A study on overweight and obesity among schoolgoing adolescent girls in a district of Northern India

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ABSTRACT

Background: Among emerging public health problems globally, obesity remains a major cause associated with number of cardiovascular diseases. **Objectives:** Thus, the aim of present research work is to study the factors associated with overweight and obesity among schoolgoing adolescent girls. **Materials and Methods:** A cross-sectional study was conducted among 2400 schoolgoing adolescent girls in Barabanki, Uttar Pradesh, India from June 2016 to May 2017. Multistage sampling was used for enrolment of the study subjects. A pre-designed and pre-tested questionnaire was used for obtaining information related to biosocial, dietary, and physical activity-related information. Body weight and height were recorded for calculating body mass index (BMI). The WHO BMI-for-age cutoff classification of girls was used for the assessment of overweight and obesity. **Results:** On multivariate analysis, middle- and upper-socioeconomic status (odds ratio [OR]: 11.82; 95% confidence interval [CI]: 10.01–13.63, $P = 0.00$), general category (OR: 2.12; 95% CI: 1.98–2.26, $P = 0.03$), urban residence (OR: 1.84; 95% CI: 1.32–2.36, $P = 0.01$), mode of travel to school via bus (OR: 9.82; 95% CI: 7.56–10.08, $P = 0.00$), absence of outdoor physical activity (OR: 1.80; 95% CI: 1.66–1.94, $P = 0.03$), non-intake of vegetables everyday (OR: 2.21; 95% CI: 1.69–2.73, $P = 0.00$), and non-vegetarian dietary habits (OR: 2.08; 95% CI: 1.83–2.33, $P = 0.01$) were found to be the independent predictors of obesity and overweight among schoolgoing adolescent girls. **Conclusion:** There is need for comprehensive school-based awareness interventions with health education packages to focus importance of healthy nutrition and lifestyle for preventing obesity.

KEY WORDS: Adolescents; Obesity; Overweight

INTRODUCTION

For more than 20,000 years, obesity has affected the human life in psychological as well as physiological aspects.[1] The WHO has defined obesity and overweight as "abnormal or excessive fat accumulation that presents a risk to health.[2]"Obesity has been realized as one of the most decisive risk factors for non-communicable diseases (NCDs) leading to substantial public health burden.[3] Obesity has been found to be associated with an increased risk for a number of disease entities including Type 2 diabetes mellitus, hypertension, cardiovascular diseases, musculoskeletal disorders, cancers, and obstructive sleep apnea. Moreover, in the present society where so much importance is given on appearance and looks, obese individual often experience discrimination with rejection at school as well as their workplaces.

Obesity has reached globally to epidemic proportion. More than billion adults are overweight with 300 million of them diagnosed as clinically obese. Evidences indicate towards increased likelihood of the future generation childhood

and adolescent obesity. An estimated 10.0% of children in school-age group are overweight and 2–3% of them are obese.[4] Systematic review in context to India reported the prevalence of overweight and among adolescents ranged from 2.2% to 25.8% and 0.73% to 14.6%, respectively.[5] The factual implication of epidemiological transition fits in relation to obesity also, as the problem is now taking the developing economies in grasp. Moreover, the situation is even encroaching toward the rural setups too. Therefore, the problem of overweight and obesity has crossed the normal boundaries of economies, residence, age groups, gender, etc., and is showing a totally transforming scenario currently.

A major concern is the increased trends of obesity and overweight in younger age groups. Excess of body fat negatively affects the physical and psychosocial well-being of the children. Even this group of children are likely to stay obese during their adulthood and are more preponderate to develop NCDs. Childhood obesity is now more commonly observed due to changed lifestyle of families with increased in their purchasing power. A part from that time of engagement in sedentary work has also increased due to accelerating preference of children toward mobiles, television, video games, and computers, etc. Evening games with friends and physical activity has now been reduced or voided due to virtual technologies. A large proportion of undernourished children coexist with these overweight/obese groups. The problem has now entrapped the children and adolescents in rural areas also. Adolescent life phase is a critical fortuity phase for inculcating healthy lifestyle and behavioral changes because during this time there cognitive as well behavioral domain is best to adopt necessary and healthy habits in the long term.[6] Inculcation of healthy dietary and physical activity habits during early phases of life is realized to be the most impacting and cost-effective way to deal with the forthcoming problem.

