# Prevalence of overweight and obesity among school children in Mysuru, Karnataka

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## ABSTRACT

Childhood obesity has become a major public health challenge in developing countries including India due to the changes in the lifestyle and food habits of children owing to the influence of urban culture and technological growth. The present study is a cross-sectional, school-based study conducted to assess the prevalence of obesity and to determine the demographic variables influencing the obesity among school children. **Methods:** The study included 440 students (Boys: 240, Girls: 200) from two randomly selected schools of Mysuru city, Karnataka. WHO Standard Age and Sex specific Growth Reference charts were used for defining overweight and obesity. Modified Kuppuswamy's socioeconomic scale (2019) was adopted to assess the socioeconomic status of the family. **Results:** Obesity prevalence among the study subjects was 3.86% and overweight was 12.27%. The mean body mass index (BMI) among boys was 18.13 and girls was 18.80. The difference in the distribution of BMI between male and female groups was statistically significant ($P = 0.023$). Age and obesity status of the children was found to have a significant association ($P = 0.022$). Prevalence of overweight and obesity was more among children from higher socioeconomic class ($P = 0.01$). **Conclusion:** Prevalence of obesity and overweight among school children is comparatively higher. The higher familial income, dietary patterns, parental history of obesity and diabetes and having urban residence were identified as the major factors which influenced the obesity status of the school children.

**Keywords:** BMI, obesity, overweight, prevalence, school children

## Introduction

Childhood obesity is emerging as a major public health issue of the twenty-first century with an alarming rise in its prevalence in several developing countries.[1] As per the WHO statistics, the prevalence of obesity among children in the age group of 5-19 years has increased from 4% in 1975 to 18% in 2016, which is much higher than a three-time increase.[2]

India is witnessing a rapid economic development and nutritional transition which is linked with a change in the eating habits and physical activity of people, especially among children.[3-6] Many children today are living in an obesogenic environment. Recent globalization and urbanization has forced the children from all socioeconomic strata to depend heavily on ultra-processed, calorie rich, cheap and readily available foods which are poor in nutrients.[2,4,5,7]

Introduction of online food apps, increased pressure on academics with less or no time spent for outdoor activities, increased screen time, increased 'pocket money' and busy working pattern of parents add to the magnitude of the problem.[4,5]

A growing prevalence of obesity from 5.5 % to 17% has been reported by many Indian studies.[6,8-11] A higher prevalence of obesity was reported among children from urban areas compared to rural areas. Changes in the lifestyle of people in urban areas

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especially among children can be a major contributing factor for this disparity in the prevalence rate of obesity among children from urban areas.[5,9,10]

Most of the research studies in India have focussed on the children in metropolitan cities and very few studies are conducted in other cities which are also under the influence of lifestyle changes related to the economic and nutritional transition. Earlier studies conducted in Mysuru reported a prevalence of 4% of obesity and 8% overweight among school children.[8,11] The assessment of the magnitude of this emerging problem is crucial for implementing effective preventive strategies to ensure a healthy transition of children into adults.[3] The present study was an attempt to analyse the prevalence of obesity and its contributing factors among school children from urban areas of Mysuru.

## Aim

To assess the prevalence of obesity and to determine the demographic variables influencing the obesity among school children.

## Subjects and Methods

A cross-sectional study was conducted among school children in Mysuru city, Karnataka, India between December 2019 and February 2020. The present study was a pilot project carried out in 440 school children aged between 11 and 15 years. Formal administrative approval from the BEO of Mysuru city was obtained prior to the study. The list of schools in the North and South zones of the city was collected. Using simple random sampling technique, two schools from the South zone were selected for the study. All children studying in the 6th, 7th, 8th, 9th and 10th standards from the selected schools participated in the study with the prior permission from school authorities. The study was initiated after obtaining ethical committee approval from the Institutional Ethical Clearance Committee. (Date of Ethical committee approval: 02-11-2018). Parents of each participant were briefed about the study purpose through telephone. Informed written consent from the parents and assent from the participating children were procured.

