ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 7, Issue, 01, pp.11594-11598, January, 2015

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

A STUDY OF CORRELATES OF OVERWEIGHT/OBESITY AMONG HIGH SCHOOL CHILDREN OF MANDYA CITY, KARNATAKA

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ARTICLE INFO

Article History:
Received 22nd October, 2014
Received in revised form
20th November, 2014
Accepted 15th December, 2014
Published online 23rd January, 2015

Key words:
Childhood,
Overweight/obesity,
Body Mass Index,
High school children

ABSTRACT

Introduction: The rapid progress of urbanization and demographic trends is associated with a cluster of unhealthy lifestyles leading to overweight/obesity in children and adults. Rising prevalence of obesity in India may be attributed to various factors like sedentary life-style, unhealthy food habits, cultural practices and increasing affluence of middle class population. Obesity is a key factor for many chronic and non-communicable diseases. Complications of adult obesity are made worse if the obesity begins in childhood.

Objectives:
1.To determine the prevalence of overweight and obesity in high school children of Mandya city.
2.To describe the factors contributing to overweight/obesity among the study subjects.

Methodology: This is a cross sectional, questionnaire based study conducted on high school children of Mandya city. English and local language Kannada version questionnaire were used to study the variables. Anthropometric measurements of height, weight were taken using standard equipments. The statistical significance was evaluated at 95% confidence level ($p < 0.05$).

Results and Conclusion: The overall prevalence of overweight/obesity was 9.63% and the prevalence of overweight/obesity was 4.50% and 5.13% respectively. Final model of the multivariate logistic regression showed that the important correlates of overweight/obesity were age, sex, type of school, family history of overweight/obesity, television viewing, sleep duration, absence of consumption of snacks.

INTRODUCTION

Childhood obesity is one of the most serious public health challenges of the 21st century. The problem is global and is steadily affecting many low and middle income countries, particularly in urban settings which is creating an enormous socioeconomic and public health burden in poorer countries (Kalpana and Lakshmi, 2011 and WHO, 2000). The rapid progress of urbanization and demographic trends is associated with a cluster of unhealthy lifestyles like sedentary activities, consumption of calorie dense foods of low nutritional value (Kalpana and Lakshmi, 2011 and Kelishadi, 2008). The etiology of obesity is multi factorial and involves complex interactions between genetic, environmental, cultural and social factors such as parental obesity, television watching, sleeping hours, physical activity, dietary habitsetc (WHO, 2000 and Lau *et al*., 2007).

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Obesity has reached epidemic proportions in India in the 21st century, with morbid obesity affecting 5% of the country's population. India is following a trend of other developing countries that are steadily becoming more obese (World Health Organization, 2011; Mohan *et al*., 2007 and Gupta, 2005). Obesity is a key factor for many non-communicable diseases (Kalpana and Lakshmi, 2011). Complications of adult obesity are made worse if the obesity begins in childhood (Kishore, 2011). About 30% of obesity begins in childhood and out of which 50-80% of obese children will continue as obese adults and develop a wide range of sex hormone sensitive cancers, medical and psychosocial complications (WHO, 2000; Mohanty, 2007-2008 and Evans *et al*., 2010). Nationally representative data of childhood obesity are lacking and extensive literature search did not provide any information about studies conducted among school children in Mandya city to assess the prevalence and determinants of obesity. Studies of such a nature will be useful tools in planning and developing appropriate intervention methods. Hence the present study was conducted to determine the prevalence of overweight and obesity and to describe the

factors contributing to overweight/obesity among high school children of Mandya city.

MATERIALS AND METHODS

This is a cross sectional, questionnaire based study conducted on high school children of Mandya city, Karnataka between June 2012 and May 2013. Necessary permission from the concerned authority including the Deputy Director Public Instruction (DDPI) and school heads was obtained. The purpose of the study was explained and oral consent was obtained from the participants before enrolling them in the study. Children who gave consent for the study were included as study subjects (n = 4663) and the rest were not included due to unavailability during two visits (221) and denial of permission to conduct study in their school (186).

