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ORIGINAL ARTICLE

Prevalence of Overweight and Obesity among Adolescents in an Urban North Indian School: A Cross-sectional Study

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ABSTRACT

Introduction: Obesity and overweight have grown into a worldwide epidemic. Adolescents with overweight or obesity grow into obese adults. Hence, there is an urgent need to examine adolescents for obesity and overweight across countries and identify predisposing factors to check the menace of lifestyle diseases in adulthood.

Aims and objectives: In the present study, we have investigated the prevalence of obesity and overweight and their association with risk factors like gender, height, weight, body mass index (BMI), physical activity, eating habits like junk food, and family history of noncommunicable diseases (NCDs) and obesity.

Materials and methods: The study was carried out in a local public school in Chandigarh. Seventy-five school-going children of standard VIII to X were questioned and physically examined. Eating habits and lifestyle factors were enquired into, using a questionnaire and physical examination. Obesity and overweight were considered using Centers for Disease Control and Prevention, USA (CDC, USA) Gender-specific BMI-for-Age charts.

Results: Age-adjusted prevalence of overweight was found to be significantly correlated to female gender. Adolescent overweight and obese states were found to be significantly correlated with positive family history of lifestyle diseases.

Conclusion: Our study suggests that the children at risk be identified early and encouraged to adopt healthy lifestyle practices. India needs to develop standard BMI cut-off percentile charts for underweight/healthy weight/overweight/obese for Indian children and adolescents.

Keywords: Adolescent, Body mass index, Cardiovascular disease, Diabetes mellitus, Hypertension, North India, Obesity, Overweight, Schoolchildren, Waist–hip ratio.

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INTRODUCTION

Prevalence of obesity and its associated comorbidities have been increasing worldwide in recent times, more so in lower and middle-income countries like India. Obesity has superseded many NCDs, namely cardiovascular disease and diabetes, to epidemic proportions. It has become a major health concern, graduating from being an independent risk factor for major NCDs to being an established morbid condition by itself.[1] Early intervention is imperative for preventing short- and long-term morbidities. So arises the need to educate parents and teachers to encourage children and adolescent to adopt active and healthy lifestyle, including eating habits. Nutritional and lifestyle patterns are the major risk factors and start establishing from childhood and adolescence; hence, we embarked upon studying the same in school-going children.

Definition

Body mass index, defined as weight in kilograms divided by square of height in meters, is an inexpensive method of measurement for identifying individuals at risk for obesity-related diseases.[2,3] The standard BMI cut-offs for classifying weight status in adults are not applicable for children and adolescents. In India, no set guidelines are there to define weight status for Indian children and adolescents. Hence, for interpretation of normal gender-specific weight cut-offs, BMI-for-age (percentile) growth charts (https://nccd.cdc.gov/dnpabmi/calculator.aspx) developed by CDC, USA are used. While healthy weight range is defined as BMI between 10th and 85th percentile range, Overweight and Obesity are classified at or above 85th and 95th percentile levels respectively. Children below 5th percentile level are categorized as underweight.[4]

AIMS AND OBJECTIVES

The aim was to make the parents and teachers present to the gravity of problems concurring due to unhealthy

lifestyle and resultant adolescent obesity, thereby encouraging the children to adopt preventive lifestyle habits so that they do not need therapeutic lifestyle changes during adulthood.

MATERIALS AND METHODS

A cross-sectional study was conducted in a public school in Chandigarh, North India, involving students from class 8 to 10; 75 children were included: 42 boys and 33 girls. Necessary approvals for the study were obtained. The subjects were surveyed through a lifestyle-related questionnaire and subjected to physical examination.

The school was visited with prior intimation. The students and the teachers were briefed about the study. A parental consent form, along with contact details of Principal Investigator (PI), was distributed to the students. The PI was available to address the queries of the parents in couple of parent–teacher meetings. The consent forms were signed by either of the parents, countersigned by class teacher and vice principal/principal.

The questionnaire was used as a tool to collect data pertaining to eating habits (including intake of junk food and its frequency). Interests and hobbies were inquired from the children to understand their life style whether it was sedentary (watching TV or using computer/internet) or it incorporated outdoor activities and games. Family history was collected for lifestyle diseases like obesity, hypertension and diabetes. Data on age, weight, height, waist and hip circumference were collected for each subject through direct physical examination. The BMI and waist-to-hip ratio (WHR) were calculated. The number of underweight, normal, overweight, and obese were determined as per CDC, USA, gender-specific weight cut-offs BMI-for-age (percentile) growth charts.[4]

Personal one-to-one and group interactions were conducted by the PI with parents and children.

