



Original Research Article

STUDY OF DISTRIBUTION AND DETERMINANTS OF OVERWEIGHT & OBESITY AMONG SCHOOL-GOING ADOLESCENTS IN AGRA CITY

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ABSTRACT

Background: Over-nutrition, excessive intake of nutrients, leading to weight gain is modern day epidemic especially among children and adolescents. Proportion of overweight and obesity and related dietary and life-style factors need to be studied in details. **Objective:** to find the distribution and determinants of overweight & obesity among school-going adolescents in Agra city.

Materials and Methods: Cross-sectional surveys were conducted in selected government and private schools of Agra city. BMI-for-age for boys and girls by the WHO were used to classify overweight and obesity. A total of 480 students aged 10-19 years were studied. Appropriate statistical tests were applied for the analysis.

Results: 17.91% of school-going adolescents in Agra city were overweight; while 9.38% were obese. Among socio-demographic factors; gender and class of study were found to have no statistically significant association with over-nutrition whereas age, type of school, socio-economic class and mother's education were significantly associated with over-weight and obesity. Among life style factors; moderate to vigorous daily physical activity, mode of transport to school and screen time were found to have a statistically significant association; whereas dietary factors like number of meals per day, regularity of breakfast, amount of fruits & vegetables eaten per day, and consumption of cold drinks/beverages had a significant association with over-weight and obesity among school-going adolescents in Agra city.

Conclusion: As many dietary and life-style factors are significantly associated with overweight and obesity among school-going adolescents, special attention should be paid towards them during routine school health services.

Keywords: Over-nutrition, life-style, dietary habits, BMI-for-age, overweight, obese.

INTRODUCTION

Adolescence is treated as a transition period from childhood to adulthood. During this transitional phase, adolescents develop behavioral patterns and make lifestyles that can also affect their present health and future. Early stage of adolescent is characterized by an exceptionally rapid rate of

growth and is often variable in individuals due to its dependence on genetic hormonal and nutritional factors. Though adolescents face many health problems, malnutrition (both under-nutrition and over-nutrition) is one of their biggest health concerns.

Over-nutrition refers to an excessive intake of nutrients, particularly energy-dense foods, leading to

weight gain and an increased risk of obesity and related chronic diseases. Body mass index (BMI) is an index of weight-for-height commonly used to classify overweight and obesity. It is defined as a person's weight in kilograms divided by the square of his/her height in meters (kg/m^2). In adults, overweight is defined as a BMI of 25 or more, whereas obesity is a BMI of 30 or more.^[1] Among children and adolescents, BMI thresholds for overweight and obesity vary by age. The WHO has developed growth charts in accordance with the WHO Child Growth Standards, 2007 for boys and girls separately.^[2]

Among school-going adolescents, over-nutrition has become a significant public health concern which can result in both immediate and long-term health problems, affecting physical, social, and psychological well-being. Obesity in adolescents is a risk factor for obesity in adulthood. In addition to socio-demographic and genetic factors, adolescent obesity may be attributed to physical inactivity and unhealthy diets rich in sugar and fats, and other environmental factors. According to World Obesity Atlas 2022, India is predicted to have more than 27 million obese children, representing one in 10 children globally, by 2030. Recent Indian studies have shown the prevalence of overweight and obesity among adolescents in the range of 10 to 30%. Though modern life-style and changed dietary pattern in India has a definite impact on the occurrence of overweight and obesity; quantification of such life-style and dietary factors remain understudied. With this background a study was planned to determine the prevalence of obesity among school-going adolescents and its association with socio-demographic, lifestyle, and dietary factors.

MATERIALS AND METHODS

A descriptive observational study was done in randomly selected public and private schools of Agra city in which cross-sectional surveys were conducted to find the distribution and determinants of overweight and obesity among school-going adolescents. The study population comprised of all adolescents, in the age group of 10-19 years, attending all public and private schools of Agra city in Uttar Pradesh, India. The study was conducted between October 2020 and September 2022. A multistage random sampling was used for selection of schools, section of class, and desired number of students to reach the final sample. The selected schools were visited more than once, as per the need of the study, to ensure co-operation of school administration and collection of data. Actual surveys for collection of data were conducted between January and June, 2022.

