

Original Research Article

Epidemiological study of obesity and overweight among adolescents in schools in district Ghaziabad

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ABSTRACT

Background: Developing countries are experiencing an epidemic of obesity and overweight. Adolescence is the stage when the lifestyle behavior sets in and decides the future pattern of health. The objective was to study the prevalence and correlates of overweight and obesity among school going adolescents of district Ghaziabad.

Methods: A school based cross sectional survey was conducted in district Ghaziabad. Adolescents (10-19 years) from both urban and rural government and private schools were included. Multistage sampling technique was used to study 1128 study population. Anthropometry and a structured questionnaire were used as study tool.

Results: In urban area, the proportion of underweight students in government schools (20.9%) was significantly more than the private school (13.8%) whereas the number of overweight students in private school (18.2%) was significantly more than the government schools (10.3%). In rural area underweight students in government school (30.5%) was significantly more than the private school (21.3%) whereas the number of overweight students in private school (11.3%) was significantly more than the government school (3.2%). Obesity was significantly associated with the area of residence, type of school, consumption of carbonated drinks, fast foods and decreased physical activity.

Conclusions: An overall higher prevalence of overweight and obesity among adolescents in urban areas and increasing trend in rural areas too alarm us to focus on the modifiable risk factors.

Keywords: School going adolescents, Physical inactivity, Obesity, Fast food

INTRODUCTION

Obesity has doubled since 1980. In 2008, more than 1.4 billion adults were overweight. Of these, 200 million men and nearly 300 million women were obese. Overall about 39% of adolescents (38% of boys and 40% of girls) were overweight and 13% of adolescents (11% of boys and 15% of girls) were obese.¹ Obesity in early years of life affects self-esteem and has negative consequences on the cognitive and social development. Conditions such as type 2 diabetes mellitus, hypertension and hypercholesterolemia which were noted primarily in the adults are becoming common among children and adolescents with the increase in the prevalence of obesity. Because

obesity in adolescence often persists until adulthood, an increase number of adults will be at an increased risk of these conditions as well as cardiovascular disease, osteoarthritis and certain types of cancers. Many studies reported that obesity is associated with many chronic diseases such as coronary heart disease, hypertension, diabetes mellitus and hyperlipidemia and some forms of cancers.²⁻⁴

The underlying cause of obesity is not definitely known. It is determined by several behavioral factors which interact with environmental ones. These factors affect body energy balance (energy intake should equal energy expenditure). Increase in energy intake will lead to

overweight and/or obesity. Dietary factors are associated with age, gender, predisposition, and obesity.¹ World health organization (2008) reported that several environmental factors including low air quality, pollution, and high density traffic, lack of parks, sidewalks, violence and absence of recreational facilities due to increased urbanization might discourage participation in physical activity in both adult and adolescence, thus increasing the rate obesity and overweight in Geneva.⁵

Prevalence and associated factors of adolescent's obesity and overweight in Ghaziabad district is not well known by the healthcare providers and the policy makers, as there is no enough data that documents the problem. To develop prevention and control strategies, the prevalence, causes and factors associated with them should be well studied and documented. Adolescents are a priority group for intervention strategies for prevention of obesity because potential interventions strategies can be framed for them. Furthermore, overweight and obesity in adolescents have significant influence on both physical and psychological health of these future minds.

Objectives

- To calculate the prevalence of overweight and obesity among school going adolescents of district Ghaziabad.
- To study the association of overweight and obesity among adolescents with socio demographic, dietary and physical activity factors.

METHODS

Study design: School based cross sectional study.

Study setting

The district Ghaziabad is situated in the middle of the flat alluvial tract between the Ganges River and Yamuna River. It's area about 1933.3 square kilometers. Ghaziabad district is bounded in the north by Meerut district, in the east by Hapur district, in the west by Delhi, in the North West Baghpat district and in the South by Gautam Buddh Nagar and Bulandshaher district. As per 2011 census, this district has a population of 4,661,452 (Third Highest in UP). As per 2011 census, 81% population of Ghaziabad district lives in urban areas. The district statistical book informs that there are 6706 basic senior high schools and 159 higher secondary schools.⁶

Study period

The study was carried out from May 2017 through April 2018.

Study area

The study was carried out in rural (Dasna) and urban field practice area (Ghaziabad city) schools of Community

Medicine Department, Santosh Medical College, Ghaziabad.

Sampling frame: Intermediate (10+2) schools in the urban and rural areas of District Ghaziabad.

