



## Correlation of Body Mass Index with menstrual profile in medical students in Pune

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### ABSTRACT

**OBJECTIVE:** The study aims at finding the effect of BMI on the menstrual profile of women. It also aims at studying the factors affecting the BMI and indirectly, the menstrual cycle.

**METHODS:** Prospective cross sectional study conducted at Medical college in Pune during June and July, 2016. The data was collected from 103 medical students via structured questionnaires and interviews after obtaining informed written consent.

**RESULTS:** 50% and 25% obese candidates showed decreased amount of blood loss and irregularity of menstrual cycle. Overweight participants showed prevalence of increased cycle length, amount of blood loss and irregularity as high as 16.7%, 11.1% and 33.3% respectively. Decreased cycle length and amount of blood loss was seen in 8.3% and 41.7% of underweight participants.

**CONCLUSION:** There was a positive correlation between body mass index and menstrual profile related to duration of menstruation, amount of blood loss, cycle length, regularity of menstrual cycle & premenstrual syndrome symptoms.

**KEYWORDS :** MENSTRUAL CYCLE , BMI, LIFESTYLE

### INTRODUCTION:

The menstrual cycle is one of the most important and sensitive indicators of a woman's wellbeing. Menstruation is defined as the periodic discharge of blood, mucus, and cellular debris from the uterine mucosa. The average length of menstrual cycle is 28 days with a normal range of 21 to 35 days. The normal duration of bleeding is 5 to 7 days with a normal range of 3 to 7 days. The average blood loss during menses is 35 ml with normal range of 20 to 80 ml. The menstrual cycle is mainly regulated by the hypothalamus, in which gonadotropin releasing hormone (Gn-RH) is released in pulses to stimulate pituitary gonadotropes to secrete follicle-stimulating hormone (FSH) and luteinizing hormone (LH). These gonadotropins in turn promote follicular development with ovulation and corpus luteum formation in the ovary, inducing steroid hormone production.<sup>[1]</sup> Thus, menstruation is the physical manifestation of complex endocrine axes, the regularity and frequency of which is sensitive to endocrine disturbances that may otherwise remain sub clinical.<sup>[2]</sup> Menstruation is also a reflection of the physical well being of the individual. It is affected by exercise, stress, chronic diseases, eating disorders and dietary deficiencies among other disorders.<sup>[3]</sup>

Body Mass Index (BMI) is a tool to assess the healthy weight range for an individual or a respective stature. Thus, it is calculated as weight divided by the square root of height ( $\text{kg}/\text{m}^2$ ). BMI does not however provide a measure of the body fat percentage of the individual but due to ease of measurement has been widely used to assess the health of the individual.<sup>[2]</sup> BMI has been proven to affect the menstrual cycle in some studies. Cholesterol gets changed into a weak estrogen called esterone. Hence obese women may have higher estrogen levels and are prone to bleeding disorders while underweight women may have less estrogen leading to anovulatory cycles and in extreme cases suppression of hypothalamus.<sup>[2]</sup> Thus, we can say that nutrition and exercise have a key role in maintaining the reproductive health of a woman.

Most women face problems like premenstrual syndrome (PMS) and dysmenorrhoea but are too shy to seek professional help. These problems may lead to hindrance in daily activities, reduced productivity and may be a cause of absenteeism, especially in adolescents. With the high levels of stress, advent of junk food and the hectic lives people lead these days, the prevalence of menstrual disorders and complications arising from them have risen. Menstrual disorders like polycystic ovarian disorder (PCOS) pose a major problem if they go unchecked. They may become severe enough to cause infertility. Therefore they must be detected and

treated at the earliest.

In order to ensure the well being of the society, we must first ensure the well being of every individual. Lifestyle is one of the cornerstones of good health. Medical students are under immense pressure and have to stay in hostels away from their families. Most of them do not have good lifestyle habits and are prone to develop menstrual disorders in the long run. As future doctors, they must understand the implications of poor lifestyle habits on BMI and eventually on reproductive health and well being of the individual. Doctors have the rare opportunity of educating the community at large about the importance of exercise and diet and its effect not only on the reproductive health but also on the psyche of the individual. They can help identify and correct the disorder thus ensuring a better future for the individual. Medical students are future doctors and a better understanding of the subject may aid in improving the reproductive health of the community.

