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Assessment of Nutritional Status among Muslim Adolescents of Deganga, North 24 Parganas, West Bengal

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ABSTRACT The purpose of this study was to examine the age and sex differences in nutritional status based on new age and sex specific international BMI cut-off points, among Muslim adolescents of North 24 Parganas, West Bengal. One thousand and sixty eight (1068) Bengali speaking Muslim school boys (n=522) and girls (n=546) aged 10-17 years participated in this study. The overall (combined age and sex) frequency of undernutrition was 54.8 percent. The frequencies (combined age) of undernutrition among boys and girls were 58.04 percent and 51.65 percent respectively. The rates of undernutrition of boys varied between 35.0 percent among 16 years old to 72.7 percent at age 13 years. The rates of undernutrition of girls varied between 35.7 percent among 15 years old to 71.2 percent at age 11 years. Significant age difference was observed in mean height, weight and BMI for boys (height: F=234.37, p<.0.05, weight: F= 145.36, p<.0.05 and BMI: F= 27.47, p<.0.05) and as well as girls (height: F= 163.40, p<.0.05, weight: F= 107.82, p<.0.05 and BMI: F= 39.74, p<.0.05). There was significant age differences (boys, chi square= 62.80, $p = 0.000$, girls, Chi-square = 76.21, $p = 0.000$) in nutritional status based on BMI of studied children. In general, this study provided evidence that the Bengalee Muslim adolescents had very high rates of undernutrition. Most of the earlier Indian studies showed lower prevalence than present study.

INTRODUCTION

World Health Organization identifies adolescence as the period in human growth and development that occurs after childhood and before adulthood, from ages 10 to 19 years. The World Bank report says that the rate of malnutrition cases among children in India is almost five times more than in China, and twice than in Sub-Saharan Africa. Anthropometry has been used during adolescence in many contexts related to nutritional status (WHO 1995; Bose and Mukhopadhyay 2004). Malnutrition (undernutrition or overnutrition) which refers to an impairment of health either from a deficiency or excess or imbalance of nutrients, is of public health significance among adolescent all over the world. It creates lasting effect on the growth, development and physical fitness of a person. It is well recognized worldwide that anthropometric measurements are indispensable in diagnosing undernutrition. It has now been well established that the body mass index (BMI) is the most appropriate variable for determining nutritional status among adolescents (WHO 1995; Himes and Bouchard 1989; Must et al. 1991; Rolland-Cachera 1993). Several recent studies have investigated nutritional status of children from different parts of India (Kanade et al. 1999; Singh and Mishra 2001; Venkaiah et al. 2002, Mondal et al. 2011; Bansal et al. 2013; Mondal N 2014; Das et al. 2015; Bharthi et al. 2017). The researchers have already published two papers (Khatun et al. 2016a, b) on nutritional status comprising of the same sample using the World Health Organization (WHO 1995) recommended age and sex specific cut-off points of BMI based on the NHANES-I percentile values. However, there is scanty information on the nutritional status using new age and sex specific international BMI cut-off points (Cole et al. 2000, 2007) of Muslim adolescents from rural West Bengal. The present interpretation attempted to evaluate the nutritional status and to assess age-sex trends in the level of different categories of nutritional status on international BMI cut-off points among 10-

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17 years old Bengalee Muslim adolescents of North 24 Parganas, West Bengal.

MATERIAL AND METHODS

The investigation was carried out among adolescent Muslim boys and girls in three secondary schools in Deganga block, North 24 Parganas, West Bengal. 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 administratative headquarters of the district of North 24 Parganas, West Bengal, India.

One thousand and sixty eight school boys (n=522) and girls (n=546) participated in this study. The age range of the subjects was 10 to 17 years.

A total of twelve anthropometric measurements (height, weight, five circumferences and five skinfolds) were made in the present field survey but only two basic variables (height and weight) and a single derived variable (body mass index) have been used in the present report. All the anthropometric measurements were taken following the standard techniques recommended by Lohman et al. (1988) and body mass index (BMI) was computed using the standard equation: BMI (kg / m^2) = Weight (kg) / Height^2 (m^2).

Nutritional status of the studied children was evaluated using new age and sex specific international BMI cut-off points (Cole et al. 2000 and 2007). Statistical Package for Social Sciences (SPSS) and Microsoft Office Excel (2010) were used to analyze the data. Statistical significance was set at $p<0.05$ level. This cut-off point has been utilized by several recent studies worldwide on undernutrition among adolescents (Venkaiah et al. 2002; Woodruff and Duffield 2002).

