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Are Menstrual Patterns Associated with the Body Mass Index of University Students? A Descriptive Study in Mangalore, Karnataka, India

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Abstract

Background Menstrual cycle irregularities and anovulation have been found to occur with increased frequency in women who deviate considerably from normal weight. Ovulation abnormalities may also be caused by fluctuations in weight, such as being overweight, obese, or underweight, which are hypothesized to disrupt the energy balance.

Objectives The aim of this study was to find out the association between menstrual patterns and body mass index (BMI) among students of selected health science university.

Materials and Methods A descriptive research study was conducted among 222 university students at a selected health science university in Mangalore. The samples were selected by using simple random sampling techniques. A demographic proforma, self-reported menstrual pattern questionnaire, and anthropometric measurements like height and weight were measured. BMIwas calculated by using the standardized formula, BMI= (weight [kg]/height [m^2]) by the World Health Organization for the Asian population based on the revised consensus guidelines for India. Students who are aged between 17 and 25 years, unmarried female students who are studying under Yenepoya (deemed to be university), attained menarche, and who are willing to participate in the study were included in the study.

Results From this study, it can be considered that the mean age of menarche was 12.49 ± 0.51years. Most 68.5% students reported dysmenorrhea. It is the most common menstrual disorder among our study subjects. Of the total subjects, 38.3% cases had oligomenorrhea, which was the next most common menstrual disorder. The majority of the subjects has a normal BMI, with a mean of 21.02 kg/m^2. There is a significant association between dysmenorrhea, oligomenorrhea, and polymenorrhagia with BMI status of university students at 0.05 level significance.

Conclusion Lifestyle modification and nutritional counselling for female students could alleviate menstrual problems. It will not only improve the girls' current health, sense of well-being, and overall quality of life but may also lower her risks for future

Keywords
- adolescent
- body mass index
- menstrual irregularities
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disease and ill health after proper advice about diet and exercise. Menstrual irregularities are mostly neglected by the society due to unawareness regarding the irregular menstrual pattern and their problems.

Introduction

Menstruation, also referred to as monthly bleeding, is caused by a reduction in estrogen and progesterone levels at the end of the ovarian monthly cycle.[1–3] Women's health is influenced by their menstrual cycle. The main gynecological issue faced by adult females, particularly adolescent females, is irregular or disordered menstrual cycles, which can be extremely stressful for both the individual and their family.[4–6] The female reproductive cycle includes menstruation as a crucial component. Hormonal changes, genetics, significant illnesses, and body mass index (BMI) are among the variables that frequently affect the regularity and duration of a woman's menstrual cycle. Menstruation is an important part of the female reproductive cycle factors that often play role in the regularity and following of a woman's menstrual cycle includes hormonal changes, genetics, serious medical condition, and BMI. In addition, lower age, obesity, family history, inappropriate nutritional diet, and reduced frequency of breakfast meals per week are the other factors.[5,7–9]The prevalence of menstrual disorders in India has been recorded as high as 87%.[6] Various types of menstrual disorders are prevalent, namely menstrual irregularity, menorrhagia amenorrhea, oligomenorrhea polymenorrhagia, and dysmenorrhea'.[10–12] Where "Menorrhagia is defined as the occurrence of excessive bleeding, with respect to quantity and duration, during regular menstruation," "Amenorrhea is the absence of menstruation," "Polymenorrhagia defined as frequent and heavy menstrual bleeding" "Oligomenorrhea is defined as irregular and inconsistent menstrual blood flow in a woman" "Dysmenorrhea is defined as chronic spasmodic pain that occurs immediately before and/or during menstruation, that can last for hours or several days."[13–17]

Menstrual cycle irregularities and anovulation have been found to occur with increased frequency in women who deviate considerably from normal weight. Several studies have shown that higher obesity grades were associated with higher probabilities of irregular patterns in the menstrual cycle.[5] The increasing trends are the prevalence of childhood obesity, early puberty and menarche, and ethno-racial differences in the effect of BMI on the reproductive characteristics of young female.[7] One of the important factors that contribute to menstrual disorders is body weight, more specifically body fat content.[18] Nutritional status has the potential to cause disruption to the reproductive health of young women. Reproductive performance is influenced by food and type of nutrition. Weight variations in terms of being overweight, obese, or underweight related to changes in energy balance are also thought to result in ovulation disorders.[13,14,19] Continued obesity in adulthood will cause earlier sexual maturity and an irregular menstrual cycle.[6,7]

Menstrual cycle regularity is highly influenced by BMI.[4] The most notable alteration in girls is the beginning of menstruation, a common and natural process that occurs in women after puberty. It is possible to identify and treat several medical issues that can result in irregular or skipped menstrual cycles early on. Primary healthcare, however, largely ignores this aspect of women's health.[15–17] More than 90% of menstrual disorders can be avoided with early recognition and the proper treatment, and understanding the etiological links between menstrual ailments, BMI, and dietary practices may help with early detection.[5] Numerous studies have demonstrated that irregularities in adolescent menstrual cycles may persist into adulthood and ultimately be linked to subfertility.[20,21] So, this study was intended to find the association between menstrual patterns and BMI among students of selected health science university at Mangalore.

