

## ORIGINAL ARTICLE

*A Study of the Relationship Between Primary Dysmenorrhea and Body Mass Index Among Young Women*Chaithra M<sup>1</sup>, Manjula B<sup>2</sup> and Anusha R<sup>3</sup>

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<sup>2</sup>Multidisciplinary Research Unit, Shimoga Institute of Medical Sciences, Shivamogga, Karnataka, India.**Abstract:**

**Background:** Primary dysmenorrhea is the most prevalent menstrual problem in young females, and studies have demonstrated controversial results regarding the association between BMI and the incidence and severity of primary dysmenorrhea. The present study was undertaken to determine the prevalence of primary dysmenorrhea and the association between dysmenorrhea and body mass index (BMI) in young women. **Material & Method:** This was a cross-sectional descriptive study of 500 randomly selected participants of the age group 18 -25 years in our hospital. Anthropometric measures and clinical examination were performed on all eligible participants, and BMI was calculated as per WHO guidelines. Data were analyzed using SPSS software. **Result:** According to our study, the prevalence of primary dysmenorrhea was 85%. Mild dysmenorrhea was the most common (51.3%) followed by moderate (41.9%) and severe dysmenorrhea (6.8%). The prevalence of dysmenorrhea was higher among 18-21 years (60.7%) old participants attaining menarche at the age of 12-14 years (78.8%). Patients who were overweight (92.2%), underweight (88.3%) and obese (93.8%) experienced dysmenorrhea (U-shaped curve). A statistically significant relationship was found between extremes of BMI categories, indicating that both the underweight and obese categories had a higher risk of dysmenorrhea and severity of dysmenorrhea ( $P < 0.004$ ). **Conclusion:** This study demonstrated a significant prevalence of dysmenorrhea among young women. Additionally, a statistically significant relationship between the severity of dysmenorrhea and BMI was identified, indicating that both the underweight and obese categories had a higher risk of dysmenorrhea. Additionally, a U-shaped relationship was established. Consequently, it is necessary to educate people and create awareness of the impact of diet on dysmenorrhea and assist in improving the quality of life among young adults.

**Keywords:** Body mass index, Primary Dysmenorrhea, Adulthood, Menstrual Cycle, Underweight, Overweight, Obese.

**Introduction:**

Young adulthood is a distinctive period of development that occurs between the ages of 18 and 25 when young people are transition from adolescence into adulthood. This population is often overlooked in the context of public health and maternal and child health.<sup>[1]</sup> Moreover, on this path from adolescence to adulthood, apart from several external and internal change, approximately 88% of girls endure dysmenorrhea.<sup>[2]</sup> Dysmenorrhea refers to cyclic lower abdominal or pelvic pain that typically radiates to the back or thighs and occurs during menstruation. The term dysmenorrhea originates from the Greek words, “dys” means difficult, “meno” means month, and “rrhea” means flow.<sup>[3]</sup> It is categorized into two types : primary and secondary dysmenorrhea. Primary dysmenorrhea (PD) refers to cramping pain in the lower abdomen at the onset of menstruation in the absence of any identifiable pelvic disease. Secondary dysmenorrhea refers to painful menses resulting from an identifiable pelvic pathology, such as fibroid, adenomyosis, and pelvic inflammatory disease.<sup>[4]</sup> This debilitating condition negatively impacts the quality of life of women at their most productive stage of life. Although the exact cause of PD is unknown, however prostaglandin F<sub>2</sub>alpha (PGF<sub>2</sub>α), which is produced during endometrial shedding are believed to be responsible for most of the symptoms.[4] PGF<sub>2</sub>α induces myometrial contractions, ischemia, and heightened sensitivity of nerve endings as menstruation begins.<sup>[5]</sup> There is substantial evidence to support this perception, as higher levels of PGF<sub>2</sub>α have been found in the menstrual fluid of women with severe dysmenorrhea.<sup>[4]</sup> In addition, numerous studies have revealed the remarkable efficacy of NSAIDS, which inhibit the synthesis of prostaglandins. However, the association between increased levels of leukotrienes and vasopressin and dysmenorrhea is not entirely clear, although some

