

STUDY OF MENSTRUAL CYCLE DISORDERS IN ADOLESCENT GIRLS IN RELATION TO BMI*Bijoy Kumar Dutta¹, Tanma Saikia², Prafulla M³*¹Associate Professor, Department of Obstetrics and Gynaecology, Gauhati Medical College and Hospital, Assam, India.²Assistant Professor, Department of Obstetrics and Gynaecology, Gauhati Medical College and Hospital, Assam, India.³Postgraduate Trainee, Department of Obstetrics and Gynaecology, Gauhati Medical College and Hospital, Assam, India.**ABSTRACT****BACKGROUND**

The onset of menstruation or menarche is a hallmark of female pubertal development. Menstrual disorders are common among adolescent girls and are a significant source of morbidity in this population. Several environmental factors, status of nutrition in childhood, malnutrition ranging from undernutrition (underweight) to overnutrition (overweight/obesity) affect the regulation of menstrual cycles in females. Purpose of this study was to determine the menstrual cycle characteristics of adolescent girls and its relation to Body Mass Index (BMI).

MATERIALS AND METHODS

Hospital based observational study was carried out on 200 Adolescents with menstrual cycle disorders attending a tertiary care hospital. All these girls were interviewed for detailed history including age at menarche, menstrual cycle characteristics like length, flow duration, regularity, pain during menstruation, a thorough general-physical and systemic examination were carried out after obtaining written informed consent. Height, weight and BMI were calculated. Statistical analysis was done using SPSS (version 17) software. Relationship between BMI and other parameters were tested by Chi-square test for association. A P value of 0.05 or less was considered as statistically significant.

RESULTS

In the present study, 45.5% girls had normal BMI, 30% were underweight and 24.5% were overweight. Most (60.5%) of the girls attained menarche by 12 years of age. Mean age at menarche was 12.3 years \pm 1.01. Dysmenorrhoea (38%) was the most common menstrual complaint followed by increased cycle length (16.5%) and excessive bleeding (15%). Significant correlation was observed between BMI with menstrual cycle length ($p < 0.001$), oligomenorrhoea ($p < 0.001$), secondary amenorrhoea ($p < 0.001$), BMI with menstrual flow duration ($p = 0.014$), perception of flow ($p = 0.001$) and dysmenorrhoea ($p < 0.001$). However, we found no correlation between BMI and premenstrual syndrome ($p = 0.15$) and BMI with menstrual cycle regularity ($p = 0.23$).

CONCLUSION

Present study was an overview of adolescent menstrual problems and their relation to BMI. The study showed that almost half of the adolescents had abnormal BMI i.e., both under-weight and overweight. Menstrual problems are common in adolescent girls because of premature HPO Axis physiologically. But changing lifestyle has increased incidence of bulimia nervosa, anorexia nervosa, obesity and sedentary life style. All these factors have an influence on developing adolescent girl. This is a vicious cycle of over-eating/malnutrition adding to abnormal BMI which has an effect on physical activity of these girls which leads to menstrual problems.

KEYWORDS

Adolescent Girls, Menstrual Problems, Body Mass Index, Menstrual Cycle.

HOW TO CITE THIS ARTICLE: Dutta BK, Saikia T, Prafulla M. Study of menstrual cycle disorders in adolescent girls in relation to BMI. J. Evid. Based Med. Healthc. 2018; 5(47), 3239-3244. DOI: 10.18410/jebmh/2018/659

BACKGROUND

Adolescence is derived from Latin word *adolescere* = "to grow" is the unique period of life between childhood and adulthood. Adolescent girl is subjected to profound biological, morphological, psychological changes commence

Financial or Other, Competing Interest: None.

Submission 05-10-2018, Peer Review 10-10-2018,

Acceptance 16-10-2018, Published 13-11-2018.

Corresponding Author:

Dr. Prafulla M,

#1784/20, 7th Main,

14th Cross, Siddaveerappa Layout,

Davangere- 04, Karnataka.

