Jurnal Kesehatan Ibu dan Anak
Vol.18, No.1, July 2024, pp. 64~73
: 10.29238/kia.v18i1.2728

ISSN: 2599-3224 (Online)
ISSN: 2302-6014 (Print)

Improving maternal hemoglobin: comparing the effectiveness of dates and mung bean cookies in anemia pregnant women

Dela Yunia[1], Wiwin Mintarsih Purnamasari[2], Helmi Diana[3]
[1]Midwifery Department, Poltekkes Kemenkes Tasikmalaya, Indonesia, mikaylahaura@gmai.com
[2]Midwifery Department, Poltekkes Kemenkes Tasikmalaya, Indonesia, winpurnamasari748@gmail.com
[3]Midwifery Department, Poltekkes Kemenkes Tasikmalaya, Indonesia, helmi.diana@dosen.poltekkestasikmalaya.ac.id

ARTICLE INFO

Article history:

Received: Jan 5th 2025
Revised : July 25th 2025
Accepted: July 29th 2025

Keyword:

Iron deficiency anemia;
Nutritional supplementation;
Pregnancy nutrition;
Functional food;
Second trimester pregnancy.

ABSTRACT

Anemia remains a significant health issue among pregnant women in Indonesia, with prevalence rates reaching 50–63%. In addition to iron supplementation, food-based micronutrient interventions such as date fruit and mung bean cookies may help improve hemoglobin levels. However, limited studies have compared the effectiveness of these two food sources. This study aimed to compare the effects of date fruit and mung bean cookies on hemoglobin levels in pregnant women with anemia. A quasi-experimental study with a two-group pre-test-post-test design was conducted at Bojongasih Public Health Center, Tasikmalaya, Indonesia in 2024. A total of 34 pregnant women with anemia were recruited using total sampling and divided into two groups: date fruit (n = 17) and mung bean cookies (n = 17). Hemoglobin levels were measured before and after 14 days of intervention. Paired t-tests were used for statistical analysis. The date group showed a greater mean increase in hemoglobin levels (from 9.906 to 10.871 g/dL; increase of 0.965) compared to the mung bean cookie group (from 9.888 to 10.476 g/dL; increase of 0.588). The difference was statistically significant (p = 0.001). Date fruit was more effective than mung bean cookies in increasing hemoglobin levels among pregnant women with anemia. These findings suggest that date fruit can be considered as a complementary nutritional strategy to support iron supplementation during pregnancy.

Corresponding Author:

Dela Yunia
Midwifery Department, Poltekkes Kemenkes Tasikmalaya
Cilolohan Street No.35, Kahuripan, Tawang, Tasikmalaya, West Java, 46115 Indonesia. Phone:
Email: mikaylahaura@gmai.com

INTRODUCTION

Anemia in pregnancy remains a significant public health concern in Indonesia. National survey data from 2021 conducted by several medical faculties reported that between 50–63% of pregnant women suffer from anemia, with iron deficiency anemia being the most common type due to inadequate iron intake during pregnancy.(1,2) This condition increases the risk of maternal morbidity, low birth weight, and perinatal complications. At the provincial level, West Java continues to report a relatively high burden of anemia among pregnant women. According to the Ministry of Health (2021), 14.32% of the total 441,662 pregnant women in the province were diagnosed with anemia, indicating a pressing need for effective intervention strategies in maternal health.(3)

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Focusing further at the district level, Tasikmalaya Regency consistently shows one of the highest rates of maternal anemia in the province.(4) In 2022, there were 2,913 cases of anemia among pregnant women (13.29%), and in 2023, although there was a slight decrease, 2,695 cases (12.62%) were still reported among 21,356 pregnancies.(5) This relatively stagnant trend reflects the limited impact of current interventions in reducing anemia prevalence. At the primary healthcare level, the Bojongasih Public Health Center in Tasikmalaya has also observed a fluctuating yet concerning pattern. The prevalence of anemia among pregnant women rose from 11.8% (37 out of 312) in 2022 to 14.7% (48 out of 326) in 2023. Despite small absolute numbers, this upward trend is alarming and highlights a persistent local challenge requiring innovative nutritional approaches beyond standard iron supplementation.

