Prevalence of Obesity and Undernutrition Among Adolescents and Their Dietary Habits: A Cross Sectional Study in a Tertiary Care Centre

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ABSTRACT

Background: World Health Organization (WHO) defined adolescence as a period of life ranging from 10 to 19 years old which is the transition from dependent childhood to independent adulthood. According to the 2019–21 National Family Health Survey (NFHS-5), the prevalence of obesity among women and men increases. Overweight and obesity in younger age group lead to various non-communicable diseases in the future. The studies on adolescent dietary intake and prevalence of obesity are limited in north India, so the aim of this study was to check the prevalence of obesity among adolescents their dietary intake, type of food intake, impact of these dietary habits on prevalence of obesity and to predict the chance of metabolic syndrome among adolescents in tertiary care centre.

Materials and Methods: It was a cross-sectional descriptive study design conducted on 1000 adolescent patients aged 10-15 yrs of rural and urban area from OPD or IPD in Government Medical College, Patiala, Punjab from August 2022 to April 2023, total 9 months. The patients or their parents who gave consent and aged 10 to 15 years were included in this study. Adolescents with diagnosed cases of any chronic disease as congenital heart disease, chronic renal failure, chronic liver failure or any blood disorders and had physical deformities were excluded from this study.

Results: Out of these 1000 patients, 530 patients were of normal weight, 260 were underweight. Overweight and obesity were seen in 110 and 100 patients respectively. 54.55% of overweight and 70% of obese patients belonged to upper middle class as compared to well-nourished patients among them 69.8% belonged to upper lower class (p value of 0.021). Cereal intake was 300 - 400 grams per day among 56.6% of well-nourished patients as compared to underweight (53.85%) overweight (63.64%) and obese patients (70%) consumed 200

-300 gram of cereals per day that was statistically significant (p value= 0.04). 40% of obese and 81.8% of overweight patients took junk food three times per week a s compared to 51% of normal weight patients did not consume junk food (p value of 0.001). Hypertension was seen in 60% of obese patients, 18.18% of overweight patients (p value of 0.001). Fatty Liver by ultrasonography was seen in 70% of obese, 54.5% of overweight as compared to only 13.2% of normal weight patients had fatty liver. (p value of 0.001).

Conclusion: Our results reveal that the incidence of overweight and obesity is increasing among adolescents. Multiple factors are associated with adolescent obesity like sedentary lifestyle, working parents, improper diet, eating junk food and frequent restaurant visits. Our study observed the obese patients had deranged lipid profile, hypertension, increase liver enzymes and fatty liver on ultrasonography. So, all these factors are known for increasing risk of metabolic syndrome and other non-communicable diseases in future.

Keywords: Adolescent, Underweight, Overweight, Obesity, Metabolic Syndrome.

INTRODUCTION

Globally in 2020, 149 million children were estimated to be stunted, 45 million were estimated to be wasted, and 38.9 million were overweight or obese.[1] World Health Organization (WHO) defined adolescence as a period of life ranging from 10 to 19 years old which is the transition from dependent childhood to independent adulthood.[2] Overweight and obesity are defined as "abnormal or excessive fat accumulation that presents a risk to health.[3] Overweight and obesity in younger age group lead to various non-communicable diseases in the future, such as diabetes, hypertension, arthritis and cardiovascular diseases. [4] Among adolescents, there is increase intake of junk food, energy dense snacks and drinks that lead to overweight and obesity among them.[5] The studies on adolescent dietary intake, prevalence of obesity and type of food intake among adolescents

are limited in north India, so the aim of this study was to check the prevalence of obesity among adolescents their dietary intake, type of food intake, impact of these dietary habits on prevalence of obesity and to predict the chance of metabolic syndrome among adolescents in tertiary care centre.

