



The Correlation Between Sodium Intake and Primary Dysmenorrhea Severity in Overnourished University Students

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Abstract. Primary dysmenorrhea is commonly found in female adolescents who experience menstruation. Overnutrition can increase the risk of dysmenorrhea because excess body weight raises prostaglandin levels in the body, which triggers menstrual pain. Dietary patterns that tend to favour less nutritious foods, such as fast food that is high in sodium, can affect prostaglandin hormone levels in the body and lead to dysmenorrhea. The aim of this study was to determine the correlation between sodium intake and the severity of primary dysmenorrhea in overnourished university students. This study used an observational analytic design with a cross-sectional method. The participants were 48 overnourished female students from non-health study programs in Malang City selected using purposive sampling. Data on sodium intake was obtained using a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ), and primary dysmenorrhea pain level was measured using the Numerical Rating Scale (NRS). The results showed that 47.9% of participants experienced moderate-level primary dysmenorrhea, and 83.3% of participants had high sodium intake levels. The median sodium intake was 3,959.4 (1,804.8–8,722.0) mg/day. Based on the Spearman correlation test, a significant positive correlation with moderate strength was found between sodium intake and primary dysmenorrhea severity ($p=0.515$, $p<.001$). It can be concluded that there is a significant correlation between sodium intake and the level of primary dysmenorrhea, where higher sodium intake is associated with greater menstrual pain severity.

Keywords: Female adolescents, Primary dysmenorrhea, Overnutrition, Sodium intake, University student

1 Introduction

Adolescence represents a critical developmental phase marked by profound physical, psychological, and sexual changes, most notably the onset of puberty and reproductive maturation [1]. In females, this transition is characterized by the commencement of menstruation that for many, is accompanied by dysmenorrhea: painful uterine cramping that may radiate to the lower back, pelvis, and thighs, often co-occurring with digestive and autonomic disturbances [2]. In Indonesia, dysmenorrhea affects 64.25% of females,

with primary dysmenorrhea, principally mediated by elevated prostaglandin levels and uterine hypercontractility, accounting for most cases (54.89%) [3].

Primary dysmenorrhea affects approximately 90% of adolescent females worldwide, with more than half experiencing it in some form and 10–20% reporting symptoms severe enough to interfere with daily activities [4]. Several risk factors have been associated with primary dysmenorrhea, including early menarche, family history, prolonged menstrual duration, smoking exposure, caffeine intake, anemia, and excess nutritional status [5], [6]. Adolescents are particularly vulnerable to overnutrition, and national data from 2023 Indonesia Health Survey report that 46.5% of adult women are either overweight (15.3%) or obese (31.2%), a figure that continues to rise over year [7].

Excess nutritional status may exacerbate dysmenorrhea through several interconnected mechanisms. Adipose tissue accumulation can compress blood vessels surrounding the reproductive organs, impairing menstrual blood flow and intensifying pain [8]. Elevated estrogen levels in individuals with overnutrition promote sodium and fluid retention, contributing to bloating and worsened menstrual symptoms [9]. Although excessive sodium intake has been associated with obesity [10] and chronic inflammation [11], the direct mechanism linking sodium intake to primary dysmenorrhea remains unclear and requires further investigation. The resulting uterine vasoconstriction reduces oxygen delivery to uterine tissue, causing ischemia that stimulates pain mediators and leads to more severe menstrual cramping [12]. Additionally, diets high in sodium, saturated fat, and cholesterol, typical of junk food, are associated with increased prostaglandin production, a key driver of dysmenorrhea [13].

Despite these mechanistic links, study specifically examining the relationship between sodium intake and primary dysmenorrhea severity, particularly among overnourished populations, remains scarce. Most prior studies have focused on general dietary patterns or hormonal factors without isolating sodium's specific contribution to menstrual pain [14]. Non-health-study program students represent a particularly relevant population, as they tend to have less nutritional and menstrual health literacy compared to their peers in health-related programs [15]. Therefore, this study aims to examine the association between sodium intake and primary dysmenorrhea severity among overnourished female students enrolled in non-health study programs.

2 Methods

This study was a quantitative observational analytic design with a cross-sectional approach, conducted between July 2024 to June 2025. Participants were recruited from several public and private universities in Malang City through online announcements distributed via social media platforms. Eligible participants were enrolled in non-health study programs, including faculties of economics, engineering, law, education, social sciences, and other disciplines not related to medicine, nursing, nutrition, pharmacy, or other health sciences. Interested students completed an initial screening questionnaire to assess eligibility, after which those meeting the inclusion criteria were invited to participate in the study. A total of 48 participants were recruited through purposive sampling. Inclusion criteria were overweight with body mass index (BMI) ≥ 23 kg/m²,

willing to participate, age between 18–23 years, having good general physical health, having experienced menstruation, and being unmarried. Exclusion criteria included current smoking or alcohol consumption, and adherence to any specialized dietary regimen, including low- or high-sodium diets or the Dietary Approaches to Stop Hypertension (DASH) diet.

