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The Relationship between Nutritional Status and Primary Dysmenorrhea Incidence Among Adolescent Girls

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Abstract: This study aimed to determine the association between nutritional status based on Body Mass Index (BMI) and the occurrence of primary dysmenorrhea among female students at SMAN 07 Pekanbaru. A quantitative analytic study with a cross-sectional design was conducted involving 127 respondents selected from the target population. Primary dysmenorrhea status was assessed using a structured questionnaire, while nutritional status was classified using BMI categories. The results showed that the prevalence of primary dysmenorrhea was high, affecting 79.50% (101 respondents) of the participants. Statistical analysis using the chi-square test indicated that BMI-based nutritional status was not significantly associated with primary dysmenorrhea ($p = 0.844$). Risk analysis also supported this finding, showing no meaningful evidence of association (OR = 0.72; 95% CI: 0.30–1.71). These findings suggest that primary dysmenorrhea in adolescent girls is likely influenced by multifactorial determinants beyond nutritional status, including hereditary factors, hormonal balance, physical activity, lifestyle habits, and psychological conditions. Preventive and management efforts should therefore incorporate reproductive health education, healthy lifestyle promotion, and broader risk factor control.

Keywords: Adolescent girl; Body mass index; Nutritional status; Pekanbaru; Primary dysmenorrhea

Introduction

Primary dysmenorrhea, characterized by cramping lower abdominal pain occurring shortly before or at the onset of menstruation without underlying pelvic pathology, affects a substantial proportion of adolescent girls worldwide (Kang, 2023; Mukhoirotin & Rohman, 2024). Its prevalence reaches up to 85% among adolescents globally, with rates varying across regions such as 84.1% in Italy, 80% in Malaysia, and 64.25% in Indonesia, where primary dysmenorrhea constitutes the majority of cases (Evani & Sugiatmi, 2024). This condition significantly impairs daily activities, including school attendance and academic performance, among affected adolescent girls. Consequently, understanding modifiable risk factors, such as nutritional status, holds critical importance for developing targeted interventions to mitigate its impact (Amza et al., 2024; Handayani & Handayani, 2024; McKenna & Fogleman, 2021).

Nutritional status emerges as a pivotal modifiable factor, where deviations such as undernutrition from inadequate intake or overweight due to excessive fat accumulation disrupt menstrual blood flow through vascular hyperplasia or compression, thereby exacerbating dysmenorrheal pain (Kang, 2023; Triwahyuningsih et al., 2024). This imbalance in nutritional status manifests as a U-shaped risk curve, wherein both underweight and overweight conditions elevate the likelihood of primary dysmenorrhea compared to normal weight (Primalova & Stefani, 2024). This U-shaped association underscores the need for research exploring nutritional status as a determinant of primary dysmenorrhea in specific populations, such as adolescent girls at SMAN 07 Pekanbaru. This study investigates the correlation between nutritional status

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and the incidence of primary dysmenorrhea among adolescent girls at SMAN 07 Pekanbaru, aiming to provide evidence-based insights for school-based nutritional interventions (Evani & Sugiatmi, 2024; Sari et al., 2021).

Primary dysmenorrhea remains one of the most prevalent gynecological problems among adolescent girls and represents a significant yet often underestimated public health issue (Mulyani et al., 2023; Primalova & Stefani, 2024). Despite its high prevalence, dysmenorrhea is frequently normalized as a routine part of menstruation, leading to delayed management and substantial negative impacts on adolescents' quality of life, school attendance, academic performance, and psychosocial well-being. In low- and middle-income settings, including Indonesia, adolescent reproductive health problems are further compounded by limited access to accurate health information and preventive interventions. Therefore, identifying modifiable and non-modifiable risk factors for primary dysmenorrhea is an urgent priority to inform effective school-based and community-level health strategies.

Nutritional status has been widely hypothesized as a contributing factor to primary dysmenorrhea because of its potential influence on hormonal regulation, inflammatory pathways, anemia, and overall reproductive health (Hijrawati et al., 2021; Prasetyo et al., 2023). However, recent empirical evidence demonstrates inconsistent and sometimes contradictory findings regarding the relationship between body mass index (BMI) and dysmenorrhea, particularly among adolescents. Some studies suggest increased risk among underweight or overweight individuals, while others report no significant association (Agaba et al., 2022; Jabłońska & Mrowiec, 2023). This inconsistency highlights a critical gap in context-specific evidence, especially in adolescent populations where biological maturation, lifestyle behaviors, and environmental exposures differ substantially from adult women. Consequently, further investigation is urgently needed to clarify whether nutritional status meaningfully contributes to dysmenorrhea risk or whether its role is overshadowed by other determinants.