All children were interviewed personally by the investigator. Information regarding the sociodemographic variables influencing the weight status of children was collected using a pretested structured interview schedule. Standardised instruments and techniques were used for anthropometric measurements such as height and weight of the children. A standardised, calibrated digital weighing scale was used to measure the weight. The weight of the students was obtained while the students stood upright barefooted on the weighing machine. The height was measured by standardised, calibrated digital stadiometer. The height was recorded in centimetres while the students stood straight with horizontal gaze and barefooted. WHO Standard Growth Reference for BMI for specific age and
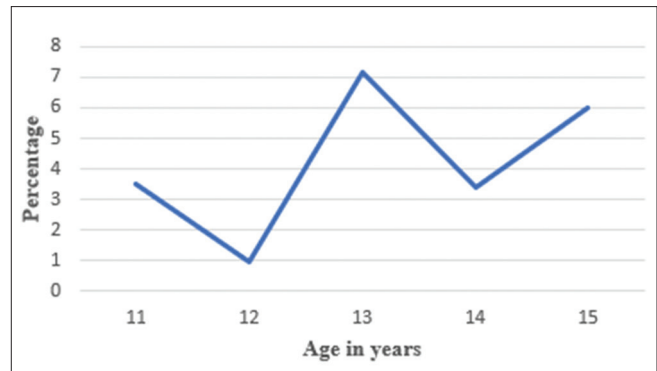


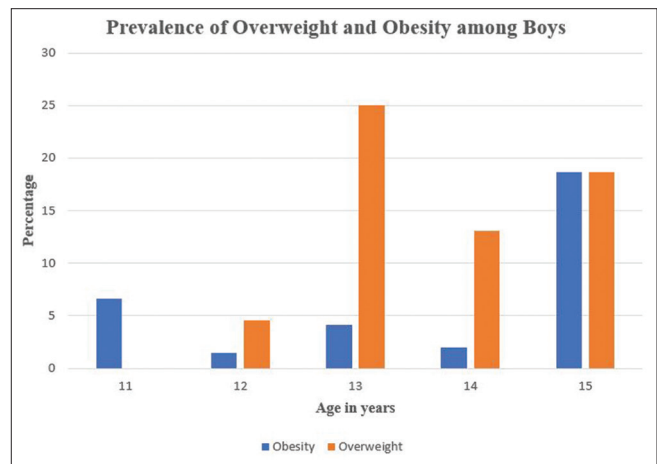**Figure 1:** Age wise prevalence of Obesity among study subjects



**Figure 2:** Prevalence of Overweight and Obesity among Boys
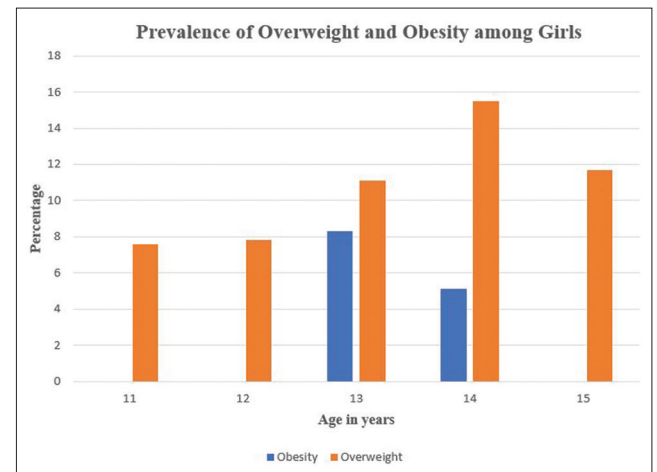


**Figure 3:** Prevalence of Overweight and Obesity among Girls

gender was used as reference standards. BMI was computed using the formula: BMI = bodyweight in kilograms divided by height in meters squared.

According to WHO Standard Age and Sex specific Growth Reference charts for children within the age of 5-19 years (2007), weight of the children was categorized as: (i) Normal weight: Weight corresponding to the WHO Growth Standard median,

(ii) Overweight: BMI for age greater than 1 standard deviation above the WHO Growth Standard median, (iii) Obesity: BMI for age greater than 2 standard deviations above the WHO Growth Standard median and (iv) Underweight: BMI for age less than 2 standard deviations below the WHO Growth Standard median.

Modified Kuppuswamy's method of socioeconomic scale (2019) was used to assess the socioeconomic status of the family. The scale was based on the following three characteristics of the family:

1. Educational qualification of the head of the family (maximum score - 7)
2. Type of occupation of the head of the family (maximum score - 10)
3. Monthly income of the family (maximum score -12)

Based on the total score, the socioeconomic status of the families of the children were classified as "Upper, Upper-Middle, Lower-Middle, Upper-Lower and Lower classes". Data was compiled using Microsoft Excel software. The results were analysed statistically using descriptive and inferential statistical tests. *P* value < 0.05 was considered as significant.

