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NUTRITIONAL STATUS AND EFFECT OF PHYSICAL ACTIVITY ON ANTHROPOMETRIC CHARACTERISTICS OF BENGALEE MUSLIM ADOLESCENTS BOYS OF NORTH 24 PARGANAS, WEST BENGAL, INDIA

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Abstract

A cross-sectional study of 522 Bengalee Muslim boys aged 10-17 years of Deganga, North 24 Parganas, West Bengal, India, was undertaken to study their age differences in nutritional status and effect of physical activity on anthropometric characteristics. The subjects were classified into eight age groups: 10-10.9 years (n = 56), 11-11.9 (n = 63), 12-12.9 (n = 65), 13-13.9 (n = 77), 14-14.9 (n = 84), 15-15.9 (n = 71), 16-16.9 (n = 60), 17-17.9 (46). Subjects were also classified into two groups, sedentary (NPE, n=240) and non sedentary (PE, n= 282). Individuals falling below the age specific fifth percentile of the World Health Organization (WHO) recommended National Health and Nutrition Examination Survey (NHANES I) were defined as undernourished. All the anthropometric variables were measured by the following standard anthropometric procedure as recommended by Lohman et al., (1988). Body mass index (BMI) – a popular indicator of generalised adiposity was calculated following the formula of World Health Organization (1995). Skin fold equation of Slaughter et al. (1988) for predicting body fat was utilized to estimate percent body fat (PBF). The overall rate of undernutrition was 52.49%. Results reveals that studied boys, who did not undertook regular physical exercise (NPE), had significantly greater amount of subcutaneous adiposity, PBF, fat mass index (FMI) and sum of 5 skin folds (S5S) than those who undertook regular physical exercise (PE). But the BMI values are similar between sedentary and non sedentary boys group.

Key words: Muslims, Boys, Adolescents, Anthropometry, Undernutrition, Physical Exercise.

Introduction

Anthropometry has been used during adolescence in many contexts related to nutritional assessment, health status and fitness. It has now well established that the body mass index (BMI) is the most appropriate variable to use to determine nutritional status among adolescents. During

adolescence, body size and composition markedly change. These changes are strongly associated with the development of various physical performance characteristics. At the same time, anthropometry and body composition during adolescence are predictors of risk factors for cardiovascular disease, diabetes and many types of cancer and chronic diseases (Dietz WH, 1998, Goran et al., 2003) which occur in adults (Guo, 1997, Katzmarzyk, 2001, Janssen et al., 2005).

The physical activity level (PAL) is a way to express a person's daily physical activity as a number, and is used to estimate a person's total energy expenditure. The physical activity level can also be estimated based on a list of the (physical) activities a person performs from day to day. Each activity is connected to a number, the physical activity ratio. The physical activity level is then the time-weighted average of the physical activity ratios (Swaminathan & Vaz, 2012).

Several recent studies have investigated nutritional status of adolescent boys from different parts of India . However, there is very little information on the nutritional status and physical activity of Muslim adolescent boys from West Bengal. The present study was undertaken to study the level of undernutrition and effect of physical activity on anthropometric characteristics among 10-17 years old Bengalee Muslim boys of North 24 Parganas, West Bengal, India.

Materials and Methods

Data were collected from three secondary schools in Deganga block, North 24 Parganas, West Bengal, India. The schools are situated in a rural area approximately 38 km to the east from the heart of the city of Kolkata and approximately 17 km from the Barasat town. Barasat is the administrative headquarters of the district of North 24 Parganas, West Bengal, India. Verification of age was done from the school records, as well from the answers to specific questions in the questionnaire which was completed by every subject. A total of 522 boys students, aged 10-17 years were randomly selected and studied. All anthropometric measurements were taken on each subject following standard protocol. Body mass index (BMI) – a popular indicator of generalised adiposity was calculated following the formula of World Health Organization (1995). One regional adiposity indices were calculated following standard manner e.g. sum of 5 skin folds (S5S).

