



ASSOCIATION OF FAST FOOD AND CAFFEINATED BEVERAGE CONSUMPTION WITH DYSMENORRHEA AMONG FEMALE MEDICAL STUDENTS AT UNIVERSITAS PRIMA INDONESIA

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ABSTRACT

Background: Dysmenorrhea is a common gynecological problem among reproductive-age women, with high prevalence among female university students. Lifestyle factors such as fast food and caffeinated beverage consumption are suspected to be associated with dysmenorrhea. This study aimed to analyze the relationship between fast food and caffeinated beverage consumption with the incidence of dysmenorrhea among medical students at Prima Indonesia University.

Methods: This cross-sectional study used an analytical observational quantitative approach. A total of 316 female students were selected using simple random sampling. Data collection was conducted through questionnaires including demographic characteristics, Food Frequency Questionnaire (FFQ), caffeinated beverage consumption questionnaire, Perceived Stress Scale (PSS-10), and dysmenorrhea assessment. Data analysis used Chi-Square test for bivariate analysis and multiple logistic regression for multivariate analysis.

Results: The prevalence of dysmenorrhea was 86.4%. Bivariate analysis showed all independent variables were significantly associated with dysmenorrhea ($p < 0.05$): fast food consumption ($p < 0.001$), caffeinated beverage consumption ($p < 0.001$), BMI ($p < 0.001$), stress level ($p < 0.001$), and menstrual cycle ($p = 0.019$). In the multivariate model, fast food consumption showed the highest odds ratio (OR = 11.667; 95% CI: 2.971–45.802), followed by stress level (OR = 8.176; 95% CI: 2.579–25.925), caffeine consumption (OR = 7.293; 95% CI: 2.401–22.151), BMI (OR = 3.435; 95% CI: 1.035–11.402), and menstrual cycle (OR = 2.683; 95% CI: 1.029–6.995). The model's Nagelkerke R-squared was 0.487, indicating moderate explanatory power. The Hosmer–Lemeshow test was 0.678, suggesting acceptable model fit.

Conclusion: Fast food and caffeinated beverage consumption were significantly associated with dysmenorrhea incidence, with fast food consumption showing the strongest association among the factors examined. Due to the cross-sectional design, these findings indicate association rather than causation. Further research is needed to determine whether modifying these lifestyle factors can reduce the risk of dysmenorrhea.

Keywords: Dysmenorrhea, fast food, caffeinated beverages, female students, stress

Introduction

Dysmenorrhea, commonly known as menstrual pain, is defined as cramping or pain in the lower abdomen that occurs before or during menstruation. This condition is not merely a routine physiological issue but a gynecological problem often accompanied by systemic symptoms such as nausea, vomiting, diarrhea, headache, and extreme fatigue (Adem et al., 2025; Anggraini et al., 2022; H et al., 2023). Its impact extends beyond physical discomfort, reducing quality of life, hindering academic productivity, and causing absenteeism from work or school. Dysmenorrhea is classified into two main types: primary and secondary. Primary dysmenorrhea is defined as painful menstruation in the absence of pelvic pathology, and it typically appears in adolescents within 6–12 months after menarche, once ovulatory cycles are established (Ariadi et al., 2019;

Ferries-Rowe et al., 2020; Itani et al., 2022). In contrast, secondary dysmenorrhea refers to painful menses due to pelvic pathology or a recognized medical condition, such as endometriosis, adenomyosis, or pelvic inflammatory disease (ACOG Committee Opinion No. 760, 2018; Itani et al., 2022). While secondary dysmenorrhea is more commonly diagnosed in older women, it can also occur in adolescents and young adults, particularly when endometriosis or obstructive reproductive tract anomalies are present. Pathophysiologically, primary dysmenorrhea is primarily driven by excessive release of prostaglandins (especially PGF 2α and PGE 2) from the sloughing endometrium. The sharp decline in progesterone levels at the end of the luteal phase triggers activation of the cyclooxygenase (COX) pathway, converting arachidonic acid into prostaglandins. Increased prostaglandins cause hypercontractility of myometrial muscle, vasoconstriction of uterine arteries, and tissue ischemia. Accumulation of anaerobic metabolites then stimulates nociceptive nerve endings, lowers the pain threshold, and produces characteristic cramping sensations (Duan et al., 2026; Fitrianiingsih & Santanu, 2021; Kusumawardani et al., 2022).

The global burden of dysmenorrhea is considerable. A recent systematic review and meta-analysis comprising 336 studies across 70 countries reported a pooled global prevalence of 71.3% (95% CI: 68.7%–73.8%), with the highest prevalence observed among adolescents and young adults (de Arruda et al., 2026). In Southeast Asia, a systematic review and meta-analysis of female medical students reported a pooled dysmenorrhea prevalence of 78.11% (95% CI: 67.07%–86.21%) (Jannah et al., 2020). In Indonesia, the prevalence of dysmenorrhea among female adolescents has been reported at 64.5%, with the highest rates found in West Java (98.8%) and Jakarta (87.5%) (Zulimartin et al., 2025). A recent study among Indonesian medical students found a high prevalence of 91.27%, with 52.35% experiencing moderate-to-severe pain (Situmorang et al., 2024). Medical students represent a particularly vulnerable population. Besides being in the active reproductive age range (17–22 years), they face heavy academic burdens, irregular sleep patterns, and high stress levels, all of which have been associated with increased dysmenorrhea prevalence.

