

Original Article:

Association of Menstrual Disorders with Body Mass Index in Undergraduate Medical Students

Shabnam Rizvi¹, Fareha Khatoon², Ayesha Ahmad², Kashish Ayaz Khan², Ekta², Kajal Singh²

Abstract:

Objective: Menstrual disorders constitute one of the major problems faced by medical students globally. Amongst the various factors attributed as causative factors in menstrual cycle variations, include body mass index [BMI] is the most easily modifiable factor. As we still do not have clear answers, this study was planned to study the association of menstrual disorders with BMI. **Methodology:** This is a cross sectional study, done in undergraduate female medical students in the age group of 18 to 30 years. Exclusion criteria included pregnancy, breast feeding, <12 months post-partum, <6 months post abortion/miscarriage, concomitant medical disorders and intake of hormonal medication. Data was collected for socio-demographic variables, detailed menstrual history, obstetric and medical history. Examination recorded anthropometric details, hirsutism, acne, any signs of virilization. Menstrual cycle variables were studied for their association with BMI. **Results:** A total of 254 students participated in the study with an average age of 23.9 years. Dysmenorrhea was globally found. Majority of cases were mild dysmenorrhea. Premenstrual syndrome [PMS] was seen commonly, commonest symptoms being mood swings and abdominal cramps. There was no association between mean menstrual blood loss [MBL], PMS and BMI and poor association with dysmenorrhea. **Conclusion:** Dysmenorrhea and PMS were very commonly seen and were not related to BMI. The mean MBL was independent of BMI. A rise in BMI had a positive association with cycle irregularity.

Keywords: Dysmenorrhea, premenstrual syndrome, menstrual blood loss, menstrual disorders.

*International Journal of Human and Health Sciences Vol. 05 No. 02 April'21 Page :330-335
DOI: <http://dx.doi.org/10.31344/ijhhs.v5i3.283>*

Introduction:

Menstrual disorders constitute one of the major problems faced by medical students globally with an estimated prevalence of 87-91%.¹ The disorders range from amenorrhea, cycle irregularity, abnormal flow, dysmenorrhea and premenstrual syndrome [PMS]. It is hypothesized that due to disproportionate degree of stress in medical education, the trainees are vulnerable to menstrual abnormalities. The stress includes both physical and psychological factors such as irregular and long working hours, insufficient sleep, irregular food and exercise habits.^{2,3}

Important factors responsible for variations in menstrual cycle include genetic and racial characteristics, hormonal changes, associated medical disorders and body mass index [BMI]. Amongst these, BMI is the most easily modifiable factor which has been seen to affect the patterns of menstrual cycle in many studies. However, we still do not have clear answers and need to study the effect of BMI on menstrual patterns in greater detail.

This study was therefore planned to observe the association of variations in menstrual patterns with body mass index [BMI].

1. Dept. Of Obst. And Gynaecology, Career Institute of Medical Sciences & Hospital, Lucknow, Uttar Pradesh, India. 226020.
2. Dept. Of Obst. And Gynaecology, Era's Lucknow Medical College and Hospital, Uttar Pradesh, India. 226003.

Correspondence to: Ayesha Ahmad, Associate Professor, Dept. Of Obst. And Gynaecology, Era's Lucknow Medical College and Hospital, Uttar Pradesh, India. 226003. E-mail: docayeshaahmad@gmail.com

Methodology:

This is a cross-sectional study done in a medical college from October to November 2020. It was approved by the institutional committee. Subjects were recruited on the basis of inclusion and exclusion criteria, after explaining the purpose and components of the planned study. Anonymity and confidentiality were ensured, and those willing to participate were asked to sign a consent form before inclusion in study.

Inclusion and Exclusion Criteria:

All undergraduate female medical students in the age group of 18 to 30 years who consented to be part of the study were included. Exclusion criteria included pregnancy, breast feeding, <12 months post-partum, <6 months post-abortion miscarriage, concomitant medical disorders and intake of hormonal medication.

