

Original Research Article

Prevalence and determinants of overweight and obesity among higher secondary students in a district in Kerala

Babu George*, Juby R. A. Raju, Leena M. Leela, Deepa Bhaskaran, Lalikumari Indiradevi, Neethu Thulaseedharan, Preema Mahendran, Liss M. Scaria

Child Development Centre, Medical College, Thiruvananthapuram, Kerala, India

Received: 21 April 2021

Accepted: 13 May 2021

*Correspondence:

Dr. Babu George,

E-mail: cdctvpm@gmail.com

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ABSTRACT

Background: Overweight and obesity among adolescents and children are associated with early onset of non-communicable diseases and greater risk of complications in adulthood. The study was conceived in the background of the high burden on adult non-communicable diseases in the state, to assess the prevalence and determinants of overweight and obesity among higher secondary students in one of its fourteen districts, with a view to explore the areas to be focused in preventive activities.

Methods: Anthropometric, blood pressure, and physical examination of 1846 class plus one students were conducted in Thiruvananthapuram. Lifestyle assessment of the children was also conducted using a self-administered prevalidated questionnaire. Prevalence of overweight and obesity was calculated based on Indian academy of pediatrics body mass index cut-offs. Logistic regression analysis was done to discover factors associated with overweight conditions.

Results: Among the students, 14.19% were overweight; 6.45% were obese. Boys, rural residents, and those from low socioeconomic background had lower odds of being overweight. Students who had main meal (s) from outside on three or more days a week (adjusted odds ratio 1.99; CI: 1.17-3.386), and with history of hypercholesterolemia (adjusted odds ratios (aOR) 1.8; CI: 1.19-2.63), obesity (aOR 1.6; CI: 1.11-2.23), or diabetes (aOR 1.5; CI: 1.17-1.95) in the immediate-family had higher odds of being overweight. Hypertension and acanthosis were significantly higher among overweight students ($p=0.001$).

Conclusions: The results warrant the adoption of screening and timely intervention for non-communicable disease risk factors from school level itself to reduce future morbidity and the risk of complications.

Keywords: Overweight, Obesity, Adolescents

INTRODUCTION

The global epidemic of obesity and overweight has been exponentially rising in the recent decades, contributing to occurrence of major non-communicable diseases (NCDs) and premature mortality. Obesity and associated metabolic problems significantly increase the risk for hypertension, stroke and other cardiovascular diseases, impaired glucose tolerance, insulin resistance and type 2 diabetes mellitus (type 2 DM), and many types of cancers. Issues like osteoarthritis, psychological problems and low self-esteem

related to body image, asthma, sleep apnea, and gall bladder diseases are also encountered in later years.¹

Genetic factors, physical inactivity, and undesirable food habits are the foremost causes of overweight and obesity. Unhealthy lifestyles are being ingrained into our children and adolescents, leading to a drastic increase in childhood and adolescent obesity. Childhood and adolescent obesity world-wide have increased more than ten folds in the past 40 years, and more than 340 million children in the age-group of 5-19 years are overweight or obese.¹⁻³

Overweight, obesity and hypertension in childhood and adolescence have also shown tendencies to 'track' into adulthood leading to complications and early onset of serious NCDs. Children aged 10-13-years with obesity have been shown to have a staggering 80% chance of becoming obese adults, who will be prone to early onset of diseases like type 2 DM, and cardiovascular diseases leading to health, and socio-economic morbidity.^{4,5}

Overweight and obesity in children and adolescents have been increasing in developing countries like India also, whose health systems are already heavily burdened by the rising NCDs, warranting an expansion of focus of existing preventive measures.⁶⁻⁸ This study was aimed at estimating the prevalence of overweight and obesity among higher secondary students in Thiruvananthapuram district of Kerala, and finding the factors associated with these conditions among the 16-18 year old adolescents.

METHODS

This cross-sectional study was conducted among class eleven students, in higher secondary schools in the public, and aided sector. The required sample size was calculated based on the prevalence of overweight and obesity obtained from a pilot study conducted in a higher secondary school in the district, precision and design effect of two percent each.⁹ A total of 1846 students were selected using a multistage cluster sampling procedure. Five schools each were selected from each of the three educational sub-districts in Thiruvananthapuram district. Science, humanities, and commerce divisions of class eleven were randomly selected for the study, from each of the five schools. Students who belonged to the selected divisions were recruited for the study after obtaining informed consent from their parents, and assent of the children. Students with problems like mental retardation, learning disabilities etc. were excluded from the study.

