Human Biology Review (ISSN 227 7 4424) 6 (3) 2017
©Human Biology Review Original scientific paper (Walia et al. pp. 206-218)
www.humanbiologyjournal.com Revised and Accepted on June 21, 2017

Comparison of Body Mass Index of Childhood and Adolescent Obesity of South Delhi and West Delhi

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Citation: Walia S, Kumari S and Mondal PR. 2017. Comparison of Body Mass Index of Childhood and Adolescent Obesity of South Delhi and West Delhi. Human Biology Review, 6 (3), 206-218.

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ABSTRACT

*Objective**:** The objective of the present study is to compare the prevalence of childhood and adolescent obesity in West Delhi and South Delhi using the body mass index.*

Methods: A cross sectional study design was devised in which anthropometric data was collected. A data of 1000 children and adolescents [6-15years] have been collected cross-sectionally from West and South Delhi Public Schools in an Indian Council Medical Research funded research, in order to study the prevalence of obesity in these parts of Delhi. Body Mass Index is a height weight system of measurement that applies to both the sexes, has been used to assess obesity.

Results: Among West Delhi males, there is a high prevalence of obesity from ages 6-11 years and there is a drop in obesity level during the adolescent spurt. The prevalence of obesity is 14.2% in West Delhi,33.4% in South Delhi.The overall prevalence of obesity and over weight is 23.8% and 24% respectively. More than 1 in 5 children now are overweight or at risk for obesity. So, this problem needs to be addressed urgently.

Conclusion: The study highlights the increasing prevalence of obesity in childhood and adolescents. This original research article serves as a model for public health policy makers, in identifying children at risk for cardiovascular diseases in future.

Key Words: Body mass index, childhood, adolescent, cardiovascular disease, Delhi.

INTRODUCTION

Obesity is now prevalent in several developing countries, particularly those in rapid socio-economic transition and affecting children, adolescents and adults. Most studies from developing countries report an increasing prevalence of obesity in childhood and adolescence. So this is an early indicator of emerging enormous health burdens due to non-communicable diseases (Shetty, 1999). Obesity in both children and adolescents is likely to become a serious health problem in India also, especially in big metropolitan cities. Because rapid economic development and modernization are altering dietary habits and lifestyle patterns which are promoting positive energy balance due to food adequacy in middle and upper socio-economic groups. If it is not timely controlled then obesity is expected to reach an epidemic proportion in this century. Obesity results from a chronic energy imbalance where the rate of energy intake exceeds the rate of energy expenditure (Salbe et al., 2002). It is recognized to be the result of a positive balance, mainly attributable to excessive energy intake accounted for by a high concentration of dietary fat. Moreover, obesity is associated with decreased participation in sports, increased television viewing and also decreased physical activity (Shetty, 1997; 1999, Faith et al., 2001; Salbe et al., 2002). At the beginning of this new millennium, a new challenge will emerge a marked increase of obesity-associated chronic diseases and their clinical onset at ever younger ages. Type 2 diabetes, a condition associated with middle aged adults, is beginning to occur in greater number of children and adolescents, not only that, childhood obesity is also related to adult level of lipids, lipoproteins, blood pressure and insulin, and morbidity from coronary heart disease. Other health consequences of obesity in children include sleep apnoea and orthopaedic complications (Pinhas-Hamiel et al., 1996; Shetty., 1999; Freedman et al., 2001; Salbe et al., 2002).

The body mass index has become the medial standard used to measure overweight and obesity. It may be used to estimate the prevalence of obesity within a population and the risk associated with it. BMI does not directly measure percent of body fat but it provides a more accurate measure of overweight and obesity then relying on weight alone. BMI generally correlates highly with adiposity, although it can sometimes misclassify total body fat content for example athletes who are muscular have a high BMI, due to muscle weighing more then fat, will have BMIs within the overweight range, even though they are not fat. The shortest and tallest subjects also tend to be misclassified as obese. It may be noted that BMI is a height weight system of measurement that applies to both the sexes. It's not a perfect

system, because very muscular people may fall into the "overweight" category when they are actually healthy and fit. But it's a useful pointer for most people.