### REVIEW OF LITERATURE:

Menstrual disorders impact a woman's life in a major way. It is important to have a healthy lifestyle to reduce incidence and severity of menstrual problems. BMI is one of the factors affecting menstrual profile which can be modified by the individual. Statistically significant correlation between very high & very low BMI with menstrual irregularity was seen in the study conducted by Wei S. Et al.<sup>[4]</sup> Another study by Nevin Samir et al found positive correlation between body mass index and parameters of menstrual cycle. It also found a positive correlation between BMI of students and their premenstrual problems.<sup>[2]</sup> In another study, students with irregular menstruation showed slightly higher BMI scores compared with those of students with regular menstruation.<sup>[5]</sup> On the contrary, a study has demonstrated that higher body mass index is associated with the probability of long cycles in college women, but found no association of body mass index with outcomes in older population groups.<sup>[6]</sup>

Premenstrual symptoms did not show significant differences in BMI compared to that in those without symptoms. It was also observed that there is considerable discrepancy between BMI and self-recognition of adequate body weight in young students and that those with relatively high BMI scores had insufficient food intake and dietary habits.<sup>[7]</sup> Premenstrual syndromes like abdominal pain, anorexia and premenstrual cramps were decreased in participants who had breakfast than participants who skipped breakfast in a study by Hayam Fathy A. Eittah.<sup>[1]</sup>

80.2% of the participants in the study conducted by Amany Edward Seedhom et al experienced various degrees of PMS symptoms which were significantly associated with a family history of PMS, physical inactivity, habitual excess consumption of coffee, high BMI, frequent consumption of fast food, and smoking.<sup>[8]</sup> A study found that the obese women (BMI more than or equal to 30) had nearly a three-fold increased risk for PMS than non-obese women.<sup>[5]</sup>

Medical students are a high risk group for developing menstrual irregularities due to lifestyle with less sleep, irregular food and poor exercise habits. Menstrual irregularities over prolonged periods of time can lead to development of infertility, endometrial hyperplasia and problems due to prolonged anovulation, besides the deterioration in the quality of life. Therefore early diagnosis and management is important. The Mini Sood et al study does not show any association between stress levels and menstrual patterns.<sup>[9]</sup> This is contradictory to the findings of the study by Ruchi Singh et al in which significant association of increased stress scores with painful periods, premenstrual problems and passage of clots was observed.<sup>[10]</sup>

Premenopausal steroid hormone levels may have an important influence on subsequent development of chronic diseases in women.<sup>[11]</sup> These hormone levels are reflected in the menstrual cycle. Chronic diseases may be avoided by detecting these changes early on and bringing about necessary lifestyle modifications in order to avoid sequelae.

Thus this study focuses on finding a relationship between BMI and menstrual cycle and the effect factors affecting body mass index have on menstrual cycle and the individual.

**AIMS AND OBJECTIVES:**

The study aims at finding the effect of BMI on the menstrual profile of medical students.

It also aims at throwing light on the factors affecting the BMI and thus, indirectly, the menstrual cycle.

**MATERIALS AND METHODS:**

Study type : Prospective cross sectional study

Study site : Medical colleges in Pune.

Duration of study : During the months of June and July, 2016.

Number of samples : 103 students from medical colleges in Pune.

Inclusion criteria : Students from undergraduate course for medicine who were willing to participate.

Exclusion criteria : Students who had completed their undergraduate course and those not willing to give consent.

Data collection : The data was collected from 103 medical students in the academic year 2016 over a span of two months via structured questionnaires and interviews. The project was explained to the participants and informed written consent was obtained. The data was obtained in 5 stages.<sup>[2]</sup>

The *first stage* obtained *demographic data* like age and residence. The *second stage* obtained data regarding the *student's lifestyle* like sleep patterns, regularity of meals, diet and stress. The students were asked to grade the perceived stress as none, mild, moderate or severe.