The socio-demographic information and lifestyle practices of the children were collected through a prevalidated, self-administered questionnaire in the local language.

Along with anthropometric measurements, blood pressure, and acanthosis nigricans neck grading were also taken.

Children were weighed wearing light clothes without footwear. Body weight was measured to a nearest of 0.01 kg using a digital weighing scale, which was calibrated for use. Height was recorded in centimeters using a precalibrated portable stadiometer. Weight and height were converted to metric measurements in order to determine the body mass index (BMI), and was classified based on the Indian academy of pediatrics (IAP) standardized BMI chart for Indian children, and extended international obesity task force (IOTF) reference in assessment of overweight and obesity.^{10,11} Blood pressure of the students were taken by trained medical professional, using precalibrated mercury sphygmomanometer, following the latest American academy of pediatrics (AAP), and American heart association (AHA) guidelines.¹² Acanthosis nigricans neck grading was done using Burke et al qualitative grading.¹³ The perceived stress levels in the students were assessed using a 10-item perceived stress scale developed by Cohen et al.¹⁴

The prevalence of overweight and obesity were calculated using statistical package for the social sciences (SPSS) (version 25) software, through BMI calculation. Bivariate analysis and multivariate logistic regression were used.

Ethical considerations

The study was carried out with the approval of the institutional ethics committee. Participants were recruited only after obtaining informed consent from the guardian, as well as assent of the participants. Confidentiality and privacy of participants were maintained.

RESULTS

Of the 1846 students included in the study, 76.06% had normal BMI, 14.19% were overweight, 6.45% were obese, and 3.3% were thin. Also, 1.84% were found to be underweight, and 1.84% were stunted as per the IAP weight-for-age and height-for-age charts (Table 1). Overweight conditions were significantly high in girl students, urban resident students, and higher socio-economic classes (Table 2).

Table 1: BMI categories.

Characteristic	Boys (n=630)		Girls (n=1216)		Total (n=1846)	
	Number	Percentage	Number	Percentage	Number	Percentage
Overweight and obese	106	16.82	275	22.62	381	20.64
Overweight	71	11.27	191	15.71	262	14.19
Obesity	35	5.56	84	6.91	119	6.45
Underweight	12	1.9	22	1.81	34	1.84
Stunting	9	1.43	25	2.06	34	1.84
Thinness	15	2.38	46	3.78	61	3.3

The prevalence of overweight conditions were also high among students whose immediate family members had obesity, hypercholesterolemia, diabetes, hypertension, and

cardiovascular diseases, those who were less frequently engaged in vigorous physical activity, and those who ate main meal (s) from outside more frequently. Overweight

and obese students also had significantly higher levels of hypertension (55%) and acanthosis nigricans (66%) (Table 2). The adjusted odds ratios (aOR) obtained through logistic regression analysis revealed that boys as well as students belonging to rural areas, and a lower socio-economic background had lower odds of being overweight or obese, and history of hypercholesterolemia (aOR=1.8,

p=0.005), obesity (aOR=1.6, p=0.012), and diabetes (aOR=1.5, p=0.002) in the immediate family increased the odds of the adolescent being overweight or obese. Students who ate main meal (s) from outside on three or more days a week (aOR=1.99, p=0.011) had almost double the odds of having high BMI levels (Table 3).

Table 2: Overweight and obesity among different student categories.

Characteristics	Not overweight	Overweight and obese (%)	Total	P value
Gender				
Male	524	106 (16.83)	630	0.004
Female	941	275 (22.62)	1216	
Socio-economic status				
BPL	711	153 (17.7)	864	0.003
APL	747	228 (23.38)	975	
Location of house				
Rural	1130	273 (19.45)	1403	0.023
Urban	333	108 (24.49)	441	
Diabetes in the immediate family				
Yes	887	274 (23.6)	1161	<0.001
No	565	104 (15.55)	669	
Hypertension in immediate family				
Yes	940	272 (22.44)	1212	0.002
No	508	107 (17.4)	615	
Hypercholesterolemia in immediate family				
Yes	641	197 (23.51)	838	0.005
No	805	179 (18.19)	984	
Obesity in immediate family				
Yes	134	53 (28.34)	187	0.006
No	1319	326 (19.82)	1645	
Cardiovascular diseases in immediate family				
Yes	483	146 (23.21)	629	0.057
No	967	233 (19.41)	1200	
Eating main meals from outside				
<3 days a week	1414	357 (20.16)	1771	0.013
≥3 days a week	51	24 (32.0)	75	
Vigorous physical activity- 10 minute continuous				
<3 days a week	1158	319 (21.6)	1477	0.025
≥3 days a week	303	59 (16.3)	362	
Blood pressure				
Normal	1064	170	1234	<0.001
Hypertension (%)	400 (27.32)	210 (55.26)	610	
Acanthosis nigricans				
Nil	1225	128	1353	<0.001
Present (%)	226 (15.78)	252 (66.32)	478	

