journal homepage: https://jablm.acclmp.com/

Journal of Applied Biochemistry & Laboratory Medicine (2021) 02 (2):12-17

Original article

Title: Usefulness of Body weight, Height and Skinfold thickness for comparing the health status of school going children at their mid growth spurt age of 6-8 years

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Keywords:
Mid age growth spurt, body weight, height, skin fold thickness, socioeconomic status.

How to cite this article
Roy S, Mukherjee D. Usefulness of Body weight, Height and Skinfold thickness for comparing the health status of school going children at their mid growth spurt age of 6-8 years. Journal of Applied Biochemistry & Laboratory Medicine 2021; 02 (2):12-17.
Access link for this article
https://jablm.acclmp.com/2021/02/02_12-17.pdf

ABSTRACT

Background: In humans post natal growth has an important span in the mid growth spurt during the age of 6 to 8 years. However, different opinions exist about its importance and existence although recent studies favour its presence worldwide. Body weight, height and skin fold thickness are the major indicators of growth in children. Different factors including the environmental and socioeconomic status influence these growth phases which are well reflected by changes in the above mentioned parameters. The present study compared these parameters as markers of mid age growth spurt between children belonging to low and high socioeconomic status.

Methodology: The study was conducted among 400 healthy male and female school children of Kolkata between 6 to 8 years of age. 202 children belonged to medium to low socioeconomic group while 198 students were from high socioeconomic status. Body weight, height and skin fold thickness at mid arm were measured by standard validated techniques in all children. Statistical comparison was done using independent t test between these parameters from both groups. The comparison was also done separately for both genders from two groups.

Results: All of the three parameters showed significantly higher values (P<.001) for the children belonging to higher socioeconomic status. The comparison between male and female children separately showed the same difference.

Conclusion: Mid age growth spurt is significantly higher in the children belonging to higher socioeconomic status. Both male and female children show the same trend.

INTRODUCTION

Assessment of growth has gained an immense importance in pediatric health surveillance1. Growth and development in early and mid childhood can be affected by any of the physiological, environmental or social factors2, 3. In humans three postnatal growth spurts have been described and given importance for monitoring. These are the initial infantile growth followed by a mid growth at 6-8 years and then finally the adolescent growth during puberty. As far as the mid growth spurt is concerned, researchers throughout the world have their definite opinions regarding the separate entity of mid growth spurt. Stalwarts like Tanner4 have a sceptic opinion regarding the mid growth spurt in children. However, the present day reports suggest the occurrence of a mid growth spurt in children and have reported growth during middle childhood to be 3-3.5 kg in body weight and 5 cms in height per year. It has been also suggested that this growth occurs in a discontinuous manner with 3 to 6 irregular spikes each year with each growth spurt ranging upto 8 weeks on average 5.

Body weight, height and skin fold thickness have been important indicators of the nutritional status in children throughout the world6. These indicators not only indicate the anthropometric measurements but also are important markers for the nutritional and metabolic status in adolescent children7. These indicators have also been used as nutritional indicators in the context of different socioeconomic status in the world as well as in our country8.

Keeping this factors in mind, the present study focussed into assessment of the differences in mid growth spurt of the children in our community with high and low socioeconomic status using the body weight, height and skin fold thickness.

Bioinformatics, since multidisciplinary in approach, is considered as computational biology at present. Biological computation combines

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METHODOLOGY:

Place of study

The study was conducted in different schools of Kolkata including Multipurpose School, Chetla Boys School, Chetla Girls School and Lakhipati Singhania School.

Study material and sample size

Four hundred children were selected between age groups 6 to 8 years from these schools. Out of them 200 children were from Multipurpose School, Chetla Boys School and Chetla Girls School and rest 200 children were from Lakhipati Singhania School.

Study type: This was an observational horizontal study including school going children of 6 to 8 years of age.

Seclection criteria: Only healthy children as apparent from physical examination and history were selected for the study. Finally, the study was conducted in 400 children of different schools of Kolkata within 6-8 years.