OBSERVATIONS AND RESULTS

A total of 75 adolescents with age between 11 and 16 years were screened for their weight, height, and waist and hip circumference. The BMI and WHR were calculated. Among 75 children, 42 (56%) were boys and 33 (44%) were girls. The observations and results are summarized in Tables 1 to 24.

Statistical Analysis

The BMI was calculated on measured height and weight and was used to identify underweight, healthy weight, overweight, and obese conditions using age- and sex-appropriate normative cut-off points as per CDC, USA

Table 1: Gender distribution

Class	*Examined*	*Boys*	*Girls*
VIII	33	22	11
IX	26	12	14
X	16	08	08
Total	N = 75	42 (56%)	33 (44%)

Table 2: Age profile (completed years/months)

Class	*Gender*	*N*	*Minimum*	*Maximum*	*Avg*
VIII	Boys	22	11/02	14/10	13/07
	Girls	11	12/03	14/03	13/08
IX	Boys	12	13/08	15/12	14/08
	Girls	14	14/01	15/06	14/08
X	Boys	8	14/09	16/05	15/08
	Girls	8	14/12	15/12	15/07

Table 3: Age distribution (years)

Age range (years)	*Frequency*	*Percent*
11–12	1	1.3
12–13	4	5.3
13–14	22	29.3
14–15	30	40.0
15–16	15	20.0
>16	3	4.0
N	75	100

Table 4: Weight profile (kg)

Class	*Gender*	*N*	*Minimum*	*Maximum*	*Avg*
VIII	Boys	22	27	69	43
	Girls	11	37	69	54
IX	Boys	12	39	75	52
	Girls	14	37	72	46
X	Boys	8	38	62	50
	Girls	8	45	87	54

Table 5: Weight distribution (kg)

Weight range (kg)	*Frequency*	*Percent*
25–35	6	8.0
35–45	27	36.0
45–55	23	30.7
55–65	13	17.3
65–75	5	6.7
>85	1	1.3
N	75	100

Table 6: Height profile (cm)

Class	*Gender*	*N*	*Minimum*	*Maximum*	*Avg*
VIII	Boys	22	130	171	157
	Girls	11	149	166	157
IX	Boys	12	159	178	168
	Girls	14	146	163	155
X	Boys	8	157	181	170
	Girls	8	147	172	158

Table 7: Height distribution (cm)

Height range (cm)	*Frequency*	*Percent*
130–140	1	1.3
140–150	7	9.3
150–160	33	44.0
160–170	24	32.0
170–180	9	12.0
>180	1	1.3
N	75	100

Table 8: Waist circumference profile (cm)

Class	*Gender*	*N*	*Minimum*	*Maximum*	*Avg*
VIII	Boys	22	54	91	68
	Girls	11	62	95	76
IX	Boys	12	62	104	75
	Girls	14	59	94	70
X	Boys	8	59	74	79
	Girls	8	63	93	72

Table 9: Waist circumference (WC) distribution (cm)

WC range (cm)	*Frequency*	*Percent*
50–60	5	6.7
60–70	36	48.0
70–80	25	33.3
80–90	4	5.3
90–100	4	5.3
>100	1	1.3
N	75	100

Table 10: Hip circumference profile (cm)

Class	*Gender*	*N*	*Minimum*	*Maximum*	*Avg*
VIII	Boys	22	68	100	80
	Girls	11	80	106	96
IX	Boys	12	81	107	89
	Girls	14	80	113	90
X	Boys	8	77	93	86
	Girls	8	83	115	92

Table 11: Hip circumference (HC) distribution (cm)

HC range (cm)	*Frequency*	*Percent*
60–70	2	2.7
70–80	16	21.3
80–90	34	45.3
90–100	15	20.0
100–110	6	8.0
>110	2	2.7
N	75	100

Table 12: Physical inactivity (hours/day) (TV)

Class	*Gender*	*N*	*Duration*
VIII	Boys	22	1.5
	Girls	11	1.4
IX	Boys	12	1.2
	Girls	14	1.5
X	Boys	8	1.9
	Girls	8	2.5

