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Original Research Article

Study of correlation between age of menarche and body mass index in adolescent

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ABSTRACT

Background: Younger age at menarche is associated with higher body mass index (BMI) for adolescents. Obesity has a strong association with infertility and menstrual irregularities. Higher BMI at menarche is associated with an earlier occurrence of menarche. The timing of menarche was associated with the BMI, waist circumference, thickness of skin fold, but more strongly so with the BMI.
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: In studied girls, maximum girls 267 (44.5%) attained menarche at age of 13 years. 129 girls (21.5%) had menarche at age of 12 years. 87 girls (14.5%) had menarche at age of 11 years. 77 girls (12.8%) had menarche at age of 14 years. 39 girls (6.5%) had menarche at age of 15 years. Only 1 girl (0.2%) had menarche at age of 10 years. 119 girls with BMI of <18.5 kg/m^2 had mean age of menarche 12.92±1.03 years. 357 girls with BMI of 18.5-24.99 kg/m^2 had mean age of menarche 12.74±1.07 years. 124 girls with BMI of >25 kg/m^2 had mean age of menarche 12.60±1.07 years.
Conclusions: Mean age of menarche in adolescent girls was 12.75±1.06 year. Mean BMI was found 21.6±3.64 kg/m^2. High BMI girls had earlier menarche, comparatively to normal BMI girls and underweight girls.

Keywords: Menarche, BMI, Adolescent girls

INTRODUCTION

WHO has defined adolescence as progression from appearance of secondary sexual characters to sexual and reproductive maturity and development of adult mental processes.[3] Menstrual cycle is a normal physiological process that is characterized by periodic and cyclic shedding of progestational endometrium.[2] The age of menarche is determined by general health, genetic, socio-economic and nutritional factors. The mean age of menarche is typically between 12 and 13 years.[1,16] Young patients and their parents frequently have difficulty assessing what constitutes normal menstrual cycles or pattern of bleeding. Girls may be unfamiliar with what is normal and may not inform their parents about menstrual irregularities or missed menses.

Menstrual disturbances are common among the adolescent age and are often explained by the immaturity of the hypothalamic-pituitary-gonadal axis.[4] Body mass index (BMI) is a simple index of weight for height. It is defined as the weight in kilograms divided by the square of the height in metres.[5] Due to change in lifestyle, habits, diet, the prevalence of obesity has increased in the developed world which results in decreased age at menarche.[12] Younger age at menarche is associated with higher BMI for young women. Obesity has a strong association with infertility and menstrual irregularities.[9] Higher BMI at menarche is associated with an earlier occurrence of

menarche. The timing of menarche was associated with the BMI, waist circumference, skin fold thickness, but more strongly so with the BMI.

Aims and objectives

The aims of this study were as follows: to impart knowledge about menstruation and menstruation related problems among young adolescent girls; to create awareness among young school girls about the significance of BMI and its relation with menstrual disorders; and to provide an idea of quality of life to young adolescent girls by improving their environment and giving them health education about menstrual disorders.

To achieve the aim, following objectives were set for this study: to study the mean age of menarche; and to find out the BMI and correlation of nutrition in terms of BMI with age of menarche.

METHODS

Study setting

The 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 (2012-2014).

Study period

The duration of the study was for one year.

Study design

It was a cross sectional research study.

Eligibility criteria

Adolescent girls between 12-to-17-year age group were eligible to participate in the study.

Inclusion criteria

Girls aged between 12-17 years age group, who were unmarried and attained menarche, and whose parents have given consent were included in the study.

Exclusion criteria

Girls who were on hormonal treatment for menstrual disorders, and who did not appear for the interview were excluded.

Study tool

The following study tools were used: pretested pre designed questionnaire, weighing machine, and height measuring tape.

Methods of collection of data

Personal interview with adolescent girls using pre designed questionnaires, height and weight measurement and physical examination. Questionnaire included name, age, sociodemographic information, basic personal details, menarcheal age, menstrual pattern (regularity, cycle length, duration, and amount of flow), source of information about menarche and whether they required medical help for menstrual disorder or not. Age of the students was rounded off. Pre designed questionnaires were distributed and collected on the same day to ensure confidentiality and to prevent information contamination. Same day height and weight 30 were also measured. Weight was measured in kilograms. Height was also taken barefooted in centimeter using a measuring tape fixed vertically and BMI was calculated using the formula weight (kg)/ height^2 (metre^2).

According to BMI, nutritional status was classified as undernourished, 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 the aim of study was explained and informed consent was obtained from adolescent girls.

