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Original Research Article

Study of menstrual disorders and its correlation with BMI in adolescents

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ABSTRACT

Background: Due to change in lifestyle, habits, diet, the prevalence of obesity has increased. Excess weight and obesity are associated with irregular menstrual cycles, which reduce fertility and increase hormone-sensitive cancers. Obesity is considered to cause abnormality of sex steroid hormone balance. Irregular menstruation is more frequently observed in women who became obese during puberty than in those who were obese during infancy. Obesity has a strong association with infertility and menstrual irregularities.
Methods: This cross-sectional study was conducted at Durgapur (West Bengal), where total 600 adolescent girls aged 12-17 years from DAV Model School, Durgapur and GMPS High School, Durgapur were selected.
Results: Out of total 600 girls, 119 girls (19.8%) had BMI<18.5 kg/m^2, 357 girls (59.5%) had BMI between 18.5-24.99 kg/m^2 and 124 girls (20.7%) had BMI>25 kg/m^2. Only 68 girls (57.1%) with less BMI, 205 girls (57.4%) with normal BMI and 62 girls (50%) with BMI>25 kg/m^2 had dysmenorrhoea. Only 19 girls (16%) with less BMI, 46 girls (12.9%) with normal BMI and only 15 girls (12.1%) with higher BMI had menorrhagia. Only 4 girls (3.4%) with less BMI, 14 girls (3.9%) with normal BMI and 12 girls (9.7%) with high BMI had hypomenorrhoea. Only 10 girls (8.4%) with less BMI, 37 girls (10.4%) with normal BMI and only 28 girls (22.5%) with high BMI had irregular cycles. Only 5 girls (4.2%) with less BMI, 12 girls (3.4%) with normal BMI and only 11 girls (8.9%) with high BMI had oligomenorrhoea. Only 2 girls (1.7%) with less BMI, 3 girls (0.8%) with normal BMI and only 4 girls (3.2%) with higher BMI had polymenorrhoea. Only 43 underweight girls (36.1%), 166 girls (46.5%) with normal BMI and 68 girls (54.8%) with higher BMI had premenstrual symptoms.
Conclusions: Mean BMI was found 21.6±3.64 kg/m^2. High BMI girls had more oligomenorrhoea, hypomenorrhoea, irregular menstrual cycles, polymenorrhoea, premenstrual symptoms and less dysmenorrhea and menorrhagia comparatively to normal BMI girls and underweight girls.

Keywords: BMI, Irregular menstruation, Obesity

INTRODUCTION

Adolescence is psychological, cognitive and cultural maturation process initiated by biological changes of puberty. Puberty is defined as a biological phenomenon that includes changes in body composition and anthropometry under hormonal and neurophysiologic control. Appearances of secondary sex characters in girls include development of breast, pubic hairs and menarche.

Menstrual cycle is a normal physiological process that is characterized by periodic and cyclic shedding of progestational endometrium accompanied by loss of blood which is an additional vital sign adds a powerful tool to the assessment of normal development and the exclusion of pathological conditions in adolescents.[1] BMI allows health professionals to identify over and underweight problems. It is a simple index of weight for height and defined as the weight in kilograms divided by the square of the height in

metres.[2] BMI as classified by WHO describes having <16 kg/m^2 as severe underweight,16.0-16.9 kg/m^2 as moderate underweight and 17.0-18.49 kg/m^2 as mild underweight. Normal BMI range is 18.5-24.99 kg/m^2. Anything >25 kg/m^2 is considered to be overweight, with 25-29.99 kg/m^2 being classified as pre-obese and >30 kg/m^2 as obese. Menstrual problems are perceived as minor health concern and irrelevant to the public health agenda particularly in developing countries. Some variety of menstrual dysfunction occurs in adolescents which affect normal life. Physical, mental, social, psychological, reproductive problems are associated with menstrual problems. Due to change in lifestyle, habits, diet, the prevalence of obesity has increased in developed world which results in decreased age at menarche.[3]

