Overweight/obesity and physical work capacity of affluent adolescent girls (13–15 years) studying in selected public schools of Delhi

Anu Taneja Gupta[1], Pushpa Sundararaj[2], Suvira Kapoor[3]

[1]Department of Food & Nutrition, Lady Irwin College, University of Delhi, Delhi, India.
[2]Reader, Bio-Chemistry, Lady Irwin College, University of Delhi, Delhi, India.
[3]Reader, Food and Nutrition, Lady Irwin College, University of Delhi, Delhi, India.
Correspondence to: Anu Taneja Gupta, E-mail: anu7398@yahoo.com

Abstract

Background: Adolescent obesity is closely linked to lifestyle factors, including unhealthy eating habits and decreased physical activity.

Objective: To identify overweight/obese adolescent girls aged 13–15 years and assess their physical work capacity.

Materials and Methods: A cross-sectional study was carried out at four public schools of Delhi catering to the affluent population involving 80 girls with body mass index (BMI) value falling above the 5th percentile. BMI was computed from height and weight measurements. General information about the subjects was obtained using a pretested semi-structured questionnaire-cum-interview schedule. Dietary intake of all the girls was assessed by 24-h recall method for 3 days. Physical work capacity determined by 3-min step test, and pre- and postexercise heart rate and blood pressure were recorded for both groups.

Result: About 70% and 50% of overweight/obese subjects possessed both parents and siblings overweight/obese, respectively. Junk food consumption was higher among the overweight/obese girls, and they indulged in activities that were purely sedentary in nature. Mean daily intake of food groups including milk, meat, fat, and sugar and of nutrients including energy, protein, thiamin, and niacin was significantly higher ($p < 0.05$) in the overweight/obese group when compared with the normal subjects. The mean pre- and postexercise heart rate and blood pressure levels were significantly higher ($p < 0.01$) for the overweight/obese group.

Conclusion: Faulty eating habits and insufficient physical activity have contributed to obesity in affluent adolescent girls of Delhi. This has led to significantly poorer physical work capacity in these girls when compared with girls showing normal weight status.

KEY WORDS: Overweight, obesity, affluent adolescent girls, physical work capacity

Introduction

Pediatric overweight/obesity is a problem that is surfacing in developing countries such as India, especially among the higher socioeconomic status groups.[1] Adolescent obesity is closely linked to lifestyle factors, including unhealthy eating habits and decreased physical activity.[2]

Adolescence is a transitional phase between childhood and adulthood characterized by rapid physical, sexual, and emotional changes. It is also the time when an adolescent girl becomes more sensitive toward her body image. Therefore, this stage in life is of great importance, and development of overweight/obesity at this period will cause adverse effects not only on physical health but also on personal achievement.

Apart from other health-related consequences, overweight/obesity can reduce physical work capacity (PWC), because it affects the cardiovascular system. Hence, this study was

Access this article online	
Website: http://www.ijmsph.com	Quick Response Code:
DOI: 10.5455/ijmsph.2016.0107201527	

envisaged with the objective of identifying overweight/obese adolescent girls belonging to the high-income group, assessing their PWC, and comparing it with that of girls showing normal weight status.

Materials and Methods

This cross-sectional study was carried out in Delhi. Four public schools were randomly selected from a list of schools obtained from the Municipal Corporation of Delhi, India. All the four schools (coeducational) were easily accessible and willing to participate in the study. A list of girls in the age range of 13–15 years was prepared from all the four schools. Selection of girls for this study was made on the following basis:

Inclusion Criteria

Girls with body mass index (BMI) above 5th percentile, regular school attendance, attainment of menarche, and Hb level ≥ 12g/dL were included in the study.

Exclusion Criteria

Girls with respiratory and breathing problems and actively participating in sports at the school level; undergoing professional slimming treatment were excluded from the study.

Anthropometric measurements including height and weight of the girls were recorded. Anthropometrical rod was used to measure height, and reading was taken to the nearest 0.1 cm. Weight was measured with a digital electronic balance with a sensitivity of 0.1 kg. BMI was computed from the height and weight measurements, and the girls were categorized using the CDC-NCHS age- and sex-specific percentile growth charts.[3] Hemoglobin level was checked using the secondary data. The final working sample consisted of 80 adolescent girls.

