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ABSTRACT

Introduction: Adolescent phase is a phase of physical, psychological and cognitive development. Studies revealed that there is always a good effect of regular physical exercise on human health. Present study was an attempt to evaluate the effect of physical activity on adiposity and body composition among Bengalee Hindu adolescent girls of Cooch Behar district, West Bengal, India.

Methods: A community based cross sectional study was conducted from April to September, 2023 among 780(urban=422, rural=358) Bengalee Hindu (10-17) years old adolescent girls of urban and rural areas of Cooch Behar district (Latitude 26º22´N, Longitude 89º29´E), West Bengal, India. Eight anthropometric measurements, height (cm), weight (kg), MUAC (cm), BSF (mm), TSF (mm), SSF (mm), SUPSF (mm), CSF (mm), were recorded by using standard procedures. The girls were divided into two groups, i.e. PE (takes part in regular physical exercise) and NPE (does not takes part in regular physical exercise).

Results: This study revealed that in both urban and rural adolescent girls, The NPE girls had significantly greater Mean height, weight, MUAC, BMI, BSF (mm), TSF (mm), SSF (mm), SUPSF (mm), CSF (mm), PBF, FM, FFM compared with PE girls. The mean differences between NPE and PE girls of all the measurements were statistically significant at the 0.05 level.

Conclusion: The present study clearly showed that, physical exercise definitely effects on adiposity, body composition and subcutaneous fat. Among both rural and urban adolescent girls, the NPE girls had significantly greater adiposity, body composition and subcutaneous fat, while PE girls showed decreased adiposity, body composition and subcutaneous fat.

Key words: Adolescent, Body composition, Anthropometry, physical exercise, adiposity.

INTRODUCTION

Adolescent phase is a phase of physical, psychological and cognitive development. Body size and body composition changes a lot during adolescent phase. Body fat, which is a typical component of Human body which assembles adipose tissue and appropriate marker to assess adiposity among individuals (Hu 2008; Sen and Mondal 2013; Colley et al. 2015; Griffiths et al. 2016; Xue et al. 2016, Debnath et al. 2018). There were few techniques like, BIA, dual x-ray absorptionmetry, underwater weighting (Lee and Gallagher 2008; Duren et al. 2008; Jensen et al. 2016; Andreoli et al. 2016; Gibby et al. 2017; Louer et al.2017, Debnath et al. 2018) for assessing body fat and body composition, still anthropometry were widely used to assess body fat and body composition. Body composition can be determined by some anthropometric measurements like: height, weight, BMI, Skinfolds thickness (biceps skin folds, triceps skin folds, subscapular skin folds, suprailiac skin folds, medial calf skin folds) etc (Rolland-Cachera 1993; Hall et al. 2007, Debnath et al. 2018). Using anthropometry for assessing body composition could be a good predictors of risk factors for cardiovascular disease, many types of cancer, diabetes and chronic diseases for both adolescents and adults (Guo et al. 1997; Dietz 1998; Katzmarzyk et al. 2001; Goran et al. 2003; Janssen et al. 2005; Khatun et al. 2016).

Physical activity could be playing games or sports, physical education, transportation, planned exercise, in school or home or during leisure time (Mukhopadhyay et al. 2005, Khatun et al. 2016). Regular physical activity can increases the respiratory system efficiency, decreases the frequency of inspirations and their capacity increases, which makes a very positive effect on entire body functioning (Żołądkiewicz 2019). Regular physical exercise can reduces the risk of premature death and increases longevity. Physical exercise also serves as primary prevention and secondary prevention of various disorders (Rezende et al. 2014).

Less physical activity occurs at school, work or in leisure time, increases in risk of obesity (Lee et al.2010). Physical Exercise is comparatively inexpensive, safe and has very minimal side effects. Physical Exercise is very beneficial for multiple types of depression, including dysthymic, seasonal, post-natal, pre-menstrual etc (Ranjbar et al. 2015).