Several identified risk factors include early menarche age, family history, long menstrual cycles, smoking, and lifestyle factors such as diet, physical activity, and psychological stress (Fathiyyah et al., 2024). A systematic review found that underweight, skipping breakfast, poor sleep quality, staying up late, and lack of physical exercise are significantly associated with primary dysmenorrhea. In recent decades, changing dietary patterns due to modernization have become a major concern. Fast food, which is high in calories, saturated fat, sugar, and sodium but low in fiber and micronutrients, has become an integral part of student lifestyles. Trans fatty acids and saturated fats in fast food may disrupt progesterone metabolism during the luteal phase and provide excess substrate (arachidonic acid) for prostaglandin synthesis, thereby potentially strengthening uterine contractions and menstrual pain (Al-Husban et al., 2022; Putra et al., 2024; Setiawati et al., 2024; Tambunan & Hidayat, 2023). A study among university students in Riau, Indonesia, reported that high fast-food consumption was associated with a sevenfold increase in the odds of dysmenorrhea (Nurhayati, 2025). Students with high fast food consumption habits have a sevenfold increased risk of experiencing dysmenorrhea compared to those with low consumption habits. High-glycemic-index diets have been hypothesized to contribute to insulin resistance and hormonal imbalances, although direct evidence linking these mechanisms to dysmenorrhea remains limited.

Caffeinated beverages, including coffee, tea, and energy drinks, differ substantially in caffeine content and added sugar. Coffee typically contains 95–200 mg caffeine per 237 mL, tea 14–70 mg per 237 mL, and energy drinks vary widely (e.g., 80–300 mg per serving), often with high added sugar (Stephanie et al., 2022). Caffeine acts as an antagonist of adenosine receptors, which normally function as natural vasodilators. When these receptors are inhibited, vasoconstriction of blood vessels occurs, including uterine arteries, reducing blood flow to the myometrium and triggering ischemic conditions and pain (Ariadi et al., 2019; Bajalan et al., 2019; Liu et al., 2024b). Primary dysmenorrhea has been significantly associated with caffeine

consumption ($p < 0.05$). Furthermore, caffeine increases intracellular calcium release in uterine smooth muscle cells, causing stronger and more frequent contractions. Caffeine's effects on sleep disturbance also contribute indirectly to hormonal dysregulation and increased pain sensitivity. Excessive consumption of caffeine and added sugars is significantly associated with higher severity of primary dysmenorrhea among female university students.

In addition to fast food and caffeine, other factors such as body mass index (BMI), stress level, and menstrual cycle characteristics have been associated with dysmenorrhea and are therefore considered as covariates in this study. Excess adipose tissue increases the conversion of androgens to estrogen through aromatase enzyme, which then stimulates endometrial proliferation and prostaglandin production (Kale¹ et al., 2022; Takata et al., 2023; Wu et al., 2022). A meta-analysis found that BMI $< 18.5 \text{ kg/m}^2$ is a significant risk factor for primary dysmenorrhea (OR: 1.51). Chronic stress activates the Hypothalamic-Pituitary-Adrenal (HPA) axis and increases cortisol levels, which in turn suppresses the Hypothalamic-Pituitary-Ovarian (HPO) axis, disrupts progesterone secretion, and triggers prostaglandin release (Lee & Kim, 2024). Short menstrual cycles (< 21 days) also reflect a shorter luteal phase, meaning progesterone decline occurs more rapidly and prostaglandin production becomes more aggressive.

Although many studies have examined the relationship of individual risk factors with dysmenorrhea, there remains a research gap regarding how the combination of fast food and caffeinated beverage consumption patterns, together with confounding factors (BMI, stress, and menstrual cycle), simultaneously interact in the medical student population in Indonesia, particularly in North Sumatra. Specifically, prior studies have not established: whether the combined effect of fast food and caffeine consumption on dysmenorrhea persists after adjusting for BMI, stress, and menstrual cycle in a single analytical model; the relative contribution of each factor when all five are considered simultaneously; and whether these associations are consistent in the Indonesian medical student context, where dietary patterns and academic stressors may differ from other populations. Research integrating all five variables simultaneously in a single analytical model remains limited. Therefore, this study aims to analyze the association of fast food and caffeinated beverage consumption with dysmenorrhea among female medical students at Universitas Prima Indonesia, while controlling for BMI, stress level, and menstrual cycle. The hypothesis of this study is that fast food and caffeinated beverage consumption are significantly associated with dysmenorrhea, even after adjusting for confounding factors.

Methods

Study Design and Setting

An analytical cross-sectional study was conducted at the Faculty of Medicine and Dentistry, Universitas Prima Indonesia. Data collection was carried out from 1 January to 31 March 2026. This study used a quantitative observational analytical approach with a cross-sectional design.

Research Subjects

The target population was all pre-clinical female students in the Medical Doctor Study Program at the Faculty of Medicine and Dentistry, Universitas Prima Indonesia, totaling 358 students. A total of 316 respondents were included in this study after completing the questionnaire fully and meeting the eligibility criteria. Sampling used simple random sampling with student registration numbers as the sampling frame and random number tables for selection. Inclusion criteria were: active female medical students, reproductive age, experiencing or not experiencing dysmenorrhea, willing to be respondents, and able to complete the research questionnaire thoroughly and honestly. There was no restriction on menstrual cycle length; cycle length was analyzed as a study variable. Exclusion criteria were: having specific gynecological diseases (endometriosis, ovarian cysts, myomas), using hormonal medication, severe menstrual disorders, history of gynecological surgery, routinely taking pain relievers or anti-inflammatory drugs, pregnant or breastfeeding, having systemic diseases affecting the menstrual cycle or pain, or incomplete questionnaire data.

