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 undernutrition. 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)/Height² (m²) 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.

ACKNOWLEDGEMENT

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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


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

<table>
<thead>
<tr>
<th>Age (Yrs.)</th>
<th>N</th>
<th>Sex</th>
<th>HT (cm.)</th>
<th>WT (Kg.)</th>
<th>SH (cm.)</th>
<th>HT (cm.)</th>
<th>Acromion (cm.)</th>
<th>MUAC (cm.)</th>
<th>HC (cm.)</th>
<th>BMI (Kg/m²)</th>
<th>SLL (cm.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>25</td>
<td>Boys</td>
<td>113.6 ±5.9</td>
<td>17.6 ±2.3</td>
<td>60.6 ±3.1</td>
<td>89.5 ±4.7</td>
<td>15.4 ±0.9</td>
<td>49.0 ±1.3</td>
<td>13.6 ±1.1</td>
<td>53.0 ±3.5</td>
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<tr>
<td></td>
<td>30</td>
<td>Girls</td>
<td>112.2 ±5.1</td>
<td>16.8 ±1.2</td>
<td>59.5 ±3.0</td>
<td>88.3 ±4.9</td>
<td>15.3 ±1.2</td>
<td>47.3 ±1.1</td>
<td>13.3 ±1.0</td>
<td>52.8 ±3.9</td>
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<tr>
<td>T</td>
<td>-8.89</td>
<td>-1.595</td>
<td>-1.353</td>
<td>-0.707</td>
<td>-5.081***</td>
<td>-0.968</td>
<td>-1.92</td>
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</tr>
<tr>
<td>7</td>
<td>45</td>
<td>Boys</td>
<td>117.7 ±5.7</td>
<td>19.2 ±4.1</td>
<td>62.2 ±2.9</td>
<td>89.5 ±4.7</td>
<td>15.6 ±2.1</td>
<td>48.9 ±1.6</td>
<td>13.8 ±2.0</td>
<td>55.4 ±3.7</td>
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<tr>
<td>54</td>
<td>*22</td>
<td>Girls</td>
<td>114.2 ±5.0</td>
<td>17.3 ±1.9</td>
<td>60.0 ±2.9</td>
<td>90.4 ±4.6</td>
<td>15.0 ±1.4</td>
<td>47.5 ±1.2</td>
<td>13.2 ±1.2</td>
<td>54.2 ±3.5</td>
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</tr>
<tr>
<td>8</td>
<td>30</td>
<td>Boys</td>
<td>122.9 ±5.3</td>
<td>20.7 ±2.9</td>
<td>64.0 ±2.7</td>
<td>97.3 ±5.3</td>
<td>16.2 ±1.8</td>
<td>48.9 ±1.1</td>
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<td>58.9 ±3.5</td>
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<tr>
<td>45</td>
<td>*39</td>
<td>Girls</td>
<td>122.8 ±6.0</td>
<td>20.9 ±3.7</td>
<td>63.9 ±3.1</td>
<td>97.6 ±5.2</td>
<td>16.1 ±1.2</td>
<td>48.4 ±1.1</td>
<td>13.8 ±1.4</td>
<td>58.9 ±3.7</td>
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<tr>
<td>T</td>
<td>-0.35</td>
<td>-0.283</td>
<td>-0.065</td>
<td>-0.200</td>
<td>-0.283</td>
<td>-2.086*</td>
<td>-0.405</td>
<td>-0.001</td>
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<td>9</td>
<td>20</td>
<td>Boys</td>
<td>125.4 ±5.3</td>
<td>22.7 ±3.8</td>
<td>64.7 ±3.3</td>
<td>99.6 ±5.3</td>
<td>16.1 ±1.5</td>
<td>49.2 ±1.1</td>
<td>14.4 ±2.0</td>
<td>60.7 ±3.3</td>
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<td>Girls</td>
<td>126.1 ±6.5</td>
<td>21.8 ±3.4</td>
<td>65.0 ±3.6</td>
<td>100.8 ±5.8</td>
<td>16.4 ±1.5</td>
<td>48.7 ±1.3</td>
<td>13.6 ±0.9</td>
<td>61.1 ±3.9</td>
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<td>0.726</td>
<td>0.617</td>
<td>-1.388</td>
<td>-1.635</td>
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<td>10</td>
<td>24</td>
<td>Boys</td>
<td>127.7 ±6.0</td>
<td>23.2 ±2.6</td>
<td>66.2 ±3.1</td>
<td>102.5 ±4.8</td>
<td>16.4 ±1.0</td>
<td>49.0 ±1.1</td>
<td>14.2 ±1.0</td>
<td>61.5 ±3.8</td>
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</tr>
<tr>
<td>6</td>
<td>*17</td>
<td>Girls</td>
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<td>21.6 ±3.2</td>
<td>64.2 ±3.1</td>
<td>98.5 ±5.8</td>
<td>16.4 ±1.3</td>
<td>48.5 ±0.9</td>
<td>14.2 ±1.1</td>
<td>58.8 ±5.1</td>
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<tr>
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<td>-1.586</td>
<td>-1.277</td>
<td>-1.351</td>
<td>-1.771</td>
<td>-0.062</td>
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<td>0.028</td>
<td>-1.451</td>
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<tr>
<td>Total (age combined)</td>
<td>144</td>
<td>Boys</td>
<td>120.8 ±7.4</td>
<td>20.4 ±3.8</td>
<td>63.3 ±3.5</td>
<td>95.8 ±6.7</td>
<td>15.9 ±1.7</td>
<td>49.0 ±1.3</td>
<td>13.9 ±1.6</td>
<td>57.5 ±4.7</td>
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<tr>
<td>159</td>
<td>*20</td>
<td>Girls</td>
<td>118.4 ±7.7</td>
<td>19.1 ±3.4</td>
<td>61.9 ±3.8</td>
<td>93.9 ±6.8</td>
<td>15.6 ±1.3</td>
<td>47.9 ±1.3</td>
<td>13.5 ±1.2</td>
<td>56.5 ±4.8</td>
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<tr>
<td>F (Boys)</td>
<td>27.189***</td>
<td>12.508***</td>
<td>13.632***</td>
<td>27.395***</td>
<td>1.891</td>
<td>0.202</td>
<td>1.143</td>
<td>25.945***</td>
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</table>

*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

Age (Years)

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

- WHO (2006)
- Khadilkar et al. (2009)
- Marwaha et al. (2011)
- Present study (2016)
Figure 2(a): Comparison of median height (cm.) among boys

Median height (cm.)

WHO (2006)
Khadilkar et al. (2009)
Marwaha et al. (2011)
Present study (2016)

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

- WHO (2006)
- Khadilkar et al. (2009)
- Marwaha et al. (2011)
- Present study (2016)
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

- NCHS (2012)
- Thakur and Goutam (2014)
- Present study (2016)