## Results

The study included a total of 440 students (240 boys 54.5% and 200 girls 45.5%). The distribution of maximum number of boys (22.5%) and girls (17.5%) was in the age of 14 years and 12 years [Table 1]. Majority of children (66.5%) were from nuclear families and 51.3% of study subjects had a family history of obesity. Family history of diabetes was reported from 48.6% of children. Most of the children (80%) were residing in the urban areas of Mysuru, while 12.7% were from semi-urban areas and only 7.3% were from rural areas. Majority of children (57.4%) represented the upper-middle class of the society, 22.2% belonged to the lower-middle, 16% belonged to the upper-middle and 4.4% children belonged to upper-class, respectively. There were no subjects from the lower class. The prevalence of obesity, overweight and underweight is shown in Table 2. Age wise and gender wise prevalence of obesity and overweight are presented in Table 1 and the Figures 1-3 respectively.

As shown in Table 2, prevalence of obesity and overweight among the study subjects was 3.86% and 12.27%, respectively. Prevalence of underweight was 16.3%. Mean BMI among the boys was 18.13% and BMI of girls was 18.80%. The difference in the distribution of BMI between male and female groups was statistically significant (*P* = 0.023).

The present study has shown an increase in the prevalence of obesity with the age of school children; with the highest prevalence of obesity in the age group of 13-15 years and least prevalence in the age group of 11-12 years [Figures 1-3]. Results revealed statistically significant association between the age and obesity status of study subjects (*P* = 0.22).

**Table 1:** Age wise Prevalence of Obesity and Overweight among School children

| Age in Years | Total Children | Obesity | Overweight |
|---|---|---|---|
| 11 | 28 | 01 (3.57%) | 01 (3.57%) |
| 12 | 102 | 01 (0.98%) | 06 (5.8%) |
| 13 | 84 | 06 (7.14%) | 15 (17.8%) |
| 14 | 176 | 06 (3.4%) | 25 (14.2%) |
| 15 | 50 | 03 (6%) | 07 (14%) |

**Table 2:** Prevalence of Obesity, Overweight and Underweight among School Children

| Grade | Boys *n*=240 | Girls *n*=200 | Total *n*=440 |
|---|---|---|---|
| Obesity | 09 (3.75%) | 08 (4%) | 17 (3.86%) |
| Overweight | 31 (12.9%) | 23 (11.5%) | 54 (12.27%) |
| Underweight | 42 (17.5%) | 30 (15%) | 72 (16.3%) |

Increased prevalence of obesity was observed among children from nuclear families and among those from urban areas, but this difference was not statistically significant (*P* > 0.05). Prevalence of overweight and obesity was more among children from higher socioeconomic class (*P* = 0.01). Overweight and obesity were observed more among children who reported a family history of diabetes mellitus and obesity. This difference was not statistically significant (*P* > 0.05).

## Discussion

Obesity among children has emerged as an important public health hazard and is reaching epidemic proportions in many Asian countries including India. It is associated with a high risk of morbidity and mortality from cardiovascular diseases and Type 2 diabetes mellitus. Hence, it is important to assess the prevalence of obesity and overweight among children to identify the magnitude of the problem and to implement appropriate action strategies to stop its progression into adulthood.

The present cross-sectional study was carried out among the school children between the age group of 11-15 years from two urban schools of Mysuru city, Karnataka. Findings of the study revealed 3.86% obese and 12.27% overweight children. Earlier studies conducted in Mysuru by Premanath *et al.*[11] and Kavita *et al.*[8] reported a prevalence of 4% obesity and 8% overweight among children of various age groups. Prevalence of overweight reported among the present-study subjects was much higher than the earlier reports, which strongly suggest the influence of progressive urbanization on the food habits and weight status of people, especially, among children in major cities.

