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Anthropometric characteristics of rural primary school children of Hooghly District, West Bengal, India

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ABSTRACT

Background: *School going children are the future generation of any country and their nutritional needs are critical for the well-being of society.*

Objectives: *To assess the anthropometric characteristics among primary school children.*

Materials and methods: *Present cross-sectional study was conducted among 303 primary school children (144 boys and 159 girls) of Jangipara Block of Hooghly district, West Bengal. Anthropometric measurements such as Height (HT), Weight (WT), Sitting Height (SH), Height Acromion, Head Circumference (HC), and Mid-Upper-Arm-Circumference (MUAC) were measured by standard techniques. Body Mass Index (BMI) and Sub-ischial Leg Length (SLL) were computed following standard techniques.*

Results: *Descriptive statistics of all anthropometric variables were prepared. Results of t-test showed that there were significant sex differences in all anthropometric variables (HT, WT, SH, HT Acromion, HC, BMI) except MUAC and SLL. ANOVA (F) test values for boys indicated that there were significant age differences in HT, WT, SH, HT Acromion, and SLL. Similarly, F values for girls revealed that significant age differences were observed in all anthropometric variables (HT; WT; SH; HT Acromion; MUAC; HC; and SLL) except BMI. Comparison of height and weight shows that studied children were shorter and lighter than other reported Indian and reference (WHO) studies. BMI comparison also indicates similar findings. Present studied children have less height, weight and BMI in relation with reference values (WHO, 2006 and NCHS, 2012).*

Conclusion: *The present cross-sectional study attempts to describe the physical growth of the rural primary school children of Hooghly District of West Bengal. in terms of anthropometric characteristics.*

Keywords: *Children, Anthropometry, Height, Weight, BMI, Growth.*

INTRODUCTION

School going children are the future generation of any country and their nutritional needs are critical for the well-being of society. In SEAR (South East Asian Region), a large number of children suffer from chronic malnutrition and anaemia, which adversely impacts their health and development (WHO, 2006). The school age period is nutritionally significant because this is the prime time to build-up body stores of nutrients in the preparation for rapid growth of adolescence. Nutrition plays a vital role during childhood because inadequate nutrition leads to malnutrition, growth retardation, reduced work capacity and poor mental and social development (Awasthi, 2000). Primary school children are an important segment of child population, as they form the first institutionalized group that can be approached for health, nutritional and educational interventions with ease. The rate of growth of children varies with the environment in which they live. Better nutritional environment of children in the high socioeconomic community accelerates growth and poor socioeconomic group retards it (Banik Datta et al., 1973). Research indicates that nutritional deficiencies and poor health in primary-school-age children are among the causes of low school enrolment, high absenteeism, early dropout, and poor classroom performance (WHO, 1997).

Malnutrition in India is in a state of "Silent Emergency "and there by demand greater priority than ever before, the nutritional state of population therefore critical to the development and well-being of the nation (NNP, 1993). According to World Health Organization, the ultimate intention of the Nutritional Assessment is to improve human health and improve nutrition which is also one of the goals of SDGs (Sustainable Development Goals). Child nutritional status is an essential component of a country's overall human development. There is a growing consensus that poor nutritional status during childhood (or even in uterus) can have long-lasting scarring consequences into adulthood, both in terms of health and mortality, and in terms of other measures of human capital such as schooling and productivity (Behrman et al., 2006). Nutritional assessment in the community is essential for accurate planning and implementation of intervention programmes to reduce morbidity and mortality associated with undernutrition (Osibogun, 1998). Extensive surveys has been carried out in different parts of India and the finding shows that sickness morbidity and mortality rates of children in India are among the highest in the world (Taneja, 1978).

Anthropometry has been used during childhood and adolescence in many contexts related to nutritional status (WHO, 1995). It is well recognized worldwide that anthropometric measurements are essential to diagnosis of undernutriton. Due to its simplicity and low cost, anthropometric evaluations give simple and reliable estimation of undernutrition prevalence. Measures obtained from anthropometry can be sensitive indicators of health, development of growth in infants and children. Thus anthropometric examination is an almost mandatory tool in any research on health and nutrition condition in childhood (Rao, 1970 and Bose and Mukhopadhyay, 2004).

Several studies worldwide have investigated the growth status of school going children of various ethnic groups (Goon et al., 2011; Rana et al., 2012; Ibegbu et al., 2013). Several recent studies evaluated the nutritional status of school children from different regions of India (Medhi et al., 2006; Basu et al., 2014; Thakur and Gautam, 2014 and 2015; Shivaprakash and Joseph, 2014; Malpani et al., 2014). Hitherto, previous studies from West Bengal have assessed the growth status of school going children (Bose et al., 2005; Bose et al., 2008; Bisai et al., 2008; Chakraborty and Bose, 2009; Das and Bose, 2011; Das et al., 2012; Mondal and Bose, 2014; Das et al., 2014). In view of this, the present study attempted to assess the anthropometric characteristics among 6-10 years old rural primary school children of Hooghly district of West Bengal, India.