Ethical considerations:

The study was carried out after getting the approval from the institutional ethics committee.

Techniques and measurements:

After completion of the study the data were analysed statistically.

Assessment of the physical growth:

It was assessed by following anthropometric measurements :

Weight in Kgs, height in cm and the mid arm skin fold thickness in mm were assessed. Weight was measured by beam balance with a degree of accuracy nearest to 25 g, height was measured using stadiometer nearest to 0.5 cm and the skin fold thickness was measured using Herpendens skin fold callipers nearest to 1 mm. The skin fold thickness measurements were done to assess nutritional status and also to study subcutaneous fat in these children

Statistical analysis:

Anthropometric measurement were obtained of 400 children between age group 6 to 8 years and were subjected to statistical analysis and evaluation. Smirnov Kolmogrov analysis suggested a normal distribution of data. Standard deviation and standard error of mean of each anthropometric data were obtained and p value calculated by student 't' test using the SPSS software version 17.0 for Windows. $p<0.001$ was considered significant for 95% confidence interval and 80 percent power.

RESULTS AND ANALYSIS:

Distribution of male and female children in the study population has been depicted in the Figure 1 age wise and gender wise:

Figure 1: Age wise and gender wise distribution of the study population.

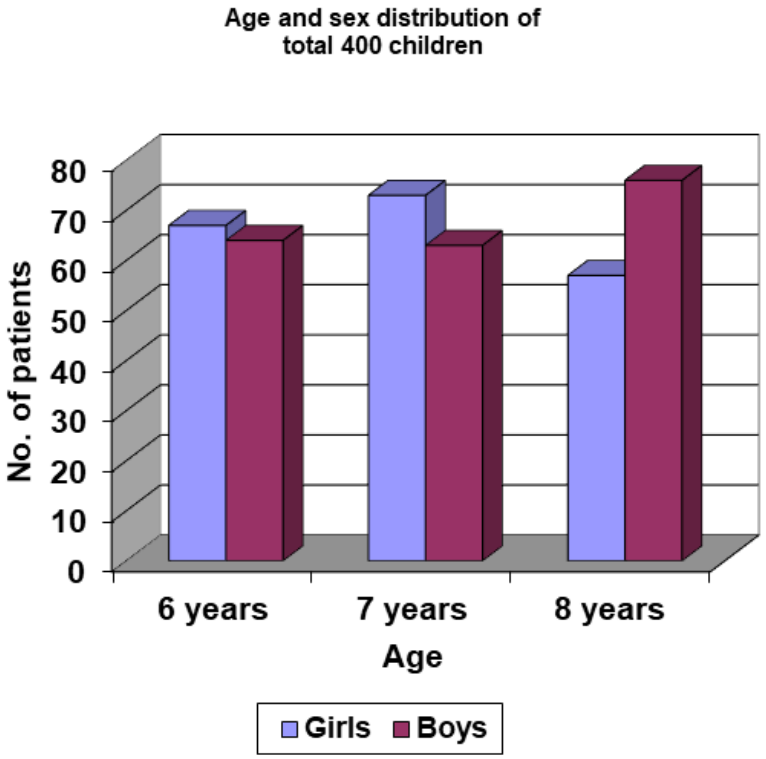

Figure 2: Socioeconomic status wise distribution of the study population

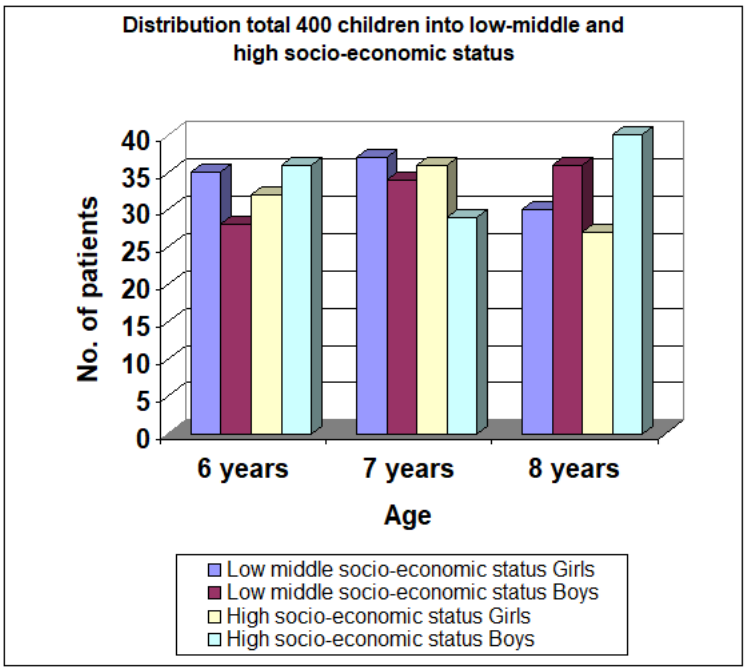

Figure 3: Comparison of mean heights of boys and girls according to low-middle and high socio-economic status with respect to National centers of health statistics (NCHS) standard

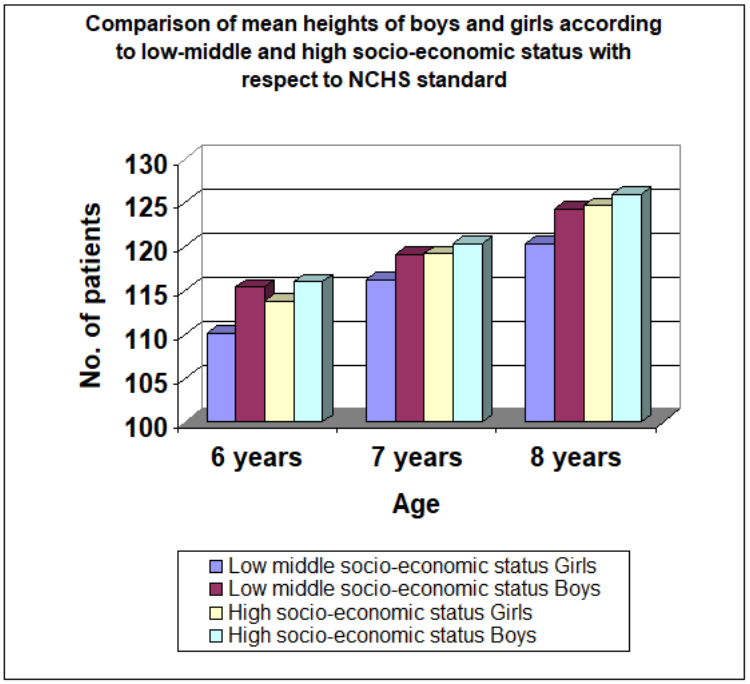

Figure 4: Comparison of mean weights of boys and girls according to low-middle and high socio-economic status with respect to NCHS standard.

