International Journal of Community Medicine and Public Health
Ghorai T et al. Int J Community Med Public Health. 2023 Feb;10(2):746-751
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20230232

Original Research Article

A study of growth pattern of school going children of Kolkata, India

Tamal Ghorai[1]*, Sahana Mazumder[1], Somnath Gangopadhyay[1], Tapomoy Chatterjee[1], Kartik Shaw[1], Payel Das[1], Amalendu Samanta[2]

[1]Department of Physiology, Rammohan College, University of Calcutta, Kolkata, West Bengal, India
[2]Ex-ARO Scientist, All India Institute of Hygiene and Public Health, Kolkata, West Bengal, India

Received: 30 November 2022
Revised: 15 January 2023
Accepted: 16 January 2023

***Correspondence:**
Tamal Ghorai,
E-mail: tamal.bittu9@gmail.com

ABSTRACT

Background: In our society only, a few peoples have good physiological status from their childhood. Health status of children and adolescents is important factor for young society. This present study highlights the peoples' state of health and nutrition. Change in height with respect to age can be seen during puberty and adolescence. Growth can also be dependent upon the geographical regions.
Methods: In this study included 230 adolescent students (boys- 146, girls- 84) in the age group of between 12-18 years. So many related growth parameters were measured using by an anthropometric rod, weighing machine, and slide calliper. BMI, p value was obtained by performing t-test at 0.05 level of significance. Statistical software SPSS version 20 was used.
Results: Growth parameter was found to be increasing with age and it was more pronounced between 16 and 17 years. Interestingly the increment of all the growth parameter was found to be more in urban and less in rural.
Conclusions: The findings of this study showed a progressively increasing of growth-related parameters with ages and the progress vary, indicating a nutritional supplementation are unequal (unequal growth pattern), as it was evident from different growth parameters percentile values of CDC and IAP values. This study will certainly help to create among the children and their parents about the physical growth and health.

Keywords: Adolescent, Anthropometry, BMI, Growth parameters, Puberty, School students

INTRODUCTION

In our society only a few peoples have good physiological status from their childhood. Health status of children and adolescents is important factor contributing to the nation's health. For better performance and life, physiological fitness is way more important.[1] Poor socio-economic status makes both malnutrition and obesity like diseases.[2] Malnutrition causes such a big number of differing kinds of morbidities like growth faltering, developmental retardation, and significant mortality.[3] Physical growth is a dynamic, complicated, and long process that continues throughout all of infancy, childhood, and adolescence.[4] Anthropometry is the branch of human sciences which is related with some parameters like measurement of size, shape, strength and dealing capacity. Physical dimension of the body is way influenced by nutrition particularly within the rapidly growing period of student community.[5] Despite the well-known importance of nutritional health several cultural, social, political, economic, and academic factors contribute to malnutrition among children.[6] School going children constitute one-fifth of the overall population and are the long run of the state.[7] The health supervision of the school children is critical and might help to spot the magnitude of morbidity and malnourishment in a very community.[8] In Asia, prevalence of undernutrition in the form of protein undernourished children in the world, contributing significantly to the high morbidity and mortality in the country.[9] Evidence from all over India

suggests that the faltering of growth among infants begin as early as in the fourth months of life.[10] But the magnitude of this growth faltering in the form of undernutrition varies from urban to rural habitations and from boys to girls. In India, there are several small-scale studies about the growth and nutritional status among preschool children (both boys and girls), which mainly concentrate in rural areas and only a few in urban slum areas and very rarely in urban affluent areas.

In recent years, anthropometric studies have mostly been directed toward the efficient operation of machinery and equipment and special attention being paid to the correct positioning of controls and to suitable seating arrangement. This present study highlights the peoples' state of health of nutrition, physiological status which will reflect the growth pattern in relation to age, gender, heights, and weight.