MATERIALS AND METHODS

Our cross-sectional study was undertaken among four rural primary schools of Jangipara Block of Hooghly district, West Bengal. Jangipara, a rural administrative Block of West Bengal. It is situated approximately 40 kilometers away from the Kolkata, the provincial city of West Bengal. The present study was conducted from July to August of 2013. All the studied children were inhabitants of Jangipara Block of Hooghly District of West Bengal. The data were collected from four primary schools situated in the block. All the registered students were eligible for this study. They were invited to participate in our study. Absenteeism due to illness was the major cause of non-participating. Date of birth of the children was recorded from the school registers. The objectives of the study were informed to their teachers of the students before the commencement of the study. Our study included 303 children (boys 144 and girls 159) aged 6-10 years. Ethical approval was obtained from relevant Vidyasagar University Ethics Committee.

All anthropometric measurements [Height (HT), Weight (WT), Sitting Height (SH), Height Acromion, Head Circumference (HC), and Mid-Upper-Arm-Circumference (MUAC)] were taken for each subject by one investigator (SP) following the standard techniques (Lohman et al., 1988). Body Mass Index (BMI) and Sub-ischial Leg Length (SLL) were derived by standard equations. BMI (kg/m2) = Weight (kg)/Height^2 (m^2) and SLL (cm.) = HT (cm.)-SH (cm.).

Descriptive statistics (mean and standard deviation) of all anthropometric characteristics by age and sex were computed. Independent sample t-test and one-way analysis of ANOVA were performed to test the significant differences in mean anthropometric characteristics by sex and age of children. All statistical analyses were undertaken using the SPSS Statistical Packages (version 16.0). Statistical Significance was set at $p<0.05$.

RESULTS

Age and sex specific sample distribution, descriptive statistics (mean and standard deviation), and results of t-test and F-test (ANOVA) of the studied children are represented in Table 1. Independent sample t-test was performed to test the significant sex differences for all anthropometric variables. It is clear from the Table 1 that there was a continuous increase in mean values of height with advancement of age among boys. It was also observed for height of girls in all age groups except at 10 years. Age-combined difference in height among both sexes was statistically significant. Boys were heavier than girls in all groups as well as overall age combined. Results of t-test showed that there was negative significant sex differences in total (age combined) for all anthropometric variables except MUAC and SLL (HT: t= -2.734, p<.01; WT: t= -3.162, p<.01; SH: t= -3.304, p<.001; HT Acromion: t= -2.369, p<.05; HC: t= -6.818, p<.001; and BMI: t= -2.257, p<.05). It showed that boys (total age combined) had higher mean values for anthropometric variables than girls (total age combined). Table 1 revealed that significant age difference was found in all mean anthropometric variables except BMI for girls (HT: F= 35.064, p<.001; WT: F= 23.694, p<.001; SH: F= 21.358, p<.001; HT Acromion: F= 33.644, p<.001; MUAC: F= 9.471, p<.001; HC: F= 7.713, p<.001; and SLL: F= 26.414, p<.001). Similarly, for boys significant age difference was observed in all mean anthropometric variables except MUAC, HC, and BMI (HT: F= 27.189, p<.001; WT: F= 12.508, p<.001; SH: F= 13.632, p<.001; HT Acromion: F= 27.395, p<.001; and SLL: F= 25.945, p<.001).

DISCUSSION

Over one-fifth of our population comprises of children aged 5-14 years, that is, the group covering primary and secondary education (Raghava, 2005). Children belonging to 5-12 years age group are vulnerable because of their rapid growth rate. They need more attention and care for the physical and mental development. Physical growth, development and well-being are directly related to the nutritional status. Chronic undernutrition is considered to be the primary cause of ill health and premature mortality among children in developing countries (Nandy et al., 2005). Height and weight are the two basic measures that are commonly used to assess the growth status of children. Figure 1(a) shows that comparison of median values of height (cm.) of studied girls with other Indian studies and WHO (2006) reference values. It indicates that studied girls are shorter than any other children studied by others (WHO, 2006; Khadilkar et al., 2009; and Marwaha et al., 2011]. The present study showed that the studied children had lower values for all measurements when compared to other Indian studies and reference studies. With increasing age, the difference between the stature of other studied children and present study are increased.

The measurement of weight is the most important reliable criterion for the assessment health and nutritional status of children and is considered to be an important trait which changes during childhood. A comparative picture of body weight [Figure 1(b)] also revealed the similar findings. Weights of the present studied girls are lesser than other reported studies. Other studies (WHO, 2006; Khadilkar et al., 2009; Marwaha et al., 2011) show that children are taller than present studied boys. Figure 2(b) reflects that present studied boys are lesser than other studied children.

The BMI is a measure of overall adiposity. The WHO (2006) recommends it as a fatness measure in children for public health screening. Figures 3(a) and 3(b) outlines the comparison of BMI of the studied children with other international (NCHS, 2012) and Indian studies [(Bose et al., 2007) and (Thakur and Gautam, 2014; 2015)]. It is evident from these figures that mean BMI of the studied children were much lower than these studies.

CONCLUSION

In our study, we assessed the physical growth of rural primary school children and compared the findings with other international and Indian studies. It was observed that boys were heavier and taller than girls. It also revealed that present studied children were shorter, lighter and had lower mean BMI than other compared international and Indian studies. Although one of the main limitations of our study was the small sample size, it unequivocally indicated that these children had unfavourable growth status. Appropriate nutritional intervention programs may be required for them so that they can attain their full growth potential.

