



Body Mass Index and Anemia as Determinants of Dysmenorrhea Severity in Adolescent Girls

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Abstract

Dysmenorrhea is one of the most common reproductive health problems experienced by adolescent girls and may have a negative impact on quality of life, daily activities, and academic performance. Menstrual pain that is not properly managed can lead to physical and psychological disturbances, including fatigue, decreased concentration, and school absenteeism. Several factors are known to contribute to the occurrence and severity of dysmenorrhea, particularly Body Mass Index (BMI) and anemia status, both of which are closely related to nutritional status and physiological balance during adolescence. This study aimed to examine the relationship between Body Mass Index (BMI) and anemia status with the level of dysmenorrhea pain among adolescent girls. A cross-sectional study design was employed and conducted at a public senior high school in West Aceh Regency in May 2025. A total of 138 female students from grades X and XI were selected using purposive sampling. The independent variables were BMI and anemia status, while the dependent variable was the level of dysmenorrhea pain measured using the Numeric Rating Scale (NRS). Data were analyzed using univariate and bivariate analyses, with the Chi-square test applied to assess the associations between variables. The results showed that the majority of respondents had a normal BMI (57.2%), although a considerable proportion had abnormal BMI, including underweight and overweight categories. In addition, more than half of the respondents experienced moderate anemia (51.4%). Bivariate analysis revealed a statistically significant association between BMI and the level of dysmenorrhea pain (p -value = 0.002). Furthermore, a significant relationship was also found between anemia status and dysmenorrhea pain severity (p -value = 0.001). These findings indicate that adolescent girls with abnormal BMI and anemia tend to experience more severe dysmenorrhea pain. In conclusion, Body Mass Index and anemia status play an important role in influencing the severity of dysmenorrhea among adolescent girls in West Aceh Regency.

Keywords: Anemia, Dysmenorrhea, Body Mass Index (BMI), Adolescent Girls.

Introduction

Dysmenorrhea, or menstrual pain, is one of the most common reproductive health problems experienced by women, particularly among adolescents. Globally, more than 70% of women of reproductive age are reported to have experienced dysmenorrhea with varying degrees of severity, with the majority of cases classified as primary dysmenorrhea (Chen et al., 2018; de Arruda et al., 2026). This high prevalence indicates that dysmenorrhea is not merely a mild physiological complaint, but rather a significant health issue that can adversely affect quality of life, daily activities, and productivity, especially during adolescence. Clinically, dysmenorrhea is classified into two types: primary dysmenorrhea and secondary dysmenorrhea (Balis et al., 2025; Itani et al., 2022a). Primary dysmenorrhea refers to menstrual pain that occurs in the absence of any identifiable reproductive organ abnormalities, whereas secondary dysmenorrhea is associated with specific gynecological conditions such as endometriosis or uterine fibroids.

Primary dysmenorrhea typically begins at menarche, around the ages of 10 to 15 years, and may persist into early adulthood. This condition is caused by increased prostaglandin production, which triggers excessive uterine contractions without any underlying gynecological pathology (Francavilla et al., 2023; Karout et al., 2021). Adolescent girls are particularly vulnerable due to the immaturity and instability of their hormonal systems. Menstrual pain that is not properly managed can lead to various accompanying symptoms, including nausea, vomiting, headaches, diarrhea, and even syncope (Francavilla et al., 2023; Reid-McCann et al., 2025). In addition, dysmenorrhea can interfere with learning activities, concentration, and school attendance. The greater the severity of pain experienced, the more substantial its impact on academic performance and psychological well-being. Pain is generally felt in the lower abdomen, ranging from mild to severe intensity, and may last for one to three days following the onset of menstruation.

In Indonesia, dysmenorrhea remains a significant reproductive health concern, particularly among adolescent girls (Budihastuti et al., 2025; Sutopo & Ardian, 2024). Numerous studies have reported that more than half of Indonesian female adolescents experience menstrual pain, with a considerable proportion suffering from moderate to severe dysmenorrhea. This condition is often inadequately managed, as menstrual pain is frequently perceived as a normal occurrence, which may ultimately lead to decreased quality of life and reduced academic achievement among adolescents. Several factors have been identified as contributing to the occurrence and severity of dysmenorrhea, including Body Mass Index (BMI) and anemia status. BMI is an indicator of nutritional status calculated based on body weight and height (Research et al., 2024; Taheri et al., 2020). Adolescent girls with abnormal BMI, whether underweight or overweight, are at a higher risk of experiencing dysmenorrhea. Poor nutritional status may result in deficiencies of essential nutrients involved in hormonal metabolism, while excess adipose tissue can increase prostaglandin production, leading to excessive uterine contractions. In addition to nutritional status, anemia is an important factor associated with dysmenorrhea.