E-mail: mprafu@gmail.com

DOI: 10.18410/jebmh/2018/659

with the growth spurt followed by secondary sexual characteristics whose changes transfer the care free child to the reproductive adult becoming fully mature and eventual fertility. WHO defines adolescence in the age group between 10 and 19 years. Early adolescence comprises 10 to 14 years age group and late adolescence includes the age group of 15-19 years.

Girls at late adolescence are at greater risk as compared to boys regarding health mainly menstrual disorders. The age at menarche is determined by general health, genetic, socio-economic and nutritional factors. The mean age of menarche is typically between 12 and 13 years.^{1,2} The initial cycles after menarche are often irregular with a particularly greater interval between first and second cycle. The early



menstrual cycles are set to be anovulatory, with frequency of ovulation being related to time since menarche and age at menarche. By third year after menarche, 60% to 80% of menstrual cycles are 21 to 34 days long, as is typical of adults.³ Abnormal body weight in the form of underweight, overweight including Obesity in adolescent girls leads to increase risk of menstrual problems.⁴ Currently BMI of adolescent age group is in increasing trend around the world. As per WHO, the BMI of 12 to 17 years old girls has increased from 5.7% on 2009 to 11.1% on 2011⁵ which may adversely affect female reproductive health. It has been observed that both underweight and overweight girls have increased risk of menstrual problem.⁴ With increasing body mass index (BMI), there was a significant increase in prevalence of oligomenorrhoea whereas polymenorrhoea was more prevalent in the girls with low BMI.⁶

The present study is being undertaken on menstrual disorders in relation to BMI among adolescent girls and to assess the burden of disease among them.

MATERIALS AND METHODS

The present study was conducted in the department of Obstetrics and Gynaecology, Gauhati Medical College and Hospital, Guwahati. In this study, 200 cases of adolescent girls with menstrual disorders having normal and abnormal BMI were studied between 1st June 2017 to 31st May 2018 after obtaining clearance from Institutional Ethical Committee of Gauhati Medical College and Hospital.

History taking, and examination of adolescent was carried out in comfortable and confidential environment. During relevant history taking of adolescent girl, presence of appropriate adult witness, support person or chaperone was made sure while examining the patient. Child / young women dignity and privacy were maintained throughout the examination. Reason for patient examination and immediate feedback on findings were given. With a valid expressed /informed consent (in case of a minor consent was obtained from guardian) height, weight, waist and hip circumference measurements of each adolescent girl were noted and vital signs were recorded. Patient was asked to lie down after the bladder being emptied. Systemic examination, breast and thyroid examination were done. Internal examination was not done in any of the patient instead a per rectal examination was done. Investigations were indicated in pathological conditions. Patients were followed up with investigation reports, drug therapy and proper counselling regarding diet, exercise, lifestyle and behavioural modifications. However, the girls who were diagnosed with menorrhagia were treated with oral hormonal medications, haematinics or blood transfusions according to haemogram reports. Some are advised admission for acute events of menorrhagia and treated accordingly.

Inclusion Criteria

- 12-19 years adolescent girls with menstrual cycle disorders.
- Unmarried
- nulliparous

Exclusion Criteria

- Married girls
- Chronic diseases
- Medications including OCPs
- H/O smoking & alcohol consumption
- Primary amenorrhoea
- Failure to follow up / drop outs
- Pregnancy

Statistical Methods

Results were presented as Mean and Standard deviation for continuous data and number and percentages for categorical data. Relationship between BMI and other parameters were tested by Chi-square test for association. A P value of 0.05 or less was considered for statistical significance. SPSS (version 17) software was used for analysis.

RESULTS

Adolescent menstrual problems are common and a significant source of morbidity in this population. The objective of this study was to assess the relationship between the BMI and menstrual cycle disorders. In our study, most of the adolescents were 18 years of age, 26% girls belong to early adolescent age group of 12-14 years whereas 74% girls belong to late adolescent group aged between 15 and 19 years.

