



RISK FACTORS OF OVERWEIGHT AND OBESITY AMONG HIGH SCHOOL STUDENTS OF A CITY IN NORTH KARNATAKA: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Childhood overweight/obesity is a risk factor for later adult disease and is associated with impaired health during childhood itself which may continue untreated for many years. The prevalence of obesity seems to be increasing in most parts of the world, even where it used to be rare. This study was undertaken to find out the prevalence and risk factors associated with overweight and obesity among high school children of Raichur city. **Objective:** To find out the prevalence and risk factors associated with overweight and obesity among the High school students of a city in north Karnataka. **Methodology:** A cross sectional study was undertaken in high schools of Raichur city. Data was collected by interviewing 1900 study subjects using pre-tested semi-structured questionnaire and by physical examination. The data was analyzed using percentages, proportions, odds ratio and chi square test with the help of Epi Info 7 software. **Results:** Prevalence of overweight and obesity among high school children of Raichur city was found to be 4.57% and 5.11% respectively. Significant association of overweight/obesity was found with gender, age, religion, socio-economic status, parent's education, type of diet and physical exercise. **Conclusions:** Considering association of overweight/obesity with various risk factors, preventive measures like lifestyle modifications, changes in dietary pattern and regular exercise should be promoted in these age group children.

KEYWORDS : Overweight; obesity; BMI; high school; childhood; Raichur; North Karnataka**INTRODUCTION:**

In last three four decades fundamental changes in social and economic situation occurred all over the world, thus leading to the presence of modern conveniences in homes as well as at the work place. These changes have shifted societies from communicable to non-communicable diseases (NCD) ^[1-3]. Obesity is now widely prevalent in several developing countries, particularly those in rapid transition and is affecting both children and adults ^[4]. The health of children and youth is of fundamental importance. Over one-fifth of our population comprises of children aged 5-14 years that is, the group covering primary and secondary education. As today's children are the citizens of tomorrow's world, their survival, protection, and development are the prerequisite for the future development of humanity. Without ensuring optimal child growth and development, efforts to accelerate economic development significantly will be unsuccessful ^[5].

Nationally representative data are lacking and extensive literature search did not provide any information about studies conducted among high school children in Raichur city to assess the prevalence and determinants of overweight and obesity. Studies of such a nature will be useful tools in planning and developing appropriate intervention methods.

METHODOLOGY:

A cross-sectional study was conducted in high school students of Raichur city from January 2016 to June 2016 after taking Ethical clearance taken from Institutional Ethical Committee of Raichur Institute of Medical Sciences. Permission was also taken from Block education officer of Raichur city and from the principals of the schools to conduct the study in their respective schools. Data was collected using a pre-tested semi-structured questionnaire after taking the verbal consent of the students and explaining each question to the students and their physical examination was done.

A study conducted by M Shashidhar Kotian among 12 to 15 year old children, from January to April 2010 in the city of Mangalore, found the prevalence of overweight and obesity to be 9.9% and 5.3% respectively ^[6]. These prevalence rates were considered to calculate the sample size.

Relative precision of 20% of prevalence.
Formula

$$N = (z^2 pq) / d^2$$

N = Sample size estimate

z = Standardized normal deviate (1.96)~2

p = Proportion of target population with characteristic being measured.

q = (100-p)

d = Relative precision.

For overweight:

$$N = (z^2 pq) / d^2$$

$$N = 2 \times 2 \times 10 \times 90 / 2 \times 2$$

$$N = 3600 / 4$$

$$N = 900$$

For obesity:

$$N = (z^2 pq) / d^2$$

$$N = 2 \times 2 \times 5 \times 95 / 1 \times 1$$

$$N = 1900 / 1$$

$$N = 1900$$

The sample size for obesity of 1900 was a better option for a good study, hence sample size of 1900 was considered for conducting this study.

Sampling Technique: Population proportionate sampling.

Total numbers of schools in Raichur city are 95 and they are divided into 5 regions (central, north, south, east and west). In each region schools are separated into two groups (government and private). A proportionate sample size was taken from both the groups of each region according to the strength of students in that group. Total number of students in high schools of Raichur city 10709.

Sample Taken From Government And Private Schools Of Each Region:

Central: Govt-74, Private-319

North: Govt-152, Private-99

South: Govt-129, Private-157

East: Govt-119, Private-289

West: Govt-137, Private-425

Schools were randomly selected from both government and private school list of each region. Sample size from both Government and Private schools of each region was taken as calculated. Schools were visited once and all the high school children present at the time of visit were taken as study subjects. If the required sample size for that zone was not available in one school then more school randomly selected from that zone was visited to complete the sample size for that zone.