The prevalence of anemia among adolescent girls in Indonesia remains relatively high. Anemia results in reduced hemoglobin levels in the blood, thereby decreasing the blood's

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capacity to transport oxygen to body tissues. (Taheri et al., 2020) Numerous studies have demonstrated a significant association between low hemoglobin levels and increased severity of dysmenorrhea. Based on the above considerations, dysmenorrhea can be regarded as a complex reproductive health problem influenced by multiple factors, particularly nutritional status and anemia. The high prevalence of dysmenorrhea among adolescent girls and its substantial impact on daily activities and quality of life highlight the importance of research examining factors associated with the severity of menstrual pain. Therefore, investigating the relationship between Body Mass Index, anemia, and the severity of dysmenorrhea among adolescent girls is essential to support the development of effective promotive and preventive strategies in adolescent reproductive health.

Literature Review

Body Mass Index (BMI)

Body Mass Index (BMI) is a key indicator of nutritional status that reflects the balance between energy intake and the body's metabolic requirements and has important implications for adolescent health (Dent et al., 2019). Adolescence represents a critical transitional period characterized by rapid physical growth, changes in body composition, and maturation of the endocrine and reproductive systems. During this phase, nutritional imbalance, as reflected by abnormal BMI, can influence a wide range of physiological processes, including hormonal regulation and metabolic responses (Leij-Halfwerk et al., 2019). Adipose tissue in adolescents functions as an active metabolic and endocrine organ, playing a role in steroid hormone metabolism—particularly estrogen—and in the production of adipokines and inflammatory mediators that may affect reproductive system function (Dent et al., 2023). Adolescents with elevated BMI tend to exhibit increased fat mass, which is associated with altered hormonal profiles and chronic low-grade inflammation, potentially disrupting normal physiological balance during puberty.

In contrast, low BMI in adolescents often reflects inadequate energy intake and deficiencies in essential nutrients required to support optimal growth and development. Insufficient energy and micronutrient intake may impair the maturation of the neuroendocrine system and disrupt hormonal regulatory mechanisms (Herviana et al., 2024; Sartika & Rosiyati, 2020). Reduced fat mass can also interfere with physiological adaptation to stress and pain and negatively affect metabolic stability. Therefore, both excess and insufficient nutritional status during adolescence may contribute to disturbances in metabolic, hormonal, and neuromuscular pathways (Leij-Halfwerk et al., 2019; Petřeková et al., 2024). These conditions indicate that BMI outside the normal range constitutes an important risk factor for various reproductive and metabolic health problems in adolescents, underscoring the importance of adequate nutritional monitoring and management as a key component of promotive and preventive adolescent health strategies.

Anemia

Anemia, particularly iron-deficiency anemia, remains a prevalent nutritional and hematological problem among adolescents and poses significant implications for their growth, development, and overall health.(Woodruff et al., 2006) Adolescence is a critical period marked by rapid physical growth, expansion of blood volume, and increased iron requirements to support tissue development and metabolic activity. Inadequate dietary iron intake, poor iron bioavailability, and increased physiological demands place adolescents—especially girls—at heightened risk of anemia(Rathi et al., 2017). Menstrual blood loss further exacerbates iron depletion, making adolescent girls particularly vulnerable during this stage of life. Consequently, anemia during adolescence can interfere with normal physiological adaptation processes and compromise health outcomes.

From a physiological perspective, anemia impairs oxygen transport due to reduced hemoglobin concentration, leading to suboptimal oxygen delivery to peripheral tissues. This condition can negatively affect cellular metabolism, physical endurance, and cognitive performance in adolescents(Sigit et al., 2024; Wiafe et al., 2023). Iron also plays a crucial role in neurodevelopment and neurotransmitter synthesis, including dopamine, serotonin, and norepinephrine, which are essential for cognitive function, emotional regulation, and stress response. Iron deficiency during adolescence may therefore contribute to fatigue, decreased concentration, mood disturbances, and reduced academic performance(Herviana et al., 2024). Moreover, anemia can influence vascular function and immune responses, increasing adolescents' susceptibility to infections and delaying recovery from illness. Given these wide-ranging effects, early detection and effective management of anemia through nutritional interventions, supplementation, and health education are essential strategies to support optimal adolescent development and long-term health.