The *third stage* obtained data regarding the *menstrual cycle* like duration and regularity. The amount of blood loss was assessed as mild moderate and severe based on the number of pads used per day. Mild being 1 or 2 pads per day, moderate 2- 4 pads per day and heavy more than 4 pads per day. The students were also asked if they

had already been diagnosed with any menstrual disorder.

The *fourth stage* obtained data about *symptoms associated with menstrual irregularities*, medications the students take to relieve them and the effect of these symptoms on the quality of life of the student. The information regarding perceived psychological and physical symptoms prior to menstruation was obtained and their effect on the individual was assessed. Data about other signs of hormonal imbalance like acne and hirsutism was obtained.

*Fifth stage* obtained data about *family history* of menstrual disturbances or of any other major disease which could possibly affect menstrual cycle.

Lastly, the student's height and weight was measured using standard procedure and BMI was calculated. The causes for menstrual disturbances were explained to the students and any queries regarding it were answered. Appropriate changes in their lifestyle were suggested in order to avoid progression of menstrual problems. Data was coded and analysed using standard and appropriate tests like mean, standard deviation and percentage and then compared.

**Ethical consideration:**

The project was approved by the institutional ethics committee. All the data obtained during the course of the project was kept confidential.

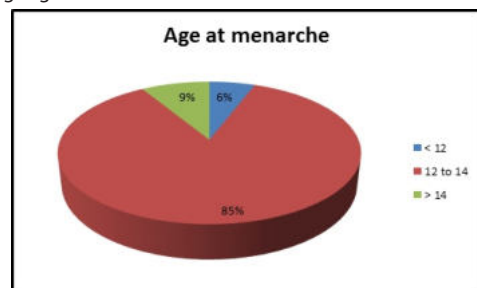
**Limitations:**

- Self-administered questionnaire which is subject to bias.
- Premenstrual symptoms, menstrual pain and irregular menstrual cycles were evaluated based solely on students' self-reports of their subjective perception and recognition.
- Restricted study population of students

**RESULTS:**

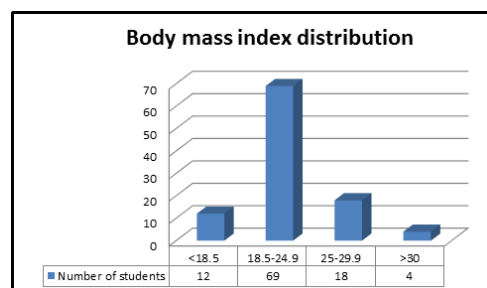
Average age of participants was 19.73.

Average age of menarche was 13.12.



**Figure 1 : showing the distribution of students according to their age of menarche**

Participants were divided into 4 BMI categories. BMI <18.5 is considered to be underweight, 18.5-24.9 is normal, 25-29.9 is overweight and > 30 is obese. 11.7% participants were underweight, 66.9% were in the normal category, and 17.5% were overweight while 3.9% were obese. (Fig. 2)

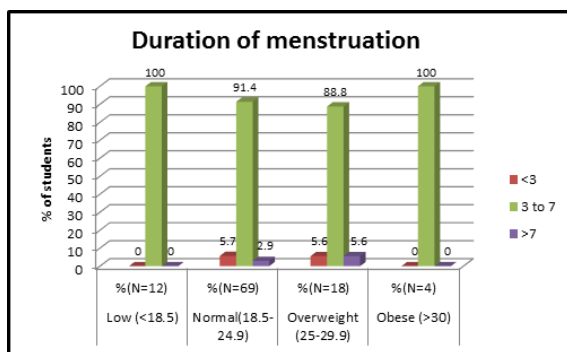


**Figure 2 : showing the distribution of students according to**

their BMI

**Table 1 : Showing distribution of students according to their BMI and its correlation to important aspects of the menstrual profile and lifestyle habits.**