Prediction of percent body fat from skin fold thicknesses is an acceptable method for the assessment of body composition in children and adolescents (Deurenberg et al., 1990, Al-Sendi et al., 2003, Mueller et al., 2003). Skinfold equation of Slaughter et al., (1988) for predicting body fat was utilized to estimate percent body fat (PBF). Four measures of body fat composition viz. fat mass (FM), fat free mass (FFM), fat mass index (FMI) and fat free mass index (FFMI) were estimated using standard formulae (van Itallie et al., 1990, Bose and Das Chaudhuri, 2003). All subjects were divided into two groups: non-sedentary (regular physical activity undertaken) and sedentary (no regular physical activity undertaken), depending on the type and duration of physical activity undertaken by them at work and at leisure. The frequency of physical activity was also noted. A set of detailed questions in the interview-schedule was utilized for this purpose. Nutritional status was evaluated using the World Organization recommended age specific cut-off points of BMI based on the National Health and Nutrition Examination Survey (NHANES) percentile values. Undernutrition (thinness) was defined as BMI < 5th percentile values of

NHANES. This cutoff point has been utilized by several recent studies worldwide on under nutrition among adolescents. Data are presented as mean, standard deviation (SD), t-test were calculated using the Statistical Package for Social Sciences (SPSS, Version 16.0).

Results

The means and standard deviations of the anthropometric characteristics by age groups of the boys are presented in Table 1. Height of boys increased progressively (37.09 cm) from 10 to 16 years. Weight of boys showed a steady positive age trend from 13 (28.28 kg) to 16 (50.09 kg) years of age. Mean BMI of boys increased progressively by 3.85 kg/m^2 from 10 years to 17 years with a pause at age 14 and 17 years.

The overall rate of undernutrition was 52.49% (Table 2). The rates of undernutrition varied between 23.33% among 16 year olds to 72.73% at age 13 years. There was a consistent increase in the rate of undernutrition from 10 (51.79%) to 13 years (72.73%). Thereafter, there was a steady decline from 14 to 16 years and an increased at age 17(30.43%) years. Comparative evaluation (Table 3) of sedentary (No physical exercise) and non sedentary (physical exercise) boys reveals that mean of height, weight, mid upper arm circumference (MUAC), body mass index (BMI), fat mass (FM), fat free mass (FFM) were higher (who practiced physical activity) than the boys who are not practiced physical activity but mean of all skin fold measurements, percent body fat (PBF), fat free mass (FFM), fat mass index (FMI) were higher the boys who are not practiced physical activity. The mean of fat mass (FM) was similar two groups of boys.

Discussion

Adolescence is a period of increased nutritional requirements and adolescent anthropometry varies significantly worldwide (WHO, 1995; Himes and Bouchard, 1989; Bhadra et al., 2001). Undernutrition is documented public health problem contributed substantially to children's survival (Rahmathullah et al., 1990). It is well known that the athletically inclined are apt to have smaller PBF and FM than sedentary individuals (Benke & Wilmore, 1974). It is a common observation that overweight people tend to be physically inactive (Baecke et al., 1983, Kromhout et al., 1988). Triosi et al., (1991) had shown that mean BMI and abdomen-hip ratio were significantly lower, even after controlling for age, among US-American men, who undertook regular physical exercise compared with those who did not. In a large epidemiological study conducted in Finland, Rissanen et al., (1991) demonstrated that the prevalence of obesity was inversely associated with physical activity. Phillippaerts et al., (1999) had observed that physical activity during work was inversely related to adiposity in young middle-aged Belgian men. Guo et al., (1999) had found that physical activity was associated with decreases in BMI, PBF and FM among US-American men. Mukhopadhyay et al., (2005) had observed that boys who did not undertake regular physical exercise (NPE) had a significantly greater mean body mass index (BMI), PBF, FM and FMI compared with those who undertook regular physical exercise (PE). It is clear from the studies cited above that there is an inverse relationship, in developed countries also in India, between physical exercise and adiposity. There is scanty information on the nutritional status and physical activity of Bengalee Muslim adolescent boys. Therefore, there is a need to

Table 1 : Age and sex variation in anthropometric characteristics of 10 – 17 years old Bengalee Muslim adolescent boys

