International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Adiposity in Menstruating and Non-Menstruating School Girls of Punjab

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Abstract: ***Growth refers to a positive change in size, often over a period of time. Human height or stature is the distance from the bottom of the feet to the top of the head in the human body, standing erect. The term body weight is used colloquially and in the biological and medical sciences to refer to a person's mass or weight. Adiposity is the medical term for obesity and is used to describe unhealthy body weight. The Body Mass Index is a standard tool often used to calculate whether one possesses a healthy body weight for his or her stature. Menarche is the first menstrual period. It is often considered as the central event of female puberty as it signals the possibility of fertility. 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 and residing in Patiala district of Punjab. The aim of the study was to access body fat distribution on the basis of adiposity in menstruating and non-menstruating school girls. Out of total sample, the menstruating girls had large values of Brachial adipo-muscular ratio, Femoral adipo - muscular ratio and Mean of the brachial and femoral adipo muscular ratio at the age of 11.5 years than non-menstruating girls. On the basis of Body Mass Index, 90 non-menstruating girls were underweight, 69 had normal weight and 5 had overweight. In menstruating girls 86 were underweight, 83 had normal weight and 5 had overweight. No one girl in menstruating and non-menstruating group was in the category of obese. The median age at menarche was 13.3 ± 1.2 years.***

Keywords: Physical Measurements or Anthropometry, Females or School Girls, Adiposity, BMI

1. Introduction

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 age of 10-19 years were placed in adolescent age group. In this period spurt in somatic growth and the accompanying appearance of secondary sexual characteristics, menarche, spermarche. This is also a period of increased nutritional requirements (WHO 1995). 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 the head in the human body, standing erect. It is measured usually in centimeters. Adult human height has varied from under 60 centimeters (2 ft 0 in.) to over 260 centimeters (8 ft 6 in.) [Lapham, Robert and Agar, Heather (2009)]. On average males are taller than females [Carter and Pamela J. (2008)]. When populations share genetic background and environmental factors, average height is frequently characteristic within the group. [Ganong and William F. (2001)]. The term body weight is used colloquially and in the biological and medical sciences to refer to a person's mass or weight. Body weight is measured in kilograms, a measure of mass. 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 [Bashkirov, P.N. Uchenieofiziches Kom razvitti cheloveka, Moscow, (1962)]. Determining the percent body fat is very important because the amount of fat in the body is related to health as well as fitness and sports performance. Fat is one of the basic components that make up the structure of body. Adipose tissue accumulation is referred to as body fat distribution [Golzynski, Diane L. (2004)]. Menarche is a landmark pubertal event for females. Menarche is correlated to body fat. About 17 percent body fat required for menarche and 22 percent body fat reported to be required to maintain or restore menstruation [Neinstein LS. (2002)]. Early menarche has been demonstrated to be associated with increased adult BMI [Sublaxmi Trikudanathan et. al. (2013)]. The WHO (2000) defines obesity as having an abnormal or excessive amount of body fat to the extent that it may impair health. 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 overwt. and a BMI of 30 kg/m^2 or above defines obesity. BMI merely be indicative of body build as opposed to fatness. [Wright, C., Parker., L. Lamnot, D., Craft, A. (2001)].

Two studies by Pierce, Leon in 2005 and by Pierce, Kuh and Hardy in 2010 adjusted for tracking of childhood adiposity from age 4-7 years. Both studies found that early menarche lead to an increase in adult obesity. They found that for each year menarche was delayed, BMI was 0.57-0.52 kg/m^2 lower in status.

Aims

The present study was conducted to assess the Patiala (Punjab) school girls as thin, obese, overwt. and normal on the basis of BMI. The study was also aimed to evaluate the changes in body fat distribution in menstruating and non-menstruating girls.

2. Material and Methods

The present cross-sectional study was carried out in Patiala district of Punjab. The sample was consists of 349 girls (179

menstruating, 170 non-menstruating girls) in the age range of 10 to 15 years. The data was collected from January to April 2010. Height, Weight, Skin folds (biceps, triceps and thigh) and Circumferences (upper-arm and thigh) of all subjects was measured by using standard techniques given by Lohman et. al. (1998). Adiposity [BAMR, FAMR, MAMR and Percentage of adipose mass] was calculated by Vague et. al. (1971) formulae:

1. BAMR: Brachial adipo-muscular ratio
   = (Area of brachial adipose tissue/area of brachial muscular tissue)
2. FAMR: Femoral adipo-muscular ratio.
   = (Area of adipose tissue/area of muscular tissue)
3. MAMR: Mean of the brachial and femoral adipo-muscular ratio is calculated and used in the assessment of adipose mass as follows:
   The per cent of adipose mass
   = MAMR × Mean percentage of fat in adipose tissue (0.80) × density of adipose mass (0.92) × 100

The absolute amount of adipose mass
= MAMR × 0.80 × 0.92 × Body weight

BMI is a standardized estimate of an individual's relative body fat calculated from his or her height and weight [Wt (kg) Ht (m^2)]. Status quo information about menarche was taken from each girl. The median age at menarche of the total sample has been calculated through Probit analysis (Finney 1952).

3. Results

On the basis of Adiposity (Table 1), the menstruating girls had larger values of BAMR at the 11.5 years of age than non-menstruating girls and then show irregular trend with the increasing age. In early years, the menstruating girls had more FAMR values than non-menstruating which was reduce in later years and further again became more by 13.5 years of age (Table 2).