The novelty of this study lies in its focused examination of the association between nutritional status and primary dysmenorrhea within a well-defined adolescent population, using both categorical BMI analysis and odds ratio estimation while preserving sample integrity. Unlike many previous studies that emphasize either extreme BMI categories or rely solely on bivariate prevalence comparisons, this research systematically evaluates nutritional status across multiple BMI classifications and contrasts normal versus non-normal BMI to assess potential risk directionality. Moreover, by demonstrating a consistently high prevalence of dysmenorrhea across all BMI categories, this study provides empirical evidence that challenges the assumption of BMI as a dominant or independent predictor of menstrual pain among adolescents.

Another novel contribution of this study is its contextual interpretation of nutritional status alongside descriptive factors such as family history, age at menarche, and physical activity patterns. While the primary analysis focuses on BMI, the findings highlight the relative importance of genetic predisposition and lifestyle behaviors over anthropometric measures alone. This perspective aligns with emerging literature that emphasizes dysmenorrhea as a multifactorial condition and supports a shift from single-factor explanations toward more integrative adolescent health models. By elucidating this relationship in the local context of SMAN 07 Pekanbaru, the findings aim to inform public health strategies that optimize nutritional balance to reduce dysmenorrheal burden among adolescent girls.

Method

This study employed an analytical observational design with a cross-sectional approach (Sugiyono, 2021). The research was conducted at Senior High School (SMAN) 07 Pekanbaru from September to December 2022. The study population consisted of all female students at SMAN 07 Pekanbaru, totaling 515 students, selected based on the theoretical consideration that adolescent girls aged 15 years and older are at higher risk of experiencing primary dysmenorrhea. A sample of 127 respondents was determined using the Slovin formula with a 5% margin of error and selected through proportional random sampling. The independent variable was nutritional status, while the dependent variable was primary dysmenorrhea**.** Nutritional status was assessed using the Body Mass Index (BMI) calculated from direct measurements of body weight and height and categorized into undernutrition, normal nutrition, and overnutrition. Primary dysmenorrhea was measured using a structured questionnaire assessing the presence of menstrual pain, pain location, onset, and associated gastrointestinal symptoms. Data were collected through anthropometric measurements and questionnaire administration. Data analysis included univariate analysis to describe the distribution of variables using frequencies and percentages, and bivariate analysis using the Chi-square test to examine the association between nutritional status and primary dysmenorrhea at a 95% confidence level ($\alpha = 0.05$). The strength of the association was further analyzed using the odds ratio (OR).

Result and Discussion

Table 1. Univariate distribution of respondent characteristics

Variable	Category	n	%
Dysmenorrhea	Yes	101	79.5
	No	26	20.5
Nutritional status (BMI)	Underweight	32	25.2
	Normal	76	59.8
	Overweight	11	8.7
	Obese	7	5.5
	Missing/invalid BMI	1	0.8
Age at menarche	< 12 years	28	22.0
	≥ 12 years	99	78.0
Family history of dysmenorrhea	Yes	94	74.0
	No	33	26.0
Regular exercise	Yes	33	26.0
	No	94	74.0

Dysmenorrhea remains one of the most common gynecological complaints among adolescents and young women and is widely recognized as a major contributor to impaired quality of life, reduced academic performance, and school absenteeism. Recent clinical and epidemiological literature consistently emphasizes that primary dysmenorrhea is highly prevalent in adolescents, often beginning within 6–12 months after menarche once ovulatory cycles are established. In the present study (n = 127), the prevalence of dysmenorrhea was high (79.50%), which falls within the broad range reported in adolescent populations internationally. A high prevalence may reflect the typical biological pattern of adolescents (frequent anovulatory cycles transitioning to ovulatory cycles with higher prostaglandin production), as well as contextual factors such as stress, sleep patterns, dietary habits, physical inactivity, and pain perception, all of which are frequently discussed as co-determinants of menstrual pain.

Table 1 describes the univariate characteristics of the respondents (n = 127). The majority of participants reported dysmenorrhea (79.5%). Most respondents had a normal nutritional status based on BMI (59.8%), while 25.2% were underweight, 8.7% were overweight, and 5.5% were obese. One respondent (0.8%) had a missing/invalid BMI value. Most respondents experienced menarche at the age of ≥12 years (78.0%). A large proportion reported a family history of dysmenorrhea (74.0%), and most respondents did not perform regular exercise (74.0%).