Table 13: Physical inactivity (hours/day) (computer use)

Class	*Gender*	*n (yes)/N*	*Duration*
VIII	Boys	19/22	0.86
	Girls	4/11	1.5
IX	Boys	11/12	1.4
	Girls	10/14	0.9
X	Boys	6/8	1.6
	Girls	6/8	1.2

Table 14: Physical inactivity distribution (hours/day) (TV/computer use)

Hours	*Frequency*	*Percent*
<1	12	16.0
1–2	27	36.0
2–3	20	26.7
3–4	8	10.7
4–5	5	6.7
5–6	2	2.7
>6	1	1.3
N	75	100

Table 15: Physical activity (hours/day) (outdoor games/walking)

Class	*Gender*	*n (yes)/N*	*Duration*
VIII	Boys	20/22	1.6
	Girls	9/11	0.94
IX	Boys	11/12	1.9
	Girls	14/14	1.2
X	Boys	6/8	0.6
	Girls	6/8	1.0

Table 16: Physical activity (hours/day) (outdoor games/walking)

Hours	*Frequency*	*Percent*
<1	47	62.7
2–3	22	29.3
2–3	3	4.0
3–4	2	2.7
5–6	1	1.3
N	75	100

Table 17: Food likes

Food type	*Frequency*	*Percent*
Junk food	41	54.7
Home food	34	45.3
N	75	100

Table 18: Family history (DM/HTN/CVD)

Family h/o NCDs	*Frequency*	*Percent*
Positive	35	46.7
Negative	40	53.3
N	75	100

Table 19: Body mass index profile (kg/m^2)

Class	*Gender*	*N*	*Minimum*	*Maximum*	*Avg*
VIII	Boys	22	13.96	25.04	17.10
	Girls	11	15.60	26.50	21.67
IX	Boys	12	13.49	29.67	18.50
	Girls	14	15.82	29.40	19.12
X	Boys	8	13.96	21.19	17.31
	Girls	8	17.06	29.41	21.23

Table 20: Body mass index distribution (kg/m^2)

BMI range	*Frequency*	*Percent*
10–15	7	9.3
15–20	50	66.7
20–25	13	17.3
25–30	5	6.7
N	75	100

Table 21: Body mass index percentile *vs* gender distribution (nth level)

Gender	*<5th*	*05–85th*	*85–95th*	*>95th*
	Under weight	Healthy weight	Overweight	Obese
Boys	13	27	1	1
Girls	1	26	4	2

Highly significant correlation, p = 0.009

Table 22: Body mass index percentile distribution (nth level)

BMI percentile	*Weight category*	*Frequency*	*Percent*
<5	Under weight	14	18.7
5–85	Healthy weight	53	70.7
85–95	Overweight	5	6.7
>95	Obese	3	4.0
N		75	100.0

Table 23: Waist-to-hip ratio *vs* gender distribution

Class	*Gender*	*N*	*Minimum*	*Maximum*	*Avg*
VIII	Boys	22	0.75	0.92	0.85
	Girls	11	0.68	0.90	0.80
IX	Boys	12	0.76	0.97	0.84
	Girls	14	0.73	0.84	0.78
X	Boys	8	0.72	0.86	0.80
	Girls	8	0.70	0.87	0.78

Adult men: 0.88; women: 0.81

Table 24: Waist-to-hip ratio distribution

WHR	*Frequency*	*Percent*
0.60–0.70	2	2.7
0.70–0.80	28	37.3
0.80–0.90	40	53.3
0.90–1.00	5	6.7
N	75	100.0

Charts.[4] The WHR was calculated for each subject. The results were subjected to Pearson chi-square test at 95% confidence interval, using Statistical Package for the Social Sciences (IBM) statistics software (version 10). The influence of various factors on the prevalence of underweight, normal, overweight, and obesity was expressed in the form of level of significance with p-value < 0.05 considered as significant.