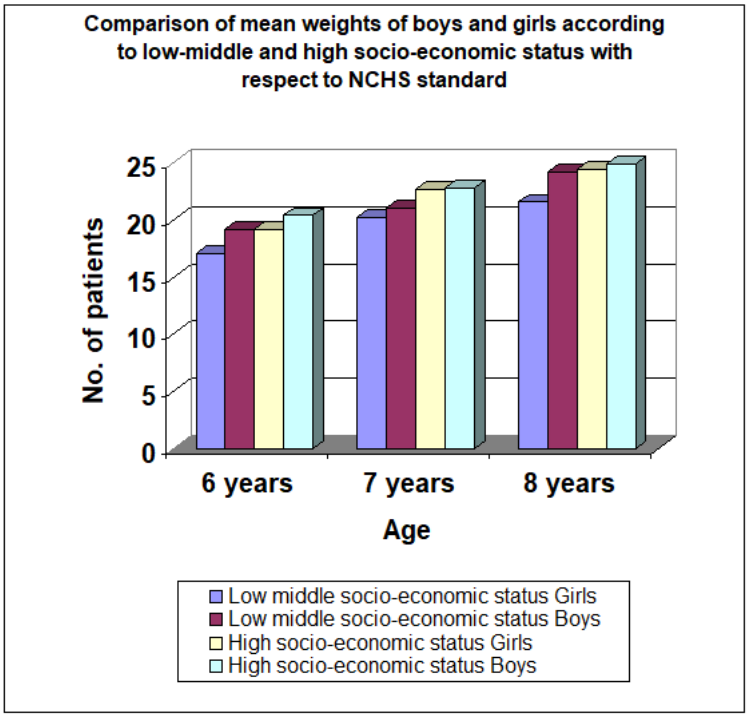

Table 1: Comparison of anthropometric measurements between high and low socioeconomic status children

P value considered significant for P < .05 for 95% confidence interval.

In the Table 1 the comparison of anthropometric measurements between all high and low socioeconomic status children has been shown. It is evident from the table that irrespective of gender difference, children from low socioeconomic status have significantly lower body weights, heights and skinfold thickness in comparison to the high socioeconomic children.

Table2: Comparison of anthropometric measurements between high and low socioeconomic status male children

	Low socioeconomic status male children (n = 104)	High socioeconomic status male children (n = 107)	P value
Body weight in Kg	20.6 ± 2.6	23.7 ± 2.3	<.000
Height in cms	118.7 ± 4.5	122.2 ± 4.0	<.000

	Low socioeconomic status children (n = 202)	High socioeconomic status children (n = 198)	P value
Body weight in Kg	20.1 ± 2.6	23.2 ± 2.3	<.001
Height in cms	117.5 ± 5.0	121.0 ± 4.3	<.001
Skin fold thickness in mm	12.1 ± 1.6	15.0 ± 2.2	<.001

Skin fold thickness in mm	16.0 ±1.9	12.7 ±1.6	<.000

P value considered significant for P < .05 for 95% confidence interval.

In Table 2 comparison of the same parameters has been shown for male children only belonging to higher and lower socioeconomic status. The results show the same trend i.e male children belonging to the higher socioeconomic status have significantly better degrees of the studied indicators for growth and development.

Table3: Comparison of anthropometric measurements between high and low socioeconomic status female children

	Low socioeconomic status female children (n = 99)	High socioeconomic status female children (n = 89)	P value
Body weight in Kg	19.5 ± 2.3	22.6 ± 2.1	<.000
Height in cms	116.2 ± 5.3	119.8 ± 4.3	<.000
Skin fold thickness in mm	11.5 ± 1.3	13.9 ± 2.1	<.000

P value considered significant for P < .05 for 95% confidence interval.
Similarly, in the Table 3, the comparison shows significantly higher body weight, height and skin fold thickness in higher socioeconomic status females in comparison to their lower socioeconomic status counterparts.

DISCUSSION:

Anthropometric measurements are one of the most important parameters for assessing the growth and nutritional status of a child. It is affected by a host of economic, biological, environmental and social factors. Income level affects the amount of resources, households devote for nurturing their children. Secondly, health related behaviour & knowledge of people like, smoking, alcohol consumption, health awareness are usually systematically correlated with levels of income. Anthropometric measurements have some advantage for predicting nutritional status of the children concerned. They are relatively easy to administer in the field and if carefully conducted they will be mostly accurate.

In our study total 400 children (aged 6-8 years) were evaluated. Out of them 197 students were girls distributed as 16.75%, 18.25% and 14.25% among 6 years, 7 years and 8 years group respectively. Rest 203 students were boys distributed as 16%, 15.75% and 19% among 6 years, 7 years and 8 years group respectively (Figure 1 & 2).

