A cross-sectional study of the prevalence of overweight and obesity amongst primary school children in Puducherry

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Abstract

Background: Globally, there is a steep escalation in the prevalence rates of overweight and obesity. Obesity during childhood is known to be related to diabetes, cancer and cardiovascular disease in adulthood

Objective: To assess the prevalence of overweight and obesity in 6-12 year old children in Puducherry and thereby educate them with the importance of following a healthy lifestyle.

Method: The study included 720 6-12 year old children, from the urban and rural zones, including both government and private schools. The body mass index (BMI) of students was converted to Z-scores using the method proposed by WHO. The distribution of students as per age, gender and BMI were calculated by applying the Chi-square test. Significance level was set at $p<0.05$.

Results: Overweight and obesity prevalence in the study group was 13.9% and 7.3% respectively ($p<0.001$). A significant association of the age of students ($p<0.001$) with their BMI status was noted. Among the government schools, 41 (11%) and 24 (7%) students were overweight and obese respectively. In private schools, 54 (15%) and 33 (9%) students were overweight and obese respectively. Children from urban schools did not have a significantly higher prevalence of overweight and obesity in comparison with those from rural schools ($p=1.0$).

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Conclusions: The study demonstrated a rise in the prevalence of overweight and obesity in children. A proportional rise in the prevalence of overweight and obesity was noted with age i.e., the odds of overweight/obese students was higher in children aged 10-12 years. There was no statistically significant difference between the prevalence of overweight and obesity in urban and rural school children in our study.

Introduction

Globally, there is a steep escalation in the prevalence rates of overweight and obesity[1]. Overweight is defined as body mass index (BMI) equal to or more than the 85th centile and less than the 95th centile for children of the same age and sex or as one standard deviation (SD) BMI for age and sex[2]. Obesity is defined as BMI equal to, or more than the 95th centile for children of the same age and sex or as 2SD BMI for age and sex[2]. World Health Organization (WHO) estimated that in 2018, approximately 40 million children, less than 5 years of age were overweight or obese and almost 50% of them were from Asia[3]. The rise in the prevalence was not gender specific[3]. Obesity during childhood is known to be related to diabetes, cancer and cardiovascular disease in adulthood[1,4]. Limited outdoor physical activities, persistent screen time and unhealthy food consumption is on the rise[5]. These life-style practices could carry on into adulthood in the absence of an intervention. The pre-school years are crucial for health promotion as this empowers children to understand the importance of leading a healthy lifestyle thereafter[4].

Objectives

To assess prevalence of overweight and obesity in 6-12 year old children in Puducherry and thereby educate them with the importance of following a healthy lifestyle.

Method

A cross-sectional study was conducted in selected schools in Puducherry, a union territory of India, from January 2018 to July 2019. Approval of the school authorities was obtained by the principal investigator.

Sample size for the study was determined using the OpenEpi software version 3.01. The anticipated frequency of overweight and obesity prevalence in children was set at 7.3%[6]. Considering a population size of 10 lakhs, absolute precision as 2% (due to low prevalence, the confidence limit was kept as $1/4^{th}$ the prevalence), design effect 1 and confidence levels as 95%, the sample size was estimated to be 643[7]. Allowing an extra 10% for possible exclusion due to incomplete data, the final sample size was elevated to 720.

This was a school-based study which included students aged 6-12 years, studying in classes 1-6. Children who experienced acute sickness on the day of the study, wheelchair bound children, physically challenged children, children with congenital anomalies/syndromes, children with known chronic diseases and parents/children who refused to give their consent were excluded from study.

Through a computerized random generation software, schools from both urban and rural areas were selected to optimize the sampling from different social and economic strata of the society. With a sample size of 720, the number of students selected were equally split between urban and rural schools. One government and one private school was chosen from both urban and rural areas. From each class i.e. 1-6, 30 students were randomly selected. Thus, a total of 180 students were sampled per school.

Children were asked to wear light clothing to measure their height and weight and standard protocol was followed while measuring height and weight. Body weight was measured to the nearest 100g with electronic weighing scale using Omron's Digital Body Weight Scale series-HN-286 manufactured in Japan. Height was measured to the nearest half centimetre using a standard wall mounted stature meter - MCP 2m/200CM Roll Ruler Wall Mounted Growth Stature Meter manufactured by Medicare Products Inc from India. The BMI was calculated and converted to Z-scores using the method proposed by WHO[8]. Children with BMI >2Z score were classified as obese, between 1 to 2Z score as overweight, between - 2 to + 1Z score as normal, < -2Z score as thinness and < -3Z score as severe thinness as per WHO classification. The primary outcome of the study was to estimate the prevalence of overweight and obesity amongst the school going children, aged 6-12 years.