Instruments and Data Collection

Data were collected using validated questionnaires adopted from previous studies. Demographic characteristics (age, semester, and menarche age) were collected using a self-report questionnaire developed by the researchers based on previous literature. Fast food consumption was measured using a 25-item Food Frequency Questionnaire (FFQ) adapted from a validated FFQ developed for Indonesian adults... In this study, fast food was operationally defined as ready-to-eat or quickly prepared foods that are high in calories, saturated fat, sugar, and sodium, and low in fiber and micronutrients, including both Western fast food (e.g., fried chicken, hamburgers, pizza, french fries) and traditional fast food (e.g., bakso, mie ayam, gorengan). Scoring was as follows: Never = 0, 1-3x/month = 1, 1-2x/week = 2, >3-6x/week = 3, 1x/day = 4. Total scores ranged from 0 to 100, and consumption was categorized as Frequent ($\geq$ median score of 62) or Rare ($<$ median score). The median cut-off was determined based on the distribution of scores in the current sample, a common approach in dietary pattern research. Caffeine consumption was assessed using a 7-item questionnaire adapted from the Caffeine Consumption Questionnaire (CCQ) and related instruments, with items rated on a 4-point Likert scale (1 = Strongly Disagree to 4 = Strongly Agree). The theoretical minimum total score is 7 (7 items $\times$ 1), and the scoring categories were: High = 19–28, Moderate = 8–18, and Low = 7 (the minimum possible score). and the scoring categories were: High = 19–28, Moderate = 8–18, and Low = 7 (the minimum possible score). The original CCQ has demonstrated good content and construct validity, with test-retest reliability (Cronbach's $\alpha > 0.70$), and a modified version with a 4-point Likert scale has been used in previous studies. Perceived stress was measured using the 10-item Perceived Stress Scale (PSS-10), a widely used instrument developed by Cohen et al. (1983). The Indonesian version of the PSS-10 has demonstrated good internal consistency (Cronbach's $\alpha = 0.862$), and confirmatory factor analysis supported a two-factor model with acceptable fit indices (CFI = 0.950) among Indonesian adolescents. Each item is rated on a 5-point Likert scale (0 = Never to 4 = Very Often). Four positively worded items (items 4, 5, 7, and 8) require reverse scoring (0 $\rightarrow$ 4, 1 $\rightarrow$ 3, 2 $\rightarrow$ 2, 3 $\rightarrow$ 1, 4 $\rightarrow$ 0) before summing across all 10 items. Total scores range from 0 to 40. Scores of 0–13 indicate low stress, 14–26 indicate moderate stress, and 27–40 indicate high perceived stress; in this study, scores were categorized as Mild stress (0–13) and Severe stress (14–40) to align with the study's analytical framework. Dysmenorrhea was assessed using a questionnaire evaluating pain presence, onset, duration, and severity. Pain severity was measured using a visual analog scale (VAS) ranging from 0 to 10; the VAS has demonstrated high reliability for acute pain measurement. Dysmenorrhea was defined as a VAS score ≥ 1 . The questionnaire was adapted from previous studies and was reviewed by the research team for content validity. BMI was calculated from self-reported weight and height and classified as Normal (18.5–22.9), Underweight (< 18.5), or Overweight (≥ 23), following the Asia-Pacific classification. Menstrual cycle length was categorized as Normal (21–35 days), < 21 days (Polymenorrhea), or > 35 days (Oligomenorrhea). Data analysis used SPSS version 25.0. Univariate analysis determined frequency distributions. Bivariate analysis used the Chi-Square test ($p < 0.05$ considered significant). When the Chi-square assumption of expected cell counts greater than 5 was not met, Fisher's exact test was used instead. Multivariate analysis used multiple logistic regression to determine the most dominant risk factors after controlling for confounding variables. The study protocol was approved by the Health Research Ethics Committee of Universitas Prima Indonesia (No. 093/KEPK/UNPRI/I/2026). Informed consent was obtained from all participants prior to data collection, and confidentiality was maintained throughout the study.

Result

Respondent Characteristics

All 358 eligible female medical students were invited to participate. Of these, 316 completed the questionnaire fully and met the eligibility criteria, resulting in a response rate of 88.3% (316/358). The remaining 42 students either did not respond, declined to participate, or had incomplete data and were excluded from the analysis.

Table 1. Demographic Characteristics Distribution

Variable	Frequency (n)	Percentage (%)
Age		
17-19 years	132	41.8
20-22 years	180	57.0
≥23 years	4	1.2
Semester		
Semester 2	92	29.1
Semester 4	110	34.8
Semester 6	114	36.1
Menarche Age		
<10 years	18	5.7
11-14 years	265	83.9
>15 years	33	10.4
Menstrual Cycle		
<21 days (Polymenorrhea)	92	29.1
21-35 days (Normal)	198	62.7
>35 days (Oligomenorrhea)	26	8.2

The majority of respondents were aged 20–22 years (57.0%). Semester distribution was as follows: Semester 2 (29.1%), Semester 4 (34.8%), and Semester 6 (36.1%). Most respondents (83.9%) experienced menarche at age 11–14 years, while 5.7% had early menarche (<10 years) and 10.4% had late menarche (>15 years). Regarding menstrual cycle, 62.7% had normal cycles (21–35 days), 29.1% had short cycles (<21 days), and 8.2% had long cycles (>35 days). Interpretation of these findings is provided in the Discussion section.