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AUTHOR'S CONTRIBUTION

SP and KB conceptualized and designed the present work. SP collected the data, prepared the first manuscript and edited by the KB. Both authors are involved in preparing the draft and approved the final manuscript.

CONFLICT OF INTEREST

Authors are declared that there are no conflicts of interest.

REFERENCES

1. Agarwal DK, Agarwal KN, Upadhyay SK, Mittal R, Prakash R, Rai S. 1992. Physical and sexual growth pattern of affluent Indian children from 5–18 years of age. *Ind. Pediatr.* 29:1203–1282.
2. Awasthi CP, Kumar S, Tiwari PP, Singh AB. 2000. Nutritional status of preschool and school children in rural area of Sultanpur district. *J. Dairying Foods & Home Sci*. 19: 16-21.
3. Basu D, Islam G, Gogoi R, Dey S, Deori J. 2014. Child's growth and nutritional status in two communities – Mishing tribe and Kaibarta caste of Assam, India. *Int. J. Sociology and Anthropology* 6(2):59-69.
4. Banik Datta ND, Nayar S, Krishna, Bakshi and Taskar AD. 1973. Growth pattern of Indian school children in relation to nutrition and adolescence. *Indian J. Pediatr*. 40(173).
5. Behrman JR, Hoddinott JF, Maluccio JA, Soler-Hampejsek E, Behrman EL, Martorell R, Ramirez-Zea M, Stein AD. 2006. What Determines Adult Cognitive Skills? Impacts of Pre-schooling, Schooling and Post-schooling Experiences in Guatemala. *PSC Working Paper Series PSC* 06-03.
6. Bisai S, Bose K, Ghosh A. 2008. Prevalence of undernutrition of Lodha children aged 1-14 years of Paschim Medinipur District, West Bengal, India. *Iran J. Pediatr*. 18(4):323-329.
7. Bose, K and Mukhopadhyay, A. 2004. Nutritional status of adolescent Bengalee Boys. *Ind. Pediatr*.41:633.
8. Bose K, Bhattacharya S, Basu K, Ghosh K, Mukhopadhyay A, Bhadra M. 2005. Age trends in anthropometric characteristics among 6-9 years old Bengalee Hindu school girls of Kolkata, India. *Anthrop. Anz.* 63(4):439-448.
9. Bose K, Bisai S, Mukhopadhyay A, Bhadra M. 2007. Overweight and obesity among affluent Bengalee schoolgirls of Lake Town, Kolkata, India. *Mater. & child Nutr*. 3:141-145.
10. Bose K, Bisai S, Mukherjee S. 2008. Anthropometric characteristics and nutritional status of rural school children. *Int. J. Biol. Anthropol.* 2:1.

11. Chakraborty R, Bose K. 2009.Very high prevalence of thinness using new international body mass index cut off points among 5-10 year old school children of Nandigram, West Bengal, India. *J. Res. Med. Sci.* 14(2):129-33.
12. Das S, Bose K. 2011. Prevalence of thinness using new international cut-off points among Santal tribal children and adolescents of Purulia District, West Bengal, India. *Sri Lanka J. Child Health* 40(3):105-110.
13. Das S, Addhya D, Chakrabarty F. 2012. Prevalence of thinness among 6-12 years rural children of Kharagpur A cross-sectional study in West Bengal, India. *Antro. J. Anth.* 8(1):5-10.
14. Das M, Mandal GC, Ray S. 2014. Prevalence of undernutrition among children aged 5-10 years of North-24 Parganas District, West Bengal, India. *Ind. J. Phys. Anthrop. & Hum. Genet.* 33(1):91-97.
15. Goon DT, Toriola AL, Shaw BS, Amusa LO, Monyeki MA, Akinyemi O, Alabi OA. 2011. Anthropometrically determined nutritional status of urban primary schoolchildren in Makurdi, Nigeria. *BMC Public Health*, 11:769. Doi: 10.1186/1471-2458-11-769.
16. Ibegbu AO, Tosin DE, Hamman WO, Umana UE, Musa SA. 2013. Nutritional evaluation using different anthropometric variables in Nigerian school children. *J. Exp. Clin. Anat.* 12(2):42-49.
17. Khadilkar VV, Khadilkar AV, Cole TJ, Sayyad MJ. 2009. Cross-sectional growth curves for height, weight and body mass index for affluent Indian children, 2007. *Ind. Pediatr.* 46:477–89.
18. Lohman TG, Roche AF, Martorell R. 1988. Anthropometric Standarization Reference Mannul. Chicago: Human Kinetics Books.
19. Malpani AK, Sarat S, Shivanand VH, Ade A. 2014. Prevalence of Malnutrition among School Children in Rural Area of North Karnataka Region. *Ind. J. Phar. Prac.* 7(2):33-36.

20. Mandal GC, Bose K. 2014. Thinness among primary school children of the migrated Santals of Arambag, West Bengal, India. *Int. J. Food Safety, Nutrition and Public Health.* 5(1):46-53.