Sample size: The formula, $N = Z^2 \times (pq) / d^2$ was used for the calculation of sample size; where Z is standard normal deviate, p is prevalence of disease,

q is 100 minus p, and d is allowable error. The study conducted by Jayalakshmi M (2018) in Kancheepuram district of Tamil Nadu was taken as reference study in which the prevalence of overweight and obesity among school-going adolescents was found to be 24.5%.⁴ So; for $Z=1.96$, $p=24.5$, $q=100-p=75.5$, and $d=20\%$ of $p=4.9$, a sample size $n = 3.84 \times 24.5 \times 75.5 / 4.9 \times 4.9 = 7103 / 24 = 295$ was calculated. For an effect size of 1.5; sample size came to 442. To compensate non-responders and for ensuring equal representation from public and private schools, boys and girls, and students from class 6th to 11th standard, a final tally of 480 was decided as adequate sample size for the present study.

Inclusion Criteria: All adolescents, aged between 10 and 19 years, studying in 6th to 11th standard of selected public and private schools were included in the study.

Exclusion Criteria: Students who were absent due to any reason on the day of data collection or who were not willing to participate in the study were excluded from the study.

Sampling Technique: In first stage, two public schools – one boy's and one girl's school and one co-educational private school were selected randomly from the lists of schools in Agra city obtained from the district education department. In second stage, one section was selected from each class, 6th to 11th, randomly. In third stage; desired number of girl and or boy students was selected from selected section of class by a simple random sampling till the desired number was achieved.



Methodology: A preliminary visit was paid to the selected schools and the principal was informed about the objective and methodology of the study. After obtaining an informed written consent from him, a section of each class was selected randomly and its class teacher was informed about the study and suitable date and timing for collection of data was decided. At the time of data collection, verbal consent/assent was also taken from the study participants. Socio-demographic characteristics, life-style and dietary factors were recorded using a pre-designed and pre-tested, semi-structured, self-administered anonymous questionnaire. Physical examination was done in a separate room, in presence of an attendant/teacher of same sex. Weight and height of the subjects was recorded using a standard technique and body mass index (BMI) was calculated. The BMI for age graphs for boys and girls, developed by the WHO, were used to classify each subject into one of the following categories: obesity (>97th percentile), overweight (85th-97th percentile), normal (15th-85th percentile), thinness (3rd-15th percentile), and severe thinness (<3rd percentile). Confidentiality of subjects was maintained throughout the study. Ethical approval was taken from institutional ethical committee of S. N. Medical College, Agra before commencing the study. Data thus collected was entered into Microsoft excel and transferred to SPSS software for analysis. Appropriate statistical tests were used in the study.

RESULTS

A cross-sectional study was conducted among 480 school-going adolescents to find the distribution and determinants of overweight & obesity in urban Agra. An equal representation was kept from each type of school (public and private), each class (6th to 11th standard), and each sex (male and female). The graph 1 shows that more than one fourth of the study participants were either overweight (17.91%) or obese (9.38%) based on the W.H.O. classification i.e. B.M.I. for age.

Maximum 52.5% of the students were early adolescents; while 41.25% were mid adolescents and 6.25% were late adolescents. Mean age of study participants was 13.36±1.96 years with a range of 10-18 (in completed years). More than half of the study participants belonged to middle socio-economic class; while only 2.91% belonged to upper class. Mothers of 40.42% students were graduates/post-graduates; while 23.54% were illiterate. 54.38% of students were involved in physical activities for at least 60 minutes per day; while 52.91% were using an auto-mobile to travel to the school. Majority 61.67% had sleep of 08-10 hours per day; while 48.13% used to watch screen for ≥2 hours per day. Only 2.91% reportedly used to smoke cigarette while 1.66% had ever consumed

alcohol. Almost 2/3rd of the students were taking meals <5 times per day while 28.75% reportedly used to eat <400 grams of fruits and vegetables per day. One in every five students (21.45%) were skipping their breakfast routinely; while 61.66% used to consume carbonated soft drink/cold drink regularly and 52.5% accepted having meal while studying or watching television.

