

## Original Research Article

# Comparison of the proportion of overweight and obesity using 2015 Indian Academy of Pediatrics and WHO body mass index charts among 5-18 years old children attending a tertiary care centre in South Kerala

Jose P. Cyril, Baburaj Stephenson\*, Bobby Christy, Roshan Sabu, Axina Ali, Silpa Mariyam John

Department of Paediatrics, Dr. Somervell Memorial CSI Medical College, Karakonam, Trivandrum, Kerala, India

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### \*Correspondence:

Dr. Baburaj Stephenson,

E-mail: drsbaburaj@gmail.com

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## ABSTRACT

**Background:** Childhood obesity is associated with impaired health during childhood and it is a risk factor for later adult diseases if left untreated. There is a rising trend of over nutrition in developing countries including India. Hence the present study has been envisaged to estimate the proportion of overweight/obesity among 5-18 years old children of a tertiary care centre in South Kerala. The objective of this study was to compare the proportion of overweight and obesity using 2015 Indian Academy of Paediatrics and WHO BMI charts among 5-18 years old children attending a tertiary care centre in South Kerala.

**Methods:** After getting ethical committee clearance this cross-sectional study was conducted among children between 5 and 18 years of age in the department of paediatrics of a tertiary care centre in South Kerala, during the period between August 2018-October 2020. The BMI was plotted and analysed with appropriate software.

**Results:** Among the 250 children the proportion of obesity and overweight was 88 (35.2%) by IAP standards, 63 (25.2%) by WHO standards. The highest proportion of obesity was found in children aged between 7-8.5 years 17 (38.6%). There was a statistically significant association between age and BMI status ( $p$  value < 0.001).

**Conclusions:** IAP BMI standards are more suitable for Indian children to identify the proportion of overweight and obesity than WHO standards. Also, this study alerts us to concentrate more on the age group between 7-10.5 years for early prevention of childhood obesity and overweight.

**Keywords:** Childhood, Overweight, Obesity, Body mass index, World Health Organization, Indian Academy of Paediatrics

## INTRODUCTION

Childhood obesity is one of the most significant and serious public health challenges of the 21<sup>st</sup> century. The prevalence has increased, which is at an alarming rate. Globally, in 2016 the number of overweight children below the age of five is estimated to be over 41 million. Almost half of all overweight children below 5 lived in

Asia and one quarter lived in Africa.<sup>1</sup> The WHO has defined overweight and obesity as 'abnormal or excessive fat accumulation that may impair health'.<sup>2</sup>

Overweight is Body mass index (BMI) [weight (kg)/(height)<sup>2</sup> (m<sup>2</sup>)] for age more than one standard deviation above the WHO growth reference median; and obesity is more than two standard deviations above the WHO growth

reference median.<sup>3</sup> Over 340 million children and adolescents in the age group 5-19 were overweight or obese in 2016. Approximately 21% of Indian population is adolescents (about 243 million) which is the largest in the world.<sup>4</sup> The level of overweight and obesity has been increasing rapidly with 1 in 10 individuals in the age group 5-17 years being overweight or obese globally.<sup>5</sup> The prevalence of overweight and obesity among children and adolescents (aged 5-19 years) has risen fiercely from 4% in 1975 to just over 18% in 2016, thus prompting the WHO to delegate obesity as a global epidemic.<sup>3,6</sup> The rise has occurred comparably among both boys and girls: in the year 2016 18% of girls and 19% of boys were overweight.<sup>3</sup> Overweight and obese children are likely to stay obese into adulthood and are more expected to develop non-communicable diseases like diabetes and cardiovascular diseases at a younger age. Overweight and obesity, as well as their associated diseases, are largely preventable. Prevention of childhood obesity therefore needs high concern. Overweight and obesity in the adolescence accredits to the increase in sedentary life style, unhealthy food habits, poor diet, deficiency of physical activity, and also to the overuse of electronic gadgets. Lack of awareness is also a governing factor when it comes to obesity in this age group.