Ethical consideration

Study was initiated after obtaining approval from the Institutional Scientific Committee and the Institutional Ethics Committee of Mandya Institute of Medical Sciences, Mandya. Children who gave consent for the study were given a pretested semi-structured questionnaire (English or local language Kannada version in which ever language the child is comfortable with) to elicit family and individual characteristics Anthropometric measurements of height, weight were taken using standard equipments (stadiometer, bathroom scale weighing machine respectively) to calculate Body mass index (BMI) following NHANES guidelines for measurement (http://www.cdc.gov/nchs/nhanes/nhanes3/anthropometric_videos.htm). The instruments used for the study were calibrated daily. The anthropometric measurements were taken by the investigator and the data was recorded in the questionnaire by interns who were adequately trained before conducting the study. Two visits were made to each school to ensure complete coverage. Children who were not available in the school during two visits were excluded from the study. Heath 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. Hand notes related to healthy habits about diet, physical activity were distributed to students.

Statistical analysis

Data was entered into Microsoft excel sheet and analysed using SPSS version 21 software. Statistical tests like frequency, percentages, measures of central tendency, measures of dispersion and inferential statistical tests like chi-square test, odds ratio, multivariate analysis were used. Odds ratio (OR) and 95 per cent confidence interval (95% CI) was calculated for each categorical risk factor. Multiple logistic regression was performed with overweight and obesity together as dependent variable with dichotomous outcome. The statistical significance was evaluated at 95% confidence level ($p < 0.05$).

RESULTS

A total of 2074(44.48%) boys and 2589(55.52%) girls were studied who belonged to the age group 11-19 years. The overall mean age of study subjects was 13.80 $\pm$ 1.07 years with a range from 11 to 19 years. The mean age of boys was 13.76 $\pm$ 1.069 years with a range from 11 to 18 years and of girls was 13.49 $\pm$ 0.976 years with a range from 11 to 19 years. Body Mass Index was used as a tool to classify the study subjects into overweight/obese or non-overweight/non-obese. The classification of obesity is made according to proposed WHO Asia-Pacific guidelines. The cut off values for overweight and obesity was obtained from WHO growth chart for 5-19 years age group. These values are equivalent to overweight and obesity cut-off for adults.

According to WHO Asia-Pacific guidelines, the cut-offs for overweight (>23 kg/m^2) and obesity (≥25 kg/m^2) are lower than the WHO criteria (World Health Organisation, 2000). In the present study, the overall prevalence of overweight / obesity was 9.63% and the prevalence of overweight and obesity was 4.50% and 5.13% respectively. Sex wise distribution of study subjects according to BMI is described in Table 1.

On Univariate analysis, the risk of becoming overweight/obesity was significantly higher in 15 – 19 years age group (OR = 1.51; 95% CI = 1.21 – 1.89), girl children (OR = 1.85; 95% CI =1.50 – 2.28), children studying in private schools than government schools (OR =1.47; 95% CI =1.18 – 1.83), children with absence of family history of overweight/obesity (OR = 1.51; 95% CI = 1.24 – 1.85), children who did not consume snacks frequently (OR = 1.39; 95% CI = 1.05-1.85), children who watched television > 1.5 hours/day, children who slept< 8 hours (OR= 1.31; 95% CI = 1.04 – 1.65) (Table 2). Significant correlates of overweight/obesity was determined by applying Step-down multiple logistic regression using backward LR method.