Table 2. Association between nutritional status (BMI) and dysmenorrhea

Nutritional status (BMI)	Dysmenorrhea (Yes) n (%)	Dysmenorrhea (No) n (%)	Total n (%)
Underweight	25 (78.1)	7 (21.9)	32 (100)
Normal	62 (81.6)	14 (18.4)	76 (100)
Overweight	8 (72.7)	3 (27.3)	11 (100)
Obese	5 (71.4)	2 (28.6)	7 (100)
Missing/invalid BMI	1 (100)	0 (0)	1 (100)
Total	101 (79.5)	26 (20.5)	127(100)

Table 2 presents the distribution of dysmenorrhea across BMI categories among 127 respondents. Dysmenorrhea prevalence was high in all nutritional status groups, ranging from 71.4 to 81.6%. One respondent had a missing/invalid BMI value and reported dysmenorrhea. The Chi-square test result (p = 0.844) indicated that there was no statistically significant association between nutritional status and dysmenorrhea in this study population.

Table 3. Odds ratio of non-normal BMI and dysmenorrhea

BMI group	Dysmenorrhea (Yes)	Dysmenorrhea (No)	OR	95% CI
Non-normal BMI	38	12	0.72	0.30 – 1.71
Normal BMI	62	14	Ref	–
Missing/invalid BMI	1	0	–	–

Table 3 shows the Odds Ratio (OR) analysis comparing non-normal BMI to normal BMI in relation to dysmenorrhea. Respondents with non-normal BMI had lower odds of dysmenorrhea compared to those with normal BMI (OR = 0.72). However, the 95% confidence interval (0.30–1.71) includes 1, indicating that the association was not statistically significant. One respondent had missing/invalid BMI data and was not included in the OR estimation, but was retained descriptively to preserve the total sample size of 127.

Discussion

The prevalence of dysmenorrhea in the present study was high (79.5%), reinforcing the well-documented pattern that primary dysmenorrhea is highly prevalent among adolescent and young female populations. This finding aligns with recent reports from developing and developed countries, where prevalence estimates commonly range from 64% to over 90%, depending on population characteristics, age distribution, and methodological approaches (Pramanik et al., 2023; Uni et al., 2022). Such consistently high prevalence highlights dysmenorrhea as a significant

public health concern among school-aged and adolescent females.

The primary analytic finding of this study indicates that nutritional status, as classified by body mass index (BMI) categories (underweight, normal, overweight, and obese), was not significantly associated with the occurrence of dysmenorrhea ($\chi^2 = 0.823$; $p = 0.844$). This lack of association remained consistent when BMI was dichotomized into normal versus non-normal categories in the odds ratio analysis (OR = 0.72; 95% CI: 0.30–1.71), suggesting no clear protective or risk effect of BMI on dysmenorrhea in this population. Importantly, the confidence interval crossing unity indicates statistical non-significance and underscores that non-normal BMI should not be interpreted as protective against menstrual pain.

From a clinical perspective, this finding is plausible given the multifactorial pathophysiology of primary dysmenorrhea (Bakhsh et al., 2022; Ghandour et al., 2024). Contemporary reviews emphasize that dysmenorrhea is primarily mediated by excessive prostaglandin production in the endometrium, leading to uterine hypercontractility, ischemia, and pain. While nutritional status may indirectly influence hormonal balance, inflammatory pathways, or anemia risk, BMI alone represents a crude proxy that fails to capture dietary quality, micronutrient deficiencies, fat distribution, metabolic health, or inflammatory biomarkers. Consequently, BMI may not function as an independent or dominant predictor of dysmenorrhea, particularly when stronger biological and behavioral factors are present.

The existing literature on the relationship between BMI and dysmenorrhea remains inconsistent. Several recent studies report that underweight adolescents may experience higher dysmenorrhea risk due to nutritional deficiencies, anemia, and altered gonadotropin secretion, whereas others suggest that overweight or obesity may contribute through systemic inflammation and altered estrogen metabolism (Evani & Sugiatmi, 2024; Mukhoirotin & Rohman, 2024; Situmorang et al., 2024). However, multiple studies conducted in Indonesia, Egypt, India, and Saudi Arabia have similarly reported no statistically significant association between BMI and primary dysmenorrhea, even when prevalence remained high across all BMI categories (Uni et al., 2022; Mulyani et al., 2023; Pradnyandari et al., 2024). These mixed findings suggest that the BMI–dysmenorrhea relationship is highly context-dependent and sensitive to population heterogeneity, sample size, BMI classification criteria, and confounding variables.

