Prevalence and Determinants of Overweight and Obesity among Urban School Going Adolescents in South Kerala - A Community Based Cross Sectional Study

Greeshma Lathika Rajasekharan Nair[1], Vimala Chellappan[2]

[1, 2] Department of Community Medicine, Government Medical College, Thiruvananthapuram, Kerala, India.

ABSTRACT

BACKGROUND

Obesity is being designated as a global epidemic by the world health organisation. The problem of obesity is confined not only to adults but also to children and adolescents. Various studies also indicate that the prevalence of overweight and obesity amongst children of all ages is increasing in developing countries in the past few decades. The present study was undertaken to find the prevalence of overweight and obesity among school going adolescents 13 to 17 years of age in urban wards under Government Medical College Health Unit, Thiruvananthapuram.

METHODS

A cross-sectional study with a sample size of 1100 selected through multistage random sampling was conducted. Physical measurements as well as data regarding sociodemographic variables, dietary behaviour, physical activity, perception of body weight, and awareness regarding overweight and obesity were obtained using a pretested semi structured questionnaire. Descriptive analysis was done, followed by bivariate and multivariate analysis to find out the major determinants of overweight and obesity.

RESULTS

The prevalence of overweight among adolescents aged 13 - 17 years attending schools under the medical college health unit area was found to be 11.3 % and that of obesity was 3.5 %. Girls had a slightly higher prevalence of overweight (12.3 %) as compared to boys (10.2 %) in the same age group of 13 - 17 years. Prevalence of overweight / obesity is found to be significantly associated with higher socioeconomic status, increased time spent on TV (more than 8 hours a week), increased intake of fatty foods like fish fry and chicken, family history of overweight, and mode of conveyance to school using motor vehicles.

CONCLUSIONS

The prevalence of overweight and obesity continues to increase even after improving our schools with more playtime periods and giving health education on healthy eating practices. Balancing interventions are of utmost necessity. There is an equal proportion of students who are underweight especially in the schools of government sector.

KEYWORDS

Adolescent, Overweight, Obesity

Corresponding Author:
Dr. Greeshma Lathika Rajasekharan Nair, TC 40 / 937, SARAS 35, Sreevaraham, Trivandrum - 695009, Kerala, India.
E-mail: greesh09@gmail.com

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BACKGROUND

'Double burden of disease' is a term increasingly being used in the health scenario nowadays especially in low and middle income countries. It constitutes the twin burden of undernutrition and overweight and obesity both contributing to ill health. On one hand there is the problem of infectious diseases and undernutrition, on the other there is a rapid upsurge in non-communicable disease risk factors such as obesity and overweight, particularly in urban settings. Nowadays it has become common to find undernutrition and obesity co-existing within the same country, the same community and the same household.[1]

The children in low and middle income countries have been constantly facing the threat of undernutrition right from prenatal, natal, postnatal and infant stages, which remains unresolved and at the same time they are exposed to low nutrient quality, high energy dense, high salt and high sugar diets from early childhood.

This makes them particularly prone to developing overweight and obesity. This nutritional transition along with sedentary lifestyle, with underlying processes of industrialization and economic growth have all contributed to the development of overweight and obesity in epidemic proportions. That is exactly the reason for obesity being called as the global epidemic and the same being a modifiable risk factor, poses a challenge to the prevention of non-communicable diseases across the globe. The problem of childhood overweight and obesity increases the burden of disease for individuals and challenges the capacity of health systems to tackle the problem of non-communicable diseases in the future.[2]

The state of Kerala has been going through an epidemiological and nutritional transition in the recent years, which has resulted in a surge in the incidence of non-communicable diseases and their complications. The lifestyle changes particularly in school going adolescents is of particular concern in this regard and there is a paucity of recent data available.

Objectives

Primary Objectives

1. To determine the prevalence of overweight among school going adolescents aged 13 to 17 years attending schools in urban wards under health unit area of Government Medical College, Thiruvananthapuram.

Secondary Objectives

1. To determine the prevalence of obesity and major determinants of overweight and obesity.
2. To assess the perceptions and awareness regarding overweight and obesity among school going adolescents in the above mentioned study setting.