Anthropometric and body composition assessments were conducted following standardized procedures, utilizing Bioelectrical Impedance Analysis (BIA) (Omron) for body composition measurement and a stadiometer (SECA) for height measurement. Overnutrition status was confirmed using Body Mass Index (BMI) calculation, with three classifications: Overweight (23–24.9 kg/m²); Obese I (25–29.9 kg/m²); Obese II (≥30 kg/m²) [16]. Dysmenorrhea severity was assessed using the Numerical Rating Scale (NRS), an instrument with a reported validity coefficient of 0.906 and a reliability coefficient of 0.637. The pain severity level is categorized as: mild (1-3); moderate (4-6); severe (7-10).

Dietary sodium intake was assessed using a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) covering the intake of the past three months, encompassing 127 food items consisting of raw food ingredients, packaged foods, and processed food products. SQ-FFQ data were subsequently analyzed using Nutrisurvey software. The sodium intake is categorized as excessive if consumed at >2,400 mg/day and normal if consumed at ≤2,400 mg/day [17]. The study protocol was approved by the Ethics Committee of the Faculty of Health Sciences, Universitas Brawijaya (Ethical Approval No.: 32/UN10.F17.10.4/TU/2025).

Statistical analysis was performed using Spearman's rank correlation test to evaluate the correlation between sodium intake and primary dysmenorrhea severity. All analyses were conducted using SPSS software.

3 Results

3.1 Characteristics of the Study Participants

Table 1. Characteristics of the study participants.

Variable	N = 48	%
Age, years		
18	1	2.1
19	10	20.8
20	8	1.7
21	16	33.3
22	11	22.9
23	2	4.2
Nutritional status		
Overweight	7	14.6
Obese I	21	43.8
Obese II	20	41.7
Age of menarche, years old		
<11	6	12.5
11–13	38	79.2

>13	4	8.3
Take medication for menstrual pain		
Yes	15	31.3
No	33	68.8
Physical activity		
Light	46	95.8
Moderate	2	4.2

This study incorporated 48 overnourished female students from non-health study programs in Malang city. The characteristics of the study participants are presented in Table 1. Most of the participants in this study were 21 years old (33.3%) and were classified as obese, with 43.8% in the obese class I and 41.7% in obesity class II category. Most participants experienced menarche between the ages of 11 and 13 years (79.2%). In addition, most participants (68.8%) reported not using medication to manage menstrual pain. Furthermore, most participants (95.8%) were engaged in low levels of physical activity.

3.2 Dietary Sodium Intake Level

Table 2. Dietary sodium intake level.

Intake (mg/day)	N = 48	%
Median (min;max)	3,959.4 (1,804.8;8,722.0)	
Intake Level		
Normal	19	39.6
Excessive	29	60.4

According to the Indonesian Recommended Dietary Allowances, sodium requirements are estimated at 1,600 mg/day for adolescent females aged 16–18 years and 1,500 mg/day for those aged 19–29 years [18]. Sodium intake is generally classified as excessive when it exceeds 2,400 mg/day and adequate when it is at or below this threshold [17]. Based on Table 2, the majority of participants (60.4%) reported excessive sodium intake.

3.3 Pain Level

Table 3. Pain Level of primary dysmenorrhea.

Pain level	N = 48	%
Mild	19	39.6
Moderate	23	47.9
Severe	6	12.5

The distribution of primary dysmenorrhea severity is shown in Table 3. All participants experienced primary dysmenorrhea. Nearly half of the participants (47.9%) reported moderate pain, followed by mild pain (39.6%) and severe pain (12.5%).

3.4 Correlation of Dietary Sodium and Pain Level of Primary Dysmenorrhea

Based on Table 4, a statistically significant association was observed between the consumption of high-sodium foods and primary dysmenorrhea, as indicated by $p < 0.001$ and $\rho = 0.515$. This reflects a moderate positive correlation, suggesting that higher intake of sodium-rich foods is associated with greater severity of dysmenorrhea. In other words, as sodium consumption increases, the intensity of primary dysmenorrhea also tends to increase.

Table 4. Correlation of Dietary Sodium and Pain Level of Primary Dysmenorrhea.

Variable	Pain level	
Dietary sodium intake level	p	<0.001
	ρ	0.515

4 Discussion

4.1 Characteristics of the Study Participants

This study aimed to examine the association between dietary sodium intake and primary dysmenorrhea severity among overnourished female students from non-health study programs in Malang City. The findings demonstrated a significant positive correlation between dietary sodium intake and primary dysmenorrhea severity, suggesting that higher sodium intake was associated with greater menstrual pain intensity.

Excess adipose tissue is known to contribute to systemic inflammation and increased prostaglandin production, both of which are implicated in the pathophysiology of dysmenorrhea [19]. Most participants experienced menarche between the ages of 11 and 13 years, which is considered the normal age of menarche [20]. In addition, most participants reported not using medication to manage menstrual pain, suggesting that menstrual discomfort may commonly be managed through non-pharmacological approaches such as therapy, massage, physical exercise, yoga, and lifestyle modification [21]. Furthermore, most participants engaged in low levels of physical activity, indicating a predominantly sedentary lifestyle. Physical activity has been reported to alleviate menstrual discomfort by promoting vasodilation of blood vessels supplying the reproductive organs and reducing ischemia [22]. This finding is consistent with another study conducted among female students which reported a significant association between physical activity levels and dysmenorrhea symptoms [23].

