

ORIGINAL ARTICLE

Assessment of risk factors for overweight and obesity among school going children in Kanpur, Uttar PradeshAtul Watharkar¹, Seema Nigam², Dinesh Singh Martolia³, Punit Varma⁴, S K Barman⁵, R P Sharma⁶¹Post Graduate Student, ^{2,3}Professor, ⁴Associate Professor, ⁵Assistant Professor, ⁶Professor and Head, Department of Community Medicine, GSVM Medical College, Kanpur.

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Corresponding Author

Address for Correspondence: Dr Atul Watharkar, Department of Community Medicine, GSVM Medical College, Kanpur.

E Mail ID: dratulw@gmail.com

Citation

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Background: Adolescent 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. **Objective:** To determine risk factors for overweight and obesity among school going children of age group 12-15 years in Kanpur. **Material and Method:** A cross-sectional study was conducted from September 2013 to August 2014 among students of age group 12-15 years in four schools of Kanpur that were selected by using multistage random sampling. Sample size was 806. The information about dietary habits and physical activity pattern was obtained by direct interview method. Height and weight were measured using standard techniques for the same and BMI was calculated. Student who had BMI >85th and <95th percentile of reference population were classified as overweight and BMI for age >95th percentile of reference population were classified as obese. **Results:** The prevalence of obesity and overweight was 3.97% and 9.80% respectively and consuming fast foods and carbonated drinks regularly, low levels of physical activity, watching television for more than 2 hours per day or playing computer games for more than 2 hours per day were significantly associated with overweight and obesity. **Conclusion:** Unhealthy dietary habits and sedentary lifestyle are the major risk factors for overweight/ obesity in adolescents. Intervention measures focusing mainly on increasing the physical activity, decreasing consumption of energy dense foods and providing psychological support is essential to fight this new emerging problem of obesity in adolescents.

Key Words

Adolescent; Overweight; Obesity; Risk factors; School Going Children

Introduction

Obesity has become a global pandemic and should be regarded as today's principal neglected public health problem. Obesity is increasing in most high-income countries as well as in developing countries undergoing nutrition transition and with under-nutrition problems. Globally, in 2010 the number of overweight children was estimated to be over 42 million. Close to 35 million of these are living in

developing countries. At least 2.8 million people die each year globally, as a result of being overweight or obese (1). WHO defines overweight and obesity as "abnormal or excessive fat accumulation that presents a risk to health."

In India, the magnitude of overweight ranges from 9% to 27.5% and obesity ranges from 1% to 12.9% among children and the prevalence is higher in urban than in rural areas (2,3,4,5). Recent studies from north India has shown that childhood obesity and

overweight is on the rise with prevalence ranging from 0.9% to 9.3% and from 2.5% to 15.5% respectively in school children (6). The National Family Health Survey (NFHS-3) showed that combined prevalence of overweight and obesity was 12.1% and 14.8% among men and women aged 15–49 years, respectively (7).

Aims & Objectives

To determine risk factors for overweight and obesity among school going children of age group 12-15 years in Kanpur.

Material and Methods

We conducted a school-based cross-sectional study during September 2013 to August 2014 in the four schools of urban Kanpur. Taking the prevalence of obesity as 8.6% in a study carried out in school going children of Meerut city, the calculated sample size being too low i.e. 125 at 95% CI, we decided to include maximum study subjects as per availability of resources. Thus total 806 study subjects were included to give more representation to the population, by applying the concept of “bigger the sample size, better the results”.

Multistage Random Sampling Technique was applied. The list of all the schools upto 10th standard was obtained from DIOS Office, Kanpur. In the first stage of sampling, four schools were selected using Simple Random Sampling without Replacement Technique (SRSWOR). At the second stage of sampling, one section each of class VIIth, VIIIth, IXth and Xth was chosen from the above four selected schools using Simple Random Sampling Technique. From each selected section, the children in the age group 12-15 years of age at the time of survey were included by complete enumeration. Consent was taken from the Principals of selected schools. The students were explained the scope and the objectives of the present study along with different procedures i.e. filling of questionnaire and recording of anthropometric measurements. Students with chronic diseases with or without ongoing treatment and who did not give consent were excluded.