Technical errors of measurements (TEM) were calculated and the results were found to be within reference values cited by Ulijaszek and Kerr (1999). Therefore, TEM was not incorporated in statistical analyses.

RESULTS

The means and standard deviations and F values of the anthropometric characteristics by age groups of the boys and girls are presented in Table 1. Height of boys and girls increased progressively (37.09 cm and 25.02 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. Weight of girls showed a steady positive age trend from 10 (23.90 kg) to 15 (43.27 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. Mean BMI of girls increased gradually by 4.42 kg/m^2 from 10 years to 15 years. Significant age difference was observed in mean height, weight and BMI for boys (height: $F=234.37$, $p<.0.05$, weight: $F= 145.36$, $p<.0.05$ and BMI: $F= 27.47$, $p<.0.05$) and as well as girls (height: $F= 163.40$, $p<.0.05$,

Table 1: Age and sex variation in anthropometric characteristics of 10-17 years old rural Bengalee Muslim adolescents

Age groups (years)	*Sex*	*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)
	Girls (n=62)	127.71 (4.59)	23.90 (2.89)	14.63 (1.26)
11.0-11.9	Boys (n=63)	131.55 (6.00)	26.01 (4.26)	14.98 (1.87)
	Girls (n=73)	133.28 (5.34)	26.34 (4.89)	14.78 (2.28)
12.0-12.9	Boys (n=65)	135.77 (5.76)	28.98 (7.99)	15.56 (3.17)
	Girls (n=82)	140.95 (6.04)	30.54 (6.19)	15.30 (2.42)
13.0-13.9	Boys (n=77)	136.09 (6.30)	28.28 (5.11)	15.18 (1.81)
	Girls (n=79)	146.80 (7.45)	37.09 (6.84)	17.09 (2.19)
14.0-14.9	Boys (n=84)	145.83 (9.91)	34.95 (7.87)	16.27 (2.19)
	Girls (n=78)	149.45 (5.82)	39.59 (6.24)	17.68 (2.33)
15.0-15.9	Boys (n=71)	158.06 (11.05)	46.09 (10.77)	18.43 (4.15)
	Girls (n=70)	150.56 (5.46)	43.27 (7.88)	19.05 (3.07)
16.0-16.9	Boys (n=60)	164.67 (5.97)	50.09 (7.00)	18.45 (2.22)
	Girls (n=55)	152.73 (4.76)	42.65 (5.85)	18.27 (2.30)
17.0-17.9	Boys (n=46)	163.51 (5.10)	49.06 (5.47)	18.36 (1.97)
	Girls (n=47)	151.82 (5.98)	43.31 (6.21)	18.76 (2.22)
F- ratio	Boys (n=522)	234.37*	145.36*	27.47*
	Girls (n=546)	163.40*	107.82*	39.74*

Standard deviations are presented in parentheses

Table 2: Prevalence of nutritional status (based on BMI) of 10-17 years old rural Bengalee Muslim adolescents