There are limited research work on overweight and obesity among adolescent school girls and those available had been carried out in cities only. The aim of the present research was to study the prevalence of overweight and obesity among adolescent girls Barabanki district of Uttar pradesh. Secondarily, an attempt will be made to study the factors associated with overweight and obesity among schoolgoing adolescent girls.

MATERIALS AND METHODS

Study Design

The study was a cross-sectional study.

Study Settings

The study was conducted in government and private schools and inter colleges of the Barabanki district, Uttar Pradesh.

Study Duration

The study was conducted from June 2016 to May 2017.

Study Population

The study population included schoolgoing girls aged 10–19 years.

Sample Size

Optimal sample size was calculated on the basis of 4.17% prevalence of overweight;[7] with an absolute precision of 20%. The sample size estimated was about 2400 using the formula z^2pq/e^2; where, p = prevalence of overweight in community q=1-p, e = allowable error.[8]

Study Subjects

Schoolgoing girls enrolled in class 6th, 7th, 8th, 9th, 10th, 11th, and 12th in adolescent age group.

Exclusion Criteria

The students who were not willing to participate in the study and those who were absent on the day of interview were excluded from the study.

Sampling Technique

Multistage sampling method was used in the present study. A total eight schools (four from urban schools and two schools each from two selected rural blocks) were selected randomly from list of schools obtained from the school authorities (District Education Office). Probability proportionate to size of the population technique was used to include students from both government and private institutions. In the firststage of the study, Barabanki district was divided into urban Barabanki and blocks of rural Barabanki. From the different blocks of rural Barabanki, two blocks were randomly selected. In the second stage, list of government/government-aided schools and private schools of Barabanki urban area and schools of two selected rural blocks were prepared. In the third stage, two government/government-aided schools and two private schools were randomly selected from the urban area. Two schools were randomly selected from each of the rural blocks. Prior permission was obtained from the principals of the selected schools for conducting the study. In the fourth stage, in each of the selected schools; list of students enrolled in classes was obtained. The students enrolled in these classes were randomly selected from each class. Thus, a total number of students covered from all the randomly selected eight schools, were 2400.

Data Collection

After briefing about the study and its purpose and assuring full confidentiality to the participants, a pre-designed, pre-tested,

self-administered questionnaire prepared in local language was given to the students according to their medium of instruction. Each question was elaborated by one of the investigators, and simultaneously, the students were asked to fill in their answers in the questionnaire. The pre-designed and pre-tested questionnaire included questions such as type of family, literacy status, occupation of father and mother, going to school by bus or bicycle, eating habits, playing video/computer games or outdoor games, sibling count. The date of birth of each student was taken from the school records to verify the age. After filling the questionnaire, study subjects were called to a separate room to take their anthropometric measurements. Privacy was maintained and a female paramedical health worker was present while taking the measurements.

Anthropometric Measurements

Weight

The weight of adolescents was recorded without footwear using electronic weighing machine having 0.1 kg accuracy.

Height

The height was measured with the help of the stadiometer, in standing position, bare foot with heels close to each other and maintaining the head in Frankfort line with accuracy up to 0.5 cm.

Assessment of Overweight and Obesity

The WHO body mass index (BMI)-for-age cutoff classification of girls was used for the assessment of overweight and obesity with overweight: >+1SD (equivalent to BMI 25 kg/m^2 at 19 years); obesity: >+2SD (equivalent to BMI 30 kg/m^2 at 19 years); underweight: <−2SD; and severe underweight: <−3SD.[9]

Statistical Analysis

Logistic regression analysis was carried out to identify possible associated factors for overweight and obesity. The dependent variable was "overweight and obesity" (coded as overweight and obesity Yes = 1 and No = 0) and, the independent variables were - age of adolescents, category, study class, type of family, type of school, parental education, socioeconomic status of parents, mode of travel to school, physical activity such as participation in indoor and outdoor games, household activities, physical inactivity (such as watching television and playing computer/video games), frequency of eating fast foods, and consuming soft/junk drinks. Value of $P < 0.05$ has been considered as statistically significant.

