Medicor : Journal of Health Informatics and Health Policy
E-ISSN : 3030-9166
Volume. 3 Issue 1 January 2025
Page No: 19-29

Breakfast Habits, Sleep Quality, and Menstrual Duration as Determinants of Anemia in Adolescent Girls

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Received : December 10, 2024
Accepted : January 12, 2025
Published : January 31, 2025

Citation: Asnir, J., Rakhman, A., Nadila, D., Hijra, Fandir, A., & Rahmawati, R., (2025). Breakfast Habits, Sleep Quality, and Menstrual Duration as Determinants of Anemia in Adolescent Girls. Medicor: Journal of Health Informatics and Health Policy, 3(1), 19-29.

ABSTRACT: The prevalence of anemia among adolescent girls in the working area of Wani Public Health Center, Donggala District, remains relatively high, reaching 49.2% in 2024. Several contributing factors include poor breakfast habits, poor sleep quality, and abnormal menstrual duration. This study aims to examine the association between breakfast habits, sleep quality, and menstrual duration with the incidence of anemia among adolescent girls. This study highlights the combined role of lifestyle factors (breakfast and sleep quality) and biological factors (menstrual duration) in relation to anemia, which has been scarcely explored in this setting. This research employed a cross-sectional design with a quantitative approach. The study population included all female students in the working area of Wani Public Health Center (n = 81). A total of 68 respondents were selected using the Slovin formula and purposive sampling technique. Data were analyzed using univariate and bivariate analysis with the chi-square test at a significance level of $\alpha = 0.05$. The findings revealed significant associations between breakfast habits and anemia ($p = 0.000$), sleep quality and anemia ($p = 0.000$), and menstrual duration and anemia ($p = 0.000$) among adolescent girls. Breakfast habits, sleep quality, and menstrual duration are significantly associated with incidence anemia among adolescent girls. These findings provide a basis for preventive efforts through nutrition education, improvement of sleep quality, and monitoring of menstrual health among adolescents.

Keywords: Anemia, Breakfast, Sleep Quality, Menstrual Duration, Adolescent Girl.

INTRODUCTION

Anemia is one of the most common health problems among adolescent girls worldwide, particularly in developing countries such as Indonesia (Putri, 2022). Adolescent girls are at a higher risk of developing anemia due to rapid growth during puberty and blood loss during menstruation, which increases the body's iron requirements (Permanasari, Y., & Wati, S, 2020). If left untreated, anemia can impair cognitive development and productivity, as well as increase the risk of health problems in adulthood, including complications during pregnancy and childbirth (Hartono et al., 2022). Globally, the prevalence of anemia among women aged 15–49 years was reported to be 29.9% in 2019, while the prevalence in Southeast Asia reached 30.7% in 2023 (World Health

Organization, 2023). In Indonesia, the prevalence of anemia among adolescents increased from 22.7% in 2013 to 32% in 2021 (Riskesdas, 2018). In Central Sulawesi Province, the prevalence of anemia among adolescent girls in 2023 was 18.69%, with Donggala District ranking fourth among areas with the highest prevalence (Central Sulawesi Health Office, 2023). Data from Wani Public Health Center also showed that 49.2% of 118 screened adolescent girls were diagnosed with anemia.

Several key factors contribute to the occurrence of anemia among adolescent girls, including breakfast habits, sleep quality, and menstrual duration. Inadequate breakfast intake, particularly of iron-rich foods, may deplete the body's iron stores and increase the risk of anemia (Banowati & Adiyaksa, 2017). Poor sleep quality is associated with hormonal imbalances and changes in iron metabolism, which can affect hemoglobin levels (Mawo et al., 2019). Meanwhile, a menstrual duration longer than normal often results in greater blood loss, accelerating iron deficiency (Hasnawati & Hafid, 2019). Previous studies have demonstrated associations between these factors and anemia. Laili et al. (2023) found that poor breakfast habits were associated with anemia among adolescents, while Zuiatna. (2020) reported that poor sleep quality increased the risk of anemia. In addition, Sari & Amalia. (2020) showed that menstrual duration had a significant effect on anemia in adolescent girls. However, research gaps remain regarding how these three factors collectively contribute to the risk of anemia, particularly in Donggala District, where its prevalence remains high.

