## ORIGINAL RESEARCH

# The prevalence of obesity and overweight in children of aged 6 to 12 years

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## ABSTRACT

Overweight and obesity are associated not only with an increased burden of diabetes, hypertension, cardiovascular diseases, some types of cancers and premature mortality but also with the social and psychological effects of excess weight. Sample collection was done from 3 government and 2 private schools.Each school authority was approached and the intention of the study was explained. 2 visits were made to each school. On the first visit questionnaires were distributed among the children. On the second visit, anthropometric, general physical examination and systemic examination of the children who brought appropriately filled questionnaires were done. 28.8% of the study subjects had BMI less than 5th percentile for their age group according to CDC reference.12% of the study subjects had BMI between 85th to 95th percentile for their age group and 3.8% of the subjects had BMI more than 95th percentile.
**Key words:** BMI, Overweight and obesity

## INTRODUCTION

Worldwide, disease profiles are transforming at a rapid pace catching the attention of medical professionals and policy makers alike. The emerging epidemics of obesity, cardiovascular disease (CVD) and diabetes form the crux of this phenomenal change. Among these entities, obesity has become a colossal epidemic causing serious public health concern and contributes to 2.6 million deaths worldwide every year [1, 2].

Overweight and obesity are associated not only with an increased burden of diabetes, hypertension, cardiovascular diseases, some types of cancers and premature mortality but also with the social and psychological effects of excess weight. The last two decades of the previous century have witnessed dramatic increase in health care costs due to obesity and related issues among children and adolescents [3].

The epidemic of obesity sits alongside the problem of under nutrition and infections in India thereby creating a greater burden of nutrition-related ill health among our children. The change in the lifestyle, diet, a decrease in physical activity and too much time spent in front of computer or television screens have been blamed for the growing number of obese children [4].

## Methodology

### Study design

Cross-sectional randomized epidemiological study.

### Study population

Children aged between 6 years to 12 years.

### Inclusion criteria

- Children who are residents of Shimoga.
- Age ranging from 6 to 12 yrs.

### Exclusion criteria

- Children suffering from disease related overweight.

**Sample size:** 500 school going children of ages between 6 to 12 years.
No randomization/blinding/intervention was done in the study.

**Follow up:** None

### Data collection methods

- Sample collection was done from 3 government and 2 private schools.Each school authority was

approached and the intention of the study was explained.

- Informed consent was taken from the principal of the school and the parents.

**Data collection was done by**

Questionnaires

Personal interviews

Physical examination.

- 2 visits were made to each school. On the first visit questionnaires were distributed among the children. Data regarding parents and family were collected through the questionnaires. Children were assigned to different socioeconomic strata according to Modified Kuppuswamy Scale. Level I and II were considered as upper socioeconomic status whereas level III, IV and V were considered as lower socioeconomic status. Data regarding diet and physical activity were also collected.
- On the second visit, anthropometric, general physical examination and systemic examination of the children who brought appropriately filled questionnaires were done.
- Examination was done in the school premises under the supervision of a senior staff. For taking anthropometric measurements non stretchable measuring tapes and electronic weighing machines (calibrated to +/- 100 grams accuracy) were used.
- Weight was recorded in kilograms with minimal clothing on, without shoes. The zero error was corrected before each measurement.
- Height was obtained as the individual was asked to stand on the horizontal platform with heels together stretching upward to the fullest extent with arms hanging on the sides and heel and buttocks touching against the wall. The height was measured in centimeter scale using a measuring tape. The head was aligned so that the

lower rim of the orbit and the auditory canal were in a horizontal plane (Frankfurt plane).

- BMI was calculated by the formula weight (kg)/ height (mt)$\}^2$.
- CDC growth charts for BMI (published May 2000; modified 10/16/00) and WHO growth charts (published in 2007) for age and sex were used as reference standards. Children with body mass index (BMI) above 95th percentile were considered as obese, those between 85th and 95th percentile as overweight, and those with BMI below the 5th percentile will be considered as underweight according to CDC growth standards and children with BMI Z score above 1 were considered overweight and those with Z score above 2 were considered as obese according to WHO growth standards.

**Results**

**Table 1: Age distribution of subjects**

| Age | Frequency | Percent |
|---|---|---|
| 6-7 | 57 | 11.4% |
| 7-8 | 68 | 13.6% |
| 8-9 | 64 | 12.8% |
| 9-10 | 36 | 7.2% |
| 10-11 | 56 | 11.2% |
| 11-12 | 110 | 22% |
| >12 | 109 | 21.8% |
| Total | 500 | 100.0 |

Table 1 shows that 11.4% of the subjects were in the age group of 6-7 years, 13.6% of the subjects belonged to 7-8 years of age, 12.8% belonged to 8-9 years of age, 7.2% belonged to 9-10 years age group 11.2% belonged to 10-11years of age, 22% belonged to age group of 11-12years and 21.8% were above 12 years of age.