Univariate Analysis

Table 2. Distribution of BMI, Stress Level, Fast Food Consumption, Caffeinated Beverage Consumption, and Dysmenorrhea Incidence

Category	Frequency (n)	Percentage (%)
BMI		
Normal (18.5-22.9)	149	47.2
Underweight (<18.5)	46	14.6
Overweight (≥23)	121	38.3
Stress Level		
Mild Stress	167	52.8
Severe Stress	149	47.2
Fast Food Consumption		
Frequent	168	53.2
Rare	148	46.8
Caffeinated Beverage Consumption		
High	42	13.3
Moderate	222	70.3
Low	52	16.5
Dysmenorrhea Incidence		

Yes	273	86.4
No	43	13.6
Pain Severity		
No pain (0)	43	13.6
Mild pain (1-3)	95	30.1
Moderate pain (4-6)	121	38.3
Severe pain (7-9)	47	14.9
Very severe pain (10)	10	3.2
Pain Onset		
One week before menstruation	52	16.5
1-2 days before menstruation	72	22.8
First day of menstruation	96	30.4
During menstruation	53	16.8
No pain	43	13.6
Pain Management		
Rest/sleep	149	47.2
Left untreated	76	24.1
Warm compress	63	19.9
Taking medication	20	6.3
Other	8	2.5
Activity Disturbance		
Yes	207	65.5
No	109	34.5

The prevalence of dysmenorrhea was 86.4% (n = 273). Moderate pain was the most common severity (38.3%), followed by mild pain (30.1%), severe pain (14.9%), and very severe pain (3.2%). The onset of pain predominantly occurred on the first day of menstruation (30.4%) and 1–2 days before menstruation (22.8%). A total of 65.5% of respondents reported that menstrual pain interfered with their daily activities. The most common pain management strategy was rest/sleep (47.2%), while 6.3% used medication. Regarding BMI, 38.3% were overweight, 47.2% had normal BMI, and 14.6% were underweight. Almost half of respondents (47.2%) experienced severe stress. Fast food consumption was frequent in 53.2% of respondents, and 83.6% consumed caffeine at moderate to high levels.

Table 3. Distribution of Fast Food Consumption Types and Frequencies

Food Type	Never n (%)	1-3x/Month n (%)	1-2x/Week n (%)	>3-6x/Week n (%)	1x/Day n (%)
Fried chicken	20 (6.3)	67 (21.2)	79 (25.0)	80 (25.3)	70 (22.2)
Fried foods	42 (13.3)	94 (29.7)	90 (28.5)	46 (14.6)	44 (13.9)
Instant noodles	31 (9.8)	115 (36.4)	102 (32.3)	28 (8.9)	40 (12.7)
Ice cream	29 (9.2)	76 (24.1)	94 (29.7)	81 (25.6)	36 (11.4)
Donuts	62 (19.6)	107 (33.9)	89 (28.2)	29 (9.2)	29 (9.2)

Snack chips	63 (19.9)	89 (28.2)	76 (24.1)	54 (17.1)	34 (10.8)
Kentang goreng	56 (17.7)	96 (30.4)	85 (26.9)	45 (14.2)	34 (10.8)
Bakso	68 (21.5)	102 (32.3)	74 (23.4)	31 (9.8)	41 (13.0)
Mie Ayam	69 (21.8)	112 (35.4)	68 (21.5)	31 (9.8)	36 (11.4)
Chicken nugget	72 (22.8)	105 (33.2)	71 (22.5)	38 (12.0)	30 (9.5)

The most frequently consumed fast foods were fried chicken (72.5% consumed at least 1-2x/week), fried foods (57.0%), and instant noodles (53.9%). Fried chicken had the highest daily consumption rate (22.2%), indicating that students heavily rely on processed, high-fat, high-sodium foods as dietary staples. The most frequently consumed fast foods were fried chicken (72.5%), fried foods (57.0%), and instant noodles (53.9%). Fried chicken had the highest daily consumption rate (22.2%). Snack foods like ice cream, donuts, and chips were also consumed frequently. Traditional fast foods such as bakso and mie ayam were also commonly consumed. Interpretation of these findings is provided in the Discussion section.

Bivariate Analysis

Table 4. Bivariate Analysis of All Variables with Dysmenorrhea Incidence

Variable	Dysmenorrhea Yes n (%)	Dysmenorrhea No n (%)	Total n (%)	p-value
Fast Food Consumption				
Frequent	161 (95.8%)	7 (4.2%)	168 (100%)	<0.001
Rare	112 (75.7%)	36 (24.3%)	148 (100%)	
Caffeinated Beverage Consumption				
High	42 (100%)	0 (0%)	42 (100%)	<0.001
Moderate	200 (90.1%)	22 (9.9%)	222 (100%)	
Low	31 (59.6%)	21 (40.4%)	52 (100%)	
BMI				
Normal	122 (81.9%)	27 (18.1%)	149 (100%)	<0.001
Underweight	33 (71.7%)	13 (28.3%)	46 (100%)	
Overweight	118 (97.5%)	3 (2.5%)	121 (100%)	
Stress Level				
Mild	128 (76.6%)	39 (23.4%)	167 (100%)	<0.001
Severe	145 (97.3%)	4 (2.7%)	149 (100%)	
Menstrual Cycle				
<21 days	86 (93.5%)	6 (6.5%)	92 (100%)	0.019
21-35 days	165 (83.3%)	33 (16.7%)	198 (100%)	
>35 days	22 (84.6%)	4 (15.4%)	26 (100%)	

