Prevalence of overweight and obesity among high school students of Thiruvananthapuram City Corporation, Kerala , India

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RESEARCH

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Abstract

Background

Obesity is a complex condition with serious social and psychological dimensions, that affects virtually all age and socioeconomic groups and threatens to overwhelm both developed and developing countries. This problem is increasing in adolescents and various factors contribute to it. As there is paucity of data regarding this problem in Kerala, India, the present study was undertaken to find the magnitude and to explore the factors associated with it.

Method

A cross sectional study was conducted among 8, 9 and 10 standard students of high schools of Thiruvananthapuram City Corporation,Kerala,India. The sample size estimated using formula is 859 and it was doubled to overcome the design effect so the sample size of this study was 1718 and the technique adopted is Multistage and stratified random sampling. Ethical clearance was obtained and permission from respective authorities of schools was also taken. Data was collected using pre designed and pretested semi structured questionnaire which is self administered. Body mass index was calculated based on physical measurements such as height and weight using standard methods.

Results

The prevalence of overweight and obesity is found to be 18.3%. The prevalence of overweight alone is 12% and obesity is 6.3%. Binary logistic regression analysis revealed that family h/o overweight/obesity, maternal occupation of business/services, watching TV/computer use more than 16 hrs/week, fast food consumption, not involved in sports and inadequate aerobic exercise are significantly associated with overweight/obesity.

Conclusion

There is increased prevalence of overweight/obesity among adolescents and many factors associated with it are modifiable.

Key Words

Overweight, Obesity, Body Mass Index

Background

Globally, non-communicable diseases are increasingly recognized as a major cause of morbidity and mortality. The increasing burden of non-communicable diseases, particularly in developing countries including India, threatens to overwhelm already stretched health services. When closely examined, non-communicable diseases are linked to a cluster of major risk factors such as tobacco use, alcohol, stress, obesity, high blood pressure, and glucose levels that are measurable and largely modifiable. Among them, Obesity is the most important one. Obesity can be seen as the first wave of a defined cluster of non communicable diseases called "New World Syndrome" creating an enormous socioeconomic and public health burden in poorer countries[1].

Obesity is a global nutritional concern. The increasing prevalence of overweight, obesity and its consequences prompted the World Health Organization to designate obesity as a global epidemic. World Health Organization's latest projections indicate that globally in 2005, approximately 1.6 billion adults were overweight and at least 400 million adults were obese. World Health Organization further projects that by 2015, approximately 2.3 billion adults will be overweight and more than 700 million will be obese[2].

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 [3, 4]. Figures on the global

prevalence of childhood obesity have been compiled by the World Health Organization where several developing countries such as Nicaragua, Brazil, Antigua, Zambia, Venezuela and Peru, show a prevalence rate of over 2%. Countries such as Barbados, Honduras, Lesotho, Bolivia, Trinidad, Iran and Mauritius have> 4% prevalence, while Jamaica and Chile top the list with 10% greater prevalence rate in school children[5]. There is only limited data on the prevalence of obesity among adolescents in India.

The rising prevalence of childhood/adolescent obesity cannot be addressed by a single etiology. Multiple factors plays role i.e. lack of physical activity, unhealthy eating patterns, or a combination of both with genetics and lifestyle playing important roles in determining a child's weight. Television, computer and video games contribute to children's inactive lifestyles [6]. Food preferences developed in childhood remain fairly constant into adulthood. Children are eating more meals away from home and those meals are often high in fat and low in fiber-rich carbohydrates such as fruits, vegetables and whole grains. It is easy for children to consume high fat, calorie-dense foods because many kids are provided with pocket money and have the freedom of choice in meals, especially breakfast and lunch. Though India is a country still combating the communicable diseases, Kerala on the other hand has an admirable health status comparable to the West and is now going through an epidemiological transition where non-communicable diseases are more prevalent. The 'nutritional transition' and the lifestyle changes are also becoming relevant among the adolescents. The popularity of 'fast foods', food from outside, sedentary lifestyles, increased 'pocket money', lack of sports, increased TV and computer watching and working parents have all led to a chance in the way of life, the effects of which have to be studied. There is paucity of data on prevalence of overweight and obesity in Kerala, especially so about the magnitude of the problem among the adolescents.