BMI	Low (<18.5)		Normal(18.5-24.9)		Overweight (25-29.9)		Obese (>30)	
	N=12	%	N=69	%	N=18	%	N=4	%
<b>Age at menarche (years)</b>								
<12	1	8.3	3	4.3	2	11.1	0	0
12 to 14	8	66.7	63	91.4	14	77.8	3	75
>14	3	25	3	4.3	2	11.1	1	25
<b>Duration (days)</b>								
<3	0	0	4	5.7	1	5.6	0	0
3 to 7	12	100	63	91.4	16	88.8	4	100
>7	0	0	2	2.9	1	5.6	0	0
<b>Cyclicity (days)</b>								
<21	1	8.3	2	2.9	0	0	0	0
21-35	11	91.7	60	87	15	83.3	4	100
>35	0	0	7	10.1	3	16.7	0	0
<b>Amount</b>								
Less	5	41.7	10	14.5	2	11.1	2	50
Normal	6	50	55	79.7	14	77.8	2	50
More	1	8.3	4	5.8	2	11.1	0	0
<b>Regularity</b>								
Regular	11	91.7	47	68.1	12	66.7	3	75
Irregular	1	8.3	22	31.9	6	33.3	1	25
<b>Other</b>								
PMS	8	66.7	49	71	14	77.8	3	75
Diagnosed PCOS	1	8.3	2	2.9	3	16.7	1	25
Dysmenorrhoea	5	41.7	31	44.9	12	66.7	2	50
<b>Sleep (hrs)</b>								
<6	1	8.3	9	13	2	11.1	1	25
6 to 8	9	75	55	79.7	14	77.8	3	75
>8	2	16.7	5	7.3	2	11.1	0	0
<b>Exercise</b>								
none	10	83.3	48	69.6	13	72.2	0	0
30 minutes	2	16.7	17	24.6	3	16.7	4	100
>30 minutes	0	0	4	5.8	2	11.1	0	0
<b>Meals</b>								
Regular	6	50	44	63.8	6	33.3	2	50
Irregular	6	50	25	36.2	12	66.7	2	50
<b>Habits</b>								
Alcohol	2	16.7	3	4.4	1	5.6	0	0
Smoking	0	0	1	1.5	0	0	0	0
<b>Caffeine consumption</b>								
none	6	50	28	40.6	8	44.4	3	75
once/day	4	33.3	28	40.6	5	27.8	1	25
> once/day	2	16.7	13	18.8	5	27.8	0	0

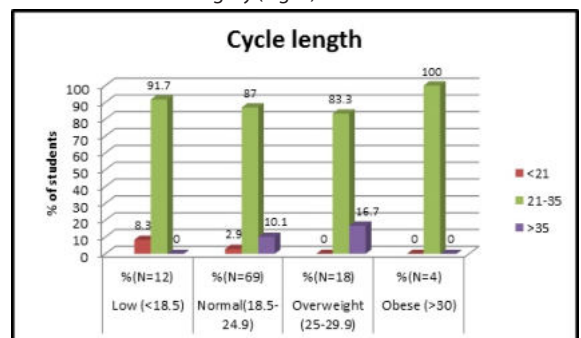


**Figure 3: distribution of participants according to their duration of menstruation and BMI**

The study found that the number of candidates showing duration less than 3 days and more than 7 days was higher in the overweight

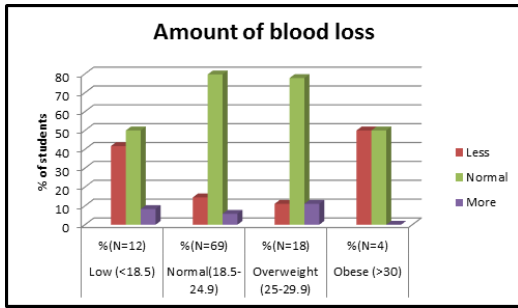
category.(Fig.3)

Similarly, the cycle length was longer in overweight candidates with 16.7% of them having cycle length more than 35 days compared to 10.1% in the normal category.(Fig.4)