Study population

All school going adolescents aged from 10 to 19 years studying up to intermediate (10+2) schools in urban and rural areas of district Ghaziabad amongst the selected schools.

Sample size

The present study was conducted on overweight and obesity among school going adolescents in District Ghaziabad. Prevalence of overweight and obesity in various locations in some previous studies was Delhi 31%, Pune 24%, Chennai 22% and Karnataka 19%. A mean prevalence of 24% was obtained from these studies and was used to calculate sample size required to conduct the present study.⁷

Sample size 'n' was calculated by the following formula:

$$n = \frac{4pq}{l^2}$$

Where, p=prevalence of overweight and obesity among adolescents (24%)

$$q = 100 - 24$$

$$l = \text{Allowable error } 15\% \text{ of } p = 3.6$$

$$\text{Therefore } n = \frac{3.84 \times 24 \times 76}{(3.6)^2} = 562.96$$

$$\text{i.e., } n = 563.$$

Thus sample size considered for this study was 564 each for urban and rural areas. Data of 564 adolescents was collected from schools of urban areas of Ghaziabad City and equal number of adolescents from rural areas of Ghaziabad. The total sample size for the study was 1128. Out of this, equal proportion of samples was collected from private schools and government schools in both urban and rural areas respectively i.e., 282 school going adolescents from each group.

Inclusion criteria

Inclusion criteria were all adolescent students present in the selected schools from age 10-19 years on the day of study were included in this study; only students with informed and written consent forms signed by their parents or by self were included; students who gave written consent forms prior to the study.

Exclusion criteria

Exclusion criteria were students whose parents refused to give permission or those without written complete consent forms; students who gave incomplete responses.

Sampling technique

Multistage sampling techniques were used to cover the sample size for the study with following stages:

Stage 1: In the urban area, list of government and private schools were obtained separately from the district authority, then from that list, schools were selected randomly to conduct the study.

Stage 2: In the selected school, data collection was started to cover the sample size, if the sample size was not covered then another school was selected with the help of simple random sampling techniques as per the research methodology and so on till the desired sample size of 282 was achieved for private school and 282 for government school in urban area. Similarly data was collected from 282 students each from government and private schools in Dasna (rural area) also. Thus total sample size of 1128 students was covered.

Study tools

A semi structured questionnaire, containing following items was used:

- Identification data i.e. age, gender, area of residence, type of school, and family details i.e. education and occupation status of parents and total income of family per month and assessment of dietary behavior and physical activity. The following items were asked to assess the dietary practices viz., frequency of intake of fruits, vegetables, carbonated drinks, visits to fast food restaurants, second helping during the major meal, milk intake in last one week.
- The following items were asked to assess the pattern of physical activity. Questions based on vigorous physical activity, strengthening exercises, moderate physical activity were used.
 - Vigorous physical activity includes exercising or participating in sports activities for at least 20 minutes that made you sweat or breathe hard, such as basketball, jogging, fast dancing, swimming laps, tennis, fast bicycling, or similar aerobic activities. Strengthening exercises includes exercises to strengthen or tone your muscles, such as pushups, sit-ups or weight lifting. Moderate physical activity includes walking or bicycling for at least 30 minutes at a time. These questions were based on healthy people 2010 guidelines recommend that adolescents participate in moderate physical activity for at least 30 minutes on 5 or more days

per week and engage in at least 20 minutes of vigorous activity at least 3 times per week.

- In line with the new epidemiological and psychometric evidence, sedentary behavior was assessed by including the average time spent in watching TV/computer per day.
- It also included questions on physical education (PE) classes attended and average time spent in these classes, average time spent in outdoor games during non-school hours.⁸
- *Measurement of height:* Height was recorded to the nearest 0.1 centimeter with the help of a Measuring tape made of non-stretchable steel. The students stood erect against the wall on a firm and level surface, with bare feet kept closed to each other, and the heel, calves, buttocks and back of the head touching the wall. The students were asked to look straight ahead with both of the eyes at the same level as the ears. A cardboard was placed on the top of the head and matched with calibration of measuring tape. Then the reading was noted down.
- *Measurement of weight:* Weight to the nearest 100 gms was recorded with the help of a electronic weighing scale with capacity up to 150 kg. The scale was placed on a hard, smooth and horizontal surface and the reading corrected to zero before each measurement. The students were asked to stand with bare feet and wearing light clothing and look straight in the horizontal direction for measurement of weight.

