., Cornwell-Hinrichs, T., & Anaya, I. (2018). Economic and health predictors of national postpartum depression prevalence: a systematic review, meta-analysis, and meta-regression of 291 studies from 56 countries. *Frontiers in psychiatry*, 8, 248. <https://doi.org/10.3389/fpsy.2017.00248>
- Jannah, A. M., Budihastuti, U. R., & Murti, B. (2019). Contextual Effect of Place Of Birth Delivery on Depression in Karanganyar, Central Java. *Journal of Maternal and Child Health*, 4(3), 212-221. <https://doi.org/10.26911/thejmch.2019.04.03.08>

- Kementerian Kesehatan Republik Indonesia. (2020). *Panduan Kesehatan Balita Pada Masa Tanggap Darurat Covid-19*. Jakarta: Kementerian Kesehatan Republik Indonesia. Retrieved from [https://infeksiemerging.kemkes.go.id/download/Panduan\\_Yankes\\_Balita\\_Pada\\_Masa\\_GapDar\\_Covid19\\_Bagi\\_Nakes.pdf](https://infeksiemerging.kemkes.go.id/download/Panduan_Yankes_Balita_Pada_Masa_GapDar_Covid19_Bagi_Nakes.pdf)
- Kim, Y. K., Hur, J. W., Kim, K. H., Oh, K. S., & Shin, Y. C. (2008). Prediction of postpartum depression by sociodemographic, obstetric and psychological factors: A prospective study. *Psychiatry and clinical neurosciences*, 62(3), 331-340. <https://doi.org/10.1111/j.1440-1819.2008.01801.x>
- Kurniasari, D., & Astuti, Y. A. (2015). Hubungan Antara Karakteristik Ibu, Kondisi Bayi dan Dukungan Sosial Suami dengan Postpartum Blues Pada Ibu dengan Persalinan SC di Rumah Sakit Umum Ahmad Yani Metro tahun 2014. *Jurnal Kesehatan Holistik*, 9(3), 115–125. Retrieved from <https://ejournalmalahayati.ac.id/index.php/holistik/article/view/215/154>
- Kusuma, R. (2023). Edukasi Nifas pada Masa Pandemi Covid 19 di Puskesmas Koni Kota Jambi. *Jurnal Abdimas Kesehatan (JAK)*, 5(1), 117–124. <https://doi.org/10.36565/jak.v5i1.462>
- Lubis (2016), *Depresi Tinjauan Psikologis*. Jakarta: Kencana
- Li, M., Zhou, B., & Hu, B. (2022). Relationship between Income and Mental Health during the COVID-19 Pandemic in China. *International Journal of Environmental Research and Public Health*, 19(15), 8944. <https://doi.org/10.3390/ijerph19158944>
- Maulida, H., Jatimi, A., Heru, M. J. A., Munir, Z., & Rahman, H. F. (2020). Depresi pada Komunitas dalam Menghadapi Pandemi COVID-19: A Systematic Review. *Jurnal Sains dan Kesehatan*, 2(4), 519–524. <https://doi.org/10.25026/jsk.v2i4.201>
- Moelyaningrum, A. D., Khoiron, K., Marufi, I., Nurika, G., & Kusnadi, K. (2022). Wanita Nelayan: Sanitasi dan Usaha Kesehatan Keluarga. *Jurnal Ilmu Kesehatan Masyarakat*, 18(4), 217-227. Retrieved from <https://jurnal.unej.ac.id/index.php/IKESMA/article/view/34477>
- Murti B (2013). *Desain dan ukuran sampel untuk penelitian kuantitatif dan kualitatif dibidang kesehatan*. Yogyakarta: Gadjah Mada University Press.
- Nugroho T, Nurezki, N., Warnaliza D, Wilis, W. (2017). *Buku Ajar Auhab Kebidanan Nifas*. Yogyakarta: Nuha Medika.
- Pham, D., Cormick, G., Amyx, M. M., Gibbons, L., Doty, M., Brown, A., ... Belizán, J. M. (2017). Factors associated with postpartum depression in women from low socioeconomic level in Argentina: A hierarchical model approach. *Journal of Affective Disorders*, 227(November 2017), 731–738. <https://doi.org/10.1016/j.jad.2017.11.091>
- Purwaningsih, H. (2020). Analisis Masalah Psikologis pada Ibu Hamil Selama Masa Pandemi Covid-19 : Literature Review. *Penelitian, Pengabdian, Dan Literature Review Di Era Pandemi COVID-19*, 9–15. Retrieved from <https://jurnal.unw.ac.id/index.php/semnasbidan/article/view/639>
- Putriarsih, R., Budihastuti, U. R., & Murti, B. (2017). Prevalence and Determinants of Postpartum Depression in Sukoharjo District, Central Java. *Journal of Maternal and Child Health*, 03(01), 395–408. <https://doi.org/10.26911/thejmch.2017.03.01.02>
- Rahmadhani, W., Kusumastuti, K., & Chamroen, P. (2022). Prevalence and determinants of postpartum depression among adolescent mothers. *International Journal of Health Sciences*, 6(2), 533–544. <https://doi.org/10.53730/ijhs.v6n2.6422>
- Ria, M. B., Budihastuti, U. R., & Sudiyanto, A. (2018). Risk Factors of Postpartum Depression at Dr. Moewardi Hospital, Surakarta. *Journal of Maternal and Child Health*, 03(01), 81–90. <https://doi.org/10.26911/thejmch.2018.03.01.08>

- Solama, W., Rivanica, R., Effendi, E., & Safitri, S. (2023). Analisis Karakteristik Ibu Nifas Tentang Depresi Postpartum. *Aisyiyah Palembang*, 8(1), 300–313. Retrieved from <http://jurnal.stikes-aisyiyah-palembang.ac.id/index.php/JAM/article/view/1008>
- Toru, T., Chemir, F., & Anand, S. (2018). Magnitude of postpartum depression and associated factors among women in Mizan Aman town, Bench Maji zone, Southwest Ethiopia. *BMC pregnancy and childbirth*, 18, 1-7. <https://doi.org/10.1186/s12884-018-2072-y>
- Vaezi, A., Soojoodi, F., Banihashemi, A. T., & Nojomi, M. (2019). The association between social support and postpartum depression in women: A cross sectional study. *Women and Birth*, 32(2), e238-e242. <https://doi.org/https://doi.org/10.1016/j.wombi.2018.07.014>
- Wubetu, A. D., Engidaw, N. A., & Gizachew, K. D. (2020). Prevalence of postpartum depression and associated factors among postnatal care attendees in Debre Berhan, Ethiopia, 2018. *BMC pregnancy and childbirth*, 20(189), 1-9. <https://doi.org/10.1186/s12884-020-02873-4>
- WHO (2017). Maternal Mental Health, WHO. Geneva: World Health Organization. Retrieved from [https://www.who.int/mentalhealth/maternal-child/maternalmental\\_health/en/](https://www.who.int/mentalhealth/maternal-child/maternalmental_health/en/)
- Yasa, K. R., & Lesmana, C. B. J. (2019). Tingkat Depresi Postpartum Pada Ibu Menyusui Di Puskesmas Denpasar Timur 1. *Jurnal Medika Udayana*, 8(12), 1–14.

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DOI: [10.31965/infokes.Vol21Iss1.879](https://doi.org/10.31965/infokes.Vol21Iss1.879)Journal homepage: <http://jurnal.poltekkeskupang.ac.id/index.php/infokes>**RESEARCH****Open Access****Maternal Parity, History of Obesity and History of Maternal GDM Risk a Macrosomia Baby****Listyaning Eko Martanti<sup>1a\*</sup>, Dhita Aulia Octaviani<sup>1b</sup>, Rizky Amelia<sup>1c</sup>, Suparmi<sup>1d</sup>, Khobibah<sup>1e</sup>**<sup>1</sup> Department of Midwifery, Politeknik Kesehatan Kementerian Kesehatan Semarang, Semarang, Central Java, Indonesia<sup>a</sup> Email address: [listy@poltekkes-smg.ac.id](mailto:listy@poltekkes-smg.ac.id)<sup>b</sup> Email address: [dhitaaulia@poltekkes-smg.ac.id](mailto:dhitaaulia@poltekkes-smg.ac.id)<sup>c</sup> Email address: [rizkyamelia81@yahoo.com](mailto:rizkyamelia81@yahoo.com)<sup>d</sup> Email address: [parmiadi@ymail.com](mailto:parmiadi@ymail.com)<sup>e</sup> Email address: [khobibah@poltekkes-smg.ac.id](mailto:khobibah@poltekkes-smg.ac.id)

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**Abstract**

Gestational diabetes mellitus (GDM) is a carbide tolerance disorder that occurs or is first recognized during pregnancy (usually at 24 weeks gestation). For some patients, this complication returns to normal after delivery. The incidence of macrosomic infants or infants weighing >4000 grams is approximately 5% of all births. Maternal GDM is a significant risk factor in the development of fetal macrosomia. This study aimed to determine the risk factors for macrosomia in newborns. The design of this research is cross-sectional design. The population of this study was macrosomic babies born at Dr. Kariadi Semarang from 2015 until 2021. The formula for estimating the sample size using a hypothesis on the mean of two independent populations obtained a total sample of 60 respondents. The sampling technique is convenience sampling. The type of data used is secondary data. This study was analyzed using the Chi-Square test. The results indicated a relationship between parity and a history of obesity and macrosomia incidence in infants with a p-value < 0.05. In contrast, there was no relationship between maternal age, gestational age, and a history of diabetes in the mother and the incidence of macrosomia in infants with a p-value > 0.05. Therefore, it is essential to educate the mother about the risk factors that can cause complications for both the mother and the fetus, including macrosomia.

**Keywords:** History of Obesity, Macrosomia, Maternal GDM, Maternal Parity, Newborns.**\*Corresponding Author:**

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## 1. INTRODUCTION

The incidence of macrosomia babies in Indonesia is around 3.7% of national births (Kementerian Kesehatan Republik Indonesia, 2019). *Macrosomia* is defined as a fetus or infant bigger than standard, sometimes known as a giant infant. Typically, a birth weight of greater than 4000 grams is used to define macrosomia. All newborns weighing four thousand grams or over, regardless of gestational age, are considered to have macrosomia (Rahayu & Rodiani, 2016). Compared to the incidence of low birth weight (LBW), which reaches 6.2% nationally, the prevalence of macrosomia is low (Kementerian Kesehatan Republik Indonesia, 2019). But so far, macrosomia is linked to pre-pregnancy women's diet and health, making it difficult for developing countries, including Indonesia, to reduce it.

The risk factors for fetal macrosomia include obesity, gestational diabetes, type 2 diabetes, obese parents, post-term pregnancy, and multiparity. Diabetes mellitus (DM) is a chronic disease characterized by elevated glucose levels in the blood. Lack of the hormone insulin, which is generated by the pancreas to reduce blood sugar levels, is the cause of diabetes (P2PTM Kemenkes RI, 2020). Gestational diabetes mellitus (DMG) is a normal pregnancy characterized by heightened insulin resistance (pregnant women fail to maintain euglycemia). Typically, it happens between the second and third trimesters. Gestational diabetes mellitus (GDM) is a significant risk factor for the development of fetal macrosomia in the mother (Adli, 2021).

To meet the criteria for gestational diabetes, poor glucose tolerance during pregnancy must return to normal within six weeks following birth. Diabetes mellitus (not gestational) is suspected if poor glucose tolerance persists after birth (Rahayu & Rodiani, 2016). GDM is often diagnosed after 20 weeks of pregnancy when the placental hormone that has the opposite effect of insulin on glucose metabolism rises significantly. This situation is transitory, and blood glucose levels will return to following normal delivery (Adli, 2021). With subsequent pregnancies, women with gestational diabetes have a significant chance of acquiring diabetes mellitus. In addition, gestational diabetes is a risk factor for type II diabetes if the mother's blood sugar levels stay elevated after delivery. Infants born to moms with gestational diabetes are more likely to develop macrosomia. GDM can occur in pregnant women over 30, obese women (BMI > 30), women with a family history of DM, or women who had babies with birth weights > 4000 grams and glucosuria in previous pregnancies (Rahayu & Rodiani, 2016).

Diabetes in pregnancy brings several challenges. Many hormones increase in quantity during pregnancy, resulting in insulin resistance and elevated glucose levels in pregnant women. In addition, insulin kinetics and insulin resistance are altered, such that glucose levels in the mother's plasma increase and blood sugar levels are up while insulin levels stay elevated. Assisted diffusion across the placental barrier causes aberrant glucose levels in fetal circulation (Rahayu & Rodiani, 2016).

The increased serum levels of metabolites in diabetic mothers (e.g., glucose, free fatty acids, ketone compounds in the body, triglycerides, and amino acids) will increase nutrient transfer to the fetus, resulting in hyperglycemia in the uterine environment and altering fetal growth and body composition. During the second trimester of pregnancy, the pancreas of fetuses with maternal gestational diabetes mellitus responds to hyperglycemia in the uterine environment by boosting insulin synthesis, resulting in hyperinsulinemia in the fetus. Hypoglycemia, polycythemia, hyperbilirubinemia, respiratory distress syndrome, and poor fetal growth or macrosomia result from the completion of metabolic processes in the uterus (Rahayu & Rodiani, 2016).

Various factors, including the uterine environment of pregnant women, the functioning of the placenta, and the availability of nutritional intake for the mother and fetus, influence the growth and development of a macrosomic fetus. During early pregnancy, insulin and insulin

developmental factors are significant determinants of fetal organ growth and development. The production of insulin in the fetus, which begins between 8-10 weeks of gestation, is primarily determined by the mother's glucose level, which  $\pm 80\%$  is distributed to the fetus through the placental membrane. Mothers with gestational diabetes mellitus offspring who have poor glycemic control are continuously exposed to high levels of glucose and insulin in the uterus, which can accelerate fetal growth. The growth of macrosomic fetuses in utero tends to accelerate (after 38 weeks), whereas non-macrosomic fetal growth is more linear during pregnancy (Rahayu & Rodiani, 2016).

Macrosomia can result in problems for both the mother and the child. Postpartum hemorrhage, vaginal lacerations, ripped perineum, and cervical lacerations are the mother's problems. Shoulder dystocia in neonates can result in brachial plexus damage, humeral fractures, and clavicle fractures. Postpartum hemorrhage and shoulder dystocia cause maternal fatalities connected with macrosomia births, whereas shoulder dystocia, poor Apgar scores, and suffocation cause macrosomia-related newborn deaths (Dungga & Husain, 2019).

According to the above description, the authors are interested in investigating the risk factors for macrosomia in infants. Once the risk factors for macrosomia are recognized, preventive measures can be taken to reduce macrosomia's incidence and mitigate its adverse effects.

## 2. RESEARCH METHOD

The design of this research is cross-sectional. This design studies exposure status, disease, or other outcomes simultaneously in individuals from a community at a time enabling epidemiologists to determine the prevalence, distribution, or relationship between disease risk factors and their manifestations (Vionalita, 2020). Given that this is a retrospective study with more than two variables, a cross-sectional design is appropriate so that the research may be conducted reasonably rapidly. This approach is helpful for macrosomia-related public health planning, monitoring, and evaluation. This study included macrosomic babies delivered at Dr. Kariadi Semarang in 2015 and 2021. Using a hypothesis test on the mean of two separate populations, the technique for determining the sample size yielded a total sample size of 60 responders. The sampling approach is convenient (non-probability); the sample is gathered without a specified procedure, and secondary data are utilized. This study's data collecting instrument is a data collection format (master table) in the form of an observation sheet to record the research outcomes.

The variables measured in this study are the mother's age, the period of healthy reproduction (age range 20-35 years) for women, parity, maternal gestational age, gestational diabetes mellitus, obesity, and macrosomia in newborns. Data were analyzed using the Chi-square test. This study has obtained ethical feasibility from the ethics committee of Dr. RSUP. Kariadi Semarang with No. 907/EC/KEPK-RSDK/2021.

## 3. RESULTS AND DISCUSSION

**Table 1.** Distribution of Macrosomia Variable Frequency, Health Reproduction of Mother, Parity, Maternal Gestational Age, History of Diabetes Mellitus, History of Obesity.