Ethical Considerations

This study was approved by the Institutional Ethics Committee of Hind Institute of Medical Sciences, Safedabad, Barabanki, Uttar Pradesh.

RESULTS

Among the total of 2400 students, 503 (21.0%) were early adolescents (10–13 years), 1100 (45.8%) were mid-adolescents (14–16 years), and 797 (33.2%) were late adolescents (17–19 years). Majority (73.9%) were Hindus and about one-fourth (26.1%) were Non-Hindu (Muslims and Christians). Almost one-third (37.4%) belonged to general caste, followed by 44.3% other backward class and 18.3% scheduled caste/scheduled tribe. Majority (61.2%) of the students belonged to class lower socioeconomic status. About two-third (62.5%) were from the rural background. About half of the students in the study population were from government schools, with 13.3% in government-aided schools and 36.7% from private schools. The fathers of one-fourth (24.6%) students were illiterate. Only 3.7% of the fathers were graduate level or above. Majority of the mothers 1876 (78.1%) were homemakers [Table 1].

Out of 2400 students, 1127 (47.0%) were underweight, 1068 (44.5%) were of normal weight, 141 (5.9%) were overweight, and only 64 (2.7%) were found to be obese [Table 2].

On univariate analysis those who belong to mid- and late-adolescent age group, Hindu religion, general or schedule castes, nuclear type family, middle- and upper-socioeconomic status, urban residence, studying in private schools and English medium, literate and with professional occupation status of parents, travelling to school via bus or other transport, absence of outdoor physical activity, non-engagement in household works, non-intake of fruits and vegetables with frequent consumption of fast food and soft drink, and non-vegetarian diet intake were found to be significantly having more risk toward overweight and obesity.

On multivariate analysis, those who belonged to general category (odds ratio [OR]: 2.12; 95% confidence interval [CI]: 1.98–2.26, $P = 0.03$), middle- and upper-socioeconomic status (OR: 11.82; 95% CI: 10.01–13.63, $P = 0.00$), urban residence (OR: 1.84; 95% CI: 1.32–2.36, $P = 0.01$), mode of travel to school via bus (OR: 9.82; 95% CI: 7.56–10.08, $P = 0.00$), absence of outdoor physical activity (OR: 1.80; 95% CI: 1.66–1.94, $P = 0.03$), non-intake of vegetables everyday (OR: 2.21; 95% CI: 1.69–2.73, $P = 0.00$), and non-vegetarian dietary habits (OR: 2.08; 95% CI: 1.83–2.33, $P = 0.01$) were found to be the independent predictors of obesity and overweight among schoolgoing adolescent girls [Table 3].

DISCUSSION

In the present study, the prevalence of overweight and obesity was found to be 5.9% and 2.7%, respectively. Furthermore, on multivariate analysis, those who belonged to general category middle- and upper-socioeconomic status, urban residence, mode of travel to school via bus, absence of outdoor physical

Table 1: Distribution of schoolgoing adolescent girls according to their biosocial characteristics (*n*=2400)

Biosocial characteristics	*n* (%)
Age group (years)	
Early adolescents (10–13)	503 (21.0)
Mid-adolescents (14–16)	1100 (45.8)
Late adolescents (17–19)	797 (33.2)
Religion	
Hindu	1774 (73.9)
Non-Hindu	626 (26.1)
Category	
General	897 (37.4)
Other backward class	1065 (44.3)
Scheduled caste/Scheduled tribe	438 (18.3)
Socioeconomic status**	
Upper	43 (1.8)
Upper middle	125 (5.2)
Middle	222 (9.2)
Lower middle	542 (22.6)
Lower	1468 (61.2)
Residence	
Rural	1500 (62.5)
Urban	900 (37.5)
Type of family	
Nuclear	1101 (45.9)
Joint	1299 (54.1)
Type of school	
Government	1202 (50.1)
Government-aided	318 (13.3)
Private	880 (36.7)
Medium of instruction	
English	640 (26.7)
Hindi	1760 (73.3)
Father education	
Illiterate	591 (24.6)
Primary	438 (18.2)
Middle	276 (11.5)
High school	614 (25.6)
Intermediate	328 (13.7)
Technical diploma	65 (2.7)
Graduate and above	88 (3.7)
Mother education	
Illiterate	1136 (47.3)
Primary	497 (20.7)
Middle	239 (10.0)
High school	276 (11.5)
Intermediate	145 (6.0)
Technical diploma	38 (1.6)
Graduate and above	69 (2.9)