A graded classification of overweight and obesity using BMI values provide valuable information about increasing body fatness. It allows meaningful comparisons of weight status within and between populations and the identification of individuals and groups at risk of morbidity and mortality. WHO (1998) advised the use of BMI cut-off points. A BMI value of 30 or more is now widely accepted as denoting obesity. It allows a firm basis for evaluating interventions. For adults, WHO (1998) has recommended 25.0 Kg/m^2 and 30.0 Kg/m^2 as the cut-off points of overweight and obesity respectively. These BMI value are age-independent and the same for both sexes. WHO (2000) recommended different ranges for the Asia-Pacific region based on risk factors and morbidities. In Asians, the cut offs for overweight (23.0kg/m^2) and obesity (25.0 Kg/m^2) are lower than the international WHO criteria. It has now been well established that the prevalence of childhood obesity is increasing rapidly worldwide. Because of their public health importance, the trends in childhood obesity have been closely monitored. The measurement of overweight and obesity in children and adolescents poses particular problems due to different rates of maturations and growth. As children are still growing, the adult BMI cut-offs are not considered appropriate for children. Adiposity measures are linked to a child's stage of maturation at the time of measurement and there are two periods when adiposity increases about the age 5-7 years and in early puberty.

Although a fixed cut off can be used to define obesity in adults, these need to be adjusted for age in childhood (and additionally) for maturation in adolescence. However recent agreement has been reached on appropriate measures of adiposity which allow classification & comparison. The BMI for age chart is recommended. Those greater than 95^{th} percentiles are considered obese whilst those greater than 85^{th} percentiles of BMI for age are at risk" WHO(1995). Previous study recommended an internationally suitable definition of child overweight and obesity, specifying the measurement, the reference population and the age and sex specific cut off points (Cole et al., 2000).

Objective of the study: The objective of the present study is to compare the prevalence of childhood and adolescent obesity in West Delhi and South Delhi using the body mass index. So, in the present study data of 500 children and adolescents have been collected from West

Delhi Public Schools and a data of 500 children and adolescents have been collected from South Delhi Public Schools with the following objectives

- In order to study the prevalence of obesity in these parts of Delhi.
- Body Mass Index have been used to calculate the percentage of obesity in the age-groups of 6 - 15 years.

MATHERIAL AND METHODS

The data of children and adolescents of both sexes were collected cross sectionally from various public schools of Delhi in an Indian Council Medical Research funded research project. The age-range of the subjects is 6 - 15 years. Schools have been selected from West Delhi and South Delhi. The type of data collected from school children and adolescent are:

1. Data of Anthropometry (WHO, 1987; Vijayaraghavan, 1987; Singh and Bhasin, 1989).

There are two main experimental groups i.e. children [6- 9 years] and adolescent [9 - 15 years] with two sexual groups in each main group.

In the present study there are two main groups i.e., Children [6 - 9 years] and adolescents [9 - 15 years] and each main group is having two sexual groups i.e. male and female. The data of 200 children [6 - 9 years] and 300 adolescents [9 - 15 years] have been collected [Total number of data = 500] from various West Delhi Public Schools and South Public Schools [100 males and 100 males of childhood group, 150 males and 150 females of adolescent group], in order to study the prevalence, nature and etiology of obesity and its attendant health consequences in. this region of Delhi.

The names of the schools were selected according to the draw method [Randomly] and even the name of the male and female students were also selected by draw method [Randomly]. The consent form was signed from parents of the students of the total students of all particular age-groups, then again through the draw method desired number of samples and their names were picked up. For the necessary permission and for the parental consent to collect data, the principals of the selected schools were approached first.