METHODS

It is a community based cross sectional study done in government, govt aided and private high schools and higher secondary schools in areas coming under Govt Medical College health unit, Thiruvananthapuram from January to May 2019. The field area of the urban health unit consists of eleven wards under the Thiruvananthapuram Corporation with around 14227 school going adolescents in the age group of 13 - 17 years being included in the study. All those students who did not give consent were excluded from the study. Physically disabled students were also excluded from the study.

Sample Size

The sample size was calculated using the formula:

$$n = (Z\alpha)2pq/\ I^2$$

(P is taken as 12 %, q is 1 - P, I = 20 % of P at 95 % confidence limits, Z = 1.96 for alpha error at 5 %) Sample size for the study was estimated to be 733. Prevalence of overweight taken to be 12 %, from a previous study by Ramesh K among school going adolescents of Trivandrum corporation.[3] In order to account for the influence of design effect, the sample size estimated was multiplied by a factor of 1.5 giving the final sample size of 1100.

Sampling Technique

The list of schools and the strength of students were obtained from District Education Office (DEO, Trivandrum) and Directorate of Higher Secondary Education, Trivandrum. The sampling frame was created by selecting mixed schools having both high school and higher secondary classes. The schools were stratified according to the pattern that exists in Kerala; government, aided and unaided. The sample was selected proportionately from Government, Aided and Unaided sectors as per the strength of students in these sectors under schools of health unit area. The total strength of High schools and higher secondary schools coming under the state education department in the area was enumerated.

Total strength of the high school and higher secondary schools was 14227 students. Schools were divided into three strata and their respective strength was enumerated. Government schools had 2135 students, Private aided schools with 3547 students and Private unaided schools constituted of 8545 students. Out of total strength, proportion of students from three strata were calculated in percentage. i.e., Government schools = 15.01 %, Private aided schools = 24.93 %, Private unaided schools = 60.06 %. Now based on this, the number of students to be selected from each stratum into the study sample was calculated. Government schools: 15.01 % of the sample size (165 students), Private aided schools: 24.93 % of the sample size (275 students) Private unaided schools: 60.06 % of the sample size (660 students).

In the first stage the schools were selected randomly from each of these strata (govt / private aided and private unaided). In the second stage, from the selected schools one class from each standard was identified at random and all eligible children in the selected class were included in the study. If the required number of boys / girls of high school and higher secondary standards were not enough in a

selected school, next school was selected randomly and similar procedure was followed.

Methods of Data Collection and Analysis

The sociodemographic variables in the study were age, gender, religion, school of study, parents' educational status and occupation, colour of ration card and type of family. The other variables included family history of overweight / diabetes / hypertension, history of drug intake, hospitalization history, dietary behaviour using food frequency charts, physical activity and screen time, menstrual history of female adolescents and also adolescents' perceptions regarding their body image. Data was collected using a semi structured Malayalam questionnaire which was devised to collect data on determinants of overweight and obesity in urban and rural areas of Thiruvananthapuram district by Dr Thankachi Yamini Ramachandran et al. in 2004.[4]

Percentile of body mass index (BMI) was used in the study to identify overweight and obesity in study subjects. NCHS / CDC - 2000 growth charts for children and adolescents aged 2 - 20 years or BMI for age and sex percentile growth curves were used to classify the subjects as overweight, obesity, normal and underweight. Those with BMI for age between 5th and 85th percentile was taken as normal and for others the classification used was as below.

CDC Growth Charts 5th and 95th Percentile		
BMI for age	≥ 95th	Obesity
BMI for age	≥ 85th < 95th	Overweight
BMI for age	< 5th	Underweight

Table 1. BMI Classification

The prevalence in each age category was found out and gender wise prevalence also sought out. Prevalence was expressed in percentages. Proportions in other variables regarding physical activity, dietary habits and awareness were also found. Bivariate analysis was performed and odds ratio and 95 % confidence interval were calculated. P value less than 0.05 was taken to be statistically significant. Odds ratio was calculated to measure the association between outcome and exposure. Binary logistic regression was performed to find out the predictors of overweight and obesity.

Statistical Analysis

Privacy and confidentiality of data was maintained. Data was entered in Excel and analysed using IBM SPSS v 20. Quantitative variables were summarized as mean and standard deviation and qualitative variables as proportions. Appropriate statistical tests of significance were used for testing association. P value less than 0.05 was taken as statistically significant.

