RESEARCH ARTICLE

GROWTH STATUS AND MENARCHEAL AGE AMONG ADOLESCENT SCHOOL GIRLS OF PUNJAB

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ABSTRACT

Menarcheal age is the age at which menstruation begins. The normal range is from 9 to 17 years of age. The aim of the study was to determined the age at menarche and growth status in the Patiala district of Punjab. The present cross- sectional study was carried out on 349 girls (179 menstruating, 170 non-menstruating girls) in the age range of 10 to 15 years. To determined the menarcheal status in the present study, status quo method was used. Height and weight were measured using standard procedure and the body mass index (BMI) was calculated. The median age at menarche calculated by probit analysis was 13±1.2 years. The menstruating girls had large values of height, weight and BMI than non-menstruating girls.

INTRODUCTION

Menarche is the first menstrual period or first menstrual bleeding. It is important from both social and medical perspectives and it is often considered the central event of female puberty, as it signals the possibility of fertility. The average age of menarche in the United States is about 12 years and 8 months. The "normal menstrual cycle" occurs every 28 days ±7 days. Menarcheal age is the most widely used indicator of sexual maturation and is known to be influenced by genetic factors, environmental conditions, body stature, family size, body mass index (BMI), socio-economic status and level of education [1-3]. It is the most accurately recalled indicator of puberty among girls [4]. It varies between individuals and populations [5]. Female anthropometry that reveals body composition had shown strong influence on their reproductive characteristics marked by the menarcheal age [6]. An early menarcheal age is associated with increased risk for breast cancer [7], obesity [8], endometrial cancer [9] and uterine leiomyomata [10]. Also, several studies had reported that age at menarche may related to subsequent reproductive performance, such as age at first pregnancy and risk of subsequent miscarriage [11]. Several studies had reported age at menarche had declined in developed countries [12-14] and this decline had also been noted in developing countries [15, 16]. Generally these declines had been associated with improvements in nutritional status and general health along with many environmental factors. The downward trend seems to had been halted in some countries [17]. The age of girls who start menstruating is an important factor in health planning, especially relating to the provision of sanitary facilities, health information concerning menstruating and contraception in primary and secondary schools, and the establishment of adolescent health centers [18].

Growth refers to a positive change in size, often over a period of time. Growth can occurs as a stage of maturation or a process towards fullness or fulfillment. Adolescent is a significant period of human growth and maturation. Individuals between the ages of 10-19 years were placed in adolescent age group. In this period spurt in somatic growth and the accompanying the appearance of secondary sexual characteristics, menarche, spermarche. This is also a period of increased nutritional requirements [19]. The beginning of biological growth and development during adolescence is signified by the onset of puberty, which is often defined as the physical transformation of a child into an adult. A myriad of biological changes occur during puberty including sexual maturation, increases in height and weight, completion of skeletal growth accompanied by a marked increase in skeletal mass and changes in body composition. Human height or stature is the distance from the bottom of the feet to the top of head in the human body, standing erect. It is measured usually in centimeters (8 ft. 6 in.) [20]. When populations share genetic background and environmental factors, average height is frequently characteristic within the group [21]. The term body weight is used colloquially and in the biological and medical

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sciences to refer to a person's mass or weight. Body weight is one way of determining a person's health. Human body weight is a function of sex, height, nutrition, heredity, socioeconomic conditions and geographic area [22].

BMI is a measure of weight for height and is commonly used to identify whether an individual or population of individuals is obese. A BMI of 25-29.9 kg/m^2 defines a person as overweight and a BMI of 30 kg/m^2 or above defines obesity.

Early menarche had been demonstrated to be associated with increased adult BMI [23]. The relationship between growth and menarche remains debatable. Stark *et al.* [24] content in their study that in affluent individual's nutrition is relatively unimportant. Other studies had indicated that girls who attained menarche were significantly heavier and taller than those of non-menstruating girls [25, 26].

Aims

The present study was aimed to evaluate the age at menarche and was also conducted to assess the Patiala (Punjab) school girls as thin, obese, overwt. and normal on the basis of BMI.

MATERIAL AND METHODS

The present cross-sectional study was conducted on 349 school girls (179 menstruating, 170 menstruating girls) in the age range of 10-15 years. The data was collected in January to February 2010. Height and weight of all subjects were measured by using standard techniques given by Lohman et al. [27]. The body mass index was calculated by using formula:

$$BMI = \frac{Weight\ (Kg)}{Height\ (m)^2}$$

For recording the menarcheal status in the present study status quo method was used. For this individual was interviewed by asking about the event whether experienced menarche or not. The median age at menarche of the total sample had been calculated through Probit Analysis [28].

The t-test was applied for finding whether the difference observed in different groups were significant or by chance occurrence. The formula was applied:

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{(SEM_1)^2 + (SEM_2)^2}}$$

where

$\overline{X}_1$ = Mean of parameter in one population
$\overline{X}_2$ = Mean of parameter in second population
(SEM_1) = Standard error of mean in one population
(SEM_2) = Standard error of mean in second population

RESULTS

The present cross-sectional study had been conducted on a total sample of 349 girls. The age range of these girls was from 10 to 15 years (Table 1).

Table 1 Age- wise distribution of sample of menstruating and non- menstruating girls

Age Group (Years)	Menstruating	Non-Menstruating
10	23	12
11	26	20
12	35	18
13	34	28
14	40	45
15	21	47
Total	179	170
Grand Total	**349**	

The study has been conducted taking into consideration what type of physical changes occurred in adolescents girls upon their experienced of menarche.