21. Medhi GK, Barua A, Mahanta J. 2006. Growth and nutritional status of school age children (6-14 years) of tea garden worker of Assam. *J. Hum. Ecol.* 19:83-85.
22. Mondal N, Basumarary B, Kropi J, Bose K. 2015. Prevalence of double burden of malnutrition among urban school going Bodo children aged 5-11 years of Assam, Northeast India. *Epide. Biostat. and Pub. Health* 12(4):e114971-10.
23. Marwaha RK, Tandon N, Ganie MA, Kanwar R, Shivaprasad C, Sabharwal A, Bhadra K, Narang A. 2011. Nationwide reference data for height, weight and body mass index of Indian school children. *Nat. Med. J. Ind.* 24(5):269-277.
24. Nandy S, Irving M, Gordon D, Subramanian SV and Smith GD. 2005. Poverty, child undernutrition and morbidity: New evidence from India. *Bull. World Organ.*83:210-216.
25. National Nutritional Policy, 1993, Government of India. Department of Women & child development. Ministry of Human resource development, New Delhi.

26. NCHS. 2012. Anthropometric Reference Data for Children and Adults: United States, 2007–2010. Vital and Health Statistics. Series 11:No. 252.

27. Osibogun A. A handbook of public health nutrition for developing countries. 1998. Lagos: Akin Osibogun consultants; 48-65.

28. Raghava PK. 2005. School health. *Ind. J. Community Med.* 30:1-3.

29. Rao, KV and Singh, D. 1970. An evaluation of the relationship between nutritional status and anthropometric measurements. *Am. J. Clin. Nutr.* 23:83-93.

30. Rana MM, Ferdoushi A, Tamanna S, Sarbin F, Nahida A. 2012. Assessment of nutritional status of 5-10 years Garo children in Sherpur District, Bangladesh. *Int. J. Biosci.* 2(11): 66-73.

31. Shivaprakash NC, Joseph RB. 2014. Nutritional Status of Rural School-Going Children (6-12 Years) of Mandya District, Karnataka. *Int. J. Sci. Stud.* 2(2):39-43.

32. Taneja MK.1978. Health status of urban shool children in western U.P. *Indian J. Pediatr.* 45(370):359-369.

33. Thakur R, Gautam RK. 2014. Prevalence of undernutrition among School going boys (5-18 years) of a Central Indian city (Sagar). *Hum. Bio. Rev.* 3 (4):364-383.
34. Thakur R, Gautam RK. 2015. Assessment of nutritional status among girls of 5-18 years of age of a Central Indian City (Sagar). *Hum. Bio. Rev.* 4 (4):325-336.
35. WHO. 1995. Physical Status: The Use and Interpretation of Anthropometry. Report of a WHO Expert Committee. Technical Report Series No.854.World Health Organization, Geneva, Switzerland.
36. WHO. 1997. Expert committee on comprehensive school health education and promotion health through schools, Report of a Geneva, WHO Technical Series No. 870.
37. WHO Multicentre Growth Reference Study Group. 2006. Assessment of differences in linear growth among populations in the WHO Multicentre Growth Reference Study. *Acta Paediatr. Suppl.* 450:56–65.

Table 1: Age-sex specific distribution, descriptive statistics, t-test value and F-test of anthropometric variables

Age (Yrs.)	N	Sex	HT (cm.)	WT (Kg.)	SH (cm.)	HT Acromion (cm.)	MUAC (cm.)	HC (cm.)	BMI (Kg/m^2)	SLL (cm.)
6	25	Boys	113.6 ±5.9	17.6 ±2.3	60.6 ±3.1	89.5 ±4.7	15.4 ±0.9	49.0 ±1.3	13.6 ±1.1	53.0 ±3.5
	30	Girls	112.2 ±5.1	16.8 ±1.2	59.5 ±3.0	88.3 ±4.9	15.3 ±1.2	47.3 ±1.1	13.3 ±1.0	52.8 ±3.9
		T	-.889	-1.595	-1.353	-.877	-.070	-5.081***	-.968	-.192
7	45	Boys	117.7 ±5.7	19.2 ±4.1	62.2 ±2.9	89.5 ±4.7	15.6 ±2.1	48.9 ±1.6	13.8 ±2.0	55.4 ±3.7
	54	Girls	114.2 ±5.0	17.3 ±1.9	60.0 ±2.9	90.4 ±4.6	15.0 ±0.9	47.5 ±1.4	13.2 ±1.2	54.2 ±3.5
		T	-3.233 **	-2.923 **	-3.832 ***	-2.567 *	-1.884	-4.501***	-1.588	-1.674
8	30	Boys	122.9 ±5.3	20.7 ±2.9	64.0 ±2.7	97.3 ±5.3	16.2 ±1.8	48.9 ±1.1	13.7 ±1.2	58.9 ±3.5
	45	Girls	122.8 ±6.0	20.9 ±3.7	63.9 ±3.1	97.6 ±5.2	16.1 ±1.2	48.4 ±1.1	13.8 ±1.4	58.9 ±3.7
		T	-.035	.283	-.065	.200	-.283	-2.086*	.405	-.001
9	20	Boys	125.4 ±5.3	22.7 ±3.8	64.7 ±3.3	99.6 ±5.3	16.1 ±1.5	49.2 ±1.1	14.4 ±2.0	60.7 ±3.3
	24	Girls	126.1 ±6.5	21.8 ±3.4	65.0 ±3.6	100.8 ±5.8	16.4 ±1.5	48.7 ±1.3	13.6 ±0.9	61.1 ±3.9
		T	.364	-.814	.249	.726	.617	-1.388	-1.635	.361
10	24	Boys	127.7 ±6.0	23.2 ±2.6	66.2 ±3.1	102.5 ±4.8	16.4 ±1.0	49.0 ±1.1	14.2 ±1.0	61.5 ±3.8
	6	Girls	123.1 ±8.0	21.6 ±3.2	64.2 ±3.1	98.5 ±5.8	16.4 ±1.3	48.5 ±0.9	14.2 ±1.1	58.8 ±5.1
		T	-1.586	-1.277	-1.351	-1.771	-.062	-1.135	.028	-1.451
Total (age com-bined)	144	Boys	120.8 ±7.4	20.4 ±3.8	63.3 ±3.5	95.8 ±6.7	15.9 ±1.7	49.0 ±1.3	13.9 ±1.6	57.5 ±4.7
	159	Girls	118.4 ±7.7	19.1 ±3.4	61.9 ±3.8	93.9 ±6.8	15.6 ±1.3	47.9 ±1.3	13.5 ±1.2	56.5 ±4.8
		T	-2.734 **	-3.162 **	-3.304 ***	-2.369 *	-1.577	-6.818***	-2.257 *	-1.811
F (Boys)			27.189**	12.508 ***	13.632 ***	27.395 ***	1.891	0.202	1.143	25.945 ***
F (Girls)			35.064 ***	23.694 ***	21.358 ***	33.644 ***	9.471 ***	7.713***	2.069	26.414 ***