Ethical Considerations

Ethical clearance was obtained from the institutional ethics committee and Informed consent from students' parents and assent from students were obtained for the study along with consent from school authorities.

RESULTS

The mean age of the students was 14. 24 years, with minimum age being 13 years and maximum being 17 years. The mean age of boys was 14. 31 years and the mean age of girls was 14. 18 years. Among the sample surveyed 36.3 % were of the age 13 years, 30.3 % were of 14 years, 13. 7 % were of 15 years, 12.3 % were of the age 16 years and 7.5 % were of 17 years. 40.6 % of the females in the sample were of 13 years of age.

Among the 1100 students taken for the study, 539 (49 %) were males and 561 (51 %) were females. Socioeconomic status was assessed by asking the colour of ration card. 7 % of the students didn't respond to the question and 4.7 % responded that they didn't know the colour of their ration cards. The rest were taken for classification of which 72.7 % belonged to above poverty line families.

The prevalence of overweight adolescents in the study population was found to be 11.3 %. Prevalence of obesity was 3.5 % and the combined prevalence was 14.8 %. Among 539 boys in the study population, 55 (10.2 %) were found to be overweight and among 561 girls, 69 (12.3 %) were found to be overweight.

AGE (Year)	Boys (with Overweight) N	%	Girls (with Overweight) N	%	Total N	%
13	23	13.5	28	12.3	51	12.8
14	14	8.1	17	10.6	31	9.3
15	5	5.6	12	19.7	17	11.3
16	9	13.2	7	10.4	16	11.9
17	4	10.8	5	11.1	9	11
Total	**55**	**10.2**	**69**	**12.3**	**124**	**11.3**

Table 2. Age and Gender Wise Prevalence of Overweight

From the study it was seen that among boys, the trend of overweight was seen to increase from 14 years with a dip towards 15 years and then again rising up. Among girls it was seen that the trend was on increasing side from 15 years onwards.

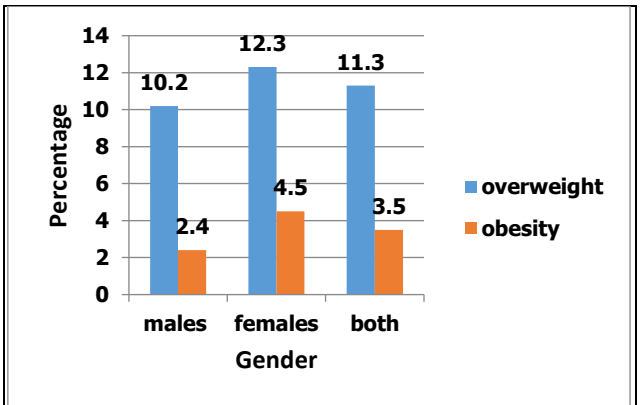

Figure 1. Gender Wise Prevalence of Overweight and Obesity (%)

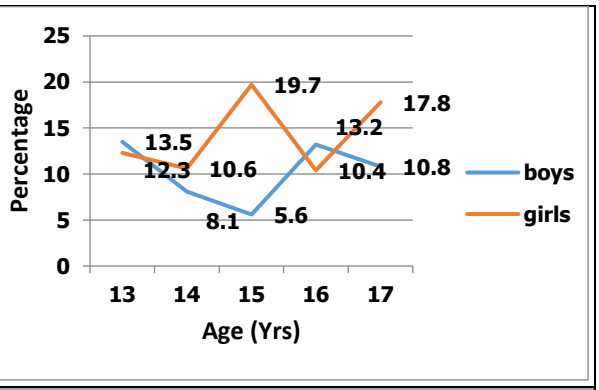

Figure 2. Trends of Overweight among Boys and Girls with Regard to Their Age

Among the study participants the prevalence of obesity seemed to be more or less similar at 13, 14 and 15 years. After that the trend went upwards through 17 years. 67.9 % of the study subjects responded that they were aware of their present bodyweight. Further 71.2 % of the study subjects perceived their bodyweight as normal, around 12 % perceived themselves to be overweight and only 0.6 % perceived themselves as obese.

Among those who reported overweight / obesity as a problem, identified lifestyle diseases (22.4 %) as the major consequence, followed by personality issues and low self - esteem (12.9 %) and difficulties in locomotion (3.4 %).