Methods

A descriptive research study involving 222 college students was performed at a chosen health science university in Mangalore. Simple random sampling methods were employed to choose the samples. A demographic proforma, a questionnaire on one's menstrual cycle, and anthropometric measurements including height and weight were taken. The study included students who are between the ages of 17 and 25 years, are single, are studying under selected health science university, attained menarche, and who are willing to participate in the study. Students who had a history/are currently on hormonal/chemo or radiotherapy, on oral contraceptive pills, who are on treatment for menstrual problems, and who had undergone pelvic or pelvic organ-related surgery were excluded from the study.

While calculating the sample size, the total sample size was calculated to be 227 by using Cochran's sample size formula $n = Z^2 P(1\text{-}P)/d^2$, where n = sample size, Z = statistic for a level of confidence (1.96 for 95% confidence level), P = Expected prevalence or proportion; the prevalence of menstrual disorders was considered as 85.0% among adolescent girls, with a 10% possible error and d = precision. The sample size was rounded off to –230. Due to nonresponse, 222 subjects' data was used for final analysis.

Administrative permission was obtained from university and college authorities and ethical clearance was obtained from the Institutional Ethical Committee-2 dated 1/9/2022. Informed consent was obtained from the university students. All the participants in the study were informed regarding the details of the study in their own language.

The following tools were used in this study to collect data; a demographic proforma was used to collect demographic

variables, a self-reported menstrual pattern questionnaire was used to identify the menstrual pattern among students that questionnaire with 12 items was developed by the investigator.[2,7–9] It includes menstrual characteristics and menstrual problems. The details of the menstrual cycle, including cycle length, number of days the period lasts, menstrual flow, dysmenorrhea, menorrhagia, polymenorrhagia, oligomenorrhea, hypomenorrhea, and amenorrhea, are measured by a self-reported menstrual pattern questionnaire.[5,22–24] Menstruation-related information was collected, and the confidentiality of responses was maintained. The questionnaire was distributed by the investigator to university students, and the time taken by the subjects to complete the questionnaire was approximately 15 minutes. To assess its reliability, the English version of the tool was administered to 10 subjects. The reliability of the menstrual pattern questionnaire for students was checked by using the Cronbach's α method to check the internal consistency and reliability coefficient obtained, which was $r = 0.86$.

BMI (kg/cm^2) was calculated using the formula BMI = weight in kg/height in m^2 as classified as BMI by the World Health Organization (WHO) for Asian populations based on the revised consensus guidelines for India. The cutoff values were followed based on the WHO categories such as less than 18.5kg/m^2 (underweight), 18.5 to 22.9 kg/m^2 (underweight), 18.5 to 22.9 kg/m^2 (healthy weight, normal, or lean), and –24.9 kg/m2 (overweight or at risk), 25 to 29.9 kg/m^2 (obese I), and more than or equal to 30 (obese II).[5,13,25] For anthropometric examination, weight was recorded using a standard weighing scale (OMARON digital weighing scale, New Delhi, India) that was kept on a firm horizontal surface.

The statistical calculations were performed using computer-based statistical software Statistical Package for the Social Sciences (SPSS) version 21.0. Both descriptive and inferential statistics were used to analyze the collected data.

Results

Demographic characteristics of university students revealed that of those 222 studied subjects most of the subjects 51.8% were in the age range of 20 to 21 years. And the mean age was 20.0 ± 0.69 standard deviation. The majority of the subjects (88.7%) belonged to the nuclear family. The majority of the subjects 97.7% consumed a mixed diet. The more than half of the subjects consumed 50.5% three meals per day. The majority of the subjects (56.3%) ate junk food two to three times junk foods in a week. Most of the subjects (74.8%) skip their meals sometimes. The majority of the subjects (74.8%) did not perform any type of physical activity, while 25.2% performed physical activity. The majority of the subjects 83.3% had not taken any pills during their menstrual pain.

The menstrual characteristics of university students revealed that in this study out of 222 subjects 52.3% of the girl's achieved menarche at the age of 11 to 13 years and 46.8% achieved it at 14 to 16 years. The mean age of menarche was 12.49 ± 0.51years. The majority (51%) of subjects had irregular menstrual periods. And of the total subjects, 46.3% had a moderate level of pain, and 22.1% had severe dysmenorrhea. The duration of menstrual cycle 4 to 7 days was seen in most subjects, that is, 107 (48.2%). The average length of the menstrual cycle was 21 to 27 days, that is, 54.1%. Menstrual flow was normal among the majority of subjects, that is, 166 (74.8%). However, very few subjects had scanty and heavy menstrual bleeding, that is, 14.4% and 10.8, respectively.