To 'halt the rise in diabetes and obesity' in adults and children was one among the global health targets set by the World Health Assembly in 2013.<sup>7</sup> The immensity of the problem among children and adolescents in India is unclear due to paucity of well-conducted nationwide studies and lack of consistency in the cut-points used to define childhood overweight and obesity.<sup>8</sup> Reference curves for the children and adolescents giving BMI distribution for age and sex have thus been developed for international use by the WHO and the International Obesity Task Force (IOTF). Although the WHO and IOTF growth references are considered to be international reference standards, they often guide to differential prevalence estimates for overweight and obesity among children and adolescents.<sup>9</sup> The Indian Academy of Paediatrics (IAP) Growth Charts Committee has constructed revised IAP growth references in January 2015 for the age group 5-18 years old Indian children based on data from fourteen cities across India.<sup>10</sup>

The aim of the study was to find out the proportion of overweight and obesity among 5-18 years old children attending a tertiary care centre. The proportion of over nutrition was compared using 2015 IAP and WHO BMI charts, to find out which chart detects more over nourished children.

### **Objective**

The objective of this study was to compare the proportion of overweight and obesity using 2015 IAP and WHO BMI charts among 5-18 years old children attending a tertiary care centre in South Kerala.

## **METHODS**

After obtaining the Ethical clearance from the Institutional Ethical Committee, the study was conducted in the department of paediatrics of Dr. SMCSI Medical College, Karakonam, Trivandrum, Kerala.

The study design was hospital based cross-sectional study. The study setting was at department of paediatrics of Dr. SMCSI Medical College and hospital, Karakonam.

The study period was August 2018-October 2020.

### **Study population**

A total of 250 children between 5 and 18 years of age attending the paediatric OPD during the study period.

### **Inclusion criteria**

Those children between 5 and 18 years of age attending the hospital whose parents consented for the study were included.

### **Exclusion criteria**

Severely ill children and children whose parents did not give consent were excluded.

### **Data collection tools**

After calibration and standardization, an electronic weighing machine (ESSAE accurate trade links) and stadiometer (SECA portable Stadiometer height-rod) were used to measure weight and height respectively.

### **Data collection**

A pretested and semi-structured performa with questions included from WHO steps instrument was used for data collection. The date of birth of the child was recorded and age was measured in completed months and later rounded off to the nearest 6 months interval. Anthropometric measurements like height and weight of each subject was measured. Height was measured using a portable standardised stadiometer (SECA portable stadiometer height-rod) with the child standing bare foot, head in Frankfurt plane and arms by the side. A thin, wooden scale was placed above the head perpendicular to the ruler and parallel to the ground and the measurements recorded to the nearest 0.1 cm. Weight was measured using electronic weighing machine (ESSAE accurate trade links) which was calibrated daily against standard weight, with the child standing barefoot, head in Frankfurt plane, empty pockets and measurements recorded to the nearest 0.1 kg. The weighing machine was calibrated to zero prior to each measurement.<sup>13</sup> The proportion of overweight and obesity was determined using the IAP standard for BMI, 2015.<sup>14</sup> The adult equivalent of 23 and 27 BMI cut-off lines as presented in the IAP BMI charts were used to define

overweight and obesity respectively.<sup>14</sup> A comparison of the proportion was done using the WHO reference 2007 and IAP 2015 BMI standard.<sup>11</sup> As per recommendations of WHO the 85th and 95th age and gender specific percentiles were used to classify as overweight and obesity.<sup>15</sup>

**Statistical analysis**

Data was entered into MS excel and was analysed using the SPSS trial version software and MS excel. Proportion of children with overweight and obesity were calculated using the IAP BMI charts by employing WHO BMI charts as gold standard. Appropriate statistical tests were done for all tests p value ≤ 0.05 was considered as statistically significant.

**RESULTS**

Among the 250 children, females 148 (59.2%) were more than males 102 (40.8%) and the female: male ratio is 1.45:1. This study group had maximum children belonged

to the age group 5 to 6.5 years 53 (21.2%) and minimum in age group 15 to 16.5 years 17 (6.8%). The proportion of obesity and overweight in the study group was 88 (35.2%) by IAP standards, 63 (25.2%) by WHO standards. The overall proportion of obesity and overweight was higher when measured using IAP reference.

