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Survey of obesity and overweight among school children in Coimbatore district, Tamil Nadu

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Abstract
Aims: The study aims to determine the prevalence of obesity and overweight among school students in Coimbatore district, Tamil Nadu, India, and to find out the BMI of school students aged between 14 to 18 years.
Materials and Methods: A survey study was conducted among 2182 school children aged between 14 to 18 years in Coimbatore district, Tamil Nadu, India. The study included 1335 boys and 847 girls, and formal administrative approval was obtained prior to the study. Eleven schools were selected using stratified sampling technique, and all children studying in the 9th to 12th standards from the selected schools participated in the study. The children were personally interviewed, and standardized instruments and techniques were used for anthropometric measurements, including height and weight. BMI was calculated using WHO Standard Growth Reference for BMI for specific age and gender.
Results: A survey of 2182 school children aged 14-18 in Coimbatore district, Tamil Nadu, India showed that 13.65% were overweight or obese. The prevalence of obesity was highest in the 17-year age group and was slightly higher among girls than boys. The prevalence of overweight was slightly higher among boys than girls, while the prevalence of underweight was significantly higher among boys than girls. The study also showed that the prevalence of obesity and overweight was higher in rural areas compared to urban areas.
Conclusion: The study found high prevalence of underweight and overweight among school children in the surveyed area. Underweight was higher among boys, while overweight was slightly higher among boys than girls. Obesity was higher among girls, with the highest prevalence observed among 17-year-olds. Rural areas had a higher prevalence of obesity and overweight than urban areas. Overall, the study highlights the need for interventions to address the high prevalence of underweight, overweight, and obesity among school children.

Keywords: Obesity, overweight, underweight, body mass index

Introduction
Obesity and overweight are becoming increasingly prevalent non-communicable diseases (NCDs) worldwide, as they result from the accumulation of excess and unnecessary body fat, leading to negative impacts on health. In India, the situation is particularly concerning, with the World Obesity Atlas predicting that over 27 million children will be obese by 2030, representing one in 10 children globally. India also ranks 99th out of 183 countries in terms of preparedness to deal with obesity, and the economic impact of overweight and obesity is expected to increase dramatically, from $23 billion in 2019 to $479 billion by 2060 [1]. Childhood obesity is especially worrying as the behaviors that lead to obesity typically begin in childhood, and obese children are more likely to become obese adults. This excess body fat can increase the risk of non-communicable diseases, including 13 types of cancer, type-2 diabetes, heart problems, and lung conditions, which can lead to premature death. In fact, obesity accounted for 2.8 million deaths globally in the previous year alone. India is now one of the top five countries in terms of adult obesity, with an estimate of 135 million Indians being overweight or obese [2].
A contributing factor to India's growing obesity problem is rapid economic development and nutritional transition, leading to changes in eating habits and physical activity, particularly among children [3, 4, 5, 6]. Many children now live in an obesogenic environment where ultra-processed, calorie-rich, cheap, and readily available foods that are poor in nutrients have become the norm [2, 4, 5, 7].

Determining whether a child is overweight can be challenging as children grow at different rates and times. A healthcare professional should evaluate a child's BMI, growth, and potential health risks due to excess body weight. Factors that may contribute to excess weight gain among school children include genetics, types and amounts of food and drinks consumed, level of physical activity, degree of time spent on sedentary behaviors, sleep habits, medical conditions or medicines, and access to and ability to afford healthy foods and safe places to be active.

Overweight and obesity increase the risk of many health problems, such as type 2 diabetes, high blood pressure, heart disease, stroke, joint problems, liver disease, gallstones, some types of cancer, and sleep and breathing problems, among other conditions. Additionally, obese children and adolescents can suffer from psychological issues such as depression, anxiety, poor self-esteem, body image, peer relationships, and eating disorders. Obesity also increases the risk of early puberty in children, menstrual irregularities in adolescent girls, sleep disorders such as obstructive sleep apnea (OSA), and cardiovascular risk factors such as Prediabetes, Type 2 Diabetes, High Cholesterol levels, Hypertension, NAFLD, and Metabolic syndrome.

Although interventions for overweight/obesity prevention have mainly focused on individual behavioral changes such as increasing daily physical exercise or improving the quality of the diet by restricting excess calorie intake, these efforts have had limited results. Therefore, there is a need for a comprehensive and sustainable approach to combat the obesity epidemic in India, addressing multiple aspects such as education, policy changes, and community involvement. In conclusion, the scholar conducted a study to determine the prevalence of obesity and overweight among school students in Coimbatore district, Tamil Nadu, India. The study aimed to identify the extent of the problem and provide insights that could help in developing effective interventions to address the issue. Through the study, it was possible to gather valuable data that shed light on the scale of the problem in the area, which could inform future policy and practice. Overall, this study highlights the need for ongoing efforts to tackle obesity and overweight among school students in the region, and underscores the importance of continued research in this area to better understand the causes and potential solutions to this growing health concern.