Table 1: Upper Arm Circumference (cm), Thigh Circumference (cm), Biceps Skin fold (mm), Triceps Skin fold (mm) and Thigh Skin fold (mm) of 10 to 15 years non-menstruating and menstruating school girls

	Upper Arm Circumference		Thigh Circumference		Biceps Skin fold		Triceps Skin fold		Thigh Skin fold	
	Non-Menst.	Menst.	Non-Menst.	Menst.	Non-Menst.	Menst.	Non-Menst.	Menst.	Non-Menst.	Menst.
Age	Mean (cm)	Mean (cm)	Mean (cm)	Mean (cm)	Mean (mm)	Mean (mm)	Mean (mm)	Mean (mm)	Mean (mm)	Mean (mm)
10.5	17.16	17.21	31.41	31.56	6.33	5.95	9.75	9.60	12.75	15.08
11.5	17.11	17.65	32.95	33.01	5.45	6.69	9.70	11.00	14.80	16.65
12.5	15.72	16.02	30.11	32.80	7.22	6.71	11.16	10.31	14.44	16.77
13.5	18.12	17.78	36.12	32.67	7.21	6.79	12.72	10.82	18.42	18.58
14.5	19.50	18.79	35.16	32.24	7.53	7.65	11.44	11.72	18.44	18.32
15.5	17.87	18.45	32.72	36.79	7.80	7.66	11.65	12.76	18.04	19.90

Table 2: BAMR, FAMR and MAMR of 10 to 15 years non-menstruating and menstruating school girls

	BAMR				FAMR				MAMR			
	Non-Menst.		Menst.		Non-Menst.		Menst.		Non-Menst.		Menst.	
Age	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
10.5	12	0.21	23	0.26	12	0.33	23	0.48	12	0.27	23	0.37
11.5	20	0.43	26	1.02	20	0.36	26	0.45	20	0.40	26	1.22
12.5	18	0.46	35	0.20	18	0.57	35	0.53	18	0.73	35	0.32
13.5	28	0.44	34	0.23	28	0.56	34	0.58	28	0.74	34	0.70
14.5	45	0.40	40	0.43	45	0.47	40	0.57	45	0.43	40	0.50
15.5	47	0.23	21	0.44	47	0.51	21	0.58	47	0.71	21	0.52

The menstruating girls had larger values than non-menstruating girls for MAMR. The mean value of non-menstruating girls was showing irregular trend from the 10 to 15 years of age. There were large differences during early years which became almost negligible during the later years (Table 2). The menstruating girls had larger value of absolute adipose mass than non-menstruating girls. The differences were significant at the years of 10.5 and 12.5 years of age. The menstruating girls had larger value of percentage of adipose mass than non-menstruating girls (Table 3).

Table 3: Absolute Adipose Mass and Percentage of Adipose Mass of 10 to 15 years non-menstruating and menstruating school girls

	Absolute Adipose Mass				Percentage of Adipose Mass			
	Non-Menst.		Menst.		Non-Menst.		Menst.	
Age	N	Mean	N	Mean	N	Mean	N	Mean
10.5	12	6.92	23	9.52	12	20.10	23	22.15
11.5	20	10.24	26	10.01	20	24.74	26	24.12
12.5	18	9.01	35	10.94	18	25.12	35	25.04
13.5	28	10.68	34	11.64	28	23.52	34	26.12
14.5	45	10.72	40	11.92	45	24.62	40	26.29
15.5	47	10.84	21	11.86	47	25.14	21	26.82

Table 4: Body Mass Index of 10 to 15 years non-menstruating and menstruating school girls

	Non-Menst.					Menst.				
Age	N	Und. wt	Nor. Wt	Over wt	Obese	N	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 weight. At the age of 13.5 years, 15 were underwt. and 10 had normal wt. At the age of 14.5 years, 18 were underwt., 23 girls had normal weight and 3 had overwt. At the age of 15.5 years, 19 were underwt., 27 girls had normal weight. 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 overweight. 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 underwt., 23 had normal wt. and 2 were overwt. At the age of 15.5 years, 7 were underwt., 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 wt. than non-menstruating girls (Table 4).

4. Discussion

In this study, the menstruating girls had larger values than non-menstruating girls of adiposity. A study conducted by Singh and Malhotra (1990) and Sidhu and Grewal (1980), the menstruating girls had larger values of adiposity than non-menstruating girls.

In this study, the median age at menarche was 13.0 ± 1.2 years. In case of Bangladesh girls, the median age at menarche determined by status quo method was 13.0 ± 0.89 years [Chowdhury et. al. (2000)].

In case of Chinese girls who reach menarche were significantly heavier and taller with higher BMI than those of the same age who are non-menstruating [Hesketh et. al. (2002)]. Hence the results of the same study are same as the earlier studies. In the present study, the mean values of wt. of menstruating girls are larger than non-menstruating girls. Similarly in case of Japanese girls, the menstruating girls tended to be more overwt. than non-menstruating girls [Shibata et. al. (1987)].

5. Conclusion

The results of the present study indicate that the school girls of 10 to 15 years of age of menstruating and non-menstruating groups, we conclude that the menstruating girls had larger values of adiposity and BMI than non-menstruating girls.

6. Abbreviations

BMI – Body Mass Index; WHO – World Health Organization; Wt – Weight; Ht – Height

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