Adolescents, particularly adolescent girls, are a group highly vulnerable to anemia. This vulnerability is due to accelerated growth during puberty, which increases the demand for nutrients, particularly iron, as well as routine blood loss from menstruation (Permanasari, Y., & Wati, S, 2020). According to Putri. (2022), adolescent girls with an unbalanced diet are more likely to develop anemia compared to adolescent boys. Anemia has a serious impact on the quality of life of adolescents. In the short term, anemia leads to decreased concentration, fatigue, and poor academic performance (Hartono et al., 2022). In the long term, anemia in adolescent girls can increase the risk of complications during pregnancy and childbirth, as well as reduce the quality of the next generation (Kementerian Kesehatan RI, 2021).

The risk factors for anemia among adolescent girls are highly diverse. Inadequate nutritional intake, particularly of iron, is the main cause of iron deficiency anemia, which is the most common type of anemia in developing countries (Stoltzfus, 2003). Skipping breakfast has also been shown to contribute to low body iron stores (Banowati & Adiyaksa., 2017; Laili et al., 2023). In addition, poor sleep quality is associated with hormonal imbalances and changes in iron metabolism, thereby affecting hemoglobin levels (Mawo et al., 2019; Zuiatna, 2020). Menstruation with a longer-than-normal duration also increases blood loss and heightens the risk of anemia (Hasnawati & Hafid, 2019; Sari & Amalia, 2020). The impacts of anemia on adolescent girls are extensive, both in the short and long term. In the short term, anemia reduces adolescents' ability to concentrate, academic performance, and productivity (Hartono et al., 2022). In the long term, anemia in adolescent girls poses risks of complications during pregnancy, delivering low birth weight (LBW) infants, and increasing the risk of maternal and infant mortality (Budiarti et al, 2021); WHO, 2021). Thus, anemia among adolescents is not only an individual health problem but also a challenge to the development of human resource quality.

Various efforts have been undertaken by the government to address anemia, such as iron–folic acid (IFA) supplementation programs in schools, nutrition education, and food fortification (Kementerian Kesehatan RI, 2021). However, the effectiveness of these programs remains limited due to factors such as adherence, eating behaviors, and adolescents' lack of awareness about the importance of anemia prevention. Therefore, further research is needed to examine the factors associated with the incidence of anemia among adolescent girls, particularly in areas with high prevalence such as Donggala District. This study is expected to provide a clearer picture of behavioral factors such as breakfast habits, sleep quality, and menstrual duration in relation to anemia, thereby serving as a basis for the formulation of more effective intervention strategies. Anemia prevention efforts among adolescent girls should not only be carried out through the provision of iron–folic acid (IFA) tablets but can also be strengthened by the consumption of functional foods rich in iron, vitamins, and bioactive compounds. Functional foods are foods containing active components that provide additional health benefits beyond their basic nutritional functions (Yuniantika, 2020).

Several studies have shown that functional foods derived from natural sources can help increase hemoglobin levels and prevent anemia. For example, the consumption of Moringa oleifera–based foods has been proven to increase hemoglobin levels due to its high iron and vitamin C content (Nurbaya et al, 2020). In addition, purple sweet potatoes are rich in anthocyanins and iron, which may contribute to improving hematological status as well as acting as antioxidants (Mulyani, 2024). Other sources of functional foods such as dates, nuts, soybeans, and spinach can also serve as alternatives to increase the body's iron stores (Anis Ervina et al., 2024). The use of these functional foods represents a more sustainable strategy because, in addition to being more acceptable to adolescents, they can improve compliance with nutrient intake compared to single supplementation, which is often neglected.

