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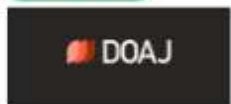
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Effect of Diabetic Foot Ulcer Prevention Education on the Knowledge, Attitude, and Practices of PKK Cadres in Suruh Kalang, Karanganyar

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A B S T R A C T

Diabetic foot ulcers are characterized by a disruption of skin integrity or infection that may extend to subcutaneous tissue, muscles, tendons, or bone. In Indonesia, the prevalence of diabetic foot ulcers is approximately 15%, with amputation rates of around 30% and mortality rates reaching up to 32%. One key strategy for preventing diabetic foot ulcers is health promotion conducted by community health cadres, who serve as frontline agents in public health initiatives.

Preventive efforts include proper foot care practices and the implementation of diabetic foot exercises. The knowledge, attitudes, and behaviours of healthcare cadres play a crucial role in the success of both preventive and promotive interventions. Adequate knowledge supports the formation of positive attitudes, which subsequently encourage appropriate health behaviours. Structured educational programs that incorporate lectures, group discussions, demonstrations, and pre- and post-intervention evaluations are effective in improving the knowledge, attitudes, and behaviours of health cadres. Evidence from such interventions demonstrates a statistically significant improvement in these domains (p -value = 0.000). Therefore, the implementation of a sustainable and continuous education program is essential to strengthen diabetic foot ulcer prevention efforts by health cadres within the community and to ultimately reduce the incidence of diabetic foot ulcers.

INTRODUCTION

Diabetes Mellitus (DM) is a chronic metabolic disease characterized by elevated blood glucose levels, which increases the risk of various serious complications, one of which is diabetic foot ulcer (Guyton & Hall, 2011). Elevated blood glucose levels are partly caused by a diet high in sugar that persists over time without being balanced by adequate physical activity. The highest prevalence of DM cases among individuals aged 20–79 years is found in China, the United States, and India, with 116.4 million, 77 million, and 31 million cases, respectively. Indonesia ranks seventh globally, with a DM prevalence of 10.7 million (Kemenkes, 2020). Patients with both type 1 and type 2 DM have a 25% risk of developing diabetic foot ulcers (Manna, 2020). A diabetic foot ulcer is a DM complication characterized by damage to the integrity of skin tissue, accompanied by infection that may spread to subcutaneous tissue, tendons, or bones. This condition is often exacerbated by neuropathy, peripheral artery disease, improper foot care, or the use of inappropriate footwear (Sofyanti Nur Deviana, Naziyah; Hidayat Rizki, 2022). Diabetic foot ulcers are a major cause of morbidity and mortality, with an increasing prevalence. The condition also imposes a significant economic burden due to the high cost of medical care. However, diabetic foot ulcers can be prevented through measures such as compression, debridement, infection control, proper foot and wound care, and regular diabetic foot exercises (Muhammad et al., 2022).

Education is a crucial strategy in preventing diabetic foot ulcers, as it facilitates improvements in knowledge, attitudes, and behaviours. Nevertheless, prior studies indicate that adequate knowledge and positive attitudes do not always result in healthy preventive behaviours, suggesting the need for more intensive and targeted educational interventions (Alsaigh et al., 2022). Research in Guilan, Iran, revealed that most diabetes patients demonstrated low knowledge regarding foot care, and half reported poor preventive behaviours, underscoring the importance of ongoing education (Pourkazemi et al., 2020).

Diabetic foot ulcers cause not only physical impairment but also psychological distress and economic hardship due to long-term treatment needs and high medical costs. Preventive measures, therefore, should aim to enhance patients' knowledge, attitudes, and behaviours through sustainable community-based health education, particularly involving community health cadres. Evidence suggests that knowledge shapes attitudes and behaviours, while positive attitudes contribute significantly to preventive practices (Budi Raharjo et al., 2022; Anam et al., 2019). Several studies have demonstrated the positive impact of health education on diabetic foot ulcer prevention. Research found a significant association between knowledge and attitudes and the level of preventive efforts among type 2 diabetes patients reported that 50.7% of respondents had moderate knowledge, 50.7% had good attitudes, and 53.7% demonstrated moderate preventive efforts. The study revealed a significant relationship between knowledge and attitudes in preventing diabetic foot ulcers among type 2 DM patients. Prevention efforts should not only be carried out individually but also involve community participation and healthcare providers to foster accurate and effective knowledge, attitudes, and preventive behaviours (Sofyanti Nur Deviana; Naziyah; Hidayat Rizki, 2022). Similarly, another research found that health education significantly improved attitudes and practices for prevention. Health education can enhance behavioural changes toward ulcer prevention among type 2 DM patients (Fatmawati, 2020).

Furthermore, research by Sukartini et al., (2020) on behavioural models for diabetic foot ulcer prevention reported that predisposing factors, such as knowledge and enabling factors, such as healthcare provider roles and family support, influence attitudes and preventive behaviours. Continuous education by healthcare professionals to patients and their families regarding DM management, lifestyle modification, and regular foot care can reduce the risk of diabetic foot ulcers. Based on these findings, the novelty of the present study lies in its intervention targeting PKK cadres as a strategy to improve knowledge, attitudes, and preventive behaviours for diabetic foot ulcers. The results of this intervention may serve as a basis for community health promotion efforts, particularly in preventing diabetic foot ulcers.

METHOD

This study employed a quantitative design with a quasi-experimental one-group pretest–posttest approach. The research was conducted in Suruh Kalang Village, Karanganyar Regency, in May 2025.

The population, defined as the generalization area consisting of subjects with specific characteristics determined by the researcher (Sugiyono, 2019). Comprised all PKK cadres in Suruh Kalang, totalling 30 individuals. The sample, representing the entire population and serving as the source of data, was selected using a total sampling technique, in which all members of the population were included in the study. The inclusion criteria were: (1) having at least six months of experience as a PKK cadre, and (2) the ability to communicate effectively. The exclusion criteria were: (1) having limitations in reading and writing, (2) experiencing hearing impairments, and (3) incomplete questionnaire responses. Data were collected using a self-developed questionnaire measuring knowledge, attitudes, and practices. Data analysis was performed using SPSS with the Wilcoxon signed-rank test.

RESULT

This study obtained ethical clearance from the Ethics Committee of Universitas Aisyiyah Surakarta (No. 379/III/AUEC/2025) on March 8, 2025. Following ethical approval, the researcher coordinated with the Suruh Kalang Midwifery Service to obtain permission and schedule the research activities. Data were collected from 30 respondents, all of whom were PKK cadres in Suruh Kalang. Each respondent completed the informed consent form and the research questionnaire in full.

Table 1. Distribution of Respondents' Characteristics

Characteristics	Frequency (f)	Percentage (%)
Age		
>35-45 years	22	73%
>45 years	8	27%
Education		
Senior High School	25	83%
Higher Education	5	17%
Occupation		
Unemployed	16	53%
Private sector/self-employed	12	40%
Civil servant	2	7%

Based on Table 1, the majority of respondents were aged 35–45 years (73%), had completed senior high school education (83%), and were unemployed (53%).

Table 2. Descriptive Statistics of Knowledge, Attitude, and Practice

Variable		N	Minimum	Maksimum	Mean	Std. Deviation
Knowledge	Pre Test	30	1	5	3.47	0,937
	Post Test	30	4	6	5.23	0,728
Attitude	Pre Test	30	6	15	11.70	1,950
	Post Test	30	16	20	17.90	1,373
Practices	Pre Test	30	11	16	13.53	1,196
	Post Test	30	13	16	14.40	0,894

Based on the data presented in Table 2, the pre-test knowledge scores ranged from a minimum of 1 to a maximum of 5, with a mean score of 3.47 and a standard deviation of 0.937. After the intervention (post-test), the knowledge scores ranged from 4 to 6, with a mean of 5.23 and a standard deviation of 0.728.

For the attitude variable, the pre-test scores ranged from 6 to 15, with a mean of 11.70 and a standard deviation of 1.950. Following the intervention, the scores ranged from 16 to 20, with a mean of 17.90 and a standard deviation of 1.373.

Regarding practice, pre-test scores ranged from 11 to 16, with a mean of 13.53 and a standard deviation of 1.196. After the intervention, the scores ranged from 13 to 16, with a mean of 14.40 and a standard deviation of 0.894.

The prerequisite test was conducted to determine whether the hypothesis testing should use parametric or non-parametric statistics. The normality test applied was the Shapiro–Wilk test. If the data were normally distributed, the hypothesis testing would be performed using parametric statistics, specifically the paired t-test.

Table 3. Normality Test

Variable		Shapiro-Wilk		
		Statistic	df	Sig.
Knowledge	Pre Test	.885	30	.004
	Post Test	.793	30	.000
Attitude	Pre Test	.943	30	.109
	Post Test	.902	30	.009
Practice	Pre Test	.938	30	.082
	Post Test	.881	30	.003

The results of the normality test presented in the table above show that, for the knowledge variable, the pre-test data had a significance value of 0.004 and the post-test data had a significance value of 0.000. Since both significance values were less than 0.05, it can be concluded that the knowledge variable data were not normally distributed. For the attitude variable, the pre-test data had a significance value of 0.109, and the post-test data had a significance value of 0.009. Since the post-test value was less than 0.05, it can be concluded that the attitude variable data were not normally distributed.

For the practice variable, the pre-test data had a significance value of 0.082, and the post-test data had a significance value of 0.003. Since the post-test value was less than 0.05, it can be concluded that the practice variable data were not normally distributed. Overall, these results indicate that the data for all variables were not normally distributed; therefore, hypothesis testing was performed using a non-parametric statistical test, namely the Wilcoxon signed-rank test.

Table 4. Wilcoxon Signed-Rank Test Result

Variable		N	Mean Rank	<i>p value</i>
Knowledge (Post Test - Pre Test)	Negative Ranks	1 ^a	5.50	0.000
	Positive Ranks	26 ^b	14.33	
	Ties	3 ^c		
	Total	30		
Attitude (Post Test - Pre Test)	Negative Ranks	0 ^a	0.00	0.000
	Positive Ranks	30 ^b	15.50	
	Ties	0 ^c		
	Total	30		
Practice (Post Test - Pre Test)	Negative Ranks	1 ^a	9.00	0.000
	Positive Ranks	21 ^b	11.62	
	Ties	8 ^c		
	Total	30		

a : Number of respondents with post-test scores < pre-test scores

b : Number of respondents with post-test scores > pre-test scores

c : Number of respondents with post-test scores = pre-test scores

Based on the table above, the comparison results for the Knowledge variable show that almost all respondents (26 individuals) had higher scores (*positive ranks*) after the post-test, 3 respondents had the same scores (*ties*), and 1 respondent had a lower post-test score (*negative rank*). The p-value of 0.000 is smaller than 0.05 ($\text{sig} < 0.05$), indicating a significant difference in knowledge before and after the test, with respondents' knowledge increasing after receiving the intervention (post-test).

For the Attitude variable, all respondents (30 individuals) had higher scores (*positive ranks*) after the post-test. The p-value of 0.000 is smaller than 0.05 ($\text{sig} < 0.05$), indicating a significant difference in attitude before and after the test, with respondents' attitudes improving after receiving the intervention (post-test).

For the Practice variable, almost all respondents (21 individuals) had higher scores (*positive ranks*) after the post-test, 8 respondents had the same scores (*ties*), and 1 respondent had a lower post-test score (*negative rank*). The p-value of 0.000 is smaller than 0.05 ($\text{sig} < 0.05$), indicating a significant difference in practice before and after the test, with respondents' practices improving after receiving the intervention (post-test).

DISCUSSION

Knowledge plays a vital role in disease prevention, including the prevention of diabetic ulcers. Adequate knowledge enables individuals to identify risk factors and early signs of the disease, as well as to adopt effective preventive measures. Previous studies have demonstrated that well-delivered health education can enhance individuals' understanding of specific diseases, thereby empowering them to take proactive steps in preventing potential health problems (Suryani, S. and Dewi, 2017; Okoro, R. N. and Odume, B. B. and Nduka, 2020). In the context of diabetic ulcers, education provided to PKK cadres enhances their understanding of the significant risks diabetes poses to foot health, the importance of regular foot

examinations, optimal blood glucose management, and appropriate foot care practices. With improved knowledge, PKK cadres are better equipped to deliver educational outreach to the broader community, particularly to individuals living with diabetes.

The development of positive attitudes toward diabetic ulcer prevention is equally important, as attitude serves as a key determinant in facilitating behavioural change. While adequate knowledge is essential, it alone may be insufficient to drive behavioural modification without the support of a positive and proactive attitude (Fishbein, M. and Ajzen, 2010). In the context of diabetic ulcers, providing education to PKK cadres significantly enhances their understanding of the substantial risks that diabetes poses to foot health, the necessity of regular foot examinations, optimal blood glucose management, and appropriate foot care practices. Strengthened knowledge equips PKK cadres to more effectively deliver educational outreach to the wider community, particularly to individuals living with diabetes.

Equally important is the cultivation of positive attitudes toward diabetic ulcer prevention, as attitude is a critical determinant in driving behavioural change. While sufficient knowledge forms the foundation, it may not be enough to prompt behavioural modification without the reinforcement of a supportive and proactive mindset (Hisham, M. and Rahman, N. and Wahab, 2020). An improved attitude toward diabetic ulcer prevention is expected to positively influence PKK cadres' behaviour in delivering education to the community and in engaging the families of individuals with diabetes in preventive efforts.

The behavioural measurements in this study also showed significant results, although these findings differ from several previous studies. One possible explanation is that behavioural change often requires a longer period of time compared to changes in knowledge or attitude. According to behavioural change models, such changes typically occur in multiple stages, and not all individuals will immediately alter their behaviour after receiving information or education.

Moreover, social factors play an important role in shaping behaviour. Glanz et al. (2015) highlighted that behavioural change is more effective when there is strong social support, whether from family, friends, or the broader community (Glanz, K. and Rimer, B. K. and Viswanath, 2015). If PKK cadres are unable to obtain support from other stakeholders, or if the community does not share the same level of understanding regarding the importance of diabetic ulcer prevention, behavioural change will be difficult to achieve. Preventive behaviours related to diabetic ulcers, such as regular foot examinations and optimal blood glucose management, require systematic support and adequate facilities. Although PKK cadres may have received education, they may not have direct access to the necessary resources or facilities to implement these preventive measures effectively, particularly in conducting foot examinations for individuals with diabetes. Furthermore, many people living with diabetes in the community may lack easy access to healthcare facilities or medical professionals capable of performing routine foot examinations.

CONCLUSION

Education on the prevention of diabetic ulcers has a significant positive impact on the knowledge and attitudes of PKK cadres, but does not have a significant effect on their behaviour. This finding indicates the need for a more comprehensive and sustainable approach, including systematic support and adequate facilities to foster more tangible behavioural change. Based on these results, several recommendations for future research and interventions are proposed, including continuous mentoring, the provision of supportive facilities, and the strengthening of social support. Communities, families, and other relevant stakeholders should be actively involved in supporting PKK cadres to promote behavioural change in diabetic ulcer prevention.

REFERENCES

- Alsaigh, S. H., Alzaghran, R. H., Alahmari, D. A., Hameed, L. N., Alfurayh, K. M., & Alaql, K. B. (2022). Knowledge, Awareness, and Practice Related to Diabetic Foot Ulcer Among Healthcare Workers and Diabetic Patients and Their Relatives in Saudi Arabia: A Cross-Sectional Study. *Cureus*, 14(12). <https://doi.org/10.7759/cureus.32221>
- Anam, A. K., Puguh, B., Kurniawan, D., Keperawatan, J., Kesehatan, P., & Malang, K. K. (2019). Gambaran Pengetahuan Pasien Diabetes Diabetik Di Klinik Ikhza Medika Description of Diabetes Mellitus Patients Concerning Diabetic Ulcer Treatment in. *Bali Medika Jurnal*, 6(2), 136–146.
- Budi Raharjo, S., Suratmin, R., Maulidia, D., Pratiwi, O., & Meutia Fidela, R. (2022). Perawatan Luka Ulkus Diabetikum: Tinjauan Literatur. *Journal Keperawatan*, 1(2), 98–104. <https://doi.org/10.58774/jourkep.v1i2.15>
- Fatmawati. (2020). Pencegahan Ulkus Diabetik Pada Pasien Diabetes Mellitus Tipe 2. *Jurnal Kesehatan Qamarul Huda*, 8, 34–41.
- Fishbein, M. and Ajzen, I. (2010). *Predicting and Changing Behaviour: The Reasoned Action Approach*. Psychology Press.
- Glanz, K. and Rimer, B. K. and Viswanath, K. (2015). *Health Behaviour and Health Education: Theory, Research, and Practice* (5th ed.). Jossey-Bass.
- Guyton & Hall. (2011). *Buku Ajar Fisiologi Kedokteran Edisi Kedua belas*. Saunders Elseiver.
- Hisham, M. and Rahman, N. and Wahab, N. (2020). Knowledge, attitude and practice towards diabetic foot care among patients attending primary health clinics in Malaysia. *Malaysian Journal of Public Health Medicine*, 20(1), 80–87.
- Kemenkes. (2020). *Tetap Produktif, Cegah dan Atasi Diabetes Mellitus*. Kementerian Kesehatan Republik Indonesia.
- Manna, C. P. S. A. B. (2020). *Diabetic Ulcer*. StatPearls Publishing.
- Muhammad Hafizh Izuddin Alzamani, L., Rianta Yolanda Marbun, M., Eka Purwanti, M., Salsabilla, R., & Rahmah, S. (2022). Ulkus Kronis: Mengenali Ulkus Dekubitus dan Ulkus Diabetikum. *Jurnal Syntax Fusion*, 2(02), 272–286. <https://doi.org/10.54543/fusion.v2i02.153>
- Okoro, R. N. and Odume, B. B. and Nduka, S. O. (2020). Effect of educational intervention on knowledge of foot care among diabetic patients in a Nigerian tertiary hospital. *Journal of Diabetes Nursing*, 24(1), 24–30.

- Pourkazemi, A., Ghanbari, A., Khojamli, M., Balo, H., Hemmati, H., Jafaryparvar, Z., & Motamed, B. (2020). Diabetic foot care: Knowledge and practice. *BMC Endocrine Disorders*, 20(1), 1–8. <https://doi.org/10.1186/s12902-020-0512-y>
- Sofyanti Nur Deviana; Naziyah; Hidayat Rizki. (2022). Hubungan Pengetahuan dan Sikap terhadap Upaya Pencegahan Ulkus Diabetikum Penderita Diabetes Mellitus Tipe 2 di Puskesmas Pancoran Jakarta Selatan. In *MANUJU : Malahayati Nursing Journal* (Vol. 4, Issue 3).
- Sugiyono. (2019). *Penelitian Kuantitatif, Kualitatif dan R&D*. Alfabet.
- Sukartini, T., Theresia Dee, T. M., Probowati, R., & Arifin, H. (2020). Behaviour model for diabetic ulcer prevention. *Journal of Diabetes and Metabolic Disorders*, 19(1), 135–143. <https://doi.org/10.1007/s40200-019-00484-1>
- Suryani, S. and Dewi, R. K. (2017). Pengaruh pendidikan kesehatan terhadap pengetahuan tentang perawatan kaki pada penderita diabetes mellitus. *Jurnal Keperawatan*, 8(2), 112–119.



The Effect of Non-Pharmacological Pain Management Using Behavioural Intervention on Pain Scale and Oxygen Saturation Among Preschool Children Undergoing Invasive Procedures

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ABSTRACT

Pain during invasive medical procedures is a major stressor for preschool children and may trigger physiological responses such as oxygen saturation decline due to crying and anxiety. This investigation examines the effect of a behavioral intervention on pain scale scores and oxygen saturation during the intravenous (IV) insertion procedure in preschoolers. This study used a quasi-experimental design with a post-test-only control group. A total of 80 children aged 3–6 years undergoing intravenous insertion at RSI Jemursari Surabaya were selected through purposive sampling and divided equally into intervention and control groups. The research instruments were the FLACC (Face, Legs, Activity, Cry, Consolability) Scale to measure pain and a pulse oximeter to measure oxygen saturation. Data analysis used the Mann–Whitney U Test. The mean pain score in the intervention group (3.44) was significantly lower than in the control group (7.57). Meanwhile, the mean oxygen saturation in the intervention group (98%) was higher than in the control group (94.12%). Statistical analysis showed a significant difference between the two variables ($p=0.001$). Behavioral intervention is effective in reducing pain and preventing oxygen desaturation during invasive procedures in preschool children. It can be recommended as a non-pharmacological approach in pediatric nursing practice.

INTRODUCTION

Invasive medical procedures are an important part of children's health services, especially in conditions that require immediate management, such as IV insertion. However, in preschoolers, the procedure is often considered a frightening experience and causes significant pain (Tran Thi et al., 2022). Pain in children is different from that in adults, because children are not able to express pain rationally and tend to react emotionally through crying, rejection, and other defensive behaviors (Sayed et al., 2020). This condition makes pain a major stressor that can affect physiological, psychological, and behavioral responses during medical procedures.

Epidemiological data show that pain from invasive procedures is a global clinical problem. In the United States, approximately 60–80% of children who underwent invasive procedures reported experiencing pain of mild to severe intensity (Walco et al., 2017). Research in Canada showed the prevalence of moderate to severe pain in 70% of preschoolers during blood collection or IV insertion (Friedrichsdorf et al., 2020). In Indonesia, based on the Indonesian Basic Health Research in 2018, 39% of children who underwent hospitalization complained of pain. In Surabaya, a prior study found that 45% of children experienced moderate pain, 32.5% mild pain, 10% severe pain, and 12.5% did not experience pain during invasive procedures (Sayed et al., 2020).

The pain response in children not only affects behavior but also physiological status, including oxygen saturation. Excessive crying, anxiety, and hyperventilation during the procedure increase sympathetic nervous system activity, which can lead to changes in breathing patterns and decreased oxygen saturation (Taddio et al., 2012; Crumm et al., 2020). A study conducted in infants during intramuscular procedures showed a decrease in saturation of 85–91% during invasive procedures, while normal saturation was 91–97% (Camacho-Cruz et al., 2023). The condition suggests that pain is not only a subjective experience but also a bodily response that can affect physiological stability. To address these problems, health workers have a responsibility to implement effective pain management interventions to prevent long-term impacts, both in the form of psychological trauma and maladaptation to future medical procedures (Azak et al., 2022). Non-pharmacological pain management is widely recommended in pediatric nursing practice because it is safe, easy to apply, has no side effects, and can be combined with pharmacological approaches when needed (Tran Thi, 2022). One non-pharmacological method that has proven effective is behavioral intervention, which includes distraction, simple breathing exercises, positive reinforcement, modeling, and parental involvement during the procedure (Salomons et al., 2024).

However, most previous studies focused more on subjective and behavioral pain scales. In contrast, physiological parameters, such as oxygen saturation, had not been widely studied as objective indicators of pain response in preschoolers. In addition, studies combining behavioral interventions with physiological measurements during invasive procedures in preschool populations remained limited, especially in Indonesia. It shows that there was a scientific gap and the need to test non-pharmacological approaches that can address pain holistically from both behavioral and physiological aspects. This investigation examines the effect of a behavioral intervention on pain scale scores and oxygen saturation during the intravenous (IV) insertion procedure in preschoolers. The results of this study are expected to serve as a basis for the application of non-pharmacological interventions in pediatric nursing services, particularly to minimize the risk of trauma, improve children's comfort, and support the practice of Evidence-Based Nursing (EBN).

METHOD

This study used a quasi-experimental design with a post-test-only control group. The study population was preschool-aged children (3–6 years old) who underwent infusion installation at RSI Jemursari Surabaya on July 20–August 04, 2025. Sampling was conducted using purposive sampling, with 80 respondents divided into two groups: 40 children in the intervention group and 40 in the control group. Inclusion criteria include preschoolers who had undergone their first IV placement, were cooperative, were accompanied by their parents, and had no history of neurological, respiratory, or developmental

disorders. Exclusion criteria included children in emergency conditions or those who refused intervention. The intervention group received behavioral intervention during the IV insertion. The control group underwent a standard procedure without additional intervention. The research instruments were the FLACC (Face, Legs, Activity, Cry, Consolability) Scale to measure pain and a pulse oximeter to measure oxygen saturation. The assessment was carried out as soon as the IV procedure was completed. Data analysis used the Mann–Whitney U Test with $\alpha = 0.05$ because the data were abnormally distributed.

RESULT

Table 1 Characteristics of Preschool Child Respondents

Characteristics Respondents	K1 (Intervention)		K2 (Control)		Total		Equivalence Test P
	f	%	f	%	f	%	
Age							
3 years	18	45	13	32.5	31	38.7	0.688
4 years	5	12.5	6	15	11	13.7	
5 years	7	17.5	10	25	17	21.3	
6 years	10	25	11	27.5	21	26.3	
Gender							
Women	20	50	19	47.5	39	51.2	0.825
Male	20	50	21	52.5	41	48.8	
Total	40	100	40	100	80	100	

Table 1 shows that the characteristics of respondents by age and gender between the intervention and control groups had a balanced distribution. The majority of respondents were 3 years old and female. The results of the equivalence test showed p-values at age ($p = 0.688$) and sex ($p = 0.825$), which means there was no significant difference between the two groups.

Table 2 Characteristics of Respondents of Parents of Preschool Children

Respondent Characteristics	K1 (Intervention)		K2 (Control)		Total		Equivalence Test P
	f	%	f	%	f	%	
Age							
Early adulthood (20-39 years old)	34	92.5	38	95.0	75	93.7	0.671
Mature (40-64 years old)	3	7.5	2	5.0	5	6.3	
Education							
Elementary (Elementary- Junior High)	6	15.0	4	10.0	10	12.5	0.627
Secondary (SMA/SMK)	21	52.5	19	47.5	40	50.0	
High (Diploma-S3)	13	32.5	17	42.5	30	37.8	
Total	40	100	40	100	80	100	

Table 2 shows that most of the respondents are in the early adult age category and have secondary education. The results of the balance test on the variables age ($p = 0.671$) and education ($p = 0.627$)

showed that there was no significant difference between the intervention and control groups, so the two groups could be considered equal.

Table 3. Distribution of pain scales in both groups

Pain scale	Intervention Groups		Control group	
	(f)	(%)	(f)	(%)
(0-3) Light	24	60	-	-
(4-6) moderate	16	40	12	30
(7-10) Weight	-	-	28	70
Total	40	100	40	100

The table shows the distribution of pain scales in both groups. In the intervention group, most of the respondents were in the category of mild pain (60%), while in the control group the majority of respondents experienced severe pain (70%). This shows that there is a difference in pain levels between the intervention and control groups.

Table 4. Average oxygen saturation

Groups	Red	Median	Mode	SD	Min	Max
Intervention	98.00	98.00	98.00	0.751	96.00	98.00
Controls	94.12	94.00	95.00	0.822	92.00	95.00

Table 4 shows that the average oxygen saturation in the intervention group was higher (Mean = 98%) than in the control group (Mean = 94.12%). The median and mode values also consistently showed that oxygen saturation was more stable in the intervention group. This indicates that the intervention provided has an effect on increasing the oxygen saturation of the respondents.

Table 5. The results of the Mann-Whitney test

Groups	Oxygen Saturation			
	F	Mean Rank	Z-value	Effect size r
Intervention	40	20.65	-7.710	0.93
Controls	40	60.35		
Mann Whitney Test Results				$p = 0.001$

Table 5 shows the results of the Mann-Whitney test which shows a significant difference in oxygen saturation between the intervention and control groups ($p = 0.001$). The mean rank value in the control group was higher than in the intervention group, with a value of $Z = -7.710$ and an effect size of 0.93, indicating that the intervention had a strong effect on oxygen saturation.

Table 6. The results of the follow-up statistical test

Groups	Oxygen Saturation			
	F	Mean Rank	z-value	Effect size r
Intervention	40	60.50	-7.856	0.87
Controls	40	20.50		
Mann Whitney Test Results				$p = 0.001$

Table 6 shows the results of the follow-up statistical test which again reinforces the significant difference between the two groups ($p = 0.001$). Z values = -7.856 and effect size of 0.87 showed that the intervention had a large effect in improving oxygen saturation compared to the control group.

DISCUSSION

This investigation showed a significant difference between the intervention and control groups on the pain scale in preschool children who underwent an IV insertion procedure (Table 5). These findings suggest that behavioral intervention is effective in reducing pain intensity and maintaining the child's physiological function during invasive procedures. The pain scale in the intervention group had a lower average score than in the control group (Table 3). It aligns with the concept that preschoolers are at a stage of cognitive and emotional development that makes them more responsive to external stimuli, including distractions and emotional support (Sayed et al., 2020). Verbal distractions, breathing exercises, and positive reinforcement have been proven to reduce children's focus on the source of pain, thereby reducing pain perception. Tran Thi (2022) state that behavioral interventions can inhibit pain stimuli through cognitive control mechanisms, thereby reducing pain perception. In addition, this investigation aligns with the study by Salomons et al. (2024) which showed that behavioral approaches were effective in reducing pain responses through cognitive and operant mechanisms that promote adaptive coping patterns. Modeling coping and emotional drive contributes to the formation of positive experiences with medical procedures. Thus, this paper reinforces previous research's findings that non-pharmacological management is a safe, effective, and widely applicable strategy in pediatric clinical practice.

In addition, this study found a significant difference in oxygen saturation between the intervention and control groups among preschool children who underwent an IV insertion procedure (Table 6). The intervention group had an average oxygen saturation of 98%, higher than the control group's 94.12% (Table 4). Decreased oxygen saturation in the control group may occur as a physiological response to anxiety, excessive crying, and tension during invasive procedures (Crumm et al., 2020). This mechanism involves activation of the sympathetic nervous system by pain stimuli, which affects breathing patterns and the body's oxygen balance. It is in line with the research of Camacho-Cruz et al. (2023), who found that invasive procedures in neonates could lead to decreased oxygen saturation and other physiological changes due to stress and pain response. Behavioral interventions help maintain physiological stability by promoting relaxation and emotional support, thereby reducing anxiety and attenuating the hyperresponse of the neuroendocrine system. Parental presence during the procedure also plays an important role in increasing the child's sense of security and strengthening the child's coping response, as Bindler et al. (2020) affirm that family presence supports stable emotional regulation during medical procedures. It suggests that a combination of behavioral techniques and emotional support has a synergistic effect in reducing excessive physiological responses, including decreases in oxygen saturation. Overall, the

findings of this study contribute to pediatric nursing practice by demonstrating that behavioral intervention is a non-pharmacological approach that is easy to implement, does not require specialized equipment, and can improve children's comfort during treatment. In addition to being physiologically and psychologically effective, these interventions also encourage the adoption of family-centered care and evidence-based practice, which are important components of modern nursing services.

CONCLUSION

Behavioral intervention is effective in reducing pain and preventing oxygen desaturation during invasive procedures in preschool children. It can be recommended as one of the non-pharmacological strategies in pediatric nursing practice to improve comfort, reduce stress response, and minimize the physiological impact of invasive procedures.

REFERENCES

- Azak, M., Aksucu, G., & Çağlar, S. (2022). The effect of parental presence on pain levels of children during invasive procedures: A systematic review. *Pain Management Nursing*, 23(5), 682–688. <https://doi.org/10.1016/j.pmn.2022.03.011>
- Bindler, R. C., Ball, J. W., & Cowen, K. J. (2020). *Child health nursing: Partnering with children and families* (3rd ed.). Pearson.
- Camacho-Cruz, J., Palacios-Ariza, M. A., Orrego-Celestino, L., Valbuena-Velandia, N., Paez-Castellanos, L., Bolaños, J. M., & Pradilla, I. (2023). Effectiveness of non-immersive virtual reality in the management of procedure-related pain in preschool children: A randomized clinical trial. *European Journal of Pediatrics*, 182(9), 4103–4112. <https://doi.org/10.1007/s00431-023-05070-5>
- Crumm, C. E., Camp, E. A., Khalil, M., & Chumpitazi, C. E. (2020). Improving the pediatric procedural experience: An analysis of pain, anxiety, and satisfaction. *Global Pediatric Health*, 6, 1–8. <https://doi.org/10.1177/2333794X19836471>
- Friedrichsdorf, S. J., Postier, A., Eull, D., Weidner, C., Foster, L., Gilbert, M., & Campbell, F. (2015). Pain outcomes in a US children's hospital: A prospective cross-sectional survey. *Hospital Pediatrics*, 5(1), 18–26. <https://doi.org/10.1542/hpeds.2014-0084>
- Postier, A. C., Eull, D., Schulz, C. A., Fitzgerald, M., Symalla, B., Watson, D., Goertzen, L., & Friedrichsdorf, S. J. (2018). Pain experience in a US children's hospital: A point prevalence survey undertaken after the implementation of a system-wide protocol to eliminate or decrease pain caused by needles. *Hospital Pediatrics*, 8(9), 515–523. <https://doi.org/10.1542/hpeds.2018-0039>
- Salomons, T. V., Noto, C., & Lavoie, M. E. (2024). Behavioral pain management in pediatric procedures: Mechanisms and applications. *PAIN Reports*, 9(1), 211–220.
- Sayed, Y. M., Mohamed, S. A.-R., & Abolwafa, N. F. (2020). Assessment of pain intensity among preschool-age children during venipuncture. *Minia Scientific Nursing Journal*, 8(1), 56–64. <https://doi.org/10.21608/msnj.2020.188041>
- Taddio, A., Appleton, M., Bortolussi, R., Chambers, C., Dubey, V., Halperin, S., Hanrahan, A., Ipp, M., Lockett, D., MacDonald, N., Midmer, D., Mousmanis, P., Palda, V., Pielak, K., Pillai Riddell, R.,

- Rieder, M., Scott, J., & Shah, V. (2010). Reducing the pain of childhood vaccination: An evidence-based clinical practice guideline. *Canadian Medical Association Journal*, 182(18), E843–E855. <https://doi.org/10.1503/cmaj.101720>
- Tran Thi, T. H., Medves, J., O'Brien, B., & Taljaard, M. (2022). Effects of distraction on reducing pain during invasive procedures in children with cancer: A systematic review and meta-analysis. *Pain Management Nursing*, 23(3), 281–292. <https://doi.org/10.1016/j.pmn.2021.12.002>
- Walco, G. A., Dworkin, R. H., Krane, E. J., LeBel, A. A., & Weisman, S. J. (2017). Clinical trial designs for pediatric chronic pain: IMMPACT recommendations. *Pain*, 158(5), 846–856. <https://doi.org/10.1097/j.pain.0000000000000831>



Mother's Commitment to Limiting Screen Time among Preschool-Aged Children and Its Influencing Factors

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ABSTRACT

Excessive use of gadgets harms children's health and development. Mothers' commitment to limiting screen time is key to preventing children from the negative impacts of gadget use. This study identifies factors associated with mothers' commitment to limiting screen time in preschool-aged children. It used a correlational design with a cross-sectional approach. The sample consisted of 60 mothers of preschool children, using a total sampling technique. The research instrument was a questionnaire. Data were analyzed using the Chi-Square statistical test, with a significance of $\alpha < 0.05$. The results showed that almost all mothers (85%) had moderate commitment to limiting screen time. Mothers' education, occupation, and motivation to limit children's gadget use, as well as the environment where children lived, correlated with mothers' commitment to limiting their preschool-aged children's screen time (p-values in sequence were 0.009, 0.001, 0.031, and 0.001). Meanwhile, mothers' age, number of children, and husbands' support in limiting preschool-aged children's screen time were not correlated with mothers' commitment to limiting their preschool-aged children's screen time (p-values in sequence were 0.339, 0.414, and 0.813). In conclusion, factors associated with mothers' commitment to limiting screen time in preschool-aged children include maternal education, occupation, and motivation, as well as the children's living environment. These findings highlight the importance of strengthening maternal capacity through targeted parental education and promoting supportive home and community environments to enhance effective screen time management in preschool children.