Based on Table 4, bivariate analysis revealed that all five variables were significantly associated with dysmenorrhea ($p < 0.05$). For fast food consumption, the crude odds ratio (OR) for frequent versus rare consumption was 7.39 (95% CI: 3.17–

17.20). For caffeine consumption, the high category had 100% dysmenorrhea (42/42) and zero participants without dysmenorrhea, resulting in a zero cell. Therefore, the Chi-square assumption was violated, and Fisher's exact test was used ($p < 0.001$). The high and moderate categories were combined for the OR calculation, yielding an OR of 7.45 (95% CI: 3.68–15.09) for high/moderate versus low. For BMI, the OR for overweight versus normal was 8.70 (95% CI: 2.57–29.43), and for underweight versus normal it was 0.56 (95% CI: 0.26–1.21). For stress, the OR for severe versus mild was 11.04 (95% CI: 3.84–31.72). For menstrual cycle, the OR for short versus normal was 2.87 (95% CI: 1.16–7.12), and for long versus normal it was 1.10 (95% CI: 0.36–3.40). Based on the crude odds ratios, the largest effect size was observed for stress, followed by overweight BMI, frequent fast food consumption, caffeine consumption (combined high/moderate vs low), and short menstrual cycle.

BMI category was significantly associated with dysmenorrhea. Overweight respondents had the highest prevalence (97.5%), followed by normal weight (81.9%) and underweight (71.7%), a difference of 25.8% between the overweight and underweight groups. Stress level was also significantly associated with dysmenorrhea. Those with severe stress had a prevalence of 97.3%, compared with 76.6% among those with mild stress, a difference of 20.7%. Menstrual cycle length showed a significant association as well. Short cycles (<21 days) had the highest prevalence (93.5%), followed by long cycles (>35 days) at 84.6% and normal cycles at 83.3%, with a difference of 10.2% between short and normal cycles.

Multivariate Analysis

Table 5. Multiple Logistic Regression Analysis of Factors Associated with Dysmenorrhea

Variable	B	S.E.	Wald	df	p	AOR	95% CI
Fast Food: Frequent vs Rare (ref: Rare)	2.456	0.698	12.389	1	<0.001	11.667	2.971–45.802
Stress: Severe vs Mild (ref: Mild)	2.101	0.589	12.725	1	<0.001	8.176	2.579–25.925
Caffeine: High/Moderate vs Low (ref: Low)	1.946	0.450	18.720	1	<0.001	7.120	2.89–16.95
BMI			8.123	2	0.017		
BMI: Underweight vs Normal (ref: Normal)	-0.321	0.415	0.598	1	0.439	0.725	0.321–1.638
BMI: Overweight vs Normal (ref: Normal)	1.234	0.612	4.065	1	0.044	3.435	1.035–11.402
Menstrual Cycle			5.678	2	0.058		
Cycle: <21 vs Normal (ref: Normal)	0.987	0.489	4.074	1	0.044	2.683	1.029–6.995
Cycle: >35 vs Normal (ref: Normal)	0.123	0.567	0.047	1	0.828	1.131	0.372–3.438

Nagelkerke R Square = 0.492 / Hosmer-Lemeshow Test = 0.715

Table 5 presents the results of the multiple logistic regression analysis examining the associations of five variables (fast food consumption, caffeinated beverage

consumption, BMI, stress level, and menstrual cycle) with dysmenorrhea after adjusting for potential confounders. After controlling for all other variables, four variables remained significantly associated with dysmenorrhea: fast food consumption, stress level, caffeine consumption, and BMI. Menstrual cycle as a whole was not statistically significant ($p = 0.058$), although the short-cycle category showed a significant association.

Fast food consumption showed the largest adjusted odds ratio in the fitted model (AOR = 11.667; 95% CI: 2.971–45.802; $p < 0.001$), indicating that students who frequently consumed fast food had higher odds of dysmenorrhea compared to those with rare consumption, after adjusting for other variables. Stress level showed the second largest adjusted odds ratio (AOR = 8.176; 95% CI: 2.579–25.925; $p < 0.001$), indicating that students with severe stress had higher odds of dysmenorrhea compared to those with mild stress. Caffeine consumption (high/moderate vs low) had an AOR of 7.00 (95% CI: 2.89–16.95; $p < 0.001$), indicating that students with high or moderate caffeine intake had higher odds of dysmenorrhea compared to those with low intake. BMI was significantly associated with dysmenorrhea overall ($p = 0.017$); the overweight category had an AOR of 3.435 (95% CI: 1.035–11.402; $p = 0.044$) compared to normal weight, while the underweight category was not significantly associated (AOR = 0.725; 95% CI: 0.321–1.638; $p = 0.439$). Menstrual cycle overall was not significantly associated with dysmenorrhea ($p = 0.058$); however, the short-cycle category (<21 days) had an AOR of 2.683 (95% CI: 1.029–6.995; $p = 0.044$) compared to normal cycle, while the long-cycle category (>35 days) was not significantly associated (AOR = 1.131; 95% CI: 0.372–3.438; $p = 0.828$). The model's Nagelkerke R-squared was 0.492, indicating moderate explanatory power. This is a pseudo-R-squared value and should not be interpreted as the proportion of variance in the outcome explained by the model. The Hosmer-Lemeshow test ($p = 0.715$) indicated acceptable model fit.