**Table 2: Descriptive statistics of actual height**

| Age | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| 6-7 | 57 | 115.157 | 6.578 | 100 | 127 |
| 7-8 | 68 | 113.897 | 12.126 | 77 | 135 |
| 8-9 | 64 | 117.656 | 11.099 | 90 | 137 |
| 9-10 | 36 | 124.922 | 10.799 | 105 | 138 |
| 10-11 | 56 | 132.714 | 12.560 | 105 | 150 |
| 11-12 | 110 | 141.985 | 9.841 | 105 | 158 |
| >12 | 109 | 148.394 | 3.396 | 143 | 167 |

Table 2 depicts that the mean height for various age groups of 6-7, 7-8, 8-9, 9-10, 10-11, 11-12, >12 years were115.157, 113.897, 117.656, 124.922, 132.714, 141.985 and 148.394 cm respectively.

**Table 3: Descriptive statistics of actual weight**

| Age | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| 6-7 | 57 | 19.096 | 3.701 | 15 | 26 |
| 7-8 | 68 | 19.523 | 3.876 | 14.9 | 28 |
| 8-9 | 64 | 20.562 | 4.460 | 15 | 34 |
| 9-10 | 36 | 23.155 | 4.430 | 18 | 31 |

| 10-11 | 56 | 27.050 | 5.260 | 18.8 | 37 |
|---|---|---|---|---|---|
| 11-12 | 110 | 33.860 | 6.888 | 20 | 46 |
| >12 | 109 | 37.669 | 7.297 | 29 | 55 |

Table 3 depicts that the mean weight for various age groups of 6-7, 7-8, 8-9, 9-10, 10-11, 11-12, >12 years are 19.096, 19.523, 20.562, 23.155, 27.050, 33.860 and 37.6697 Kg respectively.

**Table 4: Descriptive statistics of actual BMI**

| Age | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| 6-7 | 57 | 14.258 | 2.095 | 11.9 | 19 |
| 7-8 | 68 | 15.392 | 4.101 | 11.3 | 29.7 |
| 8-9 | 64 | 14.968 | 3.203 | 10.7 | 23.6 |
| 9-10 | 36 | 14.794 | 1.702 | 11.8 | 17.3 |
| 10-11 | 56 | 15.460 | 2.310 | 12.7 | 22.23 |
| 11-12 | 110 | 17.272 | 3.320 | 12.5 | 23.4 |
| >12 | 109 | 17.071 | 3.0931 | 13 | 25.5 |

Table 4 depicts that the mean BMI for various age groups of 6-7, 7-8, 8-9, 9-10, 10-11, 11-12, >12 years were14.258, 15.392, 14.968, 14.794, 15.460, 17.272, and 17.071 respectively.

**Table 5: Distribution of subjects according to their age (years) andBMI based on BMI for age WHO 2007 reference**

| WHO BMI Z Scores | Age Group | | | | | | | Total | Percent |
|---|---|---|---|---|---|---|---|---|---|
| | 6-7 | 7-8 | 8-9 | 9-10 | 10-11 | 11-12 | >12 | | |
| Below -3 | 4 | 8 | 12 | 4 | 0 | 8 | 2 | 38 | 7.6% |
| Below -2 | 12 | 0 | 0 | 0 | 8 | 8 | 23 | 51 | 10.2% |
| Below -1 | 16 | 20 | 16 | 16 | 16 | 18 | 26 | 128 | 25.6% |
| Below and Above Median | 13 | 28 | 24 | 16 | 28 | 47 | 43 | 199 | 39.8% |
| Above+1 | 12 | 8 | 4 | 0 | 4 | 25 | 12 | 65 | 13% |
| Above +2 | 0 | 4 | 8 | 0 | 0 | 4 | 3 | 19 | 3.8% |
| Total | 57 | 68 | 64 | 36 | 56 | 110 | 109 | 500 | 100% |

Table 5 shows that 7.6% and 10.2%of the study subjects had Z score for BMI below -3 and below -2 respectively according to WHO classification. 13% and 3.8% of the study subjects had Z score for BMI above +1 and above +2 for their respective age groups.

**Table 6: Distribution of subjects according to their age (years) andBMI based on BMI for age CDC 2000 reference**

| Percentiles | Age Group | | | | | | | Total | Percent |
|---|---|---|---|---|---|---|---|---|---|
| | 6-7 | 7-8 | 8-9 | 9-10 | 10-11 | 11-12 | >12 | | |
| <5th | 28 | 24 | 20 | 8 | 12 | 16 | 36 | 144 | 28.8% |
| 5th -10th | 4 | 4 | 8 | 12 | 8 | 18 | 2 | 56 | 11.2% |
| 10th -25th | 8 | 8 | 12 | 0 | 16 | 25 | 18 | 87 | 17.4% |
| 25-50th | 4 | 16 | 12 | 12 | 12 | 9 | 19 | 84 | 16.8% |
| 50-75th | 1 | 4 | 0 | 4 | 4 | 9 | 12 | 34 | 6.8% |
| 75-85th | 0 | 0 | 0 | 0 | 0 | 4 | 12 | 16 | 3.2% |
| 85-95th | 8 | 8 | 4 | 0 | 4 | 29 | 7 | 60 | 12% |
| >95th | 4 | 4 | 8 | 0 | 0 | 0 | 3 | 19 | 3.8% |
| Total | 57 | 68 | 64 | 36 | 56 | 110 | 109 | 500 | 100% |

Table 6 shows that 28.8% of the study subjects had BMI less than 5th percentile for their age group according to CDC reference.12% of the study subjects had BMI between 85th to 95th percentile for their age group and 3.8% of the subjects had BMI more than 95th percentile.