Table 1 shows that male students have higher proportion of overweight & obesity in comparison to female; but the observed differences were statistically not significant (p value =0.18). Similarly; statistically significant difference was not observed between over-nutrition and class of study (p value =0.17). The highest proportion of overweight & obesity (B.M.I. for age is ≥85th percentile) was found among the age group of 10-13 years and a declining trend of over-nutrition was observed with the advancing age (p value =0.03). Over-nutrition was twice as common among students of private schools (36.7%) in comparison to students of government schools (17.9%) with a p value of 0.000. Highest proportion of overweight & obesity was observed in upper socio-economic class students (61.5%); whereas students of middle class had 32.2% and students of lower class has lowest 6.7% proportion of overweight & obesity (p value= 0.000). The study also found a significant difference in the proportion of overweight & obesity among study subjects and their mother's education. Highest proportion of overweight & obesity was observed among subjects whose mother were graduates & post-graduates; while lowest proportion was observed among subjects whose mothers were studied up to high school (p=0.000).

Table 2 shows that proportion of overweight & obesity was more among those who were involved in moderate to vigorous physical activity for less than 60 minutes per day (p=0.006). The proportion of over-nutrition was highest among those who used to reach their school by auto-mobile (35.3%); while it was lowest 10.8% among those who used to reach their school by a cycle (p=0.000). The proportion of overweight & obesity was significantly higher among those whose daily screen time was more than 2 hours (p=0.000). Rest of the life style factors studied like; duration of sleep and consumption of alcohol & smoking, were found to have no statistically significant association with over-nutrition in the present study.

Table 3 shows that students who were taking more than or equal to five meals per day (p=0.009), taking breakfast daily (p=0.005), taking ≥400 grams of fruits & vegetables per day (p=0.000), and consuming cold drinks/beverages (p=0.000) had higher proportion of over-nutrition in compared to their counterparts. On the other hand; consumption of meal while studying or watching TV was not found to have an association with over-nutrition in the present study.

Table 1: Association of socio-demographic characteristics and over-nutrition among school-going adolescents (N=480)

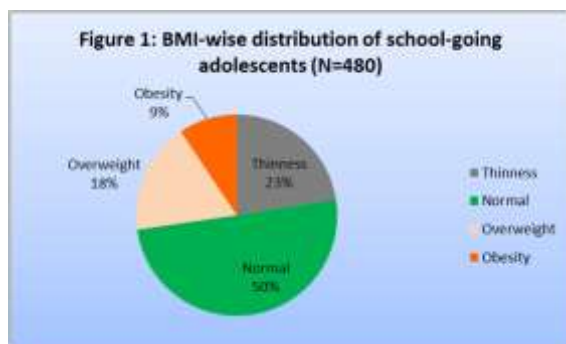
Variables	Category	Body mass index (B.M.I.)		Total Number (%)	Chi-sq, df, p-value
		<85 th percentile n (%)	≥85 th percentile n (%)		
Sex	Male	168 (70%)	72 (30%)	240 (50%)	1.77, 1, 0.18
	Female	181 (75.4%)	59 (24.6%)	240 (50%)	
Standard	6	52 (65%)	28 (35%)	80 (16.67%)	7.73, 5, 0.17
	7	52 (65%)	28 (35%)	80 (16.67%)	
	8	59 (73.75%)	21 (26.25%)	80 (16.67%)	
	9	61 (76.25%)	19 (23.75%)	80 (16.67%)	
	10	62 (77.5%)	18 (22.5%)	80 (16.67%)	
	11	63 (78.75%)	17 (21.25%)	80 (16.67%)	
School type	Private	152 (63.3%)	88 (36.7%)	240 (50%)	21.26, 1, 0.000
	Government	197 (82.1%)	43 (17.9%)	240 (50%)	
Age group (in years)	10-13	178 (70.6%)	74 (29.4%)	252 (52.5%)	7.00, 2, 0.03
	14-16	143 (72.2%)	55 (27.8%)	198 (41.25%)	
	17-19	28 (93.3%)	2 (6.7%)	30 (6.25%)	
Socio-Economic Status	Upper	5 (38.5%)	8 (61.5%)	13 (2.91%)	17.7, 2, 0.000
	Middle	175 (67.8%)	83 (32.2%)	258 (53.75%)	
	Lower	169 (80.9%)	40 (19.1%)	209 (43.54%)	
Mother's education	Illiterate	90 (79.6%)	23 (20.4%)	113 (23.54%)	21.4, 5, 0.000
	Primary school	49 (80.3%)	12 (19.7%)	61 (12.71%)	
	Middle school	30 (78.9%)	8 (21.1%)	38 (7.92%)	
	High School	36 (87.8%)	5 (12.2%)	41 (8.54%)	
	Intermediate	24 (72.7%)	9 (27.3%)	33 (6.87%)	
	Graduate/PG	120 (61.9%)	74 (38.1)	194 (40.42%)	