Table 1. Sex wise distribution of study subjects according to BMI (kg/m^2)

Gender	Underweight (< 18.5)	Normal (18.5 –22.9)	Overweight (23 – 24.9)	Obesity 1 (25 – 24.9)	Obesity 2 (≥ 30)	Total
Girls	1443 (55.73)	838 (32.37)	143 (5.52)	140 (5.41)	25 (0.97)	2589
Boys	1488 (71.74)	445 (21.46)	67 (3.23)	58 (2.80)	16 (0.77)	2074
Total	2931 (62.86)	1283 (27.51)	210 (4.50)	198 (4.25)	41 (0.88)	4663

Figures in parenthesis indicate percentage

The final model (Table 3) showed thatage group 10-14 years (OR =0.63; 95% CI =0.49 – 0.78), girl children (OR =2.15; 95% CI = 1.73 – 2.67), private schools (OR = 1.48, 95% CI = 1.18 – 1.84), absence of family history of overweight/obesity (OR = 1.46;95% CI = 1.18 – 1.79), television watching > 1.5 hours (OR = 0.63; 95 % CI = 0.47 – 0.84), absence of consumption of snacks frequently (OR = 0.58; 95% CI = 0.45 – 0.75) were significantly associated with overweight/obesity among the study population.

Table 2. Risk factors of overweight/obesity in children

Variable	Non-overweight/ non-obese	Overweight/obese	OR (95%CI)	*p* value
Age				
10-14 years	3402 (91.15)	330 (8.85)	1.51	< 0.001
15-19 years	812 (87.22)	119 (12.78)	(1.21 – 1.89)	
Gender				
Girls	2281(88.10)	308(11.90)	1.85	< 0.001
Boys	1933(93.20)	141(6.80)	(1.50 – 2.28)	
Place of residence				
Urban	3662 (90.17)	399 (9.83)	1.20	0.238
Rural	552 (91.69)	50 (8.31)	(0.88 – 1.63)	
Type of school				
Government	3315 (91.17)	321 (8.83)	1.47	< 0.001
Private	899 (87.53)	128 (12.46)	(1.18 – 1.83)	
Type of family				
Nuclear	3111 (90.49)	327 (9.51)	1.05	0.648
Joint	1103 (90.04)	122 (9.96)	(0.85 – 1.31)	
Religion				
Hindu	3341 (89.98)	372 (10.02)	0.79	0.075
Others	873 (91.89)	77 (8.10)	(0.61 – 1.02)	
Family history of overweight/obesity				
Absent	2283(88.80)	288 (11.20)	1.51	< 0.001
Present	1931 (92.30)	161 (7.70)	(1.24 -1.85)	
Type of diet				
Vegetarian	457 (88.39)	60(11.61)	0.79	0.106
Non vegetarian	3757 (90.62)	389 (9.38)	(0.59 - 1.05)	
Consumption of snacks frequently				
Yes	3634(91.08)	356(8.92)	0.61	< 0.001
No	580(86.18)	93(13.82)	(0.48 - 0.78)	
Physical exercise				
Yes	1951(89.91)	219(10.09)	1.10	0.317
No	2263(90.77)	230(9.23)	(0.91–1.34)	
Viewing television(hours/day)				
≤ 1.5	3779 (90.71)	387(9.29)	1.39	0.027
>1.5	435 (87.53)	62(12.47)	(1.05 - 1.85)	
Sleep				
≥ 8 hours	1160 (91.99)	101 (8.01)	1.31	0.022
< 8 hours	3054 (89.77)	348 (10.22)	(1.04 -1.65)	
Total	4214 (90.37)	449 (9.63)		

Table 3. Multiple logistic regression for risk factors of childhood overweight / obesity by backward likelihood ratio method

Variable	Odds ratio	95 % CI	*p* value
10-14 years	0.63	0.49 – 0.78	< 0.001
Girls	2.15	1.73 – 2.67	< 0.001
Private schools	1.48	1.18 – 1.84	0.001
Absence of family history of overweight/obesity	1.46	1.18 – 1.79	< 0.001
TV watching > 1.5 hours	0.63	0.47 – 0.84	0.002
Sleep duration< 8 hours	1.27	1.00 – 1.60	0.050
Absence of consumption of snacks	0.58	0.45 – 0.75	< 0.001

DISCUSSION AND CONCLUSION

Malnutrition, in every form, presents significant threats to human health. Growing rates of overweight and obesity worldwide are linked to a rise in chronic diseases such as cancer, cardiovascular diseases, diabetes etc. These conditions are life-threatening and very difficult to treat in places with limited resources and already overburdened health systems (http://www.who.int/mediacentre/factsheets/fs311/en).