A pretested, semi-structured, questionnaire-cum-interview schedule was used to elicit information on sociodemographic profile and lifestyle practices of the adolescent girls.

All the four school authorities, all the subjects and their mothers were informed on the nature of the study being conducted, and the necessary permissions were obtained. The subjects were interviewed during school hours.

Dietary intake of the subjects was assessed by 24-h recall method for 3 days including two weekdays and a Sunday. A questionnaire-cum-interview schedule was used for collecting the dietary information. The actual amounts eaten were obtained with reference to standard utensils shown to the subjects. Information about the weight of raw ingredients used in different preparations was obtained from the mothers of the subjects over phone and by personal visits to their homes. Mean daily intake of various foods was calculated, and the mean daily intake of the nutrients was computed.[4,5]

The PWC of the subjects was assessed by the 3-min step test, which is the modification of the original Harvard step test.[6] This test was conducted on a 12″-high bench, with a stepping rate of 24 steps/min for a period of 3 min.[7] After 3 min, heart beats were counted with the help of a clinical stethoscope

and blood pressure (BP) was measured with a sphygmomanometer. Resting heartbeat rate and BP were recorded at the beginning of the step test.

Data obtained were statistically analyzed to determine the significance of difference in the mean daily intake of food groups and nutrients (two-tailed t test) and PWC (Student's t-test) between normal and overweight/obese adolescent girls.

Result

On the basis of CDC-NCHS age- and sex-specific percentile growth charts,[3] it was seen that 36 (45.0%) subjects were in the 5th to 85th percentile (i.e., normal weight status), 21 girls were categorized as overweight as their BMI values were falling between 85th and 95th percentile, and the remaining 23 girls were classified as obese, because their BMI values were falling above the 95th percentile [Table 1]. However, in this study, the girls falling between 85th and 95th percentile were grouped along with the girls with BMI above the 95th percentile. Hence, the results were

Table 1: Distribution of 13–15 years aged adolescent girls (*n* = 80) on the basis of CDC-NCHS age- and sex-specific percentile growth charts

Percentile	Classification	*n* (%)
Less than 5th	Underweight	0
Between 5th and 85th	Normal weight	36 (45)
Between 85th and 95th	Overweight	21 (26.25)
> 95th	Obese	23 (28.75)

Table 2: Sociodemographic profile of adolescent girls (*n* = 80)

Parameters	Normal (*n* = 36), *n* (%)	Overweight/obese (*n* = 44), *n* (%)
Type of family		
Nuclear	30 (83.4)	23 (52.3)
Joint	3 (8.3)	14 (31.8)
Extended	3 (8.3)	7 (15.9)
Occupation of father		
Business	21 (58.3)	37 (84.1)
Service	15 (41.7)	7 (15.9)
Work status of parents		
Both working	10 (27.8)	7 (15.9)
One working	26 (72.2)	37 (84.1)
Weight status of parents		
Both normal	29 (80.6)	10 (22.7)
Both overweight/obese	0	28 (72.7)
One normal and one overweight/obese	7 (19.4)	2 (4.6)
Weight status of siblings[a]		
Normal	32 (94.1)	20 (50)
Overweight/obese	2 (5.9)	20 (50)

[a]Two normal and four overweight/obese subjects did not have siblings.

analyzed viz-a-viz two groups (i.e., normal weight status and overweight/obese).

The sociodemographic profile of the subjects [Table 2] revealed that majority of the subjects were from families in business and living in a nuclear setup. A little over 80% of the normal subjects possessed both parents with normal weight status, whereas 72.7% of overweight/obese subjects possessed both parents overweight/obese. Furthermore, 50% overweight/obese subjects also possessed overweight/obese siblings, while only 5.9% of normal weight subjects possessed overweight/obese siblings.

The dietary pattern of the subjects [Table 3] showed that almost 66% of overweight/obese subjects were nonvegetarians. Frequency of eating out and consumption of junk foods, at least once a week, was higher among the overweight/obese girls. They also visited the school canteen daily and consumed colas and patty/samosa/burger. The habit of nibbling on chips and biscuits in between meals and the amounts generally consumed was higher among the overweight/obese subjects (95.5%) when compared with the normal weight subjects (52.8%).