Table 2: Association of life-style factors and over-nutrition among school-going adolescents (N=480)

Variables	Category	Body mass index (B.M.I.)		Total Number (%)	Chi-sq, df, p-value
		<85 th percentile n (%)	≥85 th percentile n (%)		
Daily mod-to-vigorous activity	<60 min.	143 (66.5%)	72 (33.5%)	215 (44.79%)	7.53, 1, 0.006
	≥60 min.	206 (77.7%)	59 (22.3 %)	265 (55.21%)	
Mode of transport to school	Cycling	66 (89.2%)	8 (10.8%)	74 (15.20%)	20.4, 2, 0.000
	Walking	120 (77.9%)	34 (22.1%)	154 (31.87%)	
	Automobiles	163 (64.7%)	89 (35.3%)	252 (52.91%)	
Daily sleeping hours	<8 hours	127 (71.8%)	50 (28.2%)	177 (36.88%)	0.12, 1, 0.71
	≥8 hours	222 (73.3%)	81 (26.7%)	303 (63.12%)	
Daily screen time	≤2 hours	200 (80.3%)	49 (19.7%)	249 (51.87%)	15.1, 1, 0.000
	>2 hours	149 (64.5%)	82 (35.5%)	231 (48.13%)	
Smoking cigarette	Yes	10 (76.9%)	3 (23.1%)	13 (2.71%)	0.11, 1, 0.79
	No	339 (72.6%)	128 (27.4%)	467 (97.29%)	
Alcohol consumption	Yes	5 (62.5%)	3 (37.5%)	8 (1.66%)	0.42, 1, 0.51
	No	344 (72.9%)	128 (27.1%)	472 (98.34%)	

Table 3: Association of dietary factors and over-nutrition among school-going adolescents (N=480)

Variables	Category	Body mass index (B.M.I.)		Total Number (%)	Chi-sq, df, p-value
		<85 th percentile n (%)	≥85 th percentile n (%)		
Meals per day	<5 times	258 (76.1%)	81 (23.9%)	339 (70.62%)	6.71, 1, 0.009
	≥5 times	91 (64.5%)	50 (35.5%)	141 (29.38%)	
Daily Eating breakfast	Yes	263 (69.8%)	114 (30.2%)	377 (78.54%)	7.68, 1, 0.005
	No	86 (83.5%)	17 (16.5 %)	103 (21.45%)	
Daily fruits and vegetables ≥400 Gm	Yes	232 (67.8%)	110 (32.2%)	342 (71.25%)	14.2, 1, 0.000
	No	117 (84.8%)	21 (15.2 %)	138 (28.75%)	
Consumption of cold drink	Yes	192 (64.9%)	104 (35.1%)	296 (61.67%)	23.9, 1, 0.000
	No	157 (85.3%)	27 (14.7%)	184 (38.33%)	
Eating while studying /watching T.V.	Yes	171 (69.0%)	77 (31.0%)	248 (51.67%)	3.64, 1, 0.056
	No	178 (76.7%)	54 (23.3 %)	232 (48.33%)	



DISCUSSION

The present study has found that 17.91% of school-going adolescents were overweight (B.M.I. for age between 85th & 97th percentile); while 9.38% were obese (B.M.I. for age >97th percentile) in Agra city.