Age groups (years)	*Sex*	*Grade III orthinness 1*	*Grade II orthinness 2*	*Grade I orthinness 3*	*Overall CED*	*Normal*	*Overweight*
10.0-10.9	Boys	-	8 (14.3)	27 (48.2)	35 (62.5)	21 (37.5)	-
	Girls	2 (3.2)	8 (12.9)	27 (43.5)	37 (59.7)	25 (40.3)	-
11.0-11.9	Boys	3 (4.8)	9 (14.3)	28 (44.4)	40 (63.5)	22 (34.9)	01 (1.6)
	Girls	10 (13.7)	15 (20.5)	27 (37.0)	52 (71.2)	19 (26.0)	02 (2.7)
12.0-12.9	Boys	3 (4.6)	16 (24.6)	25 (38.5)	44 (67.7)	19 (29.2)	02 (3.1)
	Girls	19 (23.2)	14 (17.1)	22 (26.8)	55 (67.1)	25 (30.5)	02 (2.4)
13.0-13.9	Boys	11 (14.3)	16 (20.8)	29 (37.7)	56 (72.7)	21 (27.8)	-
	Girls	5 (6.3)	7 (8.9)	18 (22.8)	30 (38.0)	48 (60.8)	01 (1.3)
14.0-14.9	Boys	10 (11.9)	15 (17.9)	25 (29.8)	50 (59.5)	32 (38.1)	02 (2.4)
	Girls	3 (3.8)	8 (10.3)	23 (29.5)	34 (43.6)	41 (52.6)	03 (3.8)
15.0-15.9	Boys	5 (7.0)	7 (9.9)	22 (31.0)	34 (47.9)	28 (39.4)	9 (12.7)
	Girls	2 (2.9)	6 (8.6)	17 (24.3)	25 (35.7)	41 (58.6)	04 (5.7)
16.0-16.9	Boys	3 (5.0)	4 (6.7)	14 (23.3)	21 (35.0)	37 (61.7)	27 (49.1)
	Girls	2 (3.6)	9 (16.4)	17 (30.9)	28 (50.9)	02 (3.3)	-
17.0-17.9	Boys	1 (2.2)	8 (17.4)	14 (30.4)	23 (50.0)	23 (50.0)	-
	Girls	2 (4.3)	7 (14.9)	12 (25.5)	21 (44.7)	26 (55.3)	-
All ages	Boys	36 (6.9)	83 (15.9)	184 (35.2)	303 (58.0)	203 (38.9)	16 (3.1)
	Girls	45 (8.2)	74 (13.6)	163 (29.9)	282 (51.7)	252 (46.2)	12 (2.2)
Overall	Boys+Girls	81 (7.6)	157 (14.7)	347 (32.5)	585 (54.8)	455 (42.6)	28 (2.6)
Chi-square		(Boys) Chi square $_{(df=28)}$ = 62.80, P= 0.000			(Girls) Chi-square $_{(df=28)}$ = 76.21, P= 0.000		

weight: F= 107.82, p<.0.05 and BMI: F= 39.74, p<.0.05).

The overall (combined age and sex) frequency of undernutrition was 54.8 percent (Table 2). The frequencies (combined age) of undernutrition among boys and girls were 58.04 percent and 51.65 percent respectively. The rates of undernutrition of boys varied between 35.0 percent among 16 years old to 72.7 percent at age 13 years. The rates of undernutrition of girls