The requisite data was collected on a predesigned and pretested questionnaire by using direct personal interview method. After measuring height and weight of the students, the body mass index was computed using the standard formula: $BMI = \text{Weight (kg)} / (\text{Height in m})^2$. Overweight and obesity were assessed by classifying BMI for specific age and sex. Student with BMI >85th and <95th percentile of

reference population were classified as overweight and BMI >95th percentile of reference population were classified as obese [8]. Collected data was classified, tabulated and analyzed by using appropriate statistical tools and conclusions were made accordingly.

Results

Out of total 806 study subjects, 32 (3.97%) were found to be obese and 79 (9.80%) were overweight. ([Figure 1](#))

The problem of overweight and obesity was more in study subjects with habit of irregular breakfast (21.46%), who did not bring tiffin to the school (29.06%), who consumed vegetables occasionally (42.93%), consumed fruits occasionally (16.67%), non-vegetarian (17.94%) and who visited restaurants more than once in a week (54.78%). The association between these various dietary habits and overweight / obesity in study subjects was found to be statistically significant ([Table 1-A](#)).

In our study, the problem of overweight and obesity was more in study subjects who consumed junk food (16.60%), carbonated drinks (16.98%) regularly and who had chocolate eating habit (16.21%). There was statistically significant association between these dietary habits and overweight and obesity in study subjects ([Table 1-B](#)).

Out of the study subjects who watched TV more than two hours per day (21.47%), used computer or mobile more than 2 hours per day (16.23%), who played outdoor games occasionally (18.12%), who involved in physical exercise occasionally (15.60%), who used motorized transport as a mode of conveyance (34.40%), who had habit of sleeping in afternoon (31.15%) were overweight and obese. Association between these physical activity patterns and overweight / obesity in study subjects was found to be statistically significant ([Table 2](#)).

Discussion

The present study revealed that 32 (3.97%) and 79 (9.80%) were obese and overweight respectively giving overall prevalence of 13.77% ([Figure 1](#)) which is almost similar to the observations made by Kumar S *et al* (2007) (9), RAJ M *et al* (2007) (10), Kotian S M *et al* (2010) (11), Kumar K M *et al* (2011) (12), Vohra R *et al* (2011) (13) and Katta V. A. *et al* (2013) (14). While other studies conducted by Jain S *et al* (2010) (15), Chakraborty P *et al* (2011) (16), Goyal J P *et al* (2011) (17) and Ramesh K (2012) (18) reported higher prevalence of overweight and obesity ranging

from 17.12%-22.22%. This may be because studies were conducted in different areas and different setups.

In the present study, 21.46% of overweight/obese study subjects had habit of irregular breakfast. Association between irregular breakfast habit and overweight / obesity in study subjects was found to be statistically significant ([Table 1-A](#)). These findings are consistent with Arora M *et al* (2012) (19) who also reported that prevalence of overweight and obesity was higher (22.9%) in students who consumed breakfast irregularly.

In our study, 29.06% of overweight/obese study subjects did not bring tiffin from home at school ([Table 1-A](#)). This finding is similar with Kumar K M *et al* (2011) (12) who also reported higher prevalence of overweight/ obesity in student who did not bring tiffin from home. In our study there was statistically significant association between irregular tiffin from home habit and overweight/obesity in study subjects.

Majority (42.93%) of overweight/obese study subjects consumed vegetables occasionally while only 3.83 overweight/obese study subjects consumed vegetables regularly and among the study subjects who consumed fruits occasionally, 16.67% were overweight / obese. Association between occasional consumption of vegetables/ fruit and overweight / obesity in study subjects was found to be statistically significant ([Table 1-A](#)). Similar findings regarding vegetable and fruit intake were seen by Kumar S. *et al* (2007) (9), Kotian S. M. *et al* (2010) (11), Goyal R. K. *et al* (2010) (20), Jain G. *et al* (2012) (21) and Banjade B. *et al* (2014) (22). The children with habits like irregular breakfast, irregular tiffin from home are more prone to consume outside energy dense food.