Objectives:

1. Find out the prevalence of obesity and overweight among school students in Coimbatore district.
2. To find out the BMI of the school students between 14 to 18 years age.

Method

A cross-sectional study was conducted among school children in Coimbatore district, Tamil Nadu, India. The present study was a survey study of the project carried out in 2182 school children aged between 14 to 18 years, of which 1335 boys and 847 girls. Formal administrative approval from the Chief Educational Officer of Coimbatore was obtained prior to the study. The list of schools in the East, West, North and South zones of the city was collected. Using stratified sampling technique, eleven schools from the all zone were selected for the study. All children studying in the 9^{th}, 10^{th}, 11^{th} and 12^{th} standards from the selected schools participated in the study with the prior permission from school authorities.

All children were interviewed personally by the investigator. Standardized instruments and techniques were used for anthropometric measurements such as height and weight of the children. A standardized, 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 standardized, calibrated analog stadiometer. The height was recorded in centimeters while the students stood straight with horizontal gaze and barefooted. WHO Standard Growth Reference for BMI for specific age and 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.

Results

The study included a total of 2182 students (1335 boys 61.18% and 847 girls 38.81%). (2.61%) of students were founded as obesity, (11.04%) as overweight and (49.72%) underweight Table 2. Majority of children (65.26%) were from rural area remaining (34.74%) from urban area Table 3. (2.80%) were found as obesity from rural area and (11.72%) as overweight out of 1424 students. Out of 758 children (2.37%) were found as obesity and (9.63%) as overweight. So, the rural area is having more number of obesity and overweight than urban area in adolescent category. The prevalence of obesity, overweight and underweight is shown in Table 2. Gender wise and Area wise prevalence of obesity and overweight are presented in Table 1 and Table 3 respectively.

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

Age in Years	Total Children	Obesity	Overweight	Obesity + Overweight
13	102	00 (0%)	07 (6.86%)	07 (6.86%)
14	705	13 (1.84%)	55 (7.80%)	68 (9.64%)
15	601	14 (2.32%)	65 (10.81%)	79 (13.14%)
16	572	22 (3.84%)	76 (13.28%)	98 (17.13%)
17	190	08 (4.21%)	36 (18.94%)	44 (23.15%)
18	12	00 (0%)	02 (16.66%)	02 (16.66%)

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

Grade	Boys *n*=1335	Girls *n*=847	Total *n*=2182
Obesity	28 (2.09%)	29 (3.42%)	57 (2.61%)
Overweight	155 (11.61%)	86 (10.15%)	241 (11.04%)
Underweight	769 (57.60%)	316 (37.30%)	1085 (49.72%)

Table 3: Area wise Prevalence of Obesity and Overweight among School children

Type of Area	Total Children	Obesity	Overweight
Rural	1424	40 (2.80%)	167 (11.72%)
Urban	758	18 (2.37%)	73 (9.63%)