Variable	N (60)	%
<b>Macrosomia</b>		
No	35	58.3
Yes	25	41.7
<b>Health reproduction of mother</b>		
Healthy Reproduction (20-35 years)	49	81.7

Unhealthy Reproduction (<20 years and >35 years)	11	18.3
<b>Parity</b>		
Multipara	41	68.3
Primipara	19	31.7
<b>Mother's Gestational Age</b>		
Aterm	59	98.3
Serotinus	1	1.7
<b>History of Diabetes Melitus</b>		
No	59	98.3
Yes	1	1.7
<b>Obesitas History</b>		
No	55	91.7
Yes	5	8.3
<b>Quantity</b>	60	100.0

Table 1 reveals that of the 60 study samples, 35 (58.3%) did not have macrosomia, came from 49 (81.7%) women of healthy reproductive age (age range 20-35 years), parity of more than one was 41 (68.3%), almost all mothers were at term 59 (98.3%), nearly all mothers did not have a history of Diabetes Mellitus as many as 59 (98.3%). The sample was not overweight/obese, as many as 55 (91.7%).

**Table 2.** Bivariate Analysis of the Relationship between Maternal Healthy Reproductive Age and Macrosomia.

Health Reproduction of Mother	Macrosomia				Total	p-value	OR	CI	
	No		Yes						
	N	%	N	%					
Healthy reproduction (20-35 years)	29	82.9	20	80	49	81.7	1.000	1.2	0.324-4.507
Unhealthy Reproduction (<20 years and >35 years)	6	17.1	5	20	11	18.3			
Quantity	35	100.0	25	100.0	60	100.0			

Table 2 shows no relationship between maternal age risk factors and infant macrosomia incidence. However, the maternal age factor is 1.2 times the risk of having a macrosomic baby. This relationship is not significant, as indicated by the p-value 1,000 (> 0.05).

The higher the mother's age, the higher the risk of macrosomia (Merita, 2015). The mother's age is closely related to the baby's birth weight. Pregnancy under 16 years is a high-risk pregnancy, 2-4 times higher than pregnancy in women who are old enough. Developing reproductive organs and physiological functions is not optimal at a young age. In addition, her emotions and psychology are not yet mature enough, so during pregnancy, the mother has not been able to respond to her pregnancy ideally, and complications often occur. In addition, the younger the pregnant woman ages, the more danger of the baby being born prematurely, bleeding, and being born lightly (Sari, Amdadi & Hidayati, 2021). Age-related conditions in pregnant women that must be monitored can impact labor complications; for instance, hemorrhage frequently occurs in women over 35, as does the risk of congenital defects.

**Table 3.** Bivariate Analysis of Maternal Parity with Macrosomia.

Paritas	Macrosomia				Total		<i>p-value</i>	OR	CI
	No		Yes		N	%			
	N	%	N	%					
Multipara	20	57.1	21	84	41	68.3	0.05	0.254	0.72-0.897
Primipara	15	42.9	4	16	19	31.7			
Quantity	35	100.0	25	100.0	60	100.0			

Table 3 shows a significant relationship between parity and infant macrosomia with a *p*-value of 0.05. Because the OR value is 0.254 (<1), parity is a protective factor, meaning there is a negative relationship between parity risk factors and the incidence of babies born with macrosomia.

Based on the results of the study showed that most of the mothers who gave birth to macrosomia were multiparous. The uterus that gives birth to more than one baby experiences a change in its elasticity. The more the number of births, the more elastic and larger the uterus will become. Hence, it may be inferred that multigravida women are more likely to have infants weighing more than 4,000 grams (macrosomia) (Osok et al., 2017). There is a tendency that the birth weight of the second child and so on will be greater than that of the first child (Dungga & Husain, 2019). Multiparity moms have a higher risk of diabetes mellitus and a tendency to have a high body mass index, both of which are key predictors of macrosomia. Multiparity is a factor in the prevalence of macrosomia, according to Fajariyana (2020), which supports this view. The results of this study were possible because some of the mothers who gave birth were mothers with 2-4 times parity (multipara) in the healthy reproductive age range. The possibility of maternal health is still the same as the previous pregnancy, so subsequent pregnancies tend to give birth to babies with higher birth weights (Sujianti, 2015). Especially if the mother has had a macrosomic baby before, there is a 5 to 10 times greater risk of giving birth to a macrosomic baby again (Lestari & Sudarmanto, 2022). Consequently, it can be stated that women who give birth several times have the potential to give birth to larger babies, and the more the parity, the greater the danger of the baby developing macrosomia.

**Table 4.** Bivariate Analysis of Gestational Age with Macrosomia.

Gestational Age	Macrosomia				Total		<i>p-value</i>	OR	CI
	No		Yes		N	%			
	N	%	N	%					
Aterm	35	100	24	96	59	98.3	0.417	0.407	0.299-0.897
Serotinus	0	0	1	4	1	1.7			
Quantity	35	100.0	25	100.0	60	100.0			

Table 4 demonstrates, with a *p*-value of 0.417 (>0.05), that there is no correlation between the mother's gestational age, both aterm (at term) and serotinus (over months), and the occurrence of macrosomia. OR = 1 (0.407), which indicates that the mother's gestational age is also a protective factor since there is a negative link between the risk factor of maternal gestational age and the occurrence of kids delivered with macrosomia.

Contrary to Yunita's study (2016), findings indicated serotinus pregnancies increased macrosomia risk. Compared to term pregnancies, serotinus pregnancies have a 4.426 risk of producing macrosomia babies. This study disproves the hypothesis that post-term pregnancy increases mortality, morbidity, perinatal, or macrosomia. Because the placenta provides nutrients, O<sub>2</sub>, and other functions, post-term pregnancy alters fundamentally. If the placenta functions well, it can maintain the fetus's growth and development so that its weight increases with gestational age, eventually reaching around 4000 grams, making it a macrosomic infant.

According to Zwerding, the proportion of post-term pregnancies with an average fetal weight of more than 3,600 grams was 44.5%, while that of term pregnancies was 30.6%. Post-term pregnancies raise the chance of having a baby weighing more than 4000 grams by two to four times compared to term pregnancies (Sakinah, 2020). A post-term fetus indicates that the placenta is regularly working and that the fetus can handle the obligations of regular delivery without issue. Yet, the ongoing growth of the fetus might cause an alarming amount of cephalopelvic dysport (Handaria et al., 2016). In predicting the possibility of shoulder dystocia, clavicle fractures, or brachial plexus injuries (Kusumawati et al., 2014), which can lead to cesarean section birth, prenatal estimations of the fetus can be performed (Handaria et al., 2016). Lubis, (2019) found that the prevalence of macrosomia may raise the risk of problems such as fetal mortality. Thus, early recognition of instances and treatment of risk factors are necessary to prevent excessive fetal development.

**Table 5.** Bivariate Analysis of Relationship History of Diabetes Mellitus with Macrosomia.

History of DM	Macrosomia				Total	<i>p-value</i>	OR	CI	
	No		Yes						
	N	%	N	%					N
No	35	100	24	96	59	98.3	0.417	0.407	0.299-0.897
Yes	0	0	1	4	1	1.7			
Quantity	35	100.0	25	100.0	60	100.0			

Table 5 reveals no correlation between a mother's history of diabetes and the prevalence of macrosomia. The *p-value*, which is more than 0.05, confirms this. The history of diabetes mellitus in the mother is a protective factor since there is a negative association between the history of diabetes mellitus in the mother and the prevalence of babies born with macrosomia if the OR value is 1. In other terms, a maternal history of diabetes mellitus is not a risk factor for macrosomia based on the data shown in the table above. There is no correlation between gestational diabetes mellitus and the delivery of macrosomic babies. Hence it cannot be predicted that the newborns of mothers with gestational diabetes mellitus will have macrosomia (Muhtar, 2018). This is supported by Setiawan et al., (2014)'s finding that there was no correlation between gestational diabetes and macrosomia.

In contrast to the findings of Rachmawati, (2021) and Zain et al., (2020), which indicated a substantial correlation between diabetes in pregnancy and macrosomia, our study found no such correlation. During pregnancy, mothers with diabetes are 6,029 times more likely to give birth to babies with high birth weights. Theoretically, if the maternal glucose level rises, the baby will absorb 80 percent of the glucose via the placental membrane beginning between 8 and 10 weeks of pregnancy (Rahmawati & Bachri, 2019). Moreover, DMG raises the risk of macrosomia in neonates. This risk is influenced by birthweight, gestational age, and early breastfeeding beginning (Biade et al., 2016).

In this study, based on 60 research samples, there were 25 occurrences of infants with macrosomia. However, only one came from a mother with a history of diabetes mellitus, so there was no statistically significant relationship between a history of diabetes mellitus and the incidence of macrosomia. This result may be due to intense efforts to achieve reasonable metabolic control during pregnancy and shorter gestational duration. In addition, it may also be due to the large number of samples that may not check blood sugar levels, both before and during pregnancy. Laboratory tests, especially blood sugar levels, can prevent complications, both for the mother and the fetus, such as bleeding after delivery and the baby's death in the womb. Preferably, blood sugar checks are carried out in the second trimester, in the 24-28 week gestational age range. Normal blood sugar results are blood sugar levels equal to or less than 140 mg/dL (Nilsson et al., 2015). Based on this explanation, pregnant women with DM do not

always have a risk of having a baby with macrosomia, of course, with excellent and regular supervision or pregnancy checks.

**Table 6.** Bivariate Analysis of the Relationship between Obesity History and Macrosomia.

History of Obesity	Macrosomia				Total	<i>p-value</i>	OR	CI	
	No		Yes						
	N	%	N	%					
No	35	100	20	91.7	55	91.7	0.01	0.364	0.256-0.516
Yes	0	0	5	8.3	5	8.3			
Quantity	35	100.0	25	100.0	60	100.0			

There was a significant relationship between a history of obesity and infant macrosomia, with a *p*-value of 0.01. There is a negative link between the risk factors of Obesity History and the incidence of macrosomia in newborns. It might be stated that a history of maternal obesity is not a risk factor for macrosomia in infants. On the other hand, the history of obesity is a protective factor for infant macrosomia when viewed from the OR value of less than one, which is 0.364. It indicates that a history of obesity is a protective factor for infant macrosomia.

In regulating energy balance, excessive energy intake causes an increase in adipose tissue with an increase in circulating leptin. The hypothalamic anorexia center leptin reduces neuropeptide Y (NPY) production and reduces appetite. On the other hand, when energy requirements are higher than energy intake, adipose tissue is reduced, the hypothalamic anorexia center is stimulated, and appetite increases. High leptin levels do not cause a decrease in appetite. Leptin resistance occurs in most obese people.

Maternal obesity can cause complications for the fetus and newborn, such as giant babies, shoulder dystocia, high birth weight, and childhood obesity. Women with obesity and gestational diabetes are at risk of giving birth to giant babies at the 90th percentile gestational age (LGA), or as much as 4.5 kg. Maternal obesity is also associated with abnormal fetal growth or the development of fetal macrosomia (Natalia et al., 2020). It occurs via a resistance-raising mechanism (maternal non-diabetic mellitus) that increases fetal glucose and insulin levels. Placental lipase metabolizes triglycerides in the mother's blood and transfers free fatty acids as nutrients for the growing fetus. Increased triglyceride levels in obese mothers are associated with excessive fetal growth through increased free fatty acids (Merita, 2015).

One of the supervision of pregnant women is regulating diet and weight. It is essential because nutritional deficiencies and excesses can cause unwanted abnormalities in pregnancy. If the mother does not get adequate nutrition during pregnancy or her weight gain is less than recommended, their pregnancy is associated with an increase in low birth weight (<2500 grams). Meanwhile, if the mother gains excess weight before pregnancy or during pregnancy, there is an increase of more than 15 kg, which increases the risk of macrosomia (≥4000 grams) (Alfianti et al., 2022; Susianti, 2017). Pregnant women should avoid high-fat, incredibly saturated fatty acids as prevention because the fat can increase the appearance of fat masses that stick to the walls of blood vessels. Reducing fat can burn 30% of total calories, and reducing the consumption of excess carbohydrates will help one normal weight gain in pregnant women. Pregnant women need to ensure a balanced diet and physical activity. Physical activity improves weight management by burning calories. A good lifestyle can prevent hypercholesterolemia and high blood pressure (Natalia et al., 2020). In addition, the Royal Australian and New Zealand College of Obstetrics and Gynecology (RANZCOG) states that nutritionists and family specialists must support obesity management. Various dietary supplements are indicated for pre-pregnant individuals, including 5 mg of folic acid per day for women with a BMI of 30 kg/m<sup>2</sup> or above (Gilmore & Redman, 2015). According to RCOG recommendations, vitamin D supplementation is advised due to the inverse relationship between BMI and vitamin D levels. RANZCOG also recommends 150 g of iodine and vitamin

D per day if the patient is deficient in vitamin D (Pellonperä et al., 2018). Excessive maternal weight before pregnancy (obesity) and the rise in maternal weight gain during pregnancy might result in big infants (Farahdiba & Agusalam, 2018). This makes it necessary for mothers with a history of obesity to calculate their body mass index before pregnancy to control weight gain in each trimester of pregnancy so that they can anticipate the occurrence of macrosomia babies or other complications related to obesity.

#### 4. CONCLUSION

Eighty-one percent (81.7%) of the sixty moms were of healthy reproductive age (20-35 years). Most parity women were multiparous (2-4 births), 41 out of 60 mothers (68.3%). Virtually all gestational ages were at term, 59 out of 60 (98.3%) moms. Among 60 women with a history of diabetes mellitus, nearly all (59) had no history of diabetes mellitus (98.3%). The vast majority (91.7%), or 55 of 60 moms, had no history of obesity.

Parity and obesity history affect macrosomic newborns with a p-value <0.05. However, there was no relationship between maternal age, gestational age, history of diabetes mellitus in the mother, and the incidence of macrosomia in infants with a p-value > 0.05. The recommendation from this study is that further research is needed on other risk factors associated with macrosomia incidence with a larger sample size and BMI monitoring during pregnancy.

#### REFERENCES

- Adli, F. K. (2021). Diabetes Melitus Gestasional: Diagnosis dan Faktor Risiko. *Jurnal Medika Hutama*, 3(1), 1545–1551. Retrieved from <https://jurnalmedikahutama.com/index.php/JMH/article/view/312/214>
- Alfianti, H. N., Martanti, L. E., Damayanti, D., Sari, P. N., & Maldinawati, A. (2022). Karakteristik Bayi dengan Makrosomia di Kota Semarang. *Jurnal SMART Kebidanan*, 9(1), 27–33. <https://doi.org/10.34310/sjkb.v9i1.581>
- Biade, D. R., Julia, M., & Wibowo, T. (2016). Pengaruh Diabetes Melitus pada Ibu Hamil terhadap Hipoglikemia dan Makrosomia pada Masa Neonatus. *Thesis*. S2 Ilmu Kedokteran Klinik, Universitas Gadjah Mada. Retrieved from [http://etd.repository.ugm.ac.id/home/detail\\_pencarian/97789](http://etd.repository.ugm.ac.id/home/detail_pencarian/97789)
- Dungga, E. F., & Husain, S. W. (2019). Faktor yang Berhubungan Dengan Makrosomia. *Jambura Nursing Journal (JNJ)*, 1(2), 65–72. <https://doi.org/10.37311/jnj.v1i2.2493>
- Fajariyana, N. (2020). Faktor yang Mempengaruhi Bayi Makrosomia. *Higeia Journal of Public Health Research and Development*, 4(3), 584–594. Retrieved from <https://journal.unnes.ac.id/sju/index.php/higeia/article/view/34594>
- Farahdiba, I., & Agusalam. (2018). Hubungan antara Ibu Pengidap Diabetes dengan Kelahiran Bayi Makrosomia di RSUD Syekh Yusuf Gowa Tahun 2018. *Jurnal Kesehatan Delima Pelamonia*, 2(2), 170–174. <https://doi.org/10.37337/jkdp.v2i2.85>
- Gilmore, L. A., & Redman, L. M. (2015). Weight Gain in Pregnancy and Application of the 2009 IOM Guidelines: Toward a Uniform Approach. *Obesity*, 23(3), 507–511. <https://doi.org/10.1002/oby.20951>
- Handaria, D., Kurniati, I. D., & Yunita, A. (2016). Hubungan Usia Kehamilan dengan Kejadian Makrosomia. 5(1), 1–5. Retrieved from <https://jurnal.unimus.ac.id/index.php/kedokteran/article/view/2590>