In the present study, the prevalence of overweight/obesity was 9.63% and the prevalence of overweight and obesity was 4.50% and 5.13% respectively. This was comparable to studies done by Premanath, *et al*. (2008) conducted in Mysore which reported the prevalence of obesity and overweight to be 3.4 and 8.5% respectively (Premanath *et al*., 2010). In another study done by CA Kalpana in 35 schools of Coimbatore, the overall prevalence of overweight / obesity among school children was observed to be 7.6% and 5.6% respectively (Kalpana and Lakshmi, 2011).

In the present study, prevalence of overweight/obesity was high in 15-19 years age group (Bharati *et al*., 2008). This was comparable to a study done by Mohanty B in Puducherry where the prevalence of overweight (5.2%) and obesity (3.89%) was found high in 15year age group and a positive co-relation was found between age and obesity (Mohanty, 2007-2008). The prevalence was found high in the age group >15 years as compared to <15 years in a study done by Bharati *et al*. (2008). 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 (Laxmaiah *et al*., 2007). In the present study, the prevalence of overweight / obesity was found more in girls (11.90%) as compared to boys (6.80%). 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 (Preetam *et al*., 2011 and El-Hazmi and Warsy, 2002). In contrast to the above findings, the prevalence of overweight / obesity was found high in boys as compared to girls in other studies (Kalpana and Lakshmi, 2011; Chhatwal *et al*., 2004; Kumar *et al*., 2011 and Ramachandran *et al*., 2002). 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% (La Merrill *et al*., 2011 and Strauss, 2002). The prevalence of overweight / obesity was high in private schools (12.46%) as compared to government schools (8.83%). These observations are in line with results of previous studies (Premanath *et al*., 2010 and Kumar *et al*., 2007). The prevalence of overweight / obesity was statistically significant with relation to viewing television. The prevalence was high in children who watched television >1.5 hous/day. The possible explanation could be television viewing affects obesity by influencing food choices, encouraging excess food intake, lowering metabolic rate, reducing the time available for activities to burn calories (De Sousa A. Maternal, 2009).

The prevalence of overweight/obesity was found high in children who slept < 8 hours per day. This was in line with the study done by Kuriyan R which showed that children who slept less than 8.5 hours/day had significantly higher odds (6.7) of being overweight when compared to children who slept more than 9.5 hours/day (Kuriyan *et al*., 2007). Cross sectional and prospective epidemiological studies have also showed an increased risk of overweight / obesity in children and adolescents who were short sleepers (Van Cauter *et al*., 2008 and Hart *et al*., 2011). There was high prevalence of overweight / obesity among subjects who consumed junk food (9.8%) in previous studies (Gurpreet and Manmeet, 2012; Mohanty, 2007-2008 and Van Cauter *et al*., 2008) but in the present study, prevalence of overweight / obesity was found high in study subjects who did not consume snacks frequently. Similar finding of no association between snacks consumption and overweight was found in a study done by Gregori D. The key factor in explaining such result might be the role of physical activity of the child (Gregori *et al*., 2011).

In the present study, 7.70% who had family history were overweight / obese. 11.20% of study subjects who did not have family history of overweight / obese were obese. The odds of becoming overweight / obese was 1.51 times among those who did not have family history of obesity. In a study done by Loutan L, no difference in proportion of overweight / obesity was found in families with at least one close obese relative (Loutan, 2014). To conclude, the overall prevalence of overweight / obesity was 9.63% and the prevalence of overweight / obesity was 4.50% and 5.13% respectively. The important determinants were age, sex, type of school, family history of overweight/obesity, television viewing, sleep duration, absence of consumption of snacks. Preventive strategies at the individual and policy making level is necessary for the prevention of weight gain in children as obesity once developed in childhood is difficult to treat. Parents, siblings, teachers play a vital role in the development of child's food habits, activity level.

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