Data Collection:

Data was collected for socio-demographic variables, detailed menstrual history, obstetric and medical history. Dysmenorrhea was calculated as none, mild [able to do routine activities without medication], moderate [able to do routine activities with medication] and severe [not able to do routine activities despite medication +/- absence from classes]. Menstrual blood loss [MBL] was calculated on the basis of subjective perception of respondents and number of pads used per cycle as light, medium and heavy. Physical activity ≥ 4 -5 times per week was considered regular and 1-3 times as occasional. It included walking, dancing, yoga, exercise in gym or sports. PMS was classified as absent, mild, moderate and severe depending on number of symptoms [0,1,2-3, ≥ 4 respectively]. Examination recorded anthropometric details, hirsutism, acne, any signs of virilization.

Statistical Analysis:**Calculation of Sample Size:**

The minimum required sample size was calculated on the basis of data by Lakkawar et al⁴, with 7% margin of error and 5% level of significance. To reduce margin of error, minimum sample of 150 was proposed as per the formula:

$$N \geq [p(1-p)] / [ME/z_{\alpha}]^2$$
 where Z_{α} is value of Z at two sided alpha error of 5%, ME is margin of error and p is proportion of study subjects with abnormal menstrual disorder.

$$n > = [[. 2 2 5 * [1 - . 2 2 5]] / [.07/1.96]^2 = 136.71 = 137 [\text{approx.}]$$

Analysis:

Data was entered in MS Excel spreadsheet and analysis done using Statistical Package for Social Sciences [SPSS] version 21.0. Data was assessed for normality by Kolmogorov-Smirnov test and depending on results, parametric and non-parametric tests were used. The categorical variables were presented as numbers, percentage and continuous variables as mean \pm SD, and median.

A p-value of <0.05 was considered statistically significant.

Observations:

A total of 254 students were included for the study. Table 1 gives socio-demographic variables of the subjects. The average age of students in the present study was 23.9 years and the mean age of menarche was 13 +/- 1 years.

Table 1. Socio-demographic factors, BMI and exercise details of study subjects.

Variables		n[%]
Age	Mean = 23.9 years Median [IQR] = 23 [22-26]	
Height [cm]	Mean = 160.66 +/- 7.16 Median [IQR] = 160 [155-165.2]	
Weight [Kg]	Mean = 59.40 +/- 11.32 Median [IQR] = 58 [50-65]	
BMI	Mean	
	<18.4 [underweight]	33 [12.9]
	18.5 - 22.99 [normal weight]	107 [42.0]
	23 - 27.49 [normal weight]	74 [29.0]
	>27.50 [obese]	41 [16.1]
Residence		
	Hostel	169 [66.5]
	Day Scholar	85 [33.46]
Exercise		
	Negligible	55 [21.65]
	Mild	82 [32.2]
	Moderate	61 [24.0]
	Heavy	56 [22.04]
Family History		
	Diabetes mellitus	103 [40.55]
	Hypertension	99 [38.97]
	Hypothyroidism	48 [18.89]
	Carcinoma cervix	04 [1.57]
	Carcinoma ovary	01[0.39]
	Carcinoma endometrium	04 [1.57]

Variables		n[%]
	Carcinoma breast	06 [2.36]
Tea intake		
	None	103 [40.5]
	1-4 cups/day	151 [59.5]
	>4 cups/day	0
Coffee intake		
	None	173 [68.1]
	1-4 cups/day	80 [31.5]
	>4 cups/ day	1 [0.4]

Table 2 shows the pattern of menstrual cycle in the study population. Dysmenorrhea was reported by every respondent, however, in 65.8% of cases it was mild and did not require any medication. A lower incidence of mild dysmenorrhea was found in women with BMI in normal range [$p < 0.01$]. 7.9% subjects reported severe dysmenorrhea resulting in absence from classes. Majority of subjects had regular cycles. There was a negative association between BMI and cycle irregularity [p value = 0.04].

Table 2. Detailed Menstrual Cycle Pattern.