- Kementerian Kesehatan Republik Indonesia. (2019). *Laporan Nasional Riskeudas 2018*. Jakarta: Badan Penelitian dan Pengembangan Kesehatan. Retrieved from [https://labmandat.litbang.kemkes.go.id/images/download/laporan/RKD/2018/Laporan\\_Nasional\\_RKD2018\\_FINAL.pdf](https://labmandat.litbang.kemkes.go.id/images/download/laporan/RKD/2018/Laporan_Nasional_RKD2018_FINAL.pdf)
- Kusumawati, L., Tendean, H. M. M., & Suparman, E. (2014). Persalinan dengan Luaran Makrosomia di BLU RSUP. Prof. Dr. R. D. Kandau. *E-Clinic*, 2(2). Retrieved from <https://ejournal.unsrat.ac.id/index.php/eclinic/article/view/5023>
- Lestari, R. F., & Sudarmanto. (2022). Neonatus dengan Makrosomia dan Hipoglikemia. *Proceeding of The 15th Continuing Medical Education*, 395–405. Retrieved from <https://proceedings.ums.ac.id/index.php/kedokteran/article/view/2131/2086>
- Lubis, F. (2019). Multigravida dengan Makrosomia dan Intra Uterine Fetal Death: Suatu Studi Kasus di RS Abdul Moeloek Bandar Lampung. *JIMKI*, 7(1), 6–13. Retrieved from <https://bapin-ismki.e-journal.id/jimki/article/download/378/162/>
- Merita. (2015). Faktor Resiko Bayi Lahir Gemuk (Macrosomia) di Indonesia. *Jurnal Akademika Baiturrahim*, 4(2), 1–10. Retrieved from <http://stikba.ac.id/medias/journal/1-10.pdf>
- Muhtar, A. (2018). Hubungan Diabetes Gestasional pada Ibu HAMil dengan Kelahiran Bayi Makrosomia di RSII Sitti Khadijah I Muhammadiyah. *Jurnal Ilmiah Kesehatan Diagnosis*, 12(5), 487–490. Retrieved from <http://ejournal.stikesnh.ac.id/index.php/jikd/article/view/827>
- Natalia, J. R., Rodiani, & Zulfadli. (2020). Pengaruh Obesitas dalam Kehamilan Terhadap Berat Badan Janin. *Medula*, 10(3), 539–544. Retrieved from <http://www.journalofmedula.com/index.php/medula/article/view/134>
- Nilsson, C., Ursing, D., Strevens, H., & Olsson, M. L.-. (2015). Towards Normalized Birthweight in Gestational Diabetes Mellitus. *National Library of Medicine*, 94(10), 1090–1094. <https://doi.org/10.1111/aogs.12695>
- Osok, S., Wantania, J. J. E., & Mewengkang, M. E. (2017). Gambaran Kehamilan dengan Luaran Makrosomia Periode Januari–Desember 2014 di RSUP Prof. Dr. R. D. Kandou Manado. *E-Clinic*, 5(1), 38–43. Retrieved from <https://ejournal.unsrat.ac.id/index.php/eclinic/article/view/14765/14334>
- P2PTM Kemenkes RI. (2020). *Yuk, mengenal apa itu penyakit Diabetes Melitus (DM)*. Internet. Kementerian Kesehatan Republik Indonesia. Retrieved from <https://p2ptm.kemkes.go.id/infographic-p2ptm/penyakit-diabetes-melitus/page/5/yuk-mengenal-apa-itu-penyakit-diabetes-melitus-dm>
- Pellonperä, O., Koivuniemi, E., Vahlberg, T., Mokkala, K., Terti, K., Rönnemaa, T., & Laitinen, K. (2018). Dietary Quality Influences Bodycomposition in Overweight and Obese Pregnant Women. *Clinical Nutrition*, 38(4), 1613–1619. <https://doi.org/10.1016/j.clnu.2018.08.029>
- Rachmawati, F. (2021). Faktor Risiko Kejadian Makrosomia. *MJ (Midwifery Journal)*, 1(4), 211–218. Retrieved from <https://www.ejurnalmalahayati.ac.id/index.php/MJ/article/view/5625>
- Rahayu, A., & Rodiani. (2016). Efek Diabetes Melitus Gestasional terhadap Kelahiran Bayi Makrosomia. *MAJORITY*, 5(4), 17–22. Retrieved from <https://juke.kedokteran.unila.ac.id/index.php/majority/article/viewFile/874/785>

- Rahmawati, A., & Bachri, S. (2019). Deskripsi Faktor Risiko Diabetes Melitus Gestasional di Poli Kandungan RSD kalifat Jember. *Jurnal Kesehatan Dr. Soebandi*, 7(2), 98–105. Retrieved from <http://journal.uds.ac.id/index.php/jkds/article/view/149>
- Sakinah, A. U. (2020). *Hubungan Umur dan Paritas Ibu Bersalin dengan Kehamilan Post Date di RSIA Husada Bunda Salo Kabupaten Kampar. Skripsi*. Program Studi Kebidanan Program Sarjana Terapan, Fakultas Ilmu Kesehatan, Universitas Pahlawan Tuanku Tambusai. Retrieved from <https://repository.universitaspahlawan.ac.id/255/>
- Sari, N., Amdadi, Z. A., Hidayati. (2021). Pengaruh Senam Hamil Dengan Kejadian Ruptur Perineum di Puskesmas Minasa Upa Makassar. *Jurnal Inovasi Penelitian*, 2(11), 3787–3794. Retrieved from <https://stp-mataram.e-journal.id/JIP/article/view/1421>
- Setiawan, H., Fratidhina, Y., & Ali, M. (2014). Hubungan Ibu Hamil Pengidap Diabetes Mellitus dengan Kelahirkan Bayi Makrosomia di RSAB Harapan Kita Jakarta. *Jurnal Ilmu Dan Teknologi Kesehatan*, 1(2), 101–105. Retrieved from <https://www.ejurnal.poltekkesjakarta3.ac.id/index.php/jitek/article/view/42>
- Sujianti, S., & Widyoningsih, W. (2015). Analisis Faktor-Faktor Ibu yang Berhubungan dengan Kejadian Bayi Makrosomia di RSUD Cilacap tahun 2014. *Jurnal Kesehatan Al-Irsyad*, 5(1), 1–11. Retrieved from <http://jka.universitalirsyad.ac.id/index.php/jka/article/view/33>
- Susianti. (2017). *Faktor yang Berhubungan dengan Kejadian Makrosomia di RSUD Sawerigading Palopo*.
- Vionalita, G. (2020). *Modul Metodologi Penelitian Kuantitatif*. Universitas Esa Unggul. [https://lmsspada.kemdikbud.go.id/pluginfile.php/548169/mod\\_resource/content/1/Modul metlit kuanti part 11.pdf](https://lmsspada.kemdikbud.go.id/pluginfile.php/548169/mod_resource/content/1/Modul%20metlit%20kuanti%20part%2011.pdf)
- Yunita, A. (2016). Hubungan Kehamilan Serotinus dengan Kejadian Bayi Makrosomia di RSUD Tugurejo Semarang. *Thesis Sarjana*. Universitas Muhammdiyah semarang. <http://repository.unimus.ac.id/211/>
- Zain, I. F., Setiyorini, N., & Setyawati, A. N. (2020). Hubungan Preeklampsia dan Bayi Makrosomia dengan Kejadian Diabetes pada Kehamilan di RSUP Dr Kariadi Semarang. *Karya Tulis Ilmiah*. Universitas Diponegoro. <https://eprints2.undip.ac.id/id/eprint/9904/>

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DOI: [10.31965/infokes.Vol21Iss1.892](https://doi.org/10.31965/infokes.Vol21Iss1.892)Journal homepage: <http://jurnal.poltekeskupang.ac.id/index.php/infokes>**RESEARCH****Open Access****Preparedness of Emergency Room Nurses After Emerging Infectious Diseases Screening****Ida Ayu Agung Laksmi<sup>1a\*</sup>, I Made Dwie Pradnya Susila<sup>1b</sup>, Made Ani Suprpta<sup>1c</sup>**<sup>1</sup> Department of Nursing, Institute of Health Science Bina Usada Bali, Badung, Bali, Indonesia<sup>a</sup> Email address: [agunglaksmi41@gmail.com](mailto:agunglaksmi41@gmail.com)<sup>b</sup> Email address: [dwiepradnya@gmail.com](mailto:dwiepradnya@gmail.com)<sup>c</sup> Email address: [anikajus@yahoo.co.id](mailto:anikajus@yahoo.co.id)

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**Abstract**

Emerging infectious diseases (EID) is one of the leading causes of death worldwide since it initially attacks a population or has existed before but is increasing very rapidly in terms of the number of new cases in a population. Early detection of EID patients refers to early screening. Screening of patients with suspected EID such as Covid-19 or other airborne infectious diseases must be performed at the first contact with suspected patients. This study aims to evaluate the effectiveness of EID screening instrument applied at the Emergency Room (ER). This was a quantitative pre-experimental study with a one-group pretest-posttest design. The sample size consisted of 34 nurses at the ER of Mangusada Hospital, Bali, who were selected using a total sampling technique. The intervention administered in this study was the implementation of EID screening instrument before the patients entered triage for 1 month on June 2022 at the ER of Mangusada Hospital. After ensuring the distribution and homogeneity of the data, a paired t-test was employed for parametric statistical data analysis. The result of the study showed a p-value of (0.004) or  $p < \alpha$  (0.05). So, it can be concluded that there was an effect of the screening instrument applied at the ER of Mangusada Hospital on the preparedness of nurses in dealing with EID. Thus, the screening for patients with EID should be implemented in each emergency unit. The study finding can help improve nurse preparedness regarding the prevention of EID. In addition, future study is recommended to assess the competence of nurses regarding the prevention of EID.

**Keywords:** Emerging Infectious Disease, EID Screening Instrument, Preparedness of Emergency Room Nurses.**\*Corresponding Author:**

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## 1. INTRODUCTION

Emerging infectious disease (EID) is one of the leading causes of death worldwide (AK, 2020). It initially attacks a population or has existed before but is increasing very rapidly in terms of the number of new cases in a population. Several diseases considered as EID involve severe acute respiratory syndrome (SARS), avian influenza A (H7N9) to Covid-19 which emerged in the twenty-first century as a new disease that became a special concern for the community (Sikatta, & Adisasmito, 2020).

Southeast Asia is a hotspot for emerging infectious diseases, including those with pandemic potential (Coker et al., 2011). Several WHO countries in the Southeast Asia Region have certain conditions that may lead to the emergence of this disease, many of which are diseases that can be deadly and spread quickly. Scientific research towards 335 new diseases conducted between 1940 and 2004 indicated that some areas in the world may experience the emergence of EID. Some of the global “hotspots” for EID are countries associated with the Indo-Gangetic Plain and the Mekong watershed. The Nipah virus, Crimean-Congo hemorrhagic fever, Avian influenza (H5N1) to Covid-19 are examples of diseases emerged recently and have surrendered to the WHO for the Southeast Asia Region (Sub Directorate for Emerging Infectious, 2023). Population shifts and travels as well as climate change lead to an increase in the spread of emerging and re-emerging infections (Millán et al., 2018). Bali as a world tourist destination in Southeast Asia Region has certain risks and vulnerabilities to emerging infectious diseases.

Clinicians recognize that EID is inevitable and unpredictable (Mcgonagle, 2020). The Emergency Room (ER) as the front door of the hospital in providing health services is the main place for providing acute services, in large numbers and is available 24 hours per day. Since the onset of Covid-19 as one of the EID outbreaks, there has been a significant increase in the proportion of ER patient visits for upper respiratory tract infections, shortness of breath, and chest pain complaints. Patients with complaints resembling Covid-19 symptoms who come to the hospital are directed to the ER, while the ER is also open for emergency patients without Covid-19 symptoms. Such condition is very risky for Covid-19 transmission between patients and healthcare workers. The incident report regarding the emergency room was temporarily closed because it was the locus of transmission of Covid-19. Therefore, it is necessary to have an emergency protocol against outbreaks of infectious diseases.

One of the very important precaution protocols for early detection of patients with EID is screening. Screening of patients suspected of being infected with EID such as Covid-19 or other airborne diseases must be carried out at the first contact (Qadri, Elida, & Larasati, 2021). One of the studies conducted in Saudi Arabia reported hospital readiness and response to triage and screening, and most of the nurses revealed that screening and sorting of infectious patients were so important and hospitals should be facilitated with initial screening areas for temperature checks (Al Baalharith & Pappiya, 2021).

One indicator of the feasibility of a screening instrument is the level of nurse preparedness. Emergency preparedness for hospital nurse epidemiology is a major issue of concern. Furthermore, nurses are considered the first group who can recognize outbreaks of newly emerging infectious diseases as well as important implementers of an emergency plan for the epidemic in hospitals (Nie et al., 2022). However, at the same time, the fact that information about new viruses is discovered later requires the information obtained to be immediately transferred to the implementation area. Such situation has created worry and fear among nurses about how to deal with the virus (El-Monshed et al., 2021).

Nurse preparedness in dealing with patients with EID is an inseparable part of hospital disaster management (Mahdi, & Mudatsir, 2014), (Presiden Republik Indonesia, 2007). WHO emphasizes the implementation of hospital readiness checklists for EID to improve prevention

and management among healthcare professionals. Therefore, the preparedness component is very important for frontline nurses (Al Baalharith & Pappiya, 2021).

Mangusada Regional Hospital is one of the referral hospitals for Covid-19 patients in Bali Province, especially in Badung Regency. Based on the results of a preliminary study conducted on December 20, 2021 through interviews with 6 nurses on duty in the emergency room, 5 people said they were still not ready and were afraid and tense when dealing with EID patients such as Covid-19. In addition, 4 people said that they were not ready if there was an outbreak of other infectious diseases besides Covid-19 and experienced palpitations while managing patients with suspected Covid-19. Such findings indicated that the preparedness of nurses in dealing with patients with EID at the ER of Mangusada Hospital was still in the low level.

Based on the phenomenon found, the hospital realized the need to improve the alert protocol through screening. This study aims to determine the feasibility of a screening instrument for EID patients by analyzing the level of preparedness of nurses at the emergency room of RSD Mangusada and to evaluate the effectiveness of the EID screening instrument at the ER. The current study has a benefit to encourage respondents to be more stringent in using personal protective equipment (PPE) to protect them from the transmission of emerging infectious diseases (EID).

## **2. RESEARCH METHOD**

This was a pre-experimental study with a one-group pretest-posttest design which is an experimental design by means of a pre-test before administering an intervention and a post-test after the intervention. The sample size consisted of 34 nurses at the ER of Mangusada Hospital, Bali, who were selected using a total sampling technique. The independent variable in this study was EID patient screening and the dependent variable was nurse preparedness.

The intervention administered in this study was the implementation of EID screening instrument before the patients entered triage for 1 month on June 2022. This study assessed a screening instrument that focused on the patient screening process in which an individual was evaluated and screened using symptomatic criteria and epidemiological history. The result would determine whether the patient fell into the category of suspected infectious disease outbreak or not with the aim of isolating infected patients. Screening patients suspected of having an infectious disease such as COVID-19 may reduce exposure to other patients, visitors, and hospital staffs, prevent the spread of disease in health facilities, and ensure the use of personal protective equipment (PPE) in accordance with the guidelines (Vinet & Zhedanov, 2011).

The screening process in this study was performed in the ER triage room at Mangusada Hospital using an instrument that provided related information for symptoms of infection (eg, fever and cough) and travel history in the outbreak area which was compiled based on a literature review derived from several empirical studies (WHO, 2018); (Yaffee, Isakov & Wu, 2019). The day before the implementation of the intervention, a pre-test was conducted by measuring the preparedness of the nurses at the emergency room through a questionnaire on the preparedness of nurses in dealing with EID. After the EID screening instrument was implemented, the respondents filled in the same questionnaire as the post-test result.

The nurse preparedness in dealing with EID questionnaire consisted of 28 question items which were divided into 4 dimensions including the knowledge on preparedness for emerging infectious diseases, facility preparedness and response readiness in triage, and effective response of nurses, as well as preparedness and readiness of nurses to use personal protective equipment. Such questionnaire had been tested for validity and reliability in April 2022 among all nurses at the ER of Klungkung Hospital. The results of the person product moment test found that all instrument items were valid and reliable according to Cronbach's alpha value of

>0.90 (Laksmi & Susila, 2022).