Students who made conscious efforts to prevent overweight and obesity were following dietary changes (12.8 %) and increased physical activity (17.6 %) to tackle the same.

On doing bivariate analysis, socioeconomic status was found to have statistically significant association with prevalence of overweight (P value. 001, OR - 2.29, CI -1. 351 - 3.896) along with category of school i.e. Schooling in Private unaided category (P value - .023, OR - 1.387, CI - 1.033 - 3.88) Family history of overweight was also found to be significantly associated with overweight / obesity (P value less than 0.001, OR 2.41, CI - 1.604 - 3.647).

Significant association was found between the food consumption pattern of fish fry and chicken and prevalence of overweight and obesity according to Mann Whitney Score. Fish fry more than three times a week with a mean rank score 653.58 (overweight and obesity) 532.70 (normal weight) Mann Whitney U score (5. 92) and P value Less than .001. Consumption of chicken more than 3 times a week with a mean rank score 611.39 (overweight and obesity) 540 (normal weight) Mann Whitney U score (6. 61) and P value less than 0.005. No significant association was obtained regarding other food items like milk products, cola / soft drinks, red meat, bakery items, pastries, biriyani, noodles, pickles / papads etc. Skipping of main meals was another variable found to have significant association with overweight and obesity (P value - .019, OR - 1.544, CI - 1.077 - 2.215)

Variables in physical activity were tested for any association with prevalence of overweight as well as with combined prevalence of overweight and obesity. The variables tested were distance to school (less than / equal to 5 km and greater than 5 km), mode of conveyance to school, doing routine work at home (more than 5 days a week), outdoor play, member of sports team, doing yoga / dance etc. for combined prevalence of overweight and obesity, statistical significance was obtained for using motor vehicles as the mode of conveyance (P value - 0.000, OR-4.836, CI - 2.577 - 9.075).

Variable	Category	BMI Status		P - Value	Odds ratio (95 % CI)
		Overweight and Obesity (N)	Normal Weight (N)		
Socioeconomic status	Yes	130 (16.25)	670 (83.75)	.001 sig	2.294 1.351 - 3.896
	No	17 (7.79)	201 (92.21)		
Family history of overweight	Yes	42 (28.57)	105 (71.43)	< .001 sig	2.418 1.604 - 3.647
	No	110 (14.19)	665 (85.81)		

Table 4. Association between High Socioeconomic Status and Family History of Overweight with Overweight / Obesity

Binary logistic regression was performed to find out the significant covariates. The dependent variable chosen was overweight and obesity versus the normal weight. Covariates for overweight / obesity used in regression were those which were found as statistically significant and biologically plausible, namely, socioeconomic status, category of school (Aided and Unaided Vs Government), family history of diabetes, family history of overweight, mode of conveyance to school, TV more than 8 hours a week and smoking. Higher socioeconomic status was found to be a predictor for overweight and obesity after multivariate analysis.

DISCUSSION

Prevalence of Overweight and Obesity

A previous study in Thiruvananthapuram city corporation itself by K Ramesh et al. showed an overall prevalence of 18.3 % for overweight and obesity, that of overweight being 12 % and obesity being 6.3 %. The results of our study appears to be consistent with this as the prevalence of overweight but prevalence of obesity seems to be decreased. The present study constituted adolescents from area under urban health training centre of the medical college which caters to around 1, 21, 000 populations whereas the previously quoted study covered the adolescent population of Trivandrum corporation. Another study done in Thiruvananthapuram district itself for comparison of prevalence of overweight and obesity between urban and rural parts showed the overall prevalence of both as 5.4 %.[4] This lower prevalence as quoted in this study may be due to the inclusion of rural school and college going adolescents in the study.

Comparing the results with those from other districts of Kerala shows distinctive results mainly because of the heterogeneity in the screening criteria used, the age structure of the study population and the varied distribution of adolescents from different socioeconomic strata in the study population. A study from Kochi, Kerala by Shiji K Jacob showed that the overall prevalence of overweight and obesity among 6 - 17 year old was found to be 3.9 % which seemed to be very low as compared to other studies.[5] Another study in Kochi among 6 - 15 year olds using CDC

growth charts showed a prevalence of 10.9 % for overweight.[6] The latter study results may be compared to the present study but it contained only a part of the age structure of adolescents from the study.