Age groups (years)	Sample Size	Height (cm)	Weight (kg)	Body mass index (kg/m^2)
10.0-10.9	Boys (n=56)	127.58 (4.70)	23.66 (2.46)	14.51 (1.00)
11.0-11.9	Boys (n=63)	131.55 (6.00)	26.01(4.26)	14.98 (1.87)
12.0-12.9	Boys (n=65)	135.77 (5.76)	28.98 (7.99)	15.56 (3.17)
13.0-13.9	Boys (n=77)	136.09 (6.30)	28.28(5.11)	15.18 (1.81)
14.0-14.9	Boys (n=84)	145.83 (9.91)	34.95(7.87)	16.27 (2.19)
15.0-15.9	Boys (n=71)	158.06 (11.05)	46.09(10.77)	18.43 (4.15)
16.0-16.9	Boys (n=60)	164.67 (5.97)	50.09 (7.00)	18.45 (2.22)
17.0-17.9	Boys (n=46)	163.51 (5.10)	49.06 (5.47)	18.36 (1.97)
	Standard deviation are presented in parentheses			

Table 2: Frequency of undernutrition (based on body mass index) of the adolescent Muslim boys.

Age Groups (Years)	Sample Size	Undernourised		Normal	
		No	%	No	%
10.0-10.9	56	29	51.79	27	48.21
11.0-11.9	63	38	60.32	25	39.68
12.0-12.9	65	43	66.15	22	33.85
13.0-13.9	77	56	72.73	21	27.27
14.0-14.9	84	48	57.14	36	42.86
15.0-15.9	71	32	45.07	39	54.93
16.0-16.9	60	14	23.33	46	76.67
17.0-17.9	46	14	30.43	32	69.57
10.0-17.9	**522**	**274**	**52.49**	**248**	**47.51**

Table 3: Anthropometric and body composition characteristics of the two groups (NPE and PE) of Bengalee Muslim adolescents boys.

Variables	Boys	
	No physical exercise (NPE) n=240	Physical exercise (PE) n=282
Height(cm)	141.5(14.0)	147.7(15.6)
Weight(kg)	33.4(11.5)	37.2(12.1)
MUAC(cm)	19.2(3.1)	20.1(3.1)
BMI(kg/m^2)	16.2(3.3)	16.6(2.6)
Biceps(mm)	5.9(3.0)	5.2(2.1)
Triceps(mm)	9.1(3.5)	8.6(3.0)
PBF (%)	15.8(4.8)	14.9(3.9)
FM (kg)	5.5(3.7)	5.6(2.7)
FFM (kg)	27.8(8.7)	31.6(10.2)
FMI (kg/m^2)	2.7(1.5)	2.5(1.0)
Standard deviations are presented in parentheses		

Table 4: Comparative frequency of undernutrition among adolescent boys of different countries

Reference study	Area / Population	Sex	Date of survey	Under-nourishment
Venkaiah et al., 2002	India	Boys	1996-97	67.00%
I R C, 1997	Kakuma, Kenya	Boys	1997	75.00%
Mukhopadhyay et al., 2000	Kolkata, India	Boys	2000	41.08%
Present study	**Deganga, India**	**Boys**	**2015**	**52.49%**

develop a database of adolescent boys undernutrition and physical activity from different parts of the country.

The mean height, weight and BMI of the Bengalee Muslim boys of this study was higher than those reported among rural adolescents in a recent study from India (ICMR, 1996). The BMI of the boys of the present study was lower than a recent study of Sonowal kachari of Assam, Northeast India (Singh et al., 2014).

In the present investigation more than half (52.49%) of the rural Bengalee Muslim adolescent boys was undernourished **(Table 4)**. The rate of undernutrition among adolescent boys of the present study (52.49%) is distinctively higher than the two recent Indian studies: one of urban boys of Kolkata (50.50%) studied by de Onis et al., (2001) and another of urban Bengalee boys of Kolkata (41.08%) studied by Mukhopadhyay et al, (2000) but lower than rural boys of nine provinces of India (67%) reported by Venkaiah et al., (2002). The same is remarkably lower than those of Kenyan refugees (75%) reported by International Rescue Committee (1997). In conclusion, boys, who undertook regular physical exercise (PE), had less percent body fat (PBF) than those who have a sedentary lifestyle.

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