Discussion

This study found a high prevalence of dysmenorrhea among medical students at Prima Indonesia University, with 86.4% of respondents reporting menstrual pain. This figure is close to the 86.4% reported in a study from Beijing (Y.-L. Wang & Zhu, 2025), but the two populations are not directly comparable. The Beijing study included women of reproductive age from the general population, with a broader age range and different sampling frame, setting, and outcome measurement. Therefore, the similarity in prevalence should be interpreted with caution. A more comparable study among Indonesian medical students reported a prevalence of 91.27% (Situmorang et al., 2024). Our finding is slightly lower but still within the expected range. The difference may be due to variations in study setting, measurement tools, and population characteristics. The high prevalence observed here highlights the considerable burden of dysmenorrhea among medical students, who already face demanding academic schedules. As noted in previous research, medical students may experience higher stress levels than the general population due to intense academic pressure, competitive environments, and heavy workloads, which may contribute to the elevated prevalence of dysmenorrhea in this group (Al-Husban et al., 2022).

Fast Food Consumption and Dysmenorrhea

One notable finding of this study was the association between fast-food consumption and dysmenorrhea. Students with frequent fast-food consumption had higher odds of experiencing dysmenorrhea compared to those with rare consumption (AOR = 11.667; 95% CI: 2.971–45.802; $p < 0.001$). Similarly, a study among adolescent girls in vocational high schools found a strong positive correlation between fast-food consumption and primary dysmenorrhea ($p = 0.001$, $r = 0.833$), with more frequent consumption associated with more severe dysmenorrhea (Ayu et al., 2025). However, these findings should be interpreted with caution due to the cross-sectional

design. The observed association is compatible with several explanations, including residual confounding, reverse temporality (e.g., students with more severe dysmenorrhea may alter their diet), and unmeasured lifestyle factors. A biologically plausible hypothesis for the association involves the high saturated fat and trans fat content of fast food, which may serve as a substrate for arachidonic acid synthesis and potentially increase prostaglandin production, leading to uterine hypercontractility and ischemia. However, this mechanism was not directly tested in this study and should be regarded as a hypothesis for future research rather than a demonstrated pathway. Longitudinal or experimental studies are needed to clarify whether fast-food consumption contributes causally to dysmenorrhea (Ayu et al., 2025).

The pathophysiological mechanism underlying this association is well-established. Fast food is characterized by high content of saturated fats and trans fatty acids, which serve as substrates for arachidonic acid synthesis. Through the cyclooxygenase (COX) pathway, arachidonic acid is converted into prostaglandins, particularly PGF₂ α and PGE₂. Elevated prostaglandin levels cause hypercontractility of uterine smooth muscle, vasoconstriction of spiral arterioles, and subsequent myometrial ischemia, ultimately producing characteristic menstrual cramps (Duan et al., 2026).. Furthermore, the high sodium content and low micronutrient profile of fast food may exacerbate fluid retention and electrolyte imbalances that sensitize pain pathways (Itani et al., 2022). A systematic review and meta-analysis identified frequent consumption of fast food as a significant risk factor for dysmenorrhea among students (Liu et al., 2024). The near-universal dysmenorrhea (95.8%) observed among frequent fast-food consumers in this study highlights the critical importance of dietary modification as a primary prevention strategy.

Caffeinated Beverage Consumption and Dysmenorrhea

This study found a significant association between caffeine consumption and dysmenorrhea. In the bivariate analysis, a gradient was observed: 100% of high-caffeine consumers, 90.1% of moderate consumers, and 59.6% of low consumers experienced dysmenorrhea. Because the high-caffeine category had zero participants without dysmenorrhea, the high and moderate categories were combined for the multivariate analysis to avoid complete separation. In the adjusted model, high/moderate caffeine consumption was significantly associated with dysmenorrhea compared to low consumption (AOR = 7.00; 95% CI: 2.89–16.95; $p < 0.001$). This finding is consistent with a meta-analysis reporting a significant association between high caffeine intake and primary dysmenorrhea (OR = 2.082; 95% CI: 1.379–3.144) (Liu et al., 2024). A study conducted at King Saud University also found that primary dysmenorrhea was significantly associated with caffeine consumption ($p < 0.05$) (Al-Husban et al., 2022). Furthermore, research among female medical students in Ethiopia revealed that those who consumed more than 3 cups of coffee per day had a 3.25 times higher chance of developing primary dysmenorrhea compared to non-consumers (AOR = 3.25; 95% CI: 1.32–8.04) (Adem et al., 2025). The biological mechanism involves caffeine's antagonistic effect on adenosine receptors. Adenosine normally functions as a potent vasodilator in uterine vasculature; by blocking these receptors, caffeine induces vasoconstriction of uterine arteries, reducing blood flow to the endometrium and myometrium, leading to ischemic pain (Liu et al., 2024). Additionally, caffeine increases intracellular calcium release in uterine smooth muscle cells through ryanodine receptor activation, potentiating stronger and more sustained contractions (Febiola & Nugroho, 2023). A study on lifestyle variables found that frequent consumption of coffee, tea, and energy drinks was significantly associated with severe dysmenorrhea (Al-Husban et al., 2022; Fitrianiingsih & Santanu, 2021). All high-caffeine consumers in this study experienced dysmenorrhea, and none were free of dysmenorrhea. This pattern warrants attention, but due to the cross-sectional design, causality cannot be established. The observed association may be influenced by residual confounding, reverse temporality, or other unmeasured lifestyle factors.

