

## PREVALENCE OF OBESITY IN 11-15YRS OF URBAN SCHOOL CHILDREN USING BODY MASS INDEX, WAIST CIRCUMFERENCE AND WAIST HEIGHT RATIO

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### Abstract

**Background:** Childhood obesity is emerging as a serious public health problem in both developed and developed countries. Hence there is wide spread concern in the increase of obesity as it is considered to be one of the precursors of adverse health effects occurring in adulthood. To estimate the prevalence of obesity in 11-15yrs of urban school children using body mass index, waist circumference and waist height ratio. **Materials and Methods:** The total number of students of 11-15 years of age was obtained from Bareilly Schools (government and private). **Result:** Total no of children included in the study-860 170 children were included in each group from 11-15 years. Number of males -340 and the number of females-520 from the study population of 860 children, 859 were included and the prevalence of obesity is as follows. According to BMI - 40 children, 5% are obese; WC - 157 children, 18% are obese and WHR-119 children, 14% are obese. **Conclusion:** Obesity is becoming a public health problem in our country. The overall prevalence of obesity in our study is within the same range as compared to other studies.

## INTRODUCTION

Childhood obesity is emerging as a serious public health problem of the 21st century.<sup>[1]</sup> Hence there is widespread concern in the increase of overweight and obesity especially in children in developed and developing countries as it is considered to be one of the precursors of adverse health effects occurring in adulthood. In both developed and developing countries the prevalence of obesity is increasing and hence has become a major health issue. In both US and UK, the prevalence of obesity in children has increased significantly to about 16 – 20%.<sup>[2]</sup> Until the 1980s, the developing countries were with the lowest rates, but now it has gradually increased in children.

Data for both overweight and obesity prevalence among children in many countries in South Asia is available: 25.0% among children from 2 to 15 years in Bangladesh and 22.0% among children from 5 to 19 years in India. Moreover, secular trends indicate increasing prevalence rates in these countries: for example, 9.8 to 11.7% among children from 5 to 19 years in India during 2006–2009.<sup>[3]</sup> In recent times, developing countries have also reported an increasing incidence of obesity.

Various studies have documented the prevalence of obesity in both children and adolescents to be 12 – 29% in different parts of India.<sup>[4]</sup> Recently, Kumar et al. in a study on preschool children from urban south India have reported that 4.5% of the children were overweight while 1.4% of them were obese.<sup>[5]</sup> However, most of these studies are region-specific and have a smaller sample size. To investigate the trend in obesity in Indian children, it is necessary to assess a large sample representing different regions of India.

There is a great need for studying obesity in Indians because of the fact that there is an increase in type2 diabetes and coronary heart disease in Indian adults, especially in urban areas.<sup>[6]</sup> This epidemic has been attributed to a thrifty genotype which had helped survival in the past when there was scarce and irregular food supply, and has now led to obesity and insulin resistance in modern days where there is excess and regular food supply.<sup>[7]</sup> Recent studies have shown that Indians for a given BMI have a higher percentage of body fat when compared with other white Caucasians, Americans, and African Indians and in addition also have lower muscle mass.<sup>[8]</sup> Thus the risk of adult morbidity especially cardiovascular and mortality that might follow

childhood-onset obesity is considerably high and is of great significance to public health. So it is important that policy makers are aware and have information about the prevalence and trend of obesity.

Childhood obesity is thus a serious medical condition that affects children and adolescents. It occurs when children are well above the normal weight and height for his or her age. It is particularly troubling because the extra kilograms gained lead to health problems in children that were once confined to adults, such as diabetes, high blood pressure, psychological issues and high cholesterol. It can also lead to poor self-esteem and even depression.<sup>[9]</sup> One of the best ways to reduce obesity in children is to improve the diet and exercise habits of the entire family. Thus Treating and preventing obesity in children, protect the health of them now and also in the future.<sup>[10]</sup>

Obesity is now emerging as a common nutritional disorder, particularly among the affluent, worldwide. Obesity may be described as a condition which is characterised by excessive fat deposition in the body. It usually results when food is consumed in excess of one's physiological needs.<sup>[11]</sup>

Obesity in general is defined as the presence of excessive adipose tissue in the body to such an extent that it may lead to health hazards. It is not a single disease but a heterogeneous group of conditions associated with multiple causes. Thus body weight is determined by interactions between genetic environmental, psychological factors which act through physiological mediators of energy intake and energy expenditure. Even in India, malnutrition had attracted the focus of health workers because childhood obesity in children is increasingly being observed due to the changing lifestyle of the families who have an increased purchasing power, increasing hours of inactivity because addiction to television, computer and videogames which have replaced outdoor games and other available social activities.