Menarche	Mean age = 13 +/- 1 years	n[%]
Dysmenorrhea		
	None	0
	Mild	167 [65.8]
	Moderate	67 [26.3]
	Severe	20 [7.9]
Cycle Regularity		
	Regular	206 [81.1]
	Irregular	48 [18.9]
Cycle duration		
	<2 days	5 [2.8]
	2-8 days	242 [95.2]
	>8 days	4 [2.0]
Cycle Length		

Menarche	Mean age = 13 +/- 1 years	n[%]
	<21 days	8 [34.64]
	22-45 days	206 [81.1]
	>45 days	40 [15.74]
Menstrual blood loss		
	Light	3 [1.18]
	Medium	113 [44.48]
	Heavy	138 [54.3]
Type of pad used		
	Commercial	250 [98.43]
	Tampon	4 [1.57]
	Home made	0
No. of pads used per day [with maximum flow]		
	1-2	3 [1.18]
	3-5	250 [98.43]
	>5	1 [0.39]
PMS Symptoms		
	Nausea	103 [40.6]
	Vomiting	17 [6.7]
	Headache	78 [30.7]
	Fatiguability	165 [64.9]
	Abdominal bloating	193 [76.1]
	Abdominal cramps	45 [17.7]
	Mood swings	210 [82.7]
	Irritability	208 [81.9]
	Lack of concentration	154 [60.6]
	Breast tenderness	103 [40.6]
	Backache	186 [73.2]

Most of the subjects had moderate MBL. There was no association of mean blood loss [MBL] with BMI. PMS was found commonly. The most common symptoms were mood lability and abdominal cramps. PMS was assessed by 11 symptoms and most of them did not have an association with BMI; abdominal cramps were seen less frequently in obese women as compared to others [$p=0.01$] (Table 3).

Table 3. Association of BMI with premenstrual syndrome symptoms in study subjects.

PMS symptoms	Underweight n[%]	Normal n[%]	Overweight n[%]	Obese n[%]	p value
Nausea	9 [27.3]	25 [32.7]	22 [29.7%]	6 [14.6%]	0.17
Vomiting	4 [12.1]	8 [7.5]	4 [5.4%]	1 [2.4%]	0.38
Headache	10 [30.3]	33[30.8%]	26 [35.1%]	8 [19.5%]	0.37
Fatigue	24 [72.7]	67 [62.6%]	51 [68.9%]	23 [56.1%]	0.38
Abdominal bloating	22 [66.7]	82 [76.6%]	61 [82.4%]	28 [68.3%]	0.20
Abdominal cramps	27 [81.8]	95 [88.8%]	60 [81.1%]	27 [65.9%]	0.01
Mood swings	27 [81.8%]	95 [88.8%]	59 [79.7%]	30 [73.2%]	0.11
Irritability	28 [84.8%]	92 [86.0%]	57 [77.0%]	32 [78.0%]	0.39
Lack of concentration	19 [57.6%]	68 [63.6%]	44 [59.5%]	23 [56.1%]	0.82
Breast tenderness	14 [42.4%]	39 [36.4%]	31 [41.9%]	19 [46.3%]	0.70
Backache	25 [75.8%]	81 [75.7%]	52 [70.3%]	28 [68.3%]	0.73

Discussion:

Previous studies have noted that the prevalence of menstrual problems in medical students has risen and BMI seems to be an important contributory factor. Dysmenorrhea and PMS are important contributors to absence from classes, leading to significant loss in terms of academics as well as clinical work.⁵ MBL and cycle irregularity has also been observed to have a direct association with BMI. However, the findings are controversial, and many investigators have found contrary results. This study was thus planned to study the menstrual cycle variations in medical students and find out the variables that change with BMI.

Dysmenorrhea: In the present study, we found that dysmenorrhea was universally present to varying

degrees in the subjects. Similar high prevalence of pain during periods has been observed in Indians. Kural et al [2015]⁶ found a prevalence of 84.2% in college going girls. We observed a negative association of mild dysmenorrhea and BMI. Subjects with lower BMI had a higher incidence of pain (Table 4). Most of the investigators have similar observations. Lakkawar et al [2014]⁴ studied 200 medical students, Mirfat [2020]⁷ studied 3213 undergraduate students. Both studies observed a negative association. Rai et al [2020]⁸ found that a rise in BMI above 23 is highly associated with higher pain scores. However, in the present study, we did not find any significant association of BMI with moderate or severe dysmenorrhea. Therefore, the association with mild dysmenorrhea is at the most, probably weak.