AIMS AND OBJECTIVES
- To study the prevalence of obesity among adolescents
- To check the dietary behaviour among adolescents with underweight, overweight and obesity adolescents aged 10–18 years and to predict chance of metabolic syndrome in the future

MATERIAL AND METHODS
It was a cross-sectional descriptive study design. Adolescent patients aged 10-15 yrs of rural and urban area were chosen from OPD or IPD in Government Medical College and Rajindra hospital, Patiala, Punjab from August 2022 to April 2023, total 9 months. The patients or their parents who gave consent and aged 10 to 15 years were included in this study. Adolescents with diagnosed case of any chronic disease as congenital heart disease, chronic renal failure, chronic liver failure or any blood disorders and had physical deformities were excluded.

OPERATIONAL DEFINITIONS
Measure (Tools)
Weight was measured using a portable calibrated weighing machine, which was standardized by calibrating it against known weights regularly and to zero before each measurement. Height in centimeters was marked on a wall with the help of a measuring tape and height of all patients will be measured by using stadiometer. They asked to remove their footwear and to stand with heels together and their heads positioned so that the line of vision (Frankfurt's plane) was perpendicular to the body. A scale will be placed above the head and height will be measured.

Body Mass Index (BMI) was calculated using the standard formula: $BMI (kg/m2) = Weight (kg)/Height2 (m2)$. For anthropometric comparison, we will follow the WHO 2007 growth standards for 10-19 years old, which are also recommended for use in the manual on New Dietary Guidelines for Indians, 2011 by NIN, ICMR. BMI-for-age weight status categories and the corresponding percentiles were based on expert committee recommendations as Underweight <5th percentile, Normal Weight 5th to <85th percentile, Overweight 85th to <95th percentile and Obese ≥95th percentile. [6,7]

Statistical Analysis
The data was entered into Microsoft excel sheet. Data was analysed by using statistical package for social science software and p value <0.05 considered as significant to see the association of factors among underweight, overweight and obesity.

RESULTS
In this study, 1000 adolescent patients aged 10 to 15 years old were included from OPD or IPD in Government Medical College and Rajindra hospital Patiala, Punjab from August 2022 to April 2023, total 9 months. Among these patients 510 were females and 490 were males, 430 of the patients belonged to urban areas and 570 patients from rural area. Out of these 1000 patients, 530 patients were of normal weight. Underweight, Overweight and obesity were seen in 260,110 and 100 patients respectively.

Table 1 compared the demographic factors with underweight, overweight and obesity. 52.8% of underweight, 54.55 % overweight and 50 % obese were from age group of 10-12 years as compared to 46.15% underweight, 45.45% overweight and 50% obese belonged to age group of 13-15 years that was statistically significant with p value of (0.036). Among 57 rural patients, 6 patients were overweight and 5 patients were obese compared to urban patients, 5 were overweight and 5 obese patients that was statistically not significant(p value = 0.79). 54.55% of overweight and 70% of obese patients belonged to upper middle class as compared to normal weight patients among them 69.8% belonged to upper lower class with p value of 0.021, statistically significant. It was observed that 58.3% of normal weight patients belonged to joint families as compared to 63.64% overweight and 60% of obese belonged to nuclear family, that was statistically significant (p= 0.035). Among underweight patients, 26.92% of the patient's mother were illiterate, 23.08% of patient's mother passed secondary education, patients those were overweight, 36.3% and 27.27% of their mothers passed secondary and higher education respectively, among obese patients, 40% patient's mother passed higher and 30% were graduate with p value 0.02, statistically significant. 35.8% of underweight patient's fathers were illiterate, 26.9% of overweight patient's fathers passed graduation, among obese patients, 27.27% of patient's father had passed secondary education and 18.18% of obese patient's fathers were graduate or postgraduate with p value of 0.016 (statistically significant).