Managing anemia during pregnancy is a strategic priority to reduce maternal and perinatal morbidity and mortality. The primary pharmacological intervention promoted in Indonesia is the provision of iron (Fe) tablets, which aim to increase hemoglobin (Hb) levels and prevent iron deficiency anemia.(6) According to the Regulation of the Minister of Health No. 21 of 2021, pregnant women are recommended to consume one Fe tablet daily, with a minimum of 90 tablets during pregnancy, ideally starting from the first trimester and continuing through the postpartum period. However, despite widespread distribution efforts, adherence to Fe supplementation remains suboptimal, especially in low-resource settings. Studies have identified several challenges, including gastrointestinal side effects (e.g., nausea, constipation), metallic taste, and low motivation among pregnant women to consume the tablets regularly.(7,8) Furthermore, the bioavailability of synthetic iron may be affected by dietary inhibitors and individual absorption capacity, resulting in inconsistent hematologic responses to supplementation.(9) Given these limitations, non-pharmacological interventions have gained increasing attention. Nutrient-dense foods such as dates (*Phoenix dactylifera*) and mung bean (*Vigna radiata*) cookies are emerging as promising alternatives or adjuncts to iron tablets. These functional foods are rich in iron, folate, and vitamin C, and are generally well-accepted by pregnant women due to their pleasant taste and cultural familiarity.(10,11)

Mung beans contain approximately 7.5 mg of iron per 100 grams, along with other hematopoietic nutrients. However, they also contain phytates (approx. 2.19%), which can inhibit iron absorption. Techniques such as soaking, fermenting, or sprouting have been shown to reduce phytate content and enhance nutritional value.(12) Meanwhile, dates have been associated with improved Hb levels due to their natural iron content and antioxidant profile, making them suitable as a dietary supplement during pregnancy.(13)

Previous studies have shown that mung bean cookies can increase hemoglobin levels in pregnant women with anemia, likely due to their relatively high iron content. For example, one study reported that hemoglobin levels in the treatment group increased from 9.8 g/dL to 10.8 g/dL after mung bean cookie supplementation, with a statistically significant result ($p = 0.000$).(14) Another study found an increase from 10.494 g/dL to 11.238 g/dL.(15) However, the bioavailability of iron in mung beans is limited by the presence of phytates, known anti-nutrients that inhibit iron absorption in the gastrointestinal tract.(16) Although soaking or fermenting mung beans can reduce phytate levels, this limitation remains a concern when evaluating their clinical effectiveness.

In contrast, dates (Phoenix dactylifera) are rich in iron, as well as micronutrients such as vitamin C, vitamin B6, calcium, zinc, magnesium, and antioxidants, which are known to support erythropoiesis and enhance iron absorption. The natural sugar and fiber content of dates also make them palatable and energy-rich, which may support maternal nutritional status more broadly. A previous intervention study using seven dates per day (approximately 50 grams) showed a meaningful increase in hemoglobin levels among pregnant women, with an estimated 0.875 mg of iron intake per day.(17) Additionally, the presence of vitamin C and amino acids in dates facilitates iron bioavailability and

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ISSN: 2599-3224 (Online), ISSN: 2302-6014 (Print)

hemoglobin synthesis, positioning dates as a promising functional food in anemia management.

Despite the growing body of literature on the use of mung bean cookies and dates independently, no prior studies have directly compared their effectiveness in improving hemoglobin levels among anemic pregnant women. The absence of such comparative research presents a critical knowledge gap, as it limits evidence-based guidance for healthcare providers in choosing the most effective dietary intervention.

Therefore, this study aims to compare the effectiveness of dates and mung bean cookies in improving hemoglobin levels among pregnant women with anemia. By conducting a head-to-head trial, this research will provide novel insights and practical evidence to inform nutritional strategies in antenatal care. Given the cultural acceptability and accessibility of both foods, the results of this study could offer cost-effective and scalable alternatives to conventional iron supplementation, contributing to improved maternal health outcomes in low- and middle-income settings. This study aims to compare the effectiveness of date fruit and mung bean cookies in increasing hemoglobin levels among anemic pregnant women.