In the present study data have been collected from West Delhi Public Schools and South Delhi Public Schools. The data was put to statistical analysis using Statistical Package

for the Social Sciences (SPSS- 16). The Study was ethically cleared by the ethical committee of Department of Anthropology, University of Delhi, Delhi.

RESULTS

Among West Delhi males, there is a high prevalence of obesity at ages 6-11 years and a drop in obesity level is observed during the adolescent spurt. The highest prevalence of obesity in seen at age 9 years (52%) while among West Delhi females a high prevalence of obesity is seen at ages 7 years (24%), 8 years: (12%) 9 years (16%) and 12 years (12%)(Table-2)

In South Delhi (Table 1) among males the prevalence of obesity is tremendously high as compared to West Delhi. In the males prevalence is high at ages 6-11 yrs. i.e. 6 yrs (56%), 7 yrs (72%), 8 yrs (64%), 9 yrs (48%), 10 yrs and 11 yrs (56%), there is a sudden drop in prevalence of obesity at age 12-15 yrs showing adolescent spurt. Among South Delhi females, at ages 6– 11years the prevalence of obesity is high but at adolescent spurt that is at 12 yrs, there is a drop but the drop is less as compared to the males.

The average weight, height and body mass index at various age groups among males and females of South Delhi and West Delhi has been shown in (table and graph 3a &3b).The overall prevalence of obesity and over weight in West Delhi (table 4) is 14.2% and 25% respectively, whereas the overall prevalence of obesity and over weight in south Delhi is 33.4% and 23.6% respectively .The combined prevalence of obesity in south and west Delhi is found to be 23.8% and over weight is 24%.Table-4 shows the statistics of west Delhi and south Delhi children and adolescents. When T-test was applied, it is found that statistically significant differences (t- 2.5620,df=18) exist between obese children (6-15 years) of West Delhi and obese children (6-15 years) of South Delhi. Although non-significant difference (t=0.5918,df=18) exist between overweight children(6-15years) of West Delhi and South Delhi children (6-15 years). There were statistically non significant differences between males and females of both the directions. The figures clearly show more children are obese in South Delhi as compared to West Delhi. Another interesting fact observed is that the number of children falling in the obese category is more than the children falling in the overweight category in South Delhi .This demarcates the fact high prevalence of obesity rather future health burden persists in South Delhi. This fact should be taken as a red alert and dealt with very seriously. Environmental which includes the life style as well as social factors contribute to this difference. Children are physically inactive, they have no time for sports because of

study burden and competitions. They do not have ample time for play. Mostly both the parents are working, with no focus on child's daily routine, they plan tuitions for children, but no out-door activity. There is less focus on dietary habits ,junk food has become essential part of the diet ,replacing fruit and vegetables.

Kapil et al.,2002 ., reported 7.4% prevalence of obesity in affluent school children of Delhi. When overweight and obesity in the present study are compared, it is found to be much higher. Khadilkar et al.,2004. reported a prevalence of obesity to be 5.7% and over weight of 19.9%.,present study comparatively shows a higher frequency. Kaur etal.,2008.,reported over weight and obesity of 13.1% and 9.3% respectively, which is lower than our present study. Dhingra et al.,2011., showed an overall prevalence of obesity in Srinagar to be 25%,which is higher than our present study .All these studies show growth trend in obesity, it clearly shows that the percentage prevalence of obesity is increasing year on year, indirectly increasing the health burden year on year. It is required to reverse the trend by educating the masses on ill-effects of obesity. Physical activity should be an essential or compulsory part of every child's daily routine. Food habits and calorie intake should be taken care of, with fruits and vegetables should become an essential part of the diet.