Globally, it is estimated that 10 percent of school children of 5-17 are overweight/ obese. The prevalence of obesity in children has increased over the past few decades and its statistics are alarming. The prevalence and etiology behind childhood obesity may vary according to an individual's lifestyle and socio-economic status. Most of the reports with regards to childhood obesity are from studies conducted at metropolitan cities in India.<sup>[12]</sup>

In this study, obesity in 11-15 years of school children in Bareilly district is estimated using BMI, WC and WHR. By estimating obesity through waist circumference, central obesity which is a well known risk factor for cardiovascular disease in adults is identified. The risk factors which are associated with increase of obesity is also studied. In this study the prevalence of obesity Bareilly when compared with other cities and prevalence of obesity in males, females, private and government schools, and other associated risk factors is studied.

## MATERIALS AND METHODS

The total number of students of 11-15 years of age was obtained Bareilly Schools (government and private). The total number of students are 1,15,724 and the average number of students per class is 42,301. Duration of study was January 2022 to Aug 2022.

the sample size was calculated to be 850 and the sample strata was calculated to be 170 for each age group from 11-15 yrs.

Thus, 850 subjects from Bareilly district were selected for this study. We adopted a multistage stratified random sampling procedure. Schools were selected based on the list of schools in Bareilly. By using simple random technique, first six schools were selected. The Probability, proportional to the size sampling technique was used to select the sample from each school. Both government & private schools were included & the ratio was 1:1 in accordance with distribution of schools in Bareilly. On reaching the selected school, the classes were selected randomly from each grade. The Students were then selected from each class by again using simple random technique, with help of the students' register, till the desired sample was met. From individual classes from each institution, 50 subjects would be recruited. Students who did not submit the Performa or those whom were notable & who were not cooperative were considered as non-respondent.

### Inclusion Criteria

11-15 yrs of urban school children in Bareilly

### Exclusion Criteria

Students with major dysmorphology or signs of physical deformity

### Tools and Materials Used

A Proforma was used and details were collected, which included their involvement in physical activities such as participation in games, sports activities they preferred or predominantly indoor activities. Their screen viewing time which included watching television, playing computer and video games was also noted. Their food habit weather healthy & Unhealthy & eating junk food was taken into consideration.

The number of meals consumed while watching television and their sleeping time and morning rising time were noted. The age, educational status, occupation of both parents and their monthly income, family size and the socio-economic status were also taken into consideration. The socio-economic status was assessed based on the Modified Kuppuswamy scale.

For measuring height a portable stadiometer was used. Weight was measured using portable electronic weighing machine. Waist circumference was measured using a non-stretchable elastic tape.

## Methodology

Informed consent was from the School Principal and participants of the study for the study purposes.

### Measurement of Height

Height was measured, standing using a portable stadiometer (range 60 - 207 cm). It was ensured that the stadiometer was on level ground. The child stood in socks or barefoot on the flat base of the stadiometer, feet slightly apart and the back of the head, the shoulder blades, buttocks and heels touching the vertical rod, and head in the Frankfurt plane. Gentle traction was applied to the mandibular process and the headboard was then lowered. The reading was taken to the last completed mm, avoiding parallax, and two such readings were averaged for analysis.

Thus height was measured as per the WHO child growth standards: training course on child growth assessment, 2008. When assembling the height boards, it was checked that they are assembled correctly by measured rods of known length.