Excess weight and obesity are associated with irregular menstrual cycles, which reduce fertility and increase hormone-sensitive cancers in women.[4,5] Obesity is considered to cause abnormality of sex steroid hormone balance and sex hormone binding globulin level. In young women, the onset of obesity is significantly correlated with menstrual irregularities in reproductive age. Irregular menstruation is more frequently observed in women who became obese during puberty than in those who were obese during infancy.[6] Obesity has a strong association with infertility and menstrual irregularities.[7]

Aims and objectives

The present study entitled "study of menstrual disorders and its correlation with BMI in adolescents" has been carried out under the department of obstetrics and gynaecology, Durgapur Steel Plant Hospital, Durgapur (West Bengal).

The aims of this study were to create awareness among schoolgirls about the significance of BMI and its relationship with menstrual disorders. To provide an idea of quality of life by improving environment and giving them health education about menstrual disorders.

To achieve the aim, following objective was set for this study: to find out the BMI and correlation of nutrition in terms of BMI with menstrual disorders.

METHODS

Study design and setting

It was a cross sectional research study conducted at Durgapur (West Bengal), where total 600 girls aged 12-17 years from DAV Model School, and GMPS High School, Durgapur were selected for a period of one year.

Inclusion criteria

Adolescents between 12-17 years. Unmarried and attained menarche. Whose parents have given consent.

Exclusion criteria

Who were on hormonal treatment for menstrual disorders. Who did not appear for interview.

Study tool

The study tools were pretested predesigned questionnaire, weighing machine and height measuring tape.

Methods of collection of data

Personal interview using predesigned questionnaire, height and weight measurement and physical examination which included name, age, sociodemographic information, personal details, menarcheal age, menstrual pattern (regularity of cycle, its length, duration and amount of flow), source of information about menarche and whether they required medical help for menstrual disorder or not. Age of girls was rounded off. Predesigned pretested questionnaire was distributed and collected on the same day to ensure confidentiality and to prevent information contamination. Weight was measured in kilograms. Height was taken barefooted in centimeter using a measuring tape and BMI was calculated using the formula weight (kg)/ height^2 (metre^2). According to BMI, nutritional status was classified as underweight, normal, and overweight as BMI <18.5, 18.5-24.99 and >25 kg/ m^2 respectively.

Sample size was calculated assuming 95% confidence level, 50% high risk prevalence (for the sake of having larger sample size it was considered taking 50% as appropriate) and acceptable difference of 4%. Prior to data collection aim of present study was explained and informed consent was obtained from adolescent.

Statistical methods

Categorical variables were expressed as number of patients and percentage of patients and compared across the groups using Pearson's chi square test for independence of attributes. Continuous variables are expressed as mean±standard deviation and scatter plots have been generated. The statistical software SPSS version 16 has been used for the analysis. An alpha level of 5% has been taken, i.e. if any p value was less than 0.05 it has been considered as significant.

RESULTS

As shown in Table 1, out of total 600 girls, 119 girls (19.8%) were having BMI<18.5 kg/m^2, 357 girls (59.5%) had BMI between 18.5-24.99 kg/m^2 and 124 girls (20.7%) had BMI>25 kg/m^2.

In our study, only 68 girls (57.1%) with less BMI had dysmenorrhoea, 205 girls (57.4%) with normal BMI had dysmenorrhoea and 62 girls (50%) with higher BMI had dysmenorrhoea. So, dysmenorrhoea was more frequently found in normal BMI girls and least frequently found in 52

overweight girls. Difference was statistically not significant (p value >0.05).

Table 1: Distribution of cases according to BMI (kg/m^2).

BMI (kg/m^2)	No of girls	Percentage
<18.5	119	19.8
18.5-24.99	357	59.5
>25	124	20.7

Table 2: Correlation of dysmenorrhoea with BMI.

BMI (kg/m^2)	No. of girls	Dysmenorrhoea	%	P value
<18.5	119	68	57.1	
18.5-24.99	357	205	57.4	0.340
>25	124	62	50.0	

Table 3: Correlation of menorrhagia (heavy flow or duration >5 days or both) with BMI.