studies have suggested association.<sup>[6]</sup> The Body mass index (Quetelet index) is a statistical measure that compares an individual's height and weight. Due to its simplicity in calculation, BMI is the most widely used diagnostic tool to appraise obesity tribulations within a population. BMI is defined as the individual's body weight divided by the square of his height. However, BMI does not consider various factors such as frame size, muscularity, fat, bone, cartilage, and water weight. Despite these limitations, BMI can be calculated quickly without the need for expensive instruments. Therefore, since the 1980s, the World Health Organization (WHO) has used BMI as the standard for recording obesity statistics.<sup>[3]</sup> According to a literature survey, the prevalence of PD in females ranges from 16% to 91%, indicating significant variability.<sup>[7]</sup> With the advance of socioeconomic conditions globally, there is an increased incidence of adolescent obesity, and this coupled with amplified daily stressors and exposed chemical pollutants, predisposes young girls to anxiety and discomfort associated with PD at a young age due to the declining age of menarche (AOM) worldwide.<sup>[8]</sup> A body of work has been conducted to establish the impact of body mass index (BMI) on primary dysmenorrhea; however, there remains a major discrepancy regarding the results.<sup>[8]</sup> Although the Harlow standard deviation (SD) reported a positive association between PD and obesity, Sundell and Lathe could not find any association.<sup>[9-11]</sup> Contradicting these studies, other researchers found lose of weight to be associated with a higher incidence of PD.<sup>[9]</sup> Therefore, this study was undertaken to determine the prevalence of PD and to evaluate the relationship between PD and BMI.<sup>[12-13]</sup>

### Material and Methods:

This was a cross-sectional descriptive study, conducted between January to June 2023 in our health care center. After obtaining the Institutional Ethics Committee approval, data were collected in a self-administered questionnaire that was administered to all the females in the age group of 18-25years. The study participants were included based on the inclusion criteria such they should be between the age group 18-25 years, unmarried, attained menarche, willing to give their consent, and provided completely filled questionnaire. Individuals with known H/o PCOD, pelvic pathologies, hormonal treatment for menstrual disorders, age less than 18 and above 25 years and not willing to give consent were excluded from the study. Prior to administering the questionnaire, the purpose of the study was thoroughly explained, and informed consent was obtained from each study participants. The

questionnaire consisted of details regarding the socio-demographics, anthropometric measurements, and the participant's entire menstrual history. Girls experiencing primary dysmenorrhea were further evaluated. The intensity of pain was determined using the multidimensional scoring system developed by Andersch and Milsom.<sup>[14]</sup> Young women underwent clinical examinations by an OBG specialist, anthropometric measurements were obtained from the study participants, and BMI was computed using WHO guidelines. Weight was measured in kilograms and height was taken barefooted in centimeter using a measuring tape, BMI was calculated using the formula  $\text{weight (kg)/height}^2$  (metre<sup>2</sup>). According to BMI, nutritional status was classified as underweight, normal, overweight and obese as BMI <18.5, 18.5-24.9, 25-25.9 and >30 kg/m<sup>2</sup> respectively (WHO 2010). Dysmenorrhea among young women is a common issue in India. According to George et al., study,<sup>[15]</sup> the prevalence of dysmenorrhea was found to be 87.87%. Considering the dysmenorrhea prevalence of 88% among young women with 5% margin of  $\alpha$ - error the calculated minimum sample size needed to conduct for this study was 162 young women. In our study, 500 study participants were recruited to ensure the validity and reliability of the findings. Data were collected and presented in MS-excel and calculated the frequency and percentage distributions were calculated. The association between different variables was evaluated using the chi-square test and independent t-test. A p-value of less than 0.05 was considered statistically significant using IBM SPSS software 22.

### Results:

For our study, we recruited 500 participants based upon our study inclusion criteria. The majority of the participants (80.7%) were from urban areas. The mean age was found to be  $21.06 \pm 1.12$  years and most cases were in the age group 18-12years (Table 1). Out of 500 participants, 85% of cases had dysmenorrhea. Among them, most of the study participants (55.5%) had a normal BMI, 24.9% were overweight, 16% were underweight, and 3.5% were obese (Table 1). In our study, participants with dysmenorrhea attained menarche at the age between 12-14 years were more than the other group and there was no discernible association between dysmenorrhea and the other menstrual traits (Table 2). Furthermore, based on the data, 51.3% of cases experienced mild dysmenorrhea, 41.9% had moderate dysmenorrhea, and 6.8% suffered from severe dysmenorrhea (Table 3). Additionally, 56% of the study participants stated that dysmenorrhea interfered with their day-to-day activities.

Table 1: Frequencies of study variables among the study participants

Study variables	Dysmenorrhea	
	N	%
Age (years)		
18-21	258	60.7
22-25	167	39.3
BMI (Body mass index)		
Underweight	68	16
Normal	236	55.5
Overweight	106	24.9
Obese	15	3.5
Residence		
Rural	31	7.3
Urban	343	80.7
Sub-urban	51	12