METHODS

With the permissions of University Ethics Committee, this study was conducted on school students. Written consent was taken from the concerned school authorities and legal guardians. This is an observational study which included 230 adolescent students (boys- 146, girls- 84) in the age group of between 12-18 years selected through convenient sampling from various schools in the West Bengal, India, between the period of 01 February 2022 to 30 October 2022. The age group between 12 to 18 years was selected for this study as majority of the changes associated with adolescence take place and complete in this phase.

Inclusion and exclusion criteria

The inclusion criteria of this study were as follows: children (12-18) years were selected randomly from different areas, in an around Kolkata extended to rural areas. Children with any systemic disease or any major surgical problem which is likely to affect growth were excluded.

A total of 230 students, of both sexes were taken from the above-mentioned areas. Measurement performed with the basic standing posture, while subjects standing erect with feet together, the shoulders are relaxed, and the arms are hanging down naturally. Seven dimensions (weight, height, hip breadth, chest on bust, waist, biceps relax, calf circumference, buttock circumference) were adopted to calculate for the values of the body proportions. The one-dimensional survey was performed with the traditional measurement method using an anthropometer, weighing machine, and tape measure. Body mass index (BMI) was calculated as: weight in kilogram/height in (meters)^2 and compared with the percentile charts given by CDC 2000.[11,12] Statistical analysis was done, p value was obtained by performing t-test at 0.05 level of significance. Statistical software SPSS version 20 was used. ANOVA was performed. Comprises of six schools equally showed between urban and rural. Efforts were made to visit the different school authorities along with the parents of the children. Only permission was secured for six schools. The measurements were made by a trained anthropometrist. The age reported by the parents, which was used in all cases, was validated by the date of birth certificate in 95% of this subject.

The data were reported, however for the total population of school children independent of races where Bengali children comprised 85.69% of the total children, the children other than bengali only 14.31%. The age was expressed as the year attempt at the last birthday and the grouping of this study follows this convention.

The mean age of each category approximated the mid-point of the whole year; e.g., the 12-years-old male group consistent of a one-year cohort whose mean age was 12.31 years, which the corresponding female sample averages 12.49 years.

RESULTS

Size data and annual growth changes of measurements the size changes of height, hip breadth, chest on bust, waist, biceps relax, calf circumference, buttock circumference which represent body development, and annual growth changes of measurements by ages 12 to 18 years students are shown in Figures 1 and 2.

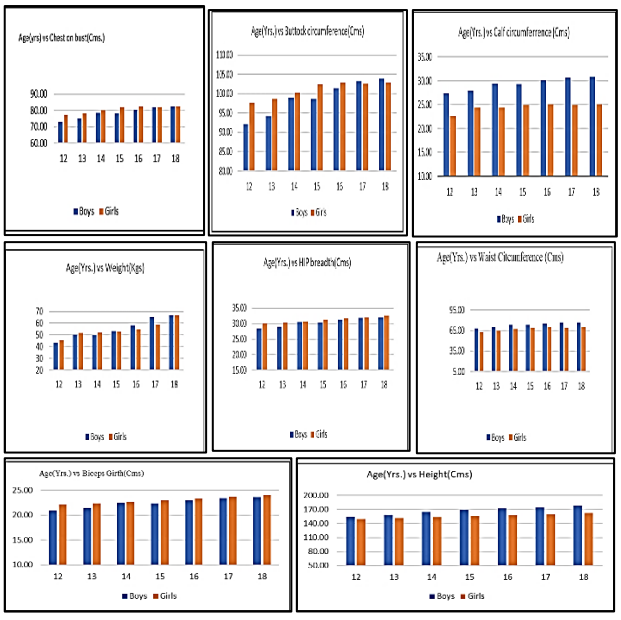

Figure 1: Depicts the size changes measurements of rural boys and rural girls.

This is statistically significant ($p<0.05$) as revealed by 't' test.

Figure 1 and 2 suggests the comparison of the mean values of both age and height, hip breadth, chest on bust, waist, biceps relax, calf circumference, buttock circumference based on the data of body dimension recorded for this study, subjects aged from 12 to 18 years.