INTRODUCTION

Gadgets are one of the technological advancements that influence the human mind. They are a medium used for communication in the modern era (Itsna & Rofi'ah, 2021). Gadget use has become commonplace, even among preschool-aged children (ages 3-6). Excessive exposure to gadgets, known as excessive screen time, at this age has raised concerns among health and education experts. Its negative impacts include disruptions to children's language, emotional, cognitive, social, and motor development (Eva & Aulia, 2024). Using gadgets for too long can make children more likely to be lazy and less likely to engage in other physical activities (Rachmania & Ludyanti, 2022). Children who are too engrossed in their gadgets often forget to interact with those around them, including their families. Parents, especially mothers, play a crucial role in limiting children's screen time. Parents often allow their children to continue using gadgets, claiming it keeps them quiet at home or prevents fussing. Mothers need to be committed to limiting their children's screen time to avoid the negative impacts of gadget use on their development.

A 2020 survey by the Indonesian Child Protection Commission found that approximately 71.3% of school-age children owned gadgets and/or used them for extended periods each day. Furthermore, 55% of them spent time playing games, both online and offline. Thus, most of them spent their free time using gadgets (Musyaffa et al., 2025). A preliminary study conducted in Babadan Village found that 7 out of 10 mothers lacked the commitment to place limits on their children when playing with gadgets. They were less able to commit because of household work; some also worked in the fields, and some sold at home, so they let their children play with gadgets for longer than the allotted time. Meanwhile, three other mothers committed to complying with the rules on the use of gadgets for their children.

In 2016, the American Academy of Pediatrics (AAP) recommended a new policy on media use for children, limiting screen time for children aged 2-5 years to 1 hour per day (Simanjutak, 2023). Limited screen time for children over 2 years of age is established to prevent inactivity caused by screen time. The obstacles parents face in limiting screen time include parents' busy schedules and environmental influences from friends who also use gadgets, so that, in the end, children become addicted due to a lack of attention and supervision (Sari et al., n.d.). The inability of parents, especially mothers, to supervise their children while they are playing with gadgets can expose them to negative content, such as violence or pornography. When children become addicted to gadgets, they will spend most of their time playing with them (Aprilia and Thaib, 2024). Furthermore, excessive screen time can harm early childhood development, disrupting or hindering children's cognitive function and academic achievement (Eva and Aulia, 2024).

Parents, especially mothers, play a crucial role in limiting their children's screen time. Mothers need to be good role models by reducing their own device use in front of their children. Diverting children's attention away from devices is crucial, and this can be achieved by providing a variety of physical and interactive activities, such as playing outside, reading books, or playing educational games. Establish and enforce clear rules regarding the duration and timing of device use, and create device-free areas at home, such as during mealtimes. Maternal commitment to limiting her child's screen time is crucial and has profound implications for her child's development. A mother's consistent commitment creates a stable and predictable environment for her child. It is highly effective in preventing gadget addiction in young children (Astria, Rahmawati, and Firnanda, 2024). By setting clear time limits and sticking to them, children learn discipline and self-regulation. This study identifies factors associated with mothers' commitment to limiting screen time in preschool-aged children.

METHOD

This study used a correlational design with a cross-sectional approach. It was conducted in Babadan Village, Kediri Regency, in October 2025. The sample consisted of 60 mothers of preschool children,

using a total sampling technique. The inclusion criteria were mothers with preschool-aged children, mothers with mobile phones with active mobile data, and mothers willing to participate in the study. The exclusion criteria in this study were mothers who did not complete the questionnaire completely. The variable studied was the mother's commitment to limiting screen time in preschool-aged children. The instrument used was a questionnaire. A 20-question questionnaire was used to collect data on mothers' commitment to limiting screen time and was tested for validity and reliability (Cronbach's Alpha = 0.952). The commitment parameters measured in the questionnaire included fulfilling promises and responsibilities, discipline, and consistent behavior. Data were analyzed using univariate and bivariate analysis. The univariate test was a descriptive statistic that details the characteristics of respondents. A bivariate analysis used the Chi-Square test to identify factors related to maternal commitment in limiting screen time among preschool-aged children, with a significant p -value < 0.05 .

RESULT

All of the respondents in this investigation were married (100%). Almost half of the respondents were 26-30 years old (35%). Most of them had graduated from Senior High School (70%), and were housewives (85%). Half of the respondents had 1 child (50%). In addition, all of the respondents had the motivation to limit the children's gadget use (100%), most of the respondents received support from their husbands and families to limit children playing with gadgets (70%), and almost all respondents lived in an environment where many children played with gadgets (95%) (Table 1).

Table 1. Respondent characteristics

Characteristics	Frequency	Percentage (%)
Age		
20-25 years old	15	25,0
26-30 years old	21	35,0
31-35 years old	12	20,0
36-40 years old	12	20,0
Education		
SD (elementary school)	0	0
SMP (Middle school)	18	30,0
SMA (High school)	42	70,0
Sarjana (Bachelor's degree)	0	0
Work		
Housewives	51	85,0
Self-employed	9	15,0
Farmers	0	0
Civil servants	0	0
Livestock breeders	0	0
Others	0	0
Number of children		
1	30	50,0
2	24	40,0
3	6	10,0
>3	0	0
Mothers have the will (motivation) to limit their children's use of gadgets.		

Ever	60	100,0
Never	0	0
Support from husband in limiting children's use of gadgets		
Received husband's support	42	70,0
Did not receive husband's support	18	30,0
The environment where children live (many children play with gadgets)		
Many children play with gadgets	57	95,0
No children play with gadgets	3	5,0
Total	60	100,0

Furthermore, almost all respondents (85%) had moderate commitment to limiting screen time among preschool-aged children. In contrast, a small portion of respondents had low (15%) (Table 2).

Table 2. Identification of mothers' commitment to limiting screen time for pre-school children.

Commitment Criteria	Frequency	Percentage (%)
High	0	0
Moderate	51	85
Low	9	15
Total	60	100

Mothers' education, occupation, and motivation to limit children's gadget use, as well as the environment where children lived, correlated with mothers' commitment to limiting their preschool-aged children's screen time (p -values in sequence were 0.009, 0.001, 0.031, and 0.001). Meanwhile, mothers' age, number of children, and husbands' support in limiting preschool-aged children's screen time were not correlated with mothers' commitment to limiting their preschool-aged children's screen time (p -values in sequence were 0.339, 0.414, and 0.813) (Table 3).

Table 3. Crosstabulation of factors related to mother's commitment in limiting screen time in preschool-aged children and Chi Square test analysis with a significant p -value < 0.05.

Factors related to commitment	Mother's commitment in limiting screen time in preschool-aged children		p-value	Corellation
	Moderate	Low		
Age				
20-25 years	12 (20%)	3 (5%)	0,339	Not related
26-30 years	18 (30%)	3 (5%)		
31-35 years	9 (15%)	3 (5%)		
36-40 years	12 (20%)	0 (0%)		
Education				
SD (elementary school)	0 (0%)	0 (0%)	0,009	Related
SMP (Middle school)	39 (65%)	3 (5%)		
SMA (High school)	12 (20%)	6 (10%)		
Sarjana (Bachelor's degree)	0 (0%)	0 (0%)		
Work				
Housewives	51 (85%)	0	0,001	Related
Self-employed	0	9 (15%)		
Farmers	0	0		
Civil servants	0	0		
Livestock breeders	0	0		
Others	0	0		
Number of children				
1	24 (40%)	6 (10%)	0,414	Not related
2	21 (35%)	3 (5%)		
3	6 (10%)	0		

>3	0	0		
Mothers have the will (motivation) to limit their children's gadget use.				
Ever	36 (60%)	6 (10%)	0,031	Related
Never	15 (25%)	3 (5%)		
Husband's support in limiting children's gadget use				
Receiving husband's support	36 (60%)	3 (5%)		
Not receiving husband's support	15 (25%)	6 (10%)	0,813	Not related
Children's living environment (many children play with gadgets)				
Many children play with gadgets	51 (85%)	6 (10%)	0,001	Related
No children play with gadgets	0	3 (5%)		

DISCUSSION

The statistical test results for the mothers' profession ($p=0.001$) and education ($p=0.009$) showed $p<0.05$, indicating a highly significant correlation between the mothers' profession and education and their commitment to limiting screen time among preschool-aged children (Table 3). Most respondents had graduated from Senior High School and were housewives (Table 1). Housewives essentially have plenty of time to supervise and limit their children's screen time. In addition, mothers with a high school education generally have basic knowledge about parenting methods and the impact of gadget use on children. Both ultimately result in a fairly good maternal commitment to limiting screen time. Working mothers, especially full-time working mothers, face limitations in their ability to accompany their children. They tend to be more fatigued than stay-at-home mothers or mothers who do not work because they juggle multiple roles. Individuals who juggle multiple roles are at risk of role conflict and fatigue, which can compromise the consistency of their parenting. It aligns with research by Nurhafizah et al. (2023), which also found that time constraints and fatigue among working parents often led to the use of digital media as a substitute caregiver, resulting in poor control over children's screen time (Nurhafizah, Hidayati, and Syam, 2023). Direct parental involvement significantly affects children's behavioral control, indicating maternal commitment to limiting screen time. Non-working mothers have more flexible time and tend to have greater opportunities to supervise their children's activities, establish rules about device use, and provide alternative activities such as playing, reading, or physical activity.

The statistical analysis also showed a p -value of 0.031 ($p<0.05$), indicating a significant relationship between maternal motivation and commitment to limiting screen time in preschool-aged children (Table 3). Thus, mothers with high motivation are more committed to managing and limiting screen time in preschool-aged children. Motivation is an internal or external drive that influences a person to perform a behavior consistently. According to the Health Belief Model, a person's motivation is influenced by their perceptions of the benefits and risks of a behavior (Salari and Filus, 2017). Mothers who strongly perceive the negative impacts of excessive screen time, such as impaired concentration, delayed language development, and sleep disturbances, are more motivated to limit screen use in preschool-aged children.

This study aligns with research by Lammers et al. (2022), which found that parental motivation was associated with screen time management behavior in early childhood (Lammers *et al.*, 2022). Parents with high motivation tend to be more consistent in enforcing digital media use rules. The Authors believe that maternal motivation plays a crucial role in determining the extent to which mothers can enforce screen time restrictions for preschool-aged children. Mothers with a strong motivation are expected to be more consistent and firm in dealing with their children's resistance, which often leads to fussy behavior.

Moreover, the statistical test results showed a p -value of 0.001 ($p < 0.05$), indicating a highly significant relationship between the child's environment and mothers' commitment to limiting screen time in preschool-aged children (Table 3). Almost all respondents in this investigation lived in environments where many children played with gadgets (Table 1). It presented a significant challenge for mothers in committing to implementing appropriate screen time. This condition affected mothers' commitment, leaving it in the moderate category (Table 2). A child's environment includes the family, social, and physical surroundings, such as the presence of television, gadgets, and digital media usage habits at home and in the surrounding area. A conducive environment will make it easier for mothers to consistently implement screen time restrictions (Theopilus *et al.*, 2024). It aligns with research by Khan & Rahman (2024), which also found that the social environment and family's digital media habits influenced parents' ability to control their children's screen time. A permissive environment regarding device use tends to weaken parents' consistency in setting rules. It can be a challenge for mothers to maintain their commitment to limiting screen time (Khan and Rahman, 2024). Providing an environment that supports physical activity and social interaction, and limits screen use, in early childhood is crucial to preventing excessive screen time. Children in environments with high levels of screen use, both from family members and peers, tend to have a greater desire to use screens. An environment that provides creative activities, play spaces, and family support will make it easier for mothers to implement these recommendations. In a supportive environment, mothers' commitment to limiting screen time in preschool-aged children can be more easily implemented and sustained.

In addition, the statistical test results showed a p -value of 0.339 ($p > 0.05$), indicating no significant relationship between maternal age and maternal commitment to limiting screen time in preschool-aged children. This result suggests that differences in maternal age, whether younger or older, do not directly influence the level of maternal commitment to regulating and limiting screen time in preschool-aged children. Research conducted by Yilmaz & Kucuk (2024) also indicated no significant relationship between maternal age and behaviors limiting screen time in preschool-aged children (Çalhan and Göksu, 2024). The study emphasized that access to information and parenting education played a more important role than age. Age is often associated with emotional maturity, life experience, and decision-making ability. However, in digital parenting, maternal age is not always the primary determinant of parenting

behaviors, including limiting screen time. Mothers will demonstrate a strong commitment to limiting screen time if supported by adequate knowledge, strong motivation, and a supportive family environment. Furthermore, the statistical test results showed a p -value of 0.414 ($p > 0.05$), indicating no significant relationship between the number of children in the family and mothers' commitment to limiting screen time for preschool-aged children. This result indicates that the number of children a mother has does not directly influence her level of commitment to managing and limiting screen time for preschool-aged children. The lack of a relationship between the number of children and mothers' commitment indicates that mothers' commitment to digital parenting is more influenced by the quality of their care than the number of children they have. If families have clear rules regarding device use and strong values about healthy parenting, the number of children will not be a major obstacle to implementing screen time restrictions.

The statistical test results in this paper also showed a p -value of 0.813 ($p > 0.05$), indicating no significant relationship between husband's support and mothers' commitment to limiting screen time for preschool-aged children. Theoretically, husband's support is a form of social support that can strengthen mothers' role in childcare (Ding *et al.*, 2024). This support can be emotional, informational, or instrumental. However, in this study, the husband's support was not always the primary determining factor in limiting screen time. If the mother has a strong commitment, motivation, and understanding of the impact of screen time, the decision to limit screen use is more determined by internal factors than external support from the husband. Husband's support is important in parenting in general, when it comes to limiting screen time, individual factors within the mother and the family environment play a more dominant role. Therefore, digital parenting interventions should focus on increasing maternal capacity through education and strengthening the parenting role, without relying too heavily on spousal support.

CONCLUSION

Factors associated with mothers' commitment to limiting screen time in preschool-aged children include maternal education, occupation, and motivation, as well as the children's living environment. Mothers with secondary education and those who were full-time homemakers tend to exhibit sufficient commitment to limiting screen time, driven by basic parenting knowledge and greater availability of time, although challenges with consistency persisted. Additionally, a residential environment with high peer gadget use posed a substantial barrier to optimal control of screen time. These findings highlight the importance of strengthening maternal capacity through targeted parental education and promoting supportive home and community environments to enhance effective screen time management in preschool children.

REFERENCES

- Aprilia, E.F. and Thaib, G. (2024) ‘Dampak Screen Time Berlebih Terhadap Perkembangan Bahasa Anak Usia Dini’, *Jurnal Ilmiah Cahaya Paud: Jurnal Pendidikan Guru Pendidikan Anak Usia Dini*, 6(1).
- Astria, N., Rahmawati, D. and Firnanda, U. (2024) ‘Pola Asuh Orang Tua dan Screen Time terhadap Perkembangan Bahasa Anak Prasekolah’, *Jurnal Kesehatan Saintika Meditory*, 7(2). Available at: <https://doi.org/http://dx.doi.org/10.30633/jsm.v7i2.2825>.
- Çalhan, C. and Göksu, İ. (2024) ‘An effort to understand parents’ media mediation roles and early childhood children’s digital game addiction tendency: A descriptive correlational survey study’, *Education and Information Technologies*, 29(14), pp. 17825–17865. Available at: <https://doi.org/10.1007/s10639-024-12544-y>.
- Ding, X. *et al.* (2024) ‘The impact of family factors and communication on recreational sedentary screen time among primary school-aged children: a cross-sectional study’, *BMC Public Health*, 24(1), p. 1733. Available at: <https://doi.org/10.1186/s12889-024-19128-y>.
- Eva, M. and Aulia, M. (2024) ‘Pengaruh Screen Time terhadap Perkembangan Anak Usia Dini’, *Al-Muhadzab: Jurnal Pendidikan Islam Anak Usia Dini*, 01(01), pp. 18–31. Available at: <https://jurnal.staidaf.ac.id/index.php/almuhadzab/article/view/273%0Ahttps://jurnal.staidaf.ac.id/index.php/almuhadzab/article/download/273/98>.
- Itsna, N.M. and Rofi’ah, R. (2021) ‘Dampak Penggunaan Gadget Pada Interaksi Sosial’, *Ummul Qura : Jurnal Institut Pesantren Sunan Drajat (INSUD) Lamongan*, 16(01), pp. 60–70.
- Khan, A. and Rahman, M. (2024) ‘Impact of Excessive Screen Time on Children’s Behavior and Development’, *Journal of Positive School Psychology*, 8(2).
- Lammers, S.M. *et al.* (2022) ‘Explaining Adherence to American Academy of Pediatrics Screen Time Recommendations With Caregiver Awareness and Parental Motivation Factors: Mixed Methods Study’, *JMIR Pediatrics and Parenting*, 5(2), p. e29102. Available at: <https://doi.org/10.2196/29102>.
- Musyaffa, N.A., Hendrawati, S. and Maulana, I. (2025) ‘Faktor Penggunaan Screen Time Anak Usia Prasekolah di Wilayah Urban dan Rural: A Systematic Review’, 8(1).
- Nurhafizah, N., Hidayati, W.R. and Syam, H. (2023) ‘Analisis Parenting Stress Orang Tua Bekerja yang Memiliki Anak Usia Dini di Kecamatan Lima Kaum’, *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, 7(3), pp. 3077–3083. Available at: <https://doi.org/10.31004/obsesi.v7i3.4537>.
- Rachmania, D. and Ludyanti, L.N. (2022) ‘Screen Time and Physical Activity in Under-Five Children’, *Pedimaternat Nursing Journal*, 8(1), pp. 1–8. Available at: <https://doi.org/10.20473/pmnj.v8i1.30024>.
- Salari, R. and Filus, A. (2017) ‘Using the Health Belief Model to Explain Mothers’ and Fathers’ Intention to Participate in Universal Parenting Programs’, *Prevention Science*, 18(1), pp. 83–94. Available at: <https://doi.org/10.1007/s11121-016-0696-6>.
- Sari, W. *et al.* (2024) ‘Gerakan BTS Sebagai Upaya Cegah Ketergantungan Screentime pada Anak Usia Prasekolah di RA ANNIDA UTTALAMIDZ Kota Tangerang’, *Jurnal Bisnis Mahasiswa*, 4(4), pp. 652–658. Available at: <https://doi.org/10.60036/jbm.v4i4.art16>.
- Simanjutak, S.R. (2023) ‘Literatur Review : Pengaruh Screen Time Terhadap Masalah Perilaku Anak’, *Jurnal Keperawatan*, 11(1), pp. 64–80.
- Theopilus, Y. *et al.* (2024) ‘Digital Interventions for Combating Internet Addiction in Young Children:

Qualitative Study of Parent and Therapist Perspectives’, *JMIR Pediatrics and Parenting*, 7(1), p. e55364. Available at: <https://doi.org/10.2196/55364>.



Relationship Between Age of Menarche and Regularity of Menstrual Cycle in Female Students At Mts Hasyim Asy'ari Lamongan

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ABSTRACT

Menarche marks the onset of reproductive hormonal maturation in adolescent girls. It plays an important role in regulating the menstrual cycle. This study analyzes the relationship between age at menarche and menstrual cycle regularity in female students. This study was conducted at MTs Hasyim Asy'ari, Kembangbahu District, Lamongan. The sample consisted of 38 female students who had experienced menarche, selected using simple random sampling. Data analysis used the Chi-Square test, with $\alpha=0.05$. Most respondents (63.1%) had an ideal age at menarche (12-13 years), a small number (21%) had a younger age at menarche (less than 11 years old), and a small number (15.8%) were older (more than 13 years old). In addition, most had regular menstrual cycles (84.2%), and a small proportion had irregular cycles (15.8%). The results of the Chi-Square test showed a p-value of 0.005 ($p<0.05$), indicating a significant relationship between age at menarche and menstrual cycle regularity. Thus, age at menarche correlates with menstrual cycle regularity in adolescent girls. It indicates that the ideal age of menarche tends to have a positive effect on the menstrual cycle regularity.

INTRODUCTION

Menarche is the first menstrual period that all women naturally experience and marks the beginning of puberty (Prastiwi, 2024). It is a significant event in a woman's life, marking the beginning of the menstrual cycle and reproductive capacity. It generally occurs between the ages of 10 and 16, during early adolescence, before entering the reproductive years. The age of menarche can vary between individuals, and several studies have shown that it can affect menstrual cycle regularity. The age of menarche among adolescent girls in Indonesia decreased from 13 years in 2010 to 12.4 years in 2018 (Hartati, Farapti, and Isaura, 2022).

The menstrual cycle describes the interval between the first day of menstruation and the first day of the next. A menstrual cycle is considered normal if it lasts no less than 21 days and no more than 35 days. According to research conducted by several experts, a younger or older age at menarche than average can increase the risk of menstrual cycle disorders (Prastiwi, 2024). Irregular menstrual cycles can indicate hormonal disorders or other health problems, so it is important to understand the relationship between menarche and menstrual cycle regularity (Utami, 2022). Adolescent girls' knowledge and attitudes about menarche can influence their readiness to face their first menstruation (Prastiwi, 2024). Appropriate reproductive health education can help adolescent girls prepare for Menarche (Utami, 2022).

Age at menarche can affect the menstrual cycle. Hartati's study (2022) showed that women who experienced menarche at a younger or older age than average might have a higher risk of experiencing

menstrual cycle disorders. In addition, Utami's study (2022) indicated that women who experience menarche at a younger age might have shorter menstrual cycles. Meanwhile, an investigation by Prastiwi (2024) found that women who experienced menarche at an average normal age would have more regular menstrual cycles. Furthermore, menstrual cycle intensity can be influenced by age at menarche. Indra's literature review (2025) showed that women who experienced menarche at an older age potentially had heavier menstrual cycles.

Therefore, understanding the relationship between menarche and menstrual cycle regularity can help improve women's reproductive health. This study analyzes the relationship between age at menarche and menstrual cycle regularity in female students. The Authors also discuss the factors that may influence this relationship and the implications of this research to improve women's reproductive health.

METHOD

The research design used a cross-sectional approach. This study was conducted at MTs Hasyim Asy'ari, Kembangbahu District, Lamongan. The population was all ninth-grade female students at MTs Hasyim Asy'ari, Kembangbahu District, Lamongan. The sample consisted of 38 female students who had experienced menarche, selected using simple random sampling. The independent variable was age at menarche, and the dependent variable was menstrual cycle regularity. Data on menarche and menstrual cycles were collected through questionnaires and interviews. Crosstabulation was then performed to determine the relationship between the independent and dependent variables. Data analysis using the Chi-Square test revealed the *p*-value used to determine the significance of the relationship between variables, with $\alpha=0.05$ (Nursalam, 2016, 2017).

RESULT

Table 1 shows that most respondents are 15 years old (60.5%) and a small number are 13 years old (5.3%). In addition, 26.3% of respondents are 14 years old, and 7.9% are 16 years old.

Table 1. Respondent characteristics by age group

Respondent's age	Frequency	Percentage (%)
13 years old	2	5,3
14 years old	10	26,3
15 years old	23	60,5
16 years old	3	7,9
Total	38	100

Most respondents (63.1%) had an ideal age at menarche (12-13 years), a small number (21%) had a younger age at menarche (less than 11 years old), and a small number (15.8%) were older (more than 13 years old). In addition, most had regular menstrual cycles (32 people, 84.2%), and a small proportion had irregular cycles (6 people, 15.8%) (Table 2).

Table 2. Respondent characteristics based on age at menarche

Characteristics	Frequency	Percentage (%)
Age at Menarche		
Younger (< 11 years old)	8	21,1
Ideal (12-13 years old)	24	63,1
Older (> 13 years old)	6	15,8
Menstrual Cycle Regularity		
Regular	32	84.2
Irregular	6	15.8
Total	38	100

Respondents with an ideal age at menarche (12-13 years) had regular menstrual cycles, with 21 respondents (55.2%). A small number of respondents with an older age of menarche (more than 13 years) had irregular menstrual cycles, with 1 respondent (2.6%). Furthermore, the results of the Chi-Square test showed a p -value of 0.005 ($p < 0.05$). Therefore, it can be concluded that H_0 is rejected, indicating a significant relationship between age at menarche and menstrual cycle regularity. Thus, age at menarche was correlated with menstrual cycle regularity (Table 3).

Table 3. Crosstabulation of age at menarche with menstrual cycle regularity and statistical analysis

Age at Menarche	Menstrual cycle regularity				Total		Chi-Square test
	Regular		Irregular				
	f	%	f	%	f	%	
Younger (< 11 years old)	6	15.8	2	5.3	8	21.1	<i>p</i> =0.005
Ideal (12-13 years old)	21	55.2	3	7.9	24	63.1	
Older (> 13 years old)	5	13.2	1	2.6	6	15.8	
Total	32	84.2	6	15.8	38	100	

DISCUSSION

Of 38 respondents, 24 had an ideal age of menarche of 12-13 years old (Table 2). The ideal age of menarche can vary depending on factors such as genetics, environment, and lifestyle. A prior study found significant relationships between macronutrient intake, physical activity, and nutritional status to age at menarche in adolescent girls aged 9-15 years. Age of Menarche can influence the menstrual cycle in adolescent girls, as hormonal changes at menarche can affect its regularity (Hartati, Farapti, and Isaura, 2022). However, in general, the age of menarche considered normal is between 11 and 15 years old. Given the varied age of menarche, adolescent girls must have sufficient knowledge and preparation for it. In addition, most respondents (84.2%) had regular menstrual cycles (Table 2). A regular menstrual cycle is crucial for women's reproductive health. A regular menstrual cycle indicates good hormonal balance in the body (Patricio and Sergio, 2019). A regular menstrual cycle can help women understand when they are most fertile, allowing them to plan their pregnancies better (Fehring, 2002). Irregular menstrual cycles can increase health risks, such as polycystic ovary syndrome (PCOS), endometriosis, and endometrial cancer. PCOS is a hormonal condition that can cause irregular menstrual cycles and increase the risk of infertility (Stener-Victorin *et al.*, 2024). A regular menstrual cycle is defined as a menstrual period with a

relatively stable interval between cycles, with variation of only about 3 days, within the individual's average cycle for at least 3 consecutive cycles. Irregular menstrual cycles often occur in adolescents due to the immaturity of the hormonal system. During the early years after menarche (first menstruation), the hypothalamic-pituitary-ovarian (HPO) axis is not yet fully functional, so many adolescents experience irregular menstrual cycles, including the possibility of anovulation (when the ovaries do not release an egg). Most adolescents have menstrual cycles within the normal range, which is between 21 and 45 days. However, some adolescents may experience shorter cycles (less than 20 days) or longer (more than 45 days). This irregularity usually improves over time as the hormonal system matures. Menstrual cycles can vary greatly from person to person, and factors such as stress, weight changes, or certain medical conditions can also affect their regularity. Individuals with irregular menstrual cycles should consult a doctor or healthcare professional (Gultom, Fitriangga, and Ilmiawan, 2021).

Most respondents (55.2%) who experienced menarche at the ideal age (12-13 years) had regular menstrual cycles. A Chi-Square Test also showed $p=0.005$ ($p<0.05$), indicating a significant relationship between age at menarche and menstrual cycle regularity. Thus, age at menarche was correlated with menstrual cycle regularity (Table 3). This study aligns with a prior study that found a significant relationship between age at menarche and menstrual cycle length in adolescent girls. In addition, it showed that menstrual cycles in adolescent girls were often irregular, especially in the first few years after menarche. It is due to the hormonal system's immaturity (Prastiwi, 2024).

Estrogen plays a crucial role in regulating the menstrual cycle, and changes in estrogen levels can affect it. Progesterone also plays a crucial role in regulating the menstrual cycle (Indra *et al.*, 2025). Adolescent girls' knowledge and attitudes about menarche and the menstrual cycle can influence their preparedness for menarche and menstrual cycle management (Utami, 2022). The relationship between age at menarche and menstrual cycle regularity is intriguing and important to understand. The ideal age at menarche (around 12-13 years) appears to have a positive impact on menstrual cycle regularity, as this research finding demonstrates. A study found that an earlier age of menarche was associated with an increased risk of menstrual cycle disorders. The study also found that an ideal age of menarche was associated with more regular menstrual cycles (Mishra, Cooper, and Kuh, 2010). Factors such as stress, nutritional status, and physical activity can influence the relationship between menarche and menstrual cycles in adolescent girls (Indra *et al.*, 2025). Each individual has unique characteristics and experiences, so the relationship between age of menarche and menstrual cycle regularity can vary depending on hormonal, genetic, and environmental factors.

CONCLUSION

Age at menarche correlates with menstrual cycle regularity in adolescent girls. It indicates that the ideal age of menarche tends to have a positive effect on the menstrual cycle regularity.

REFERENCES

- Fehring, R.J. (2002) 'Accuracy of the peak day of cervical mucus as a biological marker of fertility', *Contraception*, 66(4), pp. 231–235. Available at: [https://doi.org/10.1016/S0010-7824\(02\)00355-4](https://doi.org/10.1016/S0010-7824(02)00355-4).
- Gultom, M.M., Fitriangga, A. and Ilmiawan, M.I. (2021) 'Hubungan Indeks Massa Tubuh dan Usia Menarche dengan Pola Siklus Menstruasi Siswi SMA di Pontianak', *Cermin Dunia Kedokteran*, 48(12), pp. 696–699. Available at: <https://doi.org/10.55175/cdk.v48i12.159>.
- Hartati, T.S.P., Farapti, F. and Isaura, emyr R. (2022) 'Hubungan Asupan Makronutrien, Aktivitas Fisik, dan Status Gizi dengan Usia Menarche Pada Remaja Perempuan Usia 9-15 Tahun di Desa Kedunglosari Kabupaten Jombang', *Media Gizi Kesmas*, 11(2), pp. 572–580. Available at: <https://doi.org/10.20473/mgk.v11i2.2022.572-580>.
- Indra, Z.Y. *et al.* (2025) 'Faktor-faktor yang memengaruhi ketidakteraturan siklus menstruasi pada remaja putri: artikel review', *Jurnal Farmasetis*, 14(3), pp. 125–132.
- Mishra, G.D., Cooper, R. and Kuh, D. (2010) 'A life course approach to reproductive health: Theory and methods', *Maturitas*, 65(2), pp. 92–97. Available at: <https://doi.org/10.1016/j.maturitas.2009.12.009>.
- Nursalam (2016) *Konsep dan Penerapan Metodologi Penelitian Ilmu Keperawatan: Pedoman Skripsi, Tesis dan Instrumen Penelitian*. Jakarta: Salemba Medika.
- Nursalam (2017) *Konsep dan Penerapan Metodologi Penelitian Ilmu Keperawatan*. Jakarta: Salemba Medika.
- Patricio, B.-P. and Sergio, B.-G. (2019) 'Normal Menstrual Cycle', *Menstrual Cycle*, pp. 1–28. Available at: <https://doi.org/10.5772/intechopen.79876>.
- Prastiwi (2024) 'The Relationship Between Knowledge Level and Attitude With Readiness To Face Menarche In Adolescent Girls In SD Plus Darul Ulum Jombang', *Prima Wiyata Health*, 5(2), pp. 52–63.
- Stener-Victorin, E. *et al.* (2024) 'Polycystic ovary syndrome', *Nature Reviews Disease Primers*, 10(1), p. 27. Available at: <https://doi.org/10.1038/s41572-024-00511-3>.
- Utami (2022) 'Pengetahuan, Sikap dan Kesiapan Siswi Sekolah Dasar Islam di Surakarta Dalam Menghadapi Menarche', *Muhammadiyah Bengkulu Nursing Journal*, 10(1), pp. 1–7.



Foot Massage for Improving Sleep Quality in Hemodialysis Patients: A Case Study

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A B S T R A C T

Sleep disorders are a common and significant issue among hemodialysis (HD) patients, often leading to a decline in their quality of life. Foot massage is one of the non-pharmacological therapies that could be effective in managing sleep disorders. This study explores the potential of foot massage as a nursing intervention to improve sleep quality in hemodialysis patients. This study used a case study approach, involving three HD patients with poor sleep quality at the Hemodialysis Unit of Dr. Kariadi General Hospital, Semarang, in May 2025. The Pittsburgh Sleep Quality Index (PSQI) was an instrument to assess sleep quality before and after the intervention. A foot massage was performed for 10 minutes during dialysis sessions, twice weekly for 4 consecutive weeks. All three participants showed a decrease in PSQI scores after the intervention, indicating improved sleep quality. The most significant decrease occurred in participant 1, from 15 to 8 (a decrease of 7 points), while participants 2 and 3 decreased from 15 to 10 (5 points) and from 13 to 9 (4 points), respectively. In conclusion, foot massage can be a part of a holistic nursing intervention to improve sleep quality in hemodialysis patients. It is a safe, easily applied non-pharmacological therapy that can provide physiological and psychological relaxation effects through improved blood circulation, the release of endorphins, and serotonin stimulation, all of which support sleep.

INTRODUCTION

Chronic Kidney Disease (CKD) is a progressive and irreversible disorder of kidney function lasting more than three months, characterized by a decrease in glomerular filtration rate and structural or functional damage to the kidneys (Calice-Silva *et al.*, 2024). It is a global health problem with a prevalence that continues to increase year on year. Patients with end-stage CKD undergoing regular hemodialysis generally experience various physical, psychological, and social problems, one of which is poor sleep quality (Lilipory, 2019; Simanjuntak, Anand, and Yulistir, 2024). Poor sleep quality is a condition characterized by difficulty sleeping, which may include one or more of the following symptoms: difficulty falling asleep (sleep latency), frequent awakenings during the night, difficulty returning to sleep, waking up too early, and being unable to sleep again, or feeling that sleep is not restful or refreshing. Generally, an individual is considered to have poor sleep quality if these symptoms occur at least 3 to 4 times a week over several weeks (Hamzi *et al.*, 2017).

Data from the World Health Organization (WHO) and the International Society of Nephrology (ISN) indicated that approximately 10–13% of the global population experienced CKD (Kovesdy, 2022). The Indonesian Basic Health Research 2018 (*Riskesdas*) recorded an End-Stage Renal Disease (ESRD) prevalence of 3.8‰, with a significant increase, especially among the productive age group (Kementerian

Kesehatan RI, 2018). Furthermore, ESRD requires renal replacement therapy to filter metabolic waste products. Hemodialysis (HD) is one of the most widely used renal replacement therapies in Indonesia (Kusuma *et al.*, 2018). A preliminary study at the dialysis unit of Dr. Kariadi General Hospital in Semarang selected 5 patients from 178 undergoing hemodialysis for assessment. This assessment found that 4 out of 5 patients (80%) experienced sleep disturbances, including difficulty falling asleep (prolonged sleep latency), frequent nocturnal awakenings, or feeling unrefreshed upon waking. These findings indicated that sleep disturbances were a significant problem experienced by CKD patients undergoing HD. However, the management of sleep disorders in the dialysis unit at Dr. Kariadi General Hospital was currently limited to pharmacological interventions, such as the administration of sleeping pills. Non-pharmacological interventions, such as foot massage, which have been proven to promote relaxation and improve sleep quality, were not routinely implemented in nursing practice at the hospital. Poor sleep quality in hemodialysis patients is caused by many factors, including inadequate dialysis processes that result in suboptimal removal of metabolic toxins. Low blood flow rates can influence this, especially in patients with cardiovascular disorders or unstable hemodynamics. This condition was commonly found in tertiary referral hospitals such as Dr. Kariadi General Hospital, which treats patients with complex comorbidities. In addition, other factors such as chronic itching (uremic pruritus), restless leg syndrome (RLS), muscle pain, mood disorders, and anxiety also worsen the patient's sleep quality. Complications such as anemia (a lack of red blood cells) can also cause hypoxemia (a lack of oxygen during sleep), leading patients to experience shortness of breath during sleep and frequent awakenings at night (Tan *et al.*, 2022). This condition can potentially disrupt comfort, worsen morbidity, and reduce overall quality of life (Ghanbari *et al.*, 2022; Nafsiyah *et al.*, 2025).