Table 1: The prevalence of obesity using the body mass index among males and females 6-15 years of South Delhi

Age	Male Overweight %	Male Obese%	Male Normal %	Female Overweight %	Female Obese %	Female Normal %
6 Yrs	12	56	32	8	24	68
7 Yrs	8	72	20	12	40	48
8 Yrs	20	64	16	28	56	16
9 Yrs	16	48	36	24	32	44
10 Yrs	20	56	24	16	32	52
11 Yrs	32	56	12	32	64	4
12 Yrs	32	4	64	24	12	64
13 Yrs	24	8	68	32	4	64
14 Yrs	32	4	64	28	20	52
15 Yrs	28	8	64	32	8	60

Graph 1: The prevalence of obesity using the body mass index among males 6-15 yrs of South Delhi

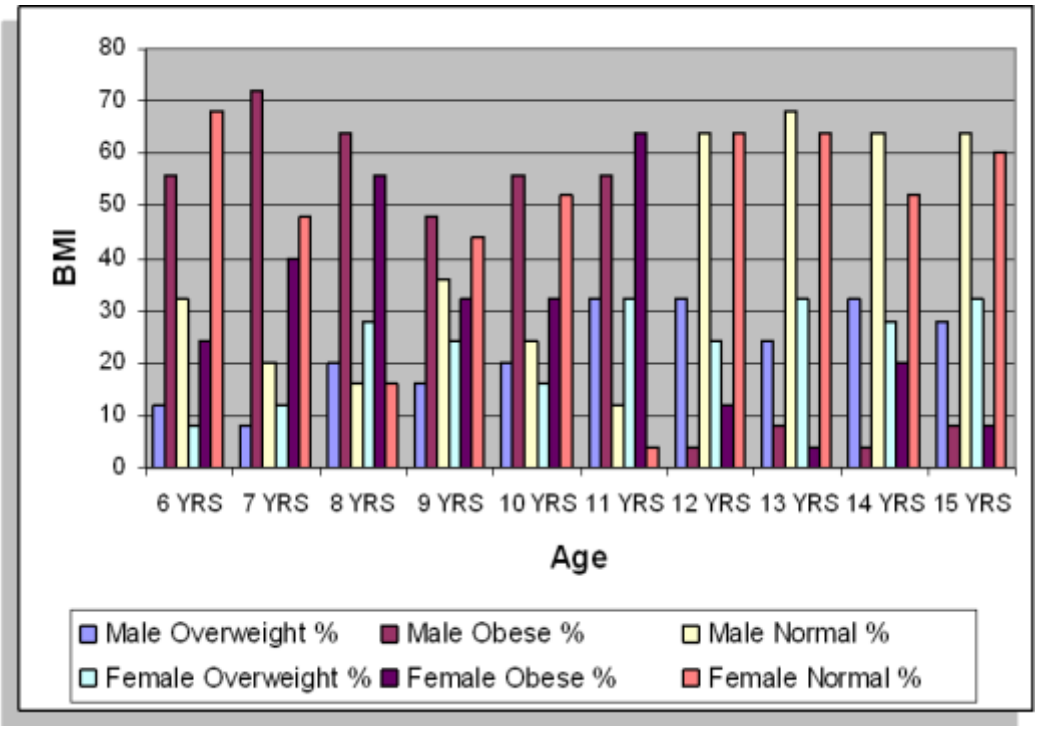

Table 2: The prevalence of obesity using the body mass index among males and females 6-15 years of West Delhi

Age	Male Overweight %	Male Obese%	Male Normal %	Female Overweight %	Female Obese %	Female Normal %
6 Yrs	16	20	64	20	4	76
7 Yrs	32	12	60	8	24	68
8 Yrs	40	12	48	24	12	64
9 Yrs	4	52	44	24	16	60
10 Yrs	36	20	44	20	4	76
11 Yrs	16	24	60	28	8	64
12 Yrs	36	8	56	24	12	64
13 Yrs	28	12	60	28	12	60
14 Yrs	16	8	76	28	8	64
15 Yrs	36	12	52	36	8	56

Graph 2 : The prevalence of obesity using the body mass index among males 6-15 yrs of West Delhi