In terms of menstrual problems among the 222 studied subjects, most of the (152, 68.5%) students reported dysmenorrhea. It is the most common menstrual disorder among our study subjects. Menorrhagia was seen in 21 (9.5%) students. Out of the total subjects, 85 (38.3%) had oligomenorrhea, which was the next most common menstrual problem. Six (2.7%) subjects had hypomenorrhea. Polymenorrhagia was seen in 17 (7.7%) students and 11 (5%) subjects reported having amenorrhea.

The BMI of the 222 university students showed that the majority, 116 (52.3%), of subjects had normal BMI status, while 53 (23.9%) were undernourished, and 12.2 and 11.7% belonged to the overweight and obese categories, respectively. Among the total population, the majority of the subjects had mean heights of 159.56 ± 5.98 cm and mean weights of 53.54 ± 9.15 kg/m2. The mean BMI was 21.02 ± 3.42 kg/m2.

►**Table 1** shows that there is a significant association between dysmenorrhea, oligomenorrhea, and polymenorrhagia with BMI status of university students at 0.05 level significance.

This study also found that when compared with students of normal weight, underweight students (90.5%), overweight students (62.4%), and obese students (76.9%) had more irregular menstrual cycles. BMI is substantially linked to dysmenorrhea, especially in underweight students (68.3%); nevertheless, dysmenorrhea is also prevalent in overweight and obese students (54.3%). Oligomenorrhea was more common among overweight students (31.7%) than other weight categories, whereas polymenorrhagia was more common among obese students (65.3%) than other weight categories.

The association between the menstrual patterns of the university students with selected demographic variables.

Table 1 Association between menstrual pattern and BMI status of university students, $n = 222$

Menstrual pattern and BMI	Frequency (%)	Fisher's exact	*p*-Value
Dysmenorrhea	152 (68.5)	11.39	0.016[a]
Oligomenorrhea	85 (38.3)	12.22	0.01[a]
Polymenorrhagia	17 (7.7)	11.62	0.01[a]

Abbreviation: BMI, body mass index.
[a]$p < 0.05$ level of significance.

The Fisher's exact value of certain variables is found to be significant at 0.05 level. There is a significant association between type of diet and first period/menstruation/menarche ($p < 0.05$). Skip meals and dysmenorrhea ($p < 0.05$) and pills during menstrual pain are associated with severity of pain ($p < 0.05$). Also, there is a significant association between the BMI status of university students and selected demographic variables like place of stay and skipping meals at the 0.05 level of significance. However, there is no association found between other demographic variables and the BMI status of university students.

Discussion

The magnitude of menstrual disorders among young women has been noted, and these issues appear to be related in some way to BMI, which could have long-term effects on obesity, chronic illness, infertility, and reproductive health. University students are more likely to experience menstrual abnormalities because of their stressful lifestyles, inconsistent eating patterns, and irregular exercise routines.

This study results showed that a total of 52.3% of the girls attained menarche at the age of 11 to 13 years and 46.8% achieved it at 14 to 16 years. The mean age of menarche was 12.49 ± 0.51years.

A study conducted by Dars et al from Pakistan revealed that 67.33% of the girls had their first menstrual period between the age of 11 and 13 (mean = 12.92 years, standard deviation of 1.41 years)[1] Similar study result reported by Rai et al from India revealed that the average age of menarche was 13.5 years with a standard deviation of 1.35.[2] Ramraj et al from Pune also reported similar findings that age of menarche was 12 years.[3] Another study results also showed similar results as present study like the mean age at menarche was 12.59 ($\pm$ 1.86) years study report by Ganesan et al.[4] So, we conclude that the average age of menarche is between the ages of 11 and 13 years based on data from both previous studies and this study.

In this study, most (68.5%) students reported dysmenorrhea. This was the most common menstrual disorder among our study subjects. And of the total subjects, 46.3% had a moderate level of pain, and 22.1% had severe dysmenorrhea. In respect of dysmenorrhea, a study conducted by Dars et al, from Pakistan, revealed that 62% of girls had primary dysmenorrhea.[1] Another similar study by Mohamed and Elsayed revealed that 87.6% of the study subject reported presence of pain with menstruation. About 61.3% subjects reported that this pain started with their menarche. According to Likert scale, 44.3% of study subject reported intermediate degree of pain.[6] From the current and previous research, it is understood that the most common menstrual disorder faced by the students was dysmenorrhea.