17.94% of students with non-vegetarian diet preference were overweight/ obese. Association between non-vegetarian diet and overweight / obesity in study subjects was found to be statistically significant ([Table 1-A](#)). Similar observations were made by Banjade B *et al* (2014) (22) in their study.

54.78% of overweight/obese study subjects visited restaurants more than once in a week. There was statistically significant association between restaurant visits more than once a week and overweight/obesity in study subjects ([Table 1-A](#)). Goyal R K *et al* (2010) (20) also reported the similar finding that obese and overweight children visit

restaurant more than once a week than their underweight and normal-weight counterparts.

In our study, 65.76% out of the total study subjects consumed fast/junk food regularly while Deshpande A V (2014) (23) observed that maximum (94%) study subjects consumed fast/junk food regularly. Among study subjects who consumed fast food regularly, 16.60% were overweight/ obese. Similar findings are seen by Kumar *et al* (2007) (9), Goyal R K *et al* (2010) (20), Jain G *et al* (2012) (21) and Banjade B *et al* (2014) (22). There was statistically significant association between fast food consumption and overweight/obesity in study subjects ([Table 1-B](#)). Jain S *et al* (2010) (15) and Vohra R *et al* (2011) (13) also found similar association.

Among study subjects who consumed carbonated drinks regularly 16.98% were overweight/ obese. Association between regular consumption of carbonated drinks and overweight / obesity in study subjects was found to be statistically significant ([Table 1-B](#)). Goyal J P *et al* (2011) (17) in their study also stated that that children consuming carbonated drink daily and more than three times per week were having 19.7 times and 6.9 times more risk of overweight and obesity while Kumar K M *et al* (2011) (12) stated that there was a positive co-relationship between overweight and obesity with the consumption of energy drinks regularly as the percentage was much higher in these (4.88% and 4.44%) compared to those who did not consume carbonated drinks regularly (0.72 and 1.81%).

Among study subjects with regular chocolate eating habit 16.21% study subjects were overweight/ obese. Association between regular chocolate eating habit and overweight / obesity in study subjects was found to be statistically significant ([Table 1-B](#)). These findings were comparable to results of Kotian S M *et al* (2010) (11) who found the higher prevalence of overweight/ obesity among those who ate chocolates daily in addition to a normal diet while Goyal R K *et al* (2010) (20) also reported that chocolate eating habits have more prevalence of obesity and overweight. Increased consumption of energy dense fast food and carbonated drinks were associated with increase in BMI of adolescents. Goyal R K *et al* (2010) (20) and Jain G *et al* (2012) (21) also reported similar findings.

Out of total study subjects 47.39% watched TV for more than two hours per day. Rani A M *et al* (2013) (24) reported that 30.40% students viewed TV more than two hours per day. Among study subjects who

viewed TV more than two hours per day, 21.47% were overweight/ obese ([Table 2](#)). Similar results were reported by Jain S *et al* (2010) (15), Goyal J P *et al* (2011) (17) and Chakraborty P *et al* (2011) (16). Association between TV watching for more than two hours per day and overweight / obesity in study subjects was found to be statistically significant ([Table 2](#)). Kuriyan R. *et al* (2007) (23) and Jain S *et al* (2010) (15) also reported similar association while Kumar K M *et al* (2011) (12) did not find any association between TV viewing for more than two hours and overweight/obesity.

In our study, out of total study subjects 58.06% used computer or mobile for more than two hours per day. This proportion was much higher than as reported by Rani A M *et al* (2013) (24) who in their study found it to be 28%. Among the study subjects who used computer or mobile more than 2 hours per day, 16.23% were overweight / obese. There was statistically significant association between computer or mobile use more than 2 hours per day and overweight/obesity in study subjects ([Table 2](#)). Chakraborty P *et al* (2011) (16) stated that the average screen time of hours per week among obese and overweight children was also higher as compared to normal children while Goyal J P *et al* (2011) (17) reported that computer use more than three hours increased risk of overweight/obesity in adolescents.