It is in this background that a study to find out the prevalence of overweight and obesity and the factors associated with it among High school students in Thiruvananthapuram Corporation was planned.

Method

The study was approved by the Human Ethical Committee, Medical College, Thiruvananthapuram, Kerala. Before collecting the data, permission was taken by the respective dean of high schools and verbal consent from the students.]
This cross-sectional study was conducted among High schools of Thiruvananthapuram city Corporation (capital city), Kerala which has high enrolment ratio and literacy rate [7] during August 2008 to January 2009. The study population consisted of 8th, 9th and 10th standard students.
Sample size is based on level of precision; precision consists of significance level of 5% and allowable error of 20%. A pilot study was conducted to find the sample size for the study and the prevalence was found to be 10.42%. So based on this, the sample size estimated was 859. Since the sampling technique adopted in this study was Multistage

and stratified sampling, the estimated sample size 859 is doubled to make the sample more representative and compensate for the design effect. So the sample size required for the study was found to be 1718.

Selection of study subjects: Schools were stratified into Government, Private aided and Private unaided.
Stage – 1: one school each was selected randomly from each stratum (government/private aided/private unaided)
Stage – 2: once the schools were selected, the required numbers of study subjects were selected randomly from each standard (8th, 9th and 10th).
If the required number of study subjects was not enough in a selected school, next school was selected randomly and similar procedure was followed. Totally nine schools were visited.

Data was collected using a pre-tested self-administered questionnaire distributed in the classroom after telling them what the study is about and taking the verbal consent of the students. Each question was explained while the students filled them up with clarification of doubts. Questions were asked about identity, socioeconomic status, family history, diet and physical activity. Simultaneously, height and weight were measured.
Food frequency table was used to assess the diet and the food items included were Sweets, Egg, Meat, Fish, Milk/Curd, Ice creams and Snacks. Other questions related to diet such as the food habits – whether vegetarian or Non vegetarian, habit of taking food in between Break fast – lunch – supper and eating food from fast food centre.
Physical activity was measured by asking about residential distance from school/ tuition centre, mode of conveyance, participation in sports, aerobic exercise, and TV watching / Computer use.

Height was taken using a standard three piece anthropometric rod at their classrooms corrected up to 1mm. students were asked to stand upright against a wall with the heels touching the wall ad the chin held horizontally so that the tragus of the ear and the eye are in a straight line, then the rod was adjusted and the height in cm was read. Weight of all students was taken using bathroom scales calibrated at the legal Metrology department and corrected with a lever balance up to 0.5 kg and calibrated daily for zero error. The students were asked to stand upright, bare footed on the weighing machine looking straight while the measurement was read.
A measurement called percentile of Body Mass Index (BMI) is used to identify overweight and obesity in study subjects. Body mass index is calculated based on physical measurements such as height and weight.

$$BMI = weight\ (kg)/height\ (m)^2$$

National Centre For Health Statistics/CDC -2000 growth charts for children and adolescents aged 2-20 years i.e. BMI for age and sex percentile growth curves are used to classify the subjects as overweight and obesity[8].
The classification adopted in this study is,
Weight Status Category   Percentile Range
Underweight - Less than the 5th percentile
Normal weigh - 5th percentile to less than the 85th percentile

Overweight   - 85th to less than the 95th percentile
Obese   - Equal to or greater than the 95th percentile
Pamphlets on adolescent health, BMI and graphs by which the children can know their BMI were distributed and steps to undertake for a healthy and fit body were also explained to them.

Data was compiled using Microsoft Excel software and analyzed using SPSS. Proportion, Chi-square test, Odds ratio and Logistic regression are the statistical tests used in this study.

Results

A total of 1718 students formed the study subjects, which included students from Government (36.2%), Private aided (43.9%) and Private unaided (19.9%) schools. Students of 8th standard, 9th standard and 10th standard constituted 32.5%, 34.2% and 33.3% of study subjects' respectively. Study subjects included were both boys (49.2%) and girls (50.8%). The age of the study subjects ranged from 12 to 16 years. Mean age of the subjects was 13.96 years (14.08 for boys and 13.84 for girls).