Table 4. Association of BMI with dysmenorrhea, menstrual blood loss, cycle regularity.

Symptom	BMI				p value
	<18.4	18.5 - 22.99	23 - 27.49	>27.50	
Dysmenorrhea					
Mild	22 [66.7%]	58 [54.2%]	55 [74.3%]	33 [80.5%]	<0.01
Moderate	8 [24.2%]	36 [33.6%]	16 [21.6%]	7 [17.1%]	0.12
Severe	3 [9.1%]	13 [12.1%]	3 [4.1%]	1 [2.4%]	0.11
Menstrual blood loss					
Mild	14 [42.4%]	43 [40.2%]	21 [28.4%]	15 [36.6%]	0.35
Moderate	16 [48.5%]	62 [57.9%]	48 [64.9%]	21 [51.2%]	0.33

Symptom	BMI				p value
	<18.4	18.5 - 22.99	23 - 27.49	>27.50	
Heavy	3 [9.1%]	2 [1.9%]	5 [6.8%]	5 [12.2%]	0.08
Cycle Regularity					
Regular	29 [87.9%]	93 [86.9%]	54 [73.0%]	30 [73.2%]	0.04
Irregular	4 [12.1%]	14 [13.1%]	20 [27.0%]	11 [26.8%]	

MBL: We did not observe any association of mean MBL and BMI (Table 4). This is in contrast with findings of Tang et al [2020]¹¹, who studied 1012 women and found MBL to be positively related with an increase in BMI; with an OR 2.28 for obese and OR 1.26 for overweight. BMI is related to anovulatory cycles, which may have a role in increased MBL observed by the authors. This effect theoretically should be found more in obesity and morbid obesity. However, we did not have the sufficient numbers of subjects in this range, therefore, it is difficult to comment on this finding. We feel that larger studies are required before any conclusion can be drawn on the subject.

Cycle regularity: We observed a significant association between cycle regularity with BMI (Table 4). A rise in BMI was negatively associated with regularity of cycles. This is in accordance with most of the studies on the subject. Rai et al [2020]⁸ studied 300 female medical students over 18 months and found significant association of cycle regularity with BMI. [Underweight: p= 0.0001; BMI >23: p = 0.001]. There is a strong association with BMI, prevalence of PCOS and anovulatory cycles. We think that many subjects with higher BMI may be having anovulatory cycles, hence more prevalence of irregular cycles.

Conclusion:

- Dysmenorrhea and premenstrual syndrome were very common among undergraduate medical students, and not related to body mass index.
- Mean menstrual blood loss was independent of body mass index.
- A rise in body mass index had a positive association with cycle irregularity.

Limitations of the study:

We anticipated that medical undergraduates have higher menstrual cycle abnormalities as compared to general age matched population, due to lifestyle patterns. However, we did not study the menstrual cycle abnormalities in controls. Besides, we did not examine the psychological factors and their association with menstrual cycle, which may be strong confounders. As the study is recall based, the subjects may not be able to give accurate answers to changes in menstrual cycle pattern during periods of stress such as examination.

Recommendations:

Prospective studies with long term follow up are needed to find out how BMI affects menstrual cycle patterns, with sufficient numbers to exclude common confounders.

Conflict of interest: The authors declare no conflict of interest.

Funding statement: None

Ethical approval issue: The study was duly approved by the hospital ethical committee.

Authors' contribution: Dr. Shabnam Rizvi: Concept, design, definition of intellectual content; Dr. Fareha Khatoon: Definition of intellectual content, proof reading, review and editing manuscript; Dr. Ayesha Ahmad: Concept, research question, manuscript writing, data interpretation, submission of manuscript; Dr. Kashish Ayaz Khan: Data Acquisition, Statistical Analysis; Dr. Ekta: Data Acquisition, Statistical Analysis; Dr. Kajal Singh: Preparation of protocol, literature search.

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