Previous studies conducted in different cities of India reported an increased prevalence of obesity among school children. A school-based obesity prevalence study carried out in Bengaluru by Sunil Kumar *et al.* documented that prevalence of overweight and obesity among school children was 7.09% and 4.08%.[12] A study conducted by Ramesh among high school students of Trivandrum city, Kerala, reported that the prevalence of

overweight was 12% and obesity was 6.3% among the study subjects.[13] Shashidhar *et al*. reported 9.9% overweight and 4.8% obesity among school children in Mangalore, South Karnataka.[14]

Additionally, research studies conducted during the recent COVID pandemic reported an increasing prevalence of obesity among children due to the restrictions of the lockdown. A literature search conducted by Stavidrou *et al*. documented that changes in the dietary habits of children with consumption of more fried foods, snacking and sedentary behaviour due to the forced home stay have resulted in the increased prevalence of obesity among them.[15] Another study by Dunton *et al*. also reported that COVID restrictions have impacted physical activity and sedentary behaviour among children.[16] Peng *et al*. reported a significant increase in BMI (21.8-22.1 kg/m², $P < 0.001$) and increased prevalence of obesity from 10.5 to 12.6% among children of various age groups during the COVID lockdown.[17]

The study has also revealed that undernutrition was prevalent at a higher magnitude among the study subjects (16.3%). A study by Saraswathi *et al*. documented an increased prevalence of undernutrition among school children from urban and rural areas of Mysuru (31.8 and 45.3%).[18]

Mean BMI among boys was 18.13 and girls was 18.80. The difference in distribution of BMI between boys and girls was statistically significant ($P = 0.023$). Contrary to these findings, a study conducted by Sunil Pathak *et al*. reported that the difference in the distribution of BMI between boys and girls was statistically not significant ($P = 0.129$).[10]

Study findings revealed a significant socioeconomic gradient in the prevalence of overweight and obesity among children, which was consistent with the findings of the other studies. Prevalence of overweight and obesity was observed more among children from higher socioeconomic class. A study conducted by Supreet Kaur *et al*. among school children in Delhi reported an increased prevalence of overweight (15.3%) and obesity (6.8%) among the children from high-income groups.[19] Similar findings are reported in the studies by Kavita *et al*.[8] and Shashidhar *et al*.[14] Anoop *et al*. also documented that prevalence of obesity was more among children from higher socioeconomic classes of the metropolitan cities.[9] Lifestyle patterns among urban children leading to unhealthy dietary habits, easy affordability of junk foods and decreased physical activity can be attributed to the higher prevalence of obesity among them.

An increase in the prevalence of obesity was seen with the age of children; with highest prevalence of obesity in the age group of 13-15 years and least prevalence in the age group of 11-12 years. Cross-sectional study conducted by Kavita *et al*. in Mysuru also reported increasing prevalence of obesity with the age of children.[8] Similar findings are observed in the study by Ramesh.[13]

The current study revealed no significant differences between the dietary patterns of children and their risk of being overweight/obese. Similar findings are reported by Sujan Gautam *et al*. among the school children in Udupi, Karnataka.[20] Kavita *et al*. in Mysuru reported a higher prevalence of obesity among children who consumed vegetarian foods.[8]

Overweight and obesity were more prevalent among children belonging to nuclear families. Sunil Pathak *et al*. reported a statistically significant positive correlation between type of residence and BMI categories among school children in Vadodara.[10] A study conducted by Ramesh reported that children from nuclear families were more obese than those from joint families.[13] This difference could be attributed to the extra pampering of children and busy working schedule of the parents in nuclear families.

The present study observed an increased rate of obesity and overweight in the children who reported a family history of diabetes mellitus and obesity. However, this difference was not statistically significant ($P > 0.05$). Contrary to these findings, significant difference was observed in the study by Ramesh, which reported a statistically significant association between prevalence of obesity and family history of diabetes and obesity.[13]

## Summary

The present study is an overview of an emerging health issue of obesity among school children in a major city of Karnataka. Higher prevalence of overweight was observed among the children. Higher familial income, dietary patterns, parental history of obesity and diabetes and having urban residence were identified as the major factors which influenced the obesity status of school children in the current study. Urbanization has resulted in a change in the lifestyle and eating patterns of people, especially among children. Tight school schedule and academic competitiveness in the present school curriculum has hindered the participation of children in outdoor activities and sports in urban areas which also add to the magnitude of the problem. Additionally, the restrictions imposed by the COVID-19 pandemic have much impact on the physical activity and sedentary behaviour among children. Taking into consideration of the alarming increase in the prevalence of obesity among children, preventive measures should be initiated by all primary health care practitioners to curb this problem at the earliest. Early identification of the problem by screening the BMI and assessment of the sedentary behaviour and eating practices of school children should be implemented at the schools. Parents and teachers need to be educated about the obesity preventive strategies with appropriate lifestyle modification practices to enable the children to go through a healthy transition into adulthood.

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## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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## Conflicts of interest

There are no conflicts of interest.

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