Outdoor Games per day: Out of the total study subjects only 21.83% were involved in regular outdoor games for more than 2 hours per day. This finding is in concordance with Deshpande A V (2014) (27%) (23) while Rani A M *et al* (2013) (24) reported very low percentage of study subjects involved in such activity (4.20%). Among the study subjects who played outdoor games occasionally, 18.12% were overweight / obese ([Table 2](#)). Similarly Goyal R K *et al* (2010) (20) stated obese and overweight children participated in sports less often than normal-weight and underweight participants while Chakraborty P *et al* (2011) (16) reported that the average outdoor activity was less among obese and overweight subjects. Also in our study, association between regular outdoor games per day and overweight / obesity in study subjects was found to be statistically significant which is in similarity with the results of Vohra R *et al* (2011) (13).

15.60% of study subjects were overweight/ obese among the study subjects who were involved in physical exercise occasionally. This was also

observed by Kumar K M *et al* (2011) (12) who reported that prevalence of overweight and obesity was high in those who didn't exercise regularly (3.2% and 4.51%) as compared to those who exercise regularly. Similarly Goyal R K *et al* (2010) (20) stated obese and overweight children participated in physical exercise less often than normal-weight and underweight participants. In our study, there was statistically significant association between occasional physical exercise and overweight/obesity in study subjects ([Table 2](#)).

In present study, out of total study subjects 17.74% walked to the school, 66.75% used cycle and 15.51% used motorized transport as a mode of conveyance. Similar pattern was observed by Deshpande A V (2014) (23) who reported that maximum (65.36%) students used cycle as a mode of conveyance followed by parental automobile 18.05%. However Rani A M *et al* (2013) (24) reported higher use of motorized vehicle (34.60%) by students for reaching school.

Among the study subjects who used motorized transport as a mode of conveyance, 34.40% were overweight /obese. Association between use of motorized transport for reaching school and overweight/obesity in study subjects was found to be statistically significant ([Table 2](#)). Similarly Goyal J P *et al* (2011) (17) stated that transport to school by bus or auto is associated with increased risk of overweight and obesity.

31.15% of study subjects were overweight/ obese among the study subjects who had habit of sleeping in afternoon. There was statistically significant association between sleeping habit in afternoon and overweight/obesity in study subjects ([Table 2](#)). Similarly Goyal R K *et al* (2010) (20) reported that overweight/obesity was more prevalent among children who were having sleeping habit in afternoon.

Conclusion

The important conclusion of this study was that irregular breakfast intake, occasional vegetable/ fruit consumption, restaurant visits more than once per week, regular consumption of fast food, carbonated drinks, chocolate eating habit, irregular outdoor games, occasional physical exercise, television watching and computer/mobile use for more than 2 hours per day, using motorized transportation and sleeping habit in the afternoon were associated with

higher magnitude of overweight and obesity in school going children.

Recommendation

At individual level, regular intake of healthy diet, regular physical exercise (in the form of cumulative moderate physical activity of at least 30 minutes every day, with an additional 20 minutes of vigorous physical activity 3 times a week) and active participation in household activities should be promoted. At school level, importance of nutrition, physical activity, games, and sports should be included in school curriculum, and facilities should be provided for outdoor games. Government should formulate policies against junk food related advertisements on TV. It is very necessary to spread awareness in the urban community on the aspects of healthy food habits and desired lifestyles to prevent overweight/obesity and its associated ill effects.

Limitation of the study

The information provided by the study subjects of class 7th to 10th is based on their recall memory. There are chances that the interpretation made by them may not be correct in view of their age and perception capacity. Waist to hip ratio and dietary history could not be assessed due to time limits and financial constraints.

Relevance of the study

Various unhealthy dietary habits and sedentary lifestyle behavior patterns are important risk factors associated with overweight and obesity in school going children.

Authors Contribution

AW, SN: Concept, Study Design, Literature search, Acquisition of data and analysis, Drafting and revising. DSM, PV, SB: Study Design, Data analysis, Drafting and revising. RPS: Concept, Study Design, Drafting and revising the article critically.