Table 2: Menstrual characteristics of study subject with primary dysmenorrhea

Study variables	Dysmenorrhea		Chi square	p-Value (5%)
	Yes (N, %)	No (N, %)		
Menarche (years)				
8 to 11	58 (13.6)	14 (18.7)	1.607	0.45NS
12 to 14	335 (78.8)	57 (76)		
More than 15	32 (7.5)	4(5.3)		
Duration of the menstrual cycle (Days)				
2 to 3	72 (16.9)	14 (18.7)	1.96	0.37NS
4 to 5	294 (69.2)	55 (73.3)		
More than 5	59 (13.9)	6 (8)		
Frequency of the menstrual cycle (days)				
Once in 28	138 (32.5)	20 (26.7)	1.19	0.55NS
Once in 29 to 30	181 (42.6)	33 (44)		
Once in 31 to 35	106 (24.9)	22 (29.3)		
Amount of flow (pads/day)				
1	31(7.3)	8 (10.7)	1.05	0.6NS
2 to 3	356(83.8)	60(80)		
More than 4	38 (8.9)	7 (9.3)		

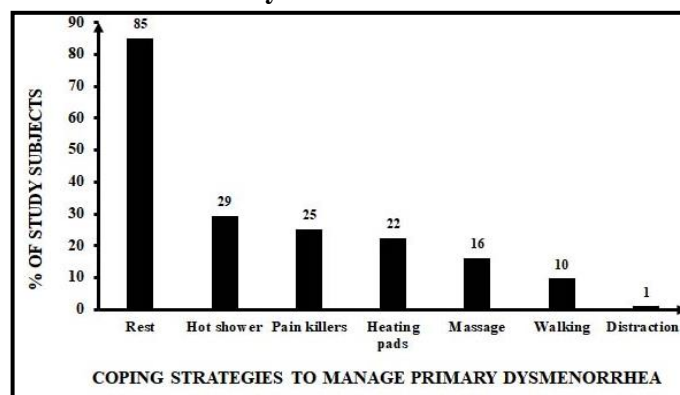
The perception of pain varied among the study participants. Almost 62.6% participants reported pain to be localized in the lower abdomen, 27.3% for the back and thighs. A smaller subset 7.1% and 3.8%, respectively, reported having myalgia and pain restricted to the vaginal area (**Table 3**).

Table 3: Severity and location of pain among primary dysmenorrhea cases

Study variables	Dysmenorrhea	
	N	%
Severity of pain		
Mild	218	51.3
Moderate	178	41.9
Severe	29	6.8
Location of the pain		
Lower abdomen	266	62.6
Back and thigh	116	27.3
Myalgia	30	7.1
Genital area	13	3

Study participants reported having their own coping mechanisms to manage their pain with different combinations. Majority (85%) of the participants in the study, reported that their dysmenorrhea relieved on taking rest, and nearly 16 to 29% of the study population reported that taking a hot shower, pain killers, use of heating pads and massage relieved their menstrual pain. However, only 10% of participants relieved their pain by walking and 1% by distractions (Fig.1).

Figure 1: Coping strategies for managing primary dysmenorrhea



When the relationship between BMI and PD was analyzed, in the underweight population, the majority (54.5%) had mild dysmenorrhea, whereas in overweight participants, 50.9% of participants had moderate dysmenorrhea. Among cases with normal BMI, only

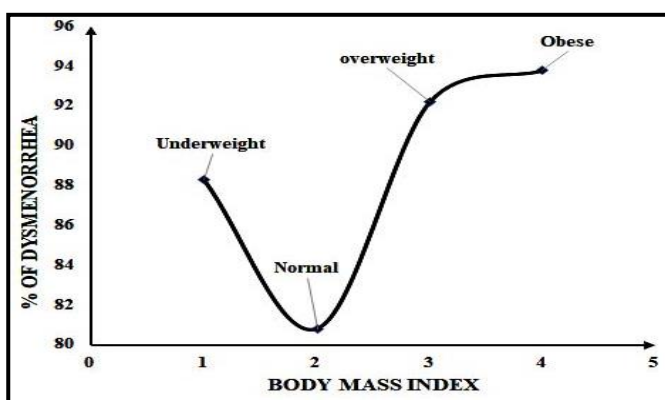
5.1% had severe dysmenorrhea compared with 16.2% in underweight and 5.7% in overweight cases. The data analysis yielded a statistically significant chi-square value of 19.35 with a p-value of 0.004 (Table 4). Thus, a positive association was deduced between the severity of dysmenorrhea and low and high BMI (underweight and overweight).

Table 4: Association between severity of pain and primary dysmenorrhea within BMI classification

BMI	Mild (N, %)	Moderate (N, %)	Severe (N, %)	Total (N, %)	Chi square	p-Value (5%)
Underweight	37 (54.4)	20 (29.4)	11 (16.2)	68 (100)	19.35	0.004*
Normal	124 (52.5)	100 (42.4)	12 (5.1)	236 (100)		
Overweight	46 (43.4)	54 (50.9)	6 (5.7)	106 (100)		
Obese	11 (73.3)	4 (26.7)	0 (0)	15 (100)		

On plotting a graph, a U-shaped relationship was deduced between body mass index (BMI) and the proportion of participants with PD. Participants in the underweight, overweight and obese categories suffered from severe PD compared with those in the normal BMI category (Fig 2).