(Contd...)

Table 1: *(Continued)*

Biosocial characteristics	*n* (%)
Father occupation	
Unemployed	121 (5.0)
Labor	570 (23.8)
Farmer	904 (37.7)
Service	436 (18.2)
Business	269 (11.2)
Professional	100 (4.2)
Mother occupation	
Homemaker	1876 (78.1)
Labor	157 (6.5)
Farmer	162 (6.8)
Service	159 (6.6)
Business	33 (1.4)
Professional	13 (0.5)

**Modified BG Prasad Socioeconomic scale 2017

Table 2: Distribution of adolescent girls according to their BMI (*n*=2400)

BMI classification	*n* (%)
Underweight	1127 (47.0)
Normal	1068 (44.5)
Overweight	141 (5.9)
Obese	64 (2.7)
Total	2400 (100)

BMI: Body mass index

activity, non-intake of vegetables everyday, and non-vegetarian dietary habits were found to be the independent predictors of obesity and overweight among schoolgoing adolescent girls.

The prevalence of overweight and obesity was quite comparable to the findings of studies in other parts of India.[10-12] However, studies conducted by Anuradha *et al.*, Nawab *et al.*, and Jain *et al.* reported comparatively higher prevalence ranging from 9.8% to 23.8% and 4.8% to 8.4%, respectively.[13-15] In contradiction to that, Vohra *et al.* reported comparatively lower prevalence (4.17% and 0.27%, respectively).[7] Furthermore, a study conducted by Bharati *et al.* reported about 3.1% and 1.2% of the schoolgoing students to be affected by overweight and obesity.[3] This variation in the prevalence could be explained due to the difference in baseline characteristic of the study population as the schoolgoing students belonged to different states with different culture and dietary pattern. Furthermore, the variation could be explained by the difference in the method and criteria used for assessment of overweight and obesity. Some used the WHO BMI standard while other used International Obesity Task Force and others used Khadilkar's BMI cutoff criteria. Similar to the findings of previous studies, the proportion of overweight and obese students in mid- and late-adolescent age group were more.[16-19] However, the association was

Table 3: Univariate and multivariate analysis of the factors associated with overweight and obesity