Data processing and analysis

The data was entered in Microsoft excel 2007 and analyzed by using IBM SPSS software trial version 17 (Statistical Package of Social Sciences). Qualitative data was expressed in percentages. Chi square test with Fishers' Exact test was applied for the relevant variables. $P < 0.05$ was considered statistically significant at a confidence interval of 95%.

RESULTS

We observed that majority of the children had normal nutrition status in both rural and urban areas and in both government and private schools. Overall the most common malnutrition observed was underweight (21.6%) amongst total study population followed by overweight (10.7%) and obese (3.6%). The prevalence of overweight and obesity in the study population was (14.3%).

In rural areas underweight (25.9%) was the most common form of malnutrition. About one-third students were underweight in rural government school and 21.3% in rural private school. Amongst the urban areas overweight and obesity (20.2%) was the most common form of malnutrition. This was higher in rural as compared to private.

Table 1: Distribution of nutritional status according to their type of school and study area.

BMI	Rural area		Urban area		Total		Total (n=1128)
	Govt. school (n=282)	Private school (n=282)	Govt. school (n=282)	Private school (n=282)	Govt. school (n=564)	Private school (n=564)	
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	
Under weight	86 (30.5)	60 (21.3)	59 (20.9)	39 (13.8)	145 (25.7)	99 (17.6)	244 (21.6)
Normal	187 (66.3)	183 (64.9)	181 (64.2)	171 (60.6)	368 (65.2)	354 (62.8)	722 (64.0)
Overweight	9 (3.2)	32 (11.3)	29 (10.3)	51 (18.2)	38 (6.7)	83 (14.7)	121 (10.7)
Obese	0 (0)	7 (2.1)	13 (4.6)	21 (7.4)	13 (2.4)	28 (4.9)	41 (3.6)

Urban area- Chi-square test: $X^2=16.67$, $df=3$, $p\leq 0.001$, rural area –Fisher's Exact test value=19.47, $df=3$, $p\leq 0.001$ type of school (Gov. Vs Priv.) $X^2=31.17$, $df=5$, $p\leq 0.001$.

Table 2: Age and sex wise distribution of students according to their nutritional status (n=1128).

Variables	Underweight				Overweight/obese			
	Rural govt. school (n=282)	Rural private school (n=282)	Urban govt. school (n=282)	Urban private school (n=282)	Rural govt. school (n=282)	Rural private school (n=282)	Urban govt. school (n=282)	Urban private school (n=282)
Age (in years)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
10-12 (n=393)	52 (13.2)	18 (4.6)	20 (5.1)	15 (3.8)	2 (0.5)	8 (2.0)	10 (2.5)	12 (3.0)
13-15 (n=367)	25 (6.8)	22 (6.0)	19 (5.2)	10 (2.7)	4 (1.1)	10 (2.7)	12 (3.3)	18 (4.9)
16-18 (n=368)	9 (2.4)	20 (5.4)	20 (5.4)	14 (3.8)	3 (0.8)	20 (5.4)	20 (5.4)	43 (11.7)
Total (n=1128)	86 (7.6)	60 (5.3)	59 (5.2)	39 (3.5)	9 (0.7)	38 (3.4)	42 (3.7)	73 (6.4)
Sex	Underweight $X^2=23.1$, $df=6$, $p\leq 0.001$,				Overweight (rural vs urban) $X^2=0.399$, $df=2$, $p=0.82$			
Male	24 (27.9)	12 (20.0)	28 (47.5)	15 (38.5)	5 (55.5)	26 (68.4)	22 (52.4)	62 (86.1)
Female	62 (72.1)	48 (80.0)	31 (52.5)	24 (61.5)	4 (45.5)	12 (31.6)	19 (47.6)	10 (13.9)
	Underweight $X^2=23.1$, $df=6$, $p\leq 0.001$,				Overweight (rural vs urban) $X^2=0.399$, $df=2$, $p=0.82$			

Table 3: Association of overweight and obesity with socio-demographic profile of study subjects (n=1128).