In nursing practice, interventions that are clinically effective, safe, easy to implement, and supportive of a holistic approach are crucial. One non-pharmacological intervention with potential to improve sleep quality is foot massage. Many studies have evaluated the effectiveness of foot massage, and the results show that this intervention improves sleep quality. A literature review indicated that more than 25 studies supported the benefits of foot massage as a safe and effective relaxation therapy. Foot massage has been practiced for thousands of years and works by stimulating reflex points on the feet that are linked to the nervous and circulatory systems, thereby influencing various parts of the body by modulating the autonomic nervous system (Wang *et al.*, 2020). In addition, this intervention works by stimulating the nervous system, improving blood circulation, and releasing relaxation hormones such as endorphins, which contribute to reducing tension and increasing comfort, thereby supporting the achievement of more profound and better quality sleep (Ghanbari *et al.*, 2022; Siburian and Silaban, 2023; Permana and Mesya, 2024). Several studies also found that foot massage improved sleep quality in cancer patients, older people, and post-operative patients (Agung, Aprina, and Astuti, 2021; Youniss *et al.*, 2021).

However, there was still limited scientific evidence on the effect of foot massage on HD patients in Indonesia.

Foot massage has several advantages compared to non-pharmacological interventions such as acupressure and progressive muscle relaxation (PMR). Acupressure helps regulate the body's energy balance by applying pressure to specific meridian points. Still, its application requires an exceptional understanding of the location of these points and the correct pressure techniques (Chao, Wade, and Kronenberg, 2008). Meanwhile, PMR requires active patient participation in systematically contracting and relaxing muscle groups, which may be difficult for patients with physical or cognitive limitations (Kato, Vogt, and Kanosue, 2019). In contrast, foot massage is passive for the recipient, easy to perform, and provides significant relaxation effects. Patient acceptance of foot massage is also higher because its gentle movements provide comfort and do not cause pain (Huang *et al.*, 2021). With all these advantages, foot massage is an effective, practical, and safe intervention for naturally and sustainably improving sleep quality. Given the limited use of non-pharmacological interventions to address sleep disorders in HD patients, particularly at Dr. Kariadi General Hospital, this study explores the potential of foot massage as a nursing intervention to improve sleep quality in hemodialysis patients. Through a case study approach, this research not only provides a deeper understanding of the effectiveness of foot massage but also contributes to the development of nursing practices that are more applicable, safe, easy to implement, and responsive to patients' individual needs.

METHOD

This study used a case study approach conducted in conjunction with the nursing care process. The population was end-stage CKD patients undergoing HD and experiencing poor sleep quality at the Dialysis Unit of Dr. Kariadi General Hospital in Semarang from 28 April to 24 May 2025. Three participants were selected using purposive sampling. The inclusion criteria were aged 18–60 years, routinely undergoing HD twice a week for the past 3 months, cooperative, hemodynamically stable, and having a poor score on the Pittsburgh Sleep Quality Index (PSQI) questionnaire; while exclusion criteria included patients with physical disorders in the legs, using femoral HD access, or taking sleeping pills. The identification, problem-solving, and achievement of research objectives were structured using a clinical reasoning framework to support systematic, logical, and patient-oriented nursing decision-making. Data were collected by completing the PSQI questionnaire and reviewing medical records and nursing care documentation. The Pittsburgh Sleep Quality Index (PSQI) is an instrument for assessing sleep quality consisting of 19 questions on a Likert scale. This instrument is valid, with a validity coefficient of 0.944, indicating strong content validity. In addition, the PSQI is reliable, with an overall reliability coefficient (Cronbach's alpha) of 0.845 across the seven components measured (Lu *et al.*,

2014). The total PSQI score is calculated from seven principal components; scores of 5 or more indicate poor sleep quality, and scores of 5 or less indicate good sleep quality.

The intervention consisted of a foot massage from the toes to the heels on both feet for 10 minutes per foot. It combined foot massage therapy with acupressure-based relaxation techniques using aromatherapy oils to enhance the overall relaxation effect. The intervention was performed at least 1 hour after vascular access was established and the dialysis process had begun, when the patient's hemodynamic condition was considered stable. It was implemented twice weekly in accordance with the patient's HD schedule. The data were then processed and presented in tables and graphs of demographic characteristics, clinical conditions, and sleep quality before and after the intervention. The data were analyzed to draw conclusions that addressed the study's focus. This study has undergone an ethical review process and has been approved by the Health Research Ethics Committee of Dr. Kariadi General Hospital. It was conducted in accordance with research ethics principles, including respect for participants' rights, confidentiality of data, and obtaining informed consent before data collection.

RESULT

Participants varied in age, sex, education level, and occupation, which could influence their responses to the intervention. Participant 1 was 32 years old, participant 2 was 39, and participant 3 was the oldest at 60 (Table 1). The younger age of participant 1 provides physiological advantages in responding to interventions, such as better physical adaptability and sleep quality, which tends to be easier to restore than in older individuals. In terms of education, participant 1 had a higher level of education than the other participants (Table 1). A higher level of education can support a better understanding of the intervention instructions and improve compliance with the recommended procedures. This factor also supports the effectiveness of the intervention received. Occupation was also an important factor that distinguished the three participants. Participant 1, who had a relatively flexible job, tended to have more control over their time for rest than participant 2, who worked as an employee with a more structured schedule and potentially a higher workload. However, Participant 3, who was not employed, might have more time to sleep, but advanced age and declining physical condition could make it harder to achieve high-quality sleep. However, all participants had BPJS (Social Security Agency for Health), so there was no difference in access to formal health services. Differences in age, education, and daily activities indicate that demographic characteristics are important in influencing the success rate of interventions to improve sleep quality.

Table1. Distribution of Demographic Characteristics of Participants Undergoing Haemodialysis at Dr. Kariadi General Hospital, May 2025 (N=3)

Demographic Characteristics	Participant 1	Participant 2	Participant 3
Age	32 years	39 years	60 years
Gender	Male	Male	Female
Education	Secondary school	Junior High School	Primary school
Occupation	Merchant	Employee	Not working
Health insurance	BPJS	BPJS	BPJS

Table 2 shows that several factors contribute to variations in intervention outcomes, including comorbidities, HD duration, physical complaints, and HD adequacy scores. Participant 1 had hypertension and diabetes, while others only had hypertension. Participant 1 also had the longest HD duration (19 months), suggesting a longer adaptation period to the routine and side effects of dialysis, and this participant was better accustomed to managing therapy-related complaints. Furthermore, he had the highest HD adequacy (1.2). On the other hand, the low hemoglobin (Hb) levels (7.5 g/dL) in participant 1 could be a barrier. In addition, physical complaints, such as lower-extremity edema in participant 1 and restless leg syndrome in participant 3, might interfere with sleep.

Table 2. Distribution of Clinical Characteristics of Participants Undergoing Haemodialysis at Dr. Kariadi General Hospital, May 2025 (N=3)

Clinical Condition Characteristics	Participant 1	Participant 2	Participant 3
Comorbidities	Hypertension and DM	Hypertension	Hypertension
Duration of HD	19 months	14 months	12 months
Access	Double Lumen	Double Lumen	Double Lumen
Sleep quality	Poor	Poor	Poor
Hb over the past two weeks	7.5 g/dL	9.5 g/dL	9.4 g/dL
Blood pressure before haemodialysis	208/106 mmHg	171/98 mmHg	160/95 mmHg
Blood pressure after HD	176/94 mmHg	182/102 mmHg	172/98 mmHg
Weight before HD	69 kg	48 kg	60 kg
Weight after HD	66 kg	47 kg	60 kg
HD adequacy	1.2	1.1	0.9
Physical complaints	Lower extremity oedema	None	<i>Restless leg syndrome</i>

All three participants showed a decrease in PSQI scores after the intervention, indicating improved sleep quality. The most significant decrease occurred in participant 1, from 15 to 8 (a decrease of 7 points), while participants 2 and 3 decreased from 15 to 10 (5 points) and from 13 to 9 (4 points), respectively. Although all final scores remained in the poor sleep quality category, the decrease indicated a positive response to the intervention (Figure 1).

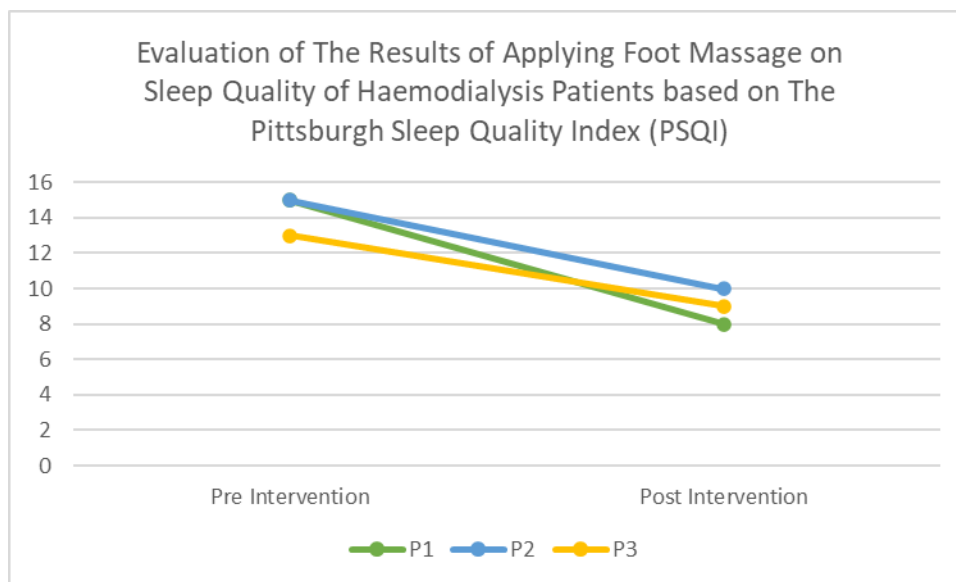


Figure 1. Changes in Sleep Quality Scores After Intervention

DISCUSSION

Chronic kidney disease is a progressive condition characterized by a gradual, irreversible decline in kidney function, in which the glomerular filtration rate (GFR) falls below 60 mL/min/1.73 m² for more than 3 months (Simanjuntak, Anand, and Yulistir, 2024). This decline in kidney function prevents the body from efficiently eliminating metabolic waste products, leading to the accumulation of toxins in the blood, such as urea and creatinine. This condition, known as uremia, has a widespread impact on various organ systems, including the central nervous system. The accumulation of uraemic toxins affects the balance of neurotransmitters such as serotonin and melatonin, which play an important role in sleep regulation. In addition, patients with CKD are also prone to physical symptoms such as muscle pain, cramps, pruritus, and RLS, which can worsen sleep quality. These sleep disturbances are exacerbated by the psychological burden of chronic illness, such as anxiety and depression (Lilipory, 2019). Various non-pharmacological approaches have been developed to address the sleep disturbances frequently experienced by CKD patients, including foot massage as a relaxation therapy.

Foot massage is a simple, safe, and easy-to-apply non-pharmacological intervention that aims to provide a relaxing effect through stimulation, improve blood and body fluid flow, and enhance the delivery of nutrients and oxygen to the body's cells (Simanjuntak, Anand, and Yulistir, 2024). Techniques in foot massage, such as strokes, kneading, rubbing, *tapotement* (tapping), and vibration, work by systematically manipulating the body's soft tissues. These techniques can reduce stress and anxiety, relieve muscle cramps, strengthen the immune system, reduce fatigue due to illness, improve blood circulation, and help overcome insomnia (Ghanbari *et al.*, 2022; Permana and Mesya, 2024). Additionally, foot massage stimulates the limbic system to release Corticotropin-Releasing Factor, which stimulates the pituitary

gland to release the Proopiomelanocortin (POMC) hormone and stimulates the adrenal medulla to increase endorphin secretion, activating the parasympathetic nervous system. It results in vasodilation of blood vessels and improved blood flow, helping tense muscles relax, stimulating the Reticular Activating System (RAS) to release serotonin, promoting sleep onset, and improving sleep quality (Robby, Agustin, and Hanifan Azka, 2022). Increased endorphins and serotonin in the brain produce feelings of physical and psychological relaxation because endorphins also suppress cortisol secretion. Foot massage particularly benefits HD patients because foot massage reduces pain and discomfort and improves sleep quality (Siburian and Silaban, 2023).

A foot massage for HD patients should be performed at least 1 hour after vascular access is established and the dialysis process begins, to ensure the patient's hemodynamic condition remains stable and to avoid potential risks, such as a drop in blood pressure from the massage's relaxing effects. Additionally, this time allows the patient to adapt to dialysis conditions, thereby accepting the intervention more comfortably and safely (Siburian and Silaban, 2023).

This investigation showed a decrease in PSQI scores in hemodialysis patients after foot massage therapy, indicating improvements in sleep duration, efficiency, and soundness (Figure 1). Several studies have shown that foot massage therapy improves sleep quality in patients undergoing HD. Research by Ghanbari et al. (2022) and Siburian & Silaban (2023) found that administering a 10-minute foot massage to each foot for 3 weeks significantly improved sleep quality in HD patients. The Pittsburgh Sleep Quality Index (PSQI) scores increased significantly, indicating improved sleep duration, efficiency, and soundness (Ghanbari *et al.*, 2022; Siburian and Silaban, 2023). Similar findings were reported by Robby et al. (2022), who stated that regular foot massage improved overall sleep patterns in HD patients. The effectiveness of this therapy is supported by the physiological theory that therapeutic touch can stimulate brain regions associated with emotions and relaxation (Robby, Agustin, and Hanifan Azka, 2022). However, discrepancies between this investigation and previous research were variations in participants' demographic characteristics, the duration of the intervention, and the intervention approach. This study combined foot massage therapy with acupressure relaxation techniques and aromatherapy oils, which have not been widely studied in previous research. This combination of interventions provides a more comprehensive relaxation effect and optimizes sleep quality.

The effectiveness of this combination of interventions cannot be separated from the influence of various factors. Several factors influenced the most significant decrease in PSQI scores in participant 1 (Figure 1). First, the age factor: participant 1 was younger, so he tended to show better adaptability and therapeutic response than the other participants. Younger participants showed greater improvement in sleep quality scores. Physiologically, younger individuals have better regenerative and adaptive capacities to therapeutic interventions, including relaxation therapies such as massage. Research by Permatasari et

al. (2022) indicated that young age facilitated entry into the deep sleep phase because the central and peripheral nervous systems are still functioning optimally. However, age is not the most dominant factor in influencing sleep quality. Kusuma's research showed that although old age was associated with insomnia, anxiety had a greater influence on the onset of sleep disorders (Kusuma *et al.*, 2018). It indicated that anxiety was a more significant factor than age in determining the sleep quality of HD patients. In this study, participants who did not experience severe anxiety showed greater improvement in sleep quality. The absence of anxiety makes it easier for the body to achieve a state of relaxation during the intervention. Nurhayati et al. (2019) state that anxiety activates the sympathetic nervous system and inhibits melatonin secretion, disrupting sleep patterns.

Third, the occupational factor also influenced the participant; participant 1 had a relatively light workload and more flexible rest times, allowing the participant to have longer sleep durations and more optimal rest opportunities. Participants with lighter workloads and more flexible rest times were likelier to have better sleep quality. Occupational conditions that are not physically or mentally demanding allow the body to recover and enable more consistent sleep times. Research by Saraswati et al. (2022) showed that individuals with low work stress tended to have better sleep quality due to more stable cortisol levels that did not interfere with circadian rhythms.

Last, from a medical perspective, participant 1 had the highest HD adequacy score among the three participants, indicating better dialysis efficiency. Participant 1, with higher HD adequacy scores, showed a more significant reduction in sleep disturbance scores. An optimal dialysis process can improve patients' physical comfort and overall condition, ultimately enhancing sleep quality. Thus, HD adequacy is also an important indicator. The mechanism relates to HD's effectiveness in removing uremic toxins, such as urea and creatinine. An increase in Kt/V values is directly proportional to a decrease in toxins that can irritate the central nervous system and cause symptoms such as restlessness, muscle cramps, or itching, which can interfere with sleep. Research by Wijaya & Sari (2021) found that Kt/V values ≥ 1.4 were associated with increased physical comfort and improved sleep patterns.

This study found that participant 3, who had restless leg syndrome, experienced the least drop in scores. Physical complaints, such as edema and RLS, can also affect sleep quality. Patients with RLS are more likely to experience sleep disturbances due to uncomfortable leg sensations that occur during rest. This sensation often prompts patients to move their legs, disrupting sleep onset and continuity. It aligns with findings that RLS was a major contributor to sleep disturbances in HD patients (Evinta, Nurhusna, and Subandi, 2025).

The duration of HD treatment also contributes to the response to intervention. Participant 1, who underwent HD for an extended period, tended to show better physiological and psychological adaptation to the side effects of therapy. It allows patients to undergo additional interventions, such as foot massage,

with more positive acceptance. Pratama et al. (2020) explain that long-term adaptation to HD can improve psychological stability and reduce sensitivity to sleep disturbances that commonly occur in the early stages of therapy.

The combination of demographic, psychological, lifestyle, and dialysis factors mutually support and accelerate improvements in sleep quality in participant 1 compared to the other participants. In addition, participant 1 was known to receive independent relaxation stimulation outside the scheduled intervention sessions, which allowed for more optimal therapeutic effects on sleep quality. Thus, Several main factors appear to influence the effectiveness of the intervention in improving sleep quality: age, psychological condition, occupation type, and HD adequacy.

Sleep disturbances in HD patients are caused by the complexity of physical and psychological disturbances due to decreased kidney function. While primary therapies such as HD are essential for sustaining life, additional interventions, such as foot massage, have been shown to improve sleep quality. Therefore, foot massage therapy could be part of a holistic nursing practice focused on patient comfort and improving the quality of life in HD patients.

CONCLUSION

Foot massage can be a part of a holistic nursing intervention to improve sleep quality in hemodialysis patients. It is a safe, easily applied non-pharmacological therapy that can provide physiological and psychological relaxation effects through improved blood circulation, the release of endorphins, and serotonin stimulation, all of which support sleep.

REFERENCES

- Agung, F. Y., Aprina, A., & Astuti, T. (2021). Effectiveness of foot massage on sleep quality among post-surgical patients in Dr. H. Abdul Moeloek Hospital, Lampung-Indonesia. *Malahayati International Journal of Nursing and Health Science*, 3(2), 94–102. <https://doi.org/10.33024/minh.v3i2.3465>
- Calice-Silva, V., et al. (2024). Capacity for the management of kidney failure in the International Society of Nephrology Latin America region: Report from the 2023 ISN Global Kidney Health Atlas (ISN-GKHA). *Kidney International Supplements*, 13(1), 43–56. <https://doi.org/10.1016/j.kisu.2024.01.001>
- Chao, M. T., Wade, C., & Kronenberg, F. (2008). Disclosure of complementary and alternative medicine to conventional medical providers: Variation by race/ethnicity and type of CAM. *Journal of the National Medical Association*, 100(11), 1341–1349. [https://doi.org/10.1016/S0027-9684\(15\)31514-5](https://doi.org/10.1016/S0027-9684(15)31514-5)
- Evinta, R., Nurhusna, & Subandi, A. (2025). Identifikasi hubungan tingkat restless legs syndrome (RLS) dengan kualitas tidur pasien gagal ginjal kronik yang menjalani hemodialisis. *Jurnal Ners Universitas Pahlawan*, 9, 829–839.

- Ghanbari, A., et al. (2022). Comparison of the effect of reflexology and Swedish massage on restless legs syndrome and sleep quality in patients undergoing hemodialysis: A randomized clinical trial. *International Journal of Therapeutic Massage & Bodywork*, 15(2), 1–13. <https://doi.org/10.3822/ijtmb.v15i2.705>
- Hamzi, M., et al. (2017). Insomnia in hemodialysis patients: A multicenter study from Morocco. *Saudi Journal of Kidney Diseases and Transplantation*, 28(5), 1112. <https://doi.org/10.4103/1319-2442.215152>
- Huang, H., et al. (2021). Can foot reflexology be a complementary therapy for sleep disturbances? Evidence appraisal through a meta-analysis of randomized controlled trials. *Journal of Advanced Nursing*, 77(4), 1683–1697. <https://doi.org/10.1111/jan.14699>
- Kato, K., Vogt, T., & Kanosue, K. (2019). Brain activity underlying muscle relaxation. *Frontiers in Physiology*, 10, Article 1457. <https://doi.org/10.3389/fphys.2019.01457>
- Kementerian Kesehatan Republik Indonesia. (2018). *Laporan nasional Riskesdas 2018*. <https://repository.badankebijakan.kemkes.go.id/id/eprint/3514>
- Kovesdy, C. P. (2022). Epidemiology of chronic kidney disease: An update 2022. *Kidney International Supplements*, 12(1), 7–11. <https://doi.org/10.1016/j.kisu.2021.11.003>
- Kusuma, H., et al. (2018). Relating factors of insomnia among haemodialysis patients. *Nurse Media Journal of Nursing*, 8(1), 44–53. <https://doi.org/10.14710/nmjn.v8i1.15741>
- Lilipory, M. (2019). Kecemasan dan kualitas tidur berhubungan dengan lama menjalani hemodialisa pada pasien gagal ginjal kronik. *Moluccas Health Journal*, 1(1), 10–18. <https://doi.org/10.54639/mhj.v1i1.45>
- Lu, T., et al. (2014). Analysis on reliability and validity of the Pittsburgh Sleep Quality Index. *Chongqing Medicine*, 260–263.
- Nafsiyah, Z., et al. (2025). Faktor-faktor yang mempengaruhi kualitas tidur pasien gagal ginjal kronik yang menjalani hemodialisis di RSUD Jendral Ahmad Yani Metro Provinsi Lampung. *Health Research Journal of Indonesia*, 3(4), 233–240. <https://doi.org/10.63004/hrji.v3i4.645>
- Permana, I., & Mesya. (2024). Complementary therapy in improving the sleep quality of hemodialysis patients: A scoping review. *Jurnal Aisyah: Jurnal Ilmu Kesehatan*, 9(1). <https://doi.org/10.30604/jika.v9i1.2603>
- Robby, A., Agustin, T., & Hanifan Azka, H. (2022). Pengaruh pijat kaki (foot massage) terhadap kualitas tidur. *Healthcare Nursing Journal*, 4(1), 206–213. <https://doi.org/10.35568/healthcare.v4i1.1845>
- Saraswati, N. L. G. I., Lestari, N. K. Y., & Putri, K. A. (2022). Hubungan tingkat stres dengan kualitas tidur pada pasien gagal ginjal kronik yang menjalani hemodialisis. *Malahayati Nursing Journal*, 4(5), 1242–1249. <https://doi.org/10.33024/mnj.v4i5.6598>
- Siburian, C. H., & Silaban, N. Y. (2023). The effect of foot massage with oil aromatherapy on hemodialysis patients' sleep quality. *Jurnal Aisyah: Jurnal Ilmu Kesehatan*, 8(1), 33–38. <https://doi.org/10.30604/jika.v8i1.1398>
- Simanjuntak, M., Anand, F., & Yulistir, B. (2024). Pengaruh pijat refleksi kaki terhadap penurunan tekanan darah pasien gagal ginjal kronik yang mengalami hipertensi intradialisis di Siloam Hospitals Asri. *Mahesa: Malahayati Health Student Journal*, 4(11), 4732–4741. <https://doi.org/10.33024/mahesa.v4i11.15274>
- Tan, L.-H., et al. (2022). Insomnia and poor sleep in CKD: A systematic review and meta-analysis. *Kidney Medicine*, 4(5), Article 100458. <https://doi.org/10.1016/j.xkme.2022.100458>

- Wang, W.-L., et al. (2020). Effect of foot reflexology intervention on depression, anxiety, and sleep quality in adults: A meta-analysis and metaregression of randomized controlled trials. *Evidence-Based Complementary and Alternative Medicine*, 2020, Article 2654353. <https://doi.org/10.1155/2020/2654353>
- Youniss, A. E., et al. (2021). Effect of foot massage on incisional pain and sleep pattern among post abdominal surgery patients. *Egyptian Journal of Health Care*, 12(4), 570–584.



Risk Management Analysis of Mobile JKN Queues for Outpatients at Islamic Hospital Surabaya With a Failure Mode Effect and Analysis Approach

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ABSTRACT

The implementation of Mobile JKN at Surabaya Islamic Hospital showed increased utilization during January–April 2024 compared to the previous year, although its use has not yet reached optimal levels. This study aimed to evaluate the utilization of Mobile JKN in outpatient services and identify potential risks using the Failure Mode and Effects Analysis (FMEA) method. A descriptive qualitative case study design was employed involving service officers and JKN patients. Data were collected through observations and in-depth interviews and analyzed using the Miles and Huberman approach. The findings revealed potential failures at almost every stage of the Mobile JKN process, including patients not installing or being unfamiliar with the application, delayed arrivals, physician delays, patient congestion, incomplete supporting examinations, and technical problems with diagnostic equipment. FMEA analysis demonstrated that the average risk score decreased from 19.5 to 12.5 after implementing improvement strategies. Nine recommendations were identified to reduce risks associated with online registration through Mobile JKN. These findings suggest that integrating patient education, technological improvements, and consistent operational management is essential to optimize the sustainable implementation of Mobile JKN in outpatient services.

INTRODUCTION

Health development is a strategic government effort to improve public health by increasing awareness, willingness, and the ability to live a healthy life. It is strengthened by the mandate of the 1945 Constitution and Law Number 40 of 2004 concerning the National Social Security System (*Sistem Jaminan Sosial Nasional* or SJSN), which affirms that every citizen has the right to obtain social security, including health insurance. The policy has been implemented through the National Health Insurance (*Jaminan Kesehatan Nasional* or JKN) program, organized by *Badan Penyelenggara Jaminan Sosial Kesehatan* (BPJS Kesehatan), since 2014, with the principle of mutual cooperation. This program aims to ensure access to comprehensive health services, including promotive, preventive, curative, and rehabilitative services for all Indonesian people.

Along with the development of information technology, *BPJS Kesehatan* launched the Mobile JKN application as part of its digital transformation to increase access to health services. This application allows participants to perform various administrative activities independently, such as checking membership status, registering services, and obtaining queue numbers online, without visiting health facilities. The implementation of Mobile JKN in hospitals, including Surabaya Islamic Hospital, can

potentially improve service efficiency, reduce queues, and support data-driven decision-making. However, this technology also carries potential risks, both technical and operational, that can affect service quality if not managed properly.

Based on data on the use of online queues at Surabaya Islamic Hospital, the achievement of using Mobile JKN still fell short of the set target, at only 17.78% of the 25% target, even though the overall use of online queues has approached the target. This condition indicates that there are problems with the optimal use of Mobile JKN that need further analysis. Therefore, a systematic risk management approach is crucial, including Failure Mode and Effects Analysis (FMEA), to identify potential failures, analyze their impacts, and determine improvement priorities. Thus, it is hoped that the implementation of Mobile JKN can run more optimally, minimize risks, and achieve the goal of improving the quality of health services. The urgency of this research lies in the still suboptimal use of Mobile JKN, which has not reached the target, so that it has the potential to cause service inefficiency, patient queues, and a decrease in service quality if risk identification and system improvements are not immediately carried out (Wahyuni et al., 2026). This study aims to comprehensively examine the use of Mobile JKN in outpatient services at Surabaya Islamic Hospital by identifying BPJS patient systems, flows, and queues, as well as potential failures and obstacles. In addition, this study analyzes risk levels using the FMEA approach by assessing severity, occurrence, and detection, and by calculating the Risk Priority Number (RPN) to determine improvement priorities and formulate process redesign recommendations to minimize high risks (Jamal & Adinda, 2025). Theoretically, this research contributes to the development of information technology-based risk management science in the health sector. At the same time, it can practically serve as a guide for hospital management and BPJS Kesehatan in improving the quality of Mobile JKN services and providing a positive impact on patients through more efficient, user-friendly services (Makmur et al., 2024).

METHOD

This study used a descriptive qualitative approach and a case study design to provide an in-depth understanding of the use of Mobile JKN (Hakim et al., 2024) at Surabaya Islamic Hospital, with the analysis unit comprising various users, such as service officers and JKN patients. Participants were key, main, and supporting informants selected for their involvement and understanding of the Mobile JKN system. Data collection was through in-depth observation and interviews, supported by instruments such as observation guidelines and interview guides, and documented using recording tools (Wahidah et al., 2023). The research component included system analysis, utilization, potential failure, and risk measurement using the FMEA method, based on severity, occurrence, and detection indicators, which produce RPN

values to identify strategic issues and recommend improvements. The data were then analyzed using Miles and Huberman's technique through data reduction (Daniati et al., 2025), data presentation, and conclusion. The data's validity was maintained through triangulation of sources, techniques, and time to ensure the research results were valid. In addition, this study also paid attention to ethical aspects by providing informed consent sheets to respondents as a form of consent after obtaining complete information on the objectives, benefits, and research process (Br Sagala & Hajad, 2022). It has passed the Ethics Test with certificate number: No. 205. EC. KEP. RSIAY.07.25.

RESULT

The use of Mobile JKN (MJKN) at Surabaya Islamic Hospital increased from January to April 2024, averaging 1.25%. However, this is still relatively low compared to total visits, reflecting the early stages of digital adoption. In terms of system quality, Mobile JKN is considered to have a clear flow, is easy to use, and has been well integrated to support user activities (Rinjani, 2022). In terms of information quality, the application can present information that is quite complete, easy to understand, and reliable. However, there are still obstacles, such as doctor delays, that affect the accuracy of service information (Suhadi et al., 2022). The quality of the process shows that using Mobile JKN can increase efficiency and reduce queues. However, there are still obstacles for certain groups, such as older people or users without adequate devices (Suhadi, 2022). Meanwhile, the quality of collaboration is considered quite good, characterized by accurate data support, fast service response, and effective system integration. However, there is still a need to increase server capacity to overcome technical obstacles, such as errors or system slowdowns (Wulanadary et al., 2019).

Table 1 Potential Failures and Impacts of Mobile JKN Users of Surabaya Islamic Hospital

Process Stages	Potential Failure from the Patient Side	Impact
Initial access to the MJKN application	Didn't have an Android/iOS cellphone or couldn't download apps.	Patients could not register online → remain in manual queues → longer queues.
Registration on the MJKN application	Not understanding how to use the app.	Patients failed to register → lost the service slot that day.
	Incorrect data input (polyclinic, date, health facility).	Patients were registered at the wrong polyclinic → cannot be served.
	Not recording or forgetting the queue number.	Confused when coming to the hospital → difficulty validating the queue → there was a delay in service.
Arrival at the hospital according to the schedule	Arriving not on time or late.	The queue number was forfeited, patients had to requeue → the waiting time was getting longer.
	Didn't know the check-in/queue validation procedure.	Inactive queues → considered absent.
Processes in the outpatient polyclinic	Not knowing the polyclinic's location or flow.	Patients went back and forth → stress, fatigue, longer service time.
	Did not bring supporting documents (referral letter, ID cards, BPJS cards).	Registration failed to be validated → service was delayed or declined.
Hospital supporting examinations or	Patients did not know where to go for supporting examinations or pharmacies.	Service was not completed in one day → must come back.

pharmacy	The patient did not understand the information provided by the doctor/nurse.	Confused about supporting examinations or rules for taking medication.
Follow-up visit	Didn't get info about the follow-up visit	Patients did not have a follow-up visit → patient was at risk of complications or did not complete treatment.
	Not keeping proof of service/documents.	Difficult when there were follow-up claims, complaints, or new referrals.

Overall, potential failures in the use of Mobile JKN from the patient's side occurred at almost all stages of the process, from initial access to follow-up visit, largely due to limited digital literacy, ignorance of service flows, and administrative negligence. The impact not only hinders individual patients, such as registration failures, service delays, and incompleteness of treatment, but also has a systemic impact in the form of increasing manual queues, irregularities in service flows, and hospital operational inefficiencies (Tauran et al., 2025). Therefore, comprehensive interventions are crucial, including patient education, streamlining processes, strengthening information systems, and active support at each service point, to minimize the risk of failure. Thus, the use of Mobile JKN can run optimally (Siallagan et al., 2025).

The risk management assessment of the non-optimal use of online registration through Mobile JKN at Surabaya Islamic Hospital was conducted through in-depth interviews with the head of outpatient, registration, pharmacy, laboratory, and radiology units, which identified various obstacles such as limited access and digital literacy of patients, discrepancies in arrival times, patient stacking, doctor delays, technical constraints in systems and supporting equipment, to problems with drug availability and non-compliance patients to the instructions of the service. Based on these findings, a risk management analysis was conducted using the FMEA approach. It assesses the frequency of occurrence, severity, and likelihood of detection on a 1–10 numerical scale, quantitatively arranged to minimize bias (Budiarti, 2024). This assessment considers the impact of any potential failure on the next service process as well as on the patients as an end user, by ensuring uniformity of scale between parameters so that it can produce accurate risk priorities as a basis for decision-making to improve Mobile JKN services at Surabaya Islamic Hospital (Hanif et al., 2015).

Table 2. Risk Management Assessment from Various Units at Surabaya Islamic Hospital in the Use of Mobile JKN

Risks	Events	Constraints	Frequency (Likelihood)	Impact	Possible Failure detected	Value
Patients did not have the Mobile JKN application.	On average, 40% of patients did not have Mobile JKN each day.	The patient could not complete the online registration, so they chose on-site registration.	10	7	10	27
Patients were not accustomed to using the JKN mobile app.	Almost all Mobile JKN users were not accustomed to using it.	Patients registered on-site, so the target indicator for achieving mobile JKN was not met.	10	5	10	25

Risks	Events	Constraints	Frequency (Likelihood)	Impact	Possible Failure detected	Value
Patients did not come at the scheduled treatment time.	On average, 3 patients did not attend treatment at the scheduled time after registering with mobile JKN each month.	The patient quota was not used, so it was consumed by other patients who wanted treatment at that time.	6	6	9	21
Patients arrived late, not on schedule.	There were 5 average incidents in 1 month of patients arriving late, not according to the existing queue number.	The queue quota would shift and did not match the existing queue sequence number.	6	6	7	19
The accumulation of patient arrival processes.	There was a buildup of patients several times a month because arrivals were not on schedule.	Waiting rooms were not enough because patients came at the same time.	8	4	9	16
Doctors arrived late.	On average, there were 10 physician delays per practice arrival hour in 1 month.	Patients piled up due to delayed services.	6	5	6	17
Patients did not arrive on schedule.	On average, four patients arrived outside the predetermined schedule each month.	The inaccuracy in the patient's schedule will affect the allocation of quotas to other patients, so that the next patient who wants to register will not be able to undergo the examination.	4	4	8	16
Patients failed to perform a supporting examination because they did not follow the officer's directions correctly.	Two patients failed to have a supporting examination in one month.	The next patient exceeded the quota for supporting examinations that day.	3	5	8	16
There were technical problems with the diagnostic devices.	Some supporting examinations could not be performed due to technical issues with the diagnostic devices. It might have occurred 2 times in 1 month.	There was a buildup of patient queues for a supporting examination.	5	5	6	16

Based on Table 2 of the risk assessment results, it can be concluded that the main problem in the use of Mobile JKN at Surabaya Islamic Hospital was dominated by patient factors, especially patients did not have the Mobile JKN application and were not accustomed to using it, which had the highest risk value, so that it had an impact on the high on-site registration and the failure to achieve the service digitization

target. In addition, non-compliance with schedules, such as patients not arriving or arriving late, also contributed to inefficient quota utilization and queue flow disruptions. Other operational risks, such as doctor delays, patient buildup, patients failing to perform supporting examinations, and technical problems with the diagnostic devices, also affected service operations, even at a moderate level of risk. Overall, the risks identified indicated that user behavior and schedule discipline were the dominant factors to prioritize in improvement efforts, along with increasing system readiness and operational management to support the optimization of Mobile JKN use. Based on the risk management assessment, a risk-reduction analysis was conducted, resulting in recommendations to reduce risk.