Clinical examination and anthropometric measurements of height and weight were taken using standard equipments to calculate Body mass index (BMI). Weighing machine used for the study was calibrated daily. Health education regarding the risk factors for overweight / obesity and other non-communicable diseases and the preventive measures for these were given at the end of filling the questionnaire and examination.

Data was entered into Microsoft Excel sheet and analysed using Epi Info 7 software. Adiposity varies with age and gender during childhood and adolescence; therefore WHO Z-scores for different age for both sexes were used to classify children based on their BMI^[7].

The prevalence of overweight and obesity was estimated. Descriptive statistics like frequency and percentages were used. Association of various risk factors with overweight and obesity were compared using odds ratio and chi-square test. The statistical significance was evaluated at 95% confidence level ($p < 0.05$).

RESULTS:

Of the 1900 study subjects in our study, 864 (45.47%) were girls and

1036 (54.53%) were boys. The mean age of study subjects was 14.08 ± 1.06 years with a range from 13 to 18 years. Majority of the study subjects were from socioeconomic class V (39.47%) followed by class IV (25.21%) and class III (18.01%). 1193 (62.78%) students were underweight, 1523 (27.52%) in normal range. 87 (4.57%) were overweight, and 97 (5.13%) were obese. Among girls, 59 (3.11%) were overweight, and 67 (3.53%) were obese. Among boys, 28 (1.46%) were overweight and 30 (1.60%) were obese. The overall prevalence of overweight / obesity was found to be 9.68%. (Table 1).

A statistically significant association of prevalence of overweight/obesity was found with gender, age, socioeconomic class, Parent's education, religion, type of diet and exercise (Table 2 & 3).

Table 1: Distribution Of Study Subjects According To Nutritional Status

Gender	Underweight	Normal	Overweight	Obese	Total
Boys	201 (23.26%)	605 (70.03%)	28 (3.24%)	30 (3.47%)	864 (100%)
Girls	322 (31.09%)	588 (56.75%)	59 (5.69%)	67 (6.47%)	1036 (100%)
Total	523 (27.53%)	1193 (62.79%)	87 (4.57%)	97 (5.11%)	1900 (100%)

Table 2: Socio-Demographic Factors Contributing To Overweight/Obesity

Factors	Overweight/ Obese		Total	Test	P value
	No	Yes			
Gender					
Boys	806 (93.29%)	58 (6.71%)	864 (100%)	OR=1.92; 95% CI=1.32-2.66	<0.001
Girls	910 (87.84%)	126 (12.16%)	1036 (100%)	$\chi^2=15.99$; df=1	
Age					
13	583 (89.41%)	69 (10.59%)	652 (100%)	$\chi^2=21.29$; df=3;	<0.001
14	654 (93.96%)	42 (6.04%)	696 (100%)		
15	332 (85.56%)	56 (14.44%)	388 (100%)		
>15	147 (89.63%)	17 (10.63%)	164 (100%)		
Type of family					
Nuclear	1274 (90.48%)	134 (9.52%)	1408 (100%)	OR=1.07 CI=0.76-1.51	0.67
Joint	442 (89.84%)	50 (10.16%)	492 (100%)	$\chi^2=0.173$, df=1	
Religion					
Hindu	1093 (87.72%)	153 (12.28%)	1246 (100%)	$\chi^2=27.87$; df=1	<0.001
Muslim & Christians	623 (97.34%)	31 (2.66%)	654 (100%)		
Socio-economic Status					
Class I	87 (83.65%)	17 (16.35%)	104 (100%)	$\chi^2=30.52$; df=4	<0.001
Class II	187 (83.11%)	38 (16.89%)	225 (100%)		
Class III	301 (88.01%)	41 (11.99%)	342 (100%)		
Class IV	440 (91.86%)	39 (8.14%)	479 (100%)		
Class V	701 (93.47%)	49 (6.53%)	750 (100%)		
Birth order					
1	785 (89.10%)	96 (10.90%)	881 (100%)	$\chi^2=3.846$; df=3	0.278
2	636 (90.37%)	65 (9.27%)	701 (100%)		
3	198 (92.52%)	16 (7.48%)	214 (100%)		
>3	97 (93.26%)	7 (6.74%)	104 (100%)		
Father's education					
Illiterate	357 (92.25%)	30 (7.75%)	387 (100%)	$\chi^2=26.93$; df=4	<0.001
Primary / middle school	409 (94.90%)	22 (5.10%)	431 (100%)		
High School	525 (89.90%)	59 (10.10%)	584 (100%)		
Intermediate / Diploma	188 (86.64%)	29 (13.36%)	217 (100%)		
Graduate / Postgraduate	237 (84.34%)	44 (15.66%)	281 (100%)		
Mother's education					
Illiterate	388 (94.17%)	24 (5.83%)	412 (100%)	$\chi^2=36.16$; df=4	<0.001
Primary / middle school	365 (92.88%)	28 (7.12%)	393 (100%)		
High School	627 (89.83%)	71 (10.17%)	698 (100%)		
Intermediate / Diploma	212 (88.70%)	27 (11.30%)	239 (100%)		
Graduate / Postgraduate	124 (78.48%)	34 (21.52%)	158 (100%)		
Family history					
Present	617 (90.34%)	66 (9.66%)	683 (100%)	OR=1.003 CI=0.731-1.378	$p < 0.981$
Absent	1099 (90.30%)	118 (9.70%)	1217 (100%)	$\chi^2=0.0005$, df=1	