Body Mass Index and Dysmenorrhea

In this study, overweight students had higher odds of dysmenorrhea compared to normal weight students (AOR = 3.435; 95% CI: 1.035–11.402; $p = 0.044$). The overall BMI variable was significantly associated with dysmenorrhea ($p = 0.017$). Overweight respondents had the highest

dysmenorrhea prevalence (97.5%), followed by normal weight (81.9%) and underweight (71.7%). Underweight was not significantly associated with dysmenorrhea in the adjusted model (AOR = 0.725; 95% CI: 0.321–1.638; $p = 0.439$). These findings are consistent with previous research showing an association between BMI and dysmenorrhea. A study in Beijing found a significant correlation between BMI and dysmenorrhea ($p = 0.032$) (Y.-L. Wang & Zhu, 2025). Research on adolescent girls also found that abnormal BMI (either underweight or overweight) is associated with hormonal disorders that can worsen pain (Ana Tasya Maulidah Saputri, 2023). A U-shaped association has been observed between BMI and dysmenorrhea, with both underweight and overweight students being more likely to experience menstrual disorders (Mitsuhashi et al., 2022). However, in this study, only the overweight category was significantly associated with dysmenorrhea. A plausible hypothesis involves excess adipose tissue increasing estrogen production through aromatization, which may stimulate endometrial proliferation and prostaglandin synthesis. However, this mechanism was not directly tested, and the cross-sectional design limits causal inference.

The pathophysiological mechanism involves adipose tissue as an active endocrine organ expressing aromatase enzyme, which converts androgens (androstenedione and testosterone) to estrogens (estrone and estradiol). Increased estrogen production from peripheral aromatization in overweight individuals promotes endometrial proliferation and hyperplasia (Takata et al., 2023). The thickened endometrium produces greater quantities of prostaglandins during menstruation, intensifying uterine contractions and pain. Additionally, adipose-derived inflammatory cytokines such as TNF- α and IL-6 may sensitize pain pathways and lower the nociceptive threshold (Bajalan et al., 2019; Reavey et al., 2021). Interestingly, some studies have found no association between BMI and dysmenorrhea, while others have identified underweight as a risk factor (Mitsuhashi et al., 2022). These inconsistencies may be due to differences in study populations, BMI categorization methods, and cultural factors. The near-universal dysmenorrhea (97.5%) among overweight respondents in our study highlights the clinical importance of weight management as a preventive strategy.

Stress Level and Dysmenorrhea

Psychological stress emerged as the second most powerful predictor of dysmenorrhea in this study, with students experiencing severe stress having approximately 8 times higher odds of dysmenorrhea compared to those with mild stress (AOR = 8.176; 95% CI: 2.579–25.925; $p < 0.001$). The dysmenorrhea incidence among severely stressed students was 97.3%, dramatically higher than those with mild stress (76.6%). This finding is consistent with a meta-analysis which identified stress as a significant risk factor for primary dysmenorrhea among female college students (OR = 1.895; 95% CI: 1.515–2.282) (Liu et al., 2024). Research among female medical students in Ethiopia found that those with studying area stress were 2.39 times more likely to develop primary dysmenorrhea compared to those without such stress (Adem et al., 2025). A study on perceived stress among university students found a significant positive correlation between perceived stress and menstrual symptoms, with 6.5% of the change in menstrual symptoms explained by perceived stress (Bharati et al., 2021; Lee & Kim, 2024).

The underlying mechanism involves activation of the hypothalamic-pituitary-adrenal (HPA) axis, leading to increased corticotropin-releasing hormone (CRH) and subsequent cortisol release. Elevated cortisol suppresses the hypothalamic-pituitary-ovarian (HPO) axis through multiple feedback mechanisms, including inhibition of gonadotropin-releasing hormone (GnRH) secretion and direct suppression of pituitary gonadotropin secretion (FSH and LH). Reduced LH levels impair luteal function and progesterone production, causing premature luteolysis and a more rapid progesterone decline (Lee & Kim, 2024). This abrupt progesterone withdrawal triggers increased endometrial prostaglandin synthesis through upregulation of COX-2 expression and arachidonic acid release (Duan et al., 2026). Additionally, stress-induced activation of the sympathetic nervous system increases circulating catecholamines, which further potentiate uterine vasoconstriction and smooth muscle contraction (Ariadi et al., 2019; Itani et al., 2022).

The finding that 97.3% of severely stressed students experience dysmenorrhea underscores the critical importance of integrating stress management and mental health support into comprehensive dysmenorrhea prevention programs for medical students.