All the subjects spent around 2 h completing their home work. The overweight/obese subjects indulged in entertainment activities that were purely sedentary in nature such as watching television (TV), painting, reading, and listening to music. Except two, none of these girls took part in any outdoor games either at school or at home. Compared with this, almost all the normal weight girls played basketball/throw ball/badminton daily, both in school and at home. They also helped in household activities regularly.

As many as 38 overweight/obese girls were aware of their excess weight status and quite sensitive about it. However, most of them were not making any efforts for reducing weight. Only three reported that they had tried dieting but without success. The normal weight girls reported being careful about their diet and resorted to weight control strategies such as exercise and walking.

The mean daily intake of cereal and pulse was comparable for both the groups [Table 4]. However, consumption of milk, meat, fat, and sugar was significantly higher ($p < 0.05$) in the overweight/obese group, whereas the intake of green leafy vegetables and fruits was significantly higher ($p < 0.05$) among the normal weight subjects.

The mean daily energy intake of normal weight girls when compared with the recommended dietary allowances (RDAs) was almost adequate [Table 5]. However, it was almost 400 kCal (19.2%) above the RDA for the overweight/obese girls and, thus, was significantly higher ($p < 0.05$) when compared with that of the normal girls. All the subjects had an adequate/more than adequate mean daily intake of protein, calcium, vitamin A, vitamin C, thiamin, and riboflavin when compared with the respective RDAs. The mean daily intake of protein, thiamin, and niacin was significantly higher ($p < 0.05$) in the overweight/obese subjects when compared with the normal girls. All the subjects fell short of the RDA for iron and niacin.

The mean preexercise heartbeat rate and BP (systolic and diastolic) were significantly higher ($p < 0.01$) for the overweight/obese group when compared with those of normal weight subjects [Table 6]. Following exercise, the mean heartbeat rate and mean systolic BP increased for both the study groups. However, the extent of increase was significantly greater ($p < 0.01$) in the case of overweight/obese subjects when compared with the normal group. The systolic BP showed a difference of 9 mm Hg between the subjects with low- and high-fitness levels.

Table 3: Dietary pattern of adolescent girls ($n = 80$)

Dietary pattern	Normal ($n = 36$), n (%)	Overweight/obese ($n = 44$), n (%)
Type of diet		
Vegetarian	21 (58.3)	6 (13.6)
Nonvegetarian	11 (30.6)	29 (65.9)
Ovovegetarian	4 (11.1)	9 (20.5)
Frequency of eating out		
Twice a week	1 (2.8)	3 (6.8)
Once a week	6 (16.7)	22 (50)
Fortnightly	8 (22.2)	8 (18.2)
Once a month	13 (36.1)	11 (25)
Rarely	8 (22.2)	0 (0)
Consumption of junk food		
Daily	3 (8.3)	5 (11.4)
Alternate days	2 (5.6)	5 (11.4)
Once a week	19 (52.8)	32 (72.7)
Fortnightly	5 (13.9)	2 (4.5)
Rarely	7 (19.4)	0 (0)
Eating pattern		
At set times	17 (47.2)	2 (4.5)
In between meals	19 (52.8)	42 (95.5)

Table 4: Mean daily intake of food groups in adolescent girls aged 13–15 years ($n = 80$)

Food groups (g)	Normal, ($n = 36$)	Overweight/obese, ($n = 44$)	p
Cereal	260	265	0.792
Pulse	60	50	0.43
Milk	300	500	0.015*
Meat	5	15	0.019*
Egg	20	20	–
Green leafy vegetables	100	50	0.002*
Other vegetables	160	150	0.25
Roots and tubers	200	200	–
Sugar	30	65	0.001*
Visible fat	30	50	0.001*
Fruits	100	30	0.001*

*Significant at $p < 0.05$.