OR- Odds ratio, χ^2 - Chi-square, CI- Confidence interval

Table 3: Risk Factors Contributing To Overweight/Obesity

Factors	Overweight/ Obese		Total	Test	P value
	Yes	No			
Type of diet					
Vegetarian	711 (96.60%)	25 (3.40%)	736 (100%)	OR=4.49, CI=2.91-6.93	$p < 0.001$
Non-vegetarian	1005 (86.34%)	159 (13.66%)	1164 (100%)	$\chi^2=54.31$, df=1	
No. of meals/day					
2	97 (91.51%)	9 (8.49%)	106 (100%)	$\chi^2=2.665$; df=2	$p=0.263$
3	1402 (89.81%)	159 (10.19%)	1561 (100%)		
>3	217 (93.13%)	16 (6.87%)	233 (100%)		
Eating junk Food					

Yes	1369 (90.30%)	147 (9.70%)	1516 (100%)	OR=1.007 CI=0.68-1.47	p=0.971
No	347 (90.36%)	37 (9.64%)	384 (100%)	$\chi^2=0.0013$, df=1	
Exercise					
Yes	693 (88.51%)	90 (11.49%)	783 (100%)	OR=1.41 CI=1.04-1.91	p=0.025
No	1023 (91.58%)	94 (8.42%)	1117 (100%)	$\chi^2=4.98$, df=1	
Duration Of Sleep/day					
4 To 6 Hours	226 (90.04%)	25 (9.96%)	251 (100%)	$\chi^2=2.343$, df=2	p=0.3099
6 To 8 Hours	1018 (89.61%)	118 (10.39%)	1136 (100%)		
>8 Hours	472 (92.00%)	41 (8.00%)	513 (100%)		
Time Spent On TV/ Video-game /Computer/Mobile Phone					
<2 Hours	1539(90.69%)	158 (9.31%)	1697 (100%)	Odds ratio=1.43 CI=0.918-	p=0.111
>2 Hours	177 (87.19%)	26 (12.81%)	203 (100%)	2.228 $\chi^2=2.535$, df=1	

OR- Odds ratio, χ^2 - Chi-square, CI – Confidence interval

DISCUSSION:

In the present study, the overall prevalence of overweight / obesity was 9.68% and the prevalence of overweight and obesity was 4.57% and 5.13% respectively. This is comparable to studies done by Premanath M. et al, (2008) conducted in Mysore which reported the prevalence of obesity and overweight to 3.4 and 8.5% respectively^[8]. In another study done by Kalpana CA in 35 schools of Coimbatore, the overall prevalence of overweight and obesity among school children was observed to be 7.6% and 5.6% respectively^[9].

The prevalence of overweight / obesity was found more in girls (12.16%) as compared to boys (6.71%) with the odds ratio of 1.92 and the difference was found to be statistically significant. Similar finding was reported from studies done in Puducherry by Preetam BM and in Saudi Arabia by El-Hazmi MA where it was observed that the prevalence of overweight / obesity was high in girls compared to boys^[10, 11]. This could be due to the fact that during puberty, females have tendency to accumulate more fat and male adolescents have larger amount of lean mass compared to females thus the amount of body fat in males decreases by approximately 40%^[12,13]. In contrast to the above findings, the prevalence of overweight/ obesity was found high in boys as compared to girls in other studies^[14-17].

The highest prevalence of overweight / obesity was found in the age 15 years (14.44%) followed by 10.63% in the age >15 years, 10.59% in the age 13 years. The difference in prevalence of overweight / obesity between different age groups was statistically significant ($p < 0.048$). In a study done by Mohanty B in Puducherry, the Prevalence of overweight (5.2%) and obesity (3.89%) was found high in 15 year age group and a positive correlation was found between age and obesity^[18]. The prevalence was found high in the age group >15 years as compared to <15 years in a study done by Bharati DR^[19]. This could be due to the fact that fat tissue and overall body weight increases in children during puberty. The number of fat cells increases during periods of rapid growth up to 16 years of age, after which increased fat ordinarily accumulates by increasing size of the fat cells already present^[20]. But the findings in a study done by Chaatwal J showed that Prevalence of obesity decreased significantly with age, from 18.5% at 9 years to 7.6% at 14 years, rising at 15 years to 12.1%^[15].