Menstrual Cycle and Dysmenorrhea

This study found that students with abnormal menstrual cycles, particularly short cycles (<21 days), had approximately 2.7 times higher odds of dysmenorrhea compared to those with normal cycles (AOR = 2.683; 95% CI: 1.029-6.995; $p = 0.019$). Respondents with short cycles had the highest dysmenorrhea incidence (93.5%), compared to 83.3% in those with normal cycles. This finding is consistent with a meta-analysis which identified irregular menstrual cycles as a significant risk factor for primary dysmenorrhea (OR = 1.662; 95% CI: 1.166-2.367) (Liu et al., 2024). A study in Indonesia found that cycle length was a significant determinant of moderate-to-severe dysmenorrhea (OR = 1.57; 95% CI: 1.01-2.43; $p = 0.044$) (Situmorang et al., 2024). Research among female medical students in Ethiopia also found that those with irregular menstrual cycles were 1.7 times more likely to develop primary dysmenorrhea (Adem et al., 2025). The pathophysiological mechanism involves the relationship between cycle length and luteal phase duration. Short cycles (<21 days) are typically characterized by abbreviated luteal phases (<11 days), often resulting from inadequate corpus luteum function and suboptimal progesterone production (Dhanalakshmi K. Thiyagarajan et al., 2024). The abbreviated luteal phase leads to earlier and more rapid progesterone withdrawal, which triggers a more pronounced surge in endometrial prostaglandin synthesis. Higher peak prostaglandin concentrations cause stronger uterine contractions and more severe ischemic pain (Duan et al., 2026). Additionally, short cycles may be associated with anovulatory cycles in some cases, which can cause irregular shedding and increased dysmenorrhea risk (Itani et al., 2022). While the association was weaker than other variables in this study, the high dysmenorrhea prevalence among students with short cycles suggests that this group may benefit from targeted preventive interventions, potentially including hormonal regulation or lifestyle modifications that prolong the luteal phase.

Integrated Multivariate Model and Clinical Implications

The multivariate model had a Nagelkerke R-squared of 0.492, indicating moderate explanatory power. This is a pseudo-R-squared value and should not be interpreted as the proportion of variation or risk explained by the model. In the fitted model, fast food consumption, stress, and caffeine consumption showed larger adjusted odds ratios than BMI and menstrual cycle. The association between fast food consumption and dysmenorrhea (AOR = 11.667) suggests that dietary interventions may be a relevant focus for prevention efforts. Medical schools could consider providing healthier food options and incorporating nutrition education (Nurhayati, 2025). The association with stress (AOR = 8.176) highlights the potential value of mental health support and stress management programs (Lee & Kim, 2024; Rajipet et al., 2021; L. Wang et al., 2022). The gradient observed for caffeine consumption (AOR = 7.00 for high/moderate vs low) supports recommendations to limit caffeine intake, particularly during the premenstrual and menstrual periods (Al-Husban et al., 2022). These findings are consistent with previous reviews suggesting that better lifestyle habits may be associated with lower occurrence of primary dysmenorrhea (Liu et al., 2024). However, because this was a cross-sectional study, no attributable-risk or causal inference can be made. Longitudinal or interventional studies are needed to determine whether modifying these factors can reduce the burden of dysmenorrhea.

Study Limitations

Several limitations should be considered when interpreting these findings. First, the cross-sectional design precludes establishing causal relationships; it only identifies associations. Second, data collection relied on self-reported questionnaires, which may introduce recall bias and social desirability bias. Third, the study population was limited to a single institution, which may limit generalizability to other populations or settings. Fourth, potential confounding factors

such as physical activity, sleep quality, family history of dysmenorrhea, and use of hormonal contraceptives were not comprehensively assessed. Fifth, the study did not measure objective biomarkers such as prostaglandin levels or inflammatory markers to confirm the proposed mechanisms. Sixth, because dysmenorrhea was a common outcome (prevalence 86.4%), the use of odds ratios from logistic regression may overestimate the strength of associations relative to prevalence ratios. Modified Poisson regression with robust standard errors could provide adjusted prevalence ratios that are more directly interpretable in this cross-sectional setting, and this should be considered in future analyses. Seventh, the presence of a zero cell in the high-caffeine category may have caused model instability, and combining categories, as done in this study, is one approach to address this issue. Finally, residual confounding cannot be ruled out despite adjustment for several covariates. Despite these limitations, this study provides useful insights into lifestyle factors associated with dysmenorrhea among medical students and highlights the need for further research using longitudinal designs and alternative modeling approaches.

Conclusion

This study found a high prevalence of dysmenorrhea (86.4%) among female medical students, with moderate pain being the most common severity and more than half reporting interference with daily activities. After adjustment for potential confounders, frequent fast food consumption and higher caffeine consumption were associated with dysmenorrhea. Stress and overweight BMI also showed associations, while menstrual cycle was not consistently associated. Due to the cross-sectional design, causality cannot be inferred. These findings highlight the potential relevance of dietary and lifestyle factors to dysmenorrhea, but longitudinal or interventional studies are needed to determine whether modifying these factors can reduce its occurrence.

SUGGESTIONS

Based on the findings of this study, female students may consider moderating their consumption of fast food and caffeinated beverages, particularly during the premenstrual and menstrual periods, and adopting stress management techniques such as regular physical activity, adequate sleep, and relaxation practices. However, because this was a cross-sectional study, it cannot be concluded that these changes will reduce the occurrence of dysmenorrhea; they may be reasonable hypotheses for preventive strategies. The Faculty of Medicine, Universitas Prima Indonesia, could consider implementing reproductive health education programs, providing healthier food options in campus cafeterias, and establishing stress management and counseling services. For future researchers, it is suggested to employ prospective or longitudinal designs, incorporate objective measurements of dietary intake and stress biomarkers, consider additional confounding variables such as physical activity and sleep quality, and expand the research to multiple institutions to enhance generalizability.

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