Ethical issues: Ethical approval was obtained from the Institutional Human Ethics Committee of the Mahatma Gandhi Medical College and Research Institute, Sri Balaji Vidyapeeth University, Puducherry, India (PG Dissertation/12/2017/95). Written informed consent was obtained from parents/legal guardians of the students before conducting the study.

Statistical analysis: Data were analysed using SPSS version 26.0 and R v386 3.6.0 software. The categorical data were represented as numbers (%). The distribution of students as per age, gender and BMI were calculated by applying the Chi-square test. Significance was set at *p<0.05*.

Results
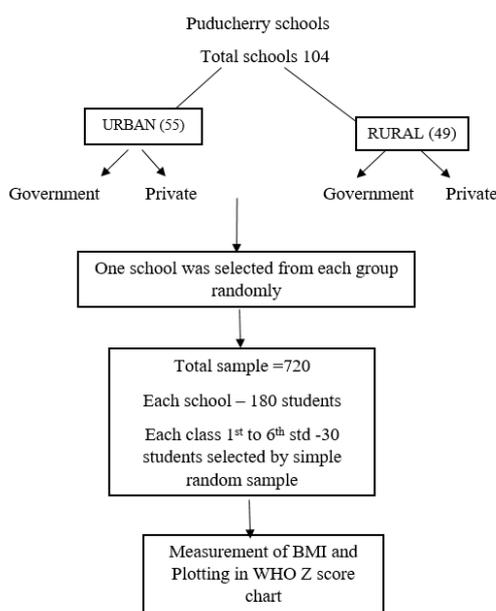The flow diagram of study methodology is depicted in Figure 1.

Figure 1: *Flow diagram summarizing the methodology*

The study included 360 students from the government schools and 360 from the private schools. Among the study population, 377 (52%) were boys and 343 (48%) were girls so that there was no gender bias. Median age of the children was 9 years, median height 133 cm, median weight 37 kg and median BMI 19.5 kg/m^2. Majority of the students (455, 63.2%) had normal BMI. Distribution of the students based on gender and BMI status was observed to be statistically significant ($p<0.001$) (Table 1).

Table 1: *Student distribution as per gender and BMI*

BMI Status	Number of students (%)			*p*-value
	Boys (n=377)	Girls (n=343)	Total (n=720)	
Thinness	57 (15.11)	56 (16.32)	113 (15.7)	<0.001*
Normal	243 (64.45)	212 (61.8)	455 (63.2)	
Overweight	48 (12.73)	47 (13.7)	95 (13.9)	
Obesity	29 (7.69)	28 (8.16)	57 (7.29)	

*p<0.05 is significant

In students aged 6-9 years, the prevalence of overweight and obesity was observed in 21 (5.83%) and 11 (3.06%) students respectively. Among the students aged 10-12 years, prevalence of overweight and obesity was observed in 74 (20.56%) and 46 (12.8%) students respectively. Association of the age of students with their BMI status was significant ($p<0.001$) (Table 2).

Table 2: *Distribution of students as per age group and BMI*

BMI Status	Age group - Number of students (%)		*p*-value
	6-9 years	10-12 years	
Thinness	59 (16.39)	54 (15)	<0.001*
Normal	269 (74.72)	186 (51.67)	
Overweight	21 (5.83)	74 (20.56)	
Obesity	11 (3.06)	46 (12.8)	

*p<0.05 is significant

The frequency of children with overweight and obesity was noted to be not significant for both urban (p=0.101) and rural schools (p=0.85) (Table 3). In government schools (n=360), 41 (11%) students were overweight and 24 (7%) were obese. In private schools (n=360), 54 (15%) students were overweight and 33 (9%) were obese.

Table 3: *Distribution of the BMI status according the schools*

Region	Schools	BMI Status – Number of students (%)				*p*-value
		Thinness	Normal	Overweight	Obesity	
Urban	Government	18 (10)	123 (68.33)	26 (14.44)	13 (7.22)	0.101
	Private	14 (7.78)	107 (59.44)	35 (19.44)	24 (13.33)	
Rural	Government	42 (23.33)	112 (62.22)	15 (8.33)	11 (6.11)	0.85
	Private	39 (21.67)	113 (62.78)	19 (10.56)	9 (5)	

*p<0.05 is significant

The study also evaluated the association of students by grouping them into normal/thin and overweight/obese categories, and the results were statistically significant (Table 4).