Table 3. Recommendations for Increasing the Utilization of Individuals Registering Online Through Mobile JKN at Surabaya Islamic Hospital

Constraints	Recommendation Efforts	Before Value	Value After	Decline
Patients were unable to complete online registration and ultimately chose on-site registration.	- Socialization for all patients, both inpatients and outpatients. - Adding JKN mobile ambassadors in terms of educating patients.	27	11	16
Patients registered on-site, so the target indicator for achieving mobile JKN was not met.	Customer Information Officers and marketing personnel conducted socialization regarding the use of Mobile JKN to foster understanding.	25	12	13
The patient quota was not used, thus preventing other patients from seeking treatment at that time.	There was a policy to remind patients on the day before the scheduled appointment (D-1) so they could use the doctor's check-up quota as scheduled.	21	13	8
The queue quota would shift and did not match the existing sequence number.	Notification of queue quotas via the information system on the WhatsApp application, so patients knew when to come.	19	13	6
The waiting room wasn't enough because patients arrived at the same time.	Notification of queue quotas via the information system on the WhatsApp application, so patients knew when to come.	21	13	8
There was an accumulation of patient arrival processes.	Notification of queue quotas via the information system on the WhatsApp application, so patients knew when to come.	17	13	4
Patients would interfere with the quota allocation, so that other patients who want to register cannot undergo the examination.	There was a policy to remind patients on the day before a follow-up visit (D-1), so they could use their check-up quota according to the schedule.	16	12	4
Other patients could not use the quota that was actually available.	Designing a system that was bridged with mobile JKN so that patients could be informed systemically, so that notification information was properly systematic.	16	13	3
There was a buildup of patients.	Quota arrangements were evenly distributed and required doctors to arrive on time, with commitment and discipline.	16	12	4
Average value		19,5	12,5	7

The average risk value decreased from 19.5 to 12.5, a decrease of 7 points. The most influential interventions included intensive patient socialization, the addition of Mobile JKN ambassadors, on-the-day-before (D-1) reminders, and WhatsApp-based notifications for queue management. In addition,

designing a system that bridged mobile JKN and a more equitable distribution of quotas also helped reduce patient buildup and improve service efficiency (Table 3).

DISCUSSION

The Mobile JKN application at Surabaya Islamic Hospital is an innovation in BPJS's digital services that aims to facilitate quick, easy, and efficient access to administrative and health services for JKN participants (Wulanadary et al., 2019). This system has been integrated with the Hospital Management Information System (*Sistem Informasi Manajemen Rumah Sakit* or SIMRS) through online queue bridging, allowing patients to register for outpatient up to D-30 before the day of service, choose the polyclinic, schedule, and doctor independently. The registration flow, which consists of several simple stages, is considered easy to understand by users and supported by features such as membership checks, online registration, service history, and health facility information. There has been an increased use of Mobile JKN at Surabaya Islamic Hospital. It is due to the hospital's commitment to providing education and assistance to patients through officers in various service units (Hakim et al., 2024).

In terms of quality, Mobile JKN at Surabaya Islamic Hospital is considered to have a fairly reliable system, is easy to use, and can provide accurate, relevant, and real-time information to users (Febriyani et al., 2022). Process quality has shown efficiency in reducing queues and accelerating outpatient service flows. However, there were still some obstacles, such as server disruptions, that sometimes cause applications to experience errors, underscoring the need for improvements in infrastructure and system durability. Overall, the quality of the Mobile JKN system, information, and processes has been good and has met user needs. However, it still needs further development to be more optimally utilized across all service units (Wahidah et al., 2023).

The potential failures that occur at each stage of Mobile JKN use indicate that the main problem lies not only in the system but also in patients' readiness and user behavior (Nurjayanti & Novratilova, 2025). This study showed that in the early stages, limited access to technology, such as not having a smartphone or the inability to download apps, became fundamental barriers that kept patients dependent on manual registration. During registration, low digital literacy also led to errors in using the application, such as selecting the wrong poly or schedule, or failing to save the queue number, which can result in not receiving services (Table 1). It indicates that even though the system is available, not all patients have the capacity to make optimal use of it (Suhadi et al., 2022).

In addition, at the arrival and service stage at the hospital, problems continue with non-adherence to schedules and a lack of understanding of check-in procedures and service flows (Kusumawati et al., 2024). The impact is that queues become irregular, waiting times increase, and service loads become

uneven. Furthermore, administrative obstacles, such as patients' confusion about the flow of polyclinics and support services, and not bringing documents, indicated that information was still not effectively conveyed to patients (Table 1). Even in the final stage of service, a lack of understanding of medical instructions and follow-up control can reduce the quality of health service outcomes (Suhadi, 2022).

Thus, this problem is multidimensional, encompassing technology, human resources, and service systems (Tawar, Santoso, and Salma, 2022). Therefore, the solutions needed are not only to strengthen the digital system but also to increase patient digital literacy, provide clear, integrated information, and ensure active assistance from officers at each service point. This approach is expected to reduce the potential for failure at every stage, increase patient compliance, and optimize the efficiency and effectiveness of Mobile JKN use in hospitals (Kusumawati et al., 2024).

The recommendations in this study significantly reduced the risk value from an average of 19.5 to 12.5, a decrease of 7 points (Table 3). This decrease showed that interventions focused on patient education, strengthening information systems, and queue management increased the use of Mobile JKN. The socialization strategy carried out by the officers, including the addition of Mobile JKN ambassadors, was also effective in increasing patient understanding and reducing the tendency toward on-site registration. In addition, implementing D-1 reminders and WhatsApp-based notifications could optimize the use of service quotas and reduce untimely patient arrivals, the main cause of queue irregularities (Nurjayanti & Novratilova, 2025). Furthermore, recommendations to strengthen the system, such as bridging information gaps and a more equitable distribution of quotas, helped reduce the risk of patient accumulation and service inefficiencies.

However, the success of implementing these recommendations depends heavily on the consistency of implementation, the discipline of medical personnel, and the readiness of the technological infrastructure. Overall, these results confirm that the combination of an educational approach, a responsive digital system, and the right operational policy can effectively improve service efficiency and the utilization of Mobile JKN at Surabaya Islamic Hospital (Suhadi et al., 2022).

CONCLUSION

Overall, nine improvement recommendations can reduce the risk value in nine risks in the use of online registration through Mobile JKN at Surabaya Islamic Hospital. It highlights that a combination of educational approaches, technological enhancement, and consistent operational management is essential to optimize the sustainable utilization of Mobile JKN.

REFERENCES

- Br Sagala, R., & Hajad, V. (2022). Inovasi Pelayanan Kesehatan Mobile JKN Di Kantor BPJS Kota Subulussalam. *Journal of Social Politics and Governance (JSPG)*, 4(1), 14–23. <https://doi.org/10.24076/JSPG.2022v4i1.775>
- Budiarti, T. (2024). Efektifitas Aplikasi Mobile JKN dalam meningkatkan Pelayanan BPJS Kesehatan di Rumah Sakit Islam Malahayati Medan. *Kesmas Prima Indonesia*, 8(2), 77–80.
- Daniati, S. E., Hasanah, Si., & Astika, F. (2025). Penerapan Penggunaan Aplikasi Mobile JKN Guna Meningkatkan Pelayanan (Fitur Pendaftaran) BPJS Di Puskesmas X Kota Pekanbaru Tahun 2025. *JHMHS: Journal of Hospital Management and Health Science*, 6(1), 1–6. <https://journal.almatani.com/index.php/jhmhs/article/view/1524>
- Febriyani, R. W., Novi, A., & Rahmat, S. (2022). Efektifitas Penggunaan Aplikasi Mobile JKN Bagi Peserta BPJS Kesehatan Di Kota Bandung. *Tolis Ilmiah: Jurnal Penelitian*, 4(1), 8–16.
- Hakim, A. U., Rustanto, A. E., Bratakusumah, D. S., & Sutawijaya, A. H. (2024). Analisis Efektivitas Penggunaan Aplikasi Mobile JKN Sebagai Bagian Pelayanan Publik Pada BPJS Kesehatan Di Kota Bekasi. *Jurnal Cahaya Mandalika*, 5(2), 1087–1095. <https://doi.org/https://doi.org/10.36312/jcm.v5i2.2744>
- Hanif, R., Rukmi, S. H., & Susanty, S. (2015). Perbaikan Kualitas Produk Keraton Luxury DI PT. X dengan Menggunakan Metode Failure Mode and Effect Analysis (FMEA) dan Fault Tree Analysis (FTA). *Jurnal Online Institut Teknologi Nasional*, Vol. 03(No. 03), 137–147. <https://ejurnal.itenas.ac.id/index.php/rekaintegra/article/view/879>
- Jamal, N., & Adinda, A. S. (2025). Pemanfaatan Mobile JKN Sebagai Bentuk Digitalisasi Kesehatan Untuk Meningkatkan Efektivitas Layanan Kesehatan. *Pelayanan Unggulan: Jurnal Pengabdian Masyarakat Terapan*, 2(4), 29–37. <https://doi.org/10.62951/unggulan.v2i4.2330>
- Kusumawati, R. M., Apriyani, A., Wulandari, K., & Suwignyo, S. (2024). Pemanfaatan Penggunaan Aplikasi Mobile JKN. *Jurnal Kebijakan Kesehatan Indonesia*, 13(1), 52. <https://doi.org/10.22146/jkki.89234>
- Makmur, S. F. A. S., Ahri, R. A., & Nurgahayu. (2024). Efektivitas Penggunaan Program Mobile JKN Dalam Pelayanan Kesehatan Di RS Pendidikan Universitas Hasanuddin. *Window of Public Health Journal*, 5(5), 786–796. <https://doi.org/10.33096/woph.v5i5.2093>
- Nurjayanti, R., & Novratilova, S. (2025). Evaluasi Penggunaan Aplikasi Mobile Jaminan Kesehatan Nasional (MJKN) Pada Pendaftaran Rawat Jalan Menggunakan Metode TAM. *Jurnal Kesehatan Tropis Indonesia*, 3(3), 161–173. <https://doi.org/10.63265/jkti.v3i3.112>
- Rinjani, R. (2022). Analisis Penerapan Aplikasi Mobile Jkn Terhadap Peserta Badan Penyelenggara Jaminan Sosial Kesehatan Cabang Subulussalam. *PUBLIKA: Jurnal Ilmu Administrasi Publik*, 8(2), 209–223. [https://doi.org/10.25299/jiap.2022.vol8\(2\).10491](https://doi.org/10.25299/jiap.2022.vol8(2).10491)
- Siallagan, A. D., Diana, H. S., Fitriya, N. I., Nurhuda, P. M., Oktaviany, V., Luginasari, Y., & Sukaesih, N. S. (2025). Revolusi Kesehatan Digital melalui teknologi Big Data Dalam Aplikasi Mobile JKN/ Rapid Review. *Bhamada: Jurnal Ilmu Dan Teknologi Kesehatan (E-Journal)*, 16(1), 1–12. <https://doi.org/10.36308/jik.v16i1.768>
- Suhadi, Jumakil, & Irma. (2022). Aplikasi Mobile JKN untuk Memudahkan Akses Pelayanan BPJS. *Jurnal Penelitian Kesehatan “Suara Forikes,”* 13(2), 262–267. <https://doi.org/http://dx.doi.org/10.33846/sf.v13i0.1847>
- Suhadi, S. (2022). Dampak Penggunaan Aplikasi Mobile JKN Terhadap Pelayanan BPJS. *Jurnal*

Kesehatan, 15(1), 11–23. <https://doi.org/10.23917/jk.v15i1.15977>

- Tauran, I., Pangandaheng, T., & Nurlina, W. O. (2025). Implementasi Aplikasi Mobile JKN Dalam Upaya Mengurangi Lama ANtrian Dan Waktu Tunggu Pelayanan Pasien Rawat Jalan. *Jurnal Penelitian Perawat Profesional*, 7(1), 1333–1336. <https://doi.org/https://doi.org/10.37287/jppp.v7i1.5955>
- Tawar, Santoso, A. F., & Salma, Y. S. (2022). Model HOT FIT dalam Manajemen Sistem Informasi. *Bincang Sains Dan Teknologi*, 1(02), 76–82. <https://doi.org/10.56741/bst.v1i02.144>
- Wahidah, M., Syaiful, A. R., Najib, R. O., Prasetya, I., Bakhri, A. S., Yuliana Sari, A. R., Sahraini, L. A., Adim, M. F., Rezki, M., & Edwin Jenuar, I. G. B. (2023). Efektivitas Implementasi Monitoring Intensif Pemanfaatan Antrean Online melalui Mobile JKN di Fasilitas Kesehatan Rujukan Tingkat Lanjutan (FKRTL) Champion Kantor Cabang Bulukumba Tahun 2022. *Jurnal Jaminan Kesehatan Nasional*, 3(1), 116–129. <https://doi.org/10.53756/jjkn.v3i1.140>
- Wahyuni, M. M. D., Yuniatri, R., Abineno, D. A., Batukh, A. Y., Yusuf, D. B., Tabun, K., Manu, N. M., Oematan, P. N., & Setiawan, T. K. P. (2026). Peningkatan Kesadaran dan Pemanfaatan Aplikasi Mobile JKN Melalui Edukasi Masyarakat di Kota Kupang. *Jurnal Pengabdian Masyarakat Bangsa*, 3(11), 6295–6300. <https://doi.org/10.59837/jpmmba.v3i11.3290>
- Wulanadary, A., Sudarman, S., & Ikhsan, I. (2019). Inovasi BPJS Kesehatan Dalam Pemberian Layanan Kepada Masyarakat: Aplikasi Mobile JKN. *Jurnal Public Policy*, 5(2), 98. <https://doi.org/10.35308/jpp.v5i2.1119>



The Relationship Between Self-Efficacy and Dietary Adherence Among Patients with Diabetes Mellitus at Jemursari Islamic Hospital, Surabaya

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ABSTRACT

Individuals with diabetes mellitus frequently experience difficulties adhering to recommended dietary regimens, resulting in unstable blood glucose levels and an increased risk of further complications. One significant factor influencing dietary adherence is self-efficacy, or patients' belief in their own ability to manage their diet. This paper investigates the relationship between self-efficacy and dietary adherence in outpatients with diabetes mellitus. This study employed a correlational analytical design with a cross-sectional approach. The population comprised 170 outpatients with type 1 and type 2 diabetes mellitus registered at the endocrine outpatient clinic of Jemursari Islamic Hospital, Surabaya. The sample consisted of 119 respondents, using simple random sampling. The instruments were the Diabetes Management Self-Efficacy Scale (DMSES) questionnaire to measure self-efficacy and the Dietary Behavior Questionnaire (DBQ) to assess dietary adherence. Data were analyzed using Spearman's Rank correlation test. The results indicated that half of the respondents (64; 50.4%) had low self-efficacy, and nearly half (55; 46.2%) had moderate diet adherence. Statistical analysis revealed a significant positive relationship between self-efficacy and dietary adherence in outpatients with diabetes mellitus ($p = 0.000$), with a strong correlation coefficient of 0.851. In conclusion, self-efficacy is associated with dietary adherence among outpatients with diabetes mellitus. The higher the self-efficacy, the greater the dietary adherence to the diabetes mellitus diet. Healthcare professionals should emphasize simple and repetitive educational approaches, particularly targeting older adult patients with low to moderate educational levels, to enhance patients' confidence in consistently and independently adhering to Diabetes dietary regimens.

INTRODUCTION

Diabetes Mellitus (DM) is a chronic metabolic disorder that requires lifelong management, including strict adherence to dietary recommendations (Pradita et al., 2025). Poorly controlled diabetes may lead to various complications, including microvascular and macrovascular disorders, which significantly increase morbidity and mortality rates (Susanti & Bistara, 2024). Therefore, effective diabetes management is essential to prevent disease progression and improve patients' quality of life (Nooseisai et al., 2021).

One of the key components of diabetes management is dietary regulation through the implementation of the 3J dietary principles, namely Quantity, Type, and Schedule of food intake (Bistara et al., 2026). Appropriate dietary management helps maintain stable blood glucose levels, reduce glycemic fluctuations, and prevent diabetes-related complications. Consuming the recommended caloric intake can prevent excessive glucose accumulation, while selecting appropriate food types, particularly complex carbohydrates, helps slow glucose absorption and minimize postprandial hyperglycemia. In addition, maintaining regular meal schedules contributes to better glycemic control (Giajati & Kusumaningrum,

2020). However, maintaining adherence to dietary recommendations remains a major challenge for many patients with diabetes.

The prevalence of diabetes continues to increase globally. According to the World Health Organization (WHO), the prevalence of diabetes increased by approximately 3% between 2000 and 2019 (Organization, 2025). Furthermore, the International Diabetes Federation (IDF) reported that approximately 463 million adults aged 20–79 years were living with diabetes worldwide in 2021 (Cahyaningrum, 2023). In Indonesia, Surabaya recorded the highest number of diabetes cases in East Java, increasing from 102,599 cases in 2017 to 115,460 cases in 2018 (Hasina et al., 2022). This increasing prevalence highlights the importance of improving self-management behaviors among patients with diabetes, particularly dietary adherence.

Previous studies have shown that dietary non-adherence remains a significant problem among patients with diabetes. Approximately 80% of patients with diabetes mellitus in Wonokromo District were reported to have inappropriate caloric intake (Manuel, 2016). Poor dietary adherence may result in unstable blood glucose levels, increased risk of complications, frequent hospital visits, and reduced quality of life. Several factors contribute to dietary non-adherence, including inadequate knowledge, lack of family support, social influences, and psychological factors such as stress, anxiety, and depression (Djaelan et al., 2022).

Among these factors, self-efficacy has been identified as one of the most important psychological determinants of successful diabetes self-management. Self-efficacy refers to an individual's belief in their ability to perform behaviors necessary to achieve desired outcomes. Patients with high self-efficacy are generally more motivated, persistent, and committed to maintaining healthy behaviors, including adhering to dietary recommendations, monitoring blood glucose levels, engaging in physical activity, and complying with treatment plans (Ting et al., 2025). Conversely, patients with low self-efficacy often experience difficulties maintaining consistent self-care behaviors.

According to the Indonesian Endocrinology Association (PERKENI), diabetes management consists of five major pillars: education, medical nutrition therapy, physical activity, pharmacological therapy, and blood glucose monitoring (PERKENI, 2021). Among these pillars, dietary management plays a central role because it directly influences glycemic control. Effective implementation of dietary recommendations requires not only knowledge but also confidence in one's ability to consistently manage eating behaviors. Consequently, self-efficacy may serve as an important predictor of dietary adherence among patients with diabetes mellitus.

Medical record data from Jemursari Islamic Hospital, Surabaya, showed a substantial increase in the number of patients diagnosed with diabetes mellitus, from 2,176 cases in 2017 to 4,910 cases in 2024.

Preliminary observations conducted at the hospital indicated that many patients still experienced difficulties adhering to dietary recommendations, while several patients reported low confidence in their ability to regulate their dietary intake consistently. These findings suggest that self-efficacy may play a crucial role in influencing dietary adherence among patients with diabetes mellitus.

Several previous studies have reported a significant relationship between self-efficacy and diabetes self-management behaviors, including dietary practices (Alharbi et al., 2023). However, limited studies have specifically examined the relationship between self-efficacy and dietary adherence among patients with diabetes mellitus in the Indonesian context, particularly in hospital-based settings. In addition, variations in socio-demographic characteristics, healthcare access, and local cultural factors may influence both self-efficacy and dietary adherence, making further investigation necessary.

Therefore, this study aimed to examine the relationship between self-efficacy and dietary adherence among patients with diabetes mellitus at Jemursari Islamic Hospital, Surabaya. Understanding this relationship is expected to provide evidence for developing interventions that strengthen patients' self-efficacy and improve adherence to dietary recommendations, ultimately contributing to better diabetes management outcomes.

METHOD

Study Design

This study employed an analytical correlational design with a cross-sectional approach to examine the relationship between self-efficacy and dietary adherence among patients with diabetes mellitus. Self-efficacy was treated as the independent variable, while dietary adherence served as the dependent variable. The study aimed to determine the association between patients' self-efficacy and adherence to the 3J dietary principles, namely Quantity, Type, and Schedule of food intake. Data on both variables were collected simultaneously at a single point in time without any intervention from the researchers.

Setting and Participants

The study was conducted at the Endocrine Outpatient Clinic of Jemursari Islamic Hospital, Surabaya. The target population consisted of all patients diagnosed with type 1 and type 2 diabetes mellitus who attended the clinic between August and October 2024. The total population comprised 170 patients. The required sample size was calculated using the Slovin formula with a margin of error of 5% ($\alpha = 0.05$), resulting in a minimum sample size of 119 respondents. Participants were selected using a simple random sampling technique, ensuring that each eligible member of the population had an equal probability of being included in the study.

Inclusion Criteria

Participants were eligible for inclusion if they:

1. Were diagnosed with type 1 or type 2 diabetes mellitus.
2. Were registered as outpatients at Jemursari Islamic Hospital, Surabaya.
3. Were aged 18 years or older.
4. Were able to communicate effectively and complete the questionnaire independently or with assistance.
5. Agreed to participate in the study by providing informed consent.

Exclusion Criteria

Participants were excluded if they:

1. Experienced severe cognitive impairment or communication difficulties.
2. Had incomplete questionnaire responses.
3. Withdrew from the study before completing data collection.

Research Instruments

Data were collected using two standardized questionnaires.

1. Diabetes Management Self-Efficacy Scale (DMSES)

Self-efficacy was measured using the Diabetes Management Self-Efficacy Scale (DMSES), adapted by Kurnia (2018). The instrument consists of 20 items assessed using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores indicate greater confidence in performing diabetes self-management behaviors.

2. Dietary Behavior Questionnaire (DBQ)

Dietary adherence was assessed using the Dietary Behavior Questionnaire (DBQ) developed by Primanda et al. (2011). The questionnaire consists of 16 items evaluating dietary behaviors related to calorie regulation, healthy food selection, meal scheduling, and challenges associated with dietary management. Higher scores reflect better adherence to dietary recommendations.

Both instruments had undergone validity and reliability testing prior to their use in this study.

Data Collection Procedures

Data collection was conducted after obtaining ethical approval from the relevant ethics committee. Eligible participants were approached during their outpatient visits and were provided with information regarding the study objectives, procedures, risks, and benefits. Written informed consent was obtained before participation. Questionnaires were distributed directly to respondents. Participants who experienced difficulties reading or understanding the questionnaire items received assistance from the researchers through standardized guidance without influencing their responses. Completed questionnaires

were reviewed for completeness before data entry. Data processing involved several stages, including editing, coding, scoring, data entry, data cleaning, and tabulation. All data were entered and analyzed using IBM SPSS Statistics version 25.0 for Windows.

Data Analysis

Descriptive statistics were used to summarize respondents' demographic characteristics, self-efficacy levels, and dietary adherence. Frequency distributions, percentages, means, and standard deviations were calculated as appropriate. Inferential analysis was performed using Spearman's rank-order correlation test because the study variables were measured on an ordinal scale and did not meet the assumption of normal distribution. The test was used to determine the strength and direction of the relationship between self-efficacy and dietary adherence among patients with diabetes mellitus. Statistical significance was established at a p-value of less than 0.05 ($p < 0.05$).

Ethical Considerations

This study received ethical approval from the Health Research Ethics Committee of Jemursari Islamic Hospital, Surabaya, under approval number 013/KEPK-RSISJS/II/2025. All research procedures were conducted in accordance with ethical principles, including respect for autonomy, confidentiality, anonymity, beneficence, and non-maleficence. Participation was voluntary, and respondents had the right to withdraw from the study at any stage without any consequences for their medical care.

RESULT

Almost half of the respondents were in the late elderly group, as many as 48 people (40.3%); followed by the elderly group, as many as 33 people (27.7%); early elderly, as many as 26 people (21.8%); and late adult, as many as 12 people (10.1%). By sex, most were female (64 people, 53.8%), while 55 were male (46.2%). In terms of education levels, most had moderate education (74 people, 62.2%), followed by basic (35 people, 29.4%) and high (10 people, 8.4%). Furthermore, most had suffered from diabetes for less than 5 years, namely 109 people (91.6%), and the remaining 10 people (8.4%) had suffered for 5 years and more (Table 1).

Table 1. Demographic characteristics Among Patients with Diabetes Mellitus at RSI Jemursari Surabaya

Variable	Total (n)	Percentage (%)
Respondent Characteristics		
Age		
36 – 45 years old	12	10,1
46 – 55 years old	26	21,8
56 – 65 years old	33	27,7
>65 years old	48	40,3
Gender		
Man	55	46,2
Woman	64	53,8
Level of education		

Elementary (Elementary – Middle School)	35	29,4
Middle School (High school)	74	62,2
High (Bachelor's)	10	8,4
Long Suffering		
< 5 years	109	91,6
> 5 years	10	8,4

Half of the respondents had low self-efficacy, totaling 64 respondents (50.4%). Furthermore, nearly half of the respondents (31, 26.1%) had a moderate level of self-efficacy, and a small proportion (24, 20.2%) had a high level of self-efficacy (Table 2).

Table 2. Self Efficacy Among Patients with Diabetes Mellitus at RSI Jemursari Surabaya

Self efficacy	Frequency	Percentage (%)
High	20	16,8
Moderate	39	32,8
Low	60	50,4
Total	119	100

Nearly half of the respondents (55; 46.2%) had moderate diet adherence, followed by 45 respondents (37.8%) with low adherence, while only 19 respondents (16.0%) had high adherence. These findings indicated that most respondents did not fully comply with the recommended diet for the management of diabetes mellitus (Table 3).

Table 3. Dietary Adherence Among Patients with Diabetes Mellitus at RSI Jemursari Surabaya

Dietary Adherence	Frequency	Percentage (%)
High	19	16
Moderate	55	46,2
Low	45	37,8
Total	119	100

Crosstabulation analysis showed that respondents with lower self-efficacy tended to have lower dietary adherence, while those with higher self-efficacy demonstrated better dietary adherence. Spearman Rank analysis revealed a significant positive relationship between self-efficacy and dietary adherence among patients with diabetes mellitus ($p < 0.001$; $r = 0.851$), indicating a very strong correlation. These findings suggest that higher self-efficacy is associated with greater adherence to dietary recommendations.

Table 4. Self-Efficacy and Diet Adherence Among Patients with Diabetes Mellitus at RSI Jemursari Surabaya

	Diet Adherence							
	High		Moderate		Low		Total	
Self efficacy	F	%	F	%	F	%	F	%
High	18	90.0	2	10.0	0	0.0	20	100
Moderate	1	2,6	38	97,4	0	0.0	39	100
Low	0	0,0	15	25.0	45	75.0	60	100
Total	19	16,0	55	46,2	45	37,8	119	100
Spearman's rank Correlation Coefficient (r) : 0,851 Significance (p) : 0,000								

DISCUSSION

Self-Efficacy Among Patients with Diabetes Mellitus

The present study found that most patients with diabetes mellitus demonstrated low levels of self-efficacy regarding dietary management. This finding suggests that many patients lacked confidence in their ability to consistently follow dietary recommendations and independently manage their condition. Self-efficacy is recognized as a key psychological determinant of diabetes self-management because it influences individuals' motivation, persistence, and confidence in performing health-related behaviors (Bandura, 2009).

Several respondent characteristics may explain the low level of self-efficacy observed in this study. First, a substantial proportion of respondents were older adults aged over 65 years. Previous studies have reported a negative relationship between age and self-efficacy among patients with type 2 diabetes mellitus, indicating that older individuals often experience lower confidence in managing their disease due to age-related declines in cognitive and physical functioning (Aseela et al., 2024). Reduced memory capacity, learning ability, and adaptability may limit patients' ability to implement complex self-management behaviors, including dietary regulation.

Gender may also contribute to variations in self-efficacy. More than half of the respondents in this study were female. Women often face multiple responsibilities related to household management, caregiving, and employment, which may increase psychological burden and reduce confidence in managing chronic illnesses. Consistent with Bandura's self-efficacy theory, emotional and physiological factors can influence an individual's perception of their capabilities. Qin et al. (2020) similarly reported lower self-efficacy among women with type 2 diabetes compared with men.

Educational attainment was another factor potentially associated with self-efficacy. Most respondents had low to moderate educational backgrounds. Higher educational levels are generally associated with better health literacy, greater access to health information, and improved understanding of disease management. Cui et al. (2019) reported that patients with higher educational attainment demonstrated better self-efficacy in managing diabetes-related behaviors, including dietary regulation, medication adherence, and physical activity. Therefore, limited educational attainment may restrict patients' ability to understand and apply diabetes self-management recommendations, thereby reducing self-efficacy.

Dietary Adherence Among Patients with Diabetes Mellitus

This study found that dietary adherence among patients with diabetes mellitus was predominantly moderate to low. Many respondents reported difficulties consistently following dietary recommendations, particularly regarding food selection, portion control, and adherence to dietary restrictions. These findings

indicate that dietary management remains a major challenge for patients with diabetes mellitus despite ongoing clinical monitoring.

Educational level may partially explain this finding. Although most respondents had completed secondary education, dietary adherence remained suboptimal. Rizqah & Basri (2018) suggested that education plays an important role in shaping health behaviors because individuals with higher educational attainment are generally better able to understand health information and apply disease-management recommendations. Health education significantly improved dietary adherence among patients with type 2 diabetes mellitus, highlighting the importance of knowledge acquisition in promoting adherence behaviors (Eshete et al., 2023; Fajriyah et al., 2024).

The duration of diabetes may also influence dietary adherence. Nearly half of the respondents had been diagnosed with diabetes for three to five years. Although a longer duration of illness theoretically provides greater opportunities to develop self-management skills and adapt to dietary restrictions, prolonged disease management may also lead to treatment fatigue. Treatment fatigue refers to the emotional and behavioral exhaustion associated with long-term disease management and may reduce patients' motivation to adhere to dietary recommendations consistently. This explanation is supported by Bistara et al. (2020), who reported that patients with long-standing diabetes may experience declining adherence without continuous educational and psychosocial support.

Relationship Between Self-Efficacy and Dietary Adherence

The findings revealed a statistically significant and strong positive relationship between self-efficacy and dietary adherence among patients with diabetes mellitus ($r = 0.851$, $p < 0.001$). This result indicates that patients with higher levels of self-efficacy were more likely to adhere to dietary recommendations than those with lower levels of self-efficacy.

This finding is consistent with Bandura's Social Cognitive Theory, which emphasizes that self-efficacy influences behavioral choices, effort, persistence, and resilience when facing challenges (Bandura, 2009). Individuals who believe in their ability to perform a specific behavior are more likely to initiate and maintain that behavior despite obstacles. In the context of diabetes management, patients with high self-efficacy are more confident in regulating food intake, controlling portion sizes, maintaining meal schedules, and resisting dietary temptations.

The findings are also consistent with previous studies. Jabbar (2024) reported a significant relationship between self-efficacy and dietary adherence among patients with diabetes mellitus in South Lampung Regency. Patients with low self-efficacy were more likely to exhibit poor adherence to diabetes treatment recommendations. Collectively, these findings suggest that self-efficacy is a critical factor influencing

adherence to self-management behaviors, including dietary regulation (Sayuti et al., 2024; Bistara, Wardani, et al., 2020).

Furthermore, educational attainment may indirectly strengthen the relationship between self-efficacy and dietary adherence. Patients with higher educational levels generally possess better health literacy, allowing them to understand diabetes management recommendations more effectively and develop greater confidence in implementing them. Ramadhani (2024) demonstrated that patients with adequate knowledge of diabetes management were more likely to adhere to dietary recommendations. Consequently, insufficient knowledge resulting from limited educational attainment may contribute to both lower self-efficacy and poorer dietary adherence.

Implications for Nursing Practice

The strong association between self-efficacy and dietary adherence identified in this study highlights the importance of incorporating self-efficacy enhancement strategies into diabetes care programs. Nurses should provide individualized education, motivational counseling, goal-setting interventions, and continuous support to strengthen patients' confidence in managing their dietary behaviors. Particular attention should be given to older adults, female patients, and individuals with lower educational backgrounds, as these groups may be at greater risk of low self-efficacy and poor dietary adherence. Strengthening self-efficacy may ultimately improve dietary adherence, glycemic control, and overall diabetes management outcomes.

CONCLUSION

Self-efficacy is associated with dietary adherence among outpatients with diabetes mellitus. The higher the self-efficacy, the greater the dietary adherence to the diabetes mellitus diet. Healthcare professionals should emphasize simple and repetitive educational approaches, particularly targeting older adult patients with low to moderate educational levels, to enhance patients' confidence in consistently and independently adhering to Diabetes dietary regimens.

REFERENCES

- Alharbi, T. A. F., Alhumaidi, B., Alharbi, M. N., Ngo, A. D., Alasqah, I., Alharbi, H. F., & Albagawi, B. (2023). Diabetes education self-management intervention in improving self-efficacy for people with type 2 diabetes in the Gulf Cooperation Council countries: A systematic review. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 102906.
- Aseela, S., Santhi, S., Anish, T. S., & Mahadevan, S. (2024). Diabetes Self-Efficacy on Glycemic Control and Well-Being of Patients With Type 2 Diabetes Mellitus: An Analytical Cross-Sectional Study. *Cureus*, 16(7).
- Bandura, A. (2009). Exercise of personal and collective efficacy in changing societies. In *Self-Efficacy in*

Changing Societies. Cambridge University Press.

- Bistara, D. N., Rusdianingseh, R., Susanti, S., Wardani, E. M., Septianingrum, Y., Ainiyah, N., Fitriasari, A., Noventi, I., & Hasina, S. N. (2020). Acceptance and commitment therapy (Act) on increasing the compliance of management diabetes mellitus type 2. *International Journal of Psychosocial Rehabilitation*, 24(9). <https://doi.org/10.37200/IJPR/V24I9/PR290115>
- Bistara, D. N., Wardani, E. M., Septianingrum, Y., Ainiyah, N., Fitriasari, A., Noventi, I., & HASINA, S. N. U. R. (2020). Acceptance and commitment therapy (ACT) on increasing the compliance of management diabetes mellitus type 2. *International Journal of Psychosocial Rehabilitation*, 24(9), 942–946.
- Bistara, D. N., Zahroh, C., Rohmawati, R., & Gusmantara, P. (2026). Self-Efficacy and Adherence as Predictors of Quality of Life in Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study at Jemursari Islamic Hospital, Surabaya. *Journal of Health Sciences*, 19(01), 1–11.
- Cahyaningrum, N. (2023). Hubungan pola makan 3J dan perilaku sedentari dengan status kadar gula darah pasien DM tipe 2 (studi kasus di Puskesmas Mulyoharjo). *Nutrizione: Nutrition Research And Development Journal*, 3(1), 12–22.
- Cui, X., Zhou, X., Ma, L., Sun, T.-W., Bishop, L., Gardiner, F., & Wang, L. (2019). A nurse-led structured education program improves self-management skills and reduces hospital readmissions in patients with chronic heart failure: a randomized and controlled trial in China. *Rural and Remote Health*, 19(2), 5270. <https://doi.org/10.22605/RRH5270>
- Djaelan, S., Lumadi, S. A., & Prastiwi, E. D. (2022). *Self Efficacy Berhubungan Dengan Kepatuhan Minum Obat Dan Pola Diet Pada Penderita Diabetes Mellitus Tipe 2*.
- Eshete, A., Lambebo, A., Mohammed, S., Shewasinad, S., & Assefa, Y. (2023). Effect of nutritional promotion intervention on dietary adherence among type II diabetes patients in North Shoa Zone Amhara Region: quasi-experimental study. *Journal of Health, Population and Nutrition*, 42(1), 49.
- Fajriyah, N., Susanti, S., & Kristiani, R. B. (2024). *Buku Ajar Keperawatan Dewasa:" Manajemen Diabetes Melitus Tipe 2 Berdasarkan Evidence–Based Practice"*.
- Giajati, S. A., & Kusumaningrum, N. S. D. (2020). Konsumsi Gizi Pada Penyandang Diabetes Mellitus Di Masyarakat. *Journal of Nutrition College*, 9(1), 38–43.
- Hasina, S. N., Shodiq, M., Ikwan, M., Putri, R. A., Noventi, I., & Masithah, D. (2022). Pengaruh Edukasi Kesehatan Terapi Buerger Allen Exercise Terhadap Pengetahuan Penderita Diabetes Mellitus Dalam Upaya Menurunkan Resiko Gangguan Perfusi Jaringan Perifer. *Jurnal Ilmiah Permas: Jurnal Ilmiah STIKES Kendal*, 12(4), 871–876.
- Jabbar, A. A. (2024). Hubungan Efikasi Diri dengan Kepatuhan Diit Penderita DM di Wilayah Kerja UPTD Puskesmas Sidomulyo Kabupaten Lampung Selatan. *Media Husada Journal Of Nursing Science*, 5(1), 10–16.
- Kurnia, A. (2018). Validitas dan reliabilitas kuesioner diabetes management self efficacy scale (DMSES). *Journals of Ners Community*, 9(02), 156–160.
- Manuel, C. L. (2016). Gambaran Asupan Kalori pada Klien Diabetes Mellitus Tipe 2 di RW 05 Kelurahan Sawunggaling Kecamatan Wonokromo Surabaya. *Jurnal Keperawatan*, 5(2), 101–105.
- Nooseisai, M., Viwattanakulvanid, P., Kumar, R., Viriyautsakul, N., Baloch, G. M., & Somrongthong, R. (2021). Effects of diabetes self-management education program on lowering blood glucose level, stress, and quality of life among females with type 2 diabetes mellitus in Thailand. *Primary*

Health Care Research & Development, 22, e46.