Table 5: Mean daily intake of nutrients in adolescent girls aged 13–15 years ($n = 80$)

Nutrient	RDA, (ICMR 2010)	Normal, ($n = 36$)		Overweight/obese, ($n = 44$)		Pp (normal vs. overweight/obese)
		Mean ± S.D	% excess/deficient of RDA	Mean ± S.D	% excess/deficient of RDA	
Energy (kCal)	2,330	2045 ± 65.0	-12.2	2450 ± 198.2	5.2	0.001*
Protein (g)	51.9	62.5 ± 4.0	20.4	68.2 ± 6.75	31.4	0.001*
Calcium (mg)	800	716.5 ± 110.6	10.4	760.5 ± 139	-4.9	0.21
Iron (mg)	27	20.1 ± 3.7	-25.5	20.8 ± 3.6	-22.9	0.413
Vitamin A (μg)	600	648.0 ± 177.3	8	608.0 ± 156.5	1.33	0.443
Vitamin C (mg)	40	77.0 ± 12.28	92.5	76.0 ± 13.12	90	0.627
Thiamin (mg)	1.2	1.17 ± 0.21	-2.5	1.37 ± 0.33	14.2	0.006*
Riboflavin (mg)	1.4	1.21 ± 0.19	-13.6	1.25 ± 0.27	-10.7	0.049*
Niacin (mg)	14	11.5 ± 2.11	-17.8	12.3 ± 2.38	-12.14	0.078

*Significant at $p < 0.05$.

Table 6: Physical work capacity of 13–15 years adolescent girls ($n = 80$)

Parameters	Normal, ($n = 36$)	Overweight/obese, ($n = 44$)	p
Heart rate/min, mean ± S.D			
Preexercise	73.5 ± 2.25	76.2 ± 1.68	0.002*
Postexercise	105.9 ± 5.69	129.0 ± 9.05	0.001*
Mean BP (mm Hg), mean ± S.D			
Preexercise			
Systolic	100 ± 4.25	109 ± 5.08	0.005*
Diastolic	74 ± 2.68	76 ± 4.65	0.006*
Postexercise			
Systolic	114 ± 5.08	138 ± 9.23	0.001*
Diastolic	74 ± 2.68	76 ± 4.65	0.002*

*Significant at $p < 0.01$.

Discussion

This study shows that overweight/obesity is present in affluent adolescent girls (13–15 years) studying in public schools of Delhi. Several studies have reported that overweight/obesity is an emerging health problem in adolescent children belonging to affluent families in Delhi.[8,9] A much larger number of overweight/obese subjects in this study also possessing overweight/obese parents and siblings is a pointer that faulty dietary habits and lifestyle practices followed in a family could affect the weight status of its members. Hence, it is important to make families aware that such practices should be suitably changed. Familial obesity in adolescents and their parents have been widely reported.[10,11]

The overweight/obese status of our study subjects could be attributed to greater indulgence in consumption of tasty calorie-dense junk foods, which were also abundantly available in the school canteens, along with a purely sedentary lifestyle that included extensive TV viewing. Excessive TV viewing also resulted in increased consumption of high-energy dense snacks. Ramachandran et al.[12] reported similar observations in their study. Prevalence of obesity reportedly increased by 2% for each additional hour of television viewed.[13] Veerman et al.[13] opined that limiting television advertising of energy-dense foods would be helpful.

The much sought-after "pencil-slim" figure has created tremendous awareness for maintaining normal body weight and proportions in adolescents, particularly, girls. However, the overweight/obese adolescent girls in this study, despite being aware of their undesirable weight status, had been unable to incorporate any improvement in their lifestyle. They also showed insufficient knowledge regarding the right kind and quantity of foods to be eaten, which was reflected in their significantly higher ($p < 0.05$) intake of meat, fat, and sugar, which are high sources of calories. However, the normal subjects generally exhibited healthier food habits, as indicated by significantly higher ($p < 0.05$) intake of green leafy vegetables and fruits. Knowledge about the importance of physical activity was also not adequate among the overweight/obese subjects. Hence, there is an urgent need to educate not only the adolescents but also their parents and the school authorities regarding healthy eating habits and essential physical activity. These should be woven in their daily lives. Singhal et al.[14] reported that multicomponent model of nutrition and lifestyle education resulted in beneficial changes in anthropometric and biochemical profiles of urban adolescents in north India.

The significantly higher heartbeat rate and mean BP observed for pre- and postexercise condition in overweight/obese girls of this study when compared with their normal

counterparts indicate that the former distinctly had compromised PWC. Unless corrected at the right time, these overweight/obese adolescent girls will grow up into overweight/obese adults with associated risk of hypertension, cardiorespiratory disease, and diabetes. A low physical fitness level and high BMI were independently associated with a high BP and the risk of developing hypertension in girls 15–20 years of age.[15] Klasson-Heggebo et al.[16] showed a significant curvilinear graded relation between cardiorespiratory fitness and waist circumference, sum of skinfolds, and systolic and diastolic BPs in 15-year-old adolescents.