Table 2 showed 52.8% of normal weight patients were consumed vegetables >300 gram as compared to 70% of obese patients consumed 200 to 300 grams of vegetables per day, 45.45% of overweight consumed >300 grams of vegetables per day, which was statistically not significant. Cereal intake was 300 - 400 grams per day among 56.6% of normal weight patients as compared to underweight (53.85%) overweight (63.64%) and obese patients (70%) consumed only 200 -300 grams of cereals per day (p value= 0.04). Fruit/ fruit juice intake was more among normal weight patients (52.83%) as compared to overweight (36.3%) and obese patients (10%) with p value of 0.01(statistically significant). 73.58% of normal weight and 69.23% of underweight patients did not eat meat/ fish/poultry whereas 60% of obese patient consumed >50 grams of meat/fish/poultry per day. (p value=0.46). Dairy product intake was < 200 gram per day among normal weight (86.79%), and underweight adolescent patients 61.54% as compared to 81.8% of overweight patients and 80% among obese patients consumed 200 -300 grams dairy products per day (p value of 0.027).

It was observed that junk food intake or soft drink consumption was more among overweight and obese patients. 40% of obese and 81.8% of overweight patients took junk food three times per week as compared to 51% of normal weight patients did not consume junk food with p value of 0.001 (statistically significant). Chocolate consumption of 60 -79 grams was seen in 54.5% of overweight patients and > 100 grams per day among 30% of obese patients as compared to normal weight patients (66%) did not consume chocolate. (p value= 0.001). Outside home/hotel/ Stall/ Restaurant visits among 50% of underweight patients were once per month but three times per month among 36.36% of overweight and 40% of obese patients with p value of 0.001 that was statistically significant.

In our study, hypertension was seen in 60% of obese patients, 18.18% of overweight patients with p value of 0.001 (statistically significant). Anaemia was present in 53.8% of underweight, 45.45% of overweight and 60% of obese patients with p value of 0.04 that was statistically significant. Increased SGOT and SGPT values were seen in 70% and 60% of obese patients respectively (p value of 0.01 and 0.002). This study revealed total cholesterol levels were increased in 70% of obese, 63.64% of overweight and 7.69% of underweight patients. (p value= 0.0001). Triglycerides levels were increased in 63.64% of obese, 7.69% of overweight and 16.9% of underweight patients. (p value= 0.001). Fatty Liver by ultrasonography was seen in 70% of obese, 54.5% of overweight and 19.25 of underweight patient with p value of 0.001, statistically significant.

Table I: Comparison of demographic factors among Underweight, Overweight and Obese patients

Factors	Normal BMI 5th to <85th percentile (n=53)	Underweight BMI < 5th percentile (n=26)	Overweight BMI 85th to <95th percentile (n=11)	Obesity BMI > 95th percentile (n=10)	p-value (Association of factors among normal, underweight, overweight and obese patients
Age-groups (years)					0.036 (S)
10-12	260 (49.06%)	140 (53.85%)	60 (54.55%)	50 (50%)	
13-15	270 (50.94%)	120 (46.15%)	50 (45.45%)	50 (50%)	
Gender					0.78 (NS)
Female	290 (54.72%)	120 (46.15%)	60 (54.55%)	40 (40%)	
Male	240 (45.28%)	140 (53.85%)	50 (45.45%)	60 (60%)	
Region					0.79 (NS)
Rural	210 (39.62%)	110(42.31%)	60 (54.55%)	50 (50%)	
Urban	320 (60.38%)	150 (57.69%)	50 (45.45%)	50 (50%)	
Type of family					0.035 (S)
Joint	280 (52.83%	200 (76.92%)	40 (36.36%)	40 (40%)	
Nuclear	250 (47%)	60 (23.08%)	70 (63.64%)	60 (60%)	
Socio-economic status					0.021 (S)
Upper	30 (5.66%)	40 (15.38%)	20 (18.18%)	20 (20%)	
Upper Middle	50 (9.43%)	20 (7.69%)	60 (54.55%)	70 (70%)	
Lower Middle	40 (7.55%)	20 (7.69%)	20 (18.18%)	10 (10%)	
Upper Lower	370 (69.81%)	110 (42.31%)	0 (0%)	0 (0%)	
Lower	40 (7.55%)	70 (26.92%)	10 (9.09%)	0 (0%)	
Education status of mother					0.025 (S)
Illiterate	40 (7.55%)	70 (26.92%)	10 (9.09%)	3 (30%)	
Primary	40 (7.55%)	40 (15.38%)	0 (0%)	0 (0%)	
Secondary	180 (33.96%)	60 (23.08%)	40 (36.36%)	0 (0%)	
Higher	160 (30.19%)	50 (19.23%)	30 (27.27%)	40 (40%)	
Graduate	100 (18.87%)	30 (11.54%)	30 (27.27%)	20 (20%)	
Postgraduate	10 (1.89%)	10 (3.85%)	0 (0%)	10 (10%)	
Education status of Father					0.016 (S)
Illiterate	40 (7.55%)	19 (35.85%)	5 (19.23%)	10 (9.09%)	
Primary	30 (5.66%)	3 (5.66%)	7 (26.92%)	10 (9.09%)	
Secondary	190 (35.85%)	13 (24.53%)	2 (7.69%)	30 (27.27%)	
Higher	140 (26.42%)	14 (26.42%)	5 (19.23%)	20 (18.18%)	
Graduate	130 (24.53%)	40 (7.55%)	50 (19.23%)	20 (18.18%)	
Postgraduate	0 (0%)	0 (0%)	20 (7.69%)	20 (18.18%)	