- Organization, W. H. (2025). *Regional Commemoration of World Diabetes Day 2024, 21–22 November 2024, Colombo, Sri Lanka*. World Health Organization. Regional Office for South-East Asia.
- PERKENI, P. E. I. (2021). *Pedoman Pengelolaan dan Pencegahan Diabetes Melitus Tipe 2 Dewasa di Indonesia 2021*. PB. PERKENI.
- Pradita, N. A., Bistara, D. N., Umamah, F., & Wardani, E. M. (2025). The Relationship between Diabetes Self-Management and Diabetes Distress in Type 2 Diabetes Mellitus Patients at Jemursari Islamic Hospital, Surabaya. *Nurse and Holistic Care*, 5(3), 299–307.
- Primanda, Y., Kritpracha, C., & Thaniwattananon, P. (2011). Dietary behaviors among patients with Type 2 diabetes mellitus in Yogyakarta, Indonesia. *Nurse Media Journal of Nursing*, 1(2), 211–223.
- Qin, W., Blanchette, J. E., & Yoon, M. (2020). Self-efficacy and diabetes self-management in middle-aged and older adults in the United States: a systematic review. *Diabetes Spectrum*, 33(4), 315–323.
- Ramadhani, A. (2024). Overview of educational level, nutritional knowledge, and dietary adherence among patients with type 2 diabetes mellitus. *Arsip Keilmuan Gizi (AKG)*, 1(2), 68–75.
- Rizqah, S. F., & Basri, H. M. (2018). Hubungan efikasi diri dengan kepatuhan diet 3j pada pasien diabetes melitus di Puskesmas Mandai Kabupaten Maros. *Diagnosis Jurnal Ilmiah Kesehatan*, 13(5), 586–591.
- Sayuti, E., Malini, H., & Lenggogeni, D. P. (2024). The impact of structured education on knowledge and self-efficacy in type 2 diabetes mellitus patients. *Healthcare in Low-Resource Settings*, 12(1).
- Susanti, S., & Bistara, D. N. (2024). The Impact of Foot Solus per Aqua (SPA) on Blood Sugar Levels and Parasthesia Sensitivity in Patients with Diabetes Mellitus Type 2. *Jurnal Keperawatan Respati Yogyakarta*, 11(2).
- Ting, Z., Huicai, W., Kudelati, Z., Yongkang, G., Alimu, A., Xiaotian, Z., Xingge, Q., & Tong, L. (2025). Exploring the dynamics of self-efficacy, resilience, and self-management on quality of life in type 2 diabetes patients: A moderated mediation approach from a positive psychology perspective. *PloS One*, 20(1), e0317753.



A Correlational Study: Fast Food Consumption Patterns And Menstrual Cycle Regularity In Adolescent Girls

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ABSTRACT

Adolescence is an important period of development marked by the maturation of the reproductive system and the onset of menstruation. A regular menstrual cycle becomes an indicator of a healthy reproductive system. However, a preliminary study showed that 68.4% female students experienced menstrual disorders. One suspected factor influencing the condition is fast-food consumption. This paper examines the relationship between fast-food consumption patterns and menstrual cycle regularity among adolescent girls. This paper was a correlational study. It used a cross-sectional research approach. It was conducted at MA Al-Munawwaroh, Kembangbahu, Lamongan, during January-March 2026. The population consisted of all female students at MA Al-Munawwaroh, totaling 45. The sample included 45 female students using a total sampling technique. The instruments were a menstrual cycle regularity checklist and a Food Frequency Questionnaire (FFQ). Data analysis used the test Chi-Square with $\alpha=0.05$. Most respondents had high fast-food consumption patterns (71.1%), and almost half had low fast-food consumption (28.9%). In addition, half of the respondents had irregular menstrual cycles (53.3%), and almost half had regular menstrual cycles (46.7%). The Chi-Square test yielded $p = 0.000$, indicating a relationship between fast-food consumption patterns and menstrual cycle regularity among adolescent girls. In conclusion, fast-food consumption patterns correlate with menstrual cycle regularity among adolescent girls. Adolescent girls should increase awareness of adopting a healthy, balanced diet and limit fast-food consumption to help balance hormone levels, so that menstrual cycles become regular and the reproductive system remains healthy.

INTRODUCTION

Adolescence is a transitional period from childhood to adulthood, marked by many changes in physical, psychological, and hormonal development. During this period, teenagers need a balanced diet to support growth and maintain health. However, in reality, the need for nutrition is often not balanced. Changing style of life, influencing the environment, as well as easy access to (fast food), make teenagers more often choose food that is practical, high in fat, sugar, and salt. In addition, social media shows various viral foods, which also encourage teenagers to follow trends out of curiosity and fear of being left behind, thereby increasing the habit of consuming unhealthy food. It can cause weight gain, obesity, and metabolic disturbances, which can affect hormone balance, including reproductive hormones. Disrupted reproductive hormones can lead to irregular menstrual cycles. Menstruation becomes longer, shorter, or irregular.

WHO data showed that 75% of adolescent girls experienced disturbances in their menstrual cycle (Efendi, Lestari, and Basit, 2024). Meanwhile, 11.7% of adolescent girls in Indonesia were reported to have experienced irregular menstruation. This number tended to be higher among teenagers living in

urban areas, namely by 14.9%. Data from East Java in 2023 showed that 13.3% of women experienced irregular menstrual cycles (Septiana, 2024). Research by Martini et al (2022) at Pondok Islamic boarding school Assalafi Nurul Huda Lamongan also reported that 66% of teenage daughters experienced irregular menstrual cycles, consisting of from 30% of cases polymenorrhea and 70% of cases oligomenorrhea (Martini et al., 2022).

A preliminary study conducted at MA Al Munawwaroh Lamongan through interviews showed that 13 of 19 female students (68.4%) experienced menstrual disorders, while 6 students (31.6%) did not experience menstrual disorders. Sixteen of the 19 female students (84.2%) stated that they often consumed fast food such as *seblak*, fried noodles, various fried foods, burgers, and donuts, as well as drink sweetened beverages such as soft drinks. In contrast, 3 other female students (15.8%) stated that they more often bring food from home. The reasons students chose fast food included not liking the food prepared at home, preferring the taste of food sold in the school canteen, or because parents rarely cook at home. Some mentioned that there were many fast-food options in the school environment, so they often ate them.

Factors that can influence the menstrual cycle include genetics, age, lifestyle (including diet and activities), physical factors, sleep patterns, stress levels, nutritional status and habits (including smoking or alcohol consumption), environment, and socioeconomic status. An unhealthy diet is one of the lifestyle factors that can contribute to disturbances in the menstrual cycle. One example of a pattern that eats no healthy food is the habit of frequent fast-food consumption. Fast food is high in fat, sodium, and sugar, but low in fiber and vitamins. The nutritional content of fast food is unbalanced; if consumed in excess, it can lead to nutritional deficiencies and increase the risk of diseases, such as obesity, skin disorders, degenerative diseases, and menstrual cycle disorders (Suryatno et al., 2023).

Excessive consumption of fast food can negatively affect the regularity of the menstrual cycle in teenagers because fast food is usually high in saturated fat, sugar, and sodium but low in nutrients essential to the body, such as fiber, vitamins, and minerals. It affects hormonal regulation, especially of estrogen and progesterone, as well as the hypothalamus-pituitary-ovarian axis, which plays an important role in menstrual cycle regulation. As a result, teenagers potentially experience irregular menstrual cycles until amenorrhea. In addition, trans fats can improve leptin and estrogen levels. Excess leptin can disrupt hypothalamic function by inhibiting the release of gonadotropin-releasing hormone (GnRH), which is important for ovulation. High sugar content can also cause insulin resistance, which affects the balance of the hormones luteinizing hormone (LH) and follicle-stimulating hormone (FSH), both of which play a role in the menstrual cycle. Moreover, excess sodium can increase systemic oxidative and inflammatory stress, thereby affecting hormonal stability during reproduction. Thus, all can cause disturbances in menstruation disorders, such as irregular menstruation cycle, menorrhagia, or amenorrhea (Wardani,

2023). This paper examines the correlation between fast-food consumption patterns and menstrual cycle regularity among adolescent girls.

METHOD

This paper was a correlational study. It used a cross-sectional research approach. It was conducted at MA Al-Munawwaroh, Kembangbahu, Lamongan, during January-March 2026. The population consisted of all female students at MA Al-Munawwaroh, totaling 45. All of them are female students from 3 classes: grades 10, 11, and 12. The sample included 45 female students using a total sampling technique. The independent variable in the study was fast-food consumption patterns. The dependent variable was menstrual cycle regularity. The instruments were a menstrual cycle regularity checklist and a Food Frequency Questionnaire (FFQ). FFQ was used to describe respondents' eating patterns over the past month. Data analysis used the test Chi-Square with $\alpha=0.05$. Research. It has passed ethical clearance from the Committee for Ethics in Health Research of Universitas Nahdlatul Ulama Surabaya, with the certificate number 0028/EC/KEPK/UNUSA/2026.

RESULT

Most respondents were late adolescents (62.2%), and almost half were middle adolescents (37.8%). In addition, almost half of the respondents were obese (33.3%), and a small proportion were normal (24.4%), underweight (22.2%), and overweight (20%) (Table 1).

Table.1 The Characteristics of Respondents Based on Age and Body Mass Index

The Characteristics of Respondents	Frequency	Percentage (%)
Age		
Early adolescence	0	0
Middle adolescence	17	37.8
Late adolescence	28	62.2
Body Mass Index (BMI)		
Underweight	10	22.2
Normal	11	24.4
Overweight	9	20.0
Obesity	15	33.3
Total	45	100

Most respondents had high fast-food consumption patterns (71.1%), and almost half had low fast-food consumption (28.9%). In addition, half of the respondents had irregular menstrual cycles (53.3%), and almost half had regular menstrual cycles (46.7%) (Table 2).

Table 2. Fast Food Consumption Patterns and Menstrual Cycle Regularity among Adolescent Girls

Variables	Frequency	Percentage (%)
Fast Food Consumption Patterns		
Low	13	28.9
High	32	71.1
Menstrual Cycle Regularity		
Regular	21	46.7
Irregular	24	53.3
Total	45	100

Half of the respondents with high fast food consumption patterns had irregular menstrual cycles (75.0%). In contrast, almost half of the respondents with low fast-food consumption patterns had regular menstrual cycles (28.9%). The Chi-Square test obtained $p = 0.000$, indicating that H_0 is rejected and H_1 is accepted. Thus, there was a relationship between fast-food consumption patterns and menstrual cycle regularity among adolescent girls.

Table 3. Cross Tabulation Relationship between Fast Food Consumption Patterns and Menstrual Cycle Regularity and Statistical Analysis

Fast Food Consumption Patterns	Menstrual Cycle Regularity				Total	
	Regular		Irregular		n	%
	n	%	N	%		
Low	13	28.9	0	0	13	28.9
High	8	17.8	24	53.3	32	71.1
Total	21	46.7	24	53.3	45	100
Chi-Square Test $p = 0.000$						

DISCUSSION

Fast Food Consumption Patterns in Adolescent Girls

The findings showed that most respondents had high fast-food consumption patterns (71.1%) (Table 1). In the modern era, fast food has already become a common food among the public, particularly teenagers. There are many types of fast food currently sold, which are very easy for teenagers to consume. In addition, fast food is easy to find anywhere and can be consumed in any condition. Adolescents can easily find fast food in the school canteen. Moreover, fast and easy delivery technology has made it easier for teenagers to buy fast food, even outside of school. Television advertisements or social media also influence fast-food consumption among teenagers. They tend to suffer from FOMO (Fear Of Missing Out) and follow viral food trends on social media, most of which are fast foods high in salt, sugar, and fat. Fast food is a type of food with low nutritional value that is served quickly. It has become an alternative for some people because it is considered more efficient and practical to consume. In one portion of fast food, 45% of the total calories come from saturated fat. The high-calorie, saturated-fat content of fast food is due to its being generally processed using deep-frying. The method often requires a lot of oil, high temperatures, and the use of recycled oil, which can promote the formation and oxidation of trans fatty acids. In addition, the sodium content of fast food ranges from 200 to 480 mg, which is about 30% of

daily sodium requirements, and is met by one portion of fast food (Anggraini, Herviana, and Rizma, 2025).

Excessive consumption of fast food is harmful to a teenager's health. It can lead to fat accumulation and contribute to obesity (Anisa, Lestari, and Amaliyah, 2024). This investigation found that almost half of the respondents were obese (Table 1). The Authors argue that fast food is high in fat and calories, so if consumed excessively and not balanced with sufficient physical activity, it can lead to excessive weight gain. Obesity is a complex condition characterized by excessive accumulation of body fat, resulting from an imbalance between energy intake and expenditure. Fast food usually contains high calories, saturated fat, added sugar, and excessive sodium, as well as low fiber and nutrients, which makes it one of the main contributors to weight gain when consumed excessively. Physiologically, excess calories from fast food that are not burned become energy and are stored as body fat. It can cause increased BMI and risk of obesity, especially in teenagers who are at the stage of active development (Vera Vera, 2025). It is supported by research conducted by Septiana (2024), which found a significant correlation between the frequency of fast-food consumption and the incidence of obesity.

Menstrual Cycle Regularity in Adolescent Girls

This research indicated that half of the respondents had irregular menstrual cycles (53.3%) (Table 2). It is likely related to an imbalance in reproductive hormones, estrogen and progesterone, caused by a lack of a healthy lifestyle. Imbalanced hormones can interfere with the ovulation process, causing irregular menstrual cycles. Therefore, it is important to maintain a balanced hormone level through a healthy lifestyle to support regular menstrual cycles.

Teenagers tend to experience menarche that has not occurred regularly, with cycles shorter than 21 days or longer than 35 days. With increasing time since menarche, menstrual cycles in teenagers become more stable and regular. In addition, the age of menarche also influences the characteristics of the menstrual cycle. Teenagers who experienced menarche at a young age were more likely to have shorter, irregular menstrual cycles and dysmenorrhea compared to adolescents who experienced menarche at a later age (Harley et al., 2024).

The menstrual cycle is the time from the first day of menstruation until the next menstrual period begins. In contrast, the length of the menstrual cycle is the interval between the start date of the previous menstruation and the start date of the next menstruation. Normal menstrual cycles range from 21 to 35 days. But menstrual cycles are often irregular and tend to vary during adolescence. A hormonal imbalance causes an irregular menstrual cycle. There are fluctuations in estrogen and progesterone levels on the hypothalamic-pituitary-ovarian axis, which can disrupt ovulation (the release of eggs) and trigger disturbances in the menstrual cycle (Habibah, Putriana, and Hidayati, 2024).

The Correlation between Fast Food Consumption Patterns and Menstrual Cycle Regularity in Adolescent Girls

This investigation showed there was a relationship between fast-food consumption patterns and menstrual cycle regularity among adolescent girls (Table 3). It aligns with research by Sulistya *et al.* (2023), which found a correlation between consuming junk food and an irregular menstrual cycle. It is also supported by research by Suryatno *et al.* (2023) Suryatno *et al.* (2023), which found a relationship between fast-food consumption patterns and menstrual cycle regularity.

Individuals who frequently consume fast food produce more estrogen. It was not only produced by the graft follicles but also produced by the glands adiopsa. The cell produces androgens and responds to Luteinizing hormone (LH) by increasing the number of receptors. Low-density lipoprotein (LDL) also plays a role in cholesterol uptake into cells. LH also stimulates the activity of specific proteins, thereby increasing androgen production. When androgen diffuses into granulosa cells and adipose tissue (fat), it undergoes aromatase-mediated metabolism into estrogen (Pang *et al.*, 2014).

The higher an individual's fat intake, the higher their estrogen levels will be. Estrogen levels should be down as a consequence of a degraded corpus luteum. Still, because excessive estrogen levels are high, the corpus luteum has to work hard too for degradation, so that causes a decline in estrogen levels, which slows down the menstrual process, causing degeneration, bleeding, and detachment from the endometrium, or the menstrual process slows down, so that the cycle becomes longer (oligomenorrhea). In addition, increased estrogen levels will cause the ovaries to stop releasing egg cells. The hormone estrogen also causes thickening of the uterine wall, which can result in disturbances in the menstrual cycle, such as long menstruation or irregular periods, and, when periods do come, the duration of her period will be longer (Naz, Dovom, and Tehrani, 2020).

CONCLUSION

Fast-food consumption patterns correlate with menstrual cycle regularity among adolescent girls. Adolescent girls should increase awareness of adopting a healthy, balanced diet and limit fast-food consumption to help balance hormone levels, so that menstrual cycles become regular and the reproductive system remains healthy.

Seblak (n): a popular Indonesian street food from Bandung, West Java, known for its fiery, savory, and aromatic broth. Its signature feature is chewy, wet crackers (tapioca) cooked in a spicy sauce alongside proteins like eggs, chicken, and meatballs, heavily flavored with aromatic ginger.

REFERENCES

Anggraini, C. D., Herviana, H., & Rizma, A. (2025). Pengetahuan dan frekuensi konsumsi fast food pada kelompok usia dewasa muda di Kepulauan Riau. *Nutrition Scientific Journal*, 3(2), 81–88.

<https://doi.org/10.37058/nsj.v3i2.13953>

- Anisa, W. N., Lestari, P., & Amaliyah, E. (2024). Hubungan Obesitas Dengan Gangguan Siklus Pagedangan Kabupaten Tangerang Tahun 2024. *Jurnal Riset Ilmu Kesehatan*, 17–24.
- Efendi, B. P., Lestari, Y. P., & Basit, M. (2024). Tingkat Stres dan Kualitas Tidur yang Mempengaruhi Siklus Menstruasi pada Remaja Putri. *Jurnal Keperawatan Jiwa*, 12(3), 667. <https://doi.org/10.26714/jkj.12.3.2024.667-676>
- Habibah, I. H., Putriana, D., & Hidayati, R. W. (2024). Hubungan Kebiasaan Konsumsi Fast Food dengan Gangguan Siklus Menstruasi pada Remaja Putri. *JURNAL Riset GIZI*, 12(2), 208–216. <https://doi.org/10.31983/jrg.v12i2.11883>
- Harley, K. G., Watson, A., Robertson, S., Vitzthum, V. J., & Shea, A. (2024). Menstrual Cycle Characteristics of U. S. Adolescents According to Gynecologic Age and Age at Menarche. *Journal of Pediatric and Adolescent Gynecology*, 37(4), 419–425. <https://doi.org/10.1016/j.jpag.2024.03.005>
- Iva Sulistya, Anindya Hapsari, & Hartati Eko Wardani. (2023). Hubungan Status Gizi, Aktivitas Fisik Dan Konsumsi Junk Food Dengan Keteraturan Siklus Menstruasi Pada Remaja Putri Di SMP Negeri 2 Kota Malang. *Jurnal Medika Nusantara*, 1(4), 436–447. <https://doi.org/10.59680/medika.v1i4.644>
- Martini, D. E., Maghfuroh, L., Aisyah, H. S., & Sari, D. P. (2022). The Correlation of Body Mass Index and the onset of menarche with the menstrual cycle in young women at Pondok Assalafi Nurul Huda, Sugio District. *Jurnal Surya*, 14(2), 55–62. <https://doi.org/10.38040/js.v14i2.508>
- Naz, M. S. G., Dovom, M. R., & Tehrani, F. R. (2020). The Menstrual Disturbances in Endocrine Disorders: A Narrative Review. *International Journal of Endocrinology and Metabolism*, 18(4). <https://doi.org/10.5812/IJEM.106694>
- Pang, G., Xie, J., Chen, Q., & Hu, Z. (2014). Energy intake, metabolic homeostasis, and human health. *Food Science and Human Wellness*, 3(3–4), 89–103. <https://doi.org/10.1016/j.fshw.2015.01.001>
- Septiana, A. D. (2024). *Hubungan Obesitas dengan Siklus Menstruasi Pada Siswi SMPN 1 Ngoro Jombang*. INSTITUT TEKNOLOGI SAINS DAN KESEHATAN INSAN CENDEKIA MEDIKA JOMBANG.
- Suryatno, H., Ayu, I. G., Adhi, M., Ratu, S. O., Astuti, F., & Ilmi, N. (2023). Hubungan Pola Konsumsi Makanan Cepat Saji dengan Keteraturan Siklus Menstruasi pada Remaja Putri Kelas XI di SMAN 7 Mataram. *PRIMA: Jurnal Ilmiah Ilmu Kesehatan*, 9(2), 160–174. <https://doi.org/https://doi.org/10.47506/sbv88220>
- Vera Vera. (2025). Pengaruh Konsumsi Fast Food terhadap Obesitas pada Remaja. *Inovasi Kesehatan Global*, 2(2), 202–209. <https://doi.org/10.62383/ikg.v2i2.1664>
- Wardani, S. S. K. (2023). Hubungan Obesitas Dengan Keteraturan Siklus Menstruasi Pada Remaja. *Jurnal Anestesi*, 1(4), 293–304. <https://doi.org/10.59680/anestesi.v1i4.531>



Comparison of Nutrition Education using Emodemo and Leaflet Media on Knowledge and Attitudes among Mothers of children aged 6–24 months with Wasting

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ABSTRACT

Wasting is a growth disorder characterized by a mismatch between a child's weight and height or length. Mothers' knowledge and attitudes are indirect factors causing wasting. Various educational media have been used in community-based nutrition programs to deliver health messages to mothers. This study analyzes differences in mothers' knowledge and attitudes after nutrition education using Emotional Demonstration (Emodemo) and Leaflet media among mothers of children aged 6–24 months with wasting. This study employed a quasi-experimental design. was conducted in the working area of Banjar PHC, Indonesia. The study population consisted of mothers who had children aged 6–24 months diagnosed with wasting. The sample consisted of 36 respondents. The intervention consisted of two media types: leaflet- and Emotional Demonstration (Emodemo)-based nutrition education over four weeks. The instruments included a multiple-choice questionnaire to measure knowledge and a Likert-scale form to assess attitudes. Data were analyzed using the Mann-Whitney test. The results showed a significant difference in mothers' knowledge after nutrition education using Emodemo media than leaflet media ($p = 0.002$). However, no significant difference in mothers' attitudes after nutrition education using both media ($p = 0.062$). In conclusion, Interactive educational strategies, such as Emodemo, can be an effective way to increase mothers' knowledge in community nutrition programs. Nevertheless, changes in mothers' attitudes may require longer intervention periods, repeated educational exposure, and continuous behavioral support. Future research should conduct follow-up measurements several weeks or months later to assess retention and behavioral changes over time.

INTRODUCTION

Child wasting remains a major global public health problem affecting millions of children under five years of age. Children aged 6-24 months are particularly vulnerable to wasting because this period represents a critical stage of growth and development. During this stage, infants transition from exclusive breastfeeding to complementary feeding, which requires a diverse diet, adequate nutrient intake, and proper feeding practices. Inadequate complementary feeding practices during this critical period can significantly contribute to the development of acute malnutrition (UNICEF, WHO, and World Bank Group, 2025).

According to joint estimates from the World Health Organization (WHO), the United Nations Children's Fund (UNICEF), and the World Bank, the number of children with wasting was approximately 45 million children under 5 worldwide, representing 6-7% of the global child population (UNICEF, WHO, and World Bank Group, 2025). Wasting is characterized by low weight-for-height and reflects acute malnutrition resulting from inadequate dietary intake, disease, or both. Children with wasting have a significantly higher risk of mortality, impaired immune function, and delayed physical and cognitive development (UNICEF, WHO, and World Bank Group, 2025). In Indonesia, child wasting continues to be a significant

nutritional challenge despite improvements in several indicators of child health. Data from the Indonesian Nutritional Status Survey (SSGI) reported that the national prevalence of wasting ranged from approximately 6.1% to 7.7%, depending on regional conditions (Kementerian Kesehatan RI, 2025). Although this prevalence is slightly lower than previous estimates, the burden remains substantial, particularly in certain provinces and districts. Wasting prevalence in East Java Province was slightly above the national average, indicating that child malnutrition remained an important public health concern in this region (Hafifah & Baliwati, 2023). These findings highlight the need for effective interventions to improve child nutrition, especially among vulnerable groups.

Maternal knowledge and attitudes regarding nutrition play an essential role in determining child feeding practices and nutritional outcomes. Mothers with adequate knowledge of child nutrition are more likely to adopt appropriate feeding behaviors that support optimal growth and development (Achjar et al., 2023). Conversely, limited knowledge and unfavorable attitudes toward nutrition may lead to inappropriate feeding practices, such as irregular meal schedules, inadequate portion sizes, and poor dietary diversity (Majidah, Sulistiyawati, and Paramashanti, 2021). Behavioral theories also suggest that knowledge is a fundamental determinant influencing attitudes and practices related to health behaviors (Candrawati et al., 2023). Therefore, improving mothers' knowledge and practices related to child feeding is considered an important strategy to prevent wasting among young children.

Nutrition education has therefore become an important strategy for improving maternal knowledge and promoting healthy feeding practices. Various educational media have been used in community-based nutrition programs to deliver health messages to mothers. Printed educational materials, such as leaflets, are commonly used because they are practical, inexpensive, and easy to distribute in primary health care settings (Prasetyo, Permatasari, and Susanti, 2023). However, leaflet-based education often relies on passive information delivery and may not effectively engage participants during the learning process. In contrast, interactive education methods have been increasingly implemented to enhance community engagement and knowledge retention. One such method is Emotional Demonstration (Emodemo), which integrates demonstrations, visual tools, and emotional engagement to convey nutrition messages more effectively. Emodemo encourages active participation and allows participants to directly observe and practice recommended behaviors (Intiyati et al., 2024). Interactive learning approaches have been shown to improve knowledge acquisition and retention compared with traditional didactic or printed educational materials (Permatasari et al., 2021).

Previous studies have demonstrated that participatory educational strategies can significantly improve maternal knowledge of child nutrition and feeding practices (Majidah, Sulistiyawati, and Paramashanti, 2021; Achjar et al., 2023). However, evidence comparing the effectiveness of different educational media

in improving mothers' knowledge and attitudes remains limited, particularly among mothers of children experiencing wasting. Most studies have focused on general mother populations rather than targeting mothers of children who are already experiencing nutritional problems. Furthermore, limited research has directly compared the effectiveness of Emodemo and leaflet media within community health center settings, particularly in rural areas where health education resources may be constrained. Understanding the relative effectiveness of these educational strategies is important for optimizing community-based nutrition programs and improving the efficiency of health promotion activities. Therefore, this study analyzes differences in mothers' knowledge and attitudes after nutrition education using Emotional Demonstration (Emodemo) and Leaflet media among mothers of children aged 6–24 months with wasting. The findings of this study are expected to provide evidence-based recommendations for selecting effective educational strategies to improve mothers' understanding of child nutrition and support the prevention and management of wasting.

METHOD

This study employed a quasi-experimental research design with a quantitative approach to examine the effectiveness of two nutrition education media, namely Emotional Demonstration (Emodemo) and leaflets, on mothers' knowledge and attitudes regarding child feeding practices. Quasi-experimental designs are commonly used in community-based intervention studies when randomization is difficult to implement, but comparison between intervention groups is required (Creswell, 2009). The study compared two intervention groups receiving different educational approaches to compare effectiveness in improving mothers' knowledge and attitudes.

The research was conducted in the working area of Banjar PHC, located in Galis District, Bangkalan Regency, East Java, Indonesia. The study population consisted of mothers who had children aged 6–24 months diagnosed with wasting. Wasting status was determined using the weight-for-height (WHZ) or weight-for-length (WLZ) indicator with Z-scores between -3 SD and < -2 SD according to the WHO Child Growth Standards (WHO, 2006). Respondents were selected based on several inclusion criteria, including mothers who were willing to participate in the study, able to read and understand Indonesian, and had no hearing impairment that could interfere with participation in educational sessions. Exclusion criteria included mothers who did not live with their children, mothers who moved away during the study period, and children diagnosed with congenital conditions such as autism or congenital heart disease. Initially, 42 mothers met the inclusion criteria and were recruited as respondents. However, six respondents were excluded during the study period because their children's nutritional status improved to

normal according to follow-up anthropometric measurements. Therefore, the final sample consisted of 36 respondents.

Data were collected using structured questionnaires designed to assess mothers' knowledge and attitudes regarding child feeding practices. Mothers' knowledge was assessed using a multiple-choice questionnaire covering feeding schedules, portion sizes, and appropriate complementary feeding practices for children aged 6–24 months. Each correct answer was scored as 1, while incorrect answers were scored as 0. The total score reflected mothers' level of knowledge about child nutrition. In addition, mothers' attitudes were measured using a Likert-scale questionnaire comprising statements on feeding practices and nutritional care for children. Respondents indicated their level of agreement using four response categories ranging from strongly disagree to agree strongly. The Likert scale is widely used to measure attitudes in behavioral and health research (Candrawati et al., 2023).

The intervention consisted of two media types: leaflet- and Emotional Demonstration (Emodemo)-based nutrition education over four weeks. The leaflet contained printed educational information about feeding schedules and appropriate portion sizes for infants and young children. The leaflet was designed using simple language and visual illustrations to facilitate understanding among mothers with different educational backgrounds. Meanwhile, the Emodemo method used interactive demonstration modules focusing on feeding schedules and portion sizes for infants and young children. Emodemo is an educational method that integrates emotional engagement, visual demonstrations, and the respondent's involvement to enhance learning effectiveness. The educational sessions were delivered in two stages during the intervention period, allowing respondents to actively observe and practice recommended feeding behaviors.

Data were analyzed using statistical software to evaluate the effectiveness of the educational interventions. Descriptive statistics were used to summarize respondent characteristics, including mothers' age, educational level, and employment status. Inferential statistical analysis was conducted using the Mann–Whitney test to compare differences in mothers' knowledge and attitudes between the Emodemo and leaflet intervention groups. The Mann–Whitney test is a nonparametric test commonly used to compare two independent groups when the data are ordinal or nonnormally distributed (Gibbons & Chakraborti, 2011). The level of statistical significance was set at $p < 0.05$. A p -value below this threshold indicated a statistically significant difference between the two groups. Ethical approval for this study was obtained from the Health Research Ethics Committee of Universitas Nahdlatul Ulama Surabaya with approval number 0075/EC/KEPK/UNUSA/2025.

RESULT

The characteristics of the respondents included mothers' age, educational level, and employment status. It is important because mothers' demographic factors may influence their ability to receive and process health education information on child nutrition (Candrawati et al., 2023). The majority of mothers were aged 26–30 years (47%), followed by those aged 20–25 years (42%), while a smaller proportion were aged 30+ (11%). Regarding educational background, most respondents had completed senior high school (61%), followed by junior high school (22%), elementary school (11%), and higher education (6%). Regarding employment status, the majority of respondents were not formally employed and were categorized as housewives (72%), while 28% were employed (Table 1). Mothers' age and educational level may influence their understanding of nutrition information delivered during educational interventions. Mothers with higher levels of education generally have better access to health information and a greater ability to interpret nutrition messages (Achjar et al., 2023).

Table 1. The Characteristics of the Respondents by Age, Education Level, and Employment Status

The Characteristics of the Respondents	Frequency (n)	Percentage (%)
Age (years old)		
20–25	15	42
26–30	17	47
>30	4	11
Education Level		
Elementary School	4	11
Junior High School	8	22
Senior High School	22	61
Higher Education	2	6
Employment Status		
Employed	10	28
Unemployed / Housewife	26	72
Total	36	100

Before the intervention, most mothers in the Emodemo group had low knowledge (67%), while almost half had moderate knowledge (33%). After receiving Emodemo-based nutrition education, a substantial improvement was observed, with most respondents (89%) having good knowledge and a small proportion (11%) having moderate knowledge. A similar improvement was observed in the leaflet group. Before the intervention, most respondents in this group had poor knowledge (72%), while 28% had moderate knowledge. After receiving leaflet-based nutrition education, most respondents had moderate knowledge (67%), and 33% had good knowledge. Furthermore, statistical analysis using the Mann–Whitney test showed a significant difference in knowledge levels between the two groups ($p = 0.005$), indicating that the educational intervention significantly improved mothers' knowledge, particularly in the Emodemo group (Table 2). The results indicate that interactive educational methods, such as Emodemo, may lead to greater improvements in mothers' knowledge compared with passive educational media, such as leaflets.

Interactive learning approaches have been shown to enhance understanding and knowledge retention among respondents (Silva et al., 2023).

Table 2. Mothers' Knowledge Before and After Nutrition Education in the Edomemo and the leaflet groups

Mothers' Knowledge	Emodemo Group		Leaflet Group	
	Pre-test n (%)	Post-test n (%)	Pre-test n (%)	Post-test n (%)
Good	0 (0)	16 (89)	0 (0)	6 (33)
Moderate	6 (33)	2 (11)	5 (28)	12 (67)
Poor	12 (67)	0 (0)	13 (72)	0 (0)

Mann-Whitney test: $p = 0.005$

In the Emodemo group, the pre-test results indicated that respondents were equally distributed between the poor and moderate attitude categories (50% each). After the intervention, most respondents (67%) had a moderate attitude, while 33% had a good attitude. In the leaflet group, the majority of respondents (72%) already had a moderate attitude at baseline. After the intervention, most respondents remained in the moderate category (83%), although a small proportion improved to the good category (17%). However, statistical analysis showed that the difference in mothers' attitudes between the two intervention groups was not statistically significant ($p = 0.085$). The results demonstrated a descriptive improvement in attitudes in both intervention groups, although the changes were not statistically significant (Table 3). Short-term educational interventions may be more effective at improving knowledge than at modifying attitudes. Changes in attitudes often require longer exposure to educational messages and repeated reinforcement (Candrawati et al., 2023).

Table 2. Mothers' Attitude Before and After Nutrition Education in the Edomemo and the leaflet groups

Mothers' Attitude	Emodemo Group		Leaflet Group	
	Pre-test n (%)	Post-test n (%)	Pre-test n (%)	Post-test n (%)
Good	0 (0)	6 (33)	0 (0)	3 (17)
Moderate	9 (50)	12 (67)	13 (72)	15 (83)
Poor	9 (50)	0 (0)	5 (28)	0 (0)

Mann-Whitney test: $p = 0.085$

DISCUSSION

The findings demonstrated that nutrition education significantly improved mothers' knowledge, particularly in the emodemo-based education group. Before the intervention, the majority of mothers in both groups had limited knowledge regarding appropriate feeding schedules and portion sizes for children aged 6–24 months. After receiving education through Emodemo, most mothers had a good knowledge, while most respondents in the leaflet group improved only to a moderate level (Table 2). These findings suggest that interactive educational methods are more effective than passive information delivery in improving mothers' understanding of child nutrition. Interactive learning approaches encourage active

participation, facilitate discussion, and enhance retention of health information (da Silva Lopes et al., 2021).