4.2 Dietary Sodium Intake Level

The high prevalence of excessive sodium intake observed in this study suggests a tendency toward energy-dense, nutrient-poor dietary patterns characterized by frequent consumption of processed and fast foods. Such dietary habits may contribute to increased prostaglandin production, thereby exacerbating menstrual pain [24]. Excessive sodium intake has also been associated with fluid retention, resulting in symptoms such

as bloating and oedema that commonly accompany primary dysmenorrhea [25]. These findings are consistent with previous studies reporting significant associations between frequent fast-food consumption and primary dysmenorrhea [26]. Importantly, unhealthy dietary patterns may not only relate to reproductive health outcomes but also reflect a clustering of unhealthy lifestyle behaviours that collectively impact metabolic and hormonal regulation.

4.3 Pain Level

Based on the level of pain experienced, dysmenorrhea can be classified into three degrees: mild, moderate, and severe. Mild dysmenorrhea is characterized by pain and cramps in the lower abdomen; however, the symptoms remain manageable and do not interfere with daily activities or academic concentration. Moderate dysmenorrhea is characterized by pain and cramps in the lower abdomen that may radiate to the lower back, with a mild disruption of daily activities and concentration. Severe dysmenorrhea is characterized by intense pain and cramps in the lower abdomen radiating to the lower back, thighs, or back, accompanied by additional symptoms such as nausea, generalized weakness, inability to perform activities, and significant impairment of academic concentration [3].

The predominance of moderate pain in this study is consistent with previous findings in Indonesia. A study in Denpasar reported that 40.3% of adolescent girls experienced moderate dysmenorrhea [27], while other study in Singkawang found an even higher proportion (59.5%) [28]. The consistency across studies suggests that moderate dysmenorrhea is a common presentation in adolescent and young adult females. From a clinical perspective, moderate dysmenorrhea may represent a critical threshold at which menstrual discomfort begins to affect productivity and quality of life.

4.4 Correlation of Dietary Sodium and Pain Level of Primary Dysmenorrhea

The present study demonstrated a significant positive association between dietary sodium intake and primary dysmenorrhea severity. This finding is consistent with a previous study reporting that individuals with excessive sodium intake were more likely to experience severe dysmenorrhea than those with adequate sodium intake [29]. Such evidence supports the interpretation that high sodium consumption may be associated with greater menstrual pain severity. Similarly, a case-control study demonstrated that frequent consumption of high-sugar foods, salty snacks, sweetened beverages, tea, coffee, added salt, fruit juices, and high-fat foods was significantly associated with dysmenorrhea. Participants with high intake of these diets had a 4.07-fold and 3.15-fold increased risk of experiencing moderate to severe dysmenorrhea compared to those with lower intake [30]. Comparable findings have also been reported in Turkey, where habitual salt addition to meals was associated with an increased risk of primary dysmenorrhea (OR = 1.06–1.18) [31].

From a physiological perspective, sodium is an essential electrolyte involved in the regulation of osmotic pressure, plasma volume, and neuromuscular function. However, chronic excessive sodium intake may disrupt fluid homeostasis and activate the renin-

angiotensin-aldosterone system (RAAS), leading to fluid retention and increased intra-pelvic pressure, as well as localized inflammatory responses within the reproductive system [32]. Excess fluid retention may contribute to uterine wall distension and stimulate the production of prostaglandin F₂ α (PGF₂ α), a key mediator of menstrual pain that induces uterine contractions and vasoconstriction of spiral arteries in the endometrium [33].

Taken together, these findings suggest that high dietary sodium intake is associated with the severity of primary dysmenorrhea through both direct mechanisms; such as inflammatory activation, RAAS stimulation, and prostaglandin-mediated uterine contractions. Because excessive sodium intake has also been associated with obesity and chronic inflammation [10], [11], the observed association may additionally reflect indirect pathways related to excess adiposity. However, the cross-sectional design of this study does not permit causal inference, and the biological mechanisms linking dietary sodium intake directly to primary dysmenorrhea remain to be fully elucidated. Therefore, longitudinal and experimental studies are needed to clarify these relationships. These findings highlight the potential importance of promoting healthy dietary habits, including appropriate sodium intake, among young women with primary dysmenorrhea. Even though the present study cannot establish causality, reducing excessive sodium intake may provide broader health benefits and could be considered as part of a healthy dietary pattern while further research continues to clarify its role in menstrual pain.

5 Conclusion

Most overnourished female students from non-health study programs in Malang city experienced moderate primary dysmenorrhea and reported high consumption of sodium-rich foods. The findings also demonstrate a significant positive association between high sodium intake and the severity of primary dysmenorrhea, indicating that higher consumption of sodium-rich foods is associated with increased menstrual pain intensity.

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