Prevalence of overweight/obesity

The combined prevalence of overweight and obesity is 18.3% (mean BMI= 19.69, SD = 4.13). The prevalence of overweight alone is 12% and whereas obesity is 6.3%. The prevalence of overweight/obesity increases with the age and is found to be high in the age group 15 yrs. The prevalence is high among girls (20%) compared to boys (16.4%) but it is not statistically significant (chi test, p = 0.05).Based on category of school, the prevalence is high among private unaided school students (22.2%) compared to private aided (17.5%) and government school (17%) students. (Table-1 provides the results).

Socioeconomic status

 Prevalence of overweight/obesity is high among the subjects who belongs to family size (family members) up to four (20.7%) compared to subjects who belong to family size more than four (13.4%) and is more in students whose both the parents are working (35.4%) compared to the students whose one of their parents (13.4%) is working and none of their parents are working (7%).

When monthly income was asked, 50.7% of study subjects did not know their family income and among those who knew the income, as income increased prevalence of overweight/obesity too increased. Prevalence also increased with better occupation of father i.e. the prevalence is found to be high in those students whose fathers are in business and service sectors (28.4% and 15.3%) compared to others and similar finding is observed with business/services occupation of mother (38.9%).

Both father's and mother's educational qualification also showed a difference in the prevalence. The prevalence is high among those study subjects whose fathers are post graduates and above (21%) followed by pre degree (20.4%), graduates (18.3%) and up to tenth standard (S.S.L.C)(16.8%) and is high among those study subjects whose mothers are post graduates and above (22.9%) followed by pre degree (19.6%), graduates (16%) and up to S.S.L.C (17.5%). (Table-2 provides the results).

Family history

The prevalence of overweight / obesity is high among study subjects with family history of overweight/ obesity (36.7%) compared to those without family history of overweigh/ obesity (8.9%) which is statistically significant (chi square test, p – 0.00, odds ratio – 5.95, 95% CI of odds ratio; 4.57 – 7.76). Family history was explored and it was found that the prevalence is high among subjects with single parent history of overweight /obesity (52.3 %) followed by both parents (36.4%), siblings (18.8%), maternal relative (18.3%), paternal relative (15.3%) and both maternal and paternal relative(13%).

Family history of Diabetes revealed that, 43.2% subjects do not have family history and remaining 56.8% subjects gave family history of diabetes. The prevalence of overweight / obesity is high among subjects with family history of diabetes (23.3%) compared to those without family history of diabetes (11.7%) which is statistically significant (chi test, p value-0.00; odds ratio – 2.28: 95% CI of odds ratio; 1.73 - .01).The prevalence is high among subjects with single parent history of diabetes followed by siblings, both the parents, both maternal and paternal relative, maternal relative, paternal relative.

The prevalence is also high among study subjects with family history of Ischemic Heart Disease (32.1%) compared to those without the family history (13.7%) which is statistically significant (chi test, p value – 0.00: odds ratio – 2.97; 95 % CI of odds ratio : 2.29 – 3.84). (Table-3 provides the results).

Physical activity

Study subjects were grouped into those whose schools are within 6 kms of distance from their residence and more than 6 kms. Within 6 kms of distance, the prevalence of overweight/obesity is found to be high among those who use vehicles as a mode of conveyance to school (19.3%) compared to those whose mode of conveyance is bicycle/walking (16.3%). Similar difference is observed among the subjects whose schools are more than 6 kms of distance from their residence i.e. the prevalence is high among vehicle users (18.3%) compared to walking/bicycle users (14.2%).

Majority of study subjects are going for tuition (84.5%) and the prevalence is slightly high among them (18.4%) with a difference of only 0.7% compared to subjects who are not going for tuition (17.7%). Among tuition going students, 21.1% use vehicles as their mode of conveyance. The prevalence is high among vehicle users (20.5%) compared to bicycle/walking users (17.7%).

The difference in prevalence is found among students involved in sports (12.0%) compared to others (20.1%) and also The prevalence of overweight/ obesity is high among study subjects whose aerobic exercise activities are not adequate (25.3%) compared to those whose aerobic exercise activities are adequate (14.6%).

The prevalence is high among study subjects who watch TV/ use computer for more than 16 hrs/week (42.9%)

compared to those who watch TV/ use computer for less than or equal to 16 hrs/week (13%). (Table-4 provides the results).