The highest proportion of obesity was found in children aged 7-8.5 years 17 (38.6%), followed by 8 (21.6%) in children who were aged 9-10.5 years on plotting in IAP 2015 BMI chart. Children in the younger age group were more obese than elder group. There was a statistically significant association between age and BMI (p value < 0.001). On plotting in WHO BMI chart, the highest proportion of obesity was found in children aged 7-8.5 years 16 (36.4%), followed by 7 (18.9%) in children who were aged 9-10.5 years, which was in accordance with the findings of revised IAP BMI chart. Children in the younger age group were more obese than elder group. There was a statistically significant association between age and BMI (p value < 0.001).

**Table 1: Frequency distribution according to age.**

Age (years)	Frequency	Percentage (%)
5-6.5	53	21.2
7-8.5	46	18.4
9-10.5	32	12.8
11-12.5	35	14
13-14.5	21	8.4
15-16.5	17	6.8
17- 18.5	46	18.4
<b>Total</b>	250	100

**Table 2: Comparison of proportion of overweight and obesity using IAP and WHO BMI references.**

Growth references of BMI used	Obesity+overweight	
	N	%
<b>Revised IAP (2015)</b>	88	35.2
<b>WHO (2007)</b>	63	25.2

**Table 3: Age wise distribution of nutritional status according to IAP 2015.**

Age (years)	2015 IAP BMI				Total
	Obesity (>27 adult equivalent)	Overweight (23-27 adult equivalent)	Normal (3 <sup>rd</sup> percentile-23 <sup>rd</sup> adult equivalent)	Thinness (<3 <sup>rd</sup> percentile)	
5-6.5	N 7	9	17	5	38
	% 18.4	23.7	44.7	13.2	100.0
7-8.5	N 17	5	18	4	44
	% 38.6	11.4	40.9	9.1	100.0
9-10.5	N 8	6	18	5	37
	% 21.6	16.2	48.6	13.5	100.0
11-12.5	N 4	11	23	1	39
	% 10.3	28.2	59.0	2.6	100.0
13-14.5	N 0	6	18	2	26
	% 0.0	23.1	69.2	7.7	100.0
15-16.5	N 0	4	7	0	11
	% 0.0	36.4	63.6	0.0	100.0

Continued.

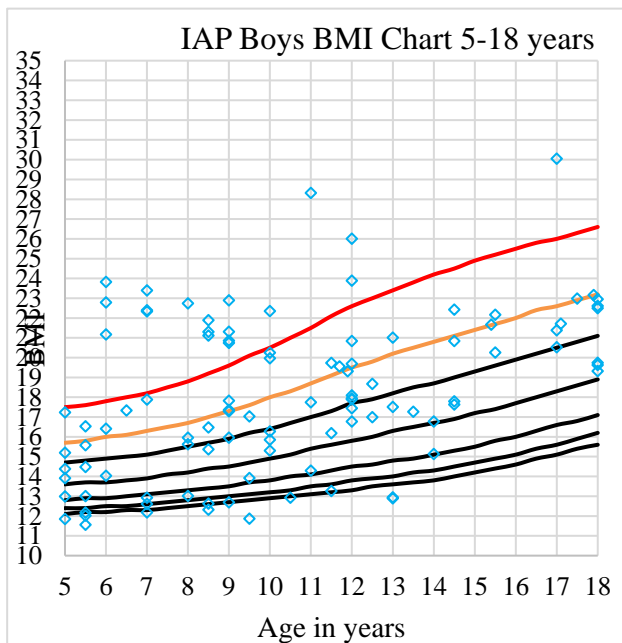
Age (years)	2015 IAP BMI				Total
	Obesity (>27 adult equivalent)	Overweight (23-27 adult equivalent)	Normal (3 <sup>rd</sup> percentile-23 <sup>rd</sup> adult equivalent)	Thinness (<3 <sup>rd</sup> percentile)	
17-18.5	N 3	8	43	1	55
	% 5.5	14.5	78.2	1.8	100.0
Total	N 39	49	144	18	250
	% 15.6	19.6	57.6	7.2	100.0

Note:  $\chi^2= 48.917$ ,  $df=18$ ,  $p \text{ value}<0.001$ .