BMI (kg/m^2)	No. of girls	Menorrhagia	%	P value
<18.5	119	19	16	
18.5-24.99	357	46	12.9	0.625
>25	124	15	12.1	

As shown above, only 19 girls (16%) with less BMI had menorrhagia, 46 girls (12.9%) with normal BMI had menorrhagia and only 15 girls (12.1%) with higher BMI had menorrhagia. So, in this study menorrhagia was more common in underweight girls and less in overweight girls. But difference was found statistically not significant (p value >0.05).

Table 4: Correlation of hypomenorrhoea (scanty flow and <2 days) with BMI.

BMI (kg/m^2)	No. of girls	Hypomenorrhoea	%	P value
<18.5	119	4	3.4	
18.5-24.99	357	14	3.9	0.027
>25	124	12	9.7	

As shown in Table 4, only 4 girls (3.4%) with less BMI, 14 girls (3.9%) with normal BMI and 12 girls (9.7%) with higher BMI had hypomenorrhoea. So hypomenorrhoea was commonly found in overweight girls. Difference was found statistically significant (p value <0.05).

As shown in Table 5, only 10 girls (8.4%) with less BMI, 37 girls (10.4%) with normal BMI and only 28 girls (22.5%) with higher BMI had irregular cycles. So, in irregular menstrual cycles were commonly found in overweight girls. Difference was found statistically significant (p value <0.05).

Table 5: Correlation of irregular menstrual cycle with BMI.

BMI (kg/m^2)	No. of girls	Irregular menstrual cycle	%	P value
<18.5	119	10	8.4	
18.5-24.99	357	37	10.4	0.027
>25	124	28	22.5	

Table 6: Correlation of oligomenorrhoea (> 35 days) with BMI.

BMI (kg/m^2)	No. of girls	Oligomenorrhoea	%	P value
<18.5	119	5	4.2	
18.5-24.99	357	12	3.4	0.042
>25	124	11	8.9	

As shown in Table 6, only 5 girls (4.2%) with less BMI, 12 girls (3.4%) with normal BMI and only 11 girls (8.9%) with higher BMI had oligomenorrhoea. So, it was frequently found in overweight girls and least common in girls with normal BMI. Difference was found statistically significant (p value <0.05).

Table 7: Correlation of polymenorrhoea (<21 days) with BMI.

BMI (kg/m^2)	No. of girls	Oligomenorrhoea	%	P value
<18.5	119	2	1.7	
18.5-24.99	357	3	0.8	0.167
>25	124	4	3.2	

As shown in Table 7, only 2 girls (1.7%) with less BMI, 3 girls (0.8%) with normal BMI and only 4 girls (3.2%) with higher BMI had polymenorrhoea. So, it was more frequently found in overweight girls and least frequently found in underweight girls. Difference was statistically not significant (p value >0.05).

Table 8: Correlation of premenstrual symptoms with BMI.

BMI (kg/m^2)	No. of girls	Premenstrual symptoms	%	P value
<18.5	119	43	36.1	
18.5-24.99	357	166	46.5	0.014
>25	124	68	54.8	

As shown, only 43 underweight girls (36.1%), 166 girls (46.5%) with normal BMI and 68 girls (54.8%) with higher BMI had premenstrual symptoms. Difference in these was statistically significant (p value <0.05).

So, in our study premenstrual symptoms were frequently found in overweight girls and least frequently found in underweight girls.

DISCUSSION

Menstruation is an inevitable part of girl's life and an indicator of physical, physiological and functional wellbeing. In this study we attempted to find out menstrual pattern and its correlation with BMI in adolescents.