Diet
The frequency of food intake of sweets, egg, meat, milk/curd, ice creams, snacks, vegetables and fruits was analyzed. There is significant association between consumption of sweets, egg, meat, and snacks and prevalence of overweight / obesity.

The prevalence is 18.4% among non vegetarians and is 14.7% among vegetarians. Majority (84.6%) of the study subjects have the habit of taking food/snacks in between breakfast – lunch – supper and only 15.4% did not have this habit. The prevalence of overweight/obesity is slightly high among those who have this habit (18.4%) compared to those without this habit (17.7%).

The prevalence of overweight/ obesity is high among study subjects who eat food from fast food centre (21.8%) compared to those who do not eat from fast food centre (10.7%). Among the study subjects who give h/o taking food from fast food centre, the prevalence of is found to be high among those who take fast food for more than 2 times/week (40.8%) compared to those who take 1-2 times/week. (Table-5 provides the results).

Binary logistic regression analysis
The independent variables (table.6) which are significantly associated with overweight/obesity on univariate analysis were considered for binary logistic regression taking overweight/obesity as a dependent variable.

Binary logistic regression using enter method was applied to determine the significant associates of overweight/obesity and the final model (table. no.7) showed that family history of overweight/obesity, TV watching/computer use (>16Hrs/week), mother occupation of services/business, not involved in sports, fast food consumption and inadequate aerobic exercise are significantly associated with overweight/obesity.

Discussion
The present study revealed that the combined prevalence of overweight and obesity is 18.3%. Comparing the results of this study with other studies in India revealed that the prevalence of overweight is consistent with other studies whereas the prevalence of obesity is high.
The prevalence study of obesity among adolescents in public schools of Ludhiana, catering to the affluent segment of population, showed that 12.7% adolescents were overweight and 3.4% were Obese [9]. Another study carried out in Amritsar district of Punjab found that the prevalence of overweight is 10.94% and obesity 5.62 % [10].

The comparative picture of the prevalence of overweight and obesity in various populations no doubt suffer from the limitations of periodic dissimilarity of field work methodology, but there is higher prevalence of overweight

and obesity in Thiruvananthapuram adolescents as revealed by this study and is almost similar to the prevalence observed in Hong Kong and Singapore but less than US population [11]. The high prevalence of overweight/obesity in adolescent is important because obese adolescents become obese adults thus increasing the risk of various diseases. This has been proved in many other studies in the past and is being researched even today to find the exact etiology.

In this study, it is also observed that the prevalence increases as the age increases. The prevalence peaked at 13, 14 and 15yrs. A school based study in Chennai done in adolescents showed that the prevalence peaked at 10,13 and 15 years [12] but whereas a study in Delhi showed that the maximum prevalence of obesity was at 10 -12 years [13]. It has been found that prevalence in higher ages of adolescents is reflective of overweight/obesity in adulthood [14].

Study subjects included were boys and girls, boys showed a higher prevalence of obesity than girls while girls showed higher prevalence of overweight than boys which is similar to the findings of Delhi study. Similarly study conducted in Punjab also revealed that overweight was high among girls compared to boys whereas obesity was high among boys. Socioeconomic status may indirectly affect the development of overweight / obesity through the alteration of dietary habits /behaviors and physical activity patterns. In this study socioeconomic status of an individual is considered using proxy measures like occupation and education of father and mother, family size, and family income. This study revealed that students who belong to family size up to four showed a risk of having overweight/obesity 1.68 times that of students of family size more than four. This was seen in the Delhi study where obesity was more in nuclear families [13].It is probably due to more attention and pampering by the parents. The present study showed that the prevalence of overweight/ obesity is more among students who's both the parents are working compared to the students whose one of their parents is working and none of their parents are working. There is a significant difference in prevalence of overweight/obesity among the students' whose paternal and maternal occupation belongs to business/service sectors compared to others. A study conducted among school going adolescents in Wardha city, central India also revealed that father and/or mother involved in service/business sectors as the important correlate of overweight/obesity [15]. Numerous studies have shown this earlier [16, 17, 18, 19,].