### Measurement of Weight

The scale was placed on a flat, hard, even surface. The children were asked to stand in the middle of the scale, feet slightly apart and they were to remain still until the weight appears on the display. Then weight was measured using a portable electronic weighing machine accurate to 100 g. As per the WHO child growth standards: training course on child growth assessment, 2008. The weighing scale was regularly checked with known standard weights of 3, 5, 10 and 20 kg. The accuracy of equipment was checked at the time of purchase and thereafter at least once weekly.

### Measurement of Waist Circumference

An important issue for both using and for interpreting waist circumference is the protocol used to obtain the measurements. Here we have the protocol as discussed, the anatomical placement of the measuring tape, its tightness and the type of tape used, the subject's posture, phase of respiration and abdominal tension.

### Statistical Analysis

The data are reported as the mean +/- SD or the median depending on their distribution. The differences in quantitative variables between the groups were assessed by means of an unpaired T test. ANOVA was then used to assess the quantitative variables. A Chi square test was used to assess the difference in categorical variables between groups. ROC curve and Odds ratio were performed. A p value of <0.05 using a two - tailed test was taken as being of significance for all statistical tests. All data were analyzed with a statistical software package (SPSS, version 16.0 for windows).

## RESULTS

Total no of children included in the study-860 170 children were included in each group from 11-15 years. Number of males -340 and the number of females-520 From the study population of 860 children, 859 were included and the prevalence of obesity is as follows. According to BMI - 40 children, 5% are obese; WC - 157 children,18% are obese and WHR-119 children, 14% are obese.

**Table 1: Prevalence of Obesity in the study Population**

| Variables | OBESE |     |
|-----------|-------|-----|
|           | YES   | NO  |
| BMI       | 40    | 819 |
| WC        | 157   | 702 |
| W/HRatio  | 119   | 740 |

Much studies have not been conducted using all three parameters for estimation of obesity and hence in this study we could estimate that by using WC for estimating obesity, then the prevalence increases by 13.6% and by using WHR the estimation of obesity increases by 9.2% and by using combined WC and WHR the estimation of obesity increases by 11.4% than BMI which only estimates 5% of obesity. Thus if only a single factor such as BMI is used obesity may be under diagnosed. The age of children being obese is more in 12 to14 years age group. According to this study, obesity is more in females in all ages

The effect size - by WC more than BMI in estimating obesity is 14%. Obesity is more in children between 12-14 yrs than 11 and 15 yrs. Obesity is more in females in all age groups.

Obese children are more in class 8 followed by class 7 and 9. Obesity is more in private schools when compared to government schools.

The total number of children from private school-460 and the number of children from government school -400 From this study.

**Table 2: Association of Mode of School with Obese in Study Population**

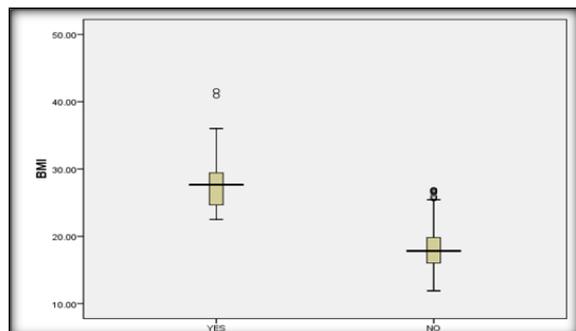
| School  | Total | OBESE |     |            |
|---------|-------|-------|-----|------------|
|         |       | BMI*  | WC* | W/H Ratio* |
| Private | 459   | 30    | 95  | 73         |
| Govt.   | 400   | 10    | 62  | 46         |

\*-->Significantat<0.05level

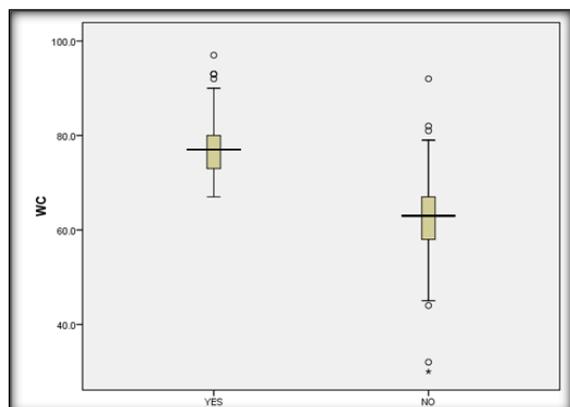
According to this study, obesity is more in private schools when compared to government schools.

