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Anthropometric Assessment of Nutritional Status of Adolescents of Kolkata, West Bengal

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ABSTRACT A cross-sectional study of 559 Bengalee adolescents (314 boys and 245 girls) of North 24 Parganas, West Bengal, was undertaken to study their age and sex differences in nutritional status. The subjects were classified into four age groups with one-year intervals. Individuals falling below the age and sex specific fifth percentile of the World Health Organization (WHO) recommended National Health and Nutrition Examination Survey (NHANES I) were defined as undernourished. The overall rate of undernutrition was 36.49%. Regardless of sex, the rate of undernutrition progressively increased from 31.88% to 39.80% with the advancement of age. However, a clear-cut age variations in the change of the rate of undernutrition have been observed in both the sexes. The prevalence of undernutrition (combining all ages) varied between boys (41.08%) and girls (30.61%). In general, this study provided evidence that the Bengalee adolescents had moderate rates of undernutrition. These rates were, in general, lower than those reported in other developing countries including previous Indian studies.

INTRODUCTION

Anthropometrics can be sensitive indicators of health, growth and development in infants and children. In particular anthropometry has been used during adolescence in many contexts related to nutritional status (WHO, 1995; Bose and Mukhopadhyay, 2004). According to World Health Organization, the ultimate intention of nutritional assessment is to improve human health (Beghin et al., 1988). 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 adolescents 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 adolescents from different parts of India (Kanade et al., 1999; Singh and Mishra, 2001; Venkaiah et al., 2002). However, there is scanty information on the nutritional status of adolescents from urban West Bengal (Woodruff and Duffield, 2002). Moreover, to date, there are no studies (de Onis et al., 2001; Bhadra et al., 2004), which have dealt with sex differences in the level of undernutrition among adolescent Bengalees. The present investigation was attempted to evaluate the overall prevalence of undernutrition and to assess age-sex trends in the level of undernutrition among 11-14 year old Bengalee adolescents of North 24 Parganas, West Bengal.

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MATERIALS AND METHODS

The present study was carried out during the period February–October 2000. The data were collected from two adjacent secondary schools (one for boys and other for girls) in the district of North 24 Parganas, West Bengal, India. Both the schools were located within the area under the jurisdiction of Kolkata Metropolitan Develop-ment Authority (KMDA). Necessary approval was obtained from both the school authorities prior to the commencement of the study. Authentication of age and ethnicity were prepared from the school records. The students were mostly upper-class Bengalees who belonged to Bengali speaking Hindu caste of West Bengal.

A total of 559 students (314 boys and 245 girls) aged 11-14 years participated in the present study. The study was cross-sectional in nature and the subjects were selected through random sampling procedure. All subjects completed a

pre-tested questionnaire containing a number of specific questions on age, ethnicity and socio-demographic profile etc.

A total of nineteen anthropometric measurements (height, weight, seven circumferences and ten skinfolds) were made by trained investigators (AM and MB) 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 was evaluated using the World Health Organization (WHO, 1995) recommended age and sex specific cut-off points of BMI based on the National Health and Nutrition Examination Survey (NHANES I) percentile values (WHO, 1985). Undernutrition (thinness) was defined as BMI < 5th percentile values of NHANES I. 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. All statistical analyses were performed using the Statistical Package for Social Sciences (SPSS, Version 7.5.1, 1996).

RESULTS

The means and standard deviations of the anthropometric characteristics by age groups of the boys and girls are presented in Table 1. There was a positive linear increasing trend in mean height and weight for boys between 11 and 14 years of age. Girls showed similar age trend for height except age 13 years and for weight excluding age 12 years. Mean BMI increased progressively by 0.70 kg/m^2 for boys and 1.00 kg/m^2 for girls, from 11 years to 14 years of age. Moreover, combining all ages, the mean BMI for girls (16.64 kg/m^2, ± 2.62) were slightly higher than boys (16.19 kg/m^2, ± 2.07).

In general, the overall rate of undernutrition was 36.49% (Table 2). The frequency of undernutrition (combining all ages) varied between boys (41.08%) and girls (30.61%). Irrespective of sex, the rate of undernutrition progressively increased from 31.88% to 39.80% with the advancement of age. Distinctive age variations in the change of the rate of undernutrition was observed in both sexes (Fig. 1). Boys demonstrated a slight decline in the rate of undernutrition from 11 to 12 years of age. Thereafter, the rate increased considerably at age 13 and 14 years. In contrast, among girls, there

Table 1: Age and sex variation in anthropometric characteristics of 11-14 years old urban Bengalee adolescents