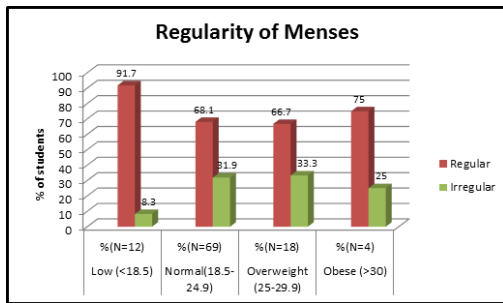
**Figure 4: distribution of participants according to their cycle**

**length and BMI**



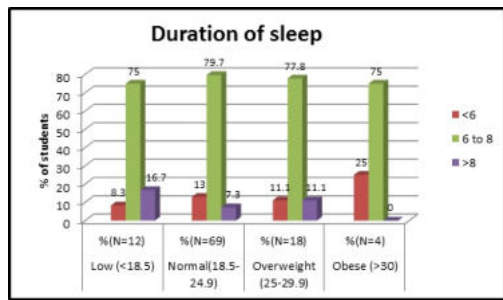
**Figure 5: distribution of participants according to the amount of blood loss and BMI**

The extremes of BMI category, the underweight and the obese, showed high prevalence of oligomenorrhoea with 41.7% underweight students and 50% of the obese candidates having oligomenorrhoea compared to 14.5% of students in the normal BMI category. The overweight category showed higher prevalence of menorrhagia compared to the normal category. (Fig. 5)



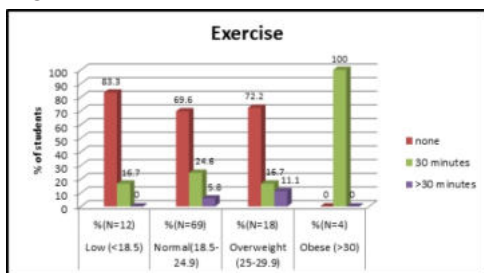
**Figure 6: distribution of participants according to the regularity of menses and BMI**

The incidence of irregularity of menstrual cycle was 33.3% in overweight and 25% in obese compared to 31.9% in normal category. (Fig. 6)



**Figure 7: distribution of participants according to the duration of sleep and BMI**

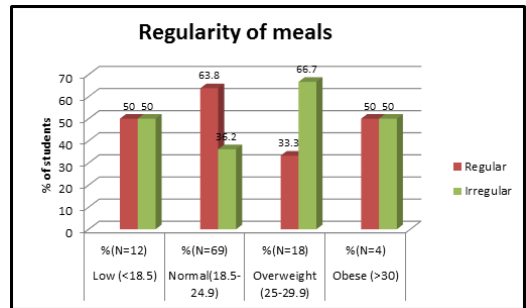
16.7% of participants in the underweight category showed longer hours of sleep and 25% of obese participants slept for less than 6 hours. (Fig.7)



**Figure 8: distribution of participants according to the amount**

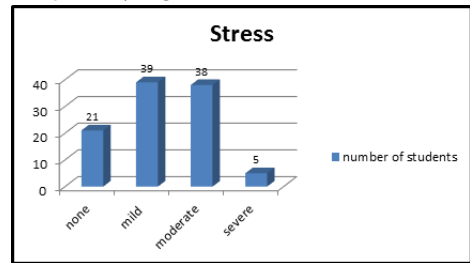
**of exercise and BMI**

Most of the students do not exercise with a few exercising in every category as seen above. (Fig.8)

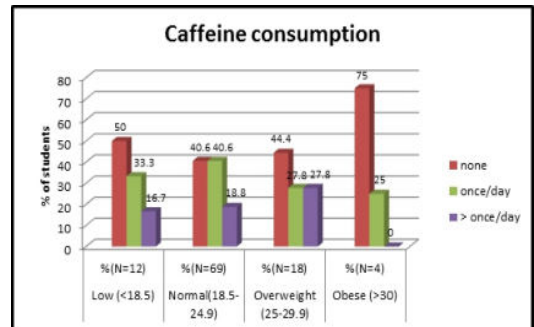


**Figure 9: distribution of participants according to the regularity of meals and BMI**

Irregularity of meals was seen in all categories with underweight, overweight and obese showing prevalence as high as 50%,66.7% and 50% respectively. (Fig. 9)