The difference in prevalence is seen with paternal/ maternal education as in a study at Wardha city, central India, there was positive significant association between paternal/maternal better education and overweight/obesity among children. The possible explanation could be, better education means better job and therefore better socio economic status and it may also reflect the rearing up practices at home. A person with better education may want to bring up his/her children with better food. Children may have more pocket money and may eat more from outside especially bakery items and junk foods. The results

of the present study are consistent with the results of other studies carried out in India.

The present study used category of the schools as one of the socio economic status indicator based on assumption that students of high economic status joins private schools. The differences in types of school, Government, private aided and unaided was also examined and prevalence of overweight/obesity was found to be more in private unaided compared to aided and Government. Similarly a study carried out in Ernakulum, Kerala showed that the proportion of overweight children was significantly higher in private schools, and the rising trend was limited to private schools[20].

In India, it is noted that the prevalence of overweight/obesity is more common among higher socio economic status but there is a powerful inverse relation between obesity and socioeconomic status in the developed world. In a systematic review by Shrewsbury V, Wardle, Socio economic status was inversely associated with adiposity[21]. Overall, there is little evidence of a pattern between overweight/obesity and socioeconomic status in children and adolescents. As the majority of youth are not in the workforce, the indicators of socioeconomic status used in the studies on youth population are based on those of their parents.

The genetic component of overweight/obesity etiology was brought out in this study too. The prevalence of overweight/obesity is found to be significantly high among the students with family h/o overweight/obesity. This has been seen earlier in many studies where parental obesity increased the prevalence[22, 23]. Here it is to be noted that parents obesity leading to increased prevalence in children is not only due to the genetic factor but also because of the life style practices and diet pattern followed in that household which are very important etiological factors in the prevalence of overweight/obesity. This study has tried to explore the genetic component of obesity related to family h/o diabetes and Ischemic heart disease. This is tried based on a study carried out in Kolkata[24] in which BMI of medical students was significantly associated with family h/o diabetes and it was high among students with family h/o CHD but not significantly associated. In the present study, the study subjects with family h/o diabetes showed a risk of having overweight/obesity 2.28 times that of subjects with out family h/o diabetes and the study subjects with family h/o IHD showed a risk of having overweight/obesity 2.97 times that of subjects with out family h/o IHD. This was not seen in literature review of other studies.

The importance of physical activity in the prevalence of obesity is evident from the present study. Lack of sports activity, more time spent on TV/computer, and inadequate aerobic exercise are significantly associated with overweight/obesity. It is also observed that the prevalence of overweight/obesity is high among students who use vehicles as mode of conveyance to school compared to those who walk/bicycle to school. The difference in prevalence between these two groups increased as the distance of school increased. The present study also revealed the sedentary lifestyle like more time spent on TV and it is found that the study subjects who watch TV/ use computer for more than 16 hrs/week showed a risk of having overweight/obesity 5.02 times that of subjects who watch TV/ use computer for less than 16 hrs/week. Some research from the United States and Canada indicates that on average, adolescent watches over 20 hours of television per week[25, 26]. Several studies have found a positive association between the times spent viewing television and increased prevalence of overweight in children[27, .28, and 29]. The explanation for this is, Television viewing displace the time that children spend in physical activities, contribute to increased energy consumption through excessive snacking and eating meals in front of the TV, influence children to make unhealthy food choices through exposure to food advertisements and it lower children's metabolic rate.

A number of studies suggest that sedentary behavior in children today is common and may be related to the development of overweight / obesity[30, 31]. A number of prospective studies on young children have confirmed that the decreased physical activity is associated with adipose weight gain over time[32].

It has been found in this study that sweets, egg, meat, and snacks are highly significant in increasing the prevalence of overweight/obesity. Similarly other studies also showed that dietary variety of sweets, snacks, condiments, entrees and carbohydrates is positively associated with body fatness whereas variety from vegetables is negatively associated[33,34]. The study subjects who eat food from fast food centre showed high prevalence compared to others. In the past 10 years in Kerala there has been a tremendous growth in the number of fast food joints and the frequency of children eating out has also gone up, coupled with the increased number of children with pocket money. All this has changed the diet to a high fat, high sugar low fibre diet and resulted in increase of prevalence. Similar diet patterns have shown high prevalence in various other studies too[33, 34]. There is no much difference in the prevalence between students having habit of taking snacks/food in-between meals and students without this habit. In a study carried out in UAE, obesity among students was associated with food intake between meals and in particular fast foods[35].