Table 4: *Representation of students based on their age and BMI status*

Age distribution based on BMI status					
Age (years)	No. of students		*p*-value	CI	Interpretation
	Normal/ Thin	Overweight/ Obesity			
6-9	328	32	<0.001*	3.3-8.08	The odds of overweight/obesity BMI status were 5.11 times more in students aged 10-12 years than in 6-9 years
10-12	240	120			

*p<0.05 is significant; CI: Confidence Interval

Discussion

India is a country with a fast-growing economy. It is currently undergoing major epidemiological, demographic and nutritional transitions, which tends to promote obesity in all age groups[9]. Although overweight and obesity are multifactorial, this study has focused on the prevalence of food preferences in children aged between 6-12 years in Puducherry.

Amongst the 720 children included in this study, overweight prevalence was 13.9% and obesity prevalence was 7.3%. This was statistically significant ($p<0.001$). Similar observations were reported from earlier studies[1,10,11]. In a few other studies conducted between 2016-2020 in India, overweight prevalence ranged from 10 to 18.6% and obesity prevalence ranged from 4.5 to 26.1%, as per guidelines of the Indian Association of Paediatrics, WHO, International Obesity Task Force and Centre for Disease Control[11-15]. In Asia, overall overweight and obesity prevalences were 11.2% and 5.8% respectively[16].

Amongst the study population, 52% were boys and 48% were girls, thus eliminating the gender bias. Overweight and obesity prevalence was 12.7% and 7.7% respectively among boys and 13.7% and 8.2% respectively amongst girls. This suggests that parents did not exhibit any bias in satisfying food preferences for their children. Similar observations were reported in earlier studies where the overweight and obesity prevalence based on gender ranged between 3.8-18%.[1,6,10]

Study population was separated into two groups: 6-9 years and 10-12 years, and overweight and obesity prevalence analysed. Overweight prevalence was 5.8% and obesity prevalence 30.6% in the 6-9 year age group and 20.6% and 12.8% respectively in the 10-12 year age group. Association of the age of students with their BMI status was significant ($p<0.001$). The steep rise in the values could be probably due to a transition from parent guided feeding habits to modern publicized food habits as children grew up. Increase in BMI with age has been reported globally[17]. Regarding the region of schools chosen, the association of frequency of overweight and obesity between urban and rural schools was not statistically significant ($p=1.0$) in contrast to observations reported earlier[5,11].

Medical consequences of overweight/obesity include diabetes, sleep apnoea, asthma and cardiovascular diseases amongst many others. These medical concerns affect the child or adolescent's social and emotional health. Physical fitness could influence the child's confidence among his/her peer groups. They could face negative stereotypes, discrimination and finally social marginalization. They may be excluded or may be embarrassed to participate in various physical activities which hampers their self-esteem and proportionally affects their academic performances. Some students miss out on school frequently to evade their peers/playtime/school at the cost of their education[20].

A comprehensive approach which involves community practices, simple educational programmes to impress the complications associated with unhealthy food preferences are the need of the hour. The desirable effects of healthy eating and physical education should be communicated. School canteens could avoid emphasis on fast foods[21]. On the domestic front, sugar sweetened beverages and screen time could be limited, and home cooking and family mealtime could be endorsed[22].

One of the strengths of the study was that a school-based population, involving both urban and rural schools - private and government school children was selected. To ensure accuracy of the data collected, individual interaction with the children of the lower class (classes 1-3) and group interactions with the children of the higher class (classes 4-6) was followed. There was no gender bias in this study.

One of the limitations of our study was that the sample size was calculated based on the primary objective of estimating the prevalence of childhood obesity. Sample size considered was small in comparison to the total population. Genetic causes and family predisposition of overweight and obesity were not probed.

Due to the diverse traditions, dietary patterns and social cultures in India; a large scale, multi-centric, observational study to determine the prevalence and risk factors of obesity among children of various regions is obligatory.

Conclusions

The study has demonstrated a rise in the prevalence of overweight and obesity in children. A proportional rise in the prevalence of overweight and obesity was noted with age i.e. the odds of overweight/obese students was higher in children aged 10-12 years. There was no statistically significant difference between the prevalence of overweight and obesity in urban and rural school children from our study.

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