Age (Yrs.)	No. of Girls	%
12	20	10.0
13	15	7.5
14	17	8.5
15	14	7.0
16	19	9.5
17	35	17.5
18	42	21.0
19	38	19.0
Total	200	100.0

Table 1. Age Distribution of Adolescents Studied

Age at menarche ranged from 10 to 15 years. Majority of girls attained menarche at 12 years of age (42.5%). Mean age at menarche in the study was 12.3±1.01.

Age at Menarche	No. of Girls	%
10 Yrs.	3	1.5
11 Yrs.	35	17.5
12 Yrs.	85	42.5
13 Yrs.	52	26.0
14 Yrs.	21	10.5
15 Yrs.	4	2.0
Total	200	100

Table 2. Age at Menarche Among Adolescents with Menstrual Disorders

Dysmenorrhoea (38%) was the most common complaints among adolescents followed by increased menstrual cycle length (16.5%) and excessive menstrual

bleeding (15%) and only 0.5% girls presented with decreased menstrual cycle length and menstrual cycle flow each.

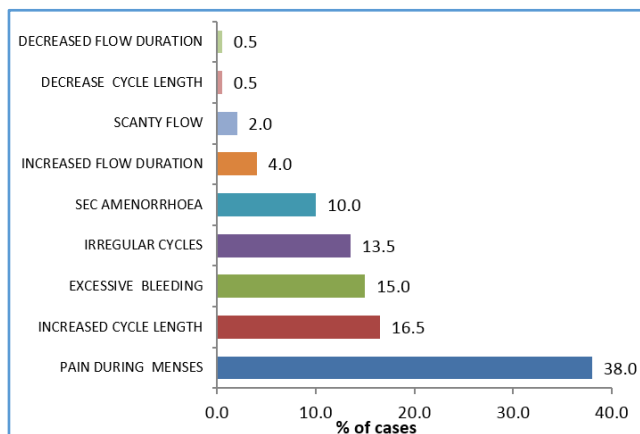


Figure 1. Bar Diagram Showing Menstrual Cycle Complaints Among Adolescent Girls

Majority of girls (45.5%) had a normal BMI of 18.5-24.99 kg/m² whereas 30% girls were underweight and 24.5% were overweight.

BMI (kg/m ²)	Categories	No. of Girls	%
< 18.49	Underweight	60	30.0
18.5-24.99	Normal	91	45.5
≥ 25.00	Overweight	49	24.5
Total		200	100.0

Table 3. Categories According to BMI

In this study, 64% girls had regular menstrual cycles whereas 36% had irregular cycles. Menstrual cycle length of 21-34 days was prevalent in 48% of girls and 24% girls had a cycle length of >45 days. Hypomenorrhoea was prevalent in 3.5% girls and hypermenorrhoea in 25.5% girls, 71% girls had a normal menstrual blood flow days of 3-7. Light menstrual flow was prevalent in 3.5%, moderate amount of flow in 75% and 21.5% girls had heavy flow. Acne, hirsutism and pallor were prevalent in 14%, 15% and 20%, respectively. Girls with acne and hirsutism mostly presented with oligomenorrhoea and secondary amenorrhoea with increased cycle length. Significant correlation observed between BMI and menstrual cycle length where increased cycle length duration was prevalent in higher BMI. Oligomenorrhoea and secondary amenorrhoea was more prevalent in overweight adolescents compared to girls with normal BMI and underweight girls. Polymenorrhoea was more prevalent in underweight girls and none of the girls had polymenorrhoea in overweight group. BMI had a significant correlation with menstrual flow duration and perception of flow. Hypomenorrhoea was more prevalent in underweight girls whereas, menorrhagia was more common among underweight and girls with normal BMI compared to overweight girls. BMI had a strong correlation with dysmenorrhoea. Underweight and normal BMI girls showed more prevalence than overweight girls. However, no

correlation was found between BMI and PMS and also BMI with regularity of cycles.