DISCUSSION

There are many reports that suggest an uptrend of overweight and obesity among adolescents,[5-8] though in India, both over- and undernourished coexist.[9] In the USA, the prevalence of obesity in children and adolescents doubled between the 1976–1980 and 1988–1994 periods. During the 10 years from 1985, the prevalence of overweight in Australian children and adolescents almost doubled and that of obesity more than tripled.[10] Brazil has witnessed the prevalence of overweight school children almost tripling from 4% in the 1970s to 14% in the late 1990s.[11] Egypt had 14% of its children classified as overweight or obese in 1997.[12] Worthy of mention, there are still controversies over the use of a series of universal BMI cut-offs to define obesity or overweight in different populations of either adults or children.[11,13] A comparison of international references still shows lower prevalence of overweight in the Eastern world. For Asian and Caucasian populations, it is suggested that different BMI cut-offs should be used for obesity. However, recent studies in India and other countries revealed that obesity is becoming a growing health problem among children and adolescents, especially in urban populations.[14]

In our study, the prevalence of overweight was 2.4% (1/42) in boys and 12.1% (4/33) in girls. Obesity was found in 2.4% (1/33) of boys and 6.1% of girls. Among some previous studies, Anand and Tandon (1996) found 6.84% (342/5000) obese children in their study on 5 to 17 years age range,[15] while Verma et al[16] found 5.11% (131/2560) to be obese in their study on 5- to 15-year-olds in northern India and Ramachandran et al[17] found the prevalence of overweight to be 17.8% (n = 2382) for boys and 15.8% (n = 2318) for girls in South Indian children.

The relatively low prevalence of obesity (3.2%) and higher overweight (14.9%) among Indian children suggests more overweight and/or obese adults in future.[18] Being overweight in adulthood is an independent risk factor.[19]

Gender was found to be significantly correlated (p = 0.009) with BMI percentile, suggesting female gender's predisposition to overweight and obesity as compared with males (Table 21). The other finding was a significant correlation (p < 0.05) of BMI percentile values with positive family history of diabetes mellitus (DM), hypertension (HTN), and cardiovascular disease (CVD) (Table 25). The gender predisposition is contrary to results found in other studies[20] where higher prevalence of overweight and obesity was found in boys compared with girls.

Table 25: Family history *vs* BMI percentile

BMI percentile	Family history DM/HTN/Obesity		Total
	Positive	Negative	
<5	3	11	14
5–85	25	28	53
85–95	4	1	5
>95	3	0	3
N	35	40	75

Significant correlation, p = 0.026

Table 26: Waist-to-hip ratio *vs* BMI percentile

BMI percentile	Waist-to-hip ratio				Total
	0.60–0.70	0.70–0.80	0.80–0.90	0.90–1.00	
<5	0	5	9	0	14
5–85	1	23	27	2	53
85–95	1	0	2	2	5
>95	0	0	2	1	3
<5	2	28	40	5	**75**

Highly significant correlation, p = 0.005

The WHR was positively correlated ($p < 0.05$) with BMI percentile values (Table 26). It can also be used as one of the parameters to confirm overweight and obesity. But no Indian WHR standards for children and adolescents are available.

Our analysis showed that sex and positive family history (possibly genetic predisposition) may operate through complex pathways to influence overweight in adolescents.

Sedentary lifestyle, physical activity, and eating patterns in children may have a predictive value in overweight and obesity in adolescents. However, our study did not show any statistically significant correlation with the same.

CONCLUSION

Adolescent obesity, more so overweight, has dramatically increased in the past few decades and poses to be a serious health hazard for developing NCDs in the adulthood. The consequences would affect the growth and economy of the nation as the "future adults" are the ones who are victims of obesity and its associated comorbidities.

Our study suggests that the children at risk be identified early and encouraged to adopt healthy lifestyle practices. India needs to develop standard BMI cut-off percentile charts for underweight/healthy weight/overweight/obese for Indian children and adolescents.

The need of the hour is to educate and motivate the parents to inculcate healthy lifestyle and eating habits. Henceforth, intervening with fervor, at the right time, i.e., "Catch Them Young," as proposed by the legendary hockey player Major Dhyan Chand, seems to be the only optimal answer, more so for kids with positive family histories of NCDs.

FUTURE DIRECTIONS

The Indian health care delivery system needs to create gender-specific standard BMI for Age percentile charts for Indian children and adolescents as developed by CDC USA. A holistic approach to tackle this epidemic is needed. Proper policymaking, mobilizing communities, restructuring organizational practices, educating primary health service providers about diet, outdoor activities, and transforming education system and social behavior are mandatory. Identification and assessment of population determinants of childhood obesity are crucial.

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