The mean height and mean weight of the urban areas school students of boys was found to be significantly higher ($p<0.05$, as revealed by 't' test) than those rural areas school students. The prevalence of underweight was found to be higher in the children of the rural school than the children of the urban school, whereas the prevalence of overweight and obesity was found to be higher in the children of the rural school than the urban school.

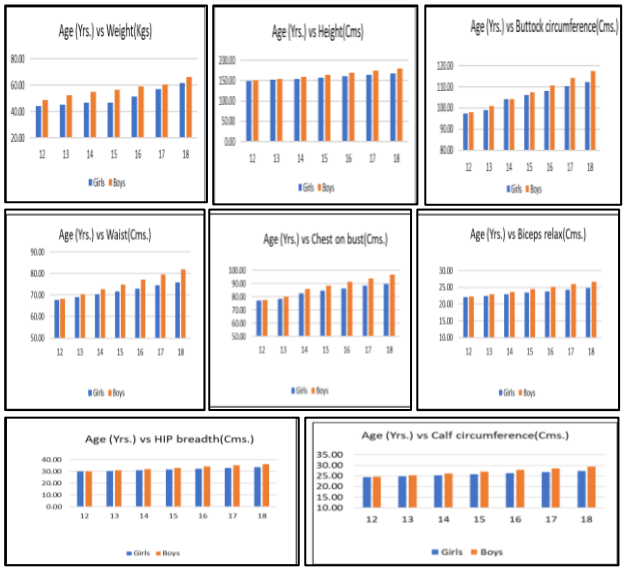

Figure 2: Showing the size changes measurements of urban boys and girls.

This is statistically significant ($p<0.05$). as revealed by 't' test.

In this study (Figure 1) the mean values of rural areas boys' weight, height, hip breadth, chest on bust, waist, biceps relax, calf circumference, and buttock circumference were 55.28 167.28, 30.48, 78.56, 73.48, 22.48, 29.38 and 98.94 cm respectively. Figure 1 also shows that the mean values of rural areas girls weight height, hip breadth, chest on bust, waist, biceps relax, calf circumference, and buttock circumference was 54.79, 155.57, 31.24, 80.70, 67.53, 23.04, 24.51, and 101.08 cm respectively. Every year height increases 2 to 6 cm between the ages of 12 to 18 years boys and girls. Hip breadths, waist, biceps relax, and calf circumference has increased about 2 to 4 cm per year from 12 to 15 years, and 1 to 2 cm increase about 16 to 18 years old for boys' and girls' students. The values of buttock circumference were concentrated in the range from 92 to 103.88 cm (boys) and 97 to 103.00 cm (girls) with the age range of 12 to 18 years which approximately covering 80% of 12 to 18 years growth value. The values of chest on bust were concentrated in the range from 73 to 82 cm with the height range of 154 to 177 cm which approximately represent 60% cover rate of 12- to 18-year-old males. Also, for girls' values of chest on bust were concentrated in the range from 77 to 82 cm with the height range of 150 to 162 cm which approximately represent 50% cover rate of 12- to 18-year-old females. The ultimate size and shape that a child attains as an adult size reached between 17 to 18 years of age.

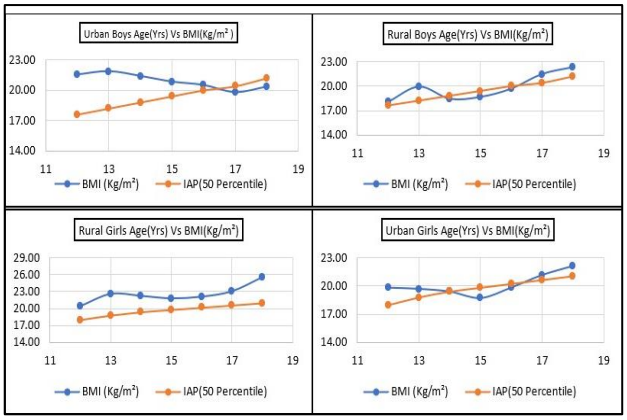

Figure 3: Comparison between school students BMI and IAP BMI, both rural and urban students.

This is statistically significant ($p<0.05$).

