Original Research Article

A study of anthropometric parameters of school children: a cross sectional study in Rajasthan

Kedar Jayant Raikar[1]*, Anis Maaheraa[2], Sumit Sobti[2]

[1]Deputy Assistant Director of Health, Alwar, Rajasthan, India
[2]Medical officer, Field Hospital, Rajasthan, India

*Correspondence:
Dr. Kedar Jayant Raikar,
E-mail: kedarzone@gmail.com

ABSTRACT

Background: The ongoing research in the school health domain is necessary to understand the secular trends in anthropometric parameters. Our study is an attempt to analyze the cross sectional findings and comparison with national reference studies to draw a conclusion on changing attributes of anthropometric parameters with time.

Methods: The present study was adapted as a school based, cross sectional, observational epidemiological study design. We have analyzed the data generated out of assessment of height and weight (anthropometric analysis) along with other evaluation as a part of comprehensive health examination.

Results: We evaluated, a total of 995 students, aged 5-16 years of which, 569 (57.2%) were boys and 426 (42.8%) were girls. BMI percentiles were calculated for both schoolboys and schoolgirls. Comparisons of the present height and weight curves with earlier data from India and multi country data from WHO was done. In this study prevalence of overweight was 10.35% which indicates the rising trends of childhood overweight and obesity.

Conclusions: The trends of changing anthropometric measurements as evident in our study indicate the schoolchildren are growing taller and heavier. With increase in BMI, the prevalence of childhood overweight is on high level but level of underweight and under nutrition per say is low, probably due to quality food availability and increased buying capacity of families.

Keywords: Secular trend, Anthropometry, BMI percentiles, Childhood obesity, WHO

INTRODUCTION

The anthropometric analysis is an effective tool for physician for the assessment of nutritional status, growth and development of children.[1] Decision making and planning in child health nutrition should be based on valid assessment on updated growth charts. The growth chart reference is a need of time since it's a fact that children worldwide have become taller and heavier.[2,3] Several Indian studies tried to establish reference standards for Indian children but the data was almost a decade old.[4,5] Agarwal et al, published the results of a large multi-centric survey of children from the upper socioeconomic strata (USES) conducted in 12 cities from all regions of India in 1992, these data are now more than 2 decades old.[6] In a study by Khadilkar et al documented a secular trend in the height and weight of schoolchildren but was based on a smaller sample size.[7]

We have analyzed the height, weight and BMI in 5 year-16 year age group in both schoolboys and schoolgirls. The percentile charts for BMI prepared and weight for age, height for age growth charts were made. The comparison with other four established studies was done to conclude with recommendations of our study. We present the reference growth charts and percentile charts of age and gender specific BMI based on 995 school children data representative of a public school.

Aim

Our study aims at understanding of anthropometric parameters (height, weight and BMI) across the school children in 5-16 years age group.

METHODS

This study is a cross sectional observational type analyzed on the data generated while annual medical examination of schoolchildren in Alwar, Rajasthan during the month of October 2018.

All the school children were included for data analysis as a universal sampling technique. As a result of data analysis on routine practice of medical examination and non-interventional study design, the ethical approval was not warranted.

The annual medical examination of school students is a routine practice under the school health activity. We analyzed the data generated out of assessment of height and weight, along with other evaluation as a part of comprehensive health examination.

The nursing assistants were trained by the co-investigator medical officer in the correct procedure and measurement of anthropometric data at the start of the examination. With portable wall mounted stadio-meter, Height was measured to the nearest 0.1 cm with the student standing straight with the head held in the Frankfurt horizontal plane. The student's weight, without shoes and while wearing uniform, was measured to the nearest 0.1 kg, on an electronic scale. The mean height and mean weight was used for each measurement taken twice and used for calculation of BMI, which was defined as the ratio of body weight (in kg) to body height (in metres) squared (kg/m^2). Daily, the scale and stadio-meter were calibrated with standard weight and height, respectively.

The data recorded on a pro-forma used for school medical examination was entered in statistical software SPSS version 20. The Chi square test of association was used; percentile charts and smooth curves were created as an analytical tool. The median height and weight charts were prepared and compared with National reference of four established studies.

We had established the BMI percentiles for schoolchildren based on which the childhood overweight assessment can be done for students.

RESULTS

We evaluated, a total of 995 students, aged 5-16 years of which, 569 (57.2%) were boys and 426 (42.8%) were girls (Table 1).

The Table 1 shows that the percentage of overweight schoolchildren is significantly more than that of percentage of underweight schoolchildren.

Table 1: Comparison of BMI among school children (n=995).

