

# Rural Childhood Obesity – An Emerging Health Concern

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## Abstract

**Background:** Childhood obesity is growing globally as an epidemic. It is the most common metabolic disease identified in children. **Objective:** To assess the nutritional status of school going children in Poonamallee, Tamil Nadu and to compare the nutritional status between urban and rural school children. **Methods:** A retrospective review of the school health records over a period of 9 months was done with Institutional Ethics Committee (IEC) approval for a total of 1,803 children aged 5 to 18 years (916- rural, 887-urban). Revised IAP growth charts (2015) were used to classify their nutrition status. **Results:** The overall prevalence of overweight/obesity and thinness/severe thinness in our study was 20% and 9.4%, respectively. In the rural schools, the prevalence of overweight/obesity and thinness was 16.2% and 12.2%, respectively, whereas in the urban schools, it was 24% and 6.4%, respectively. The rural school children had lower mean Z scores of weight for age, height for age, and BMI for age compared to urban children ( $P < 0.001$ ). **Conclusion:** Among rural school children overweight/obesity is more prevalent than undernutrition. There is an urgent need for nutrition education for the school children and community.

**Keywords:** Obesity, rural, school children, urban

## INTRODUCTION

Malnutrition includes undernutrition (wasting, stunting, and underweight), inadequate vitamins or minerals as well as overweight and obesity. Childhood obesity is growing globally as an epidemic<sup>[1]</sup> with large variations across countries with different socio-economic status.<sup>[2,3]</sup> The worldwide prevalence of childhood overweight and obesity increased from 4.2% (95% CI: 3.2%, 5.2%) in 1990 to 6.7% (95% CI: 5.6%, 7.7%) in 2010.<sup>[4]</sup> Developing countries are facing the double burden of underweight and obesity in children.<sup>[5]</sup> This study was carried out to assess the nutritional status of school going children and to compare the nutrition status of urban and rural school children.

## MATERIALS AND METHODS

This retrospective cross-sectional study was done from the school health records of our hospital with Institutional Ethics Committee approval. The study period was from June 2017 to February 2018. The total number of children evaluated in the school health program during this period was 1,803 consisting of 916 rural children and 887 urban children, in the age group of 5 to 18 years. They were from 8 schools of Poonamallee, Tamil Nadu (6 rural area schools and 2 schools

from the urban area). Schools were classified as urban or rural as per the Census of India 2011 guidelines. According to this, the urban area includes all places with municipality, corporation, and cantonment board with a minimum population of 5,000, with >75% being non-agricultural male workers. All areas which are not categorized as urban are considered as a rural area.

Data regarding the age, gender, height, and weight of the children were collected from the school health records of the children in our hospital. Body Mass Index (BMI) was calculated using the formula  $BMI = \text{weight (kg)}/\text{Ht (m)}^2$ . In our school health program, during the annual health checkups, anthropometric measurements are done by a single trained nurse from our hospital. Height is measured with a wall-mounted stadiometer and the weight using Omron HN 286 digital weighing scale.

The children were categorized into preadolescents (5 to 9 years) and adolescents (10–18 years) as per the World Health Organization. Revised Indian Academy of Pediatrics

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(IAP) growth chart (2015) was used to classify their nutrition status,<sup>[6]</sup> as Normal (N), Overweight (OW), Obesity (Ob), Thinness (T) and Severe Thinness according to BMI for age, Underweight (UW) and severe underweight (weight for age), and Stunting (S) and Severe Stunting (height for age). Weight for age between -2 SD and -3 SD is Underweight and <-3 SD is Severe Underweight. Height for age between -2 SD and -3 SD is Stunting, <-3 SD is Severe Stunting. BMI for age between 0.55 SD and 1.33 SD in males and 0.67 SD to 1.63 SD in females is overweight. The BMI for age >1.34 SD in males and >1.64 SD in females is obesity. The BMI for age between -1.88 SD and -2.3 SD is Thinness and <-2.3 SD is Severe Thinness.