**Table 7: Prevalence of Obesity and Overweight according to CDC 2000 reference**

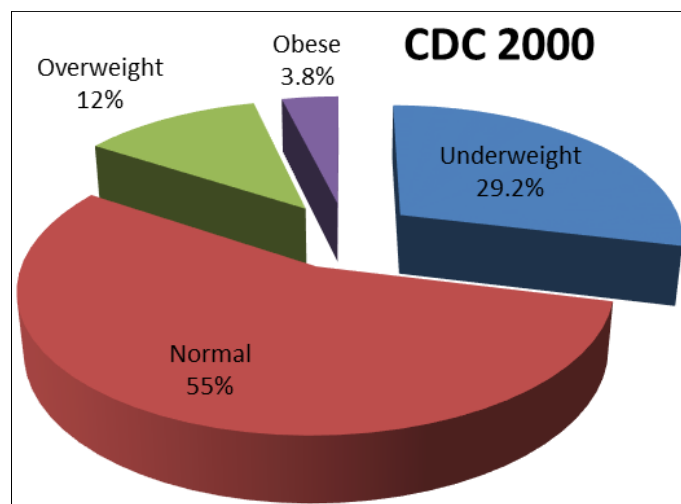| CDC 2000 | Frequency | Percentage |
|---|---|---|
| Overweight | 60 | 12% |
| Obesity | 19 | 3.8% |
| Total | 79 | 15.8% |

Table 7 shows that 3.8% of the subjects were obese, 12% were overweight and 29% were underweight according to CDC 2000 reference.

**Discussion**

In our study we found that 13% subjects were overweight and 3.8% were obese according to WHO 2007 reference where as 3.8% of the subjects were obese and 12% were overweight according to CDC 2000 reference. Various studies done in India have used different growth standards e.g. age and sex related percentile charts that are available for BMI for boys and girls from CDC (USA), KN Agarwala*et al.*, Khandilkar*et al.*, WHO and IOTF cut offs for obesity and overweight. Over past 10 years and in different regions of India Obesity was reported as low as 0.56% to as high as 10.67%. The findings of different studies are discussed in the following table [36, 6, 31, 17, 26, 7, 38, 22, 9, 16, 5, 33, 10].

**Table 8: Comparison of overweight/obesity**

| No | Author | Age group | Prevalence Overweight | Obesity |
|---|---|---|---|---|
| 1 | Subramaniam*et al.* (2003) Chennai [5] | 10-15 years | 1991:Overweight-9.62% 1998:Overweight- 9.67% | 1991Obesity- 5.94% 1998Obesity- 6.23% |
| 2 | Bose K, *et al.* (2007) Kolkata [6] | 6-9 years | Overweight- 17.63% | Obesity- 6% |
| 3 | Sharma *et al.* (2007) Delhi [7] | 4-17 years | Overweight- 22% | Obesity- 6% |
| 4 | Kumar HN *et al.* (2008) Mangalore [8] | 2-5 years | WHO: Overweight- 4.5% | Obesity- 1.4% |
| 5 | Premnath M *et al.* (2010) Mysore [9] | 5-16 years | IAP: Overweight- 8.5% | Obesity- 3.4% |
| 6 | Chakroborty*et al.* (2011) Kolkata [10] | 5-18 years | Overweight- 5.43% | Obesity- 0.56% |
| 7 | Vohra R *et al.* (2011) Lucknow[11] | 10-18 years | WHO: Overweight- 4.17% | Obesity- 0.73% |
| 8 | Misra*et al.* (2011) Multicentric (India) [12] | 8-18 years | IOTF: Overweight- 14.4% WHO: Overweight- 18.5% | IOTF Obesity- 2.8% WHO Obesity- 5.3% |
| 9 | Deoke*et al.* (2012) Nagpur[13] | 5-17 | Overweight- 5.84% | Obesity- 0.35% |
| 10 | Jigna Samir Shah *et al.* (2013)Gujarat[14] | 10-12 years | Overweight- 33.8% | Obesity- 10.67% |
| 11 | Bansal AK *et al.*(2013)Jaipur [15] | Class 5 and above | Overweight 14.83% | Obesity5.69% |
| 12 | Soniya V Ashtekar*et al.* (2014)Latur[16] | 5th -7th standard | Overweight:8.44% | Obesity - 1.54% |
| 13 | Present study (2023) Shimoga | 6-12 years | CDC: Overweight:12% WHO:Overweight:13% | CDC: Obesity: 3.8% WHO: Obesity: 3.8% |

**Conclusion**

This study shows that the prevalence of obesity is 3.8% and that of overweight is 12% (by CDC growth standards).

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