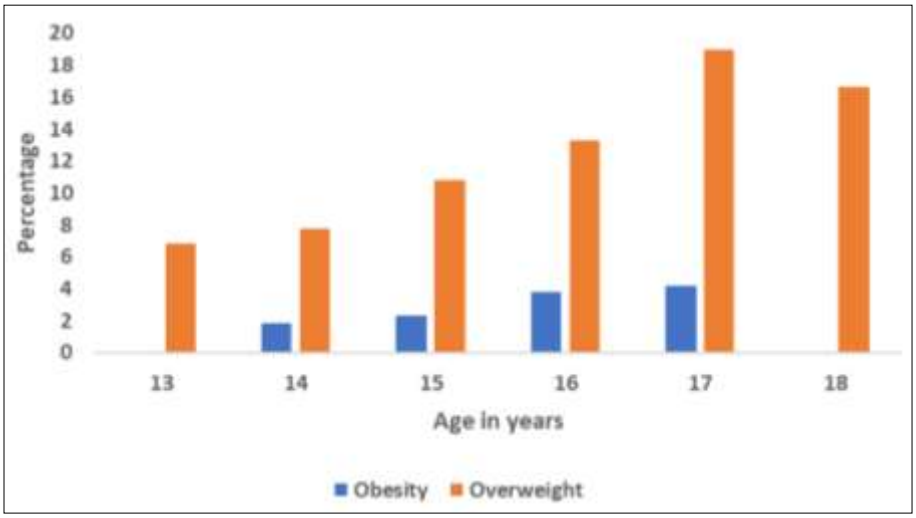

Fig 1: Age wise Prevalence of Obesity and Overweight among School Children

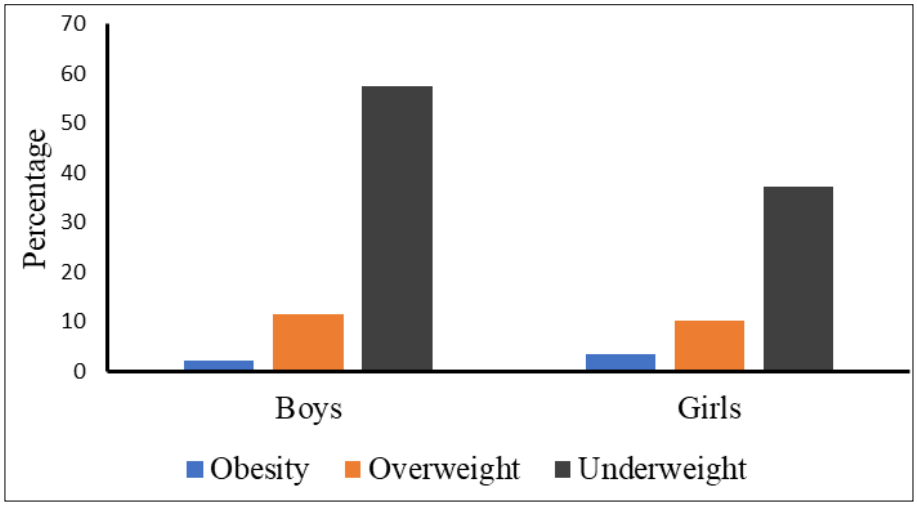

Fig 2: Prevalence of Obesity, Overweight and Underweight among School Children

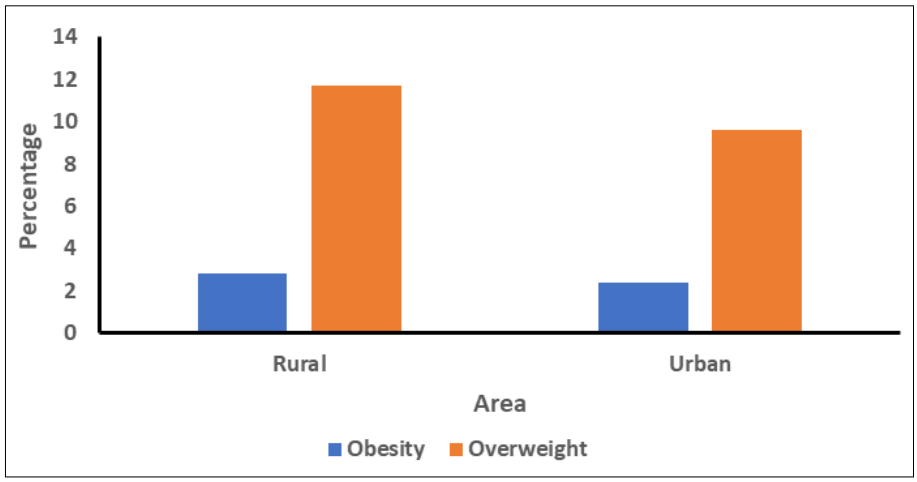

Fig 3: Area wise Prevalence of Obesity and Overweight among School Children

As shown in Table 2, 13.65% of the children considered for the study are obese and overweight. 38.81% of the children involved in the study were girls, while 61.18% were boys. Following their examination, it was shown that 13.57% of girls and 13.7% of boys were obese and overweight. By using z test for comparing two independent population proportion, at a 5% level of significance, from the sample data, there is not sufficient evidence to conclude that there is a statistically difference in the proportions of obese and overweight among the boys and girls.

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 17-year (4.21%) and least prevalence in the age group of 13&18 (0%) years [Figure 1]. The prevalence of obesity was found to be higher among girls (3.42%) than boys (2.09%). The overall prevalence of obesity among the school children was 2.61%.

The prevalence of overweight was found to be slightly higher

among boys (11.61%) than girls (10.15%). The overall prevalence of overweight among the school children was 11.04%. The prevalence of underweight was found to be significantly higher among boys (57.60%) than girls (37.30%). The overall prevalence of underweight among the school children was 49.72% [Figure 2].

The prevalence of obesity was found to be slightly higher among rural children (2.80%) than urban children (2.37%). The overall prevalence of obesity among the school children was 2.57%. The prevalence of overweight was found to be higher among rural children (11.72%) than urban children (9.63%). The overall prevalence of overweight among the school children was 10.53% [Figure 3].

Conclusion

In conclusion, the study found that a significant portion of school children in the surveyed area were either underweight or overweight. The prevalence of underweight was found to be higher among boys, while the prevalence of overweight was slightly higher among boys than girls. The prevalence of obesity was found to be higher among girls, with the highest prevalence observed among 17-year-olds. Furthermore, the study showed that rural areas had a higher prevalence of obesity and overweight than urban areas among adolescents. However, there was not enough evidence to conclude that there was a statistically significant difference in the proportions of obese and overweight among boys and girls. Overall, the study highlights the need for interventions to address the high prevalence of underweight, overweight, and obesity among school children in the surveyed area.

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