The effectiveness of Emodemo as an interactive learning observed in this study may be due to its characteristics. Emodemo integrates visual demonstrations, emotional engagement, and participatory learning activities that enable participants to observe and practice recommended behaviors directly. Such interactive methods engage multiple sensory channels during the learning process, thereby improving comprehension and memory retention. A previous study reported that participatory nutrition education strategies could significantly enhance mothers' knowledge of child feeding practices and improve understanding of appropriate complementary feeding (Achjar et al., 2023).

The findings of this investigation are also consistent with behavioral learning theory, which emphasizes that learning outcomes are influenced by the level of engagement and interaction participants experience during educational activities. Educational approaches that involve active participation and demonstration tend to produce better learning outcomes compared with passive methods such as printed materials (Candrawati et al., 2023). In the context of community nutrition programs, interactive approaches may therefore be more effective in improving mothers' understanding of recommended feeding practices.

Although leaflet-based education also improved mothers' knowledge, the improvement was lower than in the Emodemo group (Table 2). Leaflets provide written information that can be read independently. However, their effectiveness depends largely on respondents' literacy levels and motivation. Without direct interaction or explanation, some information in leaflets may be difficult to understand fully. Similar findings have also been reported in previous studies, showing that printed educational materials alone are often less effective at changing knowledge and behavior than interactive education strategies.

In contrast to the mothers' knowledge variable, this study showed that neither Emodemo- nor leaflet-based nutrition education significantly influenced mothers' attitudes toward child feeding practices. Although descriptive improvements were observed in both intervention groups, the statistical analysis indicated that the change in attitudes was not significant (Table 3). This finding suggests that short-term educational interventions may not be sufficient to produce meaningful changes in attitudes.

From a theoretical perspective, attitudes are complex psychological constructs that are shaped by beliefs, values, cultural norms, and past experiences. According to health behavior theory, attitudes tend to be more stable and require longer-term interventions to change compared with knowledge (Candrawati et al., 2023). Therefore, improvements in knowledge following a single or short-term educational intervention do not necessarily translate into immediate changes in attitudes or behaviors. Furthermore, behavior change theories emphasize that knowledge is only one of several determinants influencing attitudes and practices. Other factors, such as cultural beliefs, family support, economic conditions, and prior experiences with

child feeding, may also influence mothers' attitudes toward nutrition practices. Therefore, interventions aimed at improving mothers' attitudes may need to combine education with broader community-based strategies that address these contextual factors (Silva et al., 2023).

Recent studies have highlighted the important role of mothers' nutrition education in improving child health outcomes. A systematic review by Prasetyo et al. (2023) reported that mothers' nutrition education significantly improves their knowledge and contributes to better feeding practices and child nutritional status (Prasetyo, Permatasari, and Susanti, 2023). Similarly, research across several developing countries found that mothers' nutritional literacy was strongly associated with appropriate feeding practices and improved child growth outcomes (Tahreem et al., 2025). These findings indicate that strengthening mothers' knowledge through educational interventions is an essential strategy for addressing child malnutrition.

Interactive educational approaches have also been shown to be more effective than traditional health education methods. A study on complementary feeding interventions demonstrated that participatory education methods, including demonstrations and practical learning sessions, significantly improved mothers' understanding of feeding practices (Ikhsyana, Dwiriani, and Kustiyah, 2025). In addition, the Emotional Demonstration (Emodemo) approach has been widely used in community nutrition programs because it combines emotional engagement, visual learning, and participatory interaction, thereby enhancing comprehension and knowledge retention among mothers. Research evaluating Emodemo interventions also found improvements in mothers' knowledge, attitudes, and child feeding practices following the intervention (Mukaromah et al., 2025).

CONCLUSION

Interactive educational strategies, such as Emodemo, can be an effective way to increase mothers' knowledge in community nutrition programs. Nevertheless, changes in mothers' attitudes may require longer intervention periods, repeated educational exposure, and continuous behavioral support. Future research should conduct follow-up measurements several weeks or months later to assess retention and behavioral changes over time. In addition, future nutrition education programs should integrate interactive learning methods with sustained behavior change strategies to achieve comprehensive improvements in mothers' knowledge, attitudes, and child feeding practices.

REFERENCES

Achjar, K. A. H., Marni, N. K., Lestari, A. S., & Ribek, I. N. (2023). Health Education with Leaflet Media on the Level of Knowledge of Mother's about Toddler Rearing Partners in Stunting Prevention. *Journal of Education Research and Evaluation*, 7(2), 197–203.

<https://doi.org/10.23887/jere.v7i2.61560>

- Candrawati, R. D., Wiguna, P. K., Malik, M. F., Salbiah, A. N., Runggandini, S. A., Yanti, I., Jamaluddin, Setiawati, R., Marlina, R., Suryani, L., Isnani, T., Iswono, Bagiastra, I. N., & Salman. (2023). *Promosi dan Perilaku Kesehatan*. EUREKA MEDIA AKSARA.
- Creswell, J. W. (2009). *Research Design: qualitative, quantitative and mixed methods approaches. Third Edition*. SAGE Publications.
- da Silva Lopes, K., Yamaji, N., Rahman, M. O., Suto, M., Takemoto, Y., Garcia-Casal, M. N., & Ota, E. (2021). Nutrition-specific interventions for preventing and controlling anaemia throughout the life cycle: an overview of systematic reviews. *Cochrane Database of Systematic Reviews*, 2022(1). <https://doi.org/10.1002/14651858.CD013092.pub2>
- Gibbons, J. D., & Chakraborti, S. (2011). *Nonparametric Statistical Inference Fifth Edition*. CRC Press, Taylor and Francis Group.
- Hafifah, N., & Baliwati, Y. F. (2023). Hubungan Indikator Ketahanan Pangan dengan Prevalensi Wasting dan Underweight Balita di 34 Provinsi. *IPB University Scientific Repository, March*.
- Ikhsyana, N., Dwiriani, C. M., & Kustiyah, L. (2025). The effect of interactive nutrition education through Instagram on complementary feeding practices among infants 6-12 months. *Action: Aceh Nutrition Journal*, 10(1), 135. <https://doi.org/10.30867/action.v10i1.2285>
- Intiyati, A., Edi, I. S., Soesanti, I., Christianingsih, J., Suprihatin, K., & Widarti, L. (2024). Enhancing Maternal Knowledge and Practices in Complementary Feeding through Emotional Demonstration Methods. *Amerta Nutrition*, 8(2SP), 49–57. <https://doi.org/10.20473/amnt.v8i2SP.2024.49-57>
- Kementerian Kesehatan RI. (2025). *Survei Status Gizi Indonesia Tahun 2024*.
- Majidah, N. M., Sulistiyawati, S., & Paramashanti, B. A. (2021). Effect of Maternal Nutrition Education on Knowledge, Attitude, and Practice Related to Infant and Toddler Feeding. *Nutri-Sains: Jurnal Gizi, Pangan Dan Aplikasinya*, 5(2), 73–82. <https://doi.org/10.21580/ns.2021.5.2.5245>
- Mukaromah, I., Widya Hapsari, P., Sofiyya Wahyurin, I., Andini Surijati, K., Aryani, A. A., Proverawati, A., & Nurbaya, N. (2025). Impact of Emo-Demo IYCF Education on Dietary Intake and Growth Indicators in Children Under Two in Rural Area. *Mando Care Jurnal*, 4(2), 175–189. <https://doi.org/10.55110/mcj.v4i2.255>
- Permatasari, T. A. E., Rizqiya, F., Kusumaningati, W., Suryaalsah, I. I., & Hermiwahyoeni, Z. (2021). The effect of nutrition and reproductive health education of pregnant women in Indonesia using quasi experimental study. *BMC Pregnancy and Childbirth*, 21(1), 180. <https://doi.org/10.1186/s12884-021-03676-x>
- Prasetyo, Y. B., Permatasari, P., & Susanti, H. D. (2023). The effect of mothers' nutritional education and knowledge on children's nutritional status: a systematic review. *International Journal of Child Care and Education Policy*, 17(1), 11. <https://doi.org/10.1186/s40723-023-00114-7>
- Silva, P., Araújo, R., Lopes, F., & Ray, S. (2023). Nutrition and Food Literacy: Framing the Challenges to Health Communication. *Nutrients*, 15(22), 4708. <https://doi.org/10.3390/nu15224708>
- Tahreem, A., Rakha, A., Anwar, R., Rabail, R., Maerescu, C. M., Socol, C. T., Criste, F. L., Abdi, G., & Aadil, R. M. (2025). Impact of maternal nutritional literacy and feeding practices on the growth outcomes of children (6–23 months) in Gujranwala: a cross-sectional study. *Frontiers in Nutrition*, 11(January). <https://doi.org/10.3389/fnut.2024.1460200>
- UNICEF, WHO, & World Bank Group. (2025). Levels and Trends in Child Malnutrition. *Joint Child Malnutrition Estimates 2025 Edition*, 1–24.

WHO. (2006). *WHO Child Growth Standards*. World Health Organization.



Multinomial Logistic Regression (MLR) Analysis: Predictive Model of Risk Factors for the Incidence of Period Pain (Primary Dysmenorrhea) in Adolescent Girls

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ABSTRACT

World epidemiological data states that primary dysmenorrhea occurs most frequently in women aged 17-24 years. Multinomial Logistic Regression (MLR) is suitable for producing predictive models with a dependent variable (menstrual pain) that has four categories. This study analyzes the predictive model of risk factors for the incidence of menstrual pain (primary dysmenorrhea) in adolescent girls in Pekalongan City. The research design was an analytic survey with a cross-sectional design. A total of 100 samples were collected using multistage random sampling at four school sites. The questionnaires used included NRS, PSS-10, and anthropometric measurements. Of the fourteen variables studied, three variables, family history of menstrual pain, sleep duration, and exercise habits, proved to significantly affect the incidence of menstrual pain in adolescent girls (p -value <0.05). The Multinomial Logistic Regression model produced three logit equations. The independent variables, consisting of age, age of menarche, Body Mass Index (BMI), duration of menstruation, menstrual cycle, family history of menstrual pain, meal skipping, night sleep time, morning wake-up time, sleep duration, exercise habits, cigarette smoke exposure, alcohol consumption, and stress level, could influence menstrual pain by 61.2%. Meanwhile, the other 39.8% was influenced by variables not studied. The accuracy of the classification table, with a prediction truth rate of 80.9%, explained that respondents with a family history of menstrual pain were 98.319 times more likely to have moderate menstrual pain compared to those without a family history of menstrual pain. The predictive modeling has good accuracy.

INTRODUCTION

The issue of adolescent health is currently a serious concern in the global arena, not least about adolescent reproductive health. There are various changes and reproductive health risks during adolescence. Adolescent girls generally have health problems related to adolescent reproduction, including menstrual disorders. Menstruation is a natural periodic bleeding from the uterus in women, including adolescent girls. Adolescent girls often experience pain during menstruation. Pain during menstruation is a menstrual disorder (Kusyanti & Fay, 2023). According to the World Health Organization (WHO), dysmenorrhea is a painful condition that occurs during or before menstruation and is a common complaint experienced by women, including adolescent girls. Its classification consists of primary and secondary dysmenorrhea. World epidemiological data stated that primary dysmenorrhea occurs most frequently in women aged 17-24 years, averaging around 50% of women in each country, with an increasing trend (De Sanctis et al., 2016). The results of research by Hasan *et al.* (2023) and Badri *et al.* (2024) on the prevalence of menstrual pain showed that 25% occurred in older women and 75% occurred at a young age. The

incidence of menstrual pain in several countries was quite diverse, namely 62.5% in Bangladesh, 34% in Egypt, 94% in Oman, and Korea by 0.9%. Menstrual pain decreases with age. So far, there is no mortality data due to menstrual pain, but menstrual pain is associated with significant morbidity. Research estimated that 40% of individuals with menstrual pain had significant symptoms. In addition, 16-29% of women who experience menstrual pain had a significant impact on decreased quality of life. Menstrual pain can also reduce productivity through increased absenteeism and lost school days (Francavilla et al., 2023; Kusyanti & Fay, 2023; Zeba et al., 2024).

A review article interpreted that the risk factors for menstrual pain included Body Mass Index (BMI) < 20, age of menarche < 12 years, long menstrual intervals, family history of dysmenorrhea, irregular bleeding, unhealthy lifestyles, stress, and depression (Zeba et al., 2024). Research by Angelia, Sitorus, and Etrawati (2017) also found that several factors contribute to primary dysmenorrhea among students at one high school in Palembang, including stress, timing of sleep, timing of waking in the morning, sleep duration, family history of dysmenorrhea, and menstruation duration. In addition, a prior study by Munir *et al.* (2023) found that menstrual duration, nutritional status, and family history correlated with menstrual pain, using a sample of 62 students from one of the Midwifery Academies in Bogor.

The development of statistics is very important for solving problems across various scientific fields, particularly in public health. Therefore, a researcher needs a rational basis for selecting the most appropriate statistical test for their analysis (Ramadani et al., 2023). Based on Indriyani *et al.* (2024) and Sobari *et al.* (2024), Multinomial Logistic Regression (MLR) is a set of logistic regressions that assume the dependent variable (Y) has a polycotomous or multinomial scale, i.e., more than two categories. The advantages of Multinomial Logistic Regression are that it can handle dependent variables with a multinomial scale, enabling more complex analyses than binary logistic regression. According to Putri *et al.* (2022), the flexibility of this model enables researchers to model the relationships between independent variables and multiple dependent categories, providing deeper insight into the factors that influence these categories. Thus, Multinomial Logistic Regression modeling can be used to predict future data on risk factors for the incidence of menstrual pain. This study analyzes the predictive model of risk factors for the incidence of menstrual pain (primary dysmenorrhea) in adolescent girls in Pekalongan City.

METHOD

The research design was an analytic survey with a cross-sectional design. Multistage random sampling was chosen as the sampling technique. Pekalongan city has four sub-districts: West Pekalongan, East Pekalongan, South Pekalongan, and North Pekalongan. Each sub-district will randomly select one Senior High School (SMA or SMK) using the Wheel of Names. 4 school loci were selected: SMA N 1

Pekalongan (East Pekalongan District), SMA N 2 Pekalongan (North Pekalongan District), SMK N 3 Pekalongan (West Pekalongan District), and SMK N 4 Pekalongan (South Pekalongan District), with each school taking a sample of 25 students, so that the sample amounted to 100. Data collection used questionnaire interviews with adolescents in each locus. In addition, anthropometric measurement methods include body weight and height of adolescent girls to determine their Body Mass Index. The instruments were questionnaires, scales, and height-measuring instruments. The questionnaires included the Numeric Rating Scale (NRS) questionnaire, the Perceived Stress Scale (PSS-10) questionnaire, and a questionnaire containing the research variables. Data analysis used Multinomial Logistic Regression test using SPSS 26.0 software. The stages of data analysis include simultaneous testing to determine which independent variables affect the dependent variable, partial testing to examine the p-values of each parameter β_{jk} , and fit testing (model fitting) to assess the model's fit to both the independent and dependent variables.

RESULT

MLR analysis produces several statistical values, including pseudo R-Square. The statistical value was the percentage of the 14 independent variables studied that could explain 1 dependent variable. This table includes 3 models: Cox and Snell, Nagelkerke, and McFadden. The Nagelkerke model obtained 0.612, indicating that the independent variables consisting of age (X_1), age of menarche (X_2), Body Mass Index (BMI) (X_3), duration of menstruation (X_4), menstrual cycle (X_5), family history of menstrual pain (X_6), meal skipping (X_7), night sleep time (X_8), morning wake-up time (X_9), sleep duration (X_{10}), exercise habits (X_{11}), cigarette smoke exposure (X_{12}), alcohol consumption (X_{13}) and stress level (X_{14}) could influence the dependent variable, namely menstrual pain (Y) by 61.2%. Meanwhile, the other 39.8% was influenced by variables not studied (Table 1).

Table 1. Pseudo R-Square

	Pseudo R-Square
Cox and Snell	0,555
Nagelkerke	0,612
McFadden	0,340

Furthermore, Likelihood Ratio Tests indicated which of the 14 independent variables can affect the dependent variable. If the p-value is <0.05 , then the interpretation is that the independent variables partially influence the dependent variable. The partial test showed that family history of dysmenorrhea ($p = 0.001$), sleep duration ($p = 0.013$), and exercise habits ($p = 0.031$) influenced the incidence of menstrual pain among adolescent girls in Pekalongan City (Table 2).

Table 2. Likelihood Ratio Tests

Effect	Model Fitting Criteria -2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	156,058 ^a	0,000	0	.
Age (X ₁)	160,598	4,540	3	0,209
Age of menarche (X ₂)	161,570	5,511	6	0,480
Body Mass Index (BMI) (X ₃)	172,843	16,785	12	0,158
Duration of menstruation (X ₄)	158,295	2,237	3	0,525
Menstrual cycle (X ₅)	162,174	6,116	6	0,410
Family history of menstrual pain (X ₆)	173,767	17,709	3	0,001
Meal skipping (X ₇)	159,390	3,332	3	0,343
Night sleep time (X ₈)	158,870	2,812	3	0,422
Morning wake-up time (X ₉)	156,780	0,722	3	0,868
Amount of sleep time (X ₁₀)	166,859	10,801	3	0,013
Exercise habits (X ₁₁)	164,917	8,859	3	0,031
Cigarette smoke exposure (X ₁₂)	160,975	4,917	3	0,178
Alcohol consumption (X ₁₃)	158,416	2,358	3	0,502
Stress level (X ₁₄)	162,909	6,851	6	0,335

Table 3 describes model fit information. It compares the values from an MLR model with those from a model with only an intercept and determines which is the better fit. If the -2 Log Likelihood value from Intercept Only to Final decreases, the Multinomial Logistic Regression model performs much better. The results showed that the -2 Log Likelihood values decreased from Intercept to Final, from 237.121 to 156.058. The magnitude of the Chi-Square value was 81.083, and the *p*-value was 0.036 (*p*<0.05). Thus, it indicated that the Multinomial Logistic Regression model with 14 independent variables could show better accuracy to predict risk factors for the incidence of menstrual pain (dysmenorrhea) in adolescent girls in Pekalongan City (Table 3).

Table 3. Model Fitting Information

Model	Model Fitting Criteria			Likelihood Ratio Tests		
	AIC	BIC	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	243,121	250,937	237,121			
Final	282,058	446,184	156,058	81,083	60	0,036

The Goodness-of-fit showed a *p*-value of 0.998 (*p* > 0.05), indicating that the Multinomial Logistic Regression model fit the observed data (Table 4). In addition, the parameter estimation table in the multinomial logistic regression displays the estimated regression coefficients for each category of the dependent variable, excluding the reference category, along with *p*-values indicating the significance of each independent variable's effect on the odds of each category relative to the reference category.

Table 4. Goodness of Fit

	Chi-Square	df	Sig.
Pearson	175,189	231	0,998
Deviance	154,672	231	1,000

As a result of the Parameter Estimate analysis, three simultaneous logit function equations of Multinomial Logistic Regressions were obtained as follows:

$$\begin{aligned} \text{i. } \ln \left(\frac{p(y=2)}{p(y=1)} \right) &= \left(\frac{\text{mild menstrual pain}}{\text{no menstrual pain}} \right) = \alpha + \beta_1 X_1 + \beta_6 X_{6(1)} = 24.492 - 1.626 \text{ age} + 3.610 \text{ there are women in family who have a history dysmenorrhea} \\ \text{ii. } \ln \left(\frac{p(y=3)}{p(y=1)} \right) &= \left(\frac{\text{moderate menstrual pain}}{\text{no menstrual pain}} \right) = \alpha + \beta_6 X_{6(1)} = 33.381 + 4.588 \text{ there are women in the family who have a history of dysmenorrhea} \\ \text{iii. } \ln \left(\frac{p(y=4)}{p(y=1)} \right) &= \left(\frac{\text{severe menstrual pain}}{\text{no menstrual pain}} \right) = \alpha + \beta_6 X_{6(1)} = 8.341 + 6.202 \text{ there are women in the family who have a history of dysmenorrhea} \end{aligned}$$

The usefulness of the Odds Ratio (OR) is to facilitate the interpretation of the logistic regression model. Based on the interpretation results of the p -value on the parameters partially, we can continue to interpret the OR value in this study as follows:

1. The Odds Ratio or Exp(B) value of variable X_1 (age) was 0.197, indicating that if there was an increase in age, it was estimated that there was a 0.197 times greater chance of having mild menstrual pain.
2. The Odds Ratio or Exp(B) value of variable $X_{6(1)}$ (history of dysmenorrhea) was 36.960, indicating that respondents with a family history of dysmenorrhea were 36.960 times more likely to have mild menstrual pain compared to those without a family history of dysmenorrhea.
3. The Odds Ratio or Exp(B) value of variable $X_{6(1)}$ (history of dysmenorrhea) was 98.319, indicating that respondents with a family history of dysmenorrhea were 98.319 times more likely to have moderate menstrual pain compared to those without a family history of dysmenorrhea.
4. The Odds Ratio or Exp(B) value of variable $X_{6(1)}$ (no history of dysmenorrhea) was 493.804, indicating that respondents with a family history of dysmenorrhea were 493.804 times more likely to have severe menstrual pain compared to those without a family history of dysmenorrhea.

Table 5. Classification

Observed	Predicted				Percent Correct (%)
	No menstrual pain	Mild menstrual pain	Moderate menstrual pain	Severe menstrual pain	
No menstrual pain	6	2	3	0	54,5
Mild menstrual pain	2	14	13	3	43,8
Moderate menstrual pain	1	8	38	0	80,9
Severe menstrual pain	0	3	3	4	40
Overall Percentage (%)	9	27	57	7	62

A classification table is used to determine classification accuracy. Of the 11 respondents with no menstrual pain, 2 were predicted to experience mild menstrual pain, and 3 would experience moderate menstrual pain, with a prediction accuracy rate of 54.5%. In addition, 32 respondents with mild menstrual pain, 2 were predicted to have no menstrual pain, 13 were predicted to experience moderate menstrual pain, and 3 were predicted to experience severe menstrual pain, with a prediction accuracy rate 43.8%. Of 47 respondents with moderate menstrual pain, 1 was predicted to have no menstrual pain, 8 were predicted to have mild menstrual pain, and none were predicted to have severe menstrual pain, with a prediction accuracy rate of 80.9%. Of the 10 respondents who experienced severe menstrual pain, none (0) were predicted to have no menstrual pain, 3 were predicted to experience mild menstrual pain, and 3 were predicted to experience moderate menstrual pain, with a prediction correctness rate of 40%. The

overall percentages for 100 respondents were: 11 with no menstrual pain, 32 with mild menstrual pain, 47 with moderate menstrual pain, and 10 with severe menstrual pain, with the model's accuracy at 62%.

DISCUSSION

It is in line with prior studies by Tsamara *et al.* (2020) and Zeba *et al.* (2024), finding that the incidence of menstrual pain (primary dysmenorrhea) peaks at the transition between the late adolescent group and the young adult group, namely around the age of 17-24 years or 15-25 years. However, menstrual pain levels between individuals vary from one to another, ranging from those who do not experience pain, experience mild pain, moderate pain, to severe pain (Nasution *et al.*, 2022).

The findings showed that most respondents experienced moderate menstrual pain. Without realizing it, menstrual pain has a considerable impact on female students. mentioned that. So far, there is no mortality data due to menstrual pain, but menstrual pain is associated with significant morbidity (Kusyanti & Fay, 2023). Dysmenorrhea in school students can reduce concentration and even motivation to learn in class, more seriously even not going to class because of complaints of menstrual pain that is quite serious. Menstrual pain or dysmenorrhea is synonymous with symptoms of endometriosis. It is quite worrying because every teenager with complaints of menstrual pain has the opportunity to have infertility complaints (Silaen, Ani, and Putri, 2019).

Rosyida (2020) mentions that young women with BMI in the category of less than normal weight and overweight are much more likely to experience menstrual pain complaints compared to young women who have BMI in the normal category. It is because young women with BMI in the less-than-normal-weight category tend to have poor endurance when experiencing complaints of menstrual pain or dysmenorrhea, especially if the menstrual pain is severe. Meanwhile, adolescent girls who have a BMI in the overweight category have the potential to store quite a lot of fat in their bodies. It disrupts the reproductive system through hormonal imbalance and results in pain.

It is in accordance with a study by Zeba *et al.* (2024), which found that a family history of dysmenorrhea is one of the risk factors for the incidence of menstrual pain. Based on the theory of HL. Blum (1974) explains that genetic factors are among the determinants of health status. The families of women who have a history of menstrual pain include genetics and heredity (De Sanctis *et al.*, 2016). According to the Ministry of Health, adolescents aged 12-18 years ideally sleep around 8-9 hours/day. Getting enough sleep will affect overall body health. The high social activity during adolescence is a factor that contributes to poor sleep quality among adolescents (Nasution *et al.*, 2022).

Exercise is an investment in future health for adolescent girls. Prostaglandin hormone secretion can decrease with regular exercise. However, if young women are reluctant to exercise regularly, the blood

vessels of the reproductive organs will undergo vasoconstriction, reducing the oxygen supply. As a result, young women have complaints of dysmenorrhea (Purwati et al., 2020).

Nicotine has properties that obstruct blood flow to the endometrium. This kind of mechanism in the body can trigger complaints of pain during menstruation (Rosyida, 2020). Adolescents with significant levels of stress trigger estrogen and progesterone levels in the body to drop. In addition, prostaglandin synthesis increases. These two things that do not synergize cause uterine muscle contractions so that adolescent girls feel menstrual pain (Mayangsari & Ayubi, 2024; Purwati et al., 2020).

Partial test showed that three variables, history of dysmenorrhea, amount of sleep time, and exercise, influenced the incidence of menstrual pain in adolescent girls in Pekalongan City, with p -value <0.05 (Table 2). The results of the study have similarities with the research of Angelia *et al.* (2017), showing that several factors cause primary dysmenorrhea in students of one of the high schools in Palembang, including stress, sleep time at night, time when getting up early, sleep duration, female families who have a history of dysmenorrhea, and menstruation duration. A study by Munir *et al.* (2023) found that family history factors were associated with menstrual pain ($p = 0.013$). In addition, research by Hasan *et al.* (2023) found that lifestyle factors were influential in the incidence of dysmenorrhea. Moreover, research on adolescent girls in Pekalongan City indicated that sleep duration and exercise habits affected menstrual pain. These studies support each other, indicating that sleep time and exercise habits are lifestyle factors that can affect the quality of life of adolescent girls during menstruation.

However, this study did not find a significant effect on 11 other variables: age, menarche age, BMI, duration of menstruation, menstrual cycle, meal skipping, bedtime, wake-up time, cigarette exposure, alcohol consumption, and stress level. It is not in line with the research by Nasution *et al.* (2022), which showed that physical activity, nutritional status, and stress levels were associated with the incidence of dysmenorrhea. In contrast, another study stated that the age of menarche was not associated with menstrual pain. However, there was a relationship between the menstrual cycle, length of menstruation, nutritional status, and family history of dysmenorrhea with the incidence of dysmenorrhea in students in Bogor (Munir et al., 2023).

Thus, the Multinomial Logistic Regression model fit the observed data and can be interpreted with a fairly good level of accuracy in this investigation (Table 4). This study also produced three logit equations. It aligns with a study showing that the global model's accuracy in predicting the incidence of menstrual pain among adolescent girls in Pekalongan City was fairly high (Arofah & Sofro, 2022; Sobari et al., 2024).

CONCLUSION

Multinomial Logistic Regression analysis proves statistically to produce a global model accuracy in correctly predicting the incidence of menstrual pain among adolescent girls in Pekalongan City. Family history of menstrual pain, sleep duration, and exercise habits partially influence the incidence of menstrual pain. Family history of menstrual pain is the most dominant risk factor.

REFERENCES

- Angelia, L. M., Sitorus, R. J., & Etrawati, F. (2017). Model Prediksi Kejadian Dismenore Primer pada Siswi SMA Negeri di Palembang. *Jurnal Ilmu Kesehatan Masyarakat*, 8(1), 10–18.
- Arofah, F., & Sofro, A. (2022). Penerapan Regresi Logistik Multinomial untuk Analisis Model Tingkat Depresi pada Lansia. *MATHunesa: Jurnal Ilmiah Matematika*, 10(1), 84–93. <https://doi.org/10.26740/mathunesa.v10n1.p84-93>
- Badri, P. R. A., Febriani, R., Saraswati, N. A., Artanto, A., Febrianti, Y., Apriyani, S., & Najwa, A. N. (2024). Dysmenorrhea and Seborrhic Dermatitis due to Occupational Stress Among Female Bank Workers. *The Indonesian Journal of Occupational Safety and Health*, 13(1), 4–12. <https://doi.org/10.20473/ijosh.v13i1.2024.4-12>
- De Sanctis, V., Soliman, A. T., Elsedfy, H., Soliman, N. A., Elalaily, R., & El Kholy, M. (2016). Dysmenorrhea in adolescents and young adults: A review in different countries. In *Acta Biomedica* (Vol. 87, Issue 3, pp. 233–246).
- Direktorat Kesehatan Keluarga. (2017). *Buku Saku Pedoman Remaja pada Situasi Krisis Kesehatan*. Kementerian Kesehatan RI.
- Francavilla, R., Petraroli, M., Messina, G., Stanyevic, B., Bellani, A. M., Esposito, S. M., & Street, M. E. (2023). Dysmenorrhea: Epidemiology, Causes and Current State of the Art for Treatment. *Clinical and Experimental Obstetrics & Gynecology*, 50(12), 265–269. <https://doi.org/10.31083/j.ceog5012274>
- Hasan, R., Akter, S., Ali, M. S., & Islam, S. (2023). Dysmenorrhea Prevalence and Associated Risk Factors in Bangladeshi Women: A Comprehensive Epidemiological Analysis. *Asian Research Journal of Gynaecology and Obstetrics*, 6(1 SE-Original Research Article), 265–269.
- Indriyani, Y., Diah Prihatiningsih, Ibrahim, M. M., Ulfa, M., Kurniawan, A., Putri, S. M., Afnina, Amalia, N., & Mirani, N. (2024). *Biostatistika Kesehatan* (M. E. Darwel, SKM (ed.); first). CV Hei Publishing Indonesia.
- Kementerian Koordinator PMK RI. (2022). *Peraturan Menteri Koordinator Bidang Pembangunan Manusia dan Kebudayaan Republik Indonesia Nomor 1 Tahun 2022 tentang Rencana Aksi Nasional Peningkatan Kesejahteraan Anak Usia Sekolah dan Remaja*.
- Kusyanti, F., & Fay, A. D. J. (2023). Hubungan Antara Gangguan Menstruasi (Dismenorea) Dengan Aktifitas Belajar Pada Mahasiswa Program Studi D -III Kebidanan. *The Shine Cahaya Dunia Ners*, 8(01), 23. <https://doi.org/10.35720/tscnrs.v8i01.408>
- Mayangsari, A., & Ayubi, D. (2024). Perilaku Swamedikasi Remaja Putri Mengatasi Nyeri Menstruasi: Literature Review. *Journal of Midwifery Science and Women's Health*, 5(1), 63–77. <https://doi.org/https://doi.org/10.36082/jmswh.v5i1.1974>
- Munir, R., Lestari, F., Zakiah, L., Kusmiati, M., Anggun Anggun, Dhea A, Diva F, Mutia A, & Puput

- Puput. (2023). Analisa Faktor Yang Mempengaruhi Nyeri Haid (Dismenorhea) Pada Mahasiswa Akademi Kebidanan Prima Husada Bogor. *Detector: Jurnal Inovasi Riset Ilmu Kesehatan*, 2(1), 62–70. <https://doi.org/10.55606/detector.v2i1.3133>
- Nasution, A. S., Jayanti, R., Munir, R., & Ariandini, S. (2022). Determinan Kejadian Dismenore pada Mahasiswi. *Jurnal Kesehatan Vokasional*, 7(2), 79. <https://doi.org/10.22146/jkesvo.72218>
- Purwati, A. E., Srinayanti, Y., Rosmiati, R., & Badriah, L. S. A. (2020). Gaya Hidup dan Kejadian Dysmenorrhea pada Remaja Putri. *2-TRIK: Tunas-Tunas Riset Kesehatan*, 10(1), 59–66.
- Putri, F. C., Andriyati, A., & Rohaeti, E. (2022). Analisis Regresi Logistik Multinomial pada Faktor-Faktor yang Mempengaruhi Status Pasien Covid-19 di Kota Depok. *Jurnal Matematika Integratif*, 18(2), 103. <https://doi.org/10.24198/jmi.v18.n2.40058.103-114>
- Ramadani, F. N., Khoiriyah Parinduri, F., Jayanti, R., Prisella, E., & Rahmawati, K. (2023). Prevalensi dan Self-Care Practice untuk Mengatasi Nyeri Haid (Dismenore) pada Remaja Putri di Pondok Pesantren Darul Fallah. *PROMOTOR*, 6(2), 135–140. <https://doi.org/10.32832/pro.v6i2.237>
- Rosyida, D. A. C. (2020). *Kesehatan Reproduksi Remaja dan Wanita*. PT Pustaka.
- Silaen, R. M. A., Ani, L. S., & Putri, W. C. W. S. (2019). Prevalensi Dysmenorrhea dan Karakteristiknya pada Remaja Putri di Denpasar. *E-Jurnal Medika Udayana*, 8(11), 1–6.
- Sobari, M., Putri, D. I., Prama, D. R., & Suparman, Y. (2024). Multinomial Logistic Regression To Determine Factors Influencing The Selection Of Health Care Facilities In Indonesia. *Journal of Fundamental Mathematics and Applications (JFMA)*, 7(2), 187–198. <https://doi.org/10.14710/jfma.v7i2.16499>
- Tsamara, G., Raharjo, W., & Putri, E. A. (2020). The Relationship Between Lifestyle and the Incidence of Primary Dysmenorrhea. *Jurnal Nasional Ilmu Kesehatan*, 2(3), 130–140.
- Zeba, D., Benarjee, S., Biswas, R., Akter, S., & Rahman, R. M. (2024). Dysmenorrhea in Adolescents: How to approach: A Review Article. *Bangabandhu Sheikh Mujib Medical College Journal*, 3(1), 44–48. <https://doi.org/10.3329/bsmmcj.v3i1.72065>



Maternal Psychosocial Determinants and Child Stunting in a Socioeconomically Vulnerable Region of Eastern Indonesia

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A B S T R A C T

Stunting remains a persistent public health challenge in socioeconomically vulnerable regions, where behavioral and structural determinants interact to influence child growth outcomes. The contribution of maternal psychosocial factors within structurally constrained settings remains insufficiently understood. This study examined the structural relationships between maternal self-efficacy, maternal social support, child feeding practices, and child stunting in a stunting-prone area of Eastern Indonesia. An analytic cross-sectional study was conducted among 233 mother-child dyads at a Public Health Center (PHC) using consecutive sampling. Maternal self-efficacy, social support, and child feeding practices were assessed using validated Likert-scale instruments. Stunting was defined as a height-for-age Z-score below -2 standard deviations, according to the WHO 2006 Child Growth Standards. Data were analyzed using Partial Least Squares Structural Equation Modeling. Results showed that maternal self-efficacy and social support demonstrated limited explanatory power in predicting child feeding practices and stunting. Structural relationships were weak ($\beta < 0.20$), and effect sizes were small to trivial ($F^2 < 0.03$). In conclusion, maternal psychosocial determinants alone may not substantially influence the prediction of child feeding practices and stunting in socioeconomically vulnerable populations. Behavioral constructs appear constrained by socioeconomic conditions. Effective stunting reduction strategies should integrate maternal-level interventions with systemic improvements in food security, sanitation, and social protection.