This study shows that faulty eating habits and lack of adequate physical activity resulted in overweight and obesity in affluent adolescent girls (13–15 years) of Delhi. They showed significantly poorer physical work capacity in terms of cardiorespiratory fitness when compared with their non-overweight/nonobese counterparts. It is, therefore, imperative that concerned professionals, school authorities, parents, and children take cognizance of the situation and prevent it from becoming a major health issue in affluent urban populations.

Conclusion

Faulty eating habits and insufficient physical activity have contributed to obesity in affluent adolescent girls of Delhi. This has led to significantly poorer PWC in these girls when compared with girls with normal weight status.

Acknowledgment

References

1. Chhatwal J, Verma M, Riar SK. Obesity among pre-adolescent and adolescents of a developing country (India). Asia Pac J Clin Nutr 2004;13(3):231–5.
2. Bharati DR, Deshmukh PR, Garg BS. Correlates of overweight and obesity among school going children of Wardha city, Central India. Ind J Med Res 2008;127(6):539–43.
3. CDC-NCHS. *Age and Sex Specific Percentile Growth Charts*. Available at: http://www.cdc.gov/growthcharts (last accessed on December 8, 2011).
4. Gopalan C, Rama Sastri BV, Balasubramaniam SC, Narsinga Rao NS, Deosthale YG, Pant KC. *Nutritive Value of Indian foods*. Hyderabad: NIN, ICMR, 1989.
5. Indian Council of Medical Research (ICMR). *Nutrient Requirements and Recommended Dietary Allowances for Indians*. A Report of the Expert Group of the Indian Council of Medical Research 2010, Hyderabad, India: National Institute of Nutrition, 2010.
6. Mathews DK. Cardiovascular test. In: *Measurement in Physical Education*, 5th edn. Philadelphia, PA: WB Saunders, 1978. pp. 260–70.
7. Pate RR, Blair SN, Durstin JL, Eddy DO, Hanson P, Painter P, et al. *Guidelines for Exercise Testing and Prescription*. Philadelphia, PA: Tea and Febiger, 1991. pp. 11–55.
8. Marwaha RK, Tandon N, Singh Y, Aggarwal R, Grewal K, Mani K. A study of growth parameters and prevalence of overweight and obesity in school children from Delhi. Indian Pediatr 2006;43(11):943–52.
9. Mehta M, Bhasin SK, Agrawal K, Dwivedi S. Obesity amongst affluent adolescent girls. Indian J Pediatr 2007;74(7):619–22.
10. Singhal N, Misra A, Shah P, Rastogi K, Vikram NK. Secular trends in obesity, regional adiposity and metabolic parameters among Asian Indian adolescents in North India: a comparative data analysis of two selective samples 5 years apart (2003, 2008). Ann Nutr Met 2010;56:176–81.
11. Grinker JA, Garn SM, Rosenberg KR. Effects of parental weight and fatness on relative weight and fatness of young children—comparison of cross-sectional and prospective clinical data. Ann NY Acad Sci 2006;575:521–4.
12. Ramachandran A, Snehalata C, Vinitha R, Thayyil M, Kumar CK, Sheeba L, et al. Prevalence of overweight in urban Indian adolescent school children. Diab Res Clin Pract 2002;57(3):185–90.
13. Veerman JL, Van Beeck EF, Barendregt JJ, Mackenbach JP. By how much would limiting TV food advertising reduce childhood obesity? Eur J Pub Health 2009;19(4):365–9.
14. Singhal N, Misra A, Shah P, Gulati S. Effects of controlled school-based multi-component model of nutrition and lifestyle interventions on behavior modification, anthropometry and metabolic risk profile of urban Asian Indian adolescents in North India. Eur J Clin Nutr 2010;64(4):364–73.
15. Nielsen GA, Andersen LB. The association between high blood pressure, physical fitness, and body mass index in adolescents. Prev Med 2003;36:229–34.
16. Klasson-Heggebo L, Andersen LB, Wennlof AH, Sardinha LB, Harro M, Froberg K, et al. Graded associations between cardiorespiratory fitness, fatness, and blood pressure in children and adolescents. Br J Sports Med 2006;40(1):25–9; discussion 25–9.