Sl. No.	Variables	Frequency	Percentage (%)
1.	Regularity		
	Regular	128	64
	Irregular	72	36
2.	Cycle Length (days)		
	<21	2	1
	21-34	96	48
	35-45	32	16
	>45	49	24.5
	IR	21	10.5
3.	Flow Duration (days)		
	<3	7	3.5
	3-7	142	71
	>7	51	25.5
4.	Perception of Flow		
	Light	7	3.5
	Moderate	150	75
	Heavy	43	21.5

Table 4. No. of Adolescents with Menstrual Characteristics

DISCUSSION

The menstrual cycle is the natural phenomena that occurs in the female reproductive system from menarche to menopause and is essential for human reproduction. Adolescent girls in the age group of 13 to 19 years suffer from menstrual disorders ranging from scanty or excessive menstrual blood loss, duration of bleed, length and regularity of menstrual cycle.

In the present study, out of 200 adolescents, 74% of girls belong to late adolescent age group. The mean age at menarche among 200 adolescents was 12.3 years, 85 girls attained menarche at 12 years of age. Most of the girls presented with dysmenorrhoea as their chief complaint followed by increased cycle length, excessive bleeding and irregular menstrual cycles.

Among the girls studied, 45.5% girls had normal BMI, 30% girls were underweight, and 24.5% girls were overweight. It was observed that in our study, BMI had a significant relationship with menstrual cycle length, oligomenorrhoea, secondary amenorrhoea, dysmenorrhoea and menstrual flow. Both overweight and underweight adolescents had increased prevalence of irregular menstrual cycles and increased menstrual cycle length.

Variables	BMI of Respondents (%)			p value
	< 18.49 (underweight)	18.5-24.99 (normal weight)	≥ 25 (over weight)	
Regularity				
Regular	58.3	70.3	59.2	0.23
irregular	41.7	29.7	40.8	
Cycle Length (days)				
<21	1.7	1.1	-	<0.001
21-34	45	67	16.3	
35-45	13.3	14.3	22.4	
>45	23.3	11	51	
IR	16.7	6.6	10.2	
Oligomenorrhoea				
with	36.7	25.3	73.5	<0.001
without	63.3	74.7	26.5	
Secondary Amenorrhoea				
With	1.7	-	38.8	<0.001
without	98.3	100	61.2	
Flow Duration (Days)				
<3	8.3	1.1	2	0.014
3-7	63.3	68.1	85.7	
>7	28.4	30.8	12.2	
Perception of Flow				
Light	6.7	1.1	4.1	0.001
Moderate	56.7	80.2	87.7	
Heavy	36.6	18.7	8.2	
Dysmenorrhoea				
With	51.7	68.1	26.5	<0.001
Without	48.3	31.9	73.5	
PMS				
With	16.7	30.8	12.2	0.15
without	83.3	69.2	75.5	

Table 5. Relationship between BMI and Menstrual Cycle Characteristics

Relationship between dysmenorrhoea and BMI was found to be highly significant ($p = <0.001$) with increased prevalence of dysmenorrhoea in underweight girls (51.7%) as compared to overweight girls (26.5%). Our results were supported by the study of Hirata et al. who found the frequency of dysmenorrhoea to be greatest in the underweight group.⁷ Similarly, Madhubala Chauhan and Jyoti kala did a cross-sectional study on 400 school going girls in the age group 12-18 years and found highly significant relation between dysmenorrhoea and BMI with increased prevalence of dysmenorrhoea in the low BMI group.⁸ But in the study done by Harlow et al being overweight was important factor for dysmenorrhoea.⁹ Montero et al found that attempting to lose weight were significantly associated with dysmenorrhoea, but their findings were independent of BMI.¹⁰ Primary physiological dysmenorrhoea which is prostaglandin-mediated physiological menstrual cramping typical of ovulatory cycles is usually not present at menarche; it accompanies the establishment of ovulatory cycles.