Age (in years)		*Height (cm)*	*Weight (kg)*	*Body mass index (kg/m^2)*
		Mean SD	*Mean SD*	*Mean SD*
11	Boys	132.01	27.51	15.70
	(n=53)	8.16	5.13	1.95
	Girls	142.02	33.81	16.48
	(n=85)	9.04	8.65	2.56
12	Boys	138.00	30.89	16.12
	(n=87)	8.70	5.88	2.01
	Girls	143.75	33.68	16.12
	(n=61)	7.85	7.80	2.59
13	Boys	145.51	34.88	16.35
	(n=116)	8.01	7.05	2.24
	Girls	141.60	34.05	16.82
	(n=59)	8.10	7.51	2.64
	Boys	153.09	38.79	16.40
14	(n=58)	8.90	7.53	1.88
	Girls	145.33	37.28	17.48
	(n=40)	8.64	8.11	2.64
All ages	Boys	142.55	33.26	16.19
	(n=314)	10.88	7.50	2.07
	Girls	142.89	34.40	16.64
	(n=245)	8.52	8.14	2.62

Table 2: Prevalence of undernutrition (based on < 5th percentile of BMI) of 11-14 year old urban Bengalee adolescents

Age (in years)	*Normal*		*Under-nutrition*		*Overall nutrition*
	Boys	*Girls*	*Boys*	*Girls*	*Boys+Girls*
	No. %	*No. %*	*No. %*	*No. %*	*No. %*
11	34	60	19	25	44
	64.15	70.59	35.85	29.41	31.88
12	57	38	30	23	53
	65.52	62.30	34.48	37.70	35.81
13	66	41	50	18	68
	56.90	69.49	43.10	30.51	38.86
14	28	31	30	9	39
	48.28	77.50	51.72	22.50	39.80
All	185	170	129	75	204
ages	58.92	69.39	41.08	30.61	36.49

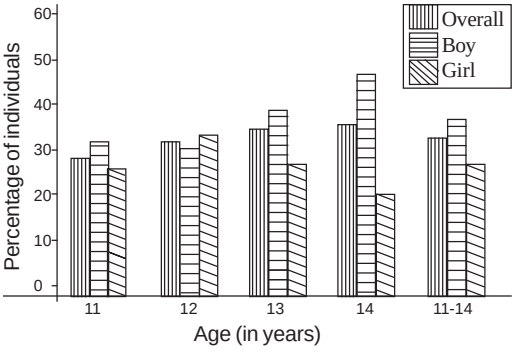

Fig. 1. Prevalence of undernutrition among Bengalee adolescents

was a substantial increase in the rate of undernutrition from 11 to 12 years of age followed by a distinctive decrease at the ages 13 and 14 years.

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 contributing substantially to children's survival (Rahmathullah et al., 1990). There is scanty information on the nutritional status of Bengalee adolescents. Therefore, there is a need to develop a database of adolescent undernutri-tion from different parts of the country.

The mean height, weight and BMI of the Bengalee boys and girls of this study was higher than those reported among rural adolescents in a recent study from India (Venkaiah et al., 2002). However, the mean height of the boys of the present study was lower but BMI was higher than those among urban boys of Kolkata reported by de Onis et al. (2001).

In the present investigation more than one third (36.49%) of the urban Bengalee adolescents was undernourished (Table 3). The extent of undernutrition was slightly higher to those among Nepali refugees reported by Woodruff et al. 1999 (34%); and markedly higher than those observed among rural African adolescents reported by Kurz 1996 (23%). However, the rate of undernutrition of the present study is quite similar to those of rural Nepalese (36%, Kurz 1996) but significantly lower than those reported

Table 3: Comparative frequency of undernutrition among adolescents of different countries

Reference study	*Area / Population*	*Sex*	*Date of survey*	*Under-nutrition*
Kurz, 1996	Bombay, India	Both	1992-93	53.00%
Kurz, 1996	Nepal	Both	1992-93	36.00%
Kurz, 1996	Benin, West Africa	Both	1992-93	23.00%
Cookson et al., 1998	Dadaab, Kenya	Both	1998	61.00%
Woodruff et al., 1998	Kakuma, Kenya	Both	1998	57.00%
Woodruff et al., 1999	Nepal	Both	1999	34.00%
Present Study	Kolkata, India	Both	2000	36.49%
de Onis et al., 2001	India	Boys	1982-83	50.50%
Venkaiah et al., 2002	India	Boys	1996-97	67.00%
I R C, 1997	Kakuma, Kenya	Boys	1997	75.00%
Present Study	Kolkata, India	Boys	2000	41.08%
Venkaiah et al., 2002	India	Girls	1996-97	40.00%
I R C, 1997	Kakuma, Kenya	Girls	1997	55.00%
Ahmed et al., 1998	Dhaka, Bangladesh	Girls	1995	16.00%
Present Study	Kolkata, India	Girls	2000	30.61%

by one Indian study (53%, Kurz 1996) and two Kenyan investigations, i.e. 61% (Cookson et al., 1998) and 57% (Woodruff et al., 1998).

Considering sex variation, the rate of undernutrition among adolescent boys of the present study (41.08%) is distinctively lower than the two recent Indian studies: one of urban boys of Kolkata (50.50%) studied by de Onis et al. (2001) and another among 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). On the other hand, the rate of undernutrition among adolescent girls of the present sample (30.61%) demonstrated a significantly higher rate of undernutrition compared to Bangladeshi girls (16%) studied by Ahmed et al. (1998), but lower than Kenyan refugee girls (55%) and rural Indian girls (40%) reported by IRC (1997) and Venkaiah et al. (2002) respectively. In conclusion, this study provided three vital messages:

1. Urban adolescents of North 24 Parganas, West Bengal, had moderate rates of undernutrition

(overall = 36.49%).
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 lower than other developing countries and specifically lesser than earlier Indian findings.