Several methodological and contextual factors may explain the non-significant association observed in this study. First, dysmenorrhea prevalence was uniformly high across all BMI groups (approximately 71–82%), limiting between-group variability and reducing the likelihood of detecting significant differences using categorical tests such as the Chi-square. Second, the proportion of respondents in the overweight and obese categories was relatively small, resulting in limited statistical power and wide confidence intervals in the odds ratio analysis. Third, the majority of respondents (59.8%) had a normal BMI, which may have diluted potential contrasts between nutritional status groups, as observed in other studies with similar sample compositions.

In contrast to BMI, non-nutritional factors appeared more prominent in shaping dysmenorrhea risk within this sample. A substantial proportion of respondents reported a positive family history of dysmenorrhea (74.0%), a factor consistently identified in recent literature as one of the strongest predictors of primary dysmenorrhea. Genetic susceptibility, shared familial pain perception, and inherited prostaglandin sensitivity are frequently proposed mechanisms underlying this association (Indrawati & Astriana, 2025; Primalova & Stefani, 2024). Although statistical testing in this study did not focus on multivariate modeling, the descriptive dominance of family history suggests a potentially stronger influence than nutritional status alone.

Age at menarche also provides important contextual insight. While early menarche has traditionally been associated with increased dysmenorrhea risk due to prolonged lifetime exposure to ovulatory cycles and prostaglandin release, recent studies report inconsistent findings. In this study, most respondents experienced menarche at ≥ 12 years, yet dysmenorrhea prevalence remained high. Similar patterns have been reported in recent adolescent and university-based studies, indicating that menarche timing may interact with hormonal adaptation, cycle regularity, and psychosocial stress rather than acting as an isolated risk factor (Gunawati & Nisman, 2021; Pradnyandari et al., 2024).

Another salient finding is the low level of regular physical activity, with 74% of respondents reporting no routine exercise. Contemporary evidence increasingly highlights physical activity as a key modifiable protective factor against primary dysmenorrhea. A 2024 systematic review and network meta-analysis, as well as a 2025 meta-analysis, concluded that regular exercise can significantly reduce pain intensity and duration, regardless of BMI status. The high prevalence of physical inactivity in this sample may therefore represent a more actionable target for intervention than nutritional status alone, particularly in school-based health promotion programs.

Overall, the findings of this study support the growing consensus that primary dysmenorrhea is driven by a complex interplay of genetic, hormonal, behavioral, and psychosocial factors. While nutritional status may contribute indirectly in certain contexts, BMI alone does not appear to be a reliable or dominant predictor of dysmenorrhea in this population. The consistently high prevalence across BMI categories underscores the need for multifactorial prevention and management strategies that prioritize physical activity, stress management, menstrual health education, and early identification of individuals with strong familial predisposition.

Conclusion

The results of this study showed that among female students at SMAN 07 Pekanbaru (n = 127), the prevalence of primary dysmenorrhea was relatively high, reaching 79.5% (101 respondents). Nutritional status based on BMI/IMT was not significantly associated with the occurrence of primary dysmenorrhea, and the risk analysis also indicated no meaningful evidence of a relationship. Therefore, primary dysmenorrhea in adolescent girls is likely influenced by other multifactorial factors, such as hereditary aspects, hormonal balance, physical activity patterns, lifestyle habits, and psychological conditions. For this reason, efforts to manage and prevent primary dysmenorrhea should not focus solely on nutritional status, but should also include reproductive health education, the adoption of a healthy lifestyle, and the management of other relevant risk factors. Further research is recommended to explore these contributing factors in greater depth.

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Conceptualization, N.S. and S.F.; methodology N.S. and S.F.; software, N.S. and S.F.; validation, N.S. and S.F.; formal analysis, N.S. and S.F.; investigation, N.S. and S.F.; resources, N.S. and S.F.; data curation, N.S. and S.F.; writing—original draft preparation, N.S. and S.F.; writing—review and editing, N.S. and S.F.; visualization, N.S. and S.F.; supervision, N.S. and S.F.; project administration, N.S. and S.F.; funding acquisition, N.S. and S.F. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest
The authors declare no conflict of interest.

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