There are so many studies on growth, nutritional status, development, and diet among the adolescents from various populations in India as well as the world. But there were two or three studies were found on adiposity and body composition in relation with physical activity among Indian adolescents. After an extensive literature review, no studies on effect of physical activity on adiposity and body composition were found on Bengalee Hindu adolescent girls in the present study area. Present study was an attempt to evaluate the effect of physical activity on adiposity and body composition among Bengalee Hindu adolescent girls of Cooch Behar district, West Bengal, India.

MATERIALS AND METHODS

A community based cross sectional study was conducted from April to September, 2023 among 780 (urban=422, rural=358) Bengalee Hindu (10-17) years old adolescent girls of urban and rural areas of Cooch Behar district (Latitude 26º22´N, Longitude 89º29´E), West Bengal, India.

The studied population was selected using simple random sampling technique. Before data collection, school authorities, students and their parents were informed about the purpose of the present study. The girls were divided into two groups, i.e. PE (takes part in regular physical exercise) and NPE (does not takes part in regular physical exercise) (Mukhopadhyay et al. 2005; Khatun et al. 2016). 780 Bengalee Hindu adolescent school going girls from both rural and urban areas spontaneously joined and cooperated in the present study. Among urban girls, n=422 girls were grouped as PE=192 and NPE =230 and among rural adolescent girls, n=358 girls were grouped as PE=187 and NPE =171. A set of pre tested and pre prepared questions in the interview-schedule was used for data collection. The subjects were measured and interviewed during working hours of school. Age of the subjects was confirmed on the basis of their birth certificates. The frequency of physical exercise was recorded per week and duration was noted per minutes in the present study.

Eight anthropometric measurements, such as height (cm), weight (kg), MUAC (cm), skinfolds (mm) [biceps skinfolds (BSF), triceps skinfolds (TSF), subscapular skinfolds (SSF), suprailiac skinfolds (SUPSF), medial-calf skinfolds (CSF)] were recorded by using standard procedures, following the protocol of Lohman et al. (1988).

BMI were calculated using following formula: BMI= Weight (kg)/Height^2 (m^2).

For the assessment of body composition among children and adolescents, derived variable percent body fat (PBF) from skin fold thickness is common and allowable method (Deurenberg et al. 1990; Al-Sendi et al.2003; Mueller et al.2003; Khatun et al.2016). PBF were assessed by using the following equations of Slaughter et al. (1988) for girls; PBF=1.33(TSF+SSF)-0.008(TSF+SSF)^2-2.5(for girls)

To assess the proportion of fat mass (FM) and fat free mass (FFM), the equations of Van Itallie et al. (1990) was used;

FM (kg) = (PBF/100) × weight (kg)

FFM (kg) = weight (kg)-FM (kg)

Descriptive statistics was done in terms of mean and standard deviation (±SD). Statistical tests like, independent sample t-tests were done used to find out significant differences of anthropometric measurements on the basis of PE and NPE in both urban and rural adolescents. The p value <0.05 was considered as significant. All statistical analysis were done using Statistical package for social science (SPSS Inc., Chicago, IL, version 20.0).

RESULTS

Table 1 clearly showed that among urban adolescents, The NPE girls had significantly greater mean height, weight, MUAC, BMI, BSF, TSF, SSF, SUPSF, CSF, PBF, FM, FFM compared with PE girls. The mean differences between NPE and PE girls of all the measurements in each age group were statistically significant at the 0.05 level.

Table 2 also showed that among rural adolescents, The NPE girls had significantly greater mean weight, MUAC, BMI, BSF, TSF, SSF, SUPSF, CSF, PBF, FM, FFM compared with PE girls. The mean differences between NPE and PE girls of all the measurements in each age group were statistically significant at the 0.05 level except mean height.

Comparative evaluation of NPE urban and rural girls revealed that mean of all anthropometric characteristics, PBF, FM, FFM, were significantly high among urban Bengalee Hindu girls compared to rural Bengalee Hindu adolescent girls. Comparative evaluation of PE urban and rural girls revealed that mean values of height, weight, MUAC, BMI, PBF, FM, FFM were also significantly greater among urban Bengalee Hindu adolescent girls.