Table 3: Overweight and obesity- adjusted odds ratios.

Characteristic	Adjusted odds ratio (aOR)	aOR 95% confidence interval		P value
		Lower	Upper	
Overweight/obesity				
Male	0.691	0.534	0.895	0.005
Socio-economic status- below poverty line	0.755	0.595	0.957	0.02

Continued.

Characteristic	Adjusted odds ratio (aOR)	aOR 95% confidence interval		P value
		Lower	Upper	
History of diabetes in the immediate family	1.509	1.166	1.954	0.002
History of obesity in the immediate family	1.569	1.106	2.225	0.012
Main meals from outside on three or more days a week	1.991	1.17	3.386	0.011
Obesity				
Rural residence	0.639	0.423	0.965	0.033
Socio-economic status-below poverty line	0.663	0.444	0.991	0.045
History of hypercholesterolemia in the immediate family	1.77	1.192	2.627	0.005
History of obesity in the immediate family	1.717	1.015	2.903	0.044

DISCUSSION

The prevalence of overweight and obesity among the study participants was 20.66%. The present study also showed higher prevalence of obesity in girls, those with low physical activity, more frequent eating out, higher income families and with family history of NCDs.

The study has used self-reported diet, physical activity patterns, and other information collected from the students, along with physical assessments, which may have added some amount of recall bias. To limit the bias, each question in the pretested questionnaire was read out and explained uniformly for each class by trained research assistants, along with the use of precalibrated instruments and standard protocol.

Studies in and outside Kerala among adolescents have shown overweight and obesity prevalence varying between 9.7% to as high as 42.66%, and 4.3% to 11% respectively.^{6,7,15} The present results are comparable to most of these results, and not near the outliers. Higher levels of obesity in girls and higher economic strata have also been documented.^{6-8,15,16}

Among the participants in the present study, it was found that hypercholesterolemia in the immediate family members of the adolescent increased the odds of the child being obese, while such a family history of obesity and diabetes increased the odds of the child being overweight or obese. This hints at the genotypic predisposition of individuals towards problems with the lipid and carbohydrate metabolism, which increases the risk for these conditions and other cardiovascular complications, as well as acquired risks like common diet pattern, and other unhealthy practices.¹⁷⁻²⁰ In a state like Kerala with high burden of adult NCDs, the results hint at a significant crop of adult NCDs in the coming years, with early onset and higher risk for undesirable health and economic consequences.

CONCLUSION

The levels of overweight and obesity among the adolescents in the study suggest that the number of children and adolescents who require lifestyle interventions for overweight conditions and NCD prevention in the district and the state will be significant, and these children will be added to the NCD burden of the state in the near future. In order to prevent such, existing preventive measures for screening of NCDs in the state needs to be augmented with school level screening and intervention programs, aimed at identifying children and adolescents at risk, behavioral change communications among students, parents, and teachers, along with preventive and therapeutic medical interventions where needed. For this, anthropometric assessments can be made use of in school and community settings, with easily available equipment, and BMI charts, in cost-effective manner. Further epidemiological and biomedical research on these determinants is also advisable.

ACKNOWLEDGEMENTS

Authors would like to acknowledge co-operation of the Directorate of Higher Secondary Education, Kerala in conducting the study. They sincerely thank the head of the institutions and the teachers of the higher secondary schools for providing their support and coordinating the school level activities of the project.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: George B, Raju JRA, Leela LM, Bhaskaran D, Indiradevi L, Thulaseedharan N. Prevalence and determinants of overweight and obesity among higher secondary students in a district in Kerala. *Int J Community Med Public Health* 2021;8:3074-8.