Variables	Overweight/obesity		Chi-square test value and P value*
	No (n=966)	Yes (n=162)	
	N (%)	N (%)	
Age (in years)			
10-12 (n=393)	361 (91.9)	32 (8.1)	$X^2=99.12$, $p<0.001$
13-15 (n=367)	323 (88.0)	44 (12.0)	
16-18 (n=368)	282 (76.6)	86 (23.4)	
Sex			
Male (n=620)	505 (81.4)	115 (18.6)	$X^2=21.54$, $p<0.001$
Female (n=508)	461 (90.7)	47 (9.3)	
Area of residence			
Urban (n=564)	450 (79.8)	114 (20.2)	$X^2=31.39$, $p<0.001$
Rural (n=564)	516 (91.5)	48 (5.8)	
Type of school			
Private (n=564)	453 (80.3)	111 (19.7)	$X^2=31.39$, $p<0.001$
Government (n=564)	513 (90.9)	51 (9.1)	
Per capita income			
<5000 (n=862)	780 (90.5)	82 (9.5)	$X^2=69.88$, $p<0.001$
≥ 5000 (n=266)	186 (69.9)	80 (30.1)	

Continued.

Variables	Overweight/obesity		Chi-square test value and P value*
	No (n=966)	Yes (n=162)	
	N (%)	N (%)	
Intake of vegetables			
Nil (n=37)	20 (54.1)	17 (45.9)	X²=58.8, p≤0.001
1 time/day (n=279)	218 (78.1)	61 (21.9)	
2 or more times/day (n=812)	722 (88.9)	90 (11.1)	
Intake of fruits			
Nil (n=232)	166 (71.5)	66 (28.5)	X²=48.1, p≤0.001
1 time/day (n=532)	470 (88.3)	62 (11.7)	
2 or more times/day (n=364)	330 (90.7)	34 (9.3)	
Intake of soft drinks			
Nil (n=660)	585 (88.6)	75 (11.4)	X²=33.04, p≤0.001
1 time/day (n=291)	254 (87.3)	37 (12.8)	
2 or more times/day (n=177)	127 (71.7)	50 (28.3)	
Intake of fast food in restaurants			
Nil (n=208)	188 (90.4)	20 (9.6)	X²=6.82, p=0.03
1-2 times/week (n=630)	540 (85.7)	90 (14.3)	
3 or more times/week (n=290)	238 (82.1)	52 (17.9)	
Intake of second helpings during meals			
Healthy (n=557)	509 (91.4)	48 (8.6)	X²=29.52, p≤0.001
Junk (n=571)	457 (80.0)	114 (20.0)	
Intake of meal after fast food meal			
Yes (n=274)	224 (81.7)	50 (18.3)	X²=4.44, p=0.035
No (n=854)	742 (86.9)	112 (13.1)	
Intake of milk			
Yes (n=847)	725 (85.6)	122 (14.4)	X²=2.25, p=0.13
No (n=281)	241 (85.8)	40 (14.2)	
Vigorous physical activity			
<3 days/week (n=515)	375 (72.8)	375 (72.8)	X²=126.69, p≤0.001
≥3days/week (n=613)	591 (96.4)	591 (96.4)	
Strengthening exercises			
<3 days/week (n=872)	735 (84.3)	735 (84.3)	X²=5.69, p=0.02
≥3 days/week (n=256)	231 (90.3)	231 (90.3)	
Moderate-physical activity			
< 5 days /week (n=548)	424 (77.4)	424 (77.4)	X²=59.21, p≤0.001
≥ 5 days/week (n=580)	542 (93.4)	542 (93.4)	
No. of days of physical education classes /week			
<5 days /week (n=918)	769 (83.8)	769 (83.8)	X²=14.01, p=0.0001
≥ 5 days/week (n=210)	197 (93.8)	197 (93.8)	
Time spent in watching TV/computer			
<2 hours (n=748)	690 (92.5)	690 (92.5)	X²=78.82, p≤0.001
≥ 2 hours (n=380)	276 (72.6)	276 (72.6)	

Amongst the government school underweight was the most common malnutrition (25.7%) and amongst the private school overweight/ obesity was the most common malnutrition (19.6%). The difference observed in the malnutrition prevalence amongst the study subjects in urban and rural areas was statistically highly significant ($p<0.001$) (Table 1).

It was seen that underweight was most common in the younger age group (10-12 years) and the prevalence of underweight was decreasing with increasing age in the students from rural areas. Overweight and obesity was

most common in the older age group (16-18 years) and the prevalence was increasing with increasing age in both rural and urban private school students. This difference observed in the distribution of underweight and overweight and obesity was statistically significant amongst the study population. Overweight and obesity was most frequent in males of the study population and underweight was most frequent in the females of the study population. In rural government school majority of the overweight students were males (86.1%) and the majority of the underweight students were females (80.0%). Similar distribution was observed in rural

private schools. In urban private and urban government school majority of the overweight and obesity students were males (52.4%) and majority of the underweight were females (61.5%). This difference observed in the distribution of underweight, overweight and obesity amongst the male and female population was statistically highly significant amongst the study population (Table 2).