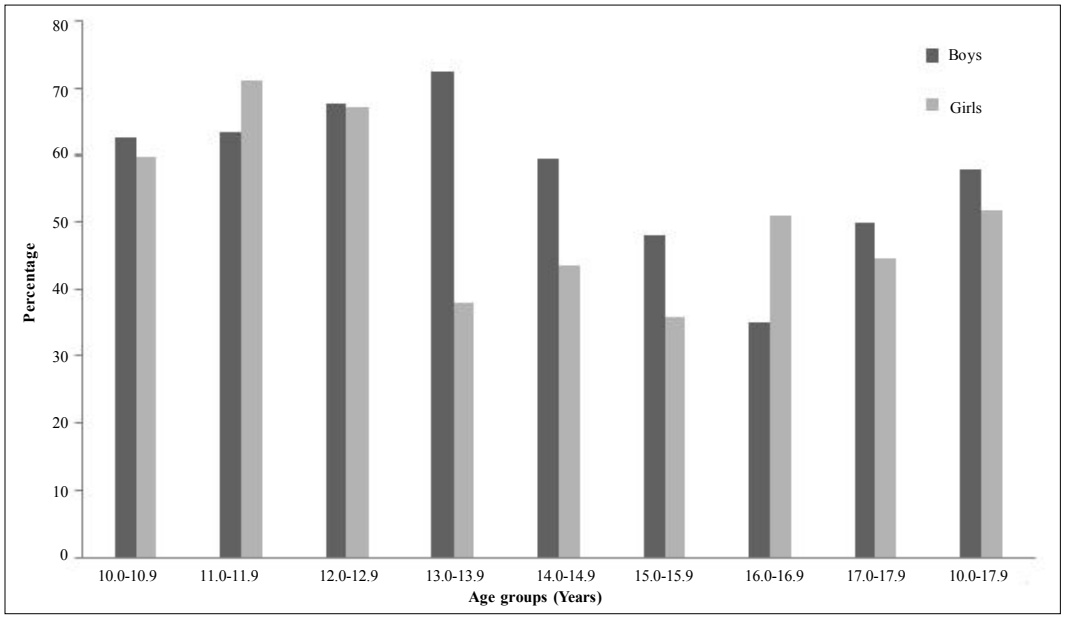

Fig. 1. Prevalence of undernutrition among Muslim adolescents

Table 3: Comparison of the prevalence of undernutrition among Indian children

Studied children	*Age groups*	*n*	*Methods*	*Prevalence (%)*	*References*
School children, Bankura District, West Bengal	6-14	454	BMI/age Z-score	23.1	Bose et al., 2008
School children, Paschim Medinipur and Purulia District, West Bengal	10-15	2016	Thinness by BMI	44.5	Bose and Bisai, 2008
School children, Dibrugarh district, Assam	6-14	304	Thinness by BMI	53.9	Medhi et al., 2006
Children, Dibrugarh district, Assam	10-18	605	Thinness by BMI	50.2	Medhi et al., 2006
Kora-Mudi tribal children, Paschim Mediniapur, West Bengal	2-13	119	Thinness by BMI	67.2	Bisai et al., 2010
Muslim school children, Nadia, West Bengal	6-16	638	Thinness by BMI	56.7	Mondal et al., 2011
Paschim Medinipur, West Bengal	6-12	500	Thinness by BMI	77.0	Das et al., 2012
School children, Darjeeling, West Bengal	10-18	1165	Thinness by BMI	49.1	Mondal N, 2014
North 24 Parganas, West Bengal	10-17	1068	Thinness by BMI	54.8	Present study

varied between 35.7 percent among 15 years old to 71.2 percent at age 11 years. The overall (combined age and sex) frequency of undernutrition was 28 percent. A distinctive age variation in the change of the rate of undernutrition was observed in both sexes (Fig. 1). Boys demonstrated a steady increased in the rate of undernutrition from 10 to 13 years of age. Thereafter, the rate decreased from 14 to 16 years then increased at age 17 years. Contrarily, among girls there was a substantial increase in the rate of undernutrition from 10 to 11 years of age followed by a distinctive decrease from 12 to 13 years, and then it is increase at age 14 years and slightly decreases at age 15 years. Thereafter, there was an increase at the 16 years and a slight decrease at 17 years. There was significant age differences (boys, Chi-square= 62.80, $p = 0.000$, girls, Chi-square = 76.21, $p = 0.000$) in nutritional status based on BMI of studied children.

DISCUSSION

Adolesence 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 a significant problem and continues to be a cause of morbidity and mortality among children in developing countries like India (UNICEF 2006). Cole et al. (2007) has stated that undernutrition is better assessed as thinness (low body mass index for age) than as wasting (low weight for height). Malnutrition (under-nutrition and over-nutrition) continues to be a problem of considerable magnitude in most developing countries of the world (Som et al. 2006). The mean height, weight and BMI of the Bengalee Muslim boys and girls of this study were higher than those reported among rural adolescents in a recent syudy from India (ICMR 1996). The comparison of prevalence of undernutrition among Indian children with present study is presented in Table 3. In the present investigation more than half (54.8%) of the rural Bengalee Muslim adolescents was undernourished. The rate of undernutrition of children of present study was higher than those reported by six Indian studies, that is, 23.1 percent (Bankura District, Bose et al. 2008), 44.5 percent (Paschim Medinipur and Purulia Districts, Bose and Bisai 2008), 53.9 percent, 50.2 percent (Dibrugarh District, Assam, Medhi et al. 2006), and 49.1 percent (Darjeeling Districts, Mondal N. 2014). However, the rate of undernutrition of the present study is lower to those of two Paschim Medinipur studies that is, 67.2 percent (Bisai et al. 2010) and 77 percent (Das et al. 2012) and the Muslim school children of Nadia Districts that is, 56.7 percent (Mondal et al. 2011).

CONCLUSION

The present study revealed that both under and over nutrition is present study among Muslim school children.

This study provided three vital messages:

1. Rural Muslim adolescents of North 24 Parganas, West Bengal, had critical situation of undernutrition (overall = 54.8%, boys= 58.04 % and girls=51.65).
2. There were straightforward age and sex variations in the rates of undernutrition prevalent among the studied samples.
3. These rates of undernutrition of the present study were higher than maximum earlier Indian findings (Bose et al. 2008, Bose and Bisai 2008, Medhi et al. 2006, Bansal et al. 2013 Mondal N. 2014).

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