INTRODUCTION

Stunting remains a critical global public health challenge, disproportionately affecting children in low and middle income countries and reflecting deep structural inequalities in early life conditions. Impaired linear growth during the first five years of life is associated with long term consequences, including compromised cognitive development, lower educational attainment, reduced economic productivity, and increased risk of chronic diseases in adulthood (Mulyani et al., 2025). Recent global reports indicate that progress in reducing stunting has slowed, particularly in socioeconomically vulnerable regions where poverty, food insecurity, and limited access to basic services persist (Jalaludin et al., 2025a). In Indonesia, substantial regional disparities remain evident, with Eastern provinces experiencing consistently higher prevalence rates than national averages. These patterns suggest that stunting cannot be understood solely as a nutritional deficit but must be situated within broader structural and social determinants of health.

Behavioural science frameworks have increasingly been used to explain maternal influences on child nutrition. Social Cognitive Theory posits that self-efficacy shapes behaviour through perceived capability to perform specific actions (Egele et al., 2025), while the Theory of Planned Behaviour emphasizes perceived behavioural control and social norms as determinants of intention and practice (Hagger &

Hamilton, 2024). Empirical evidence suggests that maternal self-efficacy and social support are positively associated with improved feeding practices and dietary diversity (Brani et al., 2024a; Zambetti et al., 2025). However, recent reviews highlight inconsistencies in translating psychosocial improvements into measurable anthropometric gains, particularly in low resource environments where structural barriers may constrain behavioural agency (Arqam et al., 2026). This inconsistency raises important theoretical questions regarding the boundary conditions of behavioural models in structurally constrained settings.

The Social Ecological Model proposes that child growth emerges from dynamic interactions across individual, interpersonal, community, and systemic levels (Oudat et al., 2025). Despite this multilevel understanding, most empirical studies either examine psychosocial predictors of feeding practices or analyse socioeconomic determinants of stunting independently. Few studies have tested an integrated structural framework that simultaneously links maternal self-efficacy, maternal social support, feeding practices, and child stunting within high risk populations. Evidence from Eastern Indonesia remains particularly limited, restricting insight into whether behavioural constructs derived from dominant health theories retain explanatory relevance in regions characterized by structural vulnerability. Addressing this gap is essential to avoid overreliance on behaviour centered interventions in contexts where structural determinants may predominate.

This study addresses that gap by examining the structural relationships between maternal self-efficacy, maternal social support, child feeding practices, and stunting among mother child dyads in a stunting prone district of Eastern Indonesia using structural equation modelling. By empirically testing the boundary conditions of behavioural constructs within a socioeconomically vulnerable setting, this research contributes to the refinement of theory application in child nutrition. The findings aim to clarify the relative contribution of maternal level determinants within a broader ecological system and to inform the development of more context sensitive, multilevel strategies for stunting prevention.

METHOD

Study Design and Setting

This study employed an analytic cross-sectional design to examine the structural relationships between maternal self-efficacy, maternal social support, child feeding practices, and stunting in a stunting-prone area of Eastern Indonesia. A cross-sectional approach was considered appropriate for assessing associations among psychosocial constructs, behavioral practices, and anthropometric outcomes within a defined population at a single point in time. The study was conducted at Fakfak City Health Care Centre, Fakfak District, West Papua Province, a district characterized by persistent stunting prevalence and socioeconomic vulnerability.

Participants and Sampling

The study population consisted of biological mothers with children aged 0–59 months residing within the working area of Fakfak City Health Care Centre. Participants were recruited using consecutive sampling, whereby all eligible mother–child dyads attending maternal and child health services during the data collection period were invited to participate until the required sample size was achieved. This approach was selected to enhance representativeness within routine service settings while maintaining feasibility in a community-based context. Sample size estimation was conducted using G*Power software based on structural model testing parameters, assuming a small effect size, statistical power of 0.80, and alpha level of 0.05. The minimum required sample size was met, and the final analytic sample included 233 respondents. This sample size was also consistent with recommendations for Partial Least Squares Structural Equation Modeling (PLS-SEM), which accommodates small to medium samples depending on model complexity. Inclusion criteria were: (1) mothers aged 18 years or older; (2) having a child aged 0–59 months; (3) residing in the study area for at least six months; and (4) providing written informed consent. Exclusion criteria included: (1) children with congenital anomalies or chronic conditions affecting growth; (2) mothers with documented cognitive impairment limiting comprehension of the questionnaire; and (3) incomplete anthropometric or questionnaire data.

Measures and Instruments

Maternal Self-Efficacy

Maternal self-efficacy was measured using a structured questionnaire developed based on feeding self-efficacy and balanced nutrition principles. The instrument assessed mothers' confidence in selecting nutritious foods, preparing diverse menus, managing feeding difficulties, ensuring hygiene and food safety, and maintaining appropriate feeding frequency. Items were rated on a five-point Likert scale ranging from 1 indicating strongly disagree or not confident to 5 indicating strongly agree or very confident. Higher scores reflected greater perceived self-efficacy.

Maternal Social Support

Maternal social support was assessed using a multidimensional instrument capturing emotional, instrumental, informational, and appraisal support. The questionnaire measured perceived support from spouses, extended family members, and healthcare workers or community health cadres. All items were rated on a five-point Likert scale, with higher scores indicating stronger perceived support.

Child Feeding Practices

Child feeding practices were evaluated using indicators reflecting dietary diversity, feeding frequency, responsive feeding behavior, and feeding difficulty management. Dietary diversity assessment was aligned with WHO Infant and Young Child Feeding guidelines and included consumption across seven

food groups within the reference period. Behavioral dimensions were measured using Likert-scale items adapted from established feeding practice frameworks.

Stunting Measurement

Child height was measured by trained health personnel using standardized anthropometric procedures. Height-for-age Z-scores were calculated according to the WHO Child Growth Standards 2006 reference. Stunting was defined as height-for-age Z-score below minus two standard deviations. Anthropometric measurements followed WHO protocols to ensure measurement reliability and standardization.

Data Collection Procedure

Data collection was conducted during routine maternal and child health service sessions at Fakfak City Health Care Centre. After obtaining written informed consent, mothers completed structured questionnaires under supervision of trained enumerators to minimize missing responses and clarify item comprehension. Anthropometric measurements were obtained during the same visit using calibrated equipment. All research assistants underwent standardized training prior to data collection to ensure consistency in interview administration and measurement procedures.

Statistical Analysis

Data were analysed using SmartPLS version 4.1.1.6. A two-step PLS-SEM approach was applied, consisting of evaluation of the measurement model followed by assessment of the structural model.

PLS-SEM was selected due to its suitability for exploratory structural modeling, its robustness with small to medium sample sizes, and its prediction-oriented focus when theory testing occurs in relatively underexplored settings. Unlike covariance-based SEM, PLS-SEM does not require multivariate normality assumptions and is appropriate for complex models with latent constructs measured by multiple indicators. Measurement model evaluation included assessment of indicator reliability through outer loadings, internal consistency reliability using Cronbach's alpha and composite reliability, and convergent validity using Average Variance Extracted. Threshold values of 0.70 for reliability coefficients and 0.50 for Average Variance Extracted were considered acceptable. Discriminant validity was assessed using the Heterotrait-Monotrait ratio criterion. Structural model evaluation included examination of standardized path coefficients, coefficients of determination, effect sizes, collinearity diagnostics using Variance Inflation Factor, and model fit using Standardized Root Mean Square Residual. Statistical significance was determined through bootstrapping with 5,000 resamples to generate robust standard errors and confidence intervals.

Ethical Considerations

This study received ethical approval from the Health Research Ethics Committee of Politeknik Kesehatan Kementerian Kesehatan Sorong. Number DP.04.03/F.LIII.13.a./393/2026 on 17 January 2026. Written informed consent was obtained from all participants prior to data collection. Confidentiality of personal

information was strictly maintained, and participation was voluntary. Respondents were informed that they could withdraw from the study at any time without affecting their access to health services.

RESULT

Sample Characteristics

A total of 233 mother–child dyads were included in this investigation. The mean maternal age was 29.8 ± 6.4 years, with the majority aged 20–35 years (69.5%). Most mothers had completed secondary education (30.5%) and were not formally employed (67.0%). Over half of the respondents had two to three children (67.0%) and identified as indigenous Papuan (63.5%). Children had a mean age of 26.7 ± 15.2 months, with the largest proportion aged 12–36 months (40.3%). The prevalence of low birth weight (<2500 g) was 12.4%, while 72.1% had received complete basic immunization. More than half of households reported income below the regional minimum wage (57.9%) and had more than 4 household members (57.9%). Access to improved sanitation remained suboptimal, with nearly one-fifth lacking a private sanitary latrine (Table 1).

Table 1. Socio-Demographic Characteristics of Mothers, Children, and Households

Variable	n	%
Maternal Characteristics		
Maternal Age, Mean $\pm$ SD (years)	29.8 ± 6.4	
< 20 years	18	7.7
20–35 years	162	69.5
> 35 years	53	22.8
Educational Attainment		
No formal education / Did not complete primary school	21	9.0
Primary school or equivalent	48	20.6
Junior secondary school or equivalent	63	27.0
Senior secondary school or equivalent	71	30.5
Diploma / Bachelor's degree	30	12.9
Employment Status		
Homemaker	156	67.0
Civil servant / Military / Police	18	7.7
Private sector employee / Contract worker	32	13.7
Self-employed / Trader	19	8.2
Farmer / Fisher	8	3.4
Parity		
1 child	74	31.8
2–3 children	121	51.9
≥ 4 children	38	16.3
Ethnicity		
Indigenous Papuan	148	63.5
Non-Indigenous Papuan	85	36.5
Child Characteristics		
Child Age, Mean $\pm$ SD (months)	26.7 ± 15.2	
0–11 months	76	32.6
12–36 months	94	40.3
37–59 months	63	27.1
Sex		
Male	121	51.9
Female	112	48.1
Birth Weight		

< 2500 g (Low Birth Weight)	29	12.4
≥ 2500 g	204	87.6
Basic Immunization Status		
Complete	168	72.1
Incomplete	49	21.0
Never immunized	16	6.9
Household Characteristics		
Household Income		
Below Fakfak District Minimum Wage	137	58.8
At or above Fakfak District Minimum Wage	96	41.2
Household Size		
≤ 4 members	98	42.1
> 4 members	135	57.9
Primary Source of Drinking Water		
Piped water supply (municipal)	64	27.5
Protected well / Borehole	88	37.8
Protected spring	41	17.6
Rainwater / River / Other sources	40	17.1
Sanitation Facility		
Private household latrine (septic tank)	112	48.1
Shared / Public latrine	76	32.6
No improved sanitation facility	45	19.3

Note: SD = standard deviation; Low Birth Weight defined as < 2500 g.

The structural model demonstrated limited explanatory power. The R^2 values indicated weak predictive capacity for child feeding practices (0.010), maternal self-efficacy (0.009), and child stunting (0.036). Model fit evaluation showed an SRMR of 0.102, exceeding the recommended threshold of 0.08, suggesting suboptimal model fit. Collinearity diagnostics revealed no multicollinearity concerns (VIF range: 1.000–1.054). The standardized path coefficients and corresponding effect sizes are summarized in Table 2. Overall, structural relationships were weak ($\beta < 0.20$), and effect sizes were small to trivial ($f^2 < 0.03$).

Table 2. Structural Model Summary

Structural Path		β	f^2	R^2
Mothers' Self-Efficacy → Feeding Practices		-0.030	0.001	0.010
Maternal Social Support → Feeding Practices		0.093	0.009	0.010
Mothers' Self-Efficacy → Stunting		0.047	0.002	0.036
Maternal Social Support → Stunting		0.070	0.005	0.036
Feeding Practices → Stunting		0.167	0.029	0.036
Maternal Social Support → Mothers' Self-Efficacy		-0.096	0.009	0.009
Model Fit Indices:	SRMR = 0.102; NFI = -1.838; Chi-square = 148.771			
Collinearity: VIF range = 1.000–1.054				

Note: β = standardized path coefficient; f^2 = effect size (0.02 small, 0.15 medium, 0.35 large); $R^2 < 0.25$ indicates weak explanatory power.

Furthermore, Figure 1 describes the final structural model of maternal self-efficacy, maternal social support, child feeding practices, and child stunting.

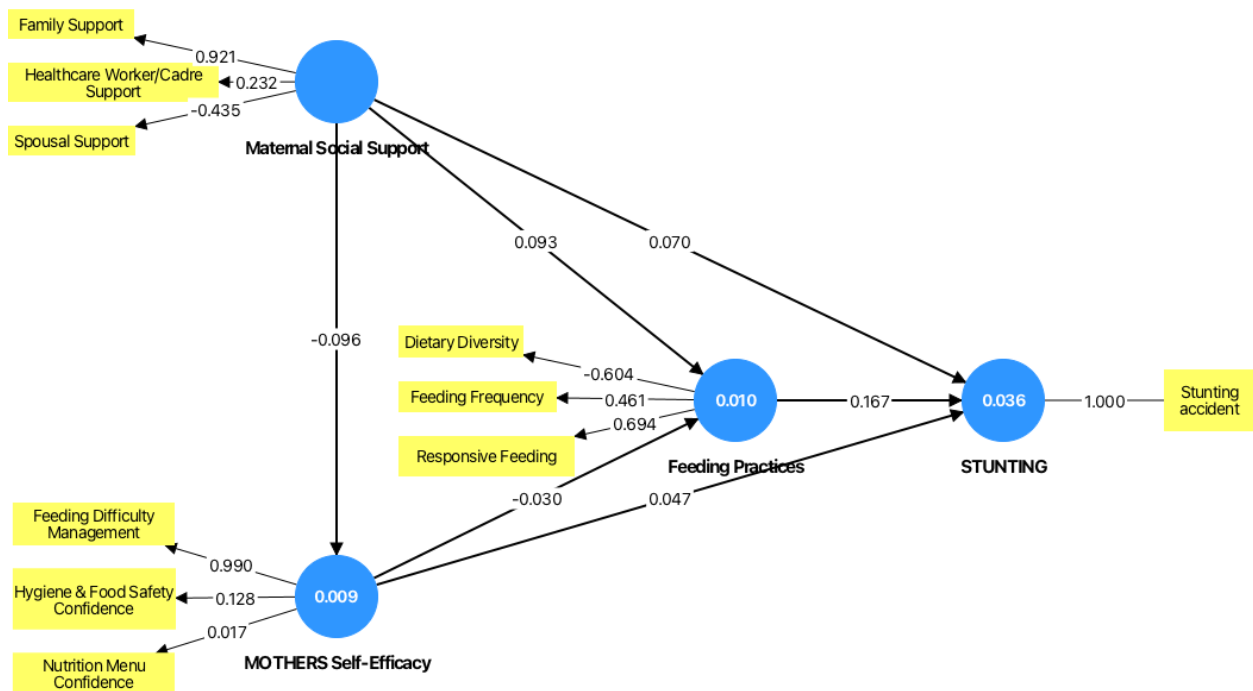


Figure 1. Final Structural Model of Maternal Self-Efficacy, Social Support, Feeding Practices, and Stunting

DISCUSSION

The findings indicated that psychosocial determinants demonstrated limited explanatory power in predicting child stunting (Table 2). These results suggest that individual-level behavioral constructs do not necessarily translate into measurable anthropometric improvements in environments characterized by socioeconomic vulnerability. Global evidence consistently identifies stunting as a multidimensional phenomenon shaped by complex interactions among biological, environmental, and structural determinants (Arief et al., 2025; Astuti et al., 2025). This paper extends this understanding by highlighting the constrained influence of maternal psychosocial factors within structurally disadvantaged settings.

Social Cognitive Theory posits that self-efficacy influences behavior through perceived capability to execute actions required to achieve desired outcomes (Egele et al., 2025). In child nutrition, higher maternal self-efficacy is theoretically associated with improved feeding practices and healthier growth trajectories. However, the current findings indicate that confidence alone may be insufficient to produce meaningful changes in child growth indicators. Empirical evidence suggests that the behavioral impact of self-efficacy becomes more pronounced when individuals operate within enabling environments that provide adequate resources and institutional support (Hendra et al., 2025; Xiao & Zheng, 2025; Yang et al., 2025). In structurally constrained contexts marked by poverty, food insecurity, and inadequate sanitation, cognitive determinants may be overshadowed by material limitations that restrict behavioral agency.

The Social Ecological Model provides a useful framework for interpreting these results. This model conceptualizes child health outcomes as products of dynamic interactions across multiple levels, including individual, interpersonal, community, and structural domains (Kong et al., 2025). The limited explanatory capacity observed in this study reinforces the argument that models focusing predominantly on individual-level predictors may inadequately capture the complexity of stunting in high-risk populations. Structural determinants such as household food insecurity, poor sanitation, limited economic resilience, and restricted access to quality health services have been consistently identified as major contributors to growth faltering (Cameron et al., 2021; Jalaludin et al., 2025b). By empirically examining psychosocial constructs within a structurally vulnerable population, this study contributes to testing the boundary conditions of behavioral theories in real-world settings.

The Theory of Planned Behavior further posits that behavioral performance is shaped by intention, subjective norms, and perceived behavioral control (Ajzen, 1991). Social support is expected to reinforce normative expectations and enhance maternal motivation to adopt recommended feeding practices. Prior studies have demonstrated positive associations between spousal or family support and improved child feeding behaviors (Douglas et al., 2023; Hu et al., 2025). However, the present findings indicate that perceived social support alone may not sufficiently offset structural barriers that constrain household decision-making. When economic pressures and environmental limitations dominate daily life, normative reinforcement and internal motivation may exert limited influence on child growth outcomes.

Differences between the present findings and prior studies reporting significant associations between maternal self-efficacy and feeding practices (Brani et al., 2024b; Özdemir & Ercan-Şahin, 2025) may reflect variation in contextual vulnerability. In settings with relatively stronger infrastructure and economic stability, psychosocial determinants may play a more decisive role in shaping nutritional outcomes. In contrast, in structurally disadvantaged environments, biological risks and material deprivation may exert stronger effects on linear growth. These findings underscore the importance of contextualizing behavioral models within broader socioeconomic realities rather than assuming universal applicability.

From a policy perspective in Indonesia, these findings carry important implications. National stunting reduction strategies have emphasized behavioral change communication and maternal education as central pillars of intervention. The present study suggests that such approaches should be systematically integrated with structural interventions targeting household food security, social protection, sanitation infrastructure, and strengthening of primary healthcare services. Fragmented interventions that prioritize behavioral modification without addressing structural constraints may yield limited impact in high-risk regions.

Conceptually, these findings support a reframing of intervention paradigms from behavior-centered models toward integrated structural reform approaches that situate individual agency within broader systems of opportunity and constraint. Addressing stunting in socioeconomically vulnerable regions requires multilevel strategies that combine psychosocial strengthening with systemic improvements in living conditions. Behavioral determinants remain relevant, but their effectiveness depends on the structural environments in which mothers attempt to exercise agency.

This study has several limitations. The cross-sectional design precludes causal inference. Self-reported measures may introduce social desirability bias. The structural model did not incorporate additional determinants such as household food insecurity, maternal nutritional status, or infection exposure, which may further explain variation in child growth outcomes. Future research should employ longitudinal and multilevel designs to examine cross-level interactions and refine explanatory models of stunting within structurally vulnerable populations.

Overall, this study demonstrates that maternal self-efficacy and social support exert limited influence on stunting outcomes in settings characterized by structural disadvantage. Integrating Social Cognitive Theory, the Theory of Planned Behavior, and the Social Ecological Model provides a comprehensive conceptual lens for understanding these findings and reinforces the necessity of systemic, multilevel approaches to sustainable stunting reduction.

CONCLUSION

Maternal psychosocial determinants alone may not substantially influence the prediction of child feeding practices and stunting in socioeconomically vulnerable populations. This study contributes to the literature by empirically showing that behavioral constructs derived from Social Cognitive Theory and the Theory of Planned Behavior do not operate independently from broader ecological constraints. By integrating behavioral and ecological perspectives within a single structural framework, this research provides evidence that maternal-level interventions alone may be insufficient to substantially reduce child stunting in high-risk regions. In addition, from a theoretical perspective, this investigation underscores the need to situate behavioral determinants within multilevel models that explicitly account for socioeconomic and environmental influences. Furthermore, from a practical standpoint, stunting prevention strategies should combine behavioral strengthening approaches with structural improvements in food security, sanitation, and economic resilience. However, this study was limited by its cross-sectional design and reliance on self-reported measures, which restrict causal interpretation. Future research should employ longitudinal and multilevel approaches to clarify dynamic pathways between psychosocial factors and child growth outcomes in vulnerable settings. Addressing stunting in high-risk regions requires a paradigm shift from isolated behavioral interventions toward systemic transformation of social determinants.

REFERENCES

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, Theories of Cognitive Self-Regulation*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Arief, Y. S., Yunita, F. C., Efendi, F., Murti, F. A. K., Pradipta, R. O., & McKenna, L. (2025). Social and Environmental Determinants of Childhood Stunting in Indonesia: National Cross-Sectional Study. *JMIR Pediatrics and Parenting*, 8, e68918. <https://doi.org/10.2196/68918>
- Arqam, Mhd. L., Firdaus, A. A., Atmojo, A. M., Saputri, G. Z., Furizal, Palahuddin, & Sirnopati, R. (2026). Integrating education-based interventions and machine learning for stunting prevention: A case study in East Lombok, Indonesia. *Dialogues in Health*, 8, 100264. <https://doi.org/10.1016/j.dialog.2025.100264>
- Astuti, S. J. W., Suindyah Dwiningwarni, S., & Atmojo, S. (2025). Modeling environmental interactions and collaborative interventions for childhood stunting: A case from Indonesia. *Dialogues in Health*, 6, 100206. <https://doi.org/10.1016/j.dialog.2025.100206>
- Brani, P., Mrvoljak-Theodoropoulou, I., Pechlivani, F., Gourounti, K., Iliadou, M., Palaska, E., Antsaklis, P., Drakakis, P., & Dagla, M. (2024a). Mothers' Breastfeeding Self-Efficacy after a High-Risk or Normal Pregnancy: A Greek Longitudinal Cohort Study. *European Journal of Investigation in Health, Psychology and Education*, 14(6), 1803–1820. <https://doi.org/10.3390/ejihpe14060119>
- Brani, P., Mrvoljak-Theodoropoulou, I., Pechlivani, F., Gourounti, K., Iliadou, M., Palaska, E., Antsaklis, P., Drakakis, P., & Dagla, M. (2024b). Mothers' Breastfeeding Self-Efficacy after a High-Risk or Normal Pregnancy: A Greek Longitudinal Cohort Study. *European Journal of Investigation in Health, Psychology and Education*, 14(6), 1803–1820. <https://doi.org/10.3390/ejihpe14060119>
- Cameron, L., Chase, C., Haque, S., Joseph, G., Pinto, R., & Wang, Q. (2021). Childhood stunting and cognitive effects of water and sanitation in Indonesia. *Economics & Human Biology*, 40, 100944. <https://doi.org/10.1016/j.ehb.2020.100944>
- Douglas, S., Walton, K., Schoppe-Sullivan, S., Tam, S., & Haines, J. (2023). Associations between feeding coparenting and food parenting practices: An observational study. *Appetite*, 191, 107088. <https://doi.org/10.1016/j.appet.2023.107088>
- Egele, V. S., Klopp, E., & Stark, R. (2025). How Valid Is Bandura's Social Cognitive Theory to Explain Physical Activity Behavior? *European Journal of Investigation in Health, Psychology and Education*, 15(2), 20. <https://doi.org/10.3390/ejihpe15020020>
- Hagger, M. S., & Hamilton, K. (2024). Longitudinal tests of the theory of planned behaviour: A meta-analysis. *European Review of Social Psychology*, 35(1), 198–254. <https://doi.org/10.1080/10463283.2023.2225897>
- Hendra, R., Habibi, A., Ridwan, A., Sembiring, D. A. E. P., Wijaya, T. T., Denmar, D., & Widana, I. W. (2025). *The Impact of Perfectionism, Self-Efficacy, Academic Stress, and Workload on Academic Fatigue and Learning Achievement: Indonesian Perspectives*. <https://www.degruyterbrill.com/document/doi/10.1515/edu-2025-0071/html?srsId=AfmBOopaaRuNELvan8PdRQvBKcWqyPS8moEj31BJc6DTPLAVN6SQMrrR>
- Hu, L., He, W., & Zhou, L. (2025). Association Between Family Support and Breastfeeding Self-Efficacy in a Cross-Sectional Study. *Nursing Open*, 12(4), e70210. <https://doi.org/10.1002/nop2.70210>
- Jalaludin, M. Y., Fauzi, M. D., Sidiartha, I. G. L., John, C., Aviella, S., Novery, E., Permatasari, A., & Muhardi, L. (2025a). Addressing Stunting in Children Under Five: Insights and Opportunities

- from Nepal, Bangladesh, and Vietnam—A Review of Literature. *Children*, 12(5), 641. <https://doi.org/10.3390/children12050641>
- Jalaludin, M. Y., Fauzi, M. D., Sidiartha, I. G. L., John, C., Aviella, S., Noverly, E., Permatasari, A., & Muhandi, L. (2025b). Addressing Stunting in Children Under Five: Insights and Opportunities from Nepal, Bangladesh, and Vietnam—A Review of Literature. *Children*, 12(5), 641. <https://doi.org/10.3390/children12050641>
- Kong, W., Yang, C., Li, X., Ning, Y., Shi, J., Liu, L., Liu, H., Guo, Y., & Li, M. (2025). The social ecological model of interpersonal health communication among rural older residents: A consensual qualitative study. *Frontiers in Public Health*, 13, 1615088. <https://doi.org/10.3389/fpubh.2025.1615088>
- Mulyani, A. T., Khairinisa, M. A., Khatib, A., & Chaerunisaa, A. Y. (2025). Understanding Stunting: Impact, Causes, and Strategy to Accelerate Stunting Reduction—A Narrative Review. *Nutrients*, 17(9), 1493. <https://doi.org/10.3390/nu17091493>
- Oudat, Q., Messiah, S. E., Ghoneum, A. D., & Okour, A. (2025). A Narrative Review of Multifactorial Determinants of Childhood Eating Behaviors: Insights and Interventions Using the Social Ecological Model. *Children*, 12(3), 388. <https://doi.org/10.3390/children12030388>
- Özdemir, E. H., & Ercan-Şahin, N. (2025). Determination of mothers' breastfeeding self-efficacy and mindful breastfeeding levels and their relationship. *Scientific Reports*, 15, 35959. <https://doi.org/10.1038/s41598-025-07651-w>
- Xiao, Y., & Zheng, L. (2025). The Relationship Between Self-Efficacy and Job Satisfaction: A Meta-Analysis from the Perspective of Teacher Mental Health. *Healthcare*, 13(14), 1715. <https://doi.org/10.3390/healthcare13141715>
- Yang, Y., Yan, Z., Zhu, J., Guo, W., Wu, J., & Huang, B. (2025). Exploring the mediating effect of feedback self-efficacy between students' self-feedback behavior and academic proficiency. *Frontiers in Psychology*, 16, 1637028. <https://doi.org/10.3389/fpsyg.2025.1637028>
- Zambetti, E., Crepaldi, M., Orgiu, F., Brivio, F., Colombi, M., Ince, A., Palestini, P., Cazzaniga, E., & Greco, A. (2025). Maternal Self-Efficacy and the Relation with Children's Dietary Behaviors in the Digital Era. *Dietetics*, 5(1), 1. <https://doi.org/10.3390/dietetics5010001>



Detection of DNA Changes in the Parp-1 Gene in the Small Intestine Tissue of Male White Rats Exposed to Pesticides Using PCR

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ABSTRACT

Excessive exposure to pesticides can damage DNA. This paper analyzes the effects of pesticide exposure on the small intestine tissue (ileum) of white rats (*Rattus Norvegicus*), focusing on DNA mutation, particularly in the Parp-1 gene. This paper was an experimental study with a posttest-only design. It involved 18 male white rats (*Rattus Norvegicus*), divided into 5 groups: dose 1 (1.1 ml) and dose 2 (2.2 ml) groups for 7 days of oral pesticide administration, dose 1 (1.1 ml) and dose 2 (2.2 ml) groups for 14 days of oral pesticide administration, and a control group. Blood samples were collected to measure acetylcholinesterase enzyme levels, and ileal tissue was collected for analysis of PARP-1 gene expression. DNA was isolated from the ileum of the small intestine, and amplification was performed using forward (5'-TGGCCAAAAGAAATCTAAG-3') and reverse (5'-ATCCCCAGTACAGTAA TAAG-3') primers. Results found that the lowest average acetylcholinesterase levels were observed in the high-dose group (2.2 ml) with a treatment period of 14 days, namely 18%. In contrast, the highest average acetylcholinesterase levels were observed in the low-dose group (1.1 ml) with a 7-day treatment period, namely 49%. Furthermore, the PARP-1 gene was detected by band thickness (band) in samples ranging from 260 to 347, using the PCR method with PARP-1 gene primers. Thus, pesticide exposure changes PARP-1 gene expression in the small intestinal tissue of white rats (*Rattus Norvegicus*). It indicates that pesticides can cause DNA mutation, leading to damage in the rat's small intestinal tissue.

INTRODUCTION

Pesticides are highly harmful to health and the environment because they are pollutants that generate free radicals that damage organs, trigger cell damage, and cause premature aging and decreased fertility (Jayati et al., 2020). If pesticides enter the food chain, then toxic chemical residues from pesticides also enter the human body, if in the long term it can interfere with human health due to the large content of carcinogenic chemicals that can cause various diseases such as cancer, Parkinson's, mutations, congenital disabilities, CAIDS (chemically acquired deficiency syndrome), and several other disorders (Siswoyo et al., 2018).

The digestive tract consists of the mouth, pharynx, esophagus, stomach, small intestine, colon, and anus (Chairunnisa, 2021). The intestine is part of the digestive tract, a complex, multi-fold tube that extends from the pylorus to the ileocecal valve. The intestine fills the middle and lower parts of the abdominal cavity. Changes in the histological structure of the intestine can be affected by the entry of certain amounts and types of compounds, including food, into the intestinal organs, because these compounds undergo absorption, distribution, metabolism, and excretion (Ersawati et al., 2018).

Excessive exposure to pesticides can disrupt the balance of enzymatic antioxidants. These disorders can increase free radical levels and trigger the production of reactive oxygen species (ROS) (Salampe et al., 2021). Increasing ROS levels can induce oxidative stress, leading to damage to various cellular molecules, including fats, carbohydrates, proteins, and DNA. If DNA damage is not repaired before replication, mutations will occur. DNA damage caused by carcinogenic materials can occur in the Parp-1 gene (ADP-ribose polymerase-1), which encodes a protein involved in DNA damage response, cell cycle arrest, and apoptosis. Under physiological conditions, PARP-1 is synthesized at low levels and increases in response to DNA damage (Karima & Widyarti, 2016). In the last decade, Parp-1 has been shown to play an important role in DNA damage repair in germ cells and in apoptosis in testicular germ cells. Several studies have shown the teratogenic and cytotoxic effects of pesticides, including one that reports that intraperitoneal administration of high doses can cause changes in spermatogonial cells. This paper analyzes the effects of pesticide exposure on the small intestine tissue (ileum) of white rats (*Rattus Norvegicus*), focusing on DNA mutation, particularly in the Parp-1 gene.

METHOD

This paper was an experimental study with a posttest-only design. The sample in this study consisted of 20 rats weighing 200-250 grams, but 2 died during observation. Thus, this study involved 18 male white rats (*Rattus Norvegicus*), divided into 5 groups: 2 rats in the negative control group for comparison, and 16 rats divided into 4 groups, each consisting of 4 rats. These 4 groups were treated with the same dose, different for 7 days and 14 days. However, one rat in the 14-day group with high doses died during treatment. Blood samples were collected to measure acetylcholinesterase enzyme levels, and ileal tissue was collected for analysis of PARP-1 gene expression. Research procedures were:

Blood Preparation and Sampling

Blood was collected after the rats were orally administered pesticides. The authors prepared the equipment in advance, including blood collection tubes. Then, we anesthetized the rats by placing them in a container and adding cotton soaked in 10% ether solution. Blood was collected from the orbital sinuses of the eye using a capillary tube, then transferred to a Vacutainer tube.

Organ DNA Isolation

The ileum tissue weighed up to 20 mg. The small intestine was homogenized in a mortar and pestle. Homogenate was mixed with 250 µl digestion buffer (100 mM NaCl; 10 mM Tris Cl, pH 8; 25 mM EDTA, pH 8; 0.5% (w/v) SDS; 0.1 mg/ml proteinase K), vortexed, and incubated at 55°C. for 12-18 hours. Homogenate was mixed with 250 µl of CI (chloroform: isoamyl alcohol) solution and centrifuged

at 4000 rpm, 4°C for 10 minutes. The formed supernatant layer was collected, along with a CI solution equal to the volume of supernatant taken (1:1), and centrifuged at 4000 rpm, 4°C for 10 minutes. For the DNA purification stage, the supernatant was transferred to a new endorf tube, then 1.5 volumes of 7.5 M ammonium acetate and 2 times the volume of absolute ethanol were added, and the mixture was centrifuged at 10000 rpm, 4°C for 10 minutes. The supernatant was discarded, the pellets were resuspended in 500 µl of 70% ethanol, and re-centrifuged at 10000 rpm, 4°C for 10 minutes. Next, the pellets were dried, aerated, and 50 µl of TE buffer was added until the DNA dissolved. The isolate was then stored at 4°C.

PCR (Polymerase Chain Reaction)

The ileum DNA sample was subjected to PCR to amplify the PARP-1 gene. The size of the PARP-1 gene amplification product was 254 bp (base pairs). The forward and reverse primers used were those reported by Widyarti & Wibi (2009), namely the forward (5'-GTTGTTTGTGTGTGTTTCCTA-3') and reverse (5'TTTTGTAGCTCAAAAAATGCTTAA-3') primers. Table 1 describes the reaction composition for the PCR process.

Table 1. Reaction composition for PARP-1 gene amplification

Composition	Volume (µl)	Concentration
BSA	6	400 ng/µl
Primer forward	3	10 pmol/µl
Primer forward	15	10 pmol/µl
PCR Mix (KAPA 2G Fast Ready Mix)		
DNA template	2	400 ng/µl

Then, the PCR was performed using the TaKaRa PCR Thermal Cycler instrument with the following program (Table 2).

Table 2. PCR Program

Process		Temperature	Time
Initial Denaturation	1 Cycle	95°C	5 minute
Denaturation		95°C	
Annealing	33 Cycles	55°C	45 minute
Extension		72°C	
Extension		72 °C	10 Minute

Elektroforesis Gel Agarosa 1.5%

Electrophoresis on a 1.5% agarose gel was performed to determine the success of the PCR. The tools used are plates, combs, and chambers. The plate installed with a comb was adjusted for flatness using a Waterpass. Next, agarose powder was weighed to 0.3 g in an Erlenmeyer flask and added to 1X TBE buffer to a final volume of 20 ml. The Erlenmeyer was covered with perforated plastic wrap (to allow evaporation) and heated in the microwave for 1-2 minutes at 50°C until it boiled and appeared clear. Then, we added 3 µl of EtBr and homogenized. The agarose solution was poured onto the plate and left to harden for 1 hour. After the agarose gel had hardened, the comb was removed, the plate was attached to the

chamber, and 1X TBE buffer was poured until the gel was submerged. Amplified samples and DNA markers (O'GeneRuler™ 50 bp) were diluted to 3 µl each and added to each well. The electrode was connected to a power supply at 100 volts for 30-45 minutes. The electrophoresis gel was collected, visualized under a UV transilluminator, and documented with a camera.

RESULT

The results in this study were shown in Table 3, Figure 1, and Figure 2. It involved 15 blood and ileum tissue samples from pesticide-exposed rats and 2 from the control group. Table 3 presents the frequency distributions of ingested pesticides and AChE levels in rats.