Table II: Comparison of dietary intake among Underweight, Overweight and Obese patients

Factors	Normal BMI 5th to <85th percentile (n=53)	Underweight BMI < 5th percentile (n=26)	Overweight BMI 85th to <95th percentile (n=11)	Obesity BMI > 95th percentile (n=10)	p-value (Association of factors among normal, underweight, overweight and obese patients
Vegetables intake per day (grams)					0.11 (NS)
< 200	20 (3.77%)	130 (50%)	20 (18.18%)	20 (20%)	
200-300	230 (43.40%)	120 (46.15%)	40 (36.36%)	70 (70%)	
>300	280 (52.83%)	10 (3.85%)	50 (45.45%)	10 (10%)	
Cereal intake per day					0.04 (S)
< 200	40 (%)	0 (0%)	0 (0%)	0 (0%)	
200-300	10 (1.89%)	140 (53.85%)	70 (63.64%)	70 (70%)	
300 - 400	300 (56.60%)	100 (38.46%)	40 (36.36%)	30 (30%)	
> 400	180 (33.96%)	20 (7.69%)	0 (0%)	0 (0%)	
Legume/Nuts intake per day					0.48 (NS)
< 200	50 (9.43%)	90 (34.62%)	50 (45.45%)	60 (60%)	
200-300	220 (41.51%)	160 (61.54%)	40 (36.36%)	30 (30%)	
>300	260 (49.06%)	10 (3.85%)	20 (18.18%)	10 (10%)	
Fruits/Fruit juice intake /day					0.01 (S)
< 100	10 (1.89%)	90 (34.62%)	10 (9.09%)	30 (30%)	
100-200	30 (5.66%)	140 (53.85%)	60 (54.55%)	60 (60%)	
200 - 300	210 (39.62%)	1 (3.85%)	40 (36.36%)	10 (10%)	
>300	280 (52.83%)	20 (7.69%)	0 (0%)	0 (0%)	
Meat/Poultry/Fish intake per day					0.46 (NS)
No intake	390 (73.58%)	180 (69.23%)	40 (36.36%)	30 (30%)	
< 50 grams	140 (26.42%)	70 (26.92%)	60 (54.55%)	10 (10%	
>50 grams	0 (0%)	10 (3.85%)	10 (9.09%)	60 (60%)	
Dairy intake per day					0.027
No intake	10 (1.89%)	10 (3.85%)	10 (9.09%)	10 (10%)	
<200	460 (86.79%)	160 (61.54%)	10 (9.09%)	10 (10%)	
200- 300	40 (7.55%)	50 (19.23%)	90 (81.82%)	80 (80%)	
>300	20 (3.77%)	40 (15.38%)	0 (0%)	0 (0%)	
Junk food /Soft drink intake per week					0.001 (HS)
No intake	270 (50.94%)	90 (34.62%)	10 (9.09%)	20 (20%)	
Once	250 (47.17%)	130 (50%)	10 (9.09%)	20 (20%)	
Twice	10 (1.89%)	30 (11.54%)	0 (0%)	10 (10%)	
Three times	0 (0%)	10 (3.85%)	90 (81.82%)	40 (40%)	
Four times	0 (0%)	0 (0%)	0 (0%)	10 (10%)	
Chocolate intake per week (grams)					0.001 (HS)
No intake	350 (66.04%)	130 (50%)	0 (0%)	20 (20%)	
<40	170 (32.08%)	110 (42.31%)	30 (27.27%)	0 (0%)	
40 - 59	0 (0%)	10 (3.85%)	20 (18.18%)	20 (20%)	
60 - 79	10 (1.89%)	0 (0%)	60 (54.55%)	10 (10%)	
80 -99	0 (0%)	0 (0%)	0 (0%)	20 (20%)	
> 100	0 (0%)	10 (3.85%)	0 (0%)	30 (30%)	
Outside home (Stalls, hotels/restaurants) visit per month					0.001 (HS)
0	230 (43.40%)	80 (30.77%)	40 (36.36%)	0 (0%)	
1	270 (50.94%)	130 (50%)	10 (9.09%)	10 (10%)	
2	20 (3.77%)	40 (15.38%)	20 (18.18%)	20 (20%)	
3	10 (1.89%)	0 (0%)	40 (36.36%)	40 (40%)	
4	0 (0%)	10 (3.85%)	0 (0%)	30 (30%)	