According to chart, the graphs show that the mean value of urban boys and girls growth parameter are increasing both in rural boys and girls. In this chart the average value of boys with respect to weight, height, hip breadth, chest on bust, waist, biceps relax, calf circumference, and buttock circumference was 56.93, 164.99, 33.13, 87.83, 74.92, 24.43, 26.99, 107.56 cm respectively. Figure 2 also shows that the mean values of urban areas girls weight height, hip breadth, chest on bust, waist, biceps relax, calf circumference, and buttock circumference were 50.44, 158.04, 31.73, 84.03, 71.77, 23.41, 25.85, and 105.33 cm respectively. Every year boys' and girls' weight and all other parameters were gradually increasing 2 to 5 cm between the ages of 12 to 18 years. CDC and IAP growth charts were considered with collecting data, as shown in Figure 4. In this curve between age group and height. rural girls' height growth was not very satisfied to compared with IAP standard curve.

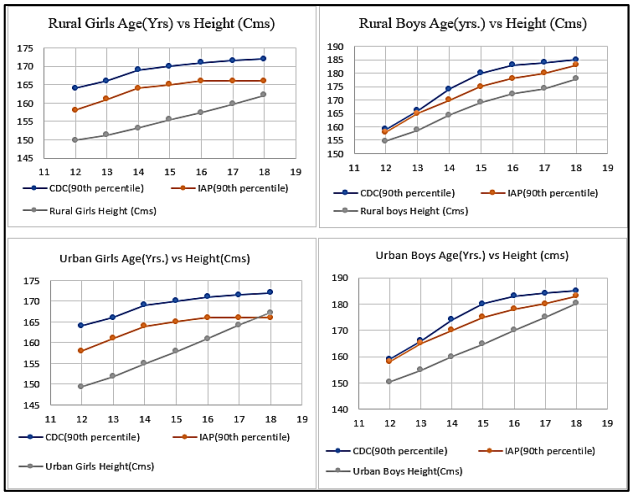

Figure 4: Comparison between age (Yrs.) vs height (cm) data CDC, IAP, both rural and urban students.

This is statistically significant ($p<0.05$).

Body mass index (BMI) was calculated and compared with the percentile charts given by CDC and IAP.[13,14]

BMI values after being scrutinized manually it was found that more than 90th percentile was taken as obesity and that between 70th and 85th as overweight and below 5th was taken as underweight.

Researchers found that the mean value of height, weight and BMI of Qatari children increased with age but there was slight decrease in BMI in the age group of 17-18 years.[15] Another study also found that age was significantly and positively related to height and weight. In the present study also, the mean weight and mean height increased with age in all categories but some variations were observed in the mean BMI values in the present subjects.[16] However, the mean BMI of the rural areas girls was found to increase with ages. The variation could be due to small sample size at each age group. In this scientifical present study, 2013 according to growth standards compiled and present recommendation of WHO the rural areas boys prevalence of severe underweight was 9.6%, moderate underweight was 10.95%, mild underweight 17.80%.[17,18]

DISCUSSION

According to literature, anthropometric dimensions of Indian 134 farm workers of east Indians which were smaller than German, USA, and Japanese males in all body dimensions expect popliteal height of Japanese.[19] This study also has shown that waist and buttock circumference were gradually increasing with age both boys and girls. Whereas, another study has worked with anthropometry of south Indian workers and have shown 27 body dimensions, 128 workmen aged (18-35 years) body dimension is changed to different regions people.[20]

The UNICEF reported that million children are malnourished worldwide and reported that one in every three malnourished children live in India.[21] According to the WHO, an estimated 250 million children in more than 100 countries are vitamin 'A' deficient.[22] In developing countries like India various forms of malnutrition affect a large segment of population and both macro and micronutrients deficiencies are of major concern. The school age period is nutritionally significant because this is the prime time to build up body stores of nutrients in preparation for rapid growth. Various attempts have been made by researchers to study the anthropometric body dimensions of the people in different regions of India. Many researchers shown that, there is a considerable difference between the anthropometric data of Indians and Westerners.[23]