Thus from this study it is evident that factors like family history, diet pattern and sedentary lifestyles have led to overweight/obesity and it is time to think of strategies to curb this epidemic at the earliest lest it should run out of control.

Strengths and Limitations
The whole study was done by a single investigator who had supervised each questionnaire filled and measurements taken by the two trained assistants. A large sample was selected to represent the whole population of high school students. The study was carried out not only as a survey but also a service as pamphlets were distributed to each and every student about adolescent health including calculation of BMI. The limitations are: Recall bias among the children

especially about the diet may have confounded some findings.

Conclusion

The prevalence of overweight/obesity is high among high school students of Thiruvananthapuram Corporation compared to other studies carried out in India. There was a strong association of this prevalence with family history, lack of physical activity and dietary pattern. Most of the variables found to be significantly associated with overweight/obesity are modifiable.

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PEER REVIEW

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CONFLICTS OF INTEREST

The author has no conflicts of interest to declare

Tables

Table 1: Prevalence of overweight and obesity

	Underweight	Normal weight	Overweight	Obesity	Total
Overall	439(25.5%)	965(56.2%)	206(12.0%)	108(6.3%)	1718
Sex					
Boys	299(35.3%)	407(48.3%)	85(10.0%)	54(6.4%)	845
Girls	140(16.1%)	558(63.9%)	121(13.8%)	54(6.2%)	873
Category of school					
Government	102(16.3%)	414(66.8%)	65(10.4%)	41(6.5%)	622
Private aided	301(39.9%)	321(42.7%)	95(12.5%)	37(4.9%)	754
Private unaided	36(10.5%)	230(67.4%)	46(13.4%)	30(8.7%)	342

Table 2: socioeconomic status and prevalence of overweight/obesity

Family size	Overweight/obese	Non overweight/obese	Total	'p' value
Up to 4	238 (20.7%)	912 (79.3%)	1150	0.00
> 4	76 (13.4%)	492 (86.6%)	568	
Working parents				
None	8 (7.0%)	107 (93.0%)	115	0.00
One	160 (13.4%)	1031 (86.6%)	1191	
Both	146 (35.4%)	266 (64.6%)	412	
Family monthly income				
> 6000 Rs	140 (38.6%)	223 (61.4%)	363	0.00
Up to 6000 Rs	76 (15.7%)	408 (84.3%)	484	
Paternal occupation				
Unemployed	4 (10.8%)	33 (89.2%)	37	0.00
Unskilled	22 (11.3%)	173 (88.7%)	195	
Semiskilled	6 (7.1%)	79 (92.9%)	85	
Skilled	24 (10.8%)	198 (89.2%)	222	
Business	65 (15.3%)	361 (84.7%)	426	
Services	158 (28.4%)	398 (71.6%)	556	
Others	35 (17.8%)	162 (82.2%)	197	
Maternal occupation				0.00
Unemployed /housewife	164 (13.1%)	1089 (86.9%)	1253	
Unskilled/semiskilled/skilled	5 (9.0%)	50 (91.0%)	55	
Business /services	138 (38.9%)	217 (61.1%)	355	
Others	7 (12.7%)	48 (87.3%)	55	
Paternal education				
Up to 10th standard	148 (16.8%)	732 (83.2%)	880	0.36
Pre degree	88 (20.4%)	344 (79.6%)	432	
Graduate	49 (18.3%)	219 (81.7%)	268	
Postgraduate and above	29 (21.0%)	109 (79.0%)	138	
Maternal education				
Up to 10th standard	136 (17.5%)	640 (82.5%)	776	0.32
Pre degree	107 (19.6%)	439 (80.4%)	546	
Graduate	46 (16.0%)	241 (84.0%)	287	
Postgraduate and above	25 (22.9%)	84 (77.1%)	109	