Variables	Overweight/obesity			Unadjusted OR (95% CI)	Adjusted OR (95% CI)
	Present	**Absent**	**Total**		
	(*n*=205)	**(*n*=2195)**	**(*n*=2400)**		
Age category (years)					
Mid and late adolescents (14–19)	181 (9.5)	1716 (90.5)	1897	2.10 (1.35–3.26)	1.23 (0.93–1.53)
Early adolescents (10–13)	24 (4.8)	479 (95.2)	503	Reference	
Religion					
Hindu	1670 (94.1)	104 (5.9)	1774	3.08 (2.31–4.13)	1.12 (0.66–1.58)
Non-Hindu	525 (83.9)	101 (16.1)	626	Reference	
Category					
General	108 (12.0)	789 (88.0)	897	2.21 (1.60-3.07)	2.12 (1.98–2.26)*
Scheduled caste/scheduled tribe	35 (8.0)	403 (92.0)	438	1.41 (0.91–2.16)	1.01 (0.39–1.63)
Other backward class	62 (5.8)	1003 (94.2)	1065	Reference	
Type of family					
Nuclear (*n*=1101)	126 (11.4)	975 (88.6)	1101	1.99 (1.48–2.67)	1.32 (0.36–2.28)
Joint (*n*=1299)	79 (6.1)	1220 (93.9)	1299	Reference	
Socioeconomic class*					
Upper, upper middle, and middle (*n*=389)	151 (38.8)	238 (61.2)	389	22.9 (16.3–32.2)	11.82 (10.01–13.63)*
Lower middle/lower (*n*=2011)	54 (2.7)	1957 (97.3)	2011	Reference	
Residence					
Urban	127 (14.1)	773 (85.9)	900	2.99 (2.22–4.02)	1.84 (1.32–2.36)*
Rural	78 (5.2)	1422 (94.8)	1500	Reference	
Type of school					
Private	106 (12.0)	774 (88.0)	880	1.96 (1.47–2.62)	1.00 (0.88–1.12)
Government/government-aided	99 (6.5)	1421 (93.5)	1520	Reference	
Medium of instruction					
English	116 (18.1)	524 (81.9)	640	4.15 (3.10–5.57)	1.83 (0.90–2.79)
Hindi	89 (5.1)	1671 (94.9)	1760	Reference	
Father education					
Middle school and above	182 (13.3)	1189 (86.7)	1371	6.69 (4.30–10.41)	1.02 (0.70–1.34)
Upto primary	23 (2.2)	1006 (97.8)	1029	Reference	
Mother education					
Middle school and above	155 (20.2)	612 (79.8)	767	8.018 (5.75–11.1)	1.43 (0.84–2.02)
Upto primary	50 (3.1)	1583 (96.9)	1633	Reference	
Father occupation					
Professional/Service/Business	168 (20.9)	637 (79.1)	805	11.10 (7.68–16.0)	1.02 (0.79–1.25)
Unemployed/Labour/Farmer	37 (2.3)	1558 (97.7)	1595	Reference	
Mother occupation					
Others	149 (28.4)	375 (71.6)	524	12.91 (9.31–17.9)	1.12 (0.45–1.79)
Unemployed	56 (3.0)	1820 (97.0)	1876	Reference	
Mode of travel to school					
School bus/other transport	140 (37.6)	232 (62.4)	372	18.2 (13.1–25.2)	9.82 (7.56–10.08)*
Walking/bicycle	65 (3.2)	1963 (96.8)	2028	Reference	
Outdoor physical activity					
Absent	117 (15.0)	66 (85.0)	781	3.06 (2.29–4.10)	1.80 (1.66–1.94)*
Present	88 (5.4)	1531 (94.6)	1619	Reference	
Indoor activity					
Present	127 (9.2)	1260 (90.8)	1387	1.20 (0.90–1.62)	1.00 (0.92–1.08)

(Contd...)

Table 3: *(Continued)*

Variables	Overweight/obesity			Unadjusted OR (95% CI)	Adjusted OR (95% CI)
	Present	**Absent**	**Total**		
	(*n*=205)	**(*n*=2195)**	**(*n*=2400)**		
Absent	78 (7.7)	935 (92.3)	1013	Reference	
Household activity					
Absent	104 (11.0)	844 (89.0)	948	1.64 (1.23–2.19)	1.00 (0.65–1.35)
Present	101 (7.0)	1351 (93.0)	1452	Reference	
Watching television/engagement in social media for more than 1 h a day					
Present	177 (12.0)	1301 (88.0)	1478	4.34 (2.89–6.53)	2.12 (1.51–2.73)
Absent	28 (3.0)	894 (97.0)	922	Reference	
Fruit intake everyday					
No	23 (15.3)	127 (84.7)	150	2.05 (1.28–3.29)	1.34 (0.72–1.96)
Yes	182 (8.1)	2068 (91.9)	2250	Reference	
Vegetable intake everyday					
No	39 (31.0)	87 (69.0)	126	5.69 (3.78–8.57)	2.21 (1.69–2.73)*
Yes	166 (7.3)	2108 (92.7)	2274	Reference	
Soft drink					
Yes	176 (9.6)	1661 (90.4)	1837	1.95 (1.30–2.93)	1.01 (0.92–1.09)
No	29 (5.2)	534 (94.8)	563	Reference	
Fast food consumption everyday					
Yes	123 (11.7)	174 (88.3)	197	1.46 (0.92–2.32)	NA
No	82 (8.3)	2021 (91.7)	2203	Reference	
Dietary habit					
Non-vegetarian	145 (20.5)	562 (79.5)	707	7.02 (5.12–9.62)	2.08 (1.83–2.33)
Vegetarian	60 (3.5)	1633 (96.5)	1693	Reference	