The data were entered and analyzed using IBM SPSS version 20. For ease of further analysis and comparison, the anthropometric measurement values were converted to Z score using a template. The comparison of the Z scores between urban and rural population was carried out using Independent sample *t* test. A *P* value < 0.05 was considered statistically significant.

## RESULTS

In this study, 51% (916) of the participants belonged to rural schools and 49% (887) belonged to urban schools. There were no differences observed in the gender ratio among both the groups. Among both male and female children, rural children had significantly lower Z scores of weight for age, height for age, and BMI for age compared to urban children (*P* < 0.001) [Table 1].

Overall, 6% of the participants were underweight, 9.4% had thinness/severe thinness, 20% were overweight or obese, and 6.9% had stunting (including severe stunting). The prevalence of underweight was higher among the rural boys (12%) than the other study groups (*P* < 0.001). Rural school children had significantly higher prevalence of stunting including severe stunting (11.4%) than their urban counterparts (2.36%), *P* < 0.001 [Table 2].

The prevalence of thinness in rural children (12.2%) was significantly higher than in urban children (6.4%) for both

genders, (*P* < 0.001). The prevalence of overweight (16.6%) and obesity (7.4%) in urban children was significantly higher than the rural children (10.2% overweight and 6% obesity) (*P* < 0.001).

Among rural children, the prevalence of overweight and obesity (16.2%) was higher than the prevalence of thinness and severe thinness (12.2%). Among rural male children, the prevalence of overweight and obesity (14%) was almost equal to the prevalence of thinness and severe thinness (13%). In rural female children, the prevalence of overweight and obesity (18.6%) was higher than the prevalence of thinness and severe thinness (11.4%) [Table 2]. This may suggest a possible shift of trend toward overweight and obesity in rural area children.

For further analysis, children were divided into different age groups considering the completed age. Age categories were examined and compared. It showed a difference among rural and urban school children. Among the rural school children, the highest prevalence of overweight and obesity was seen in children of age between 5 and 6 years (22%), followed by children of age 15–16 years (21.3%). Among the urban school children, the highest prevalence was found in children of age between 13 and 14 years (31.8%), followed by the children of age between 11 and 12 years (27.3%).

In rural schools, the highest prevalence of obesity/overweight was seen in boys of age group 5–6 years (20.6%) and in girls (26.7%) of age 15–16 years [Table 3]. In urban schools, the highest prevalence was seen in boys (27.3%) between 11 and 12 years of age and in girls (41.3%) between 13 and 14 years of age.

On comparing the prevalence of obesity/overweight between rural and urban girls, there was a statistically significant difference in the age group of 13–14 years (22.5% rural vs. 41.3% urban) with a *P* value of 0.026. Similarly, for boys, we observed a statistically significant difference between the urban and rural participants in the age group of 7–8 years (10.1% rural vs. 20.8% urban) with a *P* value 0.046 and also in the age group of 9–10 years (7.7% rural vs. 21.2% urban) with *P* value 0.01. In all other age groups, there was no significant difference in obesity/overweight among rural and urban school children.

## DISCUSSION

This study has observed that 70.6% of the participants had normal nutrition status as per BMI for age. Overweight and obesity are the major nutritional problems identified in both urban and rural school children. The combined prevalence of overweight and obesity was 24% in urban and 16.2% in rural children, and this was higher than the prevalence of combined thinness and severe thinness (6.4% in urban and 12.2% in rural). Therefore, currently, obesity is the most common metabolic disease identified among children.<sup>[7]</sup>

Various studies from India have shown a rise in the prevalence of overweight and obesity among children.<sup>[8,9]</sup> Ying-Xiu Zhang