METHOD

This study employed a quasi-experimental design with a two-group pre-test and post-test design, conducted between January and July 2024 at Bojongasih Public Health Center, Tasikmalaya Regency, Indonesia. A total of 34 pregnant women with anemia were included using total sampling and divided equally into two groups (n=17 each) receiving either date fruit or mung bean cookies. Inclusion criteria included pregnant women in the second or third trimester, hemoglobin levels <11 g/dL, and willingness to participate. Exclusion criteria included chronic illnesses, iron supplement intake outside of the intervention, or allergy to intervention foods. The date fruit group received 7 pieces of dates (approx. 50g) daily, while the mung bean group received 2 mung bean cookies (approx. 50g total) daily for 14 consecutive days. Hemoglobin levels (g/dL) were measured using Hemocue Hb 201+ before and after the intervention. The instruments were calibrated prior to use, and the observation form used to record compliance had been pre-validated. Data were analyzed using univariate descriptive statistics, paired t-test for within-group analysis, and linear regression to assess the effect of interventions on Hb levels, with significance set at $p<0.05$. The study received ethical clearance from the Health Research Ethics Commission of Poltekkes Tasikmalaya (No. DP.04.03/F.XXVI.20/367/2024).

RESULTS

The study was conducted on 34 pregnant women to determine hemoglobin levels before and after intervention with dates and green bean cookies. All respondents were divided into two groups, namely 17 people in the date intervention group and 17 people in the green bean cookies intervention group. Before the intervention was carried out, all pregnant women had passed a characteristic test with the average age of pregnant women in both the date and green bean cookies groups being in the 20–35-year age category with a presentation of 88.2% (dates) and 100% (green bean cookies). Meanwhile, the gestational age in the date group was on average in the second trimester with a presentation of 58.8% and the green bean cookies group was on average in the second trimester with a presentation of 76.5%. All respondents were pregnant women with anemia. The results of the characteristic test can be seen in Table 1.

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Table 1. Frequency Distribution of Respondent Characteristics Research

Variable	Category	Date Group		Green Bean Cookies Group	
		Score f (n =)	Percent %	Score f (n =)	Percent %
Age	<20	1	5.9	0	0
	20-35	15	88.2	17	100
	>35	1	5.9	0	0
Gestational age	Trimester II	10	58.8	13	76.5
	Trimester III	7	41.2	4	23.5
Score		17	100	17	100

Next, a univariate analysis was carried out to determine the increase in hemoglobin levels before and after the intervention, both in the group of pregnant women who consumed Fe tablets and dates, and the group of pregnant women who consumed Fe tablets and mung bean cookies. The results of the hemoglobin level assessment in the group of pregnant women who consumed Fe tablets and dates averaged 9.906 before being given treatment. The average hemoglobin level after being given treatment was 10.871. Meanwhile, the results of the increase in hemoglobin levels in the group of pregnant women who consumed Fe tablets and mung bean cookies, the average before being given treatment was 9.888, the average hemoglobin level after being given treatment was 11.476. The results can be seen in Table 2.

Table 2. Frequency Distribution of Hemoglobin Levels Before and After Consuming Fe Tablets and Dates Compare to Consuming Fe Tablets and Mung Bean Cookies

Intervention	Fe Tablet and Date Group					Fe Tablets and Mung Bean Cookies				
	N	Min	Max	Average	SD	N	Min	Max	Average	SD
Before	17	8.9	10.9	9.906	.6159	17	8.7	10.7	9.888	.6009
After	17	9.7	11.7	10.871	.5752	17	9.2	11.2	10.476	.5728

Analysis of the effect of giving dates and mung bean cookies showed a significant increase in hemoglobin levels. The results of the assessment in the group given Fe tablets and dates before and after treatment were 0.965. The results of the statistical test using Paired T-test data obtained a P value of 0.001 <0.05. Then Ha is accepted, which means that there is an effect. Likewise, in the group given Fe and mung bean cookies before and after treatment, there was an increase of 0.588. The results of the statistical test obtained a P value of 0.001 <0.05. Then Ha is accepted, meaning that giving Fe tablets and mung bean cookies affects increasing hemoglobin levels. The increase in hemoglobin levels in the date group was 0.965 while in the mung bean cookies group it was 0.588. The results of the statistical test showed that giving dates was more effective in changing the hemoglobin levels of pregnant women compared to giving mung bean cookies. The results can be seen in Table 3.