The prevalence of overweight / obesity was high in Hindus (12.28%) and in Muslims and Christians combined it was 2.66%, these results are comparable to a study done by Bharati D R, et al, where the prevalence of overweight / obesity was high in Hindu children in school going children of Wardha city^[19].

The relationship between prevalence of overweight / obesity and socioeconomic status was statistically significant with high proportion of overweight / obesity seen in class II and I (16.89% and 16.35%) respectively. Our study results are similar to other studies (Vohra R, et al, and Laxmaiah A, et al) where the prevalence was high in children belonging to high socio economic status^[15,21].

Overweight/obesity was found more in subjects whose father and mother were graduates or postgraduates (15.66% and 21.52% respectively). A study by Bharati DR, et al, has mentioned that parents' educational status has an effect on children's obesity. It was noticed that the prevalence of overweight / obesity was high in children whose father and/or mother were graduates^[19]. But in a study done by Chaput JP, et al, low parental educational status was significantly associated with childhood overweight / obesity^[22].

The prevalence of overweight / obesity was observed more in study subjects with birth order of 1 (10.90%), followed by birth order of 2

(9.27%) but the difference was not statistically significant. This is in comparison with study done by Bullapa A, in which also overweight / obesity was found highest among subjects with birth order 1 (10.82%) followed by birth order 2 (9.19%)^[23].

The non-vegetarians were found to be having 4.49 times greater risk of becoming overweight / obese as compared to vegetarians. These results are in contrast to a study done by Mohanty B in Puducherry where the prevalence of overweight / obesity was found high in vegetarians^[18].

In present study the prevalence overweight / obesity was highest among the study subjects who had 3 meals in a day (10.19%) followed by 9 (8.49%) of study subjects who had 2 meals per day. Theses finding are in contrast to study done by Bullapa A in Mandya city where highest prevalence of overweight/ obesity was found in subjects who eat 5 times a day^[23].

There was high prevalence of overweight / obesity among subjects who consumed junk food (9.8%) in studies done by De Onis M, Theresa AN and Laxmaiah A et al^[20,24,25]. In the present study, prevalence of overweight / obesity was found slightly high in study subjects who consume snacks in between meals (9.70%) as compared to those who did not consume (9.64%) and the odds ratio was found to be 1.007 but the difference was statistically not significant. Similar finding of no significant association between snacks consumption and overweight was found in a study done by Gregori D^[26].

In the present study the risk of becoming overweight / obese was 1.41 times more among those who exercise as compared to those who do not. The finding of the present study was in contrast to the studies which showed that the risk of becoming overweight / obese was less when exercised regularly^[16,17,19,20].

The prevalence of overweight / obesity was high in study 118 subjects (10.39%) who slept for 6-8 hours per day but was not statistically significant. This is in contrast with the study done by Kuriyan R which showed that children who slept less than 8.5 hours / day had significantly higher risk (6.7 times) of becoming overweight when compared to children who slept more than 9.5 hours/day^[27].

Those who spend time in watching television/computer/video-game/mobile phone >2 hours/day were found to have 1.43 times higher risk of becoming overweight / obese. This study is in line with other studies where increase in television watching was associated with increase in body fat^[16,17,18,27].

CONCLUSION:

Majority of the study subjects were aged 14 and 13 years. Girls were more than boys. The prevalence of overweight / obesity in children were observed to be 4.50% and 5.13% respectively. Prevalence of overweight and obesity was 1.92 times more in girls than boys. Education of parents and socio-economic status has direct relationship on childhood obesity. Non-vegetarian diet and exercise had a direct influence on the prevalence of overweight/ obesity.

Recommendations:

Regular class hours on healthy food habits, nutritive values of different food items, lifestyle and behavioural modification should be incorporated in school schedule. Periodic health checkups in the schools should be made compulsory which is useful for early detection of childhood obesity. Every student should be motivated to take part in outdoor games and sports, irrespective of gender. The children as well as parents should be educated about obesity problems

Limitations:

Study findings were based on oral questionnaire (except for measurement of height and weight) which are subjected to reporting and recall bias. The recall bias may have affected the accuracy of information provided on dietary patterns, physical activity, sleep duration, and screen-time behaviors, as students may not accurately remember or quantify their past habits. Reporting bias - particularly social desirability bias - may have led participants to underreport unhealthy food intake, or sedentary behavior and to over-report physical activity, resulting in potential distortion of associations with behavioral factors. Genetic and psychological factors of obesity could not be examined because of lack of resources.

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