Statistical methods

Categorical variables are 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 statistical package for the social sciences (SPSS) version 16 has been used for the analysis. An alpha level of 5% has been taken, i.e. if any p value is less than 0.05 it has been considered as significant.

RESULTS

As shown in Table 1, the mean age of girls in our study was 13.9±1.32 years in which minimum age was 12 years and maximum age was 17 years.

Table 1: Age of adolescent girls.

Total no. of girls	Age of girls (years)		
	Mean±SD	Minimum	Maximum
600	13.9±1.32	12	17

As shown in Table 2, mean BMI in the studied girl was found 21.6±3.64 kg/m^2. Minimum BMI seen in study was 15.4 kg/m^2 and maximum BMI found was 29.7 kg/m^2.

Table 2: BMI among adolescent girls.

Total no. of girls	BMI (kg/m^2)		
	Mean±SD	Minimum	Maximum
600	21.6±3.64	15.4	29.7

As shown in Table 3, mean age of menarche was found 12.75±1.06 years. Minimum age of menarche was 10 years and maximum age was found 15 years.

Table 3: Age of menarche among adolescent girls.

Total no. of girls	Age of menarche (years)		
	Mean±SD	Minimum	Maximum
600	12.75±1.06	10	15

As shown in Table 4, maximum girls 267 (44.5%) attained menarche at age of 13 years. 129 girls (21.5%) had menarche at the age of 12 years. 87 girls (14.5%) had menarche at the age of 11 years. 77 girls (12.8%) had menarche at the age of 14 years. 39 girls (6.5%) had menarche at the age of 15 years. Only 1 girl (0.2%) had menarche at the age of 10 years.

As shown in Table 5, out of total 600 adolescent girls, 119 girls (19.8%) were having BMI <18.5 kg/m^2, 357 girls (59.5%) were having BMI between 18.5–24.99 kg/m^2 and 124 girls (20.7%) were having BMI >25 kg/m^2. So maximum girls had BMI 18.5–24.99 kg/m^2.

Table 4: Distribution of cases according to age of menarche.

Age of menarche (years)	No. of girls	Percentage
10	1	0.2
11	87	14.5
12	129	21.5
13	267	44.5
14	77	12.8
15	39	6.5
16	-	0
17	-	0

Table 5: 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

As shown in Table 6, out of a total 600 girls, 119 girls with BMI <18.5 kg/m^2 had mean age of menarche 12.92±1.03 years. 357 girls with BMI of 18.5-24.99 kg/m^2 had mean age of menarche 12.74±1.07 years. 124 girls with BMI of >25 kg/m^2 had mean age of menarche 12.60±1.07 years. So, in this study, girls with higher BMI had attained menarche earlier than normal BMI and underweight girls.

Table 6: Correlation of mean age of menarche with BMI.

BMI (kg/m^2)	No. of girls	Mean age of menarche	Standard deviation	P value
<18.5	119	12.92	1.03	0.056
18.5-24.99	357	12.74	1.07	
>25	124	12.60	1.07	

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

DISCUSSION

Menstruation is an inevitable part of a girl's life and more so an important indicator of normal physical, physiological and functional wellbeing. In this study we attempted to find out the menstrual pattern and its correlation with BMI in adolescent girls.

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.[6,7,10,13,14]

In present study all 600 adolescent girls were distributed according to their age groups. Out of total 600 girls, 98 girls (16.3%) were of 12 years age, 166 girls (27.7%) were of 13 years age, 113 girls (18.8%) were of 14 years age, 149 girls (24.8%) were of 15 years age, 64 girls (10.7%) were of 16 years age and only 10 girls (1.7%) were of 17 years age group. Among these 600 girls, maximum girls were of 13 years age group and minimum girls were of 17 years age. In this study the mean age of adolescents was 13.9±1.32 years. Maximum age was 17 years and minimum age was 12 years as per inclusion criteria.

In the present study, the mean age of menarche was found 12.75±1.06 years. Minimum age at which menarche attained was 10 years and found in only 1 girl (0.2%). Maximum age of attainment of menarche was 15 years and found in 39 girls (6.5%). Majority of girls attained menarche at the age of 13 years which was 44.5% (267 girls). 129 girls (21.5%) attained menarche at age of 12 years. 87 girls (14.5%) attained menarche at the age of 11 years and 77 girls (12.8%) had menarche at age of 14 years. All the girls in this study attained menarche before the age of 16.