A preliminary study conducted at Al-Amiin Vocational School (SMK Al-Amiin Wani) in Donggala District involving 10 adolescent girls showed that 50% had hemoglobin levels below normal, 5 out of 10 skipped breakfast, and 7 out of 10 had poor sleep quality. These findings underscore the urgency of investigating this issue in a larger population. Therefore, this study aims to examine the relationship between breakfast habits, sleep quality, and menstrual duration with the incidence of anemia among adolescent girls in the working area of Wani Public Health Center, Donggala District. Various efforts have been undertaken by the government to address anemia, such as iron folic acid (IFA) supplementation programs in schools, nutrition education, and food fortification (Kementerian Kesehatan RI, 2021). However, the effectiveness of these programs remains limited due to factors such as adherence, dietary behaviors, and adolescents' lack of awareness regarding the importance of anemia prevention. Therefore, further research is needed to examine the factors associated with the incidence of anemia among adolescent girls, particularly in areas with high prevalence such as Donggala District. This study is expected to provide a clearer understanding of behavioral factors such as breakfast habits, sleep quality, and menstrual duration in relation to anemia, thereby serving as a basis for the formulation of more effective intervention strategies.

METHOD

This study employed a quantitative analytical observational design with a cross-sectional method to assess the relationship between breakfast habits, sleep quality, and menstrual duration with anemia incidence at a single point in time.

The study population comprised 81 female students in the Wani Public Health Center area, Donggala Regency. Using Slovin's formula with a 5% margin of error, 68 respondents were selected through purposive sampling based on inclusion criteria: female adolescents aged 15–18 years, menstruating, willing to participate, and providing informed consent.

The study was conducted from January to February 2025 in schools located within the working area of Wani Public Health Center, Donggala Regency, Central Sulawesi, Indonesia.

The research employed a range of standardized instruments to collect data comprehensively. Hemoglobin levels of the respondents were measured using the Easy Touch GCHb device, which provides accurate and practical point-of-care testing for field studies. Breakfast habits were assessed using a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ), allowing researchers to evaluate both the frequency and the types of foods consumed by the participants. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI), a widely validated tool for assessing various components of sleep. In addition, information on menstrual duration was obtained through a structured questionnaire designed to capture the length and regularity of participants' menstrual periods.

Data collection followed a standardized procedure. After obtaining informed consent, primary and secondary data were collected. Hemoglobin levels were measured directly, while questionnaires were self-administered under supervision. Data quality was ensured through editing, coding, entry, and cleaning prior to analysis.

Data analysis consisted of univariate analysis to describe respondent characteristics and bivariate analysis using the Chi-Square test ($p < 0.05$) to examine associations between breakfast habits, sleep quality, menstrual duration, and anemia. Data were processed with SPSS version 23.0.

Ethical approval was granted by the Ethics Committee of the Faculty of Medicine, Tadulako University (Approval No. 5757/UN28.10/KL/2024). Written informed consent was obtained from all participants, and confidentiality was strictly upheld.

RESULT AND DISCUSSION

Characteristics of Respondents

The majority of respondents were female students aged 17 years (64.7%) and enrolled in grade 12 (38.2%). Most fathers worked as farmers (52.9%) and laborers (20.6%), while nearly all mothers were housewives (92.6%). Fathers generally had a higher level of education, with the largest proportion completing senior high school (42.6%), whereas mothers' education was generally lower, predominantly at the elementary school level (38.2%). Overall, the respondents came from

families with lower to middle socioeconomic backgrounds and parents with low to moderate educational attainment. (Table 1)

Table 1. Characteristics of Respondents (n=68)

Variable	Category	n	%
Age	15	5	7.4
	16	19	27.9
	17	44	64.7
Grade	Grade 10	20	29.4
	Grade 11	22	32.4
	Grade 12	26	38.2
Father's Occupation	Laborer	14	20.6
	Farmer	36	52.9
	Fisherman	6	8.8
	Self-employed	10	14.7
Mother's Occupation	Village official	2	2.9
	Housewife	63	92.6
	Farmer	1	1.5
	Self-employed	3	4.4
	Retired civil servant	1	1.5
Father's Education	Elementary	24	35.3
	Junior High	15	22.1
	Senior High	29	42.6
Mother's Education	Elementary	26	38.2
	Junior High	18	26.5
	Senior High	23	33.8
	Bachelor's degree	1	1.5