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Table 3. Differences in Hemoglobin Levels of the Group of Pregnant Women Consuming Fe Tablets and Dates with the Group of Pregnant Women Consuming Fe Tablets and Green Bean Cookies

	Fe Tablet and Date Group	Fe Tablets and Mung Bean Cookies	p-value
Pre-test Average	9.906	9.888	0.001
Post-test Average	10.871	10.476	0.001
Improvement	0.965	0.588	
P. Value *Comparison Post Test*			0.001

Normality Test: Shapiro-Wilk; *Paired T test

The results of the multivariate statistical test to see the difference in increasing hemoglobin levels in the intervention group of dates and mung bean cookies showed that the results of the multivariate analysis statistical test using linear regression produced p> 0.05 so that the independent variable did not have a significant partial effect on the dependent variable, this means that neither age nor gestational age had a significant effect on changes in hemoglobin levels in anemic pregnant women. The results can be seen in Table 4.

Table 4. Results of Multivariate Statistical Test

No	Variable	Date	Mung Bean Cookies
		p	*p*
1	Age	0.267	0.091
2	Gestational Age	0.059	0.563
	Regression	0.107	0.196

DISCUSSION

This study examined the baseline sociodemographic characteristics of pregnant women with anemia prior to the nutritional intervention, focusing on age and gestational age, which are known to influence hemoglobin levels and response to dietary interventions. Ensuring that both groups those receiving dates and those receiving mung bean cookies had comparable baseline characteristics is essential to reduce confounding and strengthen the internal validity of the findings. The analysis revealed that most participants in both groups were aged 20–35 years, accounting for 88.2% in the date group and 100% in the mung bean cookie group, which aligns with the reproductive age group commonly associated with better pregnancy outcomes. This age category also represents a biologically optimal period for maternal adaptation to increased iron needs during pregnancy. Regarding gestational age, both groups predominantly consisted of women in the second trimester, with 58.8% in the date group and 76.5% in the mung bean cookie group. The second trimester is a critical period for iron supplementation due to increased fetal demand for red blood cell production and rapid maternal blood volume expansion. These findings indicate that both intervention groups were relatively homogeneous at baseline, minimizing potential bias and allowing for a more accurate assessment of the effects of the dietary interventions on hemoglobin levels. By confirming the comparability of key demographic variables between groups before the intervention, the study adheres to best practices in clinical research design, ensuring that any observed differences in outcomes are likely due to the intervention rather than baseline disparities. Such methodological rigor is essential for drawing valid and generalizable conclusions about the relative effectiveness of dates and mung bean cookies as nutritional strategies to improve hemoglobin levels in pregnant women with anemia.

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This study aimed to evaluate the effectiveness of dates and mung bean cookies, when combined with iron (Fe) supplementation, in improving hemoglobin (Hb) levels among anemic pregnant women. The findings clearly demonstrate that both nutritional interventions led to a significant increase in maternal hemoglobin levels. In the dates group, the average hemoglobin level increased from 9.906 g/dL to 10.871 g/dL after the intervention. Similarly, in the mung bean cookie group, hemoglobin levels improved from 9.888 g/dL to 10.476 g/dL. These results confirm that both dates and mung bean cookies, when used alongside Fe tablets, serve as effective complementary nutritional strategies to enhance maternal iron status. The observed improvements are of critical clinical importance, as anemia during pregnancy is strongly associated with adverse outcomes such as preterm birth, low birth weight, intrauterine growth restriction, and increased maternal mortality.(18) Even a modest rise in hemoglobin levels can reduce the risk of complications during labor and postpartum, particularly in settings with limited access to comprehensive obstetric care. Importantly, this study adds unique evidence to the current body of literature by directly comparing two food-based interventions that are locally available, culturally accepted, and practical to integrate into maternal nutrition programs. Although both interventions were effective, the dates group showed a slightly higher increase in hemoglobin levels than the mung bean cookie group, suggesting that dates may offer a comparative advantage due to their higher iron bioavailability and content of additional supportive micronutrients like vitamin C, potassium, and folate, which enhance iron absorption.(10)