Table 3, showing comparison between PE and NPE rural Bengalee Hindu adolescent girls with PE and NPE rural Bengalee Muslim adolescent girls. Rural Bengalee Hindu adolescent PE girls had significantly greater mean height, weight, BMI, SSF, PBF, FM and FFM compared to the PE rural Bengalee Muslim girls but it was opposite for mean TSF and CSF, where Muslim PE girls had higher values. Rural Bengalee Hindu adolescent NPE girls had significantly greater mean weight, MUAC, BMI, BSF, SSF, SUPSF, PBF, FM and FFM compared with NPE rural Bengalee Muslim girls. The mean height and TSF of Muslim girls had higher values than their counterparts, but it was not statistically significant. All the measurements were statistically significant at the 0.05 level.

Table 1: Anthropometric and body composition characteristics of the two groups (NPE and PE) of urban Bengalee Hindu adolescents

Variables	urban adolescents (n=422)		t value
	physical exercise (n=192)	**no physical exercise (n=230)**	
Height (cm)	145.75(7.87)	149.92(8.58)	-5.15*
Weight(kg)	42.02(11.25)	55.65(14.73)	-10.50*
MUAC(cm)	20.91(2.66)	24.17(2.94)	-11.80*
BMI(kg/m^2)	19.64(4.27)	24.51(5.15)	-10.42*
BSF (mm)	7.56(1.67)	10.75(2.04)	-17.20*
TSF (mm)	10.04(2.11)	12.92(2.24)	-13.49*
SSF (mm)	11.76(2.77)	15.22(3.46)	-11.13*
SUPSF (mm)	12.14(2.95)	15.11(4.12)	-8.33*
CSF (mm)	12.38(2.33)	14.11(3.00)	-6.64*
PBF(%)	22.53(4.41)	28.38(4.52)	-13.36*
FM (kg)	9.80(4.34)	16.22(6.26)	-11.98*
FFM (kg)	32.22(7.21)	39.42(9.05)	-8.92*

Standard deviations are presented in parentheses; *p <0.05

Table 2: Anthropometric and body composition characteristics of the two groups (NPE and PE) of rural Bengalee Hindu adolescents

variables	rural adolescents (n=358)		t value
	physical Exercise (n=187)	**no physical exercise (171)**	**t value**
Height (cm)	144.85(7.88)	145.98(8.52)	-1.30
Weight(kg)	40.59(9.61)	47.62(13.12)	-5.70*
MUAC(cm)	20.07(2.45)	21.60(2.81)	-5.58*
BMI(kg/m^2)	19.17(3.45)	22.06(4.66)	-6.67*
BSF(mm)	7.45(1.92)	10.03(2.96)	-9.81*
TSF(mm),	9.63(2.08)	12.58(2.98)	-10.87*
SSF(mm)	11.16(2.62)	14.75(3.54)	-10.96*
SUPSF (mm)	10.80(2.69)	14.68(4.46)	-10.08*
CSF (mm)	11.43(2.06)	13.93(2.53)	-10.25*
PBF(%)	21.55(4.25)	27.59(5.44)	-11.73*
FM(kg)	8.92(3.30)	13.63(5.81)	-9.51*
FFM(kg)	31.66(6.90)	33.98(7.89)	-2.96*

Standard deviations are presented in parentheses; *p <0.05

Table 3. Anthropometric and body composition characteristics of PE and NPE Bengalee Hindu rural adolescents and Bengalee Muslim rural adolescent girls