In this study, irregular cycles and increased menstrual cycle length were more prevalent in underweight and overweight adolescents, which is similar to the study done by S. Priyanka, and Panicker S.¹¹ With increasing BMI, there

was a significant increase in the prevalence of oligomenorrhoea and secondary amenorrhoea and prevalence of polymenorrhoea was more in underweight girls (1.7%) and progressively decreased as BMI increased, while none of the obese girls presented with polymenorrhoea and these observations showed statistically high significance between BMI and oligomenorrhoea and secondary amenorrhoea. These findings were similar to results of the study done by Agarwal et al.⁶ and Shinde GR, Laddad M.¹² Subjective abnormal hair growth and acne was more prevalent in adolescents with oligomenorrhoea and secondary amenorrhoea as explained by the association of acne, hirsutism and overweight with hyperandrogenism. This is supported by the study done by Chung et al.¹³ on 577 adolescents aged 14 to 19 years found that cycle length at first consultation, previous diagnosis of PCOS and current body mass index of $\geq 23 \text{ kg/m}^2$ at follow up are risk factors for persistently long menstrual cycle length. Peripheral aromatization of androgens to steroids increased by the increase in adipose tissue which leads to changes in globulin hormone levels binding to sex hormones that can result in impaired regulation of menstrual cycle. Obesity is an independent risk factor for several hormonal abnormalities such as increased concentrations of testosterone, reduced

concentrations of Sex Hormone Binding Globulin (SHBG) which influence the menstrual cycle.

Hypomenorrhoea with a flow duration of less than 3 days was prevalent in 3.5% of adolescents, we found it to be more in underweight and obese girls whereas menorrhagia with menstrual cycle flow of more than 7 days were more in underweight girls (28.4%) compared to overweight adolescents (12.2%). However, no significant difference was found in girls with normal menstruating days of 3-7 among different BMI groups.

Perception of menstrual flow was assessed by noting down the no. of pads changed during menstrual flow days including day and night. Light menstrual flow was more prevalent in underweight girls (6.7%) and overweight (4.1%) adolescents whereas heavy flow was more in underweight girls (36.6%) compared to normal (18.7%) and overweight girls (8.2%). We observed significant relation between BMI with duration of menstrual flow and perception of flow. This was similar to the study by Binu Thapa and Tripti Shrestha,¹⁴ where there was statistical association existed between nutritional status of adolescent girls according to BMI and hypomenorrhoea. It has been documented that environmental factors, status of nutrition in childhood, malnutrition ranging from undernutrition (underweight) to overnutrition (overweight or obesity) affect the regulation of menstrual cycle in females.

No association was found between BMI and premenstrual syndrome in this study where 25% girls had PMS. Among them, 16.7% underweight girls and 12.2% overweight girls presented with PMS as compared to 30.8% girls with normal BMI. This contradicts the study done by Lee L.K and Chen¹⁵ on 2,411 girls ages between 12 to 19 where PMS was significantly more common among overweight females than those who were underweight, and this had a statistically significant relation between BMI and PMS ($p= 0.017$). Study done by Shinde GR, Laddad M¹² shows increased prevalence of PMS in underweight girls compared to overweight and girls with normal BMI. The aetiology of PMS is unknown, and it is relatively uncommon disorder during adolescence. Adolescents commonly complain of PMS when they are actually experiencing dysmenorrhoea or psychosocial problems. It is important in this respect to investigate any underlying psychosocial disorder that may co-exist with PMS. Henceforth, adolescent girls are given counselling and managed appropriately.¹⁶

As for limitations of the study, we could not validate the self-reported information about the menstrual cycles which can be influenced by subjective bias related to the memory and recall of all the events that have happened earlier. And also, short duration of follow up after few months in the study period of one year did not influence the anthropometric variables such as height and weight.

We recommend that further longitudinal studies may be undertaken with multicentric, longer duration of study period and larger sample size of similar age group using a relatively validated questionnaire for the assessment of other factors such as intake of junk foods, physical activity, stress other anthropometric indicators such as waist/height ratios and

clinical manifestations of menstrual disorders. The incorporation of hormonal assay in such study protocol will definitely be of great help in understanding the various menstrual abnormalities experienced by adolescents.