This research supports the integration of functional foods into antenatal nutrition strategies, especially in low-resource settings where pharmacological approaches face barriers such as low compliance, gastrointestinal side effects, or limited access [2]. By identifying safe, acceptable, and nutrient-rich food-based interventions, this study contributes to improving the design of maternal nutrition guidelines and offers evidence for policy-level recommendations to complement Fe supplementation with food-based strategies. The improvement in hemoglobin (Hb) levels observed in both intervention groups is biologically plausible and nutritionally justified. The positive impact of dates and mung bean cookies on hemoglobin levels can be attributed to their rich micronutrient content, particularly iron and other compounds involved in erythropoiesis (red blood cell formation). Dates (*Phoenix dactylifera*) are a natural source of dietary iron, with approximately 1.02 mg of iron per 100 g, along with vitamin C, folate, vitamin B6, magnesium, copper, and potassium. These nutrients work synergistically to support hematopoiesis. Notably, vitamin C enhances the bioavailability of non-heme iron by reducing ferric (Fe^{3+}) to ferrous (Fe^{2+}) form and forming a soluble iron ascorbate complex that is more easily absorbed in the duodenum. In addition, dates provide energy-dense sugars (glucose and fructose), which support overall maternal nutrition and reduce fatigue, a common symptom of anemia.(19) On the other hand, mung bean cookies (derived from *Vigna radiata*) are also rich in iron (~7.5 mg per 100 g) and provide protein, fiber, folate, and B-complex vitamins, which are essential for red blood cell production.(11) However, their efficacy is somewhat limited by the presence of phytates (approximately 2.19%), which are known to bind iron and reduce its absorption in the gastrointestinal tract. Phytates chelate with iron to form insoluble complexes that are not bioavailable, especially in the absence of enhancers like vitamin C.(12) This difference in nutrient bioavailability may explain why the increase in hemoglobin levels in the dates group was greater than in the mung bean group. While both interventions contributed to improved hemoglobin status, the iron absorption from dates was likely more efficient, owing to the presence of natural iron absorption enhancers and the absence of inhibitory compounds like phytate.

This mechanism is supported by a study by Ibrahim et al (2024), which highlighted that dates not only provide essential hematinic nutrients but also have a higher iron bioavailability due to their ascorbic acid and simple sugar content.(10) Conversely, Hou et

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al. (2019) explained that legumes such as mung beans, although rich in iron, tend to have lower absorption due to anti-nutritional factors like phytates and polyphenols, unless processed or fortified appropriately.(11) Thus, this study not only reaffirms the role of functional foods in maternal nutrition but also presents comparative evidence suggesting that dates may be a superior intervention for improving hemoglobin levels in pregnant women with anemia. These insights are critical for healthcare providers and policymakers in designing effective, acceptable, and food-based approaches to prevent and manage maternal anemia, particularly in low-resource settings.

The findings of this study, which showed a significant increase in hemoglobin levels in both the date and mung bean cookie groups, are consistent with and extend previous research on food-based interventions for maternal anemia. In the date group, the mean hemoglobin level increased from 9.906 g/dL to 10.871 g/dL, while in the mung bean cookie group, it rose from 9.888 g/dL to 10.476 g/dL. Statistical analysis indicated that this increase was significant, with a p-value < 0.05, confirming the efficacy of both interventions in improving hemoglobin status among anemic pregnant women. These results align with the findings of Irmawati et al. (2023), who reported increase of 9.72± 0.50 g/dL in hemoglobin levels among pregnant women consuming dates palm juice for 7 days and increase of of 9.15± 0.90 g/dL in hemoglobin levels among pregnant women consuming mung bean juice for 7 days. The authors attributed this improvement to the iron and vitamin C content of dates, which enhances non-heme iron absorption. While effective, the increase of mung bean treatment was slightly lower than that achieved with dates, a trend that also emerged in the current study.(20) A literature review conducted by Marasabessy and Tukuwain (2021) showed the effect of giving green beans, either alone or in combination, on increasing hemoglobin levels in pregnant women, with an average increase in Hb levels from 0.32 g/dL to a maximum of 1.95 g/dL. A high increase in Hb levels was obtained when giving green beans in addition to the Fe tablet consumption program for pregnant women.(21) Interestingly, a study by Narela et al. (2024) highlighted the inhibitory role of phytates in mung beans, which can reduce iron absorption despite high iron content. This supports the current finding that dates, which contain no phytates and are rich in iron enhancers like vitamin C and simple sugars, may be more effective than mung bean-based interventions in raising hemoglobin.(12) Therefore, the current study provides comparative insights and contributes novel evidence that although both interventions are beneficial, dates may offer superior hematinic effects. This reinforces the potential of culturally acceptable, nutrient-dense foods as effective strategies in anemia management, particularly when combined with standard iron supplementation.