	Normal N (%)	Overweight N (%)	Underweight N (%)	Total N (%)
Boys	474 (83.3)	48 (8.4)	47 (8.3)	569 (100)
Girls	326 (76.5)	55 (12.9)	45 (10.6)	426 (100)
Total	800 (80.4)	103 (10.4)	92 (9.2)	995 (100)

Pearson Chi-Square= 7.502 df=2 (p=0.02).

Table 2: Age and BMI percentiles for schoolboys (n=569).

	Age	Percentiles						
		5	10	25	50	75	90	95
BMI	5	12.1455	12.4860	12.9850	13.8650	14.9600	16.7510	19.0535
	6	11.2605	11.5610	12.9500	13.5300	13.8825	16.5560	19.6300
	7	12.0200	12.5600	13.1500	14.0800	14.8800	16.8320	18.3480
	8	12.0010	12.6160	13.3450	14.9200	17.1400	19.0440	19.9550
	9	12.6800	13.2000	14.2900	15.3700	17.6000	20.4460	22.4600
	10	13.1150	13.5000	14.2000	15.9500	17.3300	19.1020	19.8970
	11	12.9300	13.5600	14.6000	16.2200	19.7100	21.7400	23.5400
	12	13.4750	14.0390	15.3375	17.5100	19.8850	22.5670	23.3655
	13	14.1520	14.9560	16.0100	17.8600	21.7200	24.1840	24.9120
	14	14.6640	15.6690	16.7325	18.8000	20.7475	23.4110	26.5440
	15	15.6455	16.8420	17.9075	19.8400	22.5625	25.5740	27.9145
	16	16.8500	17.3600	17.9900	19.9600	20.8000	23.6200	26.1526

Table 3: Age and BMI percentiles for schoolgirls (n=426).

	Age	Percentiles						
		5	10	25	50	75	90	95
BMI	5	11.9390	12.2940	12.8500	13.8800	15.2400	17.6420	20.5530
	6	10.9300	11.3220	12.1175	13.1500	15.7975	16.2400	18.3651
	7	11.9400	12.2660	12.8025	14.2000	15.3350	17.1530	17.7425
	8	11.6750	11.9850	12.7750	13.6900	15.6425	19.2600	20.0225
	9	11.7650	12.9240	14.1150	15.1750	16.5300	17.9280	19.6890
	10	12.3490	12.5240	13.8350	15.7700	18.5100	19.8710	21.3760
	11	13.0540	13.8260	14.3500	15.8200	18.6400	21.1460	23.0490
	12	12.9150	13.3530	14.8650	16.2300	18.2950	20.7120	24.9605
	13	14.0100	14.6900	16.5600	18.2600	20.3400	23.5540	24.4860
	14	15.7100	16.1990	17.9650	20.1600	22.0225	26.2650	26.7530
	15	16.7985	18.1180	18.7525	20.2450	21.1300	25.3340	27.3475
	16	15.2100	15.9020	17.9700	21.4800	24.0350	28.0820	28.2350

BMI percentiles were calculated for both schoolboys and schoolgirls, showed in Table 2 and 3.

DISCUSSION

In view of changing growth patterns as evident by previous studies.[1] The reference growth charts needs to be updated regularly.

In India, a secular trend in anthropometric parameters is evident from scattered regional reports spanning the past 3–4 decades.[4-8]

The recent approach of national growth chart efforts was taken in the study by Raman et al data of which is 08 years old (2011).[8]

Thus there was a need to analyze school medical exam data for anthropometric evaluation and comparison with all standard reference data of these studies.[2,4-8]

The 50th percentile of height for both boys and girls was significantly higher in our study compared not only with that reported nearly decades ago by Agarwal et al but also with the more recent data from Khadilkar et al and Raman et al.[6-8] In case of girls, the median height was consistently higher than that reported by Agarwal et al [6] and Raman et al[8] across all age groups.

Similarly, in comparison with the data reported by Khadilkar et al, Raman et al the median height of girls in our study was higher till the age of 12-13 years, after which the difference was marginal.[8] The earlier flattening of the growth curve of girls compared with that in the study by Khadilkar et al could be due to their higher weights leading to earlier puberty/pubertal spurt and consequently earlier epiphyseal closure.

The median height of boys in our study was similar or more than that reported in the multi-country WHO study (2006) and Indian studies till the age of 10 years.[2,6-8] In the older age groups, the median height in the WHO study was between 3 cm and 5 cm more than that reported by us. Similarly, even in girls, the median height in our study was more than that in the WHO study till the age of 13 years, following which the median heights reported in the multi-country study were more by up to 4–5 cm. The better height performance of younger boys and girls could probably be explained by improved nutrition consequent to India's economic growth over the past few decade.