However, a parallel study conducted as "Recent anthropometric trends among Swedish school children; evidence for decreasing prevalence of overweight in girls" showed that, between 2000/2001 and 2004/2005, the prevalence of overweight plus obesity in girls decreased from 19.6% to 15.9% ($p<0.01$).[24]

Other researchers conducted a study on "anthropometric measurements" of school going children where comparison made separately for boys and girls, and showed that rural school children of middle and low socio-economic status are shorter and lighter as compared with even their own urban parts on whom the ICMR values are based.[25]

Table 1: Comparison of different percentile values of rural and urban boys.

Age (years)	CDC (90th percentile)	IAP (90th percentile)	Rural boys heights (cm)	Urban boys heights (cm)
12	159	158	154.63	150.32
13	166	165	158.67	154.83
14	174	170	164.34	159.95
15	180	175	169.00	164.67
16	183	178	172.30	169.92
17	184	180	174.16	174.99
18	185	183	177.84	180.25

Table 2: Comparison of different percentile values of rural and urban girls.

Age (years)	CDC (90th percentile)	IAP (90th percentile)	Rural girls heights (cm)	Urban girls heights (cm)
12	164	158	149.8	149.37
13	166	161	151.32	151.84
14	169	164	153.16	154.88
15	170	165	155.46	157.88
16	171	166	157.41	160.91
17	171.5	166	159.75	164.25
18	172	166	162.12	167.14

From these findings, comprehensive tables have been compiled showing the percentage of population distribution for sets of body dimensions and anthropometric features for the comparison of the size information between boys' and girls' different types of parameters.

In this present study (shows in the chart) the mean height and mean weight and other parameters of the urban areas school children (both boys and girls) were significantly higher than the rural areas school children (both boys and girls) (p value <0.05), Which is consistent with study of urban and rural school children from 5 to 13 years of age in Maharashtra.[26]

The present investigation was aimed to formulate the growth pattern of school children in an around Kolkata, which ultimately helps to designed sitting workplace (space and workstation) in relation to the different growth dimensional parameter of school children. The present investigation desired to cover up few more school

children which was not possible due to lack of cooperation from management or some guardians or sometimes for both. However, the results reflected in the present investigation were statistically significant

CONCLUSION

The present paper investigated the growth pattern of height and weight in relation to age along with other growth parameters of 12-18 years boys and girls spread over urban and rural areas in and around Kolkata (eastern part of India). The findings of this study showed a progressively increasing of growth-related parameters with ages but the rate of progress vary from one area to other areas of the studied population indicating a nutritional supplementation are unequal (unequal growth pattern) as it is evident from different growth parameters fell between the 75 percent of percentile values of CDC and IAP values. This study will certainly help to create among the children and their parents about the physical growth and health.

Funding: Department of science and technology, Biotechnology. West Bengal
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee University of Calcutta