The findings of this study have important implications for midwifery practice, especially in maternal nutrition education and anemia prevention. Dates and mung bean cookies, as nutrient-dense, culturally acceptable, and affordable foods, can be recommended as complementary dietary interventions for anemic pregnant women. Midwives, as frontline health professionals, can incorporate nutrition-focused counseling into routine antenatal care (ANC), encouraging pregnant women to consume iron-rich foods like dates or iron-enhanced snacks such as mung bean cookies. These foods can serve as alternatives or supplements to conventional iron supplementation, especially in areas where compliance with iron tablets is low due to gastrointestinal side effects. Moreover, this approach empowers pregnant women with accessible dietary solutions that support hemoglobin synthesis, contributing to improved pregnancy outcomes and reduced risk of maternal morbidity associated with iron-deficiency anemia.

The study contributes evidence that supports integration of functional food-based interventions into maternal health programs, particularly as part of national supplementary feeding programs (PMT – *Pemberian Makanan Tambahan*) for pregnant women. Policy-makers and health program planners should consider including dates and mung bean cookies as part of community-based nutritional interventions. Additionally, local food

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ISSN: 2599-3224 (Online), ISSN: 2302-6014 (Print)

processing units and public health centers (Puskesmas) can collaborate to produce these iron-rich snacks as standardized and regulated nutritional support. Scaling up these interventions within government maternal nutrition strategies could improve program coverage, acceptability, and long-term sustainability by utilizing locally available, cost-effective resources with proven health benefits.

This study has several limitations that should be acknowledged. First, the sample size was relatively small and limited to a specific geographic area, which may restrict the generalizability of the findings to broader populations. Second, the study relied on short-term follow-up (4 weeks), which may not capture the long-term impact of dietary interventions on hemoglobin stability or pregnancy outcomes. Third, dietary intake outside the intervention was not strictly controlled, which could potentially influence hemoglobin changes due to other iron sources or inhibitors. Fourth, biochemical markers such as serum ferritin or transferrin saturation were not assessed, which could provide more comprehensive insights into iron status. Future research should address these limitations by conducting multi-center randomized controlled trials (RCTs) with larger, more diverse samples and longer follow-up periods to assess sustained effects of dates and mung bean cookies on maternal iron status and birth outcomes. In addition, studies should consider evaluating the cost-effectiveness of these interventions to support policy-level decisions. Further investigation into bioavailability and absorption mechanisms of iron in these foods, including measurement of serum ferritin, total iron-binding capacity (TIBC), and the role of enhancers and inhibitors in food matrices, would enhance understanding of the physiological pathways involved. Finally, qualitative studies exploring pregnant women's acceptance, preferences, and adherence to these functional foods could guide culturally tailored implementation strategies.

CONCLUSION

This study concluded that both date fruit and mung bean cookies, when given alongside iron tablets, significantly increased hemoglobin levels among pregnant women with anemia. However, date fruit supplementation resulted in a greater mean increase (0.965 g/dL) compared to mung bean cookies (0.588 g/dL), indicating that date fruit is more effective as a complementary dietary intervention. These findings suggest that date fruit, a culturally acceptable and nutrient-dense food, can be used to support existing iron supplementation programs in improving maternal hemoglobin levels, particularly in resource-limited settings. Future studies with larger sample sizes, longer intervention periods, and cost-effectiveness analyses are recommended to validate these findings and support policy integration of food-based anemia prevention strategies during pregnancy.

AUTHOR CREDIT STATEMENT

DY: Conceptualization, Methodology, Data Curation, Writing – Original Draft; **WMP**: Formal Analysis, Investigation, Validation, Writing – Review & Editing; **HD**: Supervision, Review & Editing, Final Approval of the Manuscript. All authors have read and approved the final manuscript.

FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

DECLARATION OF COMPETING INTEREST

The authors declare that there is no conflict of interest related to this research, authorship, and/or publication of this article.

Jurnal Kesehatan Ibu dan Anak Vol.18, No.1, July 2024, pp. 64~73
ISSN: 2599-3224 (Online), ISSN: 2302-6014 (Print)

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