The collected data were then analyzed for univariate and bivariate data. Univariate analysis was conducted to provide a description of the respondents' characteristics including age, gender, training history, and years of service at the ER. Bivariate analysis was performed using Paired T-Test with a significance level of ( $\alpha < 0.05$ ) to analyze whether there was a difference in nurse preparedness scores before and after the implementation of EID screening.

In addition, at the implementation stage, the researcher also obtained ethical clearance from the health research ethics committee of Mangusada Hospital. This study was conducted based on ethical principles including informed consent, anonymity, and confidentiality. This study has obtained ethical clearance from the ethics commission through letter number 1488/IV/RSDM/2022 which was valid for one year since first issued on April 27, 2023.

### 3. RESULTS AND DISCUSSION

The Nurse preparedness in dealing with EID questionnaire was distributed before and after the implementation of EID screening. This study involved 34 nurses at the ER of Mangusada Hospital. The characteristics of respondents are presented in Table 1.

**Table 1.** Characteristics of respondents.

Characteristic of Respondents	Mean (SD)	n (%)
Age	32.57 (3.8)	
Years of Service	8.83 (3.9)	
<b>Gender</b>		
Male		22 (64.7)
Female		12 (35.3)
<b>Level of education</b>		
Diploma in Nursing		26 (76.5)
Professional Nursing		8 (23.5)

Table 1 revealed that the mean age and years of service of nurses at the ER of Mangusada Hospital were 32 years old and 8 years, respectively. Such findings are in contrast with a study conducted in Korea regarding the characteristics of emergency room nurses, which showed that the mean age and years of service of nurses were 28 years old and 5 years, respectively (Choi & Kim, 2018). However, the study findings are in line with previous study conducted in Bali which showed that the mean age and years of service of nurses were more than 30 years old and more than 8 years, respectively (Laksmi & Susila, 2022). The study findings indicated differences regarding the characteristics of emergency room nurses between countries.

Table 1 also showed the majority of the respondents (64.7%) were male. This is in line with previous study which showed that most of nurses at the ER were male (Alzahrani and Kyratsis, 2017). Furthermore, this study found that most of respondents (76.5%) were graduated from Diploma in Nursing. Several previous studies also showed that most of emergency room nurses in Indonesia had the level of education of Diploma in Nursing (Rochani, 2021; Emaliyawati et al., 2021).

**Table 2.** Results of the Analysis for Preparedness of Emergency Room Nurses Before and After EID Screening.

Variable	Mean	SD	p-value	t
Nurse Preparedness Value Before the Implementation of EID Screening Instrument	59.21	11.536	0.004	3.062
Nurse Preparedness Value After the Implementation of EID Screening Instrument	66.50	13.621		

Based on table 2 above, it can be observed that there was a difference in the mean nurse preparedness before and after the implementation of EID screening instrument with a p-value of (0.004) or  $p < \alpha$  (0.05). Thus, the study hypothesis was accepted which indicated that there was an effect of the EID screening instrument on the preparedness of nurses in dealing with EID at the ER of Mangusada Hospital. Table 2 also revealed that there was a difference in the mean value of preparedness of emergency room nurses in dealing with EID before ( $59.21 \pm 11.536$ ) and after the implementation of EID screening instrument ( $66.50 \pm 13.621$ ). Such finding indicated that there was an increase in nurse preparedness after the implementation of the EID screening instrument at the ER triage of Mangusada Hospital.

The current study focused on evaluating the nurse preparedness before and after the implementation of EID screening. EID is a disease that initially emerges and attacks a population or has existed before but is increasing very rapidly in terms of the number of new cases in a population, which even spreads to new geographic areas (re-emerging) (Sikatta & Adisasmito, 2020). Emerging diseases have been categorized as newly emerging, re-emerging, or deliberately emerging diseases which can be associated with bioterrorism (Morens & Fauci, 2020). This trend will continue due to several factors, including the increased global population, aging, travel, urbanization, and climate change, evolution, and spread of new pathogens (Bloom, Black, & Rappuoli, 2017).

Nurses are healthcare professionals who work across acute care hospitals, long-term care agencies, nursing homes, schools, communities, as well as government healthcare agencies (Chen, Lai, & Shioh-Luan, 2020). As front liners, ER nurses need certain preparedness including early identification and notification to deal with a pandemic. Nurses need a proper protection, including quality PPE for protection and the provision of quality care to patients with emerging infectious diseases including COVID-19 (Al Baalharith & Pappiya, 2021).

Based on the study results, it was indicated that the screening process for EID patients was effective to improve preparedness among Emergency Room nurses. In our study site, screening of patients with EID was implemented in the pre-triage room, in accordance with the EID prevention principle that screening should be carried out at the first contact with patients. In principle, screening serves to avoid potential infectious disease risks as well as help identify health needs (Beeres et al., 2018). Several studies revealed that the screening process for EID patients was very effective in preventing disease transmission. One of the studies indicated a pre-triage screening accuracy of 63.7% (Hensgens et al., 2021).

Nurse preparedness is crucial for preventing EID transmission. This study assessed the mean score of nurse preparedness in dealing with emerging infectious diseases which included: 1) dimension of knowledge on preparedness for emerging infectious diseases, 2) dimension of facility preparedness and response readiness in triage, 3) dimension of the effective response of nurses, and 4) dimension of preparedness and readiness of nurses to use personal protective equipment (Laksmi & Susila, 2022); (Susila & Laksmi, 2022). The results showed that there was an increase in the mean score of nurse preparedness in dealing with EID after the implementation of EID screening instrument at ER Mangusada Hospital (table 2).

A literature review on nurse preparedness in dealing with infectious disease formulates 4 related factors including 1) knowledge and skills, 2) Psychological preparation, 3) External resources, and 4) Attitude and Intention (Nie et al., 2022). In this study, the screening process was one of the factors included in external resources, because it focused on protective equipment, information availability, and a safe environment (Nie et al., 2022). Screening instruments can provide information regarding the initial symptoms of infection, and the patient's travel history so that it may increase the nurse's alertness and ability to prepare a safe environment, provide treatment, and avoid or reduce symptoms and other consequences, as well as improving health outcomes of the population at a reasonable cost (Iragorri & Spackman, 2018). In the current study, the existence of a screening process was found to be effective in

increasing the preparedness of nurses to manage emerging infectious diseases. Moreover, other studies also reported good economic benefits of the screening process (Atkeson, 2020).

One of the strategies recommended to better prepare frontline facilities such as ER is universal screening for symptoms of infection (e.g., fever and cough) and recent travel history (Yaffee, Isakov, & Wu, 2019). In addition, an important component of preparedness is the ability of nurses to rapidly implement an effective screening process for EID (Palagyi et al., 2019). For the prevention of EID cases, screening should be performed towards all travelers since the first time of arrival (Gostic, Kucharski, & Lloyd-Smith, 2015).

This study had several limitations. First, since the intervention administered was EID screening at the ER of Mangusada Hospital which had implemented a specific Covid-19 screening, the value of nurse preparedness before intervention was high (59.21 ±11.536). Second, the study site was only at 1 hospital, so it could not assess preparedness in each domain, especially regarding facility preparedness and response readiness.

#### 4. CONCLUSION

Based on the results and discussion above, it can be concluded that the screening process could effectively improve the preparedness of nurses in dealing with emerging infectious diseases. Therefore, the screening process for patients with EID should be implemented in each ER. The study finding can help improve nurse preparedness regarding the prevention of EID. In addition, future study is recommended to assess the competence of nurses regarding the prevention of EID.

#### REFERENCES

- AK, I. Y. D. Pengembangan sistem kewaspadaan dini penyakit new-emerging dan re-emerging, studi kasus pada penyakit mers-cov dan ebola di kantor kesehatan pelabuhan soekarno-hatta. *Journal of Information Systems for Public Health*, 4(1), 1-8. <https://doi.org/10.22146/jisph.12329>
- Al Baalharith, I. M., & Pappiya, E. M. (2021). Nurses' preparedness and response to COVID-19. *International Journal of Africa Nursing Sciences*, 14, 100302. <https://doi.org/10.1016/j.ijans.2021.100302>
- Alzahrani, F., & Kyratsis, Y. (2017). Emergency nurse disaster preparedness during mass gatherings: a cross-sectional survey of emergency nurses' perceptions in hospitals in Mecca, Saudi Arabia. *BMJ open*, 7(4), e013563. Retrieved from <https://bmjopen.bmj.com/content/7/4/e013563.abstract>
- Atkeson, A., Droste, M. C., Mina, M., & Stock, J. H. (2020). *Economic benefits of COVID-19 screening tests* (No. w28031). National Bureau of Economic Research. <https://doi.org/10.3386/w28031>
- Beeres, D. T., Cornish, D., Vonk, M., Ravensbergen, S. J., Maeckelberghe, E. L., Boele Van Hensbroek, P., & Stienstra, Y. (2018). Screening for infectious diseases of asylum seekers upon arrival: the necessity of the moral principle of reciprocity. *BMC Medical Ethics*, 19(16), 1-7. <https://doi.org/10.1186/s12910-018-0256-7>
- Bloom, D. E., Black, S., & Rappuoli, R. (2017). Emerging infectious diseases: A proactive approach. *Proceedings of the National Academy of Sciences*, 114(16), 4055-4059. <https://doi.org/10.1073/pnas.170141011>
- Chen, Shu-Ching, Yeur-Hur, L. A. I., & Shiow-Luan, T. S. A. Y. (2020). Nursing perspectives on the impacts of COVID-19. *Journal of Nursing Research*, 28(3), e85. <https://doi.org/10.1097/jnr.0000000000000389>
- Choi, J. S., & Kim, J. S. (2018). Factors influencing emergency nurses' ethical problems during the outbreak of MERS-CoV. *Nursing ethics*, 25(3), 335-345.

- <https://doi.org/10.1177/0969733016648205>.
- Coker, R. J., Hunter, B. M., Rudge, J. W., Liverani, M., & Hanvoravongchai, P. (2011). Emerging infectious diseases in southeast Asia: regional challenges to control. *The Lancet*, 377(9765), 599-609. [https://doi.org/10.1016/S0140-6736\(10\)62004-1](https://doi.org/10.1016/S0140-6736(10)62004-1)
- El-Monshed, A. H., Amr, M., Ali, A. S., Elmasry, Y. M., & Zoromba, M. (2021). Nurses' knowledge, concerns, perceived impact and preparedness toward COVID-19 pandemic: A cross-sectional survey. *International journal of nursing practice*, 27(6), e13017. <https://doi.org/10.1111/ijn.13017>.
- Emaliyawati, E., Ibrahim, K., Trisyani, Y., Mirwanti, R., Ilhami, F. M., & Arifin, H. (2021). Determinants of nurse preparedness in disaster management: a cross-sectional study among the community health nurses in coastal areas. *Open access emergency medicine*, 13, 373-379. <https://doi.org/10.2147/OAEM.S323168>.
- Gostic, K. M., Kucharski, A. J., & Lloyd-Smith, J. O. (2015). Effectiveness of traveller screening for emerging pathogens is shaped by epidemiology and natural history of infection. *Elife*, 4, e05564. <https://doi.org/10.7554/eLife.05564>
- Hensgens, K. R., van Rensen, I. H., Lekx, A. W., van Osch, F. H., Knarren, L. H., Wyers, C. E., ... & Barten, D. G. (2021). Sort and sieve: pre-triage screening of patients with suspected COVID-19 in the emergency department. *International Journal of Environmental Research and Public Health*, 18(17), 9271. <https://doi.org/10.3390/ijerph18179271>
- Iragorri, N., & Spackman, E. (2018). Assessing the value of screening tools: reviewing the challenges and opportunities of cost-effectiveness analysis. *Public health reviews*, 39(1), 1-27. <https://doi.org/10.1186/s40985-018-0093-8>
- Laksmi, I. A. A., & Susila, I. M. D. P. (2022). Validity and Reliability of the Nurse Preparedness Questionnaire in Facing Emerging Infectious Diseases. *Nursing and Health Science Journal (NHSJ)*, 2(3), 240-243. <https://doi.org/10.53713/nhs.v2i3.157>
- Mcgonagle, D. (2020). 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*.
- Millán, R., Thomas-Paulose, D., & Egan, D. J. (2018). Recognizing and managing emerging infectious diseases in the emergency department. *Emergency medicine practice*, 20(5), 1-20. Retrieved from <https://europepmc.org/article/med/29697919>
- Morens, D. M., & Fauci, A. S. (2020). Emerging pandemic diseases: how we got to COVID-19. *Cell*, 182(5), 1077-1092. <https://doi.org/10.1016/j.cell.2020.08.021>
- Mahdi, M., & Mudatsir, N. (2014). Kesiapsiagaan Perawat Dalam Menghadapi Wabah Flu Burung Di Instalasi Gawat Darurat Rumah Sakit Umum Daerah Dr. Zainoel Abidin Banda Aceh. *Jurnal Ilmu Kebencanaan: Program Pascasarjana Unsyiah*, 1(2), 22-27. Retrieved from <https://jurnal.usk.ac.id/JIKA/article/view/5597>
- Nie, A., Su, X., Dong, M., & Guan, W. (2022). Are nurses prepared to respond to next infectious disease outbreak: A narrative synthesis. *Nursing Open*, 9(2), 908-919. <https://doi.org/10.1002/nop2.1170>
- Palagyi, A., Marais, B. J., Abimbola, S., Topp, S. M., McBryde, E. S., & Negin, J. (2019). Health system preparedness for emerging infectious diseases: a synthesis of the literature. *Global Public Health*, 14(12), 1847-1868. <https://doi.org/10.1080/17441692.2019.1614645>
- Presiden Republik Indonesia. (2007). *Undang Undang Republik Indonesia Nomor 24 Tahun 2007 Tentang Penanggulangan Bencana*. Retrieved from <https://peraturan.bpk.go.id/Home/Details/39901/uu-no-24-tahun-2007>
- Qadri, U., Elida, S. S & Larasati, F. (2021). Mitigation Models and Strategies Corona Virus

- Disease 2019 (COVID19) Non-Natural Disasters (Study on BPBD of West Kalimantan Province). *Publik (Jurnal Ilmu Administrasi)*, 10(1), 109-125. <http://dx.doi.org/10.31314/pjia.10.1.109-125.2021>
- Rochani, S. (2021). Hubungan Tingkat Pendidikan dan Lama Kerja dengan Waktu Tanggap Perawat di Instalasi Gawat Darurat RSUD Dr. Adjidarmo Rangkasbitung. *Jurnal Kesehatan Saemakers PERDANA*, 4(2), 221-229. Retrieved from <https://journal.ukmc.ac.id/index.php/joh/article/view/269>
- Sikatta, F. O. A., & Adisasmito, W. B. B. (2020). Resiko Perilaku Konsumsi Satwa Liar Terhadap Kejadian Penyakit Infeksi Emerging (PIE): Tinjauan Literatur. *IAKMI Jurnal Kesehatan Masyarakat Indonesia*, 1(3), 143-150. Retrieved from <http://jurnal.iakmi.id/index.php/IJKMI/article/view/119#>
- Sub Direktorat Penyakit Infeksi Emerging, K. (2023). *Mengenal Penyakit Infeksi Emerging [Internet]*. Sub Direktorat Penyakit Infeksi Emerging, Kementerian Kesehatan Republik Indonesia. Retrieved from <https://infeksiemerging.kemkes.go.id/mengenal-penyakit-infeksi-emerging>.
- Susila, I. M. D. P., & Laksmi, I. A. A. (2022). Prevalence and Associated Factors of Burnout Risk among Emergency Nurses during COVID-19 Pandemic. *Babali Nurs. Res*, 3(1), 7-14. <https://doi.org/10.37363/bnr.2022.3169>
- Vinet, L., & Zhedanov, A. (2011). A 'missing' family of classical orthogonal polynomials. *Journal of Physics A: Mathematical and Theoretical*, 44(8), 085201. <https://doi.org/10.1088/1751-8113/44/8/085201>
- WHO. (2018). *Infection Prevention and Control Assessment Framework at The Facility Level*. Geneva: World Health Organization. Retrieved from <https://www.who.int/publications/i/item/WHO-HIS-SDS-2018.9>
- Yaffee, A. Q., Isakov, A., & Wu, H. M. (2019). How can emergency departments better prepare for emerging infectious disease threats? A returned traveler with fever walks into triage.... *Journal of Emergency Medicine*, 56(5), 568-570. <https://doi.org/10.1016/j.jemermed.2018.12.049>

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**RESEARCH**

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**The Relationship between the Knowledge of Third Trimester Pregnant Women and the Implementation of Early Breastfeeding Initiation**

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**Abstract**

Early Initiation of Breastfeeding has an important role in the success of exclusive breastfeeding. Early Initiation of Breastfeeding is also one solution to reduce the risk of bleeding among postpartum women. An increase in knowledge and understanding of pregnant women about Early Initiation of Breastfeeding may support the successful implementation of Early Initiation of Breastfeeding. This study aims to determine the effect of knowledge of pregnant women in the third trimester on the implementation of Early Initiation of Breastfeeding. This was an analytical observational study with a cross-sectional design. The study was conducted in June-July 2019. The samples consisted of 30 respondents selected by purposive sampling based on certain inclusion criteria. Data were analyzed using the chi-square test to determine the effect of knowledge of pregnant women in the third trimester on the implementation of early initiation of breastfeeding. The results showed that the majority of respondents had good knowledge and performed early initiation of breastfeeding as many as 27 people (90%). Furthermore, 3 people (10%) had poor knowledge and did not perform early initiation of breastfeeding. It was obtained a p-value of 0.000 < 0.05. Such findings revealed that knowledge of pregnant women was one of the factors that can support the successful implementation of Early Initiation of Breastfeeding. It is expected that healthcare workers and related parties can increase the provision of information about the importance of early initiation of breastfeeding, so as to increase knowledge as well as creating better implementation of early initiation of breastfeeding.