The adolescent group comprises one fifth of the total population of the world and in India, about 22% of the population falls into this age group.[8-13]

In this study nutritional status was determined by their BMI. Out of total 600 girls, 119 girls (19.8%) had a BMI<18.5 kg/m^2, 357 girls (59.5%) had normal BMI and 124 girls (20.7%) were overweight. Maximum girls were found having normal BMI. Mean BMI was found 21.6±3.64 kg/m^2. Minimum BMI was found 15.4 kg/m^2 and maximum BMI was found 29.7 kg/m^2. Study by Dars et al in adolescents, observed 108 girls (27%) with BMI 14-18.49 kg/m^2, 277 girls (69%) with BMI 18.5-24.99 kg/m^2 and only 16 girls (4%) with BMI 25-29.99 kg/m^2.[14] They observed the mean BMI 19.65±2.41 kg/m^2. Another cross-sectional study done by Mohite et al in 230 adolescent girls at slums of Maharashtra.[15] They found 94 girls (40.86%) with low BMI. 117 girls (50.86%) with normal BMI and only 19 girls (8.26%) had high BMI. Reason of different result may be that present study was done at schools of urban area and students belonged to well-educated and fair socio-economic status.

In our study, dysmenorrhoea was seen in 68 girls with BMI<18.5 kg/m^2 which was 57.1% of 119 girls. 205 girls with normal BMI were found having dysmenorrhoea which was 57.4% of 357 girls and 62 girls with BMI>25 kg/m^2 had dysmenorrhoea which was 50% of 124 girls.

So, it appears that girls with high BMI had less chances of dysmenorrhoea than normal and low BMI girls, but results were found statistically not significant (p value >0.05). So, we can say that BMI does not affect occurrence of dysmenorrhoea in our study. In study by Rupa et al they found 76.5% underweight girls, 69.4% normal weight girls and 76.3% overweight girls with dysmenorrhoea, result of their study was found statistically not significant (p value >0.05).[16] Another study by Mohite et al revealed statistically significant correlation between dysmenorrhoea and BMI.[15] They found dysmenorrhoea in 58 girls with low BMI, in 47 girls with normal BMI and 8 girls with BMI>25 kg/m^2. The difference might be due to either more tolerance in rural or slum area girls or neglect of their complaints or better acceptance of symptoms.

In this study, menorrhagia was seen in 13.3% girls. Out of them 19 girls (16%) with less BMI, 46 girls (12.9%) with normal BMI and 15 girls (12.1%) with higher BMI had menorrhagia. It was more common (16%) in underweight girls. In this study statistically not, significant correlation was found between menorrhagia and BMI (p value >0.05). Study by Rupa et al also observed statistically not significant correlation (p value >0.05).[16] Study by Mohite et al reported menorrhagia in 17.82 % girls.[17] They found menorrhagia in 13 girls with low BMI, 23 girls with normal BMI and only 5 girls with BMI>25 kg/m^2. They also found statistically not significant correlation (p value >0.05) and all these studies support our study.

In present study, hypomenorrhoea was seen in 30 girls (5%). In these 30 girls, 4 girls (3.4%) with low BMI, 14 girls (3.9%) with normal BMI and 12 girls (9.7%) with higher BMI had hypomenorrhoea. So, we can say that in our study hypomenorrhoea was more common in overweight girls. Result was found statistically significant (P value <0.05). In another cross-sectional study by Mohite et al, hypomenorrhoea was seen in 76 girls with BMI<18.5 kg/m^2, 54 girls with BMI 18.5-24.99 kg/m^2 and 5 girls with BMI>25 kg/m^2 out of 94, 117 and 19 girls respectively.[15] They also found statistically significant correlation between hypomenorrhoea and BMI (p value <0.05).

In this study, irregular menstrual cycle was found in 75 girls (12.5%). Out of these 75 girls, 10 girls (8.4%) with BMI<18.5 kg/m^2, 37 girls (10.4%) with normal BMI and 28 girls (22.5%) with BMI>25 kg/m^2 had irregular menstruation. So, in our study irregular menstruation was more common in overweight girls than normal BMI and underweight girls. Result was found statistically significant (p value <0.05).