CONCLUSION

Present study was an overview of adolescent menstrual problems and its relation to BMI. The study showed that almost half of the adolescents had abnormal BMI i.e., both under-weight and overweight. Menstrual problems are common in adolescent girls because of premature HPO Axis physiologically. But changing lifestyle has increased incidences of bulimia nervosa, anorexia nervosa, obesity and sedentary life style. All these factors have an influence on developing adolescent girl. This is a vicious cycle of over-eating/malnutrition adding do abnormal BMI which has an effect on physical activity among these girls which leads to menstrual problems.

REFERENCES

- [1] Herman-Giddens ME, Slora EJ, Wasserman RC, et al. Secondary sexual characteristics and menses in young girls seen in office practice: a study from the pediatric research in office settings network. *Pediatrics* 1997;99(4):505-512.
- [2] World Health Organization task force on adolescent reproductive health. World Health Organization multicenter study on menstrual and ovulatory patterns in adolescent girls. I. A multicenter cross-sectional study of menarche. *J Adolesc Heal Care* 1986;7(4):229-235.
- [3] Flug D, Largo RH, Prader A. Symptoms related to menstruation in adolescent Swiss girls: a longitudinal study. *Ann Hum Biol* 1985;12(2):161-168.
- [4] Lake JK, Power C, Cole TJ. Women's reproductive health: the role of body mass index in early and adult life. *Int J Obes Relat Metab Disord* 1997;21(6):432-438.
- [5] Roberts KC, Shields M, de Groh M, et al. Overweight and obesity in children and adolescents: results from the 2009 to 2011 Canadian health measures survey. *Health Rep* 2012;23(3):37-41.
- [6] Agarwal A, Venkat A. Questionnaire study on menstrual disorders in adolescent girls in Singapore. *J Pediatr Adolesc Gynecol* 2009;22(6):365-371.
- [7] Hirata M, Kumabe K, Inoue Y. Relationship between the frequency of menstrual pain and bodyweight in female adolescents. *Nihon Kosho Eisei Zasshi* 2002;49(6):516-524.
- [8] Chauhan M, Kala J. Relation between dysmenorrhoea and body mass index in adolescents with rural versus urban variation. *J Obstet Gynaecol India* 2012;62(4):442-445.
- [9] Harlow SD, Park M. A longitudinal study of risk factors for the occurrence, duration and severity of menstrual cramps in a cohort of college women. *Br J Obstet Gynaecol* 1996;103(11):1134-1142.
- [10] Montero P, Bernis C, Fernandez V, et al. Influence of body mass index and slimming habits on menstrual pain and cycle irregularity. *J Biosoc Sci* 1996;28(3):315-323.

- [11] Priyanka S, Panicker S. Menstrual pattern in adolescence and its relation to BMI. *Australasian Med J* 2012;5(1):114-115.
- [12] Shinde GR, Laddad M. Overview of adolescent menstrual problems and its relation to BMI, eating habits and physical activity. *J Evolution Med Dent Sci* 2016;5(91):6757-6761.
- [13] Chung J, Chan SSC, Yiu KW, et al. Menstrual disorders in a paediatric and adolescent gynaecology clinic: patient presentations and longitudinal outcomes. *Hong Kong Medical Journal* 2011;17(5):391-397.
- [14] Thapa B, Shrestha T. Relationship between body mass index and menstrual irregularities among the adolescents. *Int J Nurs Res Pract* 2015;2(2):7-11.
- [15] Lee LK, Chen PC, Lee KK, et al. Menstruation among adolescent girls in Malaysia: a cross-sectional school survey. *Singapore Med J* 2006;47(10):869-874.
- [16] McEvoy M, Chang J, Coupey SM. Common menstrual disorders in adolescence: nursing interventions. *MCN Am J Matern Child Nurs* 2004;29(1):41-49.