**Keywords:** Early Initiation of Breastfeeding, Knowledge, Pregnant Women.

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## 1. INTRODUCTION

The infant mortality rate (IMR) is a description of the degree of public health used as a benchmark by the government (Rahmawati, Kuntoro, & Trijanto, 2016). Various efforts have been made by the government to decrease the IMR, one of which is through exclusive breastfeeding program starting from the birth of the baby until the baby is 6 months old without any additional food (Ayukarningsih, Sutedja, & Mardiyah, 2014; Rossalia & Puteri, 2014). It aims to improve the health status of mothers as well as their babies (Fair, Ford, & Soltani, 2019; Jolly et al., 2018; Sarki, Parlesak, & Robertson, 2018).

The success of exclusive breastfeeding is determined by the implementation of Early Initiation of Breastfeeding, wherein the baby is immediately given breast milk within the first hour of birth through breastfeeding technique (Ginting & Delfira, 2018; Rudiyantri, 2013; Sudemi, Adhi, & Duarsa, 2016). Early Initiation of Breastfeeding is an action that has a major impact on the improvement of health status of newborns (Bongga, 2019; Shobo et al., 2019). One of the benefits is that the baby gets colostrum. Colostrum can boost the immune system so that the baby stays healthy and can grow and develop into a healthy human being both physically, psychologically and psychosocially (Sumarni, Apriyani, & Umarianti, 2019). In addition, early initiation of breastfeeding can also warm the baby so as to prevent hypothermia. By initiating early breastfeeding, it can make the baby's breathing more stable so as to prevent respiratory infections. If early initiation of breastfeeding is not carried out, it can have an impact on problems with the breastfeeding process and the mother's milk production. Early initiation of breastfeeding is very important to do because it can prevent infant morbidity and mortality, and can accelerate the baby's growth and development process properly (Selviyanti, et al., 2022).

The process of the initiation of early breastfeeding can stimulate the mother's brain to produce the prolactin hormone which further makes the baby to feel comfortable. The higher level of knowledge of the mother about Early Initiation of Breastfeeding and its benefits for infant growth and development, the better the understanding and implementation of Early Initiation of Breastfeeding process (Fatriani, 2018; Khoiriah & Sari, 2018; Kurnia, 2019; Sukmawati, Stang, & Bustan, 2018). Based on this, it is important to increase the knowledge and understanding of pregnant women regarding the implementation of early initiation of breastfeeding in newborns.

Based on 2018 Basic Health Research (RISKESDAS) data in Indonesia, the process of initiating early breastfeeding in the first hour after birth is only 34.5% (Masluroh & Syamsiah, 2022). Based on data from the Gorontalo Provincial Health Office in 2017, 20,859 mothers gave birth and 13,513 babies were able to initiate early breastfeeding. Whereas in 2018 there was an increase in the coverage of data on mothers who gave birth, namely as many as 21,008 people and the achievements of early breastfeeding initiation as many as 17,962 babies.

As for data from the Gorontalo District Health Office, in 2017 the number of mothers giving birth was 7,033 people and the achievements of babies getting early initiation of breastfeeding were 6,254 people, in 2018 the coverage of mothers giving birth was 7,117 people and the achievements of early initiation of breastfeeding were 6,633 babies. It can be seen that there is an increase in data. However, after conducting interviews with several pregnant women in the working area of the Gorontalo District Health Center in 2018, it was found that there were still many pregnant women who did not understand the benefits of early initiation of breastfeeding after giving birth. Many parents are also afraid and don't have the heart if their baby cries because they have

difficulty finding their mother's nipple. The pain that is felt as a result of a tear in the birth canal also hinders the mother's movement so that it overrides the implementation of early initiation of breastfeeding. Therefore, this study aims to determine the relationship between the knowledge of third trimester pregnant women and the implementation of early initiation of breastfeeding.

## 2. RESEARCH METHOD

This was an analytical observational study with a cross-sectional design. The study was conducted in June-July 2019. All third trimester pregnant women with gestational age of >38 weeks in the work area of the Gorontalo District CHC were involved as the study population. The study samples involved 30 respondents who were selected through purposive sampling technique. Inclusion criteria in this study were gestational age > 38 weeks, giving birth at the Tibawa, Limboto and Telaga Biru Health Centers, Gorontalo District, not a high-risk pregnancy, not having comorbidities and normal newborn (no abnormalities).

Data were obtained from questionnaire sheets to determine the level of pregnant women's knowledge and observation sheets on the implementation of Early Initiation of Breastfeeding. Data were analyzed using chi-square test to determine the effect of knowledge of pregnant women in the third trimester on the implementation of Early Initiation of Breastfeeding.

## 3. RESULTS AND DISCUSSION

**Table 1.** Distribution of the Level of Knowledge of Respondents.

Knowledge	N	%
Good	27	90.0
Poor	3	10.0
Total	30	100.0

Table 1 revealed that 90% of respondents had good knowledge.

**Table 2.** Distribution of Implementation of Early Initiation of Breastfeeding.

Early Initiation of Breastfeeding	N	%
Good	27	90.0
Poor	3	10.0
Total	30	100.0

Table 2 revealed that 90% of respondents performed Early Initiation of Breastfeeding.

**Table 3.** Effect of Knowledge of Pregnant Women in the Third Trimester on the Implementation of Early Initiation of Breastfeeding.

Knowledge	Early Initiation of Breastfeeding		n	p-value
	Yes	No		
Good	27	0	27	0.000
Poor	0	3	3	
Total	27	3	30	

Table 3 revealed that most of respondents had good knowledge and performed Early Initiation of Breastfeeding, as many as 27 people (90%). Statistically, there was a significant effect ( $p\text{-value} = 0.000 < 0.05$ ).

Based on the results of the chi-square test regarding the effect of knowledge of pregnant women in the third trimester on the implementation of Early Initiation of Breastfeeding, it was obtained a  $p\text{-value} = 0.000 < 0.05$ , which indicated that  $H_a$  was accepted. Thus, there was an effect of knowledge of pregnant women in the third trimester on the implementation of Early Initiation of Breastfeeding.

Notoatmodjo, (2016) states that knowledge is an important point in the formation of behavior. Information obtained by someone is very important for good level of knowledge. In addition, a person's attitude and behavior can be influenced by the level of knowledge. Similarly, the implementation of early initiation of breastfeeding can also be affected by the level of knowledge of pregnant women (Admasu, et al., 2022; Abebe et al., 2022; Naja et al., 2022; Sihombing et al., 2022; Wang, You, & Luo, 2020). In line with this opinion, a previous study found that there was an effect of women's knowledge after video viewing on the implementation of early initiation of breastfeeding with a statistically significant  $p\text{-value}$  of  $0.006 < 0.05$  (Apriastuti, 2016). Several studies revealed that health education about the benefits of breastfeeding through breastfeeding technique during pregnancy was an important factor in increasing the implementation of early initiation of breastfeeding after childbirth (Hawkins, et al., 2015; Jiang et al., 2015; Sihombing et al., 2022; Zakaria & Astuti, 2022).

Such finding is in line with other studies which showed that the understanding and behavior of mothers regarding exclusive breastfeeding was influenced by the level of knowledge regarding the importance of breastfeeding (Assriyah, et al., 2020; Diana, Komalawati, & Marwan, 2021; Iliadou, et al., 2018; Suárez-Cotelo et al., 2019). Breastfeeding is the optimal way to meet baby's nutrition requirement which aims to promote an optimal growth and development process (Debataraja, Siregar, & Batubara, 2021; Dewi, Maimunah, & Siregar, 2021; Komsiyah, Indarti, & Ekatania, 2020; Marks et al., 2018). Furthermore, other studies revealed that proper counseling regarding breastfeeding among pregnant women had a positive effect on the increase in knowledge and optimal breastfeeding practices (Abdulahi, et al., 2021; Hashim et al., 2017; Shafaei, Mirghafourvand, & Havizari, 2020).

Based on the results of this study, it can be concluded that one way that can assist the government in reducing the Infant Mortality Rate (IMR) at 28 days old is through the implementation of early initiation of breastfeeding in the first hour after the baby is born (Fitriyah, Fitriani, & Sriwahyungsih, 2022). Delays in the implementation of early initiation of breastfeeding can result in an increase in infant morbidity and mortality (Rosyati & Damayanti, 2021). Some of the impacts that can occur on babies if they do not carry out early initiation of breastfeeding are that babies get the best nutrition from colostrum, which can result in infections and low immune systems, babies are susceptible to diseases such as diarrhea and pneumonia. While the impact on the mother is that it can reduce the amount of milk production because the baby's suction plays an important role in producing the hormone prolactin. Another impact on the mother can also result in postpartum hemorrhage because the baby's suction can produce the hormone oxytocin so that the mother's uterus can contract properly (Ulfa, Fauziah, & Nora, 2022). Given the importance of implementing early breastfeeding initiation for optimal growth and development of the baby, it is important to pay attention so that the implementation of

early breastfeeding initiation can be carried out properly and correctly (Latuharhary, Suparman, & Tendean, 2014).

Mother's knowledge about the importance of the benefits and implementation of early breastfeeding initiation is one of the factors supporting the success of its implementation. The more knowledge a person has, the better the positive behavior or action that will result. The application of behavior or actions taken by someone based on knowledge and understanding will be permanent, while the behavior or actions taken by someone who is not based on knowledge or understanding will not be permanent. Respondents' knowledge, understanding, and attitudes about early initiation of breastfeeding can influence the application of respondents' behavior in carrying out early initiation of breastfeeding. In this case, the level of knowledge and understanding possessed by a person can influence the formation of one's attitude and behavior.

#### 4. CONCLUSION

There was an effect of knowledge of pregnant women in the third trimester on the implementation of Early Initiation of Breastfeeding. Healthcare workers are recommended to optimize counseling about the importance of Early Initiation of Breastfeeding to pregnant women so as to create a better achievement of Early Initiation of Breastfeeding.

#### REFERENCES

- Abdulahi, M., Fretheim, A., Argaw, A., & Magnus, J. H. (2021). Determinants of knowledge and attitude towards breastfeeding in rural pregnant women using validated instruments in ethiopia. *International Journal of Environmental Research and Public Health*, 18(15), 7930. <https://doi.org/10.3390/ijerph18157930>
- Abebe, E. C., Tiruneh, G. A., Adela, G. A., Ayele, T. M., Muche, Z. T., Mulu, A. T., & Dejenie, T. A. (2022). Levels and Determinants of Prenatal Breastfeeding Knowledge, Attitude, and Intention Among Pregnant Women: A Cross-Sectional Study in Northwest Ethiopia. *Frontiers in Public Health*, 10(July), 920355. <https://doi.org/10.3389/fpubh.2022.920355>
- Admasu, J., Egata, G., Bassore, D. G., & Feleke, F. W. (2022). Effect of maternal nutrition education on early initiation and exclusive breast-feeding practices in south Ethiopia: a cluster randomised control trial. *Journal of Nutritional Science*, 11, E37. <https://doi.org/10.1017/jns.2022.36>
- Apriastuti, D. A. (2016). Hubungan Pengetahuan Penayangan Video IMD Dengan Sikap Ibu Hamil Trimester III Terhadap Pelaksanaan IMD. *Jurnal Kebidanan*, 8(1), 84–93.
- Assriyah, H., Indriasari, R., Hidayanti, H., Thaha, A. R., & Jafar, N. (2020). Hubungan Pengetahuan, Sikap, Umur, Pendidikan, Pekerjaan, Psikologis, Dan Inisiasi Menyusui Dini Dengan Pemberian Asi Eksklusif Di Puskesmas Sudiang. *Jurnal Gizi Masyarakat Indonesia: The Journal of Indonesian Community Nutrition*, 9(1), 30–38. <https://doi.org/10.30597/jgmi.v9i1.10156>
- Ayukarningsih, Y., Sutedja, & Mardiyah, A. (2014). Knowledge, Attitude, and Behavior of Pregnant Women on Early Initiation of Breastfeeding. *Paediatrica Indonesiana*, 54(3), 174–180.
- Bongga, S. (2019). Faktor-Faktor Yang Mempengaruhi Pengetahuan Ibu Gavida I Tentang Inisiasi Menyusu Dini (IMD) Di Puskesmas Sa'dan Kab. Toraja Utara

- Tahun 2018. *MPPKI (Media Publikasi Promosi Kesehatan Indonesia): The Indonesian Journal of Health Promotion*, 2(2), 93–98. <https://doi.org/10.31934/mppki.v2i2.563>
- Debataraja, F., Siregar, N. S. N., & Batubara, W. M. (2021). Faktor – Faktor Yang Berhubungan Dengan Pelaksanaan Inisiasi Menyusui Dini (Imd) Di Puskesmas Butar Kecamatan Pagaran Kabupaten Tapanuli Utara Tahun 2020. *Jurnal Ilmiah Kebidanan Imelda*, 7(1), 12–18. <https://doi.org/10.52943/jikebi.v7i1.456>
- Dewi, S. S. S., Maimunah, & Siregar, N. (2021). Hubungan Pengetahuan, Dukungan Keluarga Dan Peran Petugas Kesehatan dengan Penerapan Inisiasi Menyusu Dini pada Ibu Post Partum DI RSUD Panyabungan. *Jurnal Kesehatan Ilmiah Indonesia*, 6(2), 159–166. <http://dx.doi.org/10.51933/health.v6i2.535>
- Diana, R., Komalawati, R., & Marwan. (2021). Hubungan Tingkat Pengetahuan dengan Sikap Ibu Hamil Tentang Inisiasi Menyusui Dini ( Imd ) di Puskesmas Kasreman Kabupaten Ngawi. *Cakra Medika*, 8(1), 1–8. <https://doi.org/10.55313/ojs.v8i1.66>
- Fair, F. J., Ford, G. L., & Soltani, H. (2019). Interventions for Supporting the Initiation and Continuation breastfeeding among women who are overweight or obese. *Cochrane Database of Systematic Reviews*, (9), 1–83. <https://doi.org/10.1002/14651858.CD012099.pub2>
- Fatriani, R. (2018). Pengaruh Kelas Ibu Hamil Terhadap Pengetahuan Dan Sikap Ibu Hamil Tentang Inisiasi Menyusu Dini. *Jurnal Kesehatan Panca Bhakti Lampung*, 6(2), 149–158. <https://doi.org/https://doi.org/10.47218/jkpbl.v6i2.52>
- Fitriyah, N., Fitriani, N., & Sriwahyungsih, A. (2022). Penyuluhan Kesehatan tentang Inisiasi Menyusu Dini (IMD) di Desa Pandai Woha. *Idea Pengabdian Masyarakat*, 2(4), 211–214. Retrieved from <http://ideapengabdianmasyarakat.ideajournal.id/index.php/ipm/article/view/143>
- Ginting, C. N., & Delfira. (2018). Pengaruh Pengetahuan Tentang Inisiasi Menyusu Dini Terhadap Proses Laktasi pada Ibu Nifas Di Klinik Sunggal Kota Medan Tahun 2017. *Jurnal Maternitas Kebidanan*, 3(1), 1–9. Retrieved from <http://jurnal.unprimdn.ac.id/index.php/jumkep/article/view/80>
- Hashim, T. H., Mgongo, M., Katanga, J., Uriyo, J. G., Damian, D. J., Stray-Pedersen, B., ... Msuya, S. E. (2017). Predictors of appropriate breastfeeding knowledge among pregnant women in Moshi Urban, Tanzania: A cross-sectional study. *International Breastfeeding Journal*, 12(11), 1–8. <https://doi.org/10.1186/s13006-017-0102-4>
- Hawkins, S. S., Stern, A. D., Baum, C. F., & Gillman, M. W. (2015). Evaluating the impact of the Baby-Friendly Hospital Initiative on breast-feeding rates: A multi-state analysis. *Public Health Nutrition*, 18(2), 189–197. <https://doi.org/10.1017/S1368980014000238>
- Iliadou, M., Lykeridou, K., Prezerakos, P., Swift, E. M., & Tziaferi, S. (2018). Measuring the Effectiveness of a Midwife-led Education Programme in Terms of Breastfeeding Knowledge and Self-efficacy, Attitudes Towards Breastfeeding, and Perceived Barriers of Breastfeeding Among Pregnant Women. *Materia Socio Medica*, 30(4), 240–245. <https://doi.org/10.5455/msm.2018.30.240-245>
- Jiang, B., Hua, J., Wang, Y., Fu, Y., Zhuang, Z., & Zhu, L. (2015). Evaluation of the impact of breast milk expression in early postpartum period on breastfeeding duration: A prospective cohort study. *BMC Pregnancy and Childbirth*, 15(1), 1–13. <https://doi.org/10.1186/s12884-015-0698-6>
- Jolly, K., Ingram, J., Clarke, J., Johnson, D., Trickey, H., Thomson, G., ... Hoddinott, P. (2018). Protocol for a feasibility trial for improving breast feeding initiation and