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Tables

TABLE 1(A) OVERWEIGHT/ OBESITY IN RELATION TO THE DIETARY HABITS OF STUDY SUBJECTS

Dietary Habits	Total n=806	Non-Overweight		Overweight/ Obese		Test of significance χ^2 d.f.=1,C.I.=95%
		No.	%	No.	%	
Breakfast Habit						
Regular	424	395	93.16	29	06.84	$\chi^2 = 34.98$ p ≤ 0.05
Irregular	382	300	78.54	82	21.46	
Tiffin from home						
Yes	603	551	91.38	52	08.62	$\chi^2 = 51.72$ p ≤ 0.05
No	203	144	70.94	59	29.06	
Vegetable intake						
Occasional	205	117	57.07	88	42.93	$\chi^2 = 193.51$ p ≤ 0.05
Regular	601	578	96.17	23	03.83	
Fruit intake						
Occasional	468	390	83.33	78	16.67	$\chi^2 = 7.30$ p ≤ 0.05
Regular	338	305	90.24	33	09.76	
Diet Preference						
Vegetarian	427	384	89.93	43	10.07	$\chi^2 = 09.82$ p ≤ 0.05
Non-vegetarian	379	311	82.06	68	17.94	
Restaurant visit/week						
Once or Nil	649	624	96.15	25	03.85	$\chi^2 = 271.81$ p ≤ 0.05
> Once	157	71	45.22	86	54.78	

TABLE 1(B) OVERWEIGHT/ OBESITY IN RELATION TO THE DIETARY HABITS OF STUDY SUBJECTS

Dietary Habits	Total n=806	Non-overweight		Overweight/ Obese		Test of significance χ^2 d.f.=1,C.I.=95%
		No.	%	No.	%	
Fast food consumption						
Occasional	276	253	91.67	23	08.33	$\chi^2 = 09.77$ p ≤ 0.05
Regular	530	442	83.40	88	16.60	
Carbonated drinks						

Occasional	223	211	94.62	12	05.38	$\chi^2= 17.31$ p ≤0.05
Regular	583	484	83.02	99	16.98	
Chocolate eating habit						
Present	512	429	83.79	83	16.21	$\chi^2= 06.48$ p ≤0.05
Absent	294	266	90.48	28	09.52	

TABLE 2 OVERWEIGHT/ OBESITY IN RELATION TO THE PHYSICAL ACTIVITY PATTERNS

Activity	Total n=806	Non-overweight		Overweight/ Obese		Test of significance χ^2 C.I.=95%
		No.	%	No.	%	
TV watching time/day						
< 2 hours	424	395	93.16	29	06.84	$\chi^2= 05.98$, d.f.=1, p ≤0.05
> 2 hours	382	300	78.53	82	21.47	
Computer or Mobile Use time/day						
< 2 hours	338	303	89.64	35	10.36	$\chi^2= 05.24$, d.f.=1, p ≤0.05
> 2 hours	468	392	83.76	76	16.23	
Outdoor Games/day						
Occasional	298	244	81.88	54	18.12	$\chi^2= 08.31$, d.f.=2 p ≤0.05
< 2 hours	332	292	87.95	40	12.05	
> 2 hours	176	159	90.34	17	09.64	
Physical Exercise/day						
Occasional	622	525	84.40	97	15.60	$\chi^2= 07.74$, d.f.=2 p ≤0.05
< 2 hours	108	99	91.67	09	08.33	
> 2 hours	76	71	93.42	05	6.58	
Mode of conveyance						
Walking	143	125	87.41	18	12.59	$\chi^2= 54.04$, d.f.=2 p ≤0.05
Cycling	538	488	90.71	50	09.29	
Motorized	125	82	65.60	43	34.40	
Sleeping habit in afternoon						
Regular	183	126	68.85	57	31.15	$\chi^2= 58.31$,d.f.=1 p ≤0.05
Irregular	623	569	91.33	54	08.67	

Figures

FIGURE 1 MAGNITUDE OF OVERWEIGHT AND OBESITY IN STUDY SUBJECTS (ON THE BASIS OF BMI)