*Modified BG Prasad socioeconomic scale 2017. OR: Odds ratio, CI: Confidence interval

statistically non-significant. This might be explained by the fact that the elder age group are exposed to modern lifestyle and therefore more predisposed to dietary risk factors. However, when viewed in context to socioeconomic status, those who belong to affluent group (higher socioeconomic status) were significantly more at risk of being overweight and obesity. Similar findings were also reported in earlier studies too.[10,11,14,17,20,21] Even a nationwide survey report by the National Institute of Nutrition, India, revealed the prevalence of overweight and obesity significantly higher among adolescent of higher socioeconomic status.[22] This could be attributed to the fact that those belonging to affluent group have more purchasing power and therefore are more habitual toward intake of food items from outside in the form of snacks, junk food, street dishes, etc., having high content of trans-fatty acids. On multivariate analysis, the schoolgoing adolescent girls belong to general category were at higher risk of overweight and obesity. This finding might be partially explained through its substantial relation to socioeconomic status subgroup interaction. On univariate analysis, parental education and occupation were found to be significantly associated with the risk of overweight and obesity. However, during regression, although the risk still persists, the association became non-significant. The findings could be compared with earlier studies leading overall same inference.[7,10,13,22,23] The

conclusions drawn were quite a matter of concern, as the more education and affluent status increases the risk of overweight and obesity. This revealed that although the parents are educated but their knowledge in context to hazards of being overweight and their perception regarding same is suboptimal from health point of view. Other than that decreased physical activity in terms reduced outdoor physical work involvement, more preference toward time spend in watching television and social media and adapting a non-exhausting feasible and easy way for school via bus or other vehicle (replacing the classical walking and use of bicycle) were found as important factor increasing the risk toward higher BMI. Similar findings were also reported in earlier studies.[7,12,17,22] These coherent findings enlighten the known fact that luxurious and changing lifestyle has replaced social activities including outdoor games, thereby disturbing the normal catabolism mechanism of body leading to increased BMI. Nawab *et al.* and Laxmaiah *et al.* also reported that watching television more than 2–3 h a day increases the risk of overweight and obesity.[12,14] In context to dietary pattern, those who were non-vegetarian were about 2 times more preponderate toward the risk of overweight and obesity. Studies done in other parts of India also reported the non-vegetarian diet preference to be one of the risk factors of the overweight and obesity.[17,21] This association is attributed to the fact that animal food products contain much more fat

than plant-based items. Therefore, consumption of such items frequently leads to weight gain with increased BMI.

The strength of the study lies in the fact that a population consisting of adolescents which is quite preponderate toward the risk of obesity in the future was studied and the finding revealed the real situation in a poor performing state like Uttar Pradesh. Furthermore, a large sample size was enrolled which reflects the more pooled findings. However, the study has some limitations. Since the study was conducted in schools therefore the results could not be generalized to whole community settings. Furthermore, since the study population consists of adolescent girls, findings could not be implicated for both genders.

CONCLUSION

The findings of the study indicate toward the increasing proportion of overweight and obesity adolescent females, with their continuously spanning domain in urban areas. To buildup a healthy future generation, the findings stipulates the importance of healthy lifestyle and behavioral changes in context to physical activity inculcation in the daily routine of the children from earlier stages itself. Apart from that special focus should be emphasized among different biosocial groups through combined and coordinated primordial and primary prevention strategies. The parents should be taken into confidence to accompany and boost their kids as they are the soul decider and most decisive stakeholder in all sorts of preventive strategies.

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