- continuation: Assets-based infant feeding help before and after birth (ABA). *BMJ Open*, 8(1), 1–13. <https://doi.org/10.1136/bmjopen-2017-019142>
- Khoiriah, A., & Sari, N. (2018). Gambaran Pengetahuan Ibu Bersalin Tentang Pelaksanaan Inisiasi Menyusu dini Di BPM Hj. Rusmiati Palembang. *Jurnal Ilmiah Kesehatan*, 7(1), 32–36. <https://doi.org/10.35952/jik.v7i1.117>
- Komsiyah, Indarti, D., & Ekatania, M. (2020). Hubungan Tingkat Pengetahuan Ibu Dengan Penerapan Inisiasi Menyusui Dini (IMD) Di Klinik Semarang. *Indonesian Journal of Nursing Research (IJNR)*, 3(2), 65–74. <https://dx.doi.org/10.35473/ijnr.v3i2.905>
- Kurnia. (2019). Karakteristik dan Tingkat Pengetahuan Ibu Nifas Tentang Inisiasi Menyusu Dini (IMD). *Ghidza: Jurnal Gizi Dan Kesehatan*, 3(1), 33–36. <https://doi.org/10.22487/j26227622.2019.v3.i1.12118>
- Latuhary, F. T. U., Suparman, E., & Tendean, H. M. M. (2014). Pengetahuan Ibu Hamil Tentang Inisiasi Menyusu Dini. *E-Clinic*, 2(2), 1–5. <https://doi.org/10.35790/ecl.2.2.2014.5024>
- Marks, E. J., Grant, C. C., De Castro, T. G., Bandara, D. K., Wall, C., & Morton, S. M. B. (2018). Agreement between future parents on infant feeding intentions and its association with breastfeeding duration: Results from the Growing Up in New Zealand cohort study. *International Journal of Environmental Research and Public Health*, 15(6), 1–16. <https://doi.org/10.3390/ijerph15061230>
- Masluroh, & Syamsiah, S. (2022). Pengaruh Minat Ibu Hamil Terhadap Pemberian Inisiasi Menyusu Dini. *Jurnal Ilmiah Permas : Jurnal Ilmiah STIKES Kendal*, 12(3), 527–534. Retrieved from <http://journal2.stikeskendal.ac.id/index.php/PSKM/article/view/242>
- Naja, F., Chatila, A., Ayoub, J. J., Abbas, N., Mahmoud, A., Abdulmalik, M. A., & Nasreddine, L. (2022). Prenatal breastfeeding knowledge, attitude and intention, and their associations with feeding practices during the first six months of life: a cohort study in Lebanon and Qatar. *International Breastfeeding Journal*, 17(15). <https://doi.org/10.1186/s13006-022-00456-x>
- Notoatmodjo, S. (2016). Ilmu Perilaku Kesehatan (Cetakan 4). Jakarta: Rineka Cipta.
- Rahmawati, E. B. S., Kuntoro, R., & Trijanto, B. (2016). Keikutsertaan Kelas Ibu Hamil Berpengaruh terhadap Pengetahuan dan Sikap Ibu dalam Praktik Inisiasi Menyusu Dini. *Majalah Obstetri & Ginekologi*, 24(1), 8–12. <https://doi.org/10.20473/mog.v24i12016.8-12>
- Rossalia, I., & Puteri, P. (2014). Pengaruh Tingkat Pengetahuan Dan Sikap Bidan Tentang Inisiasi Menyusu Dini (Imd) Dengan Penerapan Inisiasi Menyusu Dini Di Puskesmas Kota Surakarta. *Jurnal Medika Respati*, 9(3), 80–90. Retrieved from <http://medika.respati.ac.id/index.php/Medika/article/view/134>
- Rosyati, H., & Damayanti, D. S. (2021). Hubungan Inisiasi Menyusu Dini Terhadap Lamanya Pengeluaran Plasenta. *Ilmiah Kesehatan*, 11(1), 144–148. <https://doi.org/10.52657/jik.v11i1.1614>
- Rudiyanti, N. (2013). Faktor-Faktor Yang Berhubungan Dengan Pelaksanaan Inisiasi Menyusu Dini. *Jurnal Keperawatan*, IX(1), 63–70.
- Sarki, M., Parlesak, A., & Robertson, A. (2019). Comparison of national cross-sectional breast-feeding surveys by maternal education in Europe (2006–2016). *Public Health Nutrition*, 22(5), 848-861. <https://doi.org/10.1017/S1368980018002999>
- Selviyanti, E., Kartika, R. C., Umbaran, D. P. A., Fitriyah, D., & Yuanta, Y. (2022).

- Peningkatan Pengetahuan Ibu Tentang Inisiasi Menyusui Dini (IMD) Untuk Keberhasilan Memberikan ASI Eksklusif di Kabupaten Jember. *Journal of Community Development*, 3(2), 224–232. <https://doi.org/10.47134/comdev.v3i2.89>
- Shafaei, F. S., Mirghafourvand, M., & Havizari, S. (2020). The effect of prenatal counseling on breastfeeding self-efficacy and frequency of breastfeeding problems in mothers with previous unsuccessful breastfeeding: A randomized controlled clinical trial. *BMC Women's Health*, 20(94). <https://doi.org/10.1186/s12905-020-00947-1>
- Shobo, O. G., Umar, N., Gana, A., Longtoe, P., Idogho, O., & Anyanti, J. (2019). Factors influencing the early initiation of breast feeding in public primary healthcare facilities in Northeast Nigeria: A mixed-method study. *BMJ Open*, 10(4), e032835. <https://doi.org/10.1136/bmjopen-2019-032835>
- Sihombing, I. R. R., Pasaribu, M. A. N., Laia, J., Lature, M. E. I., Anggraeni, R., Siregar, S. A., & Saragih, E. F. M. (2022). Hubungan Pengetahuan Ibu tentang Inisiasi Menyusu Dini (IMD) dengan Pelaksanaan IMD selama masa Pandemi Covid-19 di Klinik Pratama Trismalia Medan Estate 2021. *JIDAN: Jurnal Ilmiah Kebidanan*, 2(1), 19-25. <https://doi.org/10.51771/jdn.v2i1.261>
- Simbung, R., & Ohorella, F. (2021). Pentingnya Inisiasi Menyusu Dini (IMD) Pada Bayi Baru Lahir. *MEGA PENA: Jurnal Pengabdian Kepada Masyarakat*, 1(1), 21-25. Retrieved from <https://journal.unimerz.com/index.php/mp/article/view/11>
- Suárez-Cotelo, Carmen, M. del, Movilla-Fernández, Jesús, M., Pita-García, P., Arias, B. F., & Novío, S. (2019). Breastfeeding knowledge and relation to prevalence. *Revista Da Escola De Enfermagem*, 53, e03433. <https://doi.org/10.1590/S1980-220X2018004503433>
- Sudemi, L., Adhi, K. T., & Duarsa, D. P. (2016). Relationship of Knowledge and Attitude among Midwives with the Implementation of Early Initiation of Breastfeeding in Badung Regency. *Public Health and Preventive Medicine Archive*, 4(2), 195–200. Retrieved from <http://phpmarchive.org/index.php/phpma/article/view/286>
- Sukmawati, S., Stang, S., & Bustan, N. (2018). Pengaruh Edukasi Terhadap Pengetahuan Dan Sikap Ibu Hamil Tentang Inisiasi Menyusui Dini (Imd) Di Wilayah Kerja Puskesmas Parangloe Kabupaten Gowa. *Jurnal Kesehatan Masyarakat Maritim*, 1(1), 7–13. <https://doi.org/10.30597/jkmm.v1i1.8690>
- Sumarni, W., Apriyani, A., & Umarianti, T. (2019). Efektifitas Inisiasi Menyusui Dini Dengan Tumbuh Kembang Bayi Usia 0-1 Bulan di PMB Bubakan Kecamatan Girimarto Wonogiri Jawa Tengah. *Concept and Communication*, (23), 301–316. <https://doi.org/10.15797/concom.2019..23.009>
- Ulfa, U., Fauziah, F., & Nora, S. (2022). Faktor-Faktor yang Berhubungan dengan Pengetahuan Ibu Post Partum Terhadap Pelaksanaan Inisiasi Menyusui Dini di Rumah Sakit Umum Daerah Kota Sabang. *Journal Of Healthcare Technology And Medicine*, 8(2), 828-844. Retrieved from <http://jurnal.uui.ac.id/index.php/JHTM/article/view/2330>
- Wang, Y., You, H. xuan, & Luo, B. ru. (2020). Exploring the breastfeeding knowledge level and its influencing factors of pregnant women with gestational diabetes mellitus. *BMC Pregnancy and Childbirth*, 20(723). <https://doi.org/10.1186/s12884-020-03430-9>
- Zakaria, R., & Astuti, S. C. D. (2022). The Effect of Black Cumin (Nigella Sativa) on Breastfeeding Mothers. *Jurnal Info Kesehatan*, 20(1), 29–40. <https://doi.org/10.31965/infokes.Vol20Iss1.627>

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DOI: [10.31965/infokes.Vol21Iss1.1016](https://doi.org/10.31965/infokes.Vol21Iss1.1016)Journal homepage: <http://jurnal.poltekkeskupang.ac.id/index.php/infokes>**RESEARCH****Open Access****Bioactive Compounds of the Ethanol Extract of Butterfly Pea Petals (*Clitoria ternatea* L.) on Gastric Proton Pump: In-Silico Analysis****Atik Kurniawati<sup>1a\*</sup>, Sri Rahayu Lestari<sup>1b</sup>, Fatchur Rohman<sup>1c</sup>**<sup>1</sup> Department of Biology, State University of Malang, Malang, East Java, Indonesia.<sup>a</sup> Email address: [atik\\_kurniawati.2003428@students.um.ac.id](mailto:atik_kurniawati.2003428@students.um.ac.id)<sup>b</sup> Email address: [sriahayulestari@um.ac.id](mailto:sriahayulestari@um.ac.id)<sup>c</sup> Email address: [fatchur.rohman.fmipa@um.ac.id](mailto:fatchur.rohman.fmipa@um.ac.id)

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**Abstract**

Biodiversity of medicinal plants in Indonesia reflects the potential to be used to treat non-communicable diseases such as cancer. Gastritis is a kind of symptom felt in the stomach which may trigger severe abnormalities leading to a state of cancer. This study aims to determine the potential of bioactive compounds derived from the ethanol extract of butterfly pea petals (*Clitoria ternatea* L.) as an in-silico anti gastritis drug candidate. This was a descriptive study with a qualitative approach. The molecular docking method applied specific docking using PLANTS software. The results of molecular docking indicated that there might be similar potential as the control drug in inhibiting the gastric proton pump. Based on the analysis of the LCHRMS results, it was found flavonoid compounds in the extract of butterfly pea petals used for docking analysis. Each flavonoid compound and the docking score from highest to lowest were Rutin (-87.05), Quercetin-3 $\beta$ -D-glucoside (-79.30), Quercetin (-79.28), Kaempferol (-74.80), Trifolin (-74.22), Genistein (-69.70), Kaempferol-3-glucoside-3''rhamnoside (-67.79), Biochanin A(1-) (-67.64), and Mauritianin (-58.26). The flavonoid compound named rutin had the highest docking score above the two control drugs of Omeprazole (-66.27) and Vonoprazan (-84.45). It can be concluded that based on in-silico study, the flavonoid compound of Rutin in the ethanol extract of butterfly pea petals (*Clitoria ternatea* L.) had the potential to inhibit the gastric proton pump to prevent gastritis. The chemical structure of Rutin differs from the two control drugs because it has a more complex structure consisting of five benzene rings. It is recommended to carry out further dynamic molecular test to find out which flavonoid compounds are the most stable affinity for the target protein. Based on the in-silico test, in vivo and in vitro study should be performed to find out more information about the potential of the flavonoid compounds in butterfly pea extract in inhibiting the action of the gastric proton pump.

**Keywords:** Anti-gastritis, Butterfly pea, in-silico.**\*Corresponding Author:**

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## 1. INTRODUCTION

Indonesia is currently facing a triple burden regarding various disease problems. The existence of new emerging and re-emerging infectious diseases such as Covid-19, infectious diseases still become major health problems in Indonesia that have not been properly resolved. In addition, the incidence of non-communicable diseases tend to increase every year (Kementerian Kesehatan Republik Indonesia, 2020). Non-communicable diseases (NCDs) refer to chronic diseases classified as non-communicable from human to human, which last a long time and usually develop slowly. Unhealthy lifestyle behavior is a driving force for the development of several NCDs. According to previous studies, the evidence showed a relationship between lifestyle with oxidative and inflammatory processes as the main drivers of cell and tissue damage that underlied the development of NCDs (Seyedsadjadi & Grant, 2021).

Inflammation as the primary driver of cell and tissue damage due to lifestyle and unhealthy behavior can affect all parts of the body. Inflammation that occurs in the stomach is known as gastritis. The gastric mucosa is lined with a mucous membrane consisting of cells that are prone to inflammation. In addition to lifestyle and behavior, bacterial infections can also cause changes in the gastric mucosa. Combination of factors can lead to severe inflammation that develops into peptic ulcers and eventually gastric cancer (Rawla & Barsouk, 2019; Rugge et al., 2020; Rugge et al., 2021).

Physiologically, the secretion of hydrochloric acid in the stomach is carried out by parietal cells. Stimulation of the parietal cells drives the H<sup>+</sup>/K<sup>+</sup> ATPase proton pump in the cell to move towards the secretory canaliculi which further pumps acid into the gastric lumen (Engevik et al., 2020; Sachs et al., 2007). Under normal physiological conditions, gastric acid production is controlled by a negative feedback mechanism. The hydrochloric acid produced will lead to a decrease in pH in the stomach. When the pH in the stomach is already acidic, these physiological changes provide feedback to D cells to release somatostatin in the gastric antrum which ultimately inhibits gastric acid secretion and restores homeostasis. In the event of gastritis, somatostatin cannot inhibit the stimulus resulting in continuous stimulation of the parietal cells (Metz et al., 2002).