A similar trend was also observed for weight percentiles in all age groups and both sexes, when we compared our data with that from earlier Indian studies. In comparison with data from Agarwal et al, the median weights in our study, in both sexes and across all age groups, were significantly more.[6] This difference became marked (>5 kg) after the age of 9-10 years. This trend was also observed when comparing data from Khadilkar et al and Raman et al though the difference in weight was less marked.[7,8]

Even the 5th centiles of BMI across all ages and both sexes were higher than that reported by Khadilkar et al and Indian studies.[6-8] This comparison of weight and BMI between the present and earlier Indian studies clearly indicates secular trends in childhood obesity, which are prominent in both sexes.

The National Task Force for Childhood Prevention of Adult Diseases of the Indian Academy of Pediatrics has recommended that Indian children >10 years of age are to be considered overweight if their BMI is >85th percentile for age or if their weight is >120% of the 50th percentile of weight for height by national standards.[9] In our study, the 50th percentile for both gender groups were less than that reported with Raman et al and 75th percentile for BMI was corresponding to estimated adult cut of BMI (25 kg/m^2 as overweight and 30 kg/m^2 as obesity) for both boys and girls.
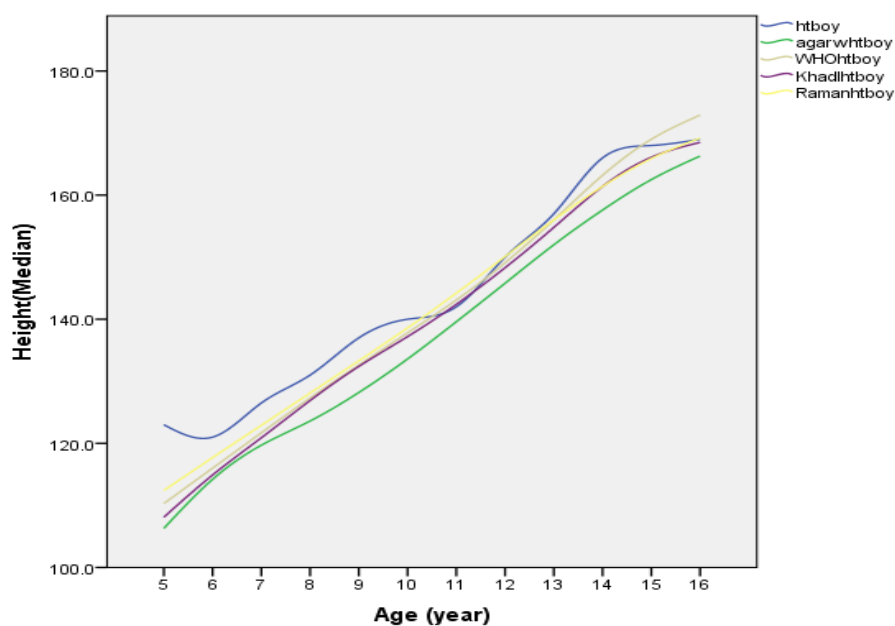
Figure 1: Comparison of median heights for age among school boys.
htboy: our study; agarwhtboy: Agarwal et al; WHOhtboy: WHO; Khadlhtboy: Khadilkar et al; Ramanhtboy: Raman et al.
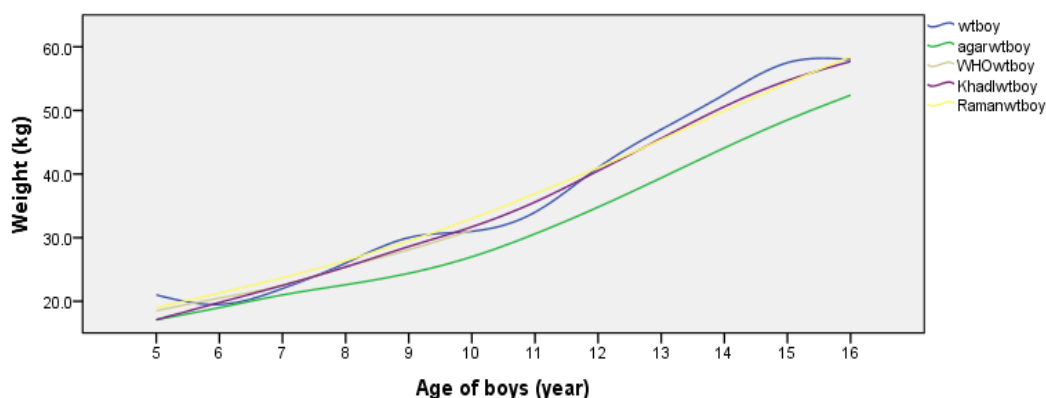