When the prevalence of obesity was concerned the results obtained from the present study was 3.5 %. Different studies conducted during last decade in India reported prevalence of obesity in range of 2.9 % – 14.3 %.[6] A study from New Delhi among urban adolescents gave a value on the higher side as 11.7 % mainly because of a large proportion of urban affluent population in the study sample.[7] The varied prevalence may be due to different standards like CDC growth charts, WHO growth charts, IOTF and IAP criteria applied in these diverse studies. The previous study by K Ramesh et al. in the similar setting, i.e. the Thiruvananthapuram Corporation showed obesity to be at 6.3 % and in the present study it was found to be decreased to 3.5 %.

Socioeconomic status, type of family and category of school as risk factors for obesity / overweight. In the present study higher socioeconomic status (P value - 0.001, OR - 2.294, CI 1.351 - 3.854) was found to be a risk factor associated with overweight / obesity whereas belonging to a nuclear family was not found to be significantly associated. Previous studies have shown that variations in the socioeconomic status such as income, education and employment have caused changes in the prevalence of overweight and obesity.[8]

In case of childhood and adolescent obesity, a higher income / socioeconomic status or greater access to energy dense foods (low socioeconomic status in industrialised countries and high status in developing countries) were associated with a greater prevalence of obesity.[9]

However, this study has found a directly proportional relationship between socioeconomic status, overweight and obesity. A study done among school going adolescents in Kochi by Alice T Cherian et al. showed higher prevalence of overweight (21.9 %) and obesity (7.5 %) among high income groups.[6] The study done by K Ramesh et al. in the similar setting, i.e. Thiruvananthapuram corporation.[3] and a study in rural and urban Thiruvananthapuram among school going adolescents[4] also showed similar results consistent with the present study, that higher socioeconomic status was significantly associated with prevalence of overweight and obesity.

In a study done in Hyderabad by Laxmaiah et al. the prevalence of overweight among the adolescents studying in private schools (9.6 %; 95 % CI: 7.1, 12.1) was significantly higher ($P < 0.05$) than among those studying in government schools (3.2 %). (98) In the previous studies done in Trivandrum Corporation setting, a significant association of overweight and obesity with school of study being private was recorded. In the present study no such association could be found out.

Dietary Habits of Adolescents

The present study shows that there is significant relation between certain dietary habits of the adolescents like skipping of meals and replacing meals with snacks which increases the prevalence of overweight and obesity. Snacking is said to be commonly associated with undesirable health outcomes and dietary patterns.[10] Children and adolescents are more particular about selecting snacks based on taste over nutrition, they choose salty tastier foods as snacks over healthier snacks. And as a consequence, snacking is commonly regarded as a contributing factor in the development of childhood overweight and obesity, although studies that have examined the association between snacking and body mass index have yielded mixed results.[11] In a study regarding nutritional transition and obesity among adolescents of different countries of South Asia by Jayavardhane et al. it was found that skipping meals especially breakfast, eating out frequently were found related to the prevalence of overweight / obesity.[12] In a study among adolescents in Kottayam district by Sivakumar et al. it was found that among the students with mid time snacking, 17 % were belonging to obese and overweight group where as it was 13.6 % among children with no mid time snacking. The total percentage of children who were obese and overweight among those who skipped breakfast once in a week or more was 22.4 % while in the group who had rarely or never skipped it was 13.1 %. The study presented with a significant association between the two.[13] These findings are consistent with that of the present study.

CONCLUSIONS

The prevalence of overweight obtained from the study is 11.3 % and that of obesity is 3.5 %. Higher socioeconomic status, studying in private aided or unaided schools, family history of overweight, replacing meals with snacks, skipping meals, using motor vehicles as mode of conveyance to school, screen time more than 8 hours a week were found to be significantly associated with overweight and obesity. More than two third of the study participants were aware of their present bodyweight and 12.1 % perceived themselves as overweight. A written school health policy was in line with WHO nutritional friendly school initiative. Fiscal interventions like fat tax by the Govt. may also be implemented to bring down consumption of snacks by adolescents after skipping their main meals.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
Financial or other competing interests: None.
Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

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