Variables	Regular Physical Exercise (PE)		t value	No Regular Physical Exercise (NPE)		t value
	Bengalee Hindu rural adolescents (n=187)	**Bengalee Muslim rural adolescents** (n=304)		**Bengalee Hindu rural adolescents (N**PE) (n=171)	**Bengalee Muslim rural adolescents (N**PE) (n=242)	
Height (cm)	144.85 (7.88)	141(10.5)	4.32*	145.98 (8.52)	146.70(9.1)	0.81
Weight(kg)	40.59(9.61)	37.1(9.0)	4.07*	47.62(13.12)	38.4(9.0)	8.47*
MUAC(cm)	20.07(2.45)	19.6(2.7)	1.94ns	21.60(2.81)	20.9(2.8)	2.50*
BMI(kg/m^2)	19.17(3.45)	16.2(2.6)	10.82*	22.06(4.66)	17.6(3.0)	11.82*
BSF(mm)	7.45(1.92)	7.3(2.9)	0.63ns	10.03(2.96)	8.5(3.0)	6.04*
TSF(mm)	9.63(2.08)	12.5(3.8)	9.49*	12.58(2.98)	13.0(3.9)	1.18
SSF(mm)	11.16(2.62)	10.7(4.8)	1.20ns	14.75(3.54)	12.5(5.2)	4.91*
SUPSF(mm)	10.80(2.69)	10.2(4.8)	1.56ns	14.68(4.46)	12.5(4.8)	4.68*
CSF(mm)	11.43(2.06)	12.2(3.3)	2.87*	13.93(2.53)	13.8(3.6)	0.41
PBF (%)	21.55(4.25)	19.4(4.9)	4.96*	27.59(5.44)	20.7(5.2)	13.20*
FM(kg)	8.92(3.30)	6.7(3.5)	6.97*	13.63(5.81)	8.3(3.8)	11.27*
FFM(kg)	31.66(6.90)	26.4(6.0)	8.90*	33.98(7.89)	30.1(5.8)	5.76*

Standard deviations are presented in parentheses. * p < 0.05

DISCUSSION

Present study attempts to explore the impact of regular physical activity on anthropometric and body composition characteristics in adolescent girls. Among both rural and urban girls, the NPE girls showed greater anthropometric characteristic and body composition (table 1 and 2). The similar findings were also declared from rural Bengalee Muslim adolescent girls of North 24 Parganas by Khatun et al. 2016 (table 3). Regular physically active girls of present study had statistically significant higher adiposity, body composition and subcutaneous fat in most of the variables than the findings of Muslim girls who were physically active in regular basis (Khatun et al. 2016). We found same results when compared with the physically inactive girls of present study and Muslim girls of North 24 Parganas (Khatun et al. 2016).

Another study by Mukhopadhyay et al. (2005) conducted among adolescent Bengalee boys and also concluded that the boys, who took regular physical exercise, had comparatively less adiposity compared to those who did not undertake physical exercise regularly. Generally, it can be said that physically inactive people tend to be overweighed (Baecke et al. 1982). Triosi et al. (1991) had shown that the mean BMI and mean abdomen-hip ratio were significantly lower, among those, who undertook physical exercise regularly compared with those who did not among US-American men. Rissanen et al. (1991) conducted a study among Finland and also concluded that the prevalence of obesity was correlated with physical inactivity. Phillippaerts et al. (1999) said that physical activity during work was conversely related to adiposity in young middle aged Belgian men. Guo et al. (1997) had found that physical activity was responsible for decreases in BMI, PBF and FM among US-American men. Actually, in last two decades, among developing countries of South-East Asia, the prevalence of overweight and obesity were very high due to rapid socio-economic changes, increased interest in western lifestyle and less physical activity. Studies also revealed that socio-economic and demographic changes, together with changing of food consumption pattern, sedentary lifestyle and physically inactivity were responsible for such prevalence in populations (Wang et al. 2009; Popkin et al. 2012; Popkin and Slining 2013; Misra and Bhadwaj 2014; Kshatriya and Acharya 2016; Deepa et al. 2017; Kulkarni et al. 2017, Debnath et al.2019).There is a fact that physically fit person have smaller Percent Body Fat and fat Mass than physically inactive person (Behnke and Wilmore 1974). So, adiposity is conversely related with physical activity. There are only few studies that described adiposity and body composition in relation to physical activity. So, studies from different parts of India on, describes the effect of exercise on adiposity and body composition, can explain the whole fact well.

Conclusion

The present study clearly showed that, physical exercise definitely effects on body composition and subcutaneous fat among both rural and urban adolescent girls, The NPE girls had significantly greater adiposity, body composition, and subcutaneous fat, while PE girls showed decreased adiposity, body composition and subcutaneous fat.

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Conflict of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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