Significantly higher proportions of males were overweight and obese (18.6%) compared to females (9.3%). It was seen that significantly higher proportion of urban (20.2%) and private (19.7%) were obese and overweight compared to the rural (5.8%) and government schools (9.1%). It was seen that significantly higher proportion of the students were overweight and obese who belonged to the families who had per capita monthly income of more than 5000 rupees (30.1%). The prevalence of overweight and obesity significantly increased with decrease in frequency of vigorous physical activity, strengthening exercises frequency, moderate physical activity, and number of days spent on physical education classes in a week. The students who used to spend two or more hours watching TV in a day in last week were significantly associated with obesity/overweight. Significant increase in overweight/obesity was observed with decrease in frequency of vegetable intake, fruit intake. No association was seen with frequency of milk intake for the prevalence of obesity in the study population (Table 3).

DISCUSSION

Overall the prevalence of obesity and overweight in the study population was (14.4%) amongst total study population followed by overweight (10.7%) and obese (3.7%). In urban areas overweight and obesity (20.2%) was the most common form of malnutrition. About one-fourth students in rural private school were underweight and less than one-fifth in urban private schools. Tharkar et al, also supported similar findings among the school children aged 8-15 years in Chennai where both overweight (22%) and obesity (13.7%) were highest among girls from affluent families.⁹

In urban area 5.3% of students from private school and 42.2% of students from government schools did not take fruits or take them less than once daily in last one week in current study. This is consistent with other evidence Health Behaviour in school aged children (HSBC) data from five Southeast Asian countries (India, Indonesia, Myanmar, Sri Lanka and Thailand) suggesting that nearly a quarter of the sample (28%) reported consuming fruits less than once per day.¹⁰ Deka and colleagues found that 52% of the adolescents residing in urban area of Jhansi district, Uttar Pradesh did not consume any fruit on daily basis.¹¹ Singhal et al, reported that intake of fresh fruits (>3 times per week) was seen in only 9.9% children in North India.¹² The prevalence of overweight and obesity

in the current study significantly increased with the increase in frequency of soft drinks, fast food, and unhealthy junk food as second helping meals and intake of meals after a fast food meal. Delhi Diabetes Research Centre (DDRC) conducted study in Delhi including over 30 government and private schools which showed that 47% of students drink one soft drink daily.¹³ Papandreou et al, reported that in their study 79.4% adolescents reported consumed carbonated drinks and they were 2.5 times more likely to become obese compared to normal peers.¹⁴ Carbonated drinks are often sweetened with sugars and contain raw calories. Children who drink one carbonated drink a day have an average 10% more total energy intake than non-consumers. Ebbeling et al, conducted a randomized controlled trial which enrolled 103 adolescents (13-18 years), and found that decreasing sugar sweetened drink consumption had a beneficial effect on body weight and the effect was greater among the subjects who drank more sugar sweetened drink at baseline.¹⁵ The daily soft drink consumption amongst 11-15 year olds, in European countries such as Denmark, Finland, Baltic countries, Greece etc. is also around 20% which is much lower than that found in our study. A comprehensive cross national data on health and wellbeing of young people (Health Behavior in School Aged children-HBSC study - 2004) in European Region and North America showed that among 15 year age group; on an average 28.8% ate fruits every day, 28.9% were eating vegetables every day, 29.9% children drank soft drinks daily, 28.9% were eating sweets every day, 28.5% met physical activity guidelines, 25.6% watched TV for >4 hours a day on weekdays and 15.3% used computer >3 hours a day on weekdays.¹⁰

In a study by French et al found that on an average frequency of fast food restaurant use was three times/week.¹⁶ The current study revealed that in urban area 31.8% students in the private school and 27.6% students in the government school were going out to eat in a fast food restaurant for >3 days in a week while there were 48.4% students in the private school and 51.7% students in the government school having fast foods for 1-2 days/week. In our study, the frequency of intake of second helping meal in form of junk food was highest in urban private schools (77.7%) and least in rural government school students. 81% of Delhi adolescents were also shown to eat at fast food joint at least once in a week.¹³ The upsurge in consumption of fast foods by the adolescents could be explained by the fact that adolescence is marked by need to express freedom from parental control and increasing influence of peers in making food choices and meal patterning. This burgeoning independence has resulted in an increased consumption of meals eaten outside the home or the school, which often comprises of take away fast foods. Also, the increase in families with two working parents and time limitations has led to the "convenience revolution" with pre-packed processed products forming the basis of the majority of meals eaten by the children.