Source: Primary Data

Association between Breakfast Habits and Anemia

Most respondents with good breakfast habits were non-anemic (88.9%), while 68.0% of those with poor breakfast habits were anemic. Statistical analysis revealed a significant association between breakfast habits and anemia ($p < 0.05$). (Table 2)

Table 2. Association between Breakfast Habits and Anemia (n = 68)

Breakfast Habit	Non-anemic n (%)	Anemic n (%)	Total	p-value
Good	16 (88.9)	2 (11.1)	18	0.000
Poor	16 (32.0)	34 (68.0)	50	
Total	32 (47.1)	36 (52.9)	68	

Source: Primary Data

Table 2 shows that breakfast habits have a strong relationship with anemia incidence. Among respondents with good breakfast habits, the majority (88.9%) were non-anemic, indicating that regular breakfast may play a protective role against anemia. Conversely, most respondents with poor breakfast habits (68.0%) were anemic, suggesting that skipping or having inadequate breakfast increases the likelihood of anemia. The Chi-Square test confirmed this association to be

statistically significant (p = 0.000). These findings highlight the importance of proper breakfast habits as a preventive measure for anemia among adolescents.

Association between Sleep Quality and Anemia

All respondents with good sleep quality were non-anemic (100.0%), whereas 76.6% of those with poor sleep quality were anemic. The association between sleep quality and anemia was statistically significant (p < 0.05). (Table 3)

Table 3. Association between Sleep Quality and Anemia (n = 68)

Sleep Quality	Non-anemic n (%)	Anemic n (%)	Total	p-value
Good	21 (100.0)	0 (0.0)	21	0.000
Poor	11 (23.4)	36 (76.6)	47	
Total	32 (47.1)	36 (52.9)	68	

Source: Primary Data

Table 3 demonstrates a clear relationship between sleep quality and anemia incidence. All respondents with good sleep quality (100%) were non-anemic, showing that adequate and restorative sleep may contribute to preventing anemia. In contrast, the majority of respondents with poor sleep quality (76.6%) were anemic, indicating that insufficient or disturbed sleep is strongly associated with higher anemia prevalence. Statistical analysis confirmed this association to be highly significant (p = 0.000). These findings emphasize the role of good sleep quality as an important factor in reducing the risk of anemia among adolescents.

Association between Menstruation Duration and Anemia

All respondents with abnormal menstruation duration experienced anemia (100.0%), while 78.0% of those with normal menstruation duration were non-anemic. A significant association was found between menstruation duration and anemia (p < 0.05). (Table 4)

Table 4. Association between Menstruation Duration and Anemia (n = 68)

Menstruation Duration	Non-anemic n (%)	Anemic n (%)	Total	p-value
Normal	32 (78.0)	9 (22.0)	41	0.000
Abnormal	0 (0.0)	27 (100.0)	27	
Total	32 (47.1)	36 (52.9)	68	

Source: Primary Data

Table 4 shows a significant relationship between menstruation duration and anemia. All respondents with abnormal menstruation duration were anemic (100%), while most with normal duration were non-anemic (78.0%). This indicates that abnormal or prolonged menstruation increases the risk of anemia due to excessive blood loss. Statistical analysis confirmed the

association ($p = 0.000$), emphasizing the importance of menstrual health in preventing anemia among adolescents.

Interpretation of Key Findings

This study demonstrated significant associations between breakfast habits, sleep quality, and menstrual duration with the incidence of anemia among adolescent girls in the working area of Wani Primary Health Center, Donggala Regency. Respondents with poor breakfast habits were more likely to develop anemia compared to those with regular breakfast consumption ($p < 0.05$). Similarly, poor sleep quality was strongly associated with anemia, with 76.6% of respondents reporting both conditions. Furthermore, prolonged or abnormal menstrual duration was identified as the strongest risk factor, as all respondents with abnormal menstruation experienced anemia. These findings indicate that anemia among adolescent girls is influenced not only by dietary practices but also by lifestyle and physiological factors such as sleep and menstruation.