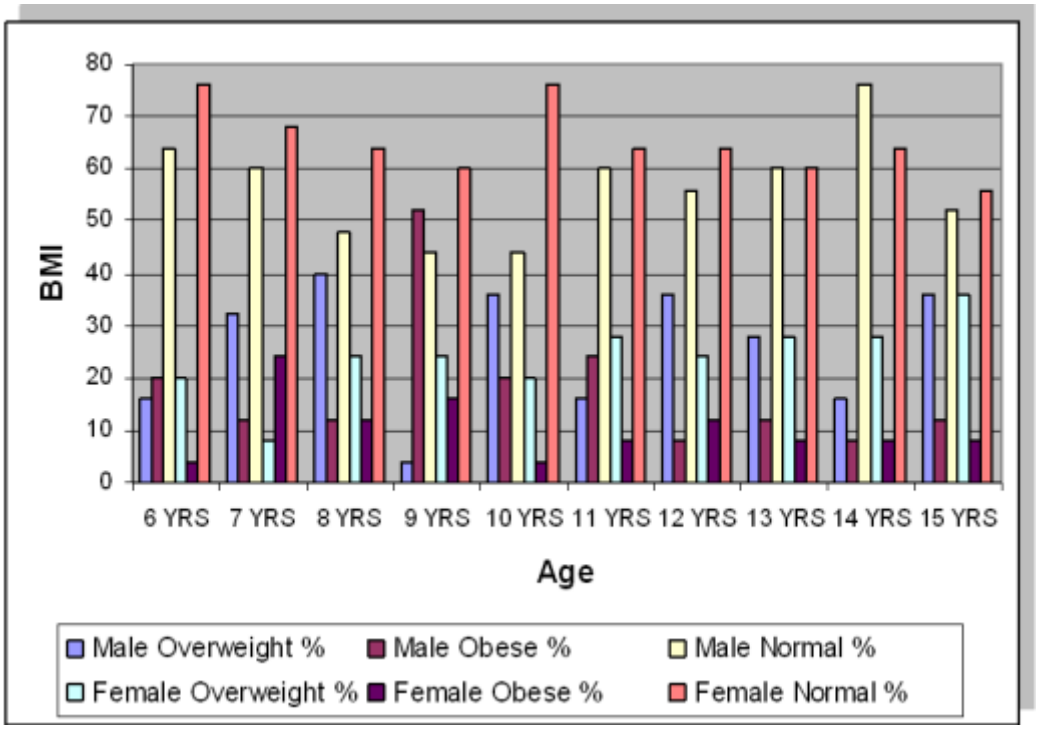

Table 3(a) Table showing the average weight, height and body mass index among children (6-15 years) of South Delhi

Age (Years)	Male Weight (Kg)	Male Height (Cm)	Male Bmi	Female Weight (Kg)	Female Height (Cm)	Female Bmi
6 yrs.	28.7	121.87	19.3	20.42	119.97	14.2
7 yrs.	29.76	130.96	17.4	25.72	122.74	17.1
8 yrs.	30.96	131.86	17.8	31.56	130.4	18.6
9 yrs.	32.0	134.5	17.7	33.21	153.12	14.2
10 yrs.	34.33	140.0	17.5	35.93	139.1	18.6
11 yrs.	37.28	141.6	18.6	40.64	145.92	18.8
12 yrs.	45.28	150.88	19.9	48.72	150.92	21.4
13 yrs.	54.76	160.86	21.2	52.8	151.74	22.9
14 yrs.	54.92	160.86	21.2	52.31	155.81	21.5
15 yrs.	57.51	161.26	22.1	55.19	159.48	21.7

Graph 3(a) Graph showing the average weight, height and body mass index among children(6-15 years) of South Delhi