Monteiro et al, observed that due to hyper palatability, attractiveness and ready-to-eat attributes, these non-essential foods are becoming a frequent and dominant component of adolescents' diets in most economically developed countries as well as developing countries like India.¹⁷ Frequent consumption of non-essential foods may contribute to a variety of negative health outcomes, including obesity, insulin resistance and heart disease. To prevent these diet-related chronic diseases, energy-dense snacks and beverages should be consumed sparingly or not at all.

The students who were least physically active were from urban government school followed by urban private school. In rural areas both in private and government schools majority were undergoing vigorous physical activity for 3 or more days in a week. European Heart Health Initiative (EHHI) report highlights that Physical education (PE) class provides an opportunity to participate in physical activity and learn relevant skills to be physically active.¹⁸ In the present study, urban government school students were not attending PE classes in majority and in urban private more than one-third were spending no time in PE classes. The most likely reason for this was an extreme emphasis on academic achievement.

In the study by, Vasconcellos et al, it was seen that the prevalence of overweight and obesity significantly increased with decrease in frequency of vigorous physical activity, strengthening exercises frequency, moderate physical activity.¹⁹ The prevalence of obesity and overweight was highest amongst those students who did not take moderate or vigorous physical activity and there is a cardio vascular risk factor involved with it. Hallal et al conducted a prospective birth cohort study to examine the effect of early social, anthropometric and behavioral variables on physical activity in adolescents in UK.²⁰ The prevalence of sedentary life style at age 10-12 years was 58.2%. Risk factors for sedentary life style in adolescence were female sex, high family income at birth, high maternal education at birth and lower birth order.

El-Bayoumy et al, in their study indicated that a lack of physical activity has contributed to the increased prevalence of obesity and overweight among intermediate adolescent school children aged between 10 and 14 years in Kuwait.²¹ The study indicated that the majority of children between the ages of 10 and 14 had increased body weight and obesity due to physical inactivity.

Over all the urban based school students were spending more time on TV than the rural based school students. The rural government school students were spending the least amount time on watching television. Kumar et al also reported that excess television viewing as potential influencing factors of childhood obesity in a study on affluent school children.²² This can be explained by the fact that children who spend more time watching television have a higher BMI and a higher percent of

body fat and are less physically active. Watching television can decrease the amount of time spent in performing physical activities and has also been associated with increased food consumption either during viewing or as a result of food advertisements. It has been reported that children are spending more time in front of the television, watching television and playing video games, than doing any other activities besides sleeping. An increase in dietary energy intake combined with decreased energy expenditure contributes to weight gain. Boyce et al reviewed the relationship between media and obesity.²³ The study was done to determine the link between obesity and media consumption. It was found that the prevalence of obesity increased by 2% in 12-17 year-olds for each additional hour of TV viewed. Obesity incidence was the lowest in children who viewed less than one hour/day of television, and highest in those who viewed more than 4 hrs/day. Kruger et al showed that overweight/obese children were least active at all times.²⁴ Another study done in Saudi Arabia by Alam et al among school children based at private schools targeting children of affluent families also found that nearly 90% of obese students lived in big houses or villas.²⁵ Watching television (TV) was more prevalent among obese children as was consumption of fast food and sweetened beverages. Thasanasuwan et al gave similar findings and explained that children who spend more time watching television tend to skip sports time and have higher BMI and a higher percent of body fat making them lesser active physically.²⁶ Watching television been associated with increased food consumption either during viewing or as a result of food advertisements. It has been reported that children are spending more time in front of the television, watching television and playing video games, than doing any other activities besides sleeping.

Adolescence is also a period of increased vulnerability to obesity. Lack of physical activity and outdoor sports, along with the consumption of fat-rich 'junk' foods, is the major cause of obesity among the affluent population. Consumption of diet high in sugar, saturated fat, salt, and calorie content in children can lead to early development of obesity, hypertension, dyslipidemia, and impaired glucose tolerance. Some dietary patterns appear quite common among adolescents, to mention a few: snacking, usually on energy-dense foods; meal skipping, particularly breakfast, or irregular meals; wide use of fast food; and low consumption of fruits and vegetables.

It is essential to address overweight and obesity among this age group as it has serious effects of health, social and economic life of individual and family. Obesity is a result of complex interaction between genetic and environmental factors. Further research is recommended to explore the link between gene, environment and obesity relations among adolescents.

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