Figure 1: Comparison of Hypertension and laboratory investigations among Underweight, Overweight and Obese patients

Comparison of Hypertension and Laborartory Investigations among Underweight, Over-weight and Obese Patients
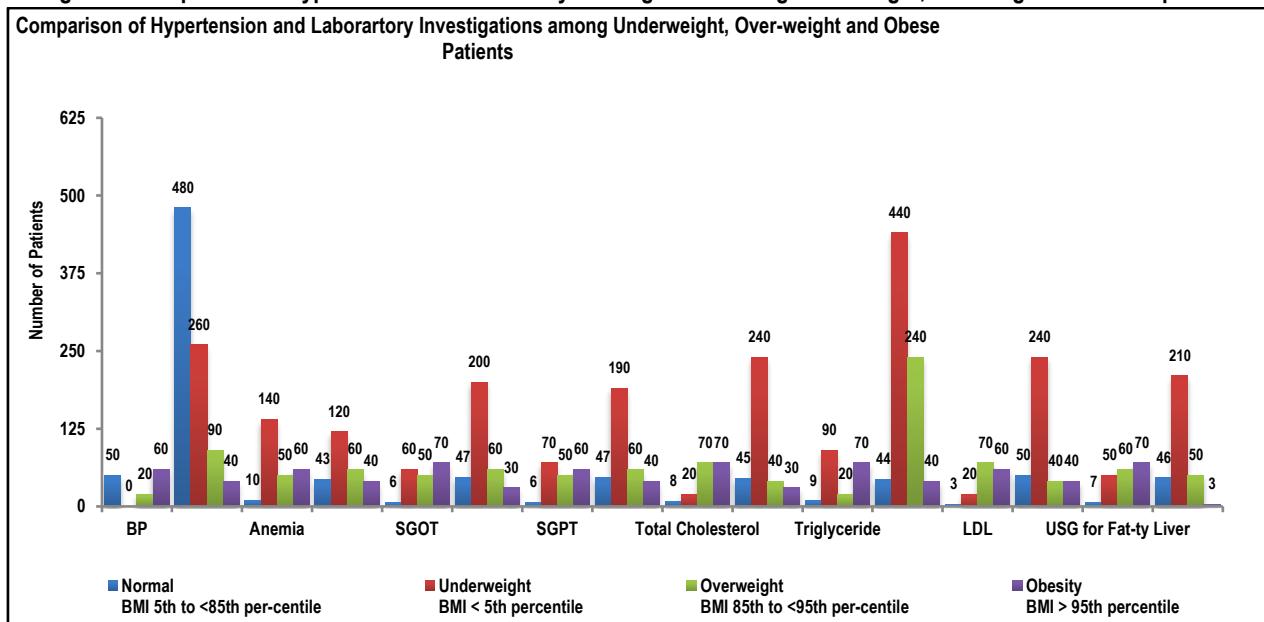
DISCUSSION