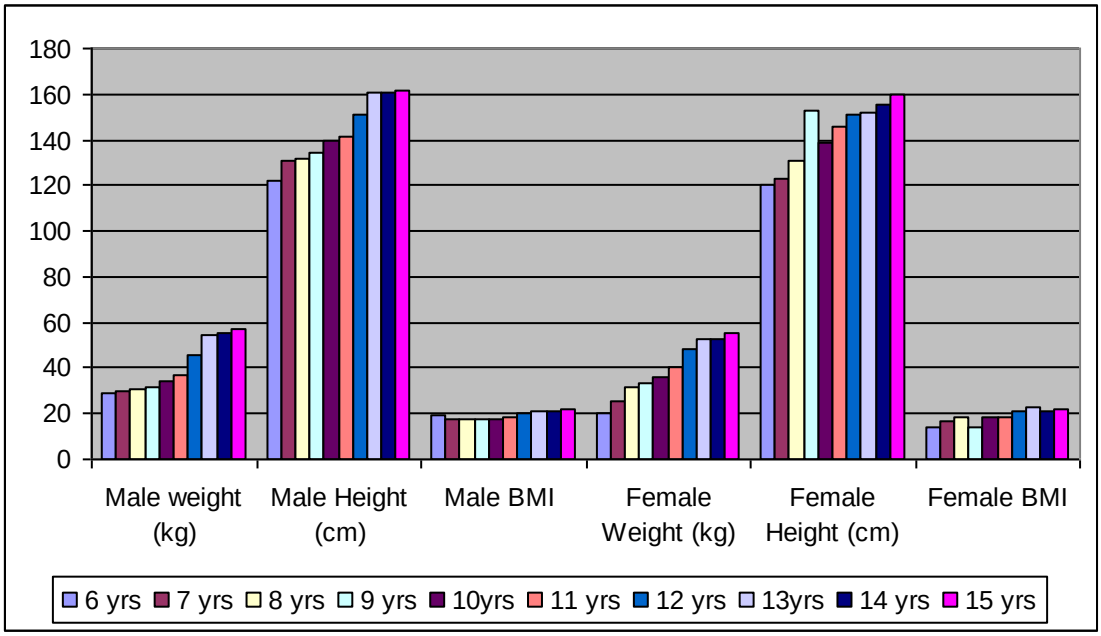

Table 3(b) Graph showing the average weight, height and body mass index among children(6-15 years) of West Delhi

Age (Years)	Male Weight (Kg)	Male Height (Cm)	Male Bmi	Female Weight (Kg)	Female Height (Cm)	Female Bmi
6 yrs.	25.92	124.57	16.3	21.76	119.4	15.3
7 yrs.	25.68	124.59	16.5	28.0	125.24	17.9
8 yrs.	31.16	131.33	18.1	29.18	131.01	17.0
9 yrs.	43.02	136.7	23.0	35.6	140.78	18.0
10 yrs.	37.21	139.46	19.1	37.43	138.74	19.4
11 yrs.	41.58	142.71	20.4	40.2	146.31	18.8
12 yrs.	45.72	149.31	20.5	44.76	150.01	19.9
13 yrs.	52.9	160.71	20.5	49.6	152.43	21.3
14 yrs.	54.12	162.21	20.6	51.52	155.31	21.2
15 yrs.	57.56	161.3	22.1	54.32	155.9	22.3

Graph 3(b) Graph showing the average weight, height and body mass index among children(6-15 years) of West Delhi