Figure 2: Comparison of median weight for age among school boys.
Wtboy: our study; agarwtboy: Agarwal et al; WHOwtboy: WHO study; Khadlwtboy: Khadilkar et al; Ramanwtboy: Raman et al.
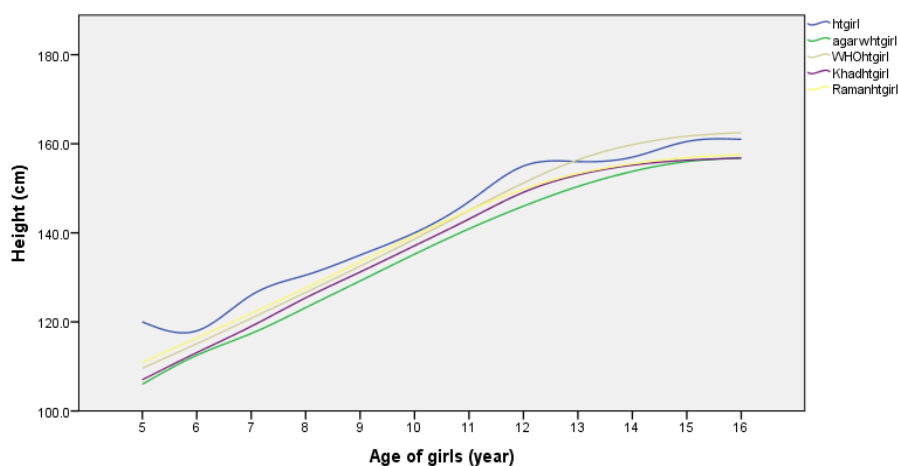

Figure 3: Comparison of median height for age among school girls.
htgirl: our study; agarwhtgirl: Agarwal et al; WHOhtgirl: WHO study; Khadhtgirl: Khadilkar et al; Ramanhtgirl: Raman et al.
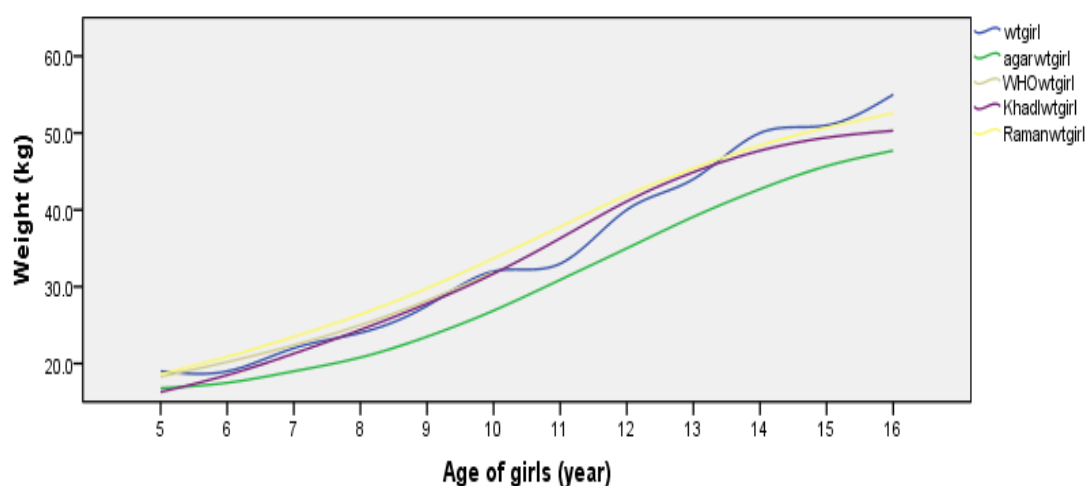
Figure 4: Comparison of median weight for age among schoolgirls.

wtgirl: our study; agarwtgirl: Agarwal et al; WHOwtgirl: WHO study; Khadlwtgirl: Khadilkar et al; Ramanwtgirl: Raman et al.

In the study by Seema et al in a field practice area, the prevalence of underweight was 48.14% while in our study it was 9.24%.[10] This difference and low percentage of underweight probably be explained with adequate family ration drawing facility for troops in Armed forces. The prevalence of overweight/obesity in a study was 7.83% while in our study it was found 10.35% which indicates the rising trends of childhood overweight and obesity.[10]

This study was a cross sectional analysis of school medical examination data which is representative of school children of public schools only, hence the results cannot be extrapolated to entire school children cohort of population. Since we had only performed the analysis of data generated out of school medical examination at public school, the factors affecting overweight and obesity could not be studied.

CONCLUSION

The cross sectional findings of anthropometric measurements as evident in our study indicate the schoolchildren were grown taller and heavier as compared with other well established studies. With increase in BMI, the prevalence of childhood overweight is on high level but the level of underweight and under nutrition per say is low, probably due to increased buying capacity of families.

Recommendations

We recommend the ongoing research in this area of interest at other schools.

This study can be useful to formulate strategies for prevention of childhood obesity which is on rising trend, compared to recently available results of other studies.

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