In addition to age and sex distribution students were also distributed according to their socio-economic status. Based on the survey conducted in 1999 to 2000 by National Council of Applied Economic Research, New Delhi[51], the estimated income per annum for low socio-economic group is upto Rs. 40,000, for lower middle group it is Rs. 40,000-80,000, for middle group it is Rs. 80,000-1,20,000, for upper middle group it is Rs. 1,20,000-1,60,000 and high group it is above Rs, 1,60,000.

In our study average total per annum income of family of 200 children belonging to Chetla school and Multipurpose school were Rs. 49999.92 so they fall under low middle class. Rest 200 children from Singhania school had average total per annum family income of Rs. 178125.72. So they fall under high socio-economic class.

According to modified Kuppuswamys index[9] the average score of children from Lakhipati Singhania school was 27. So they belong to upper class. Most of their parents were either graduate or post graduate and professional by occupation. The children of Chetla and Multipurpose school had an average score of 14 as their parents educational qualification were mostly upto high school and by profession were mostly doing clerical jobs or semiprofessional.

In figure 1 and 2, distribution of 400 school children are shown with respect to age, sex and economic status. In our study out of 400 children girls belonging to low middle socio-economic status were 8.75%, 9.25% and 7.5% in 6 years, 7 years and 8 years respectively. Boys of low middle class group were 7%, 8.5% and 9% in 6 years, 7 years and 8 years respectively. Similarly the girls belonging to high socio-economic class were 8%, 9% and 6.75% among 6 years, 7 years and 8 years respectively, and boys of higher socio-economic group were 9%, 7.25% and 10% among 6 year, 7 years and 8 years respectively.

In figure 3 analysis of mean height of boys and girls among low middle class and high class were compared with respect to NCHS[10] standard. The mean heights of girls belonging to low middle class were 96.07%, 94.08% and 95.17% of NCHS standard among 6 years, 7 years and 8 years girls respectively. Similarly mean height of girls of higher class were 99.3%, 96.5% and 98.65% NCHS standard among 6 years, 7 years and 8 years girls. Mean height of boys of higher class were 99.9%, 98.8% and 99.8% of NCHS standard among 6 years, 7 years and 8 years boys respectively.

The result of our present study showed that mean heights, body weights and skin fold thickness of students of upper class were higher in comparison to that of low middle class children in different age groups irrespective of gender differences (Table 1). Same results have been observed when students were classified on the basis of their gender. Both male and female students of low middle class had significantly lower indicators of health status in comparison to their high socioeconomic status groups. (Table 2 and 3).

The possible reason behind it is that children of higher socio-economic status got better care and nutrition during their growth spurt. In this respect the 'p' value appeared <0.001 which is statistically significant. The mean height of boys of different social status were comparatively higher than in girls.

Our study also reveal the same finding of previous workers like Aggarwal et al[11] from school children of Delhi. That elite children coming from affluent class are expected to have adequate nutrition[12]. Workers like Vashist RN et al[13] showed mean height of garhwali girls of age group 5-12 years were less than well nourished Indian girls and American girls. Because they have less number of children, and they live in congenieal environment. Moreover the small family size and better parental health awareness also contribute to high mean height in upper class children. Sinha A et al[14] also reported girl children health is dependent on level of maternal education and health awareness in parent. The cause of this higher mean weight in affluent Indians may be due to the fact that, as stated by some workers like Vijayaraghavan[15] et al 1971, the parental health is also a contributing factor. This is definitely lacking in low middle income group with inadequate nutrition, recurrent illness with unhygienic environment, leading to lower mean height.

This reflects that provision of good nutrition, higher family income, less number of children, less frequency of illness, were responsible for improved health indicators in the high socio-economic classes. Maternal health[16] and education[17] also contribute to it.

Our study also supports literatures view and again reinforces the statement that better nutrition higher income, health consciousness, small family size and better maternal education are needed most to contribute to the higher score of body weight, height and skin fold thickness in all children. The results of our study reveal that these factors must be improved for the lower socio economic group of children for achieving the goal of Health for all in our country.

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