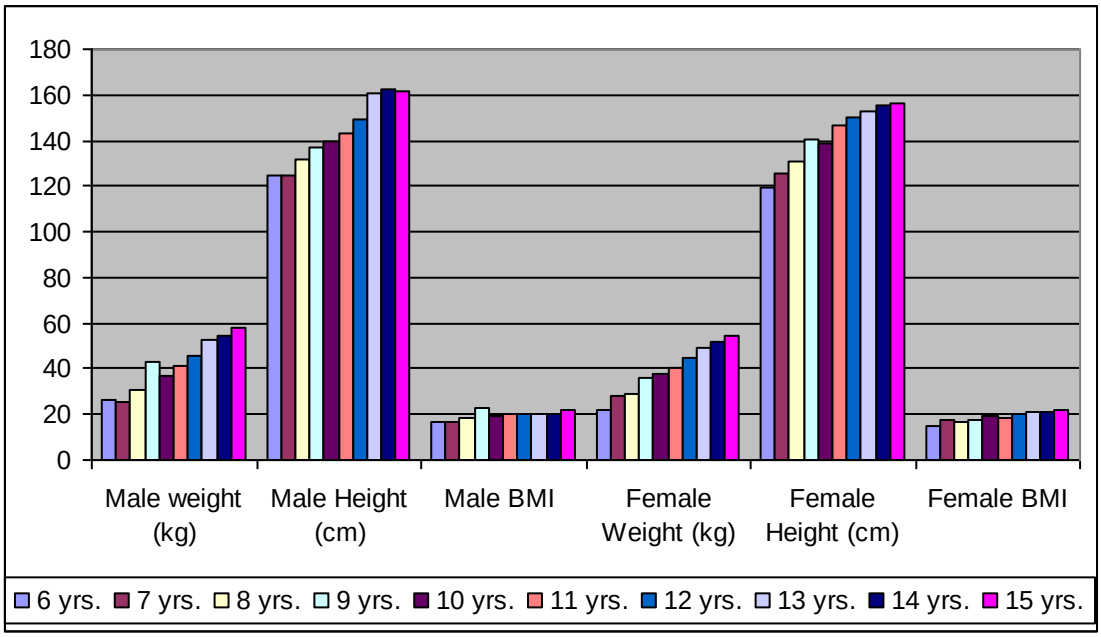

Table 4 : Showing the statistics of prevalence of obesity in South and West Delhi

West Delhi	Total N=500	Male N=250	Female N=250	T-Test	
Obese	71(14.2%)	45(18%)	26(10.4%)	1.6671	Non-significant
Over weight	125(25%)	65(26%)	60(24%)	0.4472	Non-significant
Normal	304(60.8%)	140(56%)	164(65.60%)	2.4690	Non-significant

*degree of freedom(df) =18

South Delhi	Total N=500	Male N=250	Female N=250	T-Test	
Obese	167(33.4%)	73(29.2%)	94(37.6%)	0.7752	Non-significant
Over weight	115(23.0%)	59(23.6%)	56(22.4%)	0.3082	Non-significant
Normal	218(43.6%)	118(47.2%)	100(40%)	0.7338	Non-significant

*df=18

	West Delhi N=500	**South Delhi N=500**	**T-Test**	
Overall Obese	71(14.2%)	167(33.4%)	2.5620	Significant
Overall Over weight	125(25%)	115(23.0%)	0.5918	Non-significant
Overall Normal	304(60.8%)	218(43.6%)	2.5826	Significant

*Graph Pad Software.,df=18

CONCLUSION

This trend of result is showing an alarming increase in obesity which could lead to severe medical problems in future More than 1 in 5 children now are overweight or at risk for obesity. So, this problem needs to be addressed urgently. The foundation for obesity treatment remains modification of activities and eating behaviours. For this education and knowledge to the patients and families are must to explain health consequences of obesity. There is a need to change activity of patients and families towards eating and sedentary behaviour. There is a need to promote outdoor activities i.e. games and reduction in the number of hours of watching television. There should be a reduction of fats in the diet and emphasis should be on a healthy balanced diet. There is a need for wide spread promotion of healthy eating and regular physical activity through media like television, magazines, etc. School boards should be asked to give students healthy physical education and healthy meals and to limit student's access to high calorie diets. The schools and community programmes must help to tackle society's sedentary behaviour and unhealthy diet.

ACKNOWLEDGEMENTS

The authors express their sincere thanks to the school children and their parents for providing permission to collect anthropometric data. The authors also convey thanks to the school teachers for their constant help during the study. The Indian Council of Medical research, New Delhi, financially supported this research.

Conflict of Interest: The authors declare that there is no conflict of interest regarding the publication of this paper.

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