**Figure 10: distribution of students according to the stress perceived**



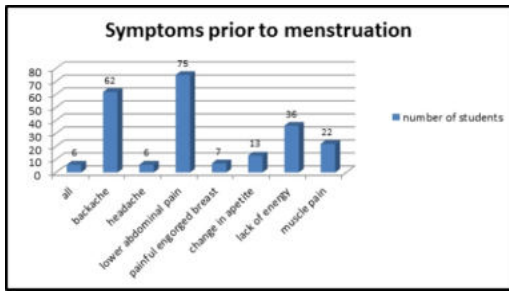
**Figure 11: distribution of participants according to the caffeine consumption and BMI**

The number of individuals consuming caffeine more than once day showed a gradual increase in each category with the overweight category having 27.8% prevalence. (Fig.11)



**Figure 12: distribution of participants according to the diet**

41% of the total participants did not have a balanced diet while 59% did. (Fig.12)



**Figure 13: distribution of participants according to the symptoms prior to menstruation**

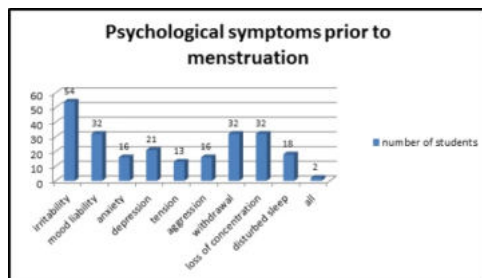
Most of the participants showed symptoms prior to menstruation with the most common physical symptom being lower abdominal pain and the commonest psychological symptom being irritability. (Fig. 13,14 & Table 2, 3)

**Table 2: Showing the prevalence of physical symptoms experienced prior to menstruation**

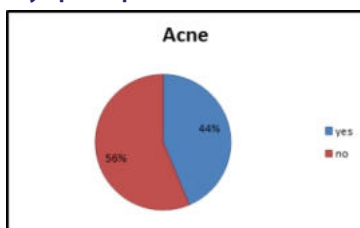
Symptoms experienced	Number of students	% of total students
all	6	5.8
backache	62	60.2
headache	6	5.8
lower abdominal pain	75	72.8
painful engorged breast	7	6.8
change in appetite	13	12.6
lack of energy	36	34.9
muscle pain	22	21.4

**Table 3: Showing the prevalence of psychological symptoms experienced prior to menstruation**

Psychological symptoms	Number of students	% of total students
irritability	54	52.4
mood liability	32	31.1
anxiety	16	15.6
depression	21	20.4
tension	13	12.6
aggression	16	15.6
withdrawal	32	31.1
loss of concentration	32	31.1
disturbed sleep	18	17.5
all	2	1.9

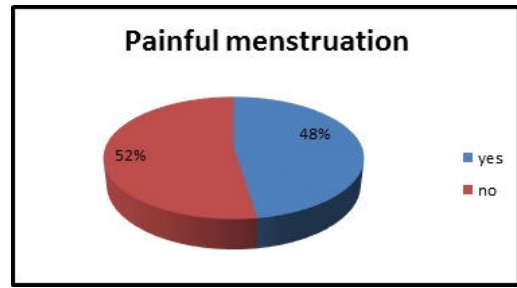


**Figure 14: distribution of participants according to the psychological symptoms prior to menstruation.**



**Figure 15: distribution of participants according to the prevalence of acne**

**44% of the individuals had acne while 56% did not. (Fig. 15)**



**Figure 16: distribution of participants according to the prevalence of painful menstruation**

Of the 48% who had painful menstruation, 10% were underweight, 24% overweight and 4% were obese while 62% were of the normal BMI category. (Fig. 16)

20.4% students reported having a female member of their family or a close relative having history of menstrual disturbances and disorders. 25% obese, 16.7% overweight and 8.3% underweight participants reported to already being diagnosed with PCOS.