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%) were having normal BMI between 18.5-24.99 kg/m^2 and 124 girls (20.7%) were overweight with BMI <25 kg/m^2. Maximum girls were found having normal BMI. Out of a total 600 girls only

119 girls were found underweight (BMI <18.5 kg/m^2). Mean BMI of all girls 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.

In the present study all girls were asked about their first menstruation (menarche) by recall method. Mean age of menarche among 119 girls with BMI <18.5 kg/m^2 was found at 12.92 years with 1.03 standard deviation. 357 girls with BMI 18.5-24.99 kg/m 2 had mean age of menarche 12.74 years with 1.07 standard deviation. 124 girls with BMI >25 kg/m^2 had mean age of menarche 12.60 years with 1.07 standard deviation. So, in our study, girls with high BMI attained menarche earlier than girls with normal BMI and underweight girls. But the result was found statistically not significant (p value >0.05).

Two large studies have confirmed that a higher gain in BMI during childhood is related to an earlier onset of puberty.[8,11] One possible explanation is that higher levels of prepubertal BMI led to an increase in the production and availability of estrogen through various mechanisms, which predisposes to early menarche.[1] The association between increased body weight and metabolic early menarche also carries long term risks.

CONCLUSION

After discussing the results of the present study with previous studies, following conclusions can be drawn: mean age of menarche in adolescent girls was 12.75±1.06-year, mean BMI was found 21.6±3.64 kg/m^2, and high BMI girls had earlier menarche, compared to normal BMI girls and underweight girls.

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REFERENCES

1. Cheng G, Buyken AE, Shi L, Karaolis-Danckert N, Kroke A, Wudy SA, Degen GH and Remer T. Beyond overweight: nutrition as an important lifestyle factor influencing timing of puberty. Nutr Rev. 2012;70(3):133-52.
2. Begum J, Hossain AM, Nazneen SA. Menstrual pattern and common menstrual disorders among students in Dinajpur College. Dinajpur Med Col J. 2009;2:37-43.
3. Padubidri VG, Daftary SN. Shaw's textbook of gynaecology. 14th Edition. Noida: Reed Elsevier India Pvt. Ltd. Chapter 4, Paediatric Gynaecology, Adolescent Problems & Puberty. 2008;44-5.
4. Wiksten-Almströmer M, Hirschberg AL and Hagenfeldt K. Menstrual disorders and associated factors among adolescent girls visiting a youth clinic. Acta Obstet Gynecol Scand. 2007;86:65-72.
5. Kantachuvessiri A. Obesity in Thailand. J Med Assoc Thai. 2005;88(4);554-62.
6. Program for Appropriate Technology in Health (PATH). Adolescent Reproductive Health. Seattle: PATH. 2004.
7. United Nations. World population prospects: The 1998 revision. Volume I: Comprehensive tables. New York: United 82 Nations, Department of Economic and Social Affairs, Population Division 1999.
8. Wang Y. Is obesity associated with early sexual maturation? A comparison of the association in American boys versus girls. Pediatrics. 2002;110:903-10.
9. Larsen GP. Obesity related knowledge, attitudes and behaviours in obese and non-obese urban Philadelphia female adolescents. Obesity Research. 2001;9:112-18.
10. United Nations. World Population Prospects: The 2000 revision. Volume II: The sex and age distribution of the world population. New York: United Nations. 2001.
11. He Q, Karlberg J. BMI in childhood and its association with height gain, timing of puberty and final height. Pediatr Res. 2001;49:244-51.
12. Chowdhury S, Shahabuddin AK, Seal AJ, Talukder KK, Hassan Q and Begum RA. Nutritional status and age at menarche in a rural area of Bangladesh. Ann Hum Biol. 2000;27:249-56.
13. World Health Organization. Programming for adolescent health and development. Report of a WHO/UNFPA/UNICEF study group on programming for adolescent health. Geneva: World Health Organization. 1999.
14. International Institute for Population Sciences (IIPS) & ORC Macro. National Family Health Survey (NFHS-2), 1998- 99: India, Mumbai: IIPS. 2000.
15. Herman-Giddens ME, Slora EJ, Wasserman RC, Bourdony CJ, Bhapkar MV, Koch GG. Secondary sexual characteristics and menses in young girls seen in office practice: A study from the paediatric research in office settings network. Pediatrics. 1997;99(4):505-12.
16. World Health Organization task force on adolescent reproductive health. World Health Organization multicenter study on menstrual and ovulatory patterns in adolescent girls. A multicenter cross-sectional study of menarche. J Adolesc Health Care. 1986;7:229-35.

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