***Significance at the level of p<0.05;**

**** Significance at the level of p<0.01 and**

***** Significance at the level of p<0.001**

Figure 1(a): Comparison of median height (cm.) among girls

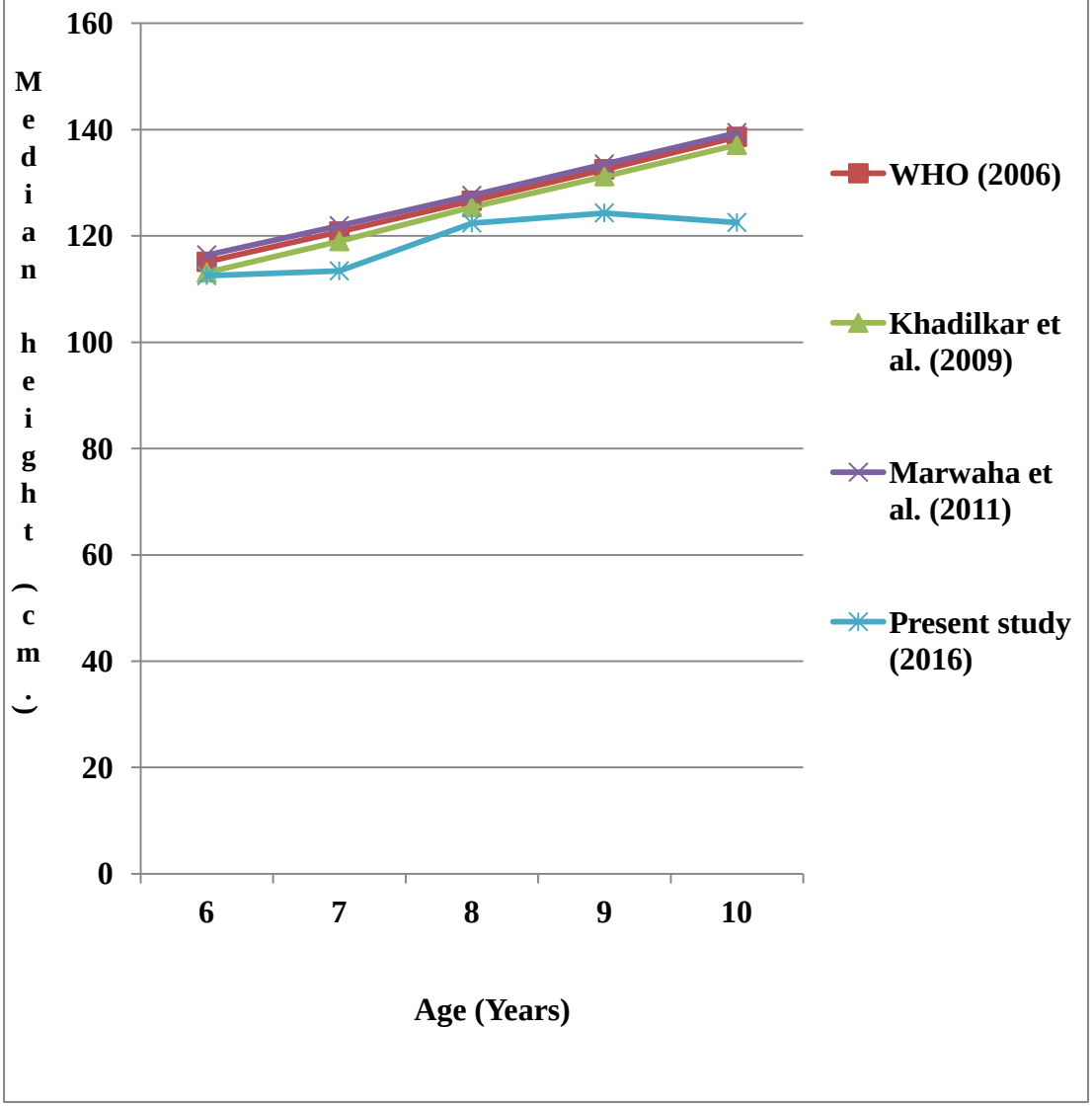

Figure 1(b): Comparison of median weight (Kg.) among girls

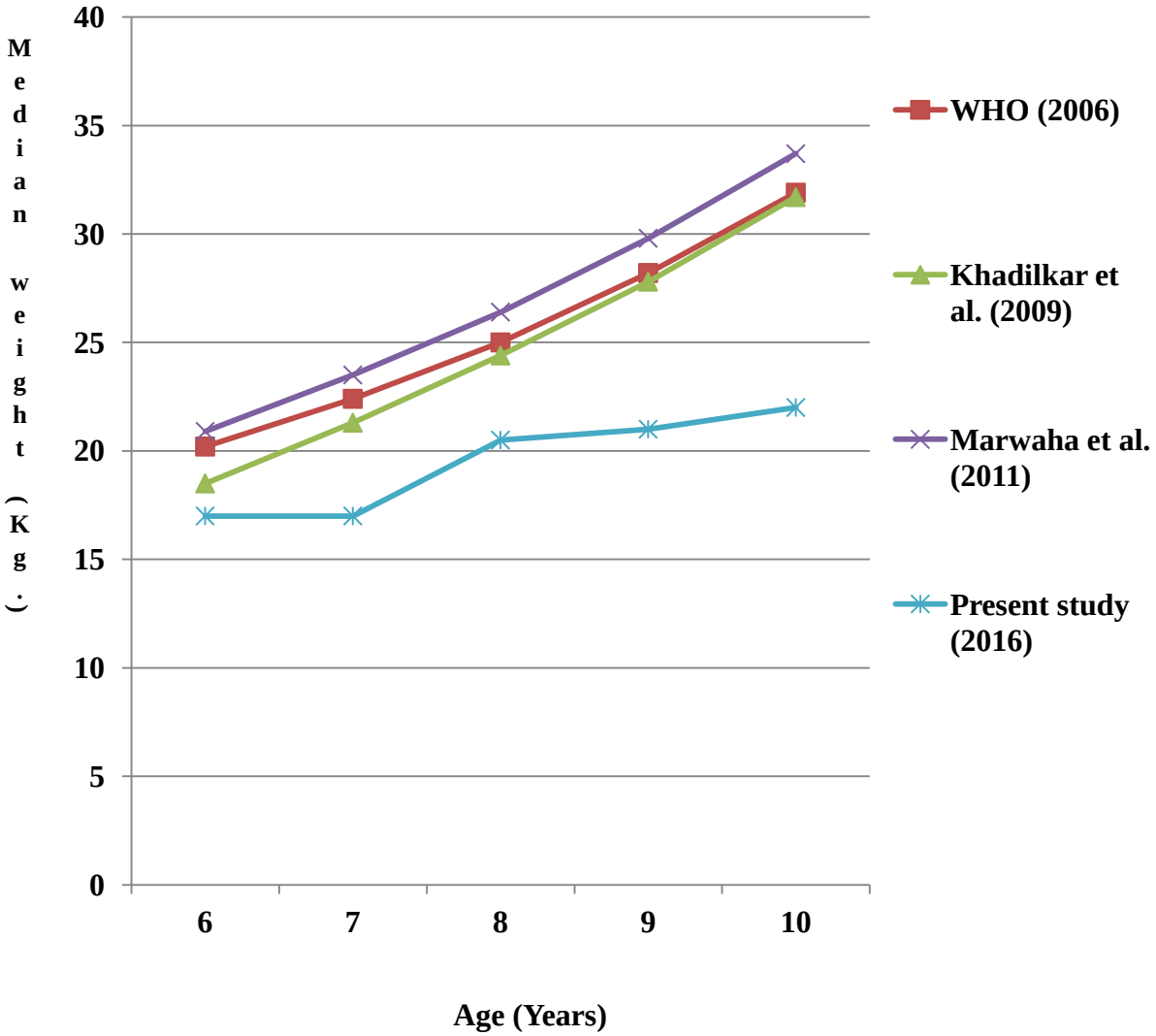

Figure 2(a): Comparison of median height (cm.) among boys