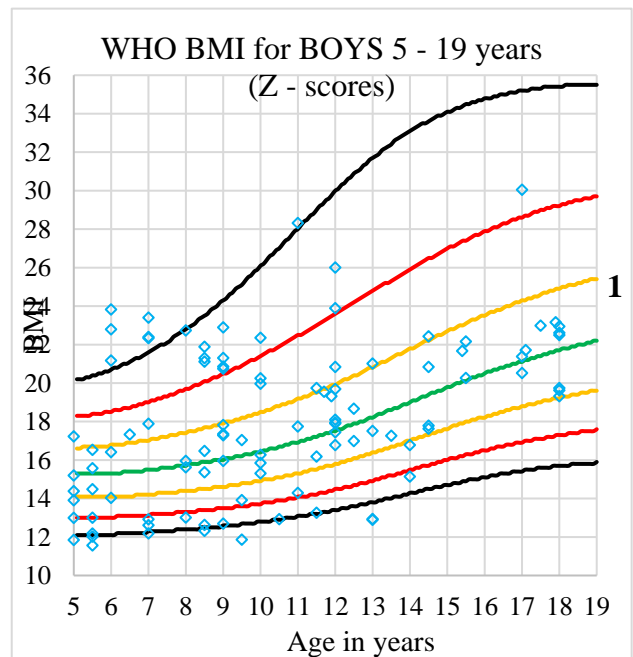
**Table 4: Age wise distribution of nutritional status according to WHO 2007.**

Age (years)	WHO BMI				Total
	Obesity (>2 SD)	Overweight (1 SD to 2 SD)	Normal (-2 SD to 1 SD)	Thinness (-3 SD to -2 SD)	
5-6.5	N 7	5	18	5	3
	% 18.4	13.2	47.4	13.2	7.9
7-8.5	N 16	5	13	6	4
	% 36.4	11.4	29.5	13.6	9.1
9-10.5	N 7	5	20	3	2
	% 18.9	13.5	54.1	8.1	5.4
11-12.5	N 4	7	26	2	0
	% 10.3	17.9	66.7	5.1	0.0
13-14.5	N 0	3	19	2	2
	% 0.0	11.5	73.1	7.7	7.7
15-16.5	N 0	0	11	0	0
	% 0.0	0.0	100.0	0.0	0.0
17-18.5	N 2	2	49	1	1
	% 3.6	3.6	89.1	1.8	1.8
Total	N 36	27	156	19	12
	% 14.4	10.8	62.4	7.6	4.8

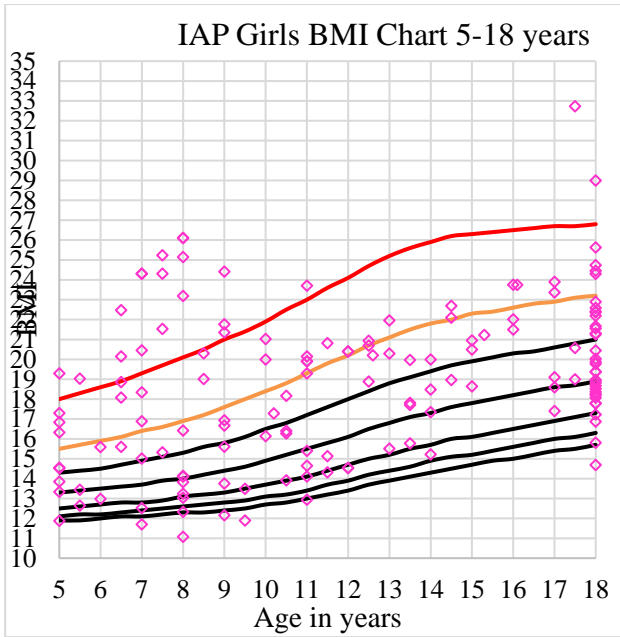
Note:  $\chi^2= 64.373$ ,  $df=24$ ,  $p \text{ value}<0.001$ .