Table 3. Frequency distribution based on ingested pesticides and AChE levels in rats

Combination of Interventions	Dose	Acetylcholinesterase Levels (%)				Average
		1	2	3	4	
7 Days	Dose 1 (1.1 ml)	44%	34%	69%	48%	49%
	Dose 2 (2.2 ml)	31%	24%	39%	43%	34%
14 Days	Dose 1 (1.1 ml)	32%	23%	23%	32%	27%
	Dose 2 (2.2 ml)	21 %	18%	16%	-	18%
Control A		59%				
Control B		43%				

In addition, Figure 1 indicates the amplification of the Parp-1 Gene in the mouse ileum (*Rattus Norvegicus*) after 7 days of intervention.

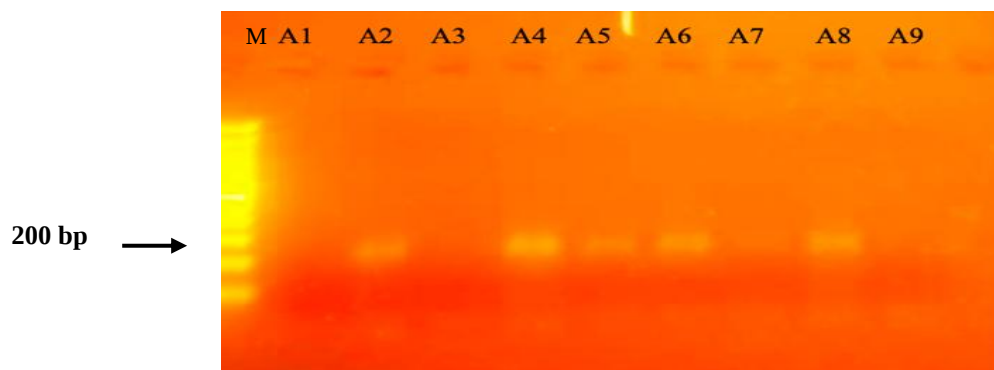


Figure 1. Results of amplification of the parp-1 gene in mouse ileum (*Rattus norvegicus*)

Furthermore, Figure 2 exhibits the amplification of the Parp-1 Gene in the mouse ileum (*Rattus Norvegicus*) after 14 days of intervention.

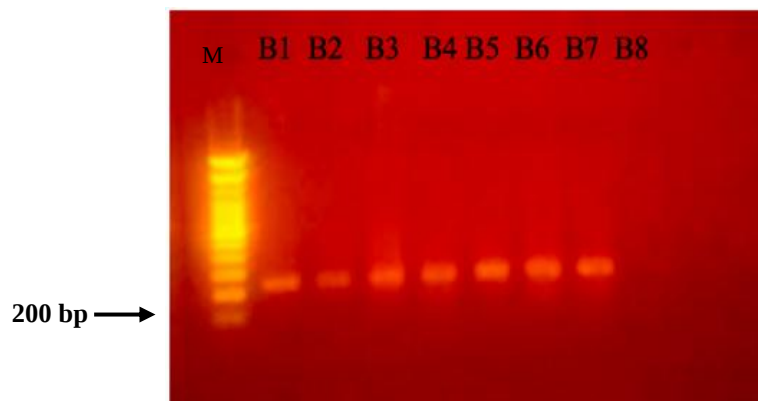


Figure 2. Results of amplification of the parp-1 gene in mouse ileum (*Rattus norvegicus*)

DISCUSSION

Results found that the lowest average acetylcholinesterase levels were observed in the high-dose group (2.2 ml) with a treatment period of 14 days, namely 18%, which fell within the 0-25% range and was categorized as severe poisoning. In contrast, the highest average acetylcholinesterase levels were observed in the low-dose group (1.1 ml) with a treatment period of 7 days, namely 49%, which fell within the 25-50% range and was categorized as moderate poisoning. The standard for acetylcholinesterase enzyme levels in blood is: normal levels: 85-100%; mild poisoning: 50-85%; moderate poisoning: 25-50%; and severe poisoning: 0-25% (Muawanah et al., 2025).

In addition, based on the visual analysis, the PARP-1 gene was detected by band thickness (band) in samples ranging from 260 to 347, using the PCR method with PARP-1 gene primers. The presence of bands indicates PARP-1 expression, which is induced by pesticides containing carcinogenic substances. According to research (Karima & Widyarti, 2016), the parp-1 gene was amplified by carcinogenic chemical exposure in the rat testicular organ, leading to histological structural changes.

CONCLUSION

Thus, pesticide exposure changes PARP-1 gene expression in the small intestinal tissue of white rats (*Rattus Norvegicus*). It indicates that pesticides can cause DNA mutation, leading to damage in the rat's small intestinal tissue.

REFERENCES

Chairunnisa, N. (2021). *Gambaran Histopatologi Ileum Tikus Putih (Rattus norvegicus) Betina Pasca Pemberian Dimethoate*. Universitas Hasanuddin.

- Ersawati, N., Susari, N. N. W., & Setiasih, N. L. E. (2018). Berat Organ Usus Tikus Putih (*Rattus Norvegicus*) Pasca Penambahan Tepung Daun Kelor (*Moringa Oleifera*) pada Pakan. *Indonesia Medicus Veterinus*, 7(3), 277. <https://doi.org/10.19087/imv.2018.7.3.277>
- Jayati, R. D., Lestari, F., & Betharia, R. (2020). Pengaruh Pestisida Nabati Ekstrak Daun Kenikir (*Cosmos Caudatus*) terhadap Mortalitas Ulat Grayak (*Spodoptera Litura*) pada Daun Bawang (*Allium Fistulosum*). *BIOEDUSAINS: Jurnal Pendidikan Biologi Dan Sains*, 3(1), 66–74. <https://doi.org/10.31539/bioedusains.v3i1.1284>
- Karima, I., & Widyarti, S. (2016). Studi Gen Parp-1 Ekson 23 pada Testis Mencit Setelah Induksi Formalin: Tidak Terdeteksi Mutasi. *Biotropika: Journal of Tropical Biology*, 4(1), 11–13. <https://biotropika.ub.ac.id/index.php/biotropika/article/view/398>
- Muawanah, Fatmawati, A., Rasyid, N. Q., Anita, & Pramudya, D. (2025). Profil Kadar Asetil Kolinesterase Pada Petani Pengguna Pestisida Di Kabupaten Jeneponto. *Medika Trada : Jurnal Teknik Elektromedik Polbitrada*, 6(1), 49–54. <https://doi.org/10.59485/jtemp.v6i1.117>
- Salampe, M., Marwati, M., & Aksa, R. (2021). Efek Pemberian Ekstrak Etanol Biji Corchorus Capsularis Terhadap Kadar Ast Dan Alt Tikus Yang Diinduksi Diazinon. *Media Farmasi*, 17(1), 5. <https://doi.org/10.32382/mf.v17i1.1863>
- Siswoyo, E., Masturah, R., & Fahmi, N. (2018). Bio-pestisida Berbasis Ekstrak Tembakau dari Limbah Puntung Rokok untuk Tanaman Tomat (*lycopersicum esculentum*). *Jurnal Presipitasi : Media Komunikasi Dan Pengembangan Teknik Lingkungan*, 15(2), 94. <https://doi.org/10.14710/presipitasi.v15i2.94-99>



The Association Between Hopelessness and Medication Adherence among Type 2 Diabetes Mellitus Patients

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ABSTRACT

Optimal glycemic control and prevention of complications in Type 2 Diabetes Mellitus (T2DM) largely depend on patients' medication adherence. However, poor adherence remains a major challenge, and psychological factors such as hopelessness may contribute to this problem. This study aimed to examine the relationship between hopelessness and medication adherence among patients with T2DM. A quantitative cross-sectional study was conducted between July and August 2024 involving 73 T2DM patients at the Kalasan Public Health Center, Yogyakarta, selected through consecutive sampling. Hopelessness was assessed using the Beck Hopelessness Scale (BHS), while medication adherence was measured using the 8-item Morisky Medication Adherence Scale (MMAS-8). Data were analyzed using the Spearman rank correlation test. The prevalence of hopelessness was 17.8%, and 21.9% of participants demonstrated low medication adherence. A significant weak negative correlation was found between hopelessness and medication adherence ($\rho = -0.268$, $p = 0.022$), indicating that higher hopelessness was associated with lower medication adherence. These findings suggest that addressing hopelessness through psychological assessment and supportive interventions may improve medication adherence and contribute to better diabetes management among patients with T2DM.

INTRODUCTION

Diabetes mellitus is a growing global public health problem with an estimated 425 million people affected in 2018 and is projected to rise to 629 million by 2040 with increases particularly prevalent in developing countries (Demos *et al.*, 2020). Type 2 Diabetes Mellitus (T2DM) is a disorder of glucose metabolism marked by long-term high blood glucose levels. It is caused by a combination of insulin resistance and low insulin secretion (Garcia-Garcia *et al.*, 2020; (Algoblan, Alalfi and Khan, 2014). T2DM is by far the most common form of diabetes mellitus and accounts for ~90% of diabetes cases (Reed, Bain and Kanamarlapudi, 2021).

The primary goal of diabetes management is to control blood glucose levels within a normal range and prevent the development of diabetes-related complications, which can be achieved through diet, physical exercise, and oral hypoglycemic medication (Fujiwara *et al.*, 2019). Extensive scientific evidence demonstrated that high adherence to antidiabetic drugs is critical to maintain glycemic control among T2DM patients (Demos *et al.*, 2020). Adherence to anti-diabetic medications refers to the extent to which an individual's medication use behaviour coincides with medical advice, and persistence as the duration of time from initiation to discontinuation of therapies (Murwanashyaka *et al.*, 2022). *Poor medication adherence*

in T2DM patients is well documented to be very common and is associated with inadequate glycemic control; increased morbidity and mortality (Polonsky and Henry, 2016). Poor medication adherence leads to increased health care resource costs, including more frequent hospitalizations (Brunton and Polonsky, 2017). In developed nations approximately 50% of diabetic patients do not adhere to the recommended therapies (Demos *et al.*, 2020). Previous study consistently demonstrated non-adherence to medication among patients with diabetes (Murwanashyaka *et al.*, 2022; Sahoo *et al.*, 2022; Alsaidan *et al.*, 2023); and non-adherence compromises safety and treatment effectiveness, leading to increased morbidity and mortality rates. This contributes to significant direct and indirect costs in the healthcare system (Lee *et al.*, 2006; Hutchins *et al.*, 2011).

Hopelessness is an important psychological construct, defined as negative expectations regarding oneself and one's future life and a negative emotional state characterized by the lack of finding a solution for one's problems (Yip and Cheung, 2006; Balsamo *et al.*, 2020; Fitriawan *et al.*, 2023). It is a cognitive feature of negative view of the self, and of the self in relation to the world and in relation to the future. In his research focused on depression mood and suicidal behavior, (Beck *et al.*, 1974) observed that patients diagnosed with depressive disorders shared common cognitive features—a negative view of the self, and of the self in relation to the world and in relation to the future. He paid special attention to one of these cognitive features—a negative view of the self in relation to the future, by introducing the construct of “hopelessness”. Unlike depression, it is oriented towards the future as opposed to the present state (Beck *et al.*, 1974; Balsamo *et al.*, 2020). Hopelessness is negatively associated with lower resilience (Huen *et al.*, 2015), and psychological resilience plays a mediating role in the relationship between depression, diabetes distress, and treatment adherence (Wojujutari, Idemudia and Ugwu, 2024).

While extensive scientific evidence demonstrated the prevalence of depression among T2DM patients and its association with medication adherence (Gonzalez *et al.*, 2008; Yang *et al.*, 2023; Yorke *et al.*, 2023), currently there is limited literature regarding the prevalence of hopelessness among T2DM and whether or not hopelessness is significantly associated with adherence to antidiabetic medication. Born from the lack of evidence on these topics, our present study aimed to explore the prevalence of hopelessness among T2DM patients and its association with medication adherence.

METHOD

Study design

Observational analytic study with quantitative approach and cross-sectional design was conducted to investigate the association between hopelessness and medication adherence among type 2 diabetes mellitus (T2DM) patients.

Study setting and periods

This study was conducted at Kalasan public health center in Sleman Regency, Special Region of Yogyakarta Province, Indonesia. The data were collected from July until August 2024.

Sample size calculation and sampling technique

We calculated the minimum sample size for this study using G*Power software version 3.1.9.7 intended to calculate sample size required for statistical test bivariate: normal model with the assumption of two tailed, $\alpha=0.05$, power level=0.95, and an correlation coefficient=0.405 obtained from previous study (Das *et al.*, 2013), which the minimum sample size was 73.

Consecutive sampling technique was used to recruit the participants. The inclusion criteria were: patients who were clinically diagnosed with type 2 diabetes mellitus (T2DM), received oral antidiabetic medication, understood Indonesia language, were able to read and write, and were voluntarily willing to participate as study participants. Patients who did not complete the informed consent form were excluded from the study.

Instruments

Self-administered validated instruments in the Indonesian language were used to measure research variables and were divided into 3 sections : 1). sociodemographic questionnaire, 2). Beck Hopelessness Scale (BHS), 3). The 8 Item of Morisky Medication Adherence Scale (MMAS-8).

In the second section, the Beck Hopelessness Scale (BHS) was used to determine hopelessness among T2DM patients. The BHS is standardized self-rated instrument developed by Beck *et al.* that widely used to assess the level of hopelessness (Beck *et al.*, 1974). This instrument consists of 20 question items and each item has a dichotomous answer: true or false. There are 11 items with negative statements (items 2, 4, 7, 9, 11, 12, 14, 16, 17, 18, 20) scored as follows: true (1 point) and false (0 points). There are 9 items with positive statement (items 1, 3, 5, 6, 8, 10, 13, 15, 19) scored as follows: true (0 points) and false (1 point). The total BHS score ranges from 0-20 and higher scores indicate greater hopelessness (Balsamo *et al.*, 2020). The BHS had a cut-off point of 9 to determine hopelessness. Based on this cut-off point, if the BHS total score obtained by participants was ≥ 9 , they were considered as hopeless (Huen *et al.*, 2015; Tin *et al.*, 2015; Fitriawan *et al.*, 2023). The Indonesian version of BHS is considered a valid instrument, Cronbach's $\alpha = 0.918$, indicating high internal consistency (Hutajulu, Djunaidi and Triwahyuni, 2021).

In the third section, medication adherence was determined using Morisky Medication Adherence Scale-8 (MMAS-8). The MMAS-8 assess the patient's experiences with medications during the 2 weeks prior to answering the questionnaire (Olagbemide *et al.*, 2021). It is an eight item scale scored as follows: Items 1–4 and 6–8 are reverse-coded, i.e., a NO is scored 1 and YES is scored 0. Item 5 is direct coded a NO is scored 0 and a YES is scored 1 while item 8 has five options scored in a negative direction from 1 (always) to 5 (never). Item 8's score is further divided by 5 when calculating a summated score. The total MMAS-8 score has a range of 0–8. Based on the total MMAS-8 score obtained by the patients, the medication

adherence level were categorized as low (≤ 6), moderate (>6 to <8), and high (8) medication adherence (Janežič, Locatelli and Kos, 2017; Olagbemide *et al.*, 2021). In this study, content validity was used to evaluate the validity of Indonesian version of MMAS-8 to measured medication adherence among T2DM patients, and 2 expert (1 internist and 1 medical surgical nurse specialist) participated in the evaluation of each of the questionnaire items. In this study, the MMAS-8 had I-CVI of 0.875, suggesting that this instrument is valid (Yusoff, 2019). In this study, the internal reliability of MMAS-8 had a Cronbach's $\alpha=0.83$, suggesting high internal reliability.

Ethical consideration

Ethical clearance was obtained from the Health Research Ethics Committee, Politeknik Kesehatan Tanjung Karang, Indonesia (ethical number: 453/KEPK-TJK/VI/2024). Before the data collection, detailed research information was provided to the participants and the informed consent was obtained from them before commencing the study. The participant's identity and their data were kept confidential throughout the study, with only the researcher having access to the study data.

RESULT

Sociodemographic characteristic of the study participants

The sociodemographic characteristics of T2DM patients who participated in this study are shown in Table 1. Most of the T2DM patients were female ($n=42$; 57.5%) and elderly with an age ≥ 60 years ($n=41$; 56.2%). Based on the education background, the majority of the T2DM patients graduated from the university ($n=29$; 39.7%), suggesting a high education background. Most of the T2DM patients had a monthly income between IDR 1-2 million ($n=19$; 26.2%). Most of the participants had been diagnosed with T2DM between 1-5 years ($n=29$; 39.7%) and had received antidiabetic medication for 1–5 years ($n=30$; 41.1%). 16.4% of the T2DM patients reported that they were smoking.

Table 1. Sociodemographic characteristic of the participants ($n=73$)

Sociodemographic profiles	n	%
Age (years)		
35-59	32	43.8
≥ 60	41	56.2
Sex		
Male	31	42.5
Female	42	57.5
Level of education		
Elementary school	15	20.5
Junior high school	9	12.3
Senior high school	20	27.5
Higher education / University	29	39.7
Monthly income (IDR/Indonesian Rupiah)		
< 1 million	21	28.7
1-2 million	19	26.2
2-3 million	15	20.5
3-4 million	12	16.4

> 5 million	6	8.2
Length of disease		
< 1 years	16	21.9
1-5 years	29	39.7
6-10 years	17	23.3
≥ 11 years	11	15.1
Length of medication		
< 1 years	18	24.6
1-5 years	30	41.1
6-10 years	16	21.9
≥ 11 years	9	12.4
Smoking		
Yes	12	16.4
No	61	83.6

Hopelessness among T2DM patients

The Beck Hopelessness Scale was used as an instrument to assess hopelessness among T2DM patients. Hopelessness among T2DM patients based on BHS was shown in Table 2. Our study elucidated that 13 (17.8%) of T2DM patients felt hopeless, suggesting a low prevalence of hopelessness among T2DM patients.

Table 2. Hopelessness among T2DM patients (n=73)

Hopelessness	BHS total score	n	%
Yes	≥9	13	17.8
No	0-8	60	82.2

Medication adherence among T2DM patients

Medication adherence was determined using the Morisky Medication Adherence Scale-8 (MMAS-8). The level of medication adherence among T2DM patients based on MMAS-8 was shown in Table 3. According to MMAS-8, high medication adherence was found only among 28 subjects (38.4%) in our setting.

Table 3. Medication adherence among T2DM patients

Adherence	MMAS-8 total score	n	%
High	8	28	38.4
Medium	>6 to <8	29	39.7
Low	≤6	16	21.9

Correlation between hopelessness and medication adherence among T2DM patients

The correlation between hopelessness and medication adherence among T2DM patients was analysed using Spearman's rank tests, and the results were shown in Figure 1.

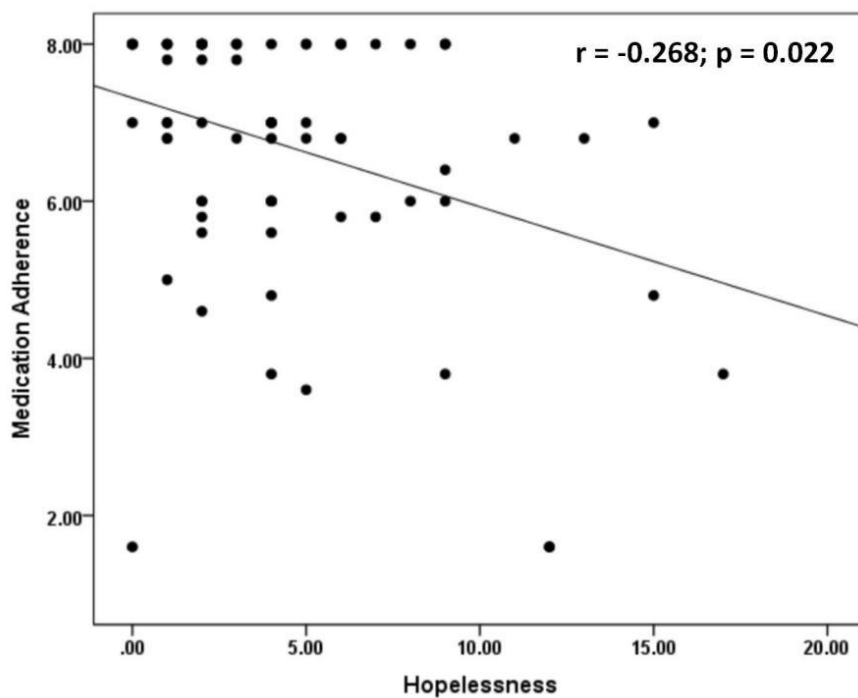


Figure 1. hopelessness had a significant weak inverse correlation with medication adherence among T2DM patients ($p = 0.022$; $r = -0.268$).

The Spearman's rank test results demonstrated a significant inverse and weak correlation between BHS score and MMAS-8 score ($p = 0.022$; $Rho = -0.268$). This result indicates the significant inverse correlation between hopelessness and medication adherence among T2DM patients. The diabetic patients with higher hopelessness levels were more likely to have lower medication adherence. In other hand, diabetic patients with lower hopelessness level were more likely to have higher medication adherence.

DISCUSSION

This study was conducted to measure adherence to medications among T2DM patients and assess the correlation between hopelessness and medication adherence.

Our study demonstrated that high medication adherence was found only among 28 (38.4%) of T2DM patients who participated. Consistent with our finding, (Sahoo *et al.*, 2022) found that only 34.14% of T2DM patients had good medication adherence (Sahoo *et al.*, 2022). (Alsaidan *et al.*, 2023) found that only 30.8% of patients with T2DM were highly adherent to the medications prescribed by doctors, and 21.5% had low medication adherence (Alsaidan *et al.*, 2023). AlQarni *et al.*, (2019). reported that only 35.8% of diabetes patients were highly adherent to medications (AlQarni *et al.*, 2019). A study by (Murwanashyaka *et al.*, 2022). in 2022 also reported that a higher proportion of participants had poor adherence practices (Murwanashyaka *et al.*, 2022). A study by (Venkatesan, Dongre and Ganapathy, 2018) found 45.4% of subjects with poor adherence (Venkatesan, Dongre and Ganapathy, 2018). Contrarily, the

study by (Sharma *et al.*, 2023) found that 79.5% of diabetic patients had a high adherence to treatment (Sharma *et al.*, 2023). Another study by (Demos *et al.*, 2020). reported that 75% of diabetic patients had good medication adherence (Demos *et al.*, 2020). Differences in rates of medication adherence may be attributed to various study settings, sociodemographic variables, and tools used (Sahoo *et al.*, 2022). A meta-analysis study reported that adherence to diabetic medicine ranged from 38.5% to 93.1%.

Hopelessness is an important psychological construct, defined as negative expectations regarding oneself and one's future life and a negative emotional state characterized by the lack of finding a solution for one's problems (Yip and Cheung, 2006; Balsamo *et al.*, 2020; Fitriawan *et al.*, 2023). It is a cognitive feature of negative view of the self, and of the self in relation to the world and in relation to the future. Our study elucidated that based on BHS, only 13 (17.8%) of participants had a hopelessness, suggesting low prevalence of hopelessness among T2DM patients in our study setting.

Our study demonstrated a significant inverse and weak correlation between hopelessness and medication adherence among T2DM patients. Our finding suggesting that the diabetic patients with higher hopelessness levels were more likely to have lower medication adherence. In other hand, diabetic patients with lower hopelessness level were more likely to have higher medication adherence. Our finding consistent with previous study that reported the negative association between hopelessness and medication adherence (Kargin, Ersöğütçü and Aslanoğlu, 2021). Chronic illness management required patient planning, time, and motivation. hopelessness may impair self-care of chronic illness by adversely effecting memory, energy, and executive function. Moreover, hopelessness associated may decrease motivation to care for chronic illness (Katon, 2011). A systematic review by (DiMatteo, Lepper and Croghan, 2000) and colleagues found that comorbid depression in patients with chronic medical illness decreased adherence to self-care regimens by threefold (DiMatteo, Lepper and Croghan, 2000). Studies in patients with diabetes have shown that depression adversely effects adherence to diet, exercise regimens, cessation of smoking, and taking the three key diabetes control medications as prescribed; oral hypoglycemics, antihypertensives, and lipid control medications (Lin *et al.*, 2004). In other study, hopelessness may lead to unstable of blood glucose and physical problems as a result of complications of DM-2. Additionally, it affects the psychosocial situation. Therefore, it is important for nurses to concern about hopelessness condition in DM-2 to prevent of unstable of blood glucose level (Destanti and Susanti, 2017). Hopelessness also negatively associated with resilience (Huen *et al.*, 2015), and psychological resilience plays a mediating role in the relationship between depression, diabetes distress, and treatment adherence (Wojujutari, Idemudia and Ugwu, 2024).

However, our current study possessed several limitations that should be considered. First, our study was performed using cross-sectional design, meaning that our study only demonstrated association but not causality effect. Second, the study participants was recruited using consecutive sampling, a type of non-

probability sampling, hence limiting the generalizability of our finding. Third, since self-administered questionnaires was used as the study instrument, our study was prone to recall bias and social desirability bias.

CONCLUSION

Our present study provides evidence regarding the low prevalence of hopelessness and low medication adherence among T2DM patients. Moreover, our study demonstrated that hopelessness had a significant weak inverse correlation with medication adherence among T2DM patients. Our findings highlight the poor medication adherence as a critical issue that potentially impedes the successful glycemic control among T2DM patients. Our findings also highlight hopelessness as an important psychological construct among T2DM patients. Assessments of medication adherence among T2DM should be performed on a regular basis to detect those who have poor adherence. Our findings also support the development of more proactive interventions to ameliorate hopelessness and increase medication adherence among T2DM patients.

REFERENCES

- Al-Goblan, A. S., Al-Alfi, M. A., & Khan, M. Z. (2014). Mechanism linking diabetes mellitus and obesity. *Diabetes, metabolic syndrome and obesity : targets and therapy*, 7, 587–591. <https://doi.org/10.2147/DMSO.S67400>
- AlQarni, K., AlQarni, E. A., Naqvi, A. A., AlShayban, D. M., Ghorri, S. A., Haseeb, A., Raafat, M., & Jamshed, S. (2019). Assessment of Medication Adherence in Saudi Patients With Type II Diabetes Mellitus in Khobar City, Saudi Arabia. *Frontiers in pharmacology*, 10, 1306. <https://doi.org/10.3389/fphar.2019.01306>
- Alsaidan, A. A., Alotaibi, S. F., Thirunavukkarasu, A., ALruwaili, B. F., Alharbi, R. H., Arnous, M. M., Alsaidan, O. A., Alduraywish, A. S., & Alwushayh, Y. A. (2023). Medication Adherence and Its Associated Factors among Patients with Type 2 Diabetes Mellitus Attending Primary Health Centers of Eastern Province, Saudi Arabia. *Medicina (Kaunas, Lithuania)*, 59(5), 989. <https://doi.org/10.3390/medicina59050989>
- Balsamo, M., Carlucci, L., Innamorati, M., Lester, D., & Pompili, M. (2020). Further Insights Into the Beck Hopelessness Scale (BHS): Unidimensionality Among Psychiatric Inpatients. *Frontiers in psychiatry*, 11, 727. <https://doi.org/10.3389/fpsy.2020.00727>
- Beck, A. T., Weissman, A., Lester, D., & Trexler, L. (1974). The measurement of pessimism: the hopelessness scale. *Journal of consulting and clinical psychology*, 42(6), 861–865. <https://doi.org/10.1037/h0037562>
- Das, R., Singh, O., Thakurta, R. G., Khandakar, M. R., Ali, S. N., Mallick, A. K., Roy, P., & Bhattacharrya, A. K. (2013). Prevalence of Depression in Patients with Type II Diabetes Mellitus and its Impact on Quality of Life. *Indian journal of psychological medicine*, 35(3), 284–289. <https://doi.org/10.4103/0253-7176.119502>

- Demoz, G. T., Wahdey, S., Bahrey, D., Kahsay, H., Woldu, G., Niriayo, Y. L., & Collier, A. (2020). Predictors of poor adherence to antidiabetic therapy in patients with type 2 diabetes: a cross-sectional study insight from Ethiopia. *Diabetology & metabolic syndrome*, 12, 62. <https://doi.org/10.1186/s13098-020-00567-7>
- Destanti, L., Susanti H. (2017). Nursing Care of Hopelessness Analysis in a Patient with Type 2 Diabetes Mellitus: A Case Study. *Proceeding on Health and Medicine*, 1, 1-2.
- DiMatteo, M. R., Lepper, H. S., & Croghan, T. W. (2000). Depression is a risk factor for noncompliance with medical treatment: meta-analysis of the effects of anxiety and depression on patient adherence. *Archives of internal medicine*, 160(14), 2101–2107. <https://doi.org/10.1001/archinte.160.14.2101>
- Fitriawan, A., Widayati, R., Rizqi, J., & Alfrendo, C. (2023). Hopelessness Among Nursing Students During The early Phase of COVID-19 Pandemic : Online Cross Sectional Study At Universitas Respati Yogyakarta. *Jurnal Keperawatan Respati Yogyakarta*, 10(1), 6-11. doi:10.35842/jkry.v10i01.716
- Fujiwara, Y., Eguchi, S., Murayama, H., Takahashi, Y., Toda, M., Imai, K., & Tsuda, K. (2019). Relationship between diet/exercise and pharmacotherapy to enhance the GLP-1 levels in type 2 diabetes. *Endocrinology, diabetes & metabolism*, 2(3), e00068. <https://doi.org/10.1002/edm2.68>
- Gonzalez, J. S., Peyrot, M., McCarl, L. A., Collins, E. M., Serpa, L., Mimiaga, M. J., & Safren, S. A. (2008). Depression and diabetes treatment nonadherence: a meta-analysis. *Diabetes care*, 31(12), 2398–2403. <https://doi.org/10.2337/dc08-1341>
- Huen, J. M., Ip, B. Y., Ho, S. M., & Yip, P. S. (2015). Hope and Hopelessness: The Role of Hope in Buffering the Impact of Hopelessness on Suicidal Ideation. *PloS one*, 10(6), e0130073. <https://doi.org/10.1371/journal.pone.0130073>
- Hutchins, V., Zhang, B., Fleurence, R. L., Krishnarajah, G., & Graham, J. (2011). A systematic review of adherence, treatment satisfaction and costs, in fixed-dose combination regimens in type 2 diabetes. *Current medical research and opinion*, 27(6), 1157–1168. <https://doi.org/10.1185/03007995.2011.570745>
- Janežič, A., Locatelli, I., & Kos, M. (2017). Criterion validity of 8-item Morisky Medication Adherence Scale in patients with asthma. *PloS one*, 12(11), e0187835. <https://doi.org/10.1371/journal.pone.0187835>
- Kargin, M., Ersöğütçü, F., & Aslanoğlu, E. (2020). Medication adherence and hopelessness in male individuals with substance use disorder. *Journal of Substance Use*, 26(2), 218–223. <https://doi.org/10.1080/14659891.2020.1851412>
- Katon W. J. (2011). Epidemiology and treatment of depression in patients with chronic medical illness. *Dialogues in clinical neuroscience*, 13(1), 7–23. <https://doi.org/10.31887/DCNS.2011.13.1/wkaton>
- Lee, W. C., Balu, S., Cobden, D., Joshi, A. V., & Pashos, C. L. (2006). Prevalence and economic consequences of medication adherence in diabetes: a systematic literature review. *Managed care interface*, 19(7), 31–41.
- Lin, E. H., Katon, W., Von Korff, M., Rutter, C., Simon, G. E., Oliver, M., Ciechanowski, P., Ludman, E. J., Bush, T., & Young, B. (2004). Relationship of depression and diabetes self-care, medication adherence, and preventive care. *Diabetes care*, 27(9), 2154–2160. <https://doi.org/10.2337/diacare.27.9.2154>

- Mira, J., Hutajulu, J., Djunaedi, A., Triwahyuni, A. (2021). Properti psikometri Beck Hopelessness Scale pada populasi non-klinis Indonesia. *Jurnal Psikologi Ilmiah*, 13(1), 24–37. DOI: 10.15294/intuisi.v13i1.28037
- Murwanashyaka, J. D., Ndagijimana, A., Biracyaza, E., Sunday, F. X., & Umugwaneza, M. (2022). Non-adherence to medication and associated factors among type 2 diabetes patients at Clinique Medicale Fraternite, Rwanda: a cross-sectional study. *BMC endocrine disorders*, 22(1), 219. <https://doi.org/10.1186/s12902-022-01133-0>
- Olagbemide, O. J., Omosanya, O. E., Ayodapo, A. O., Agboola, S. M., Adeagbo, A. O., & Olukokun, T. A. (2021). Family support and medication adherence among adult type 2 diabetes: Any meeting point?. *Annals of African medicine*, 20(4), 282–287. https://doi.org/10.4103/aam.aam_62_20
- Polonsky, W. H., & Henry, R. R. (2016). Poor medication adherence in type 2 diabetes: recognizing the scope of the problem and its key contributors. *Patient preference and adherence*, 10, 1299–1307. <https://doi.org/10.2147/PPA.S106821>
- Reed, J., Bain, S., & Kanamarlapudi, V. (2021). A Review of Current Trends with Type 2 Diabetes Epidemiology, Aetiology, Pathogenesis, Treatments and Future Perspectives. *Diabetes, metabolic syndrome and obesity : targets and therapy*, 14, 3567–3602. <https://doi.org/10.2147/DMSO.S319895>
- Sahoo, J., Mohanty, S., Kundu, A., & Epari, V. (2022). Medication Adherence Among Patients of Type II Diabetes Mellitus and Its Associated Risk Factors: A Cross-Sectional Study in a Tertiary Care Hospital of Eastern India. *Cureus*, 14(12), e33074. <https://doi.org/10.7759/cureus.33074>
- Sharma, D., Goel, N. K., Cheema, Y. S., & Garg, K. (2023). Medication Adherence and its Predictors among Type 2 Diabetes Mellitus Patients: A Cross-Sectional Study. *Indian journal of community medicine : official publication of Indian Association of Preventive & Social Medicine*, 48(5), 781–785. https://doi.org/10.4103/ijcm.ijcm_744_22
- Tin, S.T., Sidik, M.S., Rampal, L., Ibrahim, N. (2015). Prevalence and predictors of suicidality among medical students in a public university. *Med J Malaysia*, 70(1), 1–5.
- Venkatesan, M., Dongre, A. R., & Ganapathy, K. (2018). A Community-Based Study on Diabetes Medication Nonadherence and its Risk Factors in Rural Tamil Nadu. *Indian journal of community medicine : official publication of Indian Association of Preventive & Social Medicine*, 43(2), 72–76. https://doi.org/10.4103/ijcm.IJCM_261_17
- Wojujutari, A. K., Idemudia, E. S., & Ugwu, L. E. (2024). Psychological resilience mediates the relationship between diabetes distress and depression among persons with diabetes in a multi-group analysis. *Scientific reports*, 14(1), 6510. <https://doi.org/10.1038/s41598-024-57212-w>
- Yang, H., Wu, F., Gui, M., Cheng, Y., & Zhang, L. (2023). The role of medication adherence in the association between depressive symptoms and quality of life in older adults with type 2 diabetes mellitus. *BMC geriatrics*, 23(1), 196. <https://doi.org/10.1186/s12877-023-03929-8>
- Yip, P. S., & Cheung, Y. B. (2006). Quick assessment of hopelessness: a cross-sectional study. *Health and quality of life outcomes*, 4, 13. <https://doi.org/10.1186/1477-7525-4-13>
- Yorke, E., Boima, V., Ganu, V., Tetteh, J., Twumasi, L., Ekem-Ferguson, G., Kretchy, I., & Mate-Kole, C. C. (2023). The mediating role of quality of life on depression and medication adherence among patients with type 2 diabetes mellitus: A cross-sectional study. *Health science reports*, 6(9), e1539. <https://doi.org/10.1002/hsr2.1539>
- Yusoff, M.S.B. (2019). ABC of content validation and content validity index calculation. *Education in Medicine Journal*, 11(2), 49–54. <https://doi.org/10.21315/eimj2019.11.2.6>