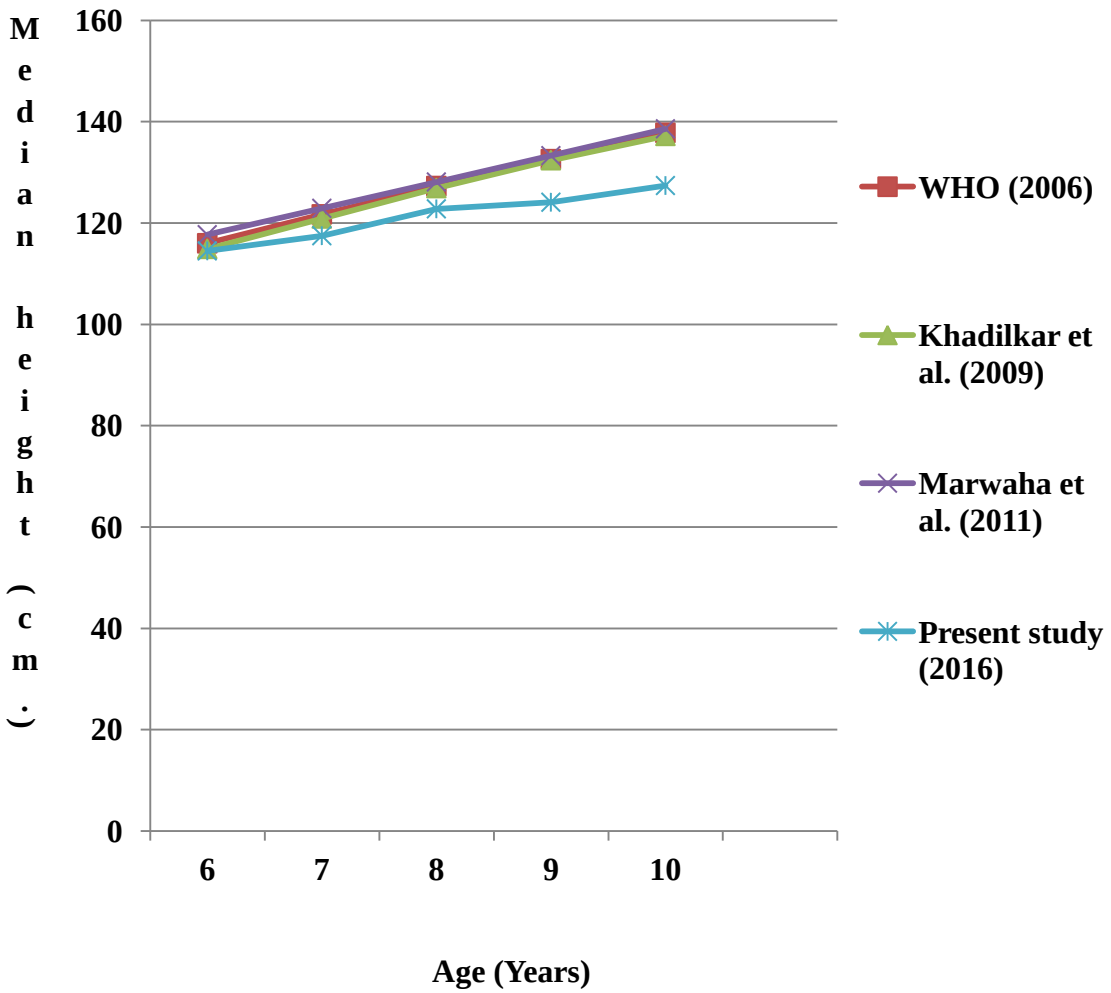

Figure 2(b): Comparison of median weight (Kg.) among boys

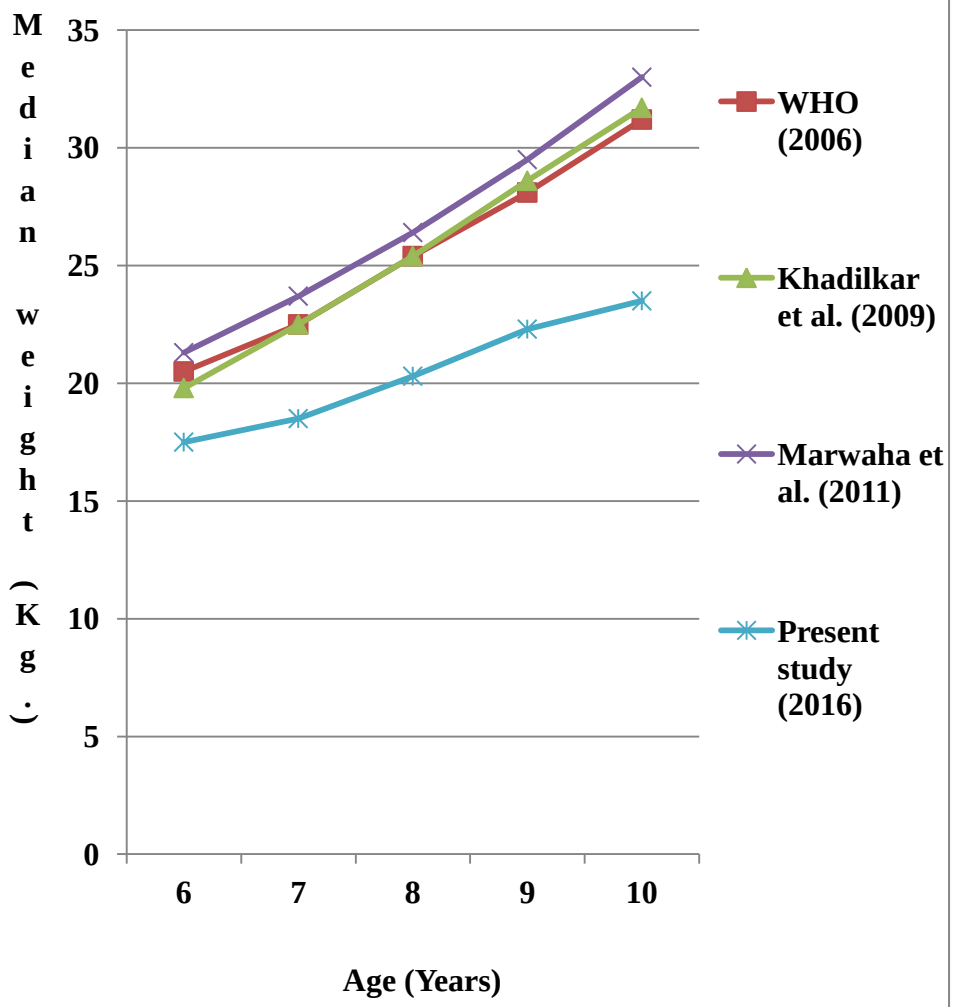

Figure 3(a): Comparison of mean Body Mass Index (kg/m2) values of studied girls with reference values

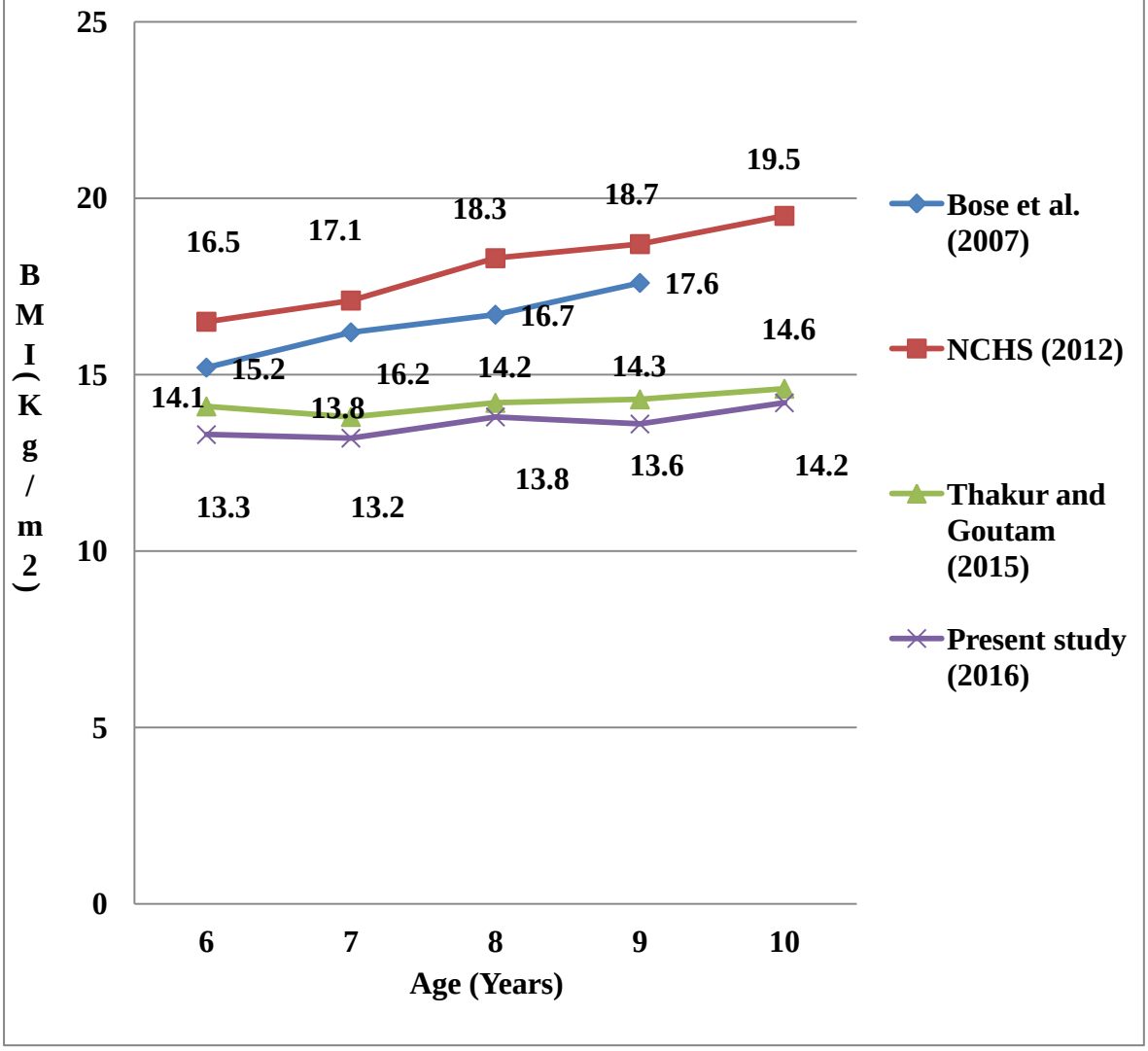

Figure 3(b): Comparison of mean Body Mass Index(Kg/m2) values of studied boys with reference values