Table 3: Family history and prevalence of overweight/obesity

Family history of overweight/obesity	Overweight/obese	Non overweight/obese	Total
No	101 (8.9%)	1037 (91.1%)	1138
Single parent	161 (52.3%)	147 (47.7%)	308
Both parents	12 (36.4%)	21 (63.6%)	33
Siblings	3 (18.8%)	13 (81.2%)	16
Maternal relative	211 (8.3%)	94 (81.7%)	115
Paternal relative	13 (15.3%)	72 (84.7%)	85
Both maternal and paternal relative	3 (13.0%)	20 (87.0%)	23
Family history of Diabetes			
No	87 (11.7%)	655 (88.3%)	742
Single parent	166 (36.5%)	289 (63.5%)	455
Both parents	6 (20.0%)	24 (80.0%)	30
Siblings	1 (25.0%)	3 (75.0%)	4
Maternal relative	29 (12.7%)	200 (87.3%)	229
Paternal relative	14 (8.1%)	158 (91.9%)	172
Both maternal and paternal relative	11 (12.8%)	75 (87.2%)	86
Family history of Ischemic heart disease			
Yes	137 (32.1%)	290 (67.9%)	427
No	177 (13.7%)	1114 (86.3%)	1291

Table 4: Physical activity and prevalence of overweight/obesity

	Overweight/ obese	Non-overweight/ obese	Total	Odds ratio	95% CI(odds ratio)	P value
Mode of conveyance to school						
0 – 6 km Using vehicles	149 (19.3%)	623 (80.7%)	772	1.22	0.87-1.72	0.23
Walking/bicycle	60 (16.3%)	306 (83.7%)	366			
> 6 km Using vehicles	102 (18.3%)	457 (81.7%)	559	1.34	0.45–5.00	0.86*
Walking/bicycle	3 (14.2%)	18 (85.8%)	21			
Tuition						
Yes	267 (18.4%)	1185 (81.6%)	1452	1.05	0.74–1.50	0.78
No	47 (17.7%)	219 (82.3%)	266			
Mode of conveyance to tuition						
Using vehicles	63 (20.5%)	244 (79.5%)	307	1.20	0.86-1.66	0.26
Walking/bicycle	203 (17.7%)	942 (82.3%)	1145			
Sports involvement						
No	267 (20.1%)	1059 (79.9%)	1326	1.85	1.32 - 2.58	0.00
Yes	47 (12.0%)	345 (88.0%)	392			
Aérobic exercise						
Not adéquate	150 (25.3%)	442 (74.7%)	592	1.99	1.55 - 2.55	0.00
Adéquate	164 (14.6%)	962 (85.4%)	1126			
TV-watching/computer use						
>16hrs/week	130 (42.9%)	173 (57.1%)	303	5.02	3.81 – 6.62	0.00
<16hrs/week	184 (13.0%)	1231 (87.0%)	1415			

Table 5: Diet and Prevalence of overweight/obesity

Food item	Overweight/ obese	Non-overweight/obese	Total	Odds ratio	95% CI	P value
Sweets				1.38	1.02 – 1.86	0.02
1-7 times/week	244 (19.5%)	1006 (80.5%)	1250			
< 1time/week Or never	70 (15%)	398 (85%)	468			
Egg				1.28	0.99 – 1.66	0.04
1-7 times/week	188 (20%)	755 (80%)	943			
< 1time/week Or never	126 (16.3%)	649 (83.7%)	775			
Meat				1.42	1.10 – 1.84	0.00
1-7 times/week	132 (21.8%)	475 (78.2%)	607			
< 1time/week Or never	182 (16.4%)	929 (83.6%)	1111			
Milk / curd				1.26	0.91 – 1.74	0.14
1-7 times/week	226 (17.2%)	1084 (82.8%)	1310			
< 1time/week Or never	58 (14.2%)	350 (85.8%)	408			
Ice creams				1.04	0.79 – 1.36	0.75
1-7 times/week	94 (18.8%)	408 (81.2%)	502			
< 1time/week Or never	220 (18%)	996 (82%)	1216			
Snacks				1.44	1.03 – 2.03	0.02
1-7 times/week	264 (19.3%)	1103 (80.7%)	1367			
< 1time/week Or never	50 (14.2%)	301 (85.6%)	351			
Vegetables				0.76	0.52 – 1.12	0.14
1-7 times/week	272 (17.8%)	1256 (82.2%)	1528			
< 1time/week Or never	42 (22.1%)	148 (77.9%)	190			
Fruits				1.00	0.76 – 1.31	0.97
1-7 times/week	221 (18.3%)	987 (81.7%)	1208			
< 1time/week Or never	93 (18.2%)	417 (81.8%)	510			
Food habit				1.31	0.64 – 2.76	0.43
Non vegetarian	304 (18.4%)	1346 (81.6%)	1650			
Vegetarian	10 (14.7%)	58 (85.3%)	68			
Eating b/w breakfast-lunch-supper				1.04	0.73 – 1.49	0.80
Yes	267(18.4%)	1186(81.6%)	1453			
No	47(17.7%)	218(82.3%)	265			
Eating from fast food centre				2.33	1.72 – 3.91	0.00
Yes	256(21.8%)	918(78.2%)	1174			
No	58(10.7%)	486(89.3%)	544			
Frequency of eating from fast food centre				4.06	3.03 – 5.44	0.00
>2times/week	133(40.8%)	193(59.2%)	326			
1-2times/week	123(14.5%)	725(85.5%)	848			