Study	Place	Overweight	Obesity
The present study (2022)	Agra city, Uttar Pradesh	17.91%	9.38%
Wangaskar SA et al (2021) ⁵	Urban Puducherry	10.2%	5.8%
Viswanathan VT et al (2020) ⁶	Rural Maharashtra	9%	5%
Sinha KV et al (2019) ⁷	Rohtas, Bihar	18.5%	5.8%
Jayalakshmi M et al (2018) ⁴	Kancheepuram, TN	18.7%	5.8%
Kunwar R et al (2018) ⁸	North-eastern India	10.5%	2.4%
Iram A et al (2018) ⁹	Aligarh, Uttar Pradesh	11.8%	1%
Deshpande S (2017) ¹⁰	Aurangabad, Maharashtra	7%	3%
Nawab T et al (2014) ¹¹	Aligarh, Uttar Pradesh	9.8%	4.8%
Tiwari H et al (2014) ¹²	Allahabad, Uttar Pradesh	6.6%	1.1%

The timeline of these studies shows that the proportion of obesity and to some extent, overweight has increased alarmingly among school-going adolescents in India during recent times. Apart from changes in socio-demographic, dietary and life-style factors; such high level of overweight & obesity, as reported in the present study, might be due to difference in place of study (urban/rural), types of schools (private/government) and or other methodological differences compared to above mentioned studies.

Over-nutrition and socio-demographic factors:

Age: The highest proportion of overweight & obesity was found in early adolescent group (10-13 years); while it was lowest in late adolescents (p value =0.03). Similar to the present study; Goyal RK et al (2010),^[13] also observed that with increase in age, prevalence of overweight & obesity decreases among adolescents. Similarly; Pandurangi R et al (2022),^[14] also assessed that prevalence of overweight & obesity was higher among early adolescents in India as compared to late adolescents. **Sex:** Gender-wise analysis shows that male had higher proportion of overweight and obesity (30%) in comparison to female (24.6%); but the observed differences were statistically not significant (p=0.18). Similarly; Kanjilal M et al (2021),^[15] found that proportion of obesity & overweight was higher among male than female among school-going adolescents in Delhi. Similar results were found by Sinha KV et al (2019),^[7] who found that male participants had higher proportion of overweight & obesity (31.01%) as compared to female (16.67%) in Rohtas, Bihar. Kunwar R et al (2018)⁸ also found that the prevalence of overweight & obesity among girls was less than boys. Study by Nawab T et al (2014),^[11] found that prevalence of overweight was 11.3% among boys and 7.9% among girls in Aligarh; while prevalence of obesity was 5.5%

among boys and 3.9% among girls. Goyal RK et al (2010),^[13] found that age-adjusted prevalence of overweight & obesity was 14.3% among boys and 9.2% among girls in Ahmedabad.

Type of school (government and private): The present study has found that adolescent students of private schools had higher proportion of overweight & obesity (36.7%) compared to students of government schools (17.9%) with a p value of 0.000. Similarly; Gupta DK et al (2011),^[16] also showed that males and privately-funded school children had significantly higher increase in prevalence and risk of being overweight and obese. Study by Sinha KV et al (2019),^[7] observed a significantly higher prevalence of overweight & obesity in private schools (38.91%) as compared to government school (20.65%) (p=0.001). Study by Ivanovitch K et al (2020),^[17] found that prevalence of overweight and obesity was more among private school participants (15%) as compared to government school participants (8.3%). Study by Deshpande S (2017),^[10] also observed that prevalence of overweight and obesity was greater in private schools than government schools in Aurangabad city of Maharashtra. Laxmaiah A et al (2017),^[18] also observed that prevalence of overweight & obesity among the adolescent studying in private school was significantly higher than those studying in government school (9.6% vs. 3.2%; p<0.005). The higher prevalence of overweight and obesity among students of private school participants might be due to decrease in physical activities or changes in nutritional habits, and or life style related issues.