There is a tremendous increase regarding the use of herbal medicines to cure ailments over the last three decades 80% of people worldwide rely on herbal medicine as the primary health care. The advantages that many people expect such as minimum side effects and low cost, maybe the reasons among patients to try complementary and alternative treatments such as herbal medicine (Bordbar et al., 2020). The study on herbal medicine regarding its therapeutic potential is based on the content of phenolic compounds, especially flavonoids. Flavonoids are the most common natural compounds of the polyphenol group found in plants (Ardalani et al., 2019). Several in vivo and in vitro researches revealed a gastro-protective effect of flavonoids on stomach ulcers (Zhang et al., 2020). Flavonoids-rich foods include fruits, vegetables, tea and cocoa plants (Egert & Rimbach, 2011). Many studies regarding the potential of flavonoids as anti-gastritis have been conducted related to their role as antioxidants. Besides that, flavonoid compounds have antiulcer activity which prevents gastric mucosal lesions due to several ulcerogenic (Elseweidy, 2011). Previous studies have shown the potential for flavonoids as anti-gastric ulcers predicted through molecular docking with gastric H<sub>2</sub> receptors (Zahran et al., 2021) and their interactions with gastric proton pump protein of H<sup>+</sup>/K<sup>+</sup> ATPase which are as strong as anti-gastritis drugs (Sofi et al., 2020).

The butterfly pea petals (*Clitoria ternatea* L.) is a source of phenolic and flavonoid compounds (Jaafar et al., 2020). This plant often grows wild or cultivated in Southeast Asia Region (Ulimaz et al., 2020). In India, this plant is often used for Ayurvedic medicine due to its various benefits, including as an antioxidant (Muhammad Ezzudin & Rabeta, 2018). The

active compounds in butterfly pea petals include anthocyanins, flavonoids, tannins and terpenoids (Deorankar et al., 2020; Ma'ruf et al., 2021; Thuy et al., 2021). In Indonesia, the content of flavonoids in butterfly pea petals has yet to be extensively explored for anti-gastritis agents. However, such potentials need to be explored further to be used widely for the development of the local drug industry in Indonesia. The development of the traditional medicine industry in Indonesia has promising opportunities because Indonesia is included in the top five countries with mega biodiversity in the world. Based on literature studies or genetic heritage, most of plants in Indonesia have benefits as medicinal plants even though they have not been scientifically proven. The development of traditional medicines is also one of the focuses in the action plan of the Ministry of Health of the Republic of Indonesia which is oriented towards increasing the production capacity of imported herbal ingredients until 2024 (Kementerian Kesehatan Republik Indonesia, 2020).

Discovery of drugs from natural ingredients can be accelerated through in-silico study. In-silico study is considered the first step in discovering new drug candidates while reducing the need for analysis in wet laboratories and expensive clinical trials. Based on such nature, in-silico study is categorized as dry lab because it does not involve significant risks (Parikesit et al., 2017). Computational method works in drug discovery by predicting the binding of a drug candidate molecule to a target protein, predicting the affinity and activity of a molecule and observing three dimensions of compound bound to the active site of the protein or better known as molecular docking (Sarkar & Kellogg, 2009).

In-silico study to determine the activity of flavonoids in herbal plants to inhibit gastric proton pumps has not been widely carried out, even though in-silico is one of the basic studies useful in assisting study on gastritis which is difficult to do because it requires a lot of resources. Several in-silico studies revealed phytochemical compounds in herbal plants used to inhibit gastric proton pumps namely ferulic acid (Umre et al., 2018), epicatechin isolated from *Potentilla fulgens* (Rosaceae) (Laloo et al., 2021), xanthenes and coumarins isolated from *Calophyllum brasiliense* (Reyes-Chilpa et al., 2006), as well as amentoflavone and quercitrin isolated from *Hypericum perforatum* (Sofi et al., 2020). However, no studies reported the phytochemical compounds in the butterfly pea petals to inhibit the gastric proton pump. Based on this background, researchers are interested in determining the bioactive compounds in the ethanol extract of butterfly pea petals (*C. ternatea* L.) which have potential as anti-gastritis candidate by inhibiting gastric proton pump protein of H<sup>+</sup>/K<sup>+</sup> ATPase in-silico.

## 2. RESEARCH METHOD

The current study was conducted in January-August 2022 at the Department of Biology, State University of Malang, Integrated Laboratory of the Polytechnic of the Ministry of Health of Malang and Central Laboratory of Life Sciences, University of Brawijaya, Malang. This was a descriptive study with a qualitative approach through relevant literature studies. The descriptive study design aims to describe various findings, including the facts regarding the potential of the bioactive compounds of butterfly pea petals (*C. ternatea* L.) as an anti-gastritis agent.

**Plant material and extraction process.** The petals of the butterfly pea harvested freshly from the garden were dried in the sun for two days. The dried butterfly pea petals were milled using a grinder to produce powder of butterfly pea petals. The powder of the butterfly pea petals was filtered through a mesh to obtain a fine powder. 5 grams of butterfly pea petals powder was added with 100 ml of 70% ethanol and heated on a magnetic hotplate stirrer at 70°C for 8 hours. The extract was then filtered using filter paper and concentrated by evaporation. Furthermore, the liquid extract of the butterfly pea petals is heated in an oven to evaporate the remaining solvent (Aditiyarini & Iswuryani, 2021; Jeyaraj et al., 2020; Ludin et al., 2018). The butterfly pea petals extract was then screened for bioactive compounds using

the Liquid Chromatography – High Resolution Mass Spectrometry (LC-HRMS) with the brand Thermo Scientific Dionex Ultimate 3000 RSLCnano using microflow meter tool at the Central Laboratory of Life Sciences, Brawijaya University.

In-silico analysis using computer/laptop devices (hardware) and software was performed to predict the bioactive compounds of butterfly pea petals (*C. ternatea* L.) based on LC-HRMS data. The results of the compounds screening were further performed by selecting the flavonoid group compounds and downloading the metadata needed. Analysis was performed with the in-silico approach through the molecular docking method using the PLANTS software. The initial stage in the search for in-silico prediction of the potential of the active compound in butterfly pea petals was searching for information on the predicted compound using the PubChem webserver <https://pubchem.ncbi.nlm.nih.gov/>. In the molecular docking protocol using the PLANTS software, the required data from PubChem was a "canonical smile". After copying the canonical smile from PubChem, the chemical structure was prepared using MarvinSketch version 5.2.5.1 downloaded from <http://www.chemaxon.com>. Structural preparation using MarvinSketch included adjustment of the body's pH and conformation of the compound to 10 conformations (default). The results of compound preparation in MarvinSketch were saved under the name of "ligand.mol2" with file type of "Tripos Mol2 (\*.mol2)" (Purnomo, 2019).

The target protein was downloaded from the RCSB Protein Data Bank web server on <https://www.rcsb.org/> and protein preparation was further performed using the YASARA software by removing water molecules, adding hydrogen and separating the native ligand from the protein. The protein file was saved in the "mol2" format under the name of "protein.mol2", while the native ligand was saved in the "mol2-sybyl mol2" format under the name of "ref\_ligand.mol2" (Purnomo, 2019).

The native ligand file that had been prepared with YASARA was opened with MarvinSketch and the preparation was performed by adjusting the human pH and setting the compound conformation as much as 10 conformations (default). The results of the native ligand preparation through MarvinSketch were saved under the name of "ligand.mol2" with file type of "Tripos Mol2 (\*.mol2)" (Purnomo, 2019).

The docking application applied here was PLANTS by referring to the method of a drug designer made by UGM Yogyakarta which successfully docked with PLANTS using 64-bit Windows via CMD (previously had to go through Co-PendriveLinux) (Purnomo, 2019). Before docking with PLANTS, it should be noted that PLANTS does not recognize the input "S.O2", so it is necessary to edit it to "S.o2" with the Notepad++ program (Purnomo, 2019).

Docking validation was performed to determine the value of Root mean square distances (RMSD). A docking protocol was acceptable if the docked RMSD heavy atoms compared to a reference were below 2.0 angstroms. Thus, if the value met the requirement of the docking protocol, further screening could be conducted virtually to find new inhibitor compounds for a target protein (Purnomo, 2019).

The docking of the predicted compound was performed after the docking protocol was accepted with the RMSD value of below 2.0 Angstrom. Steps for docking the predicted compound were made according to a valid docking protocol. The results of running docking can be observed in the work folder called "result" which contained docking files by selecting the excel file to see the docking score. The docking score described the conformation of the ligand that provided the lowest energy at the protein binding site (Purnomo, 2019)

Visualization aims to find the bond side equations between the predictive compound and the control compound. Docking results were further visualized using Ligplus and Pymol software. Before performing the visualization, there should be a treatment to make a theoretical PDB, namely the protein structure with the ligand resulting from the docking performed with

the YASARA software. At this stage an analysis of the interactions/bonds formed between the amino acid residues and the predicted compounds was performed (Purnomo, 2019).

### 3. RESULTS AND DISCUSSION

Based on the results of bioactive compounds screening using the LC-HRMS method, nine flavonoid compounds were identified from the ethanol extract of butterfly pea petals identified, namely rutin, quercetin-3 $\beta$ -D-glucoside, quercetin, kaempferol, trifolin, genistein, kaempferol-3-glucoside-3" rhamnoside, biochanin A(1), and mauritianin. Based on the results of docking using the PLANTS software (Table 1), it was revealed the docking scores of flavonoid compounds with the order from the highest to lowest: rutin (-87.05), quercetin-3 $\beta$ -D-glucoside (-79.30), quercetin (-79.28), kaempferol (-74.80), trifolin (-74.22), genistein (-69.70), kaempferol-3-glucoside-3" rhamnoside (-67.79), biochanin A(1-) (-67.64), and mauritianin (-58.26). In comparison, the comparator drugs used in this study had a score of -84.45 for Vonoprazan and -66.27 for Omeprazole.

**Table 1.** Docking Scores for Flavonoids and Control Drugs (Omeprazole and Vonoprazan) on Target Protein of H<sup>+</sup>/K<sup>+</sup> ATPase

<b>Compound name</b>	<b>Docking Score</b>
Mauritianin	-58.26
Biochanin A(1-)	-67.64
Kaempferol-3-glucoside-3" rhamnoside	-67.79
Genistein	-69.70
Trifolin	-74.22
Kaempferol	-74.80
Quercetin	-79.28
Quercetin-3 $\beta$ -D-glucoside	-79.30
Rutin	-87.05
Omeprazole	-66.27
Vonoprazan	-84.45

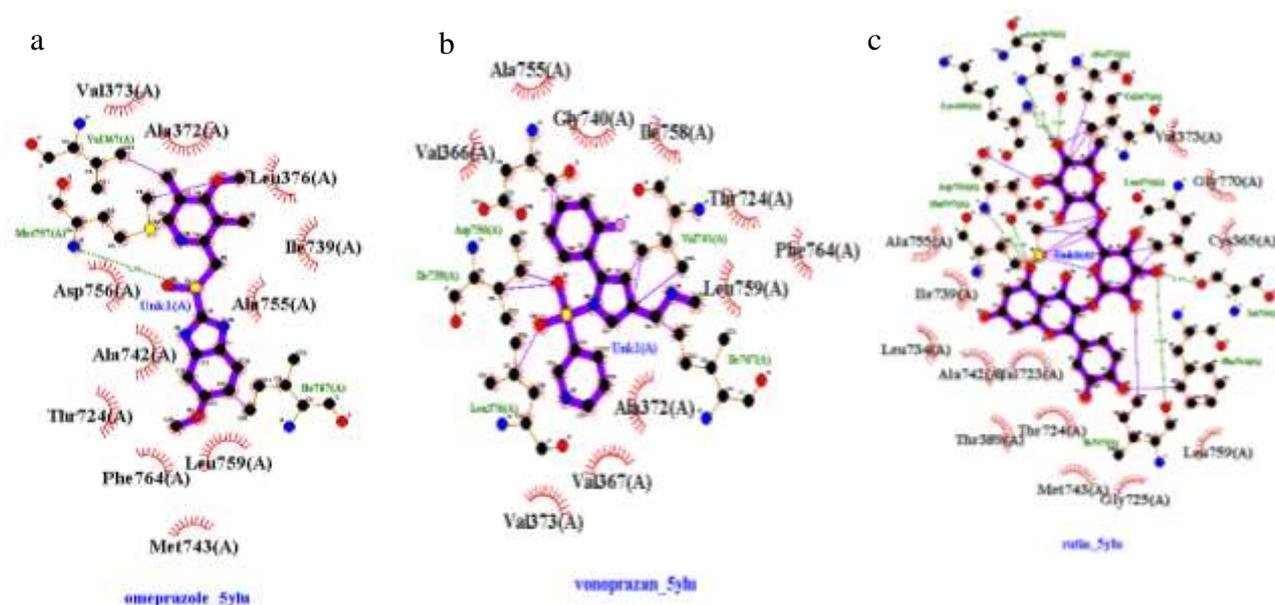
The molecular docking results showed that the majority of compounds had a higher docking score than the control drug of omeprazole. There was one compound namely mauritianin, which had a docking score below all control drugs and only one flavonoid compound namely rutin, which had a higher docking score from the two control drugs. Thus, a statistical test was performed to compare the docking scores between rutin and vonoprazan by taking the docking score from ten conformations using the PLANTS software. The docking score describes the conformation of the ligand that provides the lowest energy for binding to the H<sup>+</sup>/K<sup>+</sup> ATPase target protein. The docking score reflects an idea of how well the drug candidate molecule can bind to its target similar to experimental studies. Scoring was applied to evaluate and rank the ligand and target protein complexes predicted by the docking algorithm. A docking algorithm is a set of rules or parameters implemented in a docking tool to predict the conformation of target proteins and ligands (Dias & de Azevedo Jr., 2008). The docking algorithm applied in the PLANTS software is the Ant Colony Optimization (ACO) algorithm. ACO in PLANTS is known to perform well compared to other docking tools and is equivalent to the GOLD software used as a paid docking tool to search for drug compounds. ACO represents ant colonies that find food in real life by finding binding sites on target proteins (Korb et al., 2009; Spyraakis et al., 2021). The docking score used in the PLANTS software does not have a direct physical/chemical meaning, wherein lower scores represent the best docking produced by the docking tool. A lower docking value indicates that the predicted

compound can bind to the target protein by requiring little energy. Furthermore, the docking value can also mean positive if the predicted compound binds to the protein when energy is present, which is less favorable for the discovery of drug compounds.

**Table 2.** Protein-Ligand Interactions of Flavonoid Compounds of Butterfly Pea Petals Extract (*C. ternatea* L.) with Target Protein of H<sup>+</sup>/K<sup>+</sup> ATPase.

Name of Compound	Protein-Ligand Interaction	
	Hydrogen bond	Hydrophobic bond
Rutin	-	Leu759, Thr724, Ile739, Ala755, Val373, Phe764, Leu376, Ala372
Omeprazole	Met757 (2.51)	Leu759, Phe764, Thr724, Asp756, Ala755, Ile739, Leu376, Ala372, Val373, Val367, Ile767
Vonoprazan	-	Val373, Val367, Ala372, Leu759, Phe764, Thr724, Ala755, Ile767, Asp756, Ile739, Leu376

Based on the docking results compared between the flavonoid compounds of the ethanol extract of butterfly pea petals and the PPI drug, it was found that most of the flavonoid compounds had a lower docking score compared to the omeprazole drug. There was only one flavonoid compound namely rutin with a higher docking score compared to the two PPI drugs (omeprazole and vonoprazan). Omeprazole was the first and most widely prescribed proton pump inhibitor drug to treat gastric disorders among adults (Lindberg et al., 1990; Olbe et al., 2003). Omeprazole works to stop gastric acid secretion by selectively inhibiting protein H<sup>+</sup>/K<sup>+</sup> ATPase. Omeprazole binds covalently to cysteine residues via disulfide bridges on the alpha subunit of the H<sup>+</sup>/K<sup>+</sup> ATPase protein. Such effect may inhibit gastric acid secretion for up to 36 hours (Sachs et al., 2006).



**Figure 1.** Visualization of Interactions of Omeprazole (a), Vonoprazan (b) and Rutin (c) Compounds on the Binding Site of Target Protein of H<sup>+</sup>/K<sup>+</sup> ATPase Using LigPlot<sup>+</sup> Software.