Comparison with Previous Studies

Our findings on breakfast habits align with Ritawani & Liwanti. (2019) and Wahyudi et al. (2024), yet differ from Zanuba & Sumarmi. (2023) and Hidayah. (2022). The heterogeneity likely reflects exposure definition (frequency-only vs inclusion of quality/iron bioavailability), dietary compensation later in the day, and contextual factors such as staple fortification, tea/coffee intake, and vitamin-C co-consumption. Studies reporting null effects often had adequate total daily iron or supplementation coverage, suggesting that breakfast matters most where overall iron intake and absorption are marginal. Differences in confounder control (SES, infection/helminths, BMI, inflammation) and limited power may also attenuate associations.

The sleep–anemia association, consistent with Handini. (2023), Susanto et al. (2024), and Nirmala et al. (2024), is biologically plausible via circadian disruption, cortisol elevation, inflammation, and hepcidin-mediated iron sequestration. By contrast, studies reporting no association (Sahashika & Setiyaningrum, 2024; Kalsum et al., 2023) frequently used different PSQI cut-offs/subscales, or sampled populations with adequate iron intake/supplementation that could buffer sleep-related effects. Reverse causality is also possible: anemia may worsen sleep quality, which cross-sectional designs cannot disentangle.

For menstruation duration, our results mirror Cahyanti & Yanniarti. (2024) and Handayani et al. (2024) and diverge from Musyaropah et al. (2025) and Yunita et al. (2023). Discrepancies may arise from measurement error (recall of cycle length/flow), varying thresholds for "abnormal," hormonal contraceptive use, and programmatic factors (routine iron–folate/WIFS). Unmeasured gynecologic conditions and hemoglobinopathies could further obscure associations. Collectively, the mixed literature underscores anemia's multifactorial nature. Future work should use longitudinal designs; quantify menstrual blood loss (e.g., PBAC); obtain ferritin, sTfR, CRP, and hepcidin to separate iron deficiency from inflammation; apply actigraphy for sleep; and model effect modification by total iron intake, bioavailability (heme vs non-heme, inhibitors/enhancers),

and supplementation. Robust multivariable models and stratified analyses will clarify causal pathways and policy targets.

Limitations and Cautions

Several limitations of this study should be acknowledged. First, its cross-sectional design prevents establishing causal relationships between breakfast habits, sleep quality, menstrual duration, and anemia. Second, dietary intake was assessed through self-reported questionnaires, which may introduce recall bias. Third, the study population was limited to adolescent girls in one health center area, which may affect the generalizability of findings to other populations with different socioeconomic or cultural backgrounds.

Recommendations for Future Research

Future research should adopt longitudinal designs to confirm causal pathways between lifestyle, dietary factors, and anemia. Investigating the role of micronutrient intake, particularly bioavailable heme-iron sources, could provide further insights into preventive strategies. Expanding the study to include diverse geographic and cultural contexts would improve generalizability. Moreover, combining quantitative surveys with qualitative approaches may yield a deeper understanding of adolescent girls' perceptions and barriers to healthy dietary and lifestyle practices that influence anemia risk.

CONCLUSION

This study identified significant associations between breakfast habits, sleep quality, and menstrual duration with anemia among adolescent girls in Donggala Regency. Poor breakfast practices, inadequate sleep, and abnormal menstruation were linked to a higher risk of anemia through mechanisms such as reduced iron intake, impaired hemoglobin synthesis, and excessive blood loss. These findings emphasize the importance of nutrition education, sleep hygiene, and menstrual health monitoring in anemia prevention. Nevertheless, the cross-sectional design and limited sample size restrict causal interpretation and generalizability. Further longitudinal and interventional studies are needed to establish causal pathways and guide effective interventions.

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