Socio-economic status: Statistically significant difference in different types of over-nutrition was observed with socio-economic status of the study subjects (p value= 0.000). Highest proportion of overweight & obesity was observed in upper socio-

economic class students (61.5%) while lowest proportion of overweight & obesity was found in lower class (19.1%). Ali D et al (2016),^[19] observed that higher prevalence of overweight & obesity was seen in upper SE class than in middle and lower SE class ($p=0.001$ and 0.001 respectively) in Kashmir valley. Similarly; Ahmad S et al (2018),^[20] and Laxmaiah A et al (2017),^[18] also observed a higher prevalence of overweight & obesity among the adolescent of upper SE class in northern India and Hyderabad respectively. A higher prevalence of overweight and obesity in upper SE class may be associated with a higher calorie intake, access to carbonated drinks, and lesser physical activity including others.

Mother's education: Statistically significant differences in the proportion of overweight & obesity were observed with mother's education as highest proportion of overweight & obesity was observed among subjects whose mother were graduates & post-graduates ($p=0.000$). In their study among school-going adolescents in North India, Ahmad S et al (2018),^[20] also found that prevalence of overweight and obesity was higher among middle schooled mothers (13.4%) as compared to primary schooled mothers (2.3%).

Over-nutrition and life style factors:

Daily physical activity: The present study found that proportion of overweight & obesity was more among subjects who were physically active in moderate to vigorous activities for less than 1 hour per day ($p=0.006$). Similarly; study done by Laxmaiah A et al (2017),^[18] found that the prevalence of overweight & obesity was significantly lower among physically active urban adolescents in Hyderabad (3.1%) in compared to the those who were not physically active (9.75%) ($p=0.004$). Study by Sinha KV et al (2019),^[7] also found that prevalence of overweight & obesity was significantly higher among those who did not participated in outdoors physical activity (30.98%) as compared to those who participated in outdoor physical activity (21.10%) ($p=0.001$). Study by Kumar SS et al (2020),^[21] in Tamil Nadu also observed that children who were physically active for less than 1 hour per day were more likely to be overweight & obese compared to children with physically active for ≥ 1 hour per day ($p=0.01$).

Mode of transport: A statistically significant association was observed between over-nutrition and mode of transport to school. The study found that proportion of overweight & obesity was highest among those who were reaching school by automobile (35.3%) in compared to walking (22.1%) or cycling (10.8%) ($p=0.000$).

Screen time: The present study also found that proportion of overweight & obesity was significantly higher among those whose daily screen time was more than 2 hours compared to their counterparts ($p=0.000$). Sinha KV et al (2019),^[7] also found a statistically significant association between screen time and prevalence of overweight

& obesity in Rohtas, Bihar; whereas Tiwari HC et al (2014),^[12] estimated that prevalence of overweight & obesity in Allahabad was 2.6 times higher among those who watched screen for ≥ 3 hours as compared to who did not watched or watched < 1 hour/day.

Other life style factors like daily sleeping hours, smoking and alcohol consumption were not found to have a statistically significant association with overweight & obesity among school-going adolescents in urban Agra.

Over-nutrition and dietary habits:

Daily intake of fruits & vegetables: The present study has found that proportion overweight & obesity was highest among those who were taking ≥ 400 gm of fruits and vegetables daily. Similarly; Kanjilal M et al (2021),^[15] also found that proportion of obesity & overweight in Delhi was higher among those who were eating vegetables daily.

Regularity of breakfast: In contrast to the findings of the present study, Bhattacharjee P et al (2017),^[22] found that proportion of obesity & overweight was higher among those who were skipping their breakfast as skipping of breakfast; as they postulated that skipping of breakfast might led to overall increase in the amount of food consumed during the day due to excess hunger. On the contrary; according to the present study, daily consumption of breakfast might lead to additional calories intake contributing to increase in proportion of overweight & obesity among such subjects.

Number of meals per day: The present study found that the proportion of overweight & obesity was significantly more among subjects who were taking more than 5 meals per day. Similarly; Viswanathan VT et al (2020),^[6] in Maharashtra also found that prevalence of overweight & obesity was 3.8 times higher among those who were eating 5 or more meals per day.