REFERENCES

1. Amuta EU, Houmsou RS. Assessment of nutritional status of school children in Makurdi, Benue State. Pakistan J Nutr. 2009;8:691-4.
2. Bharati P, Itagi S, Megeri SN. Anthropometric measurments of school children of Raichur, (Karnataka). J Hum Ecol. 2005;18(3):177-9.
3. Akhtar MS, Bhatty N, Sattar M, Javed MT. Comparison of nutritional status in children of different socio-economic statuses. Med J Islam Acad Sci. 2001;14(3):97-102.
4. Tanner JM. Growth before birth. In: Foetus into man: physical growth from conception to maturity. 2nd edn. Ware, England: Castlemead Publications; 1989:36-50.
5. Tunay M, Melemez K. An analysis of biomechanical and anthropometric parameters on classroom furniture design. Afr J Biotechnol. 2008;7(8).
6. Khadilkar V, Yadav S, Agrawal KK, Tamboli S, Banerjee M, Cherian A, et al. Revised IAP growth charts for height, weight and body mass index for 5- to 18-year-old Indian children. Indian Pediatr. 2015;52(1):47-55.
7. Barroso CM, Moreira MH, Richardson CA. Age and growth of Nassarius reticulatus in the Ria de Aveiro, north-west Portugal. J Marine Biol Assoc U K. 2005;85(1):151-6.
8. Kumaravel V, Shriraam V, Anitharani M, Mahadevan S, Balamurugan AN, Sathiyasekaran BW. Are the current Indian growth charts really representative? Analysis of anthropometric assessment of school children in a South Indian district. Indian J Endocrinol Metab. 2014;18(1):56.
9. Sahu SK, Kumar SG, Bhat BV, Premarajan KC, Sarkar S, Roy G, et al. Malnutrition among under-five children in India and strategies for control. J Nat Sc Biol Med. 2015;6(1):18.
10. Khokhar A, Singh S, Talwar R, Rasania SK, Badhan SR, Mehra M. A study of malnutrition among children aged 6 months to 2 years from a resettlement colony of Delhi. Indian J Med Sci. 2003;57(7):286-9.
11. De Onis M, Garza C, Onyango AW, Borghi E. Comparison of the WHO child growth standards and the CDC 2000 growth charts. J Nutr. 2007;137(1):144-8.
12. Agarwal KN, Saxena A, Bansal AK, Agarwal DK. Physical growth assessment in adolescence. Indian Pediatr. 2001;38(11):1217-35.
13. Flegal KM, Wei R, Ogden CL, Freedman DS, Johnson CL, Curtin LR. Characterizing extreme values of body mass index–for-age by using the 2000 Centers for Disease Control and Prevention growth charts. Am J Clin Nutr. 2009;90(5):1314-20.
14. Khadilkar VV, Khadilkar AV. Revised Indian Academy of Pediatrics 2015 growth charts for height, weight and body mass index for 5-18-year-old Indian children. Indian J Endocrinol Metab. 2015;19(4):470.
15. Bener A, Kamal AA. Growth patterns of Qatari school children and adolescents aged 6-18 years. J Health Popul Nutr. 2005:250-8.
16. Hunshal SC, Gaonkar V. A study on adjustment of institutionalized children. Karnataka J Agricult Sci. 2010;21(4).
17. Agarwal KN, Bansal AK, Agarwal DK. Growth pattern in Indian children. Stat Appl. 2015;13(1-2):11-23.
18. Consultation WE. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 2004;363(9403):157-63.
19. Yadav R, Tewari VK, Prasad N. Anthropometric data of Indian farm workers- a module analysis. Appl Ergonom. 1997;28(1):69-71.
20. Fernandez JE, Uppugonduri KG. Anthropometry of South Indian industrial workmen. Ergonomics. 1992;35(11):1393-8.
21. UNICEF. Division of Communication, UNICEF. Tracking progress on child and maternal nutrition: a survival and development priority. Unicef; 2009.
22. de Benoist B. Conclusions of a WHO Technical Consultation on folate and vitamin B12 deficiencies. Food and nutrition bulletin. 2008;29(2_suppl1):S238-44.
23. Dewangan KN, Kumar GP, Suja PL, Choudhury MD. Anthropometric dimensions of farm youth of the north eastern region of India. Int J Indust Ergonom. 2005;35(11):979-89.

24. Sjöberg A, Lissner L, Albertsson-Wikland K, Mårild S. Recent anthropometric trends among Swedish school children: evidence for decreasing prevalence of overweight in girls. Acta Paediatr. 2008;97(1):118-23.
25. Sheikh M. Anthropometric studies of school going children (6-12 years) in three regions of Jammu & Kashmir State. Int J Sci Res. 2015;6(8):1958-62.
26. Kolekar SM, Sawant SU. Study on physical growth in urban and rural school children from 5 to 13 years of age: a comparative approach. New Vis Sci Tech. 2021;2:96-102.

Cite this article as: Ghorai T, Mazumder S, Gangopadhyay S, Chatterjee T, Shaw K, Das P, et al. A study of growth pattern of school going children of Kolkata, India. Int J Community Med Public Health 2023;10:746-51.