Figure 2: U-shaped association between body mass index and the percentage of primary dysmenorrhea.



**Discussion:**

The prevalence of PD is exceedingly underrated and difficult to decipher as only a handful of those suffering pursue medical help, in spite of the considerable distress that they undergo, as pain is considered to be a part and parcel of menstrual cycles (MC) rather than an illness.<sup>[16]</sup> We found the prevalence of PD to be 85% in

this study. Similar observations have been reported by other investigators (Vermaet al. [60.66%]; Mohapatra et al. [74%]; Yesuf et al. [71.8%]; Tang et al [84.20%]). [17-20] Variation in the prevalence of PD could be attributed to diverse definitions of the condition and the absence of a standard method for assessing the prevalence and severity. This research supports the association between underweight women and primary dysmenorrhea. The underlying mechanism of PD involves an overproduction of prostaglandins, leading to intense uterine contractions, ischemia, and hypoxia. Women with low body weight may experience reduced body fat and malnutrition, which can disrupt normal ovulation cycles and heighten the likelihood of primary dysmenorrhea. Additionally, malnutrition may play a significant role as a contributing factor.<sup>[21]</sup> The preceding explanation may lend credence to the observation that being underweight could heighten the likelihood of experiencing primary dysmenorrhea. Research conducted by Ju et al.,<sup>[7]</sup> indicated that the prevalence of dysmenorrhea was highest among individuals classified as underweight. In a similar vein, Tang et al.,<sup>[20]</sup> identified a significant correlation between low BMI and dysmenorrhea. Conversely, the study by Harlow et al.,<sup>[9]</sup> revealed that being overweight was a crucial factor in dysmenorrhea, significantly increasing the chances of prolonged pain episodes. Adipose tissue controls reproductive health in an inexplicable manner, where a certain level of body fat, especially gluteofemoral fat appears to be a prerequisite for maintenance of normal ovulatory cycle, while excessive fat is being associated with disruption of regular reproductive health. The studies also indicate that body weight has an influence on quality of estrogen produced by lean females making estrogen less potent in contrast to highly potent forms produced by obese females.<sup>[22]</sup> Apart from the influence of body fat on the quality of estrogen, adipocytes convert circulating androgens to estradiol and estrone through aromatase, which potentially increases estrogen levels, causing estrogenic endometrial proliferation, increasing endometrial thickness, and hence elevating the PGF2 $\alpha$  concentration, the allegedly culprit behind PD. In addition, obese females also have a low sex hormone binding globulin thus evolving in a raised free serum estradiol percentage, prompting researchers to conclude obese females to be estrogen dominant or progesterone deficient relative to circulating estrogen levels and thus sufferers of heightened of primary dysmenorrhea.<sup>[23-24]</sup> Adipokines even alter the hypothalamo-pituitary-ovarian axis, leading to impaired ovarian function and disruption of the menstrual cycle. Recent studies indicate a lower plasma oxytocin level compared with plasma vasopressin levels in people with higher BMI. This heightened

release of vasopressin without simultaneous elevation of oxytocin levels commands dysrhythmic uterine contractions that progress to uterine hypoxia and ischemia, which further increases the sensitivity of the myometrium to amplified prostaglandins.<sup>[25-27]</sup> Nonetheless, prostaglandins also account for the lowered threshold of pain perception because Type C pain neurons are excessively stimulated by anaerobic metabolites generated by an ischemic endometrium. Due to an elevated peripheral pain perception in these obese females, they are at an additional risk of other chronic painful conditions throughout the menstrual cycle, which has a negative impact on the quality of life, mood, and sleep.<sup>[5]</sup> In our study, the relationship between dysmenorrhea and BMI was found to be highly statistically significant. Our research supports a longitudinal study by Ju et al.,<sup>[12]</sup> that found a U-shaped relationship between dysmenorrhea and BMI, indicating a higher prevalence in females who are underweight as well as overweight. The strength of this study was attributed to the sufficient sample size, whereas the findings were evaluated based on the testimonies of young women. Consequently, the results of the current study cannot be extrapolated to a broader population were our study limitations.

### Conclusion:

Our study establishes an association between PD and

BMI in both underweight and obese categories. Hence, intake of a balanced diet will help them to improve their quality of life and enabling them to mature into more socially and economically productive members of society. Healthy young girls of today are tomorrow's healthy women, the future of every society and a great resource of the nation. Therefore, it is important that healthcare professionals provide adolescent, young, and adult women with training and counseling services about menstruation, managing dysmenorrhea, and the effects of BMI and nutritional habits on primary dysmenorrhea.

In addition, school and public health nurses in particular must be sensitive to this issue and address it by organizing education/counseling activities (e.g., panels, symposiums, and sports activities) to improve the quality of life.

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Conflicts of Interest: Nil

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