Consumption of cold drinks: The present study found that higher proportion of overweight & obesity was observed among those who were consuming cold drinks (35.1%) in compared to non-consumers (14.7%). Ahmad S et al (2018),^[20] and Bhattacharjee P et al (2017),^[22] reported that the prevalence of overweight & obesity among adolescents in Northern India and Greater Noida respectively was increased significantly with increase in consumption of cold/carbonated drinks. Similarly; Viswanathan VT et al (2020),^[6] in Maharashtra and Tiwari HC et al (2014),^[12] in Allahabad found that chances of overweight & obesity was increased by 4.5 times and 1.8 times respectively with consumption of cold/carbonated drinks.

Eating while studying/ watching T.V: Similar to the findings of present study, Vik FN et al (2013),^[23] found a positive association between prevalence of TV watching during meal with higher B.M.I. among children aged 10-12 years in European countries but the observed differences found in the present study were statistically non-significant.

CONCLUSION

The present study has found that one in every four school-going adolescents in Agra city were either overweight (17.91%) or obese (9.38%). No statistically significant difference in the proportion of various forms of over-nutrition i.e. overweight and obesity was observed among study subjects on the basis of their sex, and class of study. Similarly; life style factors like daily sleeping hours, smoking and alcohol consumption as well as dietary factor like having meal while studying or watching TV were also not found to have a statistically significant association with over-nutrition among study participants.

On the other hand; type of school, socio-economic class and mother's education were important socio-demographic factors which were found to have a statistically significant association with over-weight and obesity in the present study. Among various life style factors studied; moderate to vigorous daily physical activity, mode of transport to school and screen time were found to have a statistically significant association; whereas dietary factors like number of meals per day, regularity of breakfast, amount of fruits & vegetables eaten per day, and consumption of cold drinks/beverages were found to have a significant association with over-weight and obesity among school-going adolescents in Agra city.