Table 6: Variables considered for binary logistic regression

Variables	Total no. (%)	Overwt/obese N (%)	Odds ratio (95% CI)	P value
Overall	**1718 (100%)**	**314 (18.3%)**	**-**	**-**
Family size				
Up to 4	1150 (66.9)	238 (20.7)	1.68	0.000
> 4	568 (33.1)	76 (13.4)	(1.27 – 2.23)	
Father occupation				
Business/services	982 (57.2)	223 (22.7)	2.08	0.000
Others	736 (42.8)	91 (12.4)	(1.59 – 2.71)	
Mother occupation				
Business/services	355 (20.7)	138 (38.9)	4.28	0.000
Others	1363 (79.3)	176 (12.90	(3.28 – 5.590	
Family h/o overwt./obesity				
Yes	580 (33.8)	213 (36.7)	5.95	0.000
No	1138 (66.2)	101 (8.9)	(4.57 – 7.76)	
Family h/o diabetes				
Yes	976 (56.8)	227 (23.3)	2.28	0.000
No	742 (43.2)	87 (11.7)	(1.74 – 2.98)	
Family h/o IHD				
Yes	427 (24.9)	137 (32.1)	2.97	0.000
No	1291 (75.1)	177 (13.7)	(2.29 – 3.84)	
Fast food consumption				
Yes	1174 (68.3)	256 (21.8)	2.33	0.000
No	544 (31.7)	58 (10.7)	(1.72 – 3.17)	
TV/computer use				
>16 hrs/week	303 (17.6)	130 (42.9)	5.02	0.000
0 -16 hrs/week	1415 (82.4)	184 (13)	(3.81 – 6.62)	
Aerobic exercise				
Not adequate	592 (34.5)	150 (25.3)	1.99	0.000
Adequate	1126 (65.5)	164 (14.6)	(1.55 – 2.55)	
Sports involvement				
No	1326 (77.2)	267 (20.1)	1.85	0.000
Yes	392 (22.8)	47 (12)	(1.32 – 2.58)	
Sweet consumption				
1- 7 times/week	1250 (72.8)	244 (19.5)	1.37	0.029
< 1 time/week or never	468 (27.2)	70 (15)	(1.03 – 1.84)	
Egg consumption				
1- 7 times/week	943 (54.9)	188 (19.9)	1.28	0.049
< 1 time/week or never	775 (45.1)	126 (16.3)	(1.00 – 1.64)	
Meat consumption				
1- 7 times/week	607 (35.3)	132 (21.7)	1.41	0.006
< 1 time/week or never	1111 (64.7)	182 (16.4)	(1.10 – 1.82)	
Snacks consumption				
1- 7 times/week	1367 (79.6)	264 (19.3)	1.44	0.028
< 1 time/week or never	351 (20.4)	50 (14.2)	(1.03 – 2.00)	

Table 7: Final model of Logistic regression

Variables	Adjusted Odds ratio	95% CI	P value
Family h/o overweight/obesity	4.150	3.126 – 5.509	0.000
> 16hrs of TV /computer use per week	2.673	1.928 – 3.705	0.000
Mother occupation of service/business	2.467	1.805 – 3.371	0.000
Not involved in sports	1.733	1.197 – 2.507	0.004
Food consumption from fast food centre	1.672	1.198 – 2.333	0.002
Inadequate aerobic exercise	1.626	1.223 – 2.162	0.001