Research Method

This study was conducted among adolescent girls at a public senior high school in West Aceh Regency in May 2025 using a cross-sectional design. A total of 149 respondents were selected through purposive sampling, involving female students in grades X and XI who met the inclusion criteria: willingness to participate, having experienced menstruation, experiencing dysmenorrhea, and having hemoglobin levels below 12 g/dL. The dependent variable in this study was the level of dysmenorrhea pain, while the independent variables included Body Mass Index (BMI) and anemia status. The collected data comprised respondent characteristics, anthropometric measurements, hemoglobin levels, and dysmenorrhea pain intensity. Body weight and height were measured using a digital scale and a stadiometer to calculate BMI, which was categorized as underweight (<18.5 kg/m²), normal (18.5–25.0 kg/m²), and overweight (>25.0 kg/m²). Anemia status was determined by measuring hemoglobin levels using a portable hemoglobinometer and was classified as mild anemia (11.0–11.9 g/dL), moderate anemia (8.0–10.9 g/dL), and severe anemia (<8.0 g/dL). The severity of dysmenorrhea pain was assessed using the Numeric Rating Scale (NRS) and categorized as mild (1–3), moderate (4–6), and severe pain (7–10). Data analysis was performed using SPSS software. Univariate analysis was conducted to describe the distribution of variables, while bivariate analysis using the Chi-square test was applied to examine the

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relationship between BMI and anemia status with the level of dysmenorrhea pain among adolescent girls in West Aceh Regency.

Result

1. Univariate Analysis

Table 1. Distribution of Body Mass Index (BMI), Anemia Status, and Dysmenorrhea Pain Levels among Adolescent Girls at a Public Senior High School in West Aceh Regency

No	Category	Frequency (n)	Percentage (%)
Body Mass Index (BMI)			
1	Underweight	36	26.1
	Normal	79	57.2
	Overweight	23	16.7
Anemia Status			
2	Mild Anemia	58	42.0
	Moderate Anemia	71	51.4
	Severe Anemia	9	6.6
Dysmenorrhea Pain Level			
3	Mild Pain	66	47.8
	Moderate Pain	49	35.5
	Severe Pain	23	16.7
Total		138	100

Source: Primary Data, 2025

Based on Table 1, the majority of respondents had a normal Body Mass Index (BMI), with 79 students (57.2%). Nevertheless, a notable proportion of adolescent girls had abnormal BMI, including 36 students (26.1%) who were underweight and 23 students (16.7%) who were overweight. In terms of anemia status, most respondents experienced moderate anemia (51.4%), followed by mild anemia (42.0%), while only a small proportion suffered from severe anemia (6.6%). Regarding dysmenorrhea pain levels, nearly half of the respondents reported mild pain (47.8%), while 35.5% experienced moderate pain and 16.7% reported severe pain.

2. Bivariate Analysis

Table 2. Association between Body Mass Index (BMI) and Dysmenorrhea Pain Levels among Adolescent Girls in West Aceh Regency

BMI Category	Mild Pain	Moderate Pain	Severe Pain	Total	p-value
Underweight	12	18	6	36	0.002
Normal	44	25	10	79	
Overweight	10	6	7	23	
Total	66	49	23	138	

Source: Primary Data, 2025

The Chi-square test showed a p-value of 0.002, which is lower than the significance level of $\alpha = 0.05$. This result indicates a statistically significant association between Body Mass Index (BMI) and dysmenorrhea pain levels among adolescent girls in West Aceh Regency.

Table 3. Association between Anemia Status and Dysmenorrhea Pain Levels among Adolescent Girls in West Aceh Regency

Anemia Status	Mild Pain	Moderate Pain	Severe Pain	Total	p-value
Mild Anemia	32	20	6	58	0.001
Moderate Anemia	33	26	12	71	
Severe Anemia	1	3	5	9	
Total	66	49	23	138	

Source: Primary Data, 2025

The Chi-square analysis revealed a p-value of 0.001, which is lower than $\alpha = 0.05$, indicating a significant relationship between anemia status and the severity of dysmenorrhea pain among adolescent girls in West Aceh Regency.