REFERENCES

- World Health Organization (WHO). Health Topics – Obesity. Assessed from: https://www.who.int/health-topics/obesity#tab=tab_1
- World Health Organization (WHO). Tools and toolkits/ Growth reference data for 5-19 years/Indicators/BMI-for-age (5-19 years). Assessed from: <https://www.who.int/tools/growth-reference-data-for-5to19-years/indicators/bmi-for-age>
- World Obesity, author. World obesity atlas 2022 [Internet] World Obesity Federation; London: 2022. Available from: https://s3-eu-west-1.amazonaws.com/wof-files/World_Obesity_Atlas_2022.pdf
- Jayalakshmi M, Rushender CR, Kumar GD. A Study on Prevalence of Overweight and Obesity among Adolescent children in an Urban Field Practice area of a Teaching Medical College in South India. *Indian J Comm Health*. 2018; 30, 3: 273-279.
- Wangaskar SA, Sahu SK, Majella MG, Rajaa Prevalence of malnutrition and its associated sociodemographic and clinical factors among adolescents in Selected schools of Urban Puducherry, India. *Niger Postgrad Med J* 2021;28:285-90
- Viswanathan VT, Patil SS, Durgawale PM, Kakade SV. Study of Prevalence and Lifestyle Related Correlates of Overweight and Obesity Among Rural Adolescents of Western Maharashtra. *Int J Nutr Pharmacol Neurol Dis* 2020;10:29-34
- Sinha KV. Prevalence of Overweight and Obesity in Indian adolescent school going children: a cross sectional study done in an urban area of Rohtas, Bihar. *Ann. Int. Med. Den. Res*. 2019; 5(3):CM13- CM
- Kunwar R, Minhas S, Mangla V. Is obesity a problem among school children? *Indian J Public Health*. 2018 AprJun;62(2):153-155. doi: 10.4103/ijph.IJPH_430_16. PubMed PMID: 29923543
- Iram Aslam, Anisa M. Durrani. To assess the nutritional status of adolescents: an anthropometric study in Aligarh city Uttar Pradesh India. *Indian Journal of Applied Research (IJAR) | Volume-8 | Issue-8 | August-2018 | PRINT ISSN No 2249-555X*
- Deshpande Shilpa. Socio-demographic aspects and adolescent obesity. *Int J Home Sci* 2017;3(3):90-96.
- Nawab T, Khan Z, Khan IM, Ansari MA. Influence of behavioral determinants on the prevalence of overweight and obesity among school going adolescents of Aligarh. *Indian J Public Health* 2014;58:121-4
- Tiwari HC, Dwivedi S, Bali S, Parveen K. Overweight and obesity and its correlates among school going adolescents of district Allahabad – A cross sectional study. *Indian J Prev Soc Med* 2014;45:1-2
- Goyal RK, Shah VN, Saboo BD, Phatak SR, Shah NN, Gohel MC, Raval PB, Patel SS. Prevalence of overweight and obesity in Indian adolescent school going children: its relationship with socioeconomic status and associated lifestyle factors. *J Assoc Physicians India*. 2010 Mar;58:151-8. PubMed PMID: 20848812.
- Pandurangi R, Mummadi MK, Challa S, Reddy NS, Kaliaperumal V, Khadar Babu C, Telikicherla UR, Pullakandham R, Geddam JJB and Hemalatha R (2022). Burden and Predictors of Malnutrition Among Indian Adolescents (10–19 Years): Insights From Comprehensive National Nutrition Survey Data. *Front. Public Health* 10:877073. doi: 10.3389/fpubh.2022.877073
- Kanjilal M, Kumar N, Kumar G, Agrawal G, Arya RK, Batra J, Dietary Habits and their Impact on the Physical Status of School Going Adolescents in Delhi: A Cross-sectional Study 2021 Jul, Vol-15(7): OC43-OC47
- Gupta DK, Shah P, Misra A, Bharadwaj S, Gulati S, Gupta N, Sharma R, Pandey RM, Goel K. Secular trends in prevalence of overweight and obesity from 2006 to 2009 in urban asian Indian adolescents aged 14-17 years. *PLoS One*. 2011 Feb 23;6(2):e17221. doi: 10.1371/journal.pone.0017221.
- Ivanovitch K, Nick H. Overweight and Obesity Coexist with Thinness among Lao's Urban Area Adolescents Volume 2020 | Article ID 5610834
- Laxmaiah A, Nagalla B, Vijayaraghavan K, Nair M. Factors affecting prevalence of overweight among 10 to 17 year-old urban adolescents in Hyderabad, India. *Obesity*. 2017;15(6):1384-90.
- Ali D, Shah RJ, Fazili AB, Rafik MM, Mustaq B, Iqbal QM, Dar Q, study on the prevalence of thinness and obesity in school going adolescent of Kashmir Vally. *IJPH* 2016 Apr-Jun;62(2):153-155. doi: 10.4103/ijph.IJPH_430_16. PubMed PMID: 29923543
- Ahmad S, Shukla NK, Singh JV, Shukla R, Shukla M. Double burden of malnutrition among school-going adolescent in North India: A cross-sectional study. *J Family Med Prim Care* 2018;7:1417-24.
- Kumar SS, Shirley SA. Association of screen time with physical activity and BMI in middle school children at Tamilnadu, India. *Int J Contemp Pediatr* 2020;7:78-83.
- Bhattacharjee P, Mukhopadhyay S, Joshi P, Singh S. Food habits and obesity: a study in adolescents. *Int J Contemp Pediatr* 2017;4:336-40.
- Frøydís N Vik, Helga Birgit Bjørnara, Nina C Øverby, Nanna Lien, Odysseas Androutsos, Lea Maes, Natasa Jan, Eva Kovacs, Luis A Moreno, Alain Dössegger, Yannis Manios, Johannes Brug and Elling Bere. Associations between eating meals, watching TV while eating meals and weight status among children, ages 10–12 years in eight European countries: the ENERGY cross-sectional study. *International Journal of Behavioral Nutrition and Physical Activity* 2013, 10:58 <http://www.ijbnpa.org/content/10/1/58>.