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REFERENCES

Ahmed, F., Zareen, M., Khan, M.R., Banu, C.P., Haq, M.N. and Jackson A.A.: Dietary patterns, nutrient intake and growth of adolescent school girls in urban Bangladesh. *Pub. Health Nutr*., **1**: 83-92 (1998).

Beghin, I., Cap, M. and Dujardin, B.: *A Guide to Nutritional Assessment*. World Health Organization, Geneva, Switzerland (1988).

Bhadra, M., Mukhopadhyay, A. and Bose K.: Body mass index, regional adiposity and central body fat distribution among Bengalee Hindu girls: A Comparative Study of Pre-menarcheal and Menarcheal Subjects. *Acta. Med. Auxol*., **33**: 39 – 45 (2001).

Bhadra, M., Mukhopadhyay, A. and Bose K.: Sex differences in anthropometric characteristics among 11-14 year old urban Bengalees of North 24 Parganas, West Bengal, India. *Anthropologie*, **42:** 137-140 (2004).

Bose, K. and Mukhopadhyay, A.: Nutritional status of adolescent Bengalee Boys. *Indian Pediatrics*, **41**: 633 (2004).

Cookson, S. T., Woodruff, B. A. and Slutsker, L.: *Prevalence of anemia and low body mass index among adolescents 10-19 y of age in refugee camps in Dadaab District, Kenya*. Centers for Disease Control and Prevention, Atlanta, GA (1998).

de Onis, M., Dasgupta, P., Saha, S., Sengupta, D. and Blossner, M.: The National Center for Health Statistics reference and the growth of Indian adolescent boys. *Am. J. Clin. Nutr*., **74**: 248-253 (2001).

Himes, J.H. and Bouchard, C., Validity of anthropometry in classifying youths as obese. *Int. J. Obes*., **13**: 183-193 (1989).

International Rescue Committee, *Nutritional Status of School Aged Children in Kakuma Refugee Camp*. International Rescue Committee, Nairobi (1997).

Kanade, A.M., Joshi, S.B. and Rao, S., Undernutrition and adolescent growth among rural Indian boys. *Indian Pediatrics*, **36**:145-156 (1999).

Kurz, K.M., Adolescent nutritional status in developing countries. *Proc. Nutr. Soc*., **55**: 321-331 (1996).

Lohman, T.G., Roche, A.F. and Martorell, R.: *Anthropometric Standardization Reference Manual*. Human Kinetics Books, Chicago (1988).

Must, A., Dallal, G.E. and Dietz, W.H.: Reference data for obesity: 85th and 95th percentiles of body mass index (wt/ht^2) and triceps skinfold thickness. *Am. J. Clin. Nutr*., **53**: 839-846 (1991).

Rahmathullah, L., Underwood, B.A., Thulasiraj, R.D., Milton, R.C., Ramaswamy, K., Rahmathullah, R. and Babu, G.: Reduced mortality among children in Southern India receiving a small weekly dose of vitamin A. *N. Engl. J. Med*., **323**: 929 – 935 (1990).

Rolland-Cachera, M.F.: Body composition during adolescence: methods, limitations and determinants. *Hormone Research*, **39**: 25-40 (1993).

Singh, N. and Mishra, C.P.: Nutritional status of adolescent girls of a slum community of Varanarsi. *Indian J. Public Health*, **45**: 128-134 (2001).

Ulijaszek, S.J. and Kerr, D.A.: Anthropometric measurement error and the assessment of nutritional status. *Brit. J. Nutr.*, **82**:165-177 (1999).

Venkaiah, K., Damayanti, K., Nayak, M.U. and Vijayaraghavan, K.,: Diet and nutritional status of rural adolescents in India. *Eu. J.Clin. Nutr.*, **56**: 1119-1125 (2002).

Woodruff, B. A., Slutsker, L. and Cook, S. T.: *Prevalence of anemia and low body mass index in adolescents 10-19 y age in Kakuma camp, Kenya.* Centers for Disease Control and Prevention, Atlanta, GA (1998).

Woodruff, B.A., Duffield, A., Blanck, H., Larson, M.K., Pahari, S. and Bhatia, R.: *Prevalence of Low Body Mass Index and Specific Micronutrient Deficiencies in Adolescents 10-19 y of Age in Bhutanese Refugee Camps, Nepal, October 1999*. Centers for Disease Control and Prevention, Atlanta (1999).

Woodruff, B.A. and Duffield, A.: Anthropometric assessment of nutritional status in adolescent populations in humanitarian emergencies. *Eu. J.Clin. Nutr.*, **56**: 1108-1118 (2002).

World Health Organization: *Measuring nutritional status*. World Health Organization, Geneva (1985).

World Health Organization: *Physical Status: The Use and Interpretation of Anthropometry.* Technical Report Series No. 854. World Health Organization, Geneva (1995).