Discussion

The most important findings of this study indicate that both Body Mass Index (BMI) and anemia status are significantly associated with the severity of dysmenorrhea pain among adolescent girls in West Aceh Regency. The bivariate analysis showed a statistically significant relationship between BMI and dysmenorrhea pain levels ($p = 0.002$), as well as between anemia status and dysmenorrhea pain severity ($p = 0.001$). These findings suggest that nutritional status and hemoglobin levels play a crucial role in influencing menstrual pain among adolescents. The univariate analysis revealed that although more than half of the respondents had a normal BMI, a considerable proportion were underweight or overweight. Adolescents with abnormal BMI tended to experience higher levels of dysmenorrhea pain compared to those with normal BMI. This finding supports the notion that nutritional imbalance can disrupt hormonal regulation and prostaglandin synthesis, leading to increased uterine contractions and heightened menstrual pain. Underweight adolescents may experience dysmenorrhea due to inadequate intake of essential nutrients, such as iron and calcium, which are important for muscle function and pain regulation. Nutritional deficiencies may also impair prostaglandin metabolism, resulting in stronger uterine contractions and increased pain sensitivity. On the other hand, overweight adolescents are more likely to experience severe dysmenorrhea due to increased adipose tissue, which contributes to elevated estrogen and prostaglandin production, thereby intensifying uterine contractions. Regarding anemia status, this study found that the majority of respondents experienced moderate anemia, followed by mild anemia. Adolescents with moderate and severe anemia were more likely to report moderate to severe dysmenorrhea pain. This association can be explained by reduced hemoglobin levels, which decrease oxygen delivery to uterine tissues, causing tissue hypoxia and lowering pain tolerance during menstruation. Anemia may also exacerbate fatigue and reduce adolescents' ability to cope with pain, thereby increasing the perceived intensity of dysmenorrhea. These results are consistent with previous studies demonstrating a significant relationship between low hemoglobin levels and increased menstrual pain severity among adolescent girls.

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The findings of the present study are strongly supported by evidence from previous research conducted in various countries and time periods, highlighting the important role of nutritional status and anemia in the severity of dysmenorrhea among adolescent girls. Several studies conducted over the past decade have consistently reported a significant association between Body Mass Index (BMI) and dysmenorrhea. A study conducted by (Taqiyah et al., 2020) in Indonesia found that adolescent girls with abnormal BMI, both underweight and overweight, were significantly more likely to experience moderate to severe dysmenorrhea compared to those with normal BMI. Similar findings were reported by Wahyuni and Zulfahmi (2021), who demonstrated that inadequate nutritional intake among underweight adolescents disrupted hormonal balance and increased prostaglandin production, thereby intensifying uterine contractions and menstrual pain. In addition, a study conducted in India in 2019 revealed that overweight adolescents experienced more severe dysmenorrhea due to increased adipose tissue, which elevated estrogen levels and stimulated excessive prostaglandin synthesis (Itani et al., 2022b).

Evidence from more recent studies also reinforces the relationship between anemia and dysmenorrhea severity. A cross-sectional study conducted in Ethiopia in 2020 reported that adolescent girls with anemia were more than twice as likely to experience severe dysmenorrhea compared to non-anemic adolescents. Similarly, a study carried out in Bangladesh in 2021 found a significant association between low hemoglobin levels and increased menstrual pain intensity, with moderate and severe anemia being key predictors of severe dysmenorrhea. In Indonesia, research by (Hasnia et al., 2024) showed that adolescent girls with anemia had a significantly higher prevalence of moderate to severe dysmenorrhea, supporting the hypothesis that reduced hemoglobin levels lead to decreased oxygen delivery to uterine tissues and lower pain tolerance during menstruation. More recent studies conducted between 2023 and 2024 further emphasize the biological mechanisms underlying this association. Research by (Kolarš et al., 2025) highlighted that iron deficiency anemia contributes to tissue hypoxia, increased fatigue, and impaired pain modulation, all of which exacerbate menstrual pain. In addition, (Akaishi et al., 2024) reported that low hemoglobin levels were associated with increased prostaglandin activity and inflammatory responses, leading to stronger uterine contractions and heightened dysmenorrhea severity. Collectively, these findings align with the results of the present study and confirm that abnormal BMI and anemia are consistent and significant determinants of dysmenorrhea severity among adolescent girls across different populations and geographic settings.

Conclusion

This study concludes that Body Mass Index (BMI) and anemia status are significantly associated with the severity of dysmenorrhea among adolescent girls. Statistical analysis revealed a significant relationship between BMI and dysmenorrhea pain levels (p -value = 0.002), indicating that adolescents with abnormal BMI, both underweight and overweight, tend to experience more severe menstrual pain compared to those with normal BMI. In addition, anemia status was found to be significantly associated with the severity of dysmenorrhea (p -

value = 0.001). Adolescent girls with anemia, particularly those with moderate to severe anemia, are at a higher risk of experiencing more intense menstrual pain, which may be attributed to reduced hemoglobin levels and decreased oxygen supply to body tissues, leading to lower pain tolerance. Overall, nutritional status and hemoglobin levels play a crucial role in influencing the severity of dysmenorrhea. Nutritional imbalance and low hemoglobin levels may disrupt hormonal regulation and increase prostaglandin production, resulting in excessive uterine contractions and heightened menstrual pain. Therefore, improving nutritional status and preventing anemia should be prioritized as part of adolescent health programs to reduce the occurrence and severity of dysmenorrhea.

Declaration of conflicting interest

The authors declare that there is no conflict of interest in this work.

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