Deshpande et al done a cross sectional study among 200 girls and observed that 8 girls (42.1% of girls with BMI<18 kg/m^2) had irregular menstruation, 16 girls (13.6% of girls with normal BMI and 57 girls (90.4% of girls with BMI>25 kg/m^2) had irregular menstrual cycles.[17] The association was also found to be highly statistically significant (p value <0.0001). Rupa et al observed irregular cycle in 15.3% underweight girls, 17.8% normal weight girls and 21.9% overweight girls and support our study.[16] But they found that association between irregular cycles and BMI was statistically not significant (p value >0.05).

In present study, oligomenorrhoea was found in 5 girls (4.2%) with less BMI, 12 girls (3.4%) with normal BMI and 11 girls (8.9%) with BMI>25 kg/m^2. Maximum percentage of oligomenorrhoea was seen in girls with higher BMI. This result was found statistically significant (p value <0.05). Study by Dars et al also revealed statistically significant relationship between BMI and oligomenorrhoea (p value <0.001).[14] Chung et al also observed that BMI of ≥23 kg/m^2 was associated with persistently long cycle length as compared to those with a normal BMI (p value <0.01).[18] So, we can conclude that oligomenorrhoea is more frequently found in overweight girls.

In this study, all girls were asked about frequency of menstruation and polymenorrhoea was seen in 2 girls (1.7%) with less BMI, 3 girls (0.8%) with normal BMI and 4 girls (3.2%) with BMI>25 kg/m^2. So, we can say that

polymenorrhoea was more frequently found in girls with high BMI. But the association between polymenorrhoea and BMI was found statistically not significant (p value >0.05). Study by Agarwal et al found that with increasing BMI, there was a significant increase in the prevalence of oligomenorrhoea whereas polymenorrhoea was more prevalent in girls with low BMI.[19]

In our study, premenstrual symptoms were found in 43 girls (36.1%) with less BMI. 46.5% (166) girls with normal BMI and 68 girls with higher BMI which was 54.8%. So premenstrual symptoms were found more in high BMI group. Results were found statistically significant (p value <0.05). Similar results were found in study by Rupa et al.[16] They found premenstrual symptoms in 45.9% underweight girls, 52.8% normal weight girls and 58.8% overweight girls. Result was found statistically significant (p value <0.05). Study by Mohite et al also found statistically significant result (p value <0.05).[15] They observed premenstrual symptoms in 57 girls with low BMI, 44 girls with normal BMI and 6 girls with high BMI. So premenstrual symptoms are found more frequently in overweight girls (BMI>25 kg/m^2), that could be due to physical activity because it releases endorphins into the body, which improve premenstrual symptoms like getting rid of depression or anxiety. Another reason may be junk food habits in overweight because junk food being rich in saturated fatty acids might interfere with metabolism of progesterone in the luteal phase and result in premenstrual symptoms. Junk food being deficient in micronutrients like vitamin B_6, calcium, magnesium and potassium might also be responsible for triggering premenstrual symptoms.

There are few limitations. Sample size: the study has a limited sample size, which could affect the generalizability of the findings to larger populations. Selection bias: the sample cannot be representative of the general population, as the study only include adolescents from specific schools. Self-reported data: the study rely on self-reported data, which could be subject to recall bias or social desirability bias, as participants may under-report or over-report their menstrual disorders. Cross-sectional design: the study has a cross-sectional design, which can only establish a correlation between menstrual disorders and BMI but cannot establish causality or temporal relationships. BMI measurement: the study relies on BMI as the only measure of adiposity, which may not accurately reflect body fat distribution or overall body composition. Lack of hormonal assessment: the study does not assess hormonal levels, which can also impact menstrual regularity and disorders. Lack of control for confounding variables: the study does not control for all potential confounding variables, such as socioeconomic status or physical activity levels, which could impact the outcomes.

CONCLUSION

After discussing the results of the present study with previous studies, following conclusions can be drawn: mean BMI was found 21.6±3.64 kg/m^2. High BMI girls had more oligomenorrhoea, hypomenorrhoea, irregular menstrual cycles, polymenorrhoea, premenstrual symptoms and less dysmenorrhea and menorrhagia comparatively to normal BMI girls and underweight girls.

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