The docking visualization (Figure 1) in the LIGPLOT<sup>+</sup> diagram presents the interaction patterns of hydrogen bonds and hydrophobic bond contacts of each ligand (omeprazole, vonoprazan and rutin). In Figure 1, the bond between the ligands is shown in purple, which

connects the atoms in the ligand. Hydrogen bonds are shown as green dotted lines that form between the two atoms. Hydrophobic contact is indicated by the appearance of an arc with fingers or eyelashes. Contacting atoms are shown with the fingers pointing backward. Plot titles and ligand residues are shown in blue. Figure 1 revealed differences in the chemical structure of the flavonoids between rutin and the two control drugs, wherein the form of the flavonoids in rutin was more complex with five benzene rings and the two control drugs had three benzene rings.

Based on the protein-ligand interaction table, it was known that the compounds that bound the most to the target protein were rutin and kaempferol-3-glucoside-3''rhamnoside by forming hydrogen bonds and hydrophobic bonds. Based on literature, it is known that the interaction between proteins and ligands is mediated by chemical bonds such as hydrogen, hydrophobic, ionic, and so on. However, based on the same literature, hydrogen bonding has the greatest effect in protein and ligand interactions. In addition, there are hydrophobic bonds that affect protein-ligand interactions. Hydrophobic bonds can increase the affinity of most ligand compounds with their receptors. This is indicated by the relatively more significant number of hydrophobic groups compared to hydrogen bonds (Davis & Teague, 2010; Wang et al., 2020).

Rutin is flavonoid compound in plants with the potential as drug candidate due to its pharmacological properties such as antioxidants, cytoprotective, anti-carcinogenic, anti-ulcer and so on (Ganeshpurkar & Saluja, 2017). The results showed that rutin compound extracted from butterfly pea petals had the lowest score in the docking score for the H<sup>+</sup>/K<sup>+</sup> ATPase target protein. Although the statistical test results showed no significant difference between rutin and natural ligands that inhibited the target protein of H<sup>+</sup>/K<sup>+</sup> ATPase (vonoprazan), the docking results found that rutin might have potential as an anti-gastritis candidate by inhibiting H<sup>+</sup>/K<sup>+</sup> ATPase protein in the stomach. Such finding is in line with previous molecular docking studies which showed rutin activity as an inhibitor of H<sup>+</sup>/K<sup>+</sup> ATPase protein in the stomach (Dubey et al., 2013a; Dubey et al., 2013b).

The limitation in this study was regarding molecular docking without applying molecular dynamics to know clearly which predictive compound is maturely bound to the target protein so as to predict whether the protein-compound complex can change the configuration of the gastric proton pump and cause a reaction.

#### 4. CONCLUSION

Based on the results of data analysis and the discussion described, it can be concluded that: The ethanol extract of butterfly pea petals (*C. ternatea* L.) contained flavonoid compounds that have potential as anti-gastritis in inhibition of gastric proton pump protein of H<sup>+</sup>/K<sup>+</sup> ATPase through molecular docking using the PLANTS software. Flavonoid compound predicted to have the most potential as anti-gastritis by in-silico inhibition of gastric proton pump protein of H<sup>+</sup>/K<sup>+</sup> ATPase was rutin. The chemical structure of Rutin differs from the two control drugs because it has a more complex structure consisting of five benzene rings.

It is recommended to determine the content of extracts derived from solvents other than ethanol so as to identify bioactive compounds other than ethanol extract. Molecular docking prediction can be followed up with molecular dynamic simulation to comprehensively understand molecular dynamics using an in-silico approach.

#### REFERENCES

- Aditiyarini, D., & Iswuryani, E. O. (2021). Effect of various factors on anthocyanins extraction from butterfly pea flower (*Clitoria ternatea* l.). *Nova Biotechnologica et Chimica*, 20(1), e817. <https://doi.org/10.36547/nbc.817>
- Ardalani, H., Hadipanah, A., & Sahebkar, A. (2019). Medicinal Plants in the Treatment of

- Peptic Ulcer Disease: A Review. *Mini-Reviews in Medicinal Chemistry*, 20(8), 662-702. <https://doi.org/10.2174/1389557520666191227151939>
- Bordbar, G., Miri, M. B., Omidi, M., Shoja, S., & Akhavan, M. (2020). Comparison of a Novel Herbal Medicine and Omeprazole in the Treatment of Functional Dyspepsia: A Randomized Double-Blinded Clinical Trial. *Gastroenterology Research and Practice*, 2020 (5152736). <https://doi.org/10.1155/2020/5152736>
- Davis, A. M., & Teague, S. J. (2010). ChemInform Abstract: Hydrogen Bonding, Hydrophobic Interactions, and Failure of the Rigid Receptor Hypothesis. *ChemInform*, 30(24). <https://doi.org/10.1002/chin.199924325>
- Deorankar, P., Gangiwale, R., Chintamani, R., & Singh, R. P. (2020). Evaluation of ethanolic and aqueous extract of clitoria ternatea for antimicrobial activity. *Indian Journal of Natural Products and Resources (IJNPR)[Formerly Natural Product Radiance (NPR)]*, 11(3), 194-198. <http://doi.org/10.56042/ijnpr.v11i3.29958>
- Dias, R., & de Azevedo Jr., W. (2008). Molecular Docking Algorithms. *Current Drug Targets*, 9(12), 1040-1047. <https://doi.org/10.2174/138945008786949432>
- Dubey, S., Ganeshpurkar, A., Shrivastava, A., Bansal, D., & Dubey, N. (2013a). Rutin exerts antiulcer effect by inhibiting the gastric proton pump. *Indian Journal of Pharmacology*, 45(4), 415-417. <https://doi.org/10.4103/0253-7613.115011>
- Dubey, S., Ganeshpurkar, A., Bansal, D., & Dubey, N. (2013b). Experimental studies on bioactive potential of rutin. *Chronicles of Young scientists*, 4(2), 153-157. <https://doi.org/10.4103/2229-5186.115556>
- Egert, S., & Rimbach, G. (2011). Which sources of flavonoids: Complex diets or dietary supplements?. *Advances in Nutrition*, 2(1), 8-14. <https://doi.org/10.3945/an.110.000026>
- Elseweidy, M. (2011). Role of Natural Antioxidants in Gastritis. *Gastritis and Gastric Cancer - New Insights in Gastroprotection, Diagnosis and Treatments*. <https://doi.org/10.5772/24336>
- Engevik, A. C., Kaji, I., & Goldenring, J. R. (2020). The physiology of the gastric parietal cell. *Physiological Reviews*, 100(2), 573-602. <https://doi.org/10.1152/physrev.00016.2019>
- Ganeshpurkar, A., & Saluja, A. K. (2017). The Pharmacological Potential of Rutin. *Saudi Pharmaceutical Journal*, 25(2), 149-164. <https://doi.org/10.1016/j.jsps.2016.04.025>
- Jaafar, N. F., Ramli, M. E., & Salleh, R. M. (2020). Optimum extraction condition of clitoria ternatea flower on antioxidant activities, total phenolic, total flavonoid and total anthocyanin contents. *Tropical Life Sciences Research*, 31(2), 1-17. <https://doi.org/10.21315/tlsr2020.31.2.1>
- Jeyaraj, E. J., Lim, Y. Y., & Choo, W. S. (2020). Extraction methods of butterfly pea (*Clitoria ternatea*) flower and biological activities of its phytochemicals. *Journal of Food Science and Technology*, 58, 2054-2067. <https://doi.org/10.1007/s13197-020-04745-3>
- Kementerian Kesehatan Republik Indonesia. (2020). *Peraturan Menteri Kesehatan Republik Indonesia Nomor 21 Tahun 2020 Tentang Rencana Strategis Kementerian Kesehatan Tahun 2020-2024*. Jakarta: Kementerian Kesehatan Republik Indonesia.
- Korb, O., Stützle, T., & Exner, T. E. (2009). Empirical scoring functions for advanced Protein-Ligand docking with PLANTS. *Journal of Chemical Information and Modeling*, 49(1), 84-96. <https://doi.org/10.1021/ci800298z>
- Laloo, D., Sinha, S. K., Prasad, S. K., & Hemalatha, S. (2021). Gastric H<sup>+</sup>, K<sup>+</sup>-ATPase inhibitory effects of the active constituent isolated from *Potentilla fulgens* roots: An in vivo and in silico molecular docking studies. *Phytomedicine Plus*, 1(3), 100037. <https://doi.org/10.1016/j.phyplu.2021.100037>
- Lindberg, P., Brndstrm, A., Wallmark, B., Mattsson, H., Rikner, L., & Hoffmann, K. J. (1990). Omeprazole: The first proton pump inhibitor. *Medicinal Research Reviews*, 10(1), 1-54.

- <https://doi.org/10.1002/med.2610100102>
- Ludin, N. A., Al-Alwani, M. A., Mohamad, A. B., Kadhum, A. A. H., Hamid, N. H., Ibrahim, M. A., ... & Sopian, K. (2018). Utilization of natural dyes from zingiber officinale leaves and clitoria ternatea flowers to prepare new photosensitisers for dye-sensitised solar cells. *Int. J. Electrochem. Sci*, 13(8), 7451-7465. <https://doi.org/10.20964/2018.08.04>
- Ma'ruf, N. Q., Antasionasti, I., Fatimawali, F., & Tallei, T. (2021). Analisis GC-MS Ekstrak Metanol dan N-Heksan dari Bunga Telang (*Clitoria ternatea* L.). *Pharmakon*, 10(2), 857-862. <https://doi.org/10.35799/pha.10.2021.34035>
- Metz, D. C., Ferron, G. M., Paul, J., Turner, M. B., Soffer, E., Pisegna, J. R., & Bochenek, W. J. (2002). Proton pump activation in stimulated parietal cells is regulated by gastric acid secretory capacity: A human study. *Journal of Clinical Pharmacology*, 42(5), 512-519. <https://doi.org/10.1177/00912700222011562>
- Muhammad Ezzudin, R., & Rabeta, M. S. (2018). A potential of telang tree (*Clitoria ternatea*) in human health. *Food Research*, 2(5), 415-420. [https://doi.org/10.26656/fr.2017.2\(5\).073](https://doi.org/10.26656/fr.2017.2(5).073)
- Olbe, L., Carlsson, E., & Lindberg, P. (2003). A proton-pump inhibitor expedition: The case histories of omeprazole and esomeprazole. *Nature Reviews Drug Discovery*, 2, 132-139. <https://doi.org/10.1038/nrd1010>
- Parikesit, A. A., Anurogo, D., & Putranto, R. A. (2017). Pemanfaatan bioinformatika dalam bidang pertanian dan kesehatan (The utilization of bioinformatics in the field of agriculture and health). *E-Journal Menara Perkebunan*, 85(2), 105-115. <https://doi.org/10.22302/iribb.jur.mp.v85i2.237>
- Purnomo, H. (2019). *Molecular Docking Parasetamol dan Analognya Menggunakan PLANTS (Protein-Ligands ANT-System)*. Rapha Publishing.
- Rawla, P., & Barsouk, A. (2019). Epidemiology of gastric cancer: Global trends, risk factors and prevention. In *Przegląd Gastroenterologiczny*, 14(1), 26-38. <https://doi.org/10.5114/pg.2018.80001>
- Reyes-Chilpa, R., Baggio, C. H., Alavez-Solano, D., Estrada-Muñiz, E., Kauffman, F. C., Sanchez, R. I., & Mesia-Vela, S. (2006). Inhibition of gastric H<sup>+</sup>,K<sup>+</sup>-ATPase activity by flavonoids, coumarins and xanthenes isolated from Mexican medicinal plants. *Journal of Ethnopharmacology*, 105(1-2), 167-172. <https://doi.org/10.1016/j.jep.2005.10.014>
- Rugge, M., Savarino, E., Sbaraglia, M., Bricca, L., & Malfartheiner, P. (2021). Gastritis: The clinico-pathological spectrum. *Digestive and Liver Disease*, 53(10), 1237-1246. <https://doi.org/10.1016/j.dld.2021.03.007>
- Rugge, M., Sugano, K., Sacchi, D., Sbaraglia, M., & Malfartheiner, P. (2020). Gastritis: An Update in 2020. *Current Treatment Options in Gastroenterology*, 18, 488-503. <https://doi.org/10.1007/s11938-020-00298-8>
- Sachs, G., Shin, J. M., & Howden, C. W. (2006). Review article: The clinical pharmacology of proton pump inhibitors. *Alimentary Pharmacology and Therapeutics*, 23(SUPPL. 2), 2-8. <https://doi.org/10.1111/j.1365-2036.2006.02943.x>
- Sachs, George, Shin, J. M., Vagin, O., Lambrecht, N., Yakubov, I., & Munson, K. (2007). The gastric H,K ATPase as a drug target: Past, present, and future. *Journal of Clinical Gastroenterology*, 41(SUPPL.2), S226-S242. <https://doi.org/10.1097/MCG.0b013e31803233b7>
- Sarkar, A., & Kellogg, G. E. (2009). Book Review of Computational Drug Design. A Guide for Computational and Medicinal Chemists. *Journal of Medicinal Chemistry*, 52(15), 4977. <https://doi.org/10.1021/jm900605k>
- Seyedsadjadi, N., & Grant, R. (2021). The potential benefit of monitoring oxidative stress and inflammation in the prevention of non-communicable diseases (NCDs). In *Antioxidants*, 10(1), 15. <https://doi.org/10.3390/antiox10010015>

- Sofi, S. H., Nuraddin, S. M., Amin, Z. A., Al-Bustany, H. A., & Nadir, M. Q. (2020). Gastroprotective activity of *Hypericum perforatum* extract in ethanol-induced gastric mucosal injury in Wistar rats: A possible involvement of H<sup>+</sup>/K<sup>+</sup> ATPase  $\alpha$  inhibition. *Heliyon*, 6(10), E05249. <https://doi.org/10.1016/j.heliyon.2020.e05249>
- Spyrakakis, F., Sarkar, A., & Kellogg, G. E. (2021). Docking, Scoring, and Virtual Screening in Drug Discovery. *Burger's Medicinal Chemistry and Drug Discovery*. <https://doi.org/10.1002/0471266949.bmc301>
- Thuy, N. M., Minh, V. Q., Ben, T. C., Nguyen, M. T. T., Ha, H. T. N., & Van Tai, N. (2021). Identification of anthocyanin compounds in butterfly pea flowers (*Clitoria ternatea* L.) by ultra performance liquid chromatography/ultraviolet coupled to mass spectrometry. *Molecules*, 26(15), 4539. <https://doi.org/10.3390/molecules26154539>
- Ulimaz, T. A., Ustari, D., Aziza, V., Suganda, T., Concibido, V., Levita, J., & Karuniawan, A. (2020). Genetic Diversity of Butterfly Pea [*Clitoria ternatea*] from Indonesia Based on Flower and Yield Component Traits in Two Land Conditions. *Jurnal AgroBiogen*, 16(1). <https://doi.org/10.21082/jbio.v16n1.2020.p1-6>
- Umre, R., Ganeshpurkar, A., Ganeshpurkar, A., Pandey, S., Pandey, V., Shrivastava, A., & Dubey, N. (2018). In vitro, in vivo and in silico antiulcer activity of ferulic acid. *Future Journal of Pharmaceutical Sciences*, 4(2), 248-253. <https://doi.org/10.1016/j.fjps.2018.08.001>
- Wang, Y., Liu, M., & Gao, J. (2020). Enhanced receptor binding of SARS-CoV-2 through networks of hydrogen-bonding and hydrophobic interactions. *Proceedings of the National Academy of Sciences of the United States of America*, 117(25), 13967-13974. <https://doi.org/10.1073/pnas.2008209117>
- Zahran, E. M., Abdelmohsen, U. R., Hussein, A. S., Salem, M. A., Khalil, H. E., Yehia Desoukey, S., Fouad, M. A., & Kamel, M. S. (2021). Antiulcer potential and molecular docking of flavonoids from *Ocimum forskolei* Benth., family Lamiaceae. *Natural Product Research*, 35(11), 1933-1937. <https://doi.org/10.1080/14786419.2019.1645662>
- Zhang, W., Lian, Y., Li, Q., Sun, L., Chen, R., Lai, X., Lai, Z., Yuan, E., & Sun, S. (2020). Preventative and therapeutic potential of flavonoids in peptic ulcers. *Molecules*, 25(20), 4626. <https://doi.org/10.3390/molecules25204626>