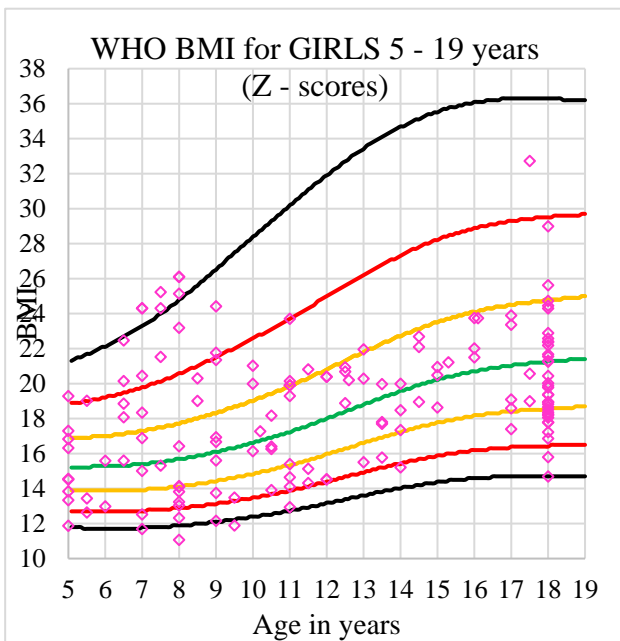
**Figure 1: BMI of boys plotted in revised IAP 2015 BMI chart.**



**Figure 2: BMI of boys plotted in WHO 2007 BMI chart.**



**Figure 3: BMI of girls plotted in revised IAP 2015 BMI chart.**



**Figure 4: BMI of girls plotted in WHO 2007 BMI chart.**

## DISCUSSION

This hospital based cross-sectional study was conducted to find out the proportion of overweight and obesity and to compare it with revised 2015 IAP and 2007 WHO BMI charts. In this study, 59.2% of the study population was females and 40.8% were males. Out of the 250 children, maximum children of 21.2% belonged to the age group 5 to 6.5 years and minimum in age group 15 to 16.5 years 6.8%.

The proportion of obesity and overweight in the study group was 35.2% by IAP standards, 25.2% by WHO standards. There were a high proportion of overweight and obese cases among study population regardless of the reference used. The study findings indicated that the proportion of overweight and obesity were higher when the new IAP BMI cut-offs were used as compared to the WHO cut-offs.

Considering overweight and obesity separately, the proportion of obesity was reported 15.6% by IAP standards, 14.4% by WHO standards. The proportion of overweight children was more with IAP standards (19.2%) than by WHO standards (10.8%), which is similar to the study of Eshwar et al.<sup>16</sup> The proportion of overweight and obesity reported in the present study is higher than different studies conducted in different parts of India.<sup>17-19</sup>

In this study, the highest proportion of obesity was found in children aged 7-8.5 years (38.6%) and the next highest proportion of obesity (21.6%) was in the age group 9-10.5 years, which is similar to Chandra et al study in which the highest prevalence of childhood obesity was seen in the 8-10 years age group (31.6% obese and 37.3% overweight).<sup>19</sup> The present study has a significant association between age and BMI status (p value<0.001).

## Limitation

The limitation of the present study was its use of a health centre-based sample rather than population-based sample.

## CONCLUSION

There are numerous BMI charts available for assessing obesity, but the one which is more accurate for our Indian population has to be used for assessing the magnitude of childhood obesity for our population. This study shows that IAP BMI standards are more suitable for Indian children to identify the proportion of overweight and obesity than WHO standards. The findings of this study alert us to concentrate more on the age group of 7-10.5 years about their diet habits, physical activity and screen time for early prevention of childhood obesity and overweight.

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*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

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