Adolescents are the backbone of the Nation, so it's important to provide proper nutrition and healthy lifestyle to the adolescent population. The prevalence of overweight and obesity was 21% in this study. Kotian MS, S GK, Kotian in 2010 conducted a study in urban Indian school children and total prevalence of obesity and overweight was 23.8%.[8] In this study 54.55% of overweight and 70% of obese patients were belonged to upper middle class, it might be because of less intake of fruits, vegetables and more consumption of junk food among them. Similar association was seen among the Asian population by Bishwajit G et al in 2020. [9] Among low socio-economic groups, there is food scarcity, less consumption of junk foods, use surplus food that protect them from obesity and overweight problems. Obesity and overweight was more among highly educated parents, because among them both parents have their jobs and less parental supervision leads to less physical activities, skipping breakfast and eating more often outside food. Similar association was seen in the study conducted by Brown CL, Halvorson EE et al. [10]

We observed vegetables, cereal and legumes intake was less among overweight and obese patients whereas chocolate, junk food and meat, poultry consumption was more among overweight and obese patients. Restaurant visits among 50% of underweight patients were once per month but three times per month among 36.36% of overweight and 40% of obese patients (statistically significant). These habits contribute to increase deposition of fat and calories. Gill and Brar also revealed the same in their study.[11] Neumark-Sztainzer D et al in their studies revealed that overweight and obese children consumed more fats and less vegetables, fruits and legumes.[12]

In our study, Hypertension was seen in 18.18% of overweight and 60% obese patients. Muntner P et al, did study and observed increase prevalence of obesity with evidence showing overweight and obesity increase the incidence of hypertension among adolescent population.[13] We also observed elevated liver enzymes and deranged lipid profile among overweight and obese patients. Similar to our study, Das et al in 2017 did the study and observed liver enzymes derangement among overweight and obese children as compared to normal weight children.[14] Jimenez‑Rivera et al. found that liver enzymes were elevated in 61% of patients with obesity and fatty liver.[15] Fatty liver was seen in 54.5% overweight and 70% obese patients. Jimenez‑Rivera et al found the prevalence of fatty liver was 85% and 66.1% in overweight and obese children respectively.[16] Hyperlipidemia, hypertension and fatty liver among adolescent obese and overweight patients increase risk of multi organ damage like cardiac structure, cardiac function, arterial stiffness, insulin resistance and metabolic syndrome in future. So proper screening of these factors among adolescent overweight and obese patients required.

CONCLUSION

In the study, our results reveal that the incidence of overweight and obesity is increasing among adolescents and increases the burden of non-communicable diseases in future. Multiple factors are associated with adolescent obesity like sedentary lifestyle, working parents, poor diet, eating junk food, frequent restaurant visits. Our study observed these patients had deranged lipid profile, hypertension, increase liver enzymes and fatty liver on ultrasonography. So, all these factors increased the risk of metabolic syndrome and other non-communicable diseases in future. Health care professionals and policy-makers need to make more programs to solve the problem. Primary health physicians, pediatricians and teachers should educate our community people to adopt healthier lifestyles, more outdoor activities in schools or at home, shifting eating habits and preventing a sedentary lifestyle.

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