**DISCUSSION:**

Menstrual cycle is of utmost importance to the well being of the individual as is evident from the study. On comparing this study with other studies it was found that age of menarche is 13.12 while that in a similar study conducted by Nevin Samir et al was 13.14. The same study found that 55.1% of the participants were in the normal BMI category while this study found that 66.9% of the participants were in the normal BMI category.<sup>[2]</sup>

Among the obese candidates we found that there was an increased prevalence of decreased amount of blood loss during menstruation with increased irregularity of menses and more cases of diagnosed PCOS. These findings may be attributed to the high prevalence of irregularity of meals in this category. More menstrual disorders were observed in the overweight category which may be due to poorer lifestyle habits adopted by them. Also the obese candidates may be more conscious of their increased weight and thus follow a healthier lifestyle than the overweight participants as observed in the study.

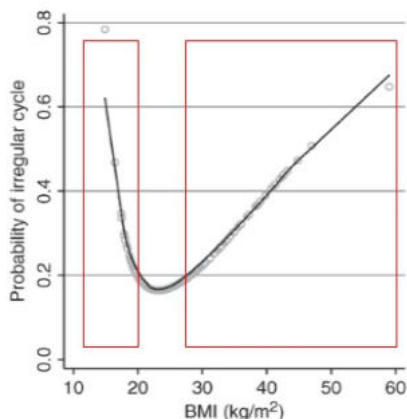
In the overweight category, we found that the duration of menstruation may show an increase or decrease with increased cycle length, amount of blood loss and irregularity of menses. This category too showed high prevalence of diagnosed PCOS cases. Few causes may be disturbed sleep cycle, irregularity of meals and high caffeine consumption.

The participants of the underweight category showed decreased cycle length and amount of blood loss during menstruation. Excessive sleep coupled with no exercise may be causative.

Most young women have premenstrual symptoms which is backed by this study in which almost all participants reported an array of physical and psychological symptoms. The commonest symptom was lower abdominal pain and back ache accompanied by irritability, mood liability, withdrawal and loss of concentration. This finding was in disagreement with that of the study by Nevin Samir in which the commonest symptoms were lower abdominal pain and painful engorged breast accompanied by irritability, aggression and sleep disturbances.<sup>[2]</sup> They were, however, consistent with the findings of Domoney et al.<sup>[12]</sup>

Another common complaint in young women is dysmenorrhoea. The prevalence of dysmenorrhoea was high across all BMI categories with a higher prevalence in the overweight and obese categories.





**Figure 17: Correlation between BMI and Menstrual disorders**

Statistically significant correlation between very high & very low BMI with menstrual irregularity was seen in a number of different studies conducted.<sup>14,7</sup> This study has shown us that all BMI categories showed deviation from normal however the percentage of participants showing these deviations were higher in the underweight and overweight category. These findings are consistent with the findings of other studies as mentioned above. (Fig.17)

The lifestyle habits of individuals in the overweight and underweight category were the worst with little or no exercise and irregular eating habits. The obese participants had modified their lifestyles and were more conscious about exercise. However diet was found to be irregular across the BMI categories. The prevalence of PCOS was highest in the obese category and may be a result of poor lifestyle followed for prolonged duration before diagnosis.

#### CONCLUSION:

The study showed that there is a positive correlation between the BMI and the determinants of menstrual profile like duration, flow and cyclicity. Menstrual disorders are common in students with poor lifestyle habits and correlates well with abnormal BMI. Students with BMI more than 25 have higher chances of disturbed menstrual cycle such as irregular cycles, dysmenorrhea, premenstrual symptoms and menorrhagia. Students need to make lifestyle changes to attain optimal BMI, like maintaining a routine and exercise regularly in order to prevent menstrual irregularities. Also they should be helped to deal with their stress and problems associated with menstruation. The study also highlights the importance of BMI in preventing menstrual disorders and complications arising from them. Thus this study lays the groundwork for further research like the effect of body fat on changes in puberty and effect of BMI on pregnancy.

#### RECOMMENDATIONS:

Girls should be educated about the importance of reproductive health and the factors affecting it like body mass index in schools to prevent menstrual disorders and their sequelae. A deeper understanding of the effect of lifestyle and body mass index on the hormonal balance and menstrual cycle would go a long way in decreasing chronic diseases of the reproductive system.

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