**Table 1: Characteristics of study population**

|                            | Rural <i>n</i> =916<br>(51%) | Urban <i>n</i> =887<br>(49%) | <i>P</i> |
|----------------------------|------------------------------|------------------------------|----------|
| Boys                       | 458 (50%)                    | 455 (51.2%)                  |          |
| Preadolescents (5-9 years) | 339 (37%)                    | 463 (52%)                    |          |
| Adolescents (10-18 years)  | 557 (63%)                    | 424 (48%)                    |          |
| Nutritional status         |                              |                              |          |
| Mean WA Z score boys       | -0.75±0.05                   | -0.12±0.5                    | 0.0001   |
| Mean HA Z score boys       | -0.87±0.05                   | 0.11±0.05                    | 0.0001   |
| Mean BMIA Z score boys     | -0.74±0.05                   | -0.31±0.05                   | 0.0001   |
| Mean WA Z score girls      | -0.54±0.06                   | -0.01±0.05                   | 0.0001   |
| Mean HA Z score girls      | -0.59±0.05                   | 0.17±0.05                    | 0.0001   |
| Mean BMIA Z score girls    | -0.46±0.06                   | -0.15±0.06                   | 0.0001   |

WA: Weight for Age, HA: Height for Age, BMIA: BMI for age

**Table 2: Comparison of nutritional status for urban and rural (male and female) children**

| Interpretation |              | Rural             |                    |                    | Urban             |                    |                    | Total<br>1803 | P      |
|----------------|--------------|-------------------|--------------------|--------------------|-------------------|--------------------|--------------------|---------------|--------|
|                |              | Boys<br>n=458 (%) | Girls<br>n=458 (%) | Total<br>n=916 (%) | Boys<br>n=455 (%) | Girls<br>n=432 (%) | Total<br>n=887 (%) |               |        |
| Weight for age | N            | 399 (87)          | 426 (93)           | 825 (90)           | 426 (94)          | 405 (93.8)         | 831 (93.7)         | 1656 (92)     | 0.0001 |
|                | UW/Severe UW | 54 (12)           | 29 (6.3)           | 83 (9.2)           | 15 (3)            | 12 (2.7)           | 27 (3)             | 110 (6)       |        |
|                | Above N      | 5 (1)             | 3 (0.7)            | 8 (0.8)            | 14 (3)            | 15 (3.5)           | 29 (3.3)           | 37 (2)        |        |
| Height for age | N            | 394 (86)          | 401 (87.6)         | 795 (86.7)         | 427 (94)          | 404 (93.5)         | 831 (93.6)         | 1626 (90.1)   | 0.0001 |
|                | S/Severe S   | 59 (12.8)         | 46 (10)            | 105 (11.4)         | 13 (3)            | 8 (1.9)            | 21 (2.36)          | 126 (6.9)     |        |
|                | Tall         | 5 (1)             | 11 (2.4)           | 16 (1.7)           | 15 (3)            | 20 (4.6)           | 35 (3.94)          | 51 (2.82)     |        |
| BMI for age    | N            | 335 (73)          | 321 (70)           | 656 (71.6)         | 325 (71)          | 292 (67.6)         | 617 (69.6)         | 1273 (70.6)   | 0.0001 |
|                | T            | 60 (13)           | 52 (11.4)          | 112 (12.2)         | 31 (7)            | 26 (6)             | 57 (6.4)           | 169 (9.4)     |        |
|                | OW           | 41 (9)            | 53 (11.6)          | 94 (10.3)          | 62 (14)           | 85 (19.7)          | 147 (16.6)         | 241 (13.4)    |        |
|                | Ob           | 22 (5)            | 32 (7)             | 54 (5.9)           | 37 (8)            | 29 (6.7)           | 66 (7.4)           | 120 (6.6)     |        |

N: Normal, UW: Underweight, S: Stunting, T: Thinness, OW: Overweight, Ob: Obesity