With regard to menstrual flow, length, duration, and regularity, menstrual periods last for the duration of 4 to 7 days as was seen in most subjects, that is, 107 (48.2%). The majority (51%) of subjects had irregular menstrual periods. The average length of the menstrual cycle was 21 to 27 days, that is, 54.1%. Menstrual flow was normal among the majority of subjects, that is, 166 (74.8%). Menorrhagia was seen in 24 (10.8%) students. Of the total subjects, 85 (38.3%) cases had oligomenorrhea, which was the next most common menstrual disorder. Out of the total subjects, six (2.7%) subjects had hypomenorrhea. Polymenorrhea was seen in 17 (7.7%) students.

A study report by Rai et al showed that the mean duration of blood flow was 4 to 8 days with a standard deviation of 1.092. The cycle length was 29.79 days with standard deviation of 4.87.[2] Another study reported by Zohora reported that out of the 250 respondents, most of them reported their menstruation duration range between 4 and 7 days (80.8%), 72.4% had regular menstrual cycles, and the length of the menstrual cycle of the 127 respondents (50.8%) was 21 to 35 days. Moderate blood flow was reported by 62% of respondents, 24% had heavy blood flow, and 14% had scanty or little blood flow.[7]Supporting the findings of this study, a study conducted by Ganesh et al reported that none of the respondents revealed of having a short menstrual period, with majority falling into having a normal menstrual period. We conclude from the available evidence and this study results that the majority of female students have irregular menstrual periods. In addition to the common menstrual disorder, it is also noticed that menorrhagia, hypomenorrhea, and polymenorrhea are also seen among students, which also need attention.

This study results revealed that the majority (52.3%) of university students have normal BMI status. However, 23.9% subjects are undernourished, and 12.2 and 11.7% belong to the overweight and obese categories, respectively. Among the total population, the majority of the subjects had mean heights of 159.56 ± 5.98 cm. This study results are consistent with a study conducted by Ganesh et al, who reported that most of the respondents had normal BMI. Results of another study report by Singh et al were contradictory to this study results; in their study almost 114 (54.3%) subjects were having low BMI, which implied that more than 50% of the girls were undernourished.[5] Another study by Dars et al, from Pakistan, revealed that 75.51% girls had BMI between 14 and 24.9. kg/m^2.[1] Another consistent study reported by Haniarti et al revealed that most of the respondent's (48.3%) BMI has a normal.[9]

This study findings showed that there is a significant association between dysmenorrhea, oligomenorrhea, and polymenorrhagia with BMI status of university students at 0.05 level significance. The mean of BMI in the study population was found to be 21.02 kg/m^2. Of the total subjects, most (68.5%) students reported dysmenorrhea. And of the total subjects, 46.3% had a moderate level of pain, and 22.1% had severe dysmenorrhea. Out of the total subjects, 85 (38.3%) cases had oligomenorrhea, which was the next most common menstrual disorder. Out of the total subjects, six (2.7%) subjects had hypomenorrhea. Polymenorrhea was seen in 17 (7.7%) students.

Similar study conducted by Rai et al reported the mean of BMI in the study population was found to be 21.42 kg/m^2. Irregular menses (including short and long cycles) are highly significantly associated with underweight and overweight BMI

as clear with *p*-value of 0.0001 and 0.0001, respectively. Irregular cycles were seen in 45 cases out of which 9 were having polymenorrhagia, that is, cycle length less than 21 days, 10 were having irregular cycle with no fixed length, and 26 were having oligomenorrhea. Out of 45 cases with irregular cycle, 19 were in underweight category, 9 in overweight category, 2 in obese class 2, and rest 15 in normal BMI category.[2] We have noticed that BMI and menstrual pattern are closely associated, and future research needs to be performed to identify other significant factors that may influence menstruation.

Conclusion

From this study, it can be considered that menstrual problems especially dysmenorrhea are the most common problem faced by study subjects. Oligomenorrhea was the next commonest menstrual disorder among university students. Menstrual irregularities are mostly neglected by the society due to unawareness regarding the irregular menstrual pattern and their problems. Lifestyle modification and nutritional counseling for female students could alleviate menstrual problems. It will not only improve the girls' current health, sense of well-being, and overall quality of life but may also lower her risks for future disease and ill health after proper advice about diet and exercise.

Limitation

The study was limited to students of single selected health science university at Mangalore, Karnataka and the study duration was short.

Ethical Approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the institutional Ethics Committee-2 dated 1/9/2022.

Authors' Contributions

A.B., A.U.K., A.K., A.M., S.M., G.G.R. contributed to the study conception and design and material preparation. A.B., A. U.K., A.K. and A.M contributed to data collection and analysis. S.M. wrote the first draft of the manuscript. All authors read and approved the final manuscript.

Conflict of Interest

None declared.

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