Table 2 Height (cm) of 10 to 15 years non-menstruating and menstruating school girls

Age	Non-Menstruating			Menstruating			t-value
	Mean	S.D.	S.E.M.	Mean	S.D.	S.E.M.	
10.5	138.25	6.40	3.01	139.09	3.30	1.89	0.26
11.5	140.41	6.48	1.44	142.60	7.80	1.53	0.92
12.5	140.59	6.78	1.59	144.41	6.09	1.36	1.81
13.5	145.41	7.80	1.58	146.07	5.09	1.21	0.59
14.5	145.71	5.11	1.21	149.36	6.66	1.05	2.11*
15.5	148.15	6.58	0.96	146.47	7.69	2.11	1.24

* statistically significant p < 0.05

The menstruating girls were taller than the non-menstruating girls (Table 2). The differences were significant at the 14.5 years of age.

Table 3 Weight (kg) of 10 to 15 years non-menstruating and menstruating school girls

Age	Non-Menstruating			Menstruating			t-value
	Mean	S.D.	S.E.M.	Mean	S.D.	S.E.M.	
10.5	34.33	8.39	2.42	33.27	7.30	1.52	0.37
11.5	33.35	8.40	1.88	37.19	8.25	1.61	1.55
12.5	32.55	6.62	1.56	37.34	7.46	1.26	2.38*
13.5	39.34	7.16	1.00	38.94	8.12	1.39	0.19
14.5	40.30	8.51	1.26	41.41	5.86	0.92	0.71
15.5	40.73	6.81	0.99	39.71	8.20	1.78	0.50

* statistically significant p < 0.05

The menstruating girls had larger values than non-menstruating girls for weight (Table 3). The differences were significant at the 12.5 years of age.

Table 4 BMI of 10 to 15 years non-menstruating and menstruating school girls

Age	N	Non-Menst.				N	Menst.			
		Und. Wt	Nor. Wt	Over wt	Obese		Und. Wt	Nor. Wt	Over wt	Obese
10.5	12	8	3	1	-	23	16	5	1	-
11.5	20	15	3	1	-	26	13	12	-	-
12.5	18	15	3	-	-	35	20	14	-	-
13.5	28	15	10	-	-	34	15	15	2	-
14.5	45	18	23	3	-	40	15	23	2	-
15.5	47	19	27	-	-	21	7	14	-	-
Total	**170**	**90**	**69**	**5**	**-**	**179**	**86**	**83**	**5**	**-**

On the basis of BMI, out of 12 non-menstruating girls at the age of 10.5 years 8 girls were underwt. , 3 had normal wt. and 1 was overwt. At the age of 11.5 years 15 girls were underwt. , 3 had normal wt. and 1 was overwt. At the age of 12.5 years, 15 were in the category of underwt. , 3 had normal wt. At the age of 13.5 yers, 15 were underwt. and 10 had normal wt. At the age of 14.5 years, 18 were underwt. , 23 girls had normal wt. and 3 had overwt. At the age of 15.5 years , 19 were underwt. ,

27 girls had normal wt. In non-menstruating girls, the age of 10 to 15 years, no one girl was in the category of obese (Table 4). In menstruating girls, at the age of 10.5 years, 16 menstruating girls were underwt. , 5 had normal wt. and there was 1 overwt. At the age of 11.5 years, 13 girls were underwt. , 12 had normal wt. At the age of 12.5 years, 20 were underwt. , 14 had normal wt. At the age of 13.5 years, 15 were underwt. , 15 had normal wt. and 2 were overwt. At the age of 14.5 years, 15 were were underwt. , 23 had normal wt. and 2 were overwt. At the age of 15.5 years, 7 had under wt.and 14 had normal wt. As in non-menstruating girls , none of the menstruating girls was not in the category of obese. The menstruating girls had higher values of normal weight than non-menstruating girls (Table 4).

DISCUSSION

In the present study, conducted in Patiala (Punjab) it can be concluded that the correlation between BMI and age at menarche was quite high and it is the most important factor to be considered to show its impact on menarche. It can also be concluded that although the timing of puberty is related to genetic factors, but other factors such as geographical location, common health status, nutrition and socio-economic status were also related to the body fat, body height, and body weight of the subject thus they can influenced the onset of menstruation and its progression. Thus in the present study, the median age at menarche was 13 ± 1.2 years. In case of Bangladesh girls, the median age at menarche determined by status quo method was 13.0 ± 0.89 years [29]. While we compare with the other groups of Patiala the median age at menarche in lower social group of Patiala was 13.65 and 12.54 years [30].

The mean values of height of the girls in the present study who had experienced menarche were higher than the non-menstruating girls. Similarly in case of Japanese girls, the height in menstruating girls was greater than non-menstruating. Non-menstruating girls had a short period of adolescent growth. Their height was short at each period before menarche [31]. Similarly in case of Bangladesh girls the mean height was found to be significantly higher at 11 to 15 years among menstruating girls [29]. In the present study the mean values of weight of the menstruating girls was larger than non-menstruating girls. In case of Japanese girls, the menstruating girls tended to be more overweight and thicker skinfolds [32]. There were similar trend in Chinese girls, the girls who were menstruating was heavier than non-menstruating girls [33].

In the present study, the menstruating girls had larger values of BMI than non-menstruating girls. Similarly in case of Norwegian adolescents girls with menarche had higher BMI than those girls who were non-menstruating [34].

CONCLUSION

The results of the present study indicated that BMI is a key factor in the onset of menarche, the girls who reached menarche were significantly heavier and taller with higher BMIs than those of the non-menstruating girls of the same age group.

Abbreviations: BMI – Body Mass Index ; Wt. – Weight ; Ht. – Height.

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