**Table 3: Age and gender wise distribution of overweight and obesity in urban and rural subjects**

| AGE          | RURAL         |               |                | URBAN         |                |              | t   |
|--------------|---------------|---------------|----------------|---------------|----------------|--------------|-----|
|              | Boys n %      | Girls n %     | t %            | Boys n %      | Girls n %      | t %          |     |
| 5-<7 years   | 7/34 (20.6)   | 8/34 (23.5)   | 15/68 (22)     | 7 (12.7)      | 15 (26.3)      | 22 (19.6)    | 37  |
| 7-<9 years   | 8/79 (10.1)   | 12/83 (14.5)  | 20/162 (12.3)  | 26 (20.8)     | 27 (22.3)      | 53 (21.5)    | 73  |
| 9-<11 years  | 8/104 (7.7)   | 16/105 (15.2) | 24/209 (11.4)  | 14 (21.2)     | 23 (24)        | 37 (22.8)    | 61  |
| 11-<13 years | 21/122 (17.2) | 14/86 (16.3)  | 35/208 (16.8)  | 21 (27.3)     | 14 (27.5)      | 35 (27.3)    | 70  |
| 13-<15 years | 13/71 (18.3)  | 18/80 (22.5)  | 31/151 (20.5)  | 16 (25)       | 19 (41.3)      | 35 (31.8)    | 66  |
| 15-<17 years | 6/43 (14)     | 16/60 (26.7)  | 22/103 (21.3)  | 11 (23.4)     | 12 (25.5)      | 23 (24.4)    | 45  |
| 17-18 years  | 0/5 (0)       | 1/10 (10)     | 1/15 (6.6)     | 4 (19)        | 4 (28.6)       | 8 (22.8)     | 9   |
| Total        | 63/458 (13.7) | 85/458 (18.5) | 148/916 (16.2) | 99/455 (21.7) | 114/432 (26.3) | 213/887 (24) | 361 |

*et al.* had observed a disparity between urban and rural areas with a rapid increase in the prevalence of overweight and obesity in rural areas. They found urban and rural children having a similar prevalence of combined overweight and obesity.<sup>[10]</sup> In another study by Ann McGrath *et al.* rural children had a higher prevalence of obesity than urban children.<sup>[11]</sup> In a study on the prevalence of overweight and obesity between private and government school children in Chennai, obesity was found to be significantly higher in government school children.<sup>[12]</sup> This trend of increasing rural obesity could be owing to the high consumption of carbohydrates and fats, increased access to junk foods, lack of knowledge with regard to the nutrition, limited access to healthy food, and diminished physical activity among the rural children.

We observed that the prevalence of overweight/obesity was highest among adolescent girls. This could have been because of cultural factors that restrict the physical activity of girls after puberty. Similar observations have been made in other studies in South India.<sup>[13,14]</sup> In the rural schools, prevalence was highest in the age group of 15–16 years (26.7%), whereas in urban schools, it was highest in the age group of 13–14 years (41.3%). The reason could be attributed to the differences in the timing of menarche and puberty between urban and rural school children. Probably, urban school children reach puberty sooner.

In addition, dietary differences between the two groups could also play a significant role.

In this study, undernutrition was more prevalent in rural compared to urban children, with a combined prevalence of thinness and severe thinness being 12.2% in rural and 6.4% in urban children. The mean nutritional indices were significantly lower in rural than in urban children ( $P < 0.001$ ). A study done in Mandya district, Karnataka shows low nutritional status (30%) in rural children.<sup>[15]</sup> In the study conducted by S.O.Oninla *et al.* and Ekekezie OO *et al.*, underweight was the major health problem among rural school children in Nigeria.<sup>[16,17]</sup> In the meta-analysis done by Johnson JA and Johnson AM, higher rate of obesity was found among rural children than urban children.<sup>[18]</sup> Obesity and overweight are growing health concerns nationwide. They are the risk factors for several non-communicable diseases such as type 2 diabetes, hypertension, and heart disease.

## CONCLUSION

The current study has observed that overall only 70.6% of the children had normal nutrition status. Undernutrition was more prevalent in rural children compared to urban children. In rural children, the prevalence of overweight and obesity was more than undernutrition. There is a need for nutrition education, reinforcement of lifestyle changes, and healthy behaviors for the schools and community.

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**Conflicts of interest**

There are no conflicts of interest.

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