**Table 3: ODDS RATIO-Private School**

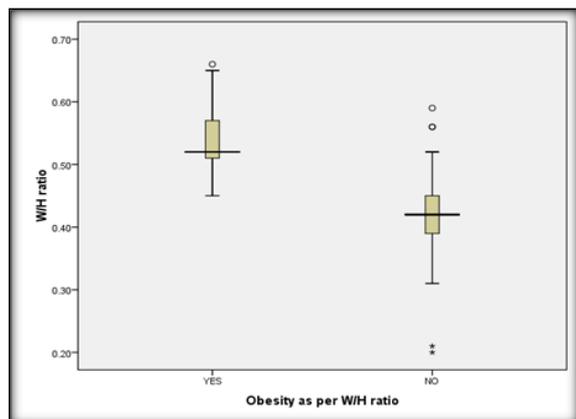
| ODDS RATIO | -Private school            |
|------------|----------------------------|
| BMI        | 2.727[95% CI :1.316-5.652] |
| WC         | 1.422[95% CI :1.000-2.024] |
| W/Hratio   | 1.455[95% CI :0.979-2.163] |



**Figure 1: Obesity as per BMI**



**Figure 2: Obesity as per WC**

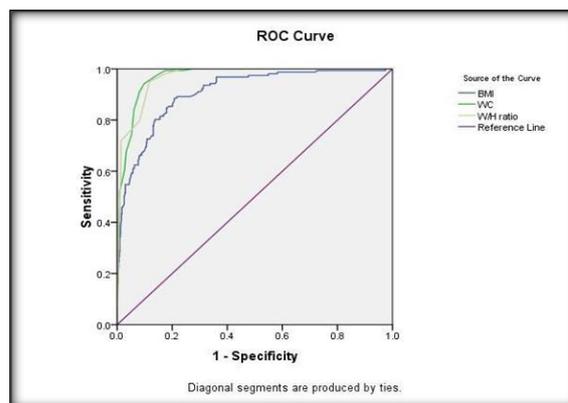


**Figure 3: Obesity as per W/H ratio**

According to this study, obese children are more when fathers are degree holders, post graduates and professionals.

For most of the children, their father's education is high school which accounts for 25%, followed by middle school and degree holders, each 21% and then the rest. Obese children are more for both father and mother who are semi-skilled and those who are business men and agriculturists. Obese children are more in families who earn between

Rs.12,000 and Rs.32,000. Children with screen viewing time of more than 3 hours are obese. Obesity is found more in children who eat more than 3 meals while watching TV or using other electronic gadgets. Obesity is more in children who are involved in indoor activities. Obesity is more for children who wake up after 6 am. Obesity is more in children who sleep after 10 pm. Obesity is more in SES class 2 followed by class 1.



**Figure 4: ROC CURVE**

## DISCUSSION

The principal outcome of the study was to estimate the prevalence of obesity in 11 to 15 year old school children using BMI, WC and WHR. When compared with other studies which were done in urban schools the prevalence is within the range of 1-13% and when WC is used the prevalence is 18%, which is slightly higher.

Much studies have not been conducted using all three parameters for estimation of obesity and hence in this study we could estimate that by using WC for estimating obesity, then the prevalence increases by 13.6% and by using WHR the estimation of obesity increases by 9.2% and by using combined WC and WHR the estimation of obesity increases by 11.4% than BMI which only estimates 5% of obesity. Thus if only a single factor such as BMI is used obesity may be under diagnosed.

Obesity, in this study, is also more in private schools when compared with government schools similar to other studies and more in females which is also similar in other studies.

Various risk factors like number of hours of screen viewing time, number of meals consumed during that time, more indoor activities and late night sleep which are statistically significant and which increase the risk of obesity has been studied.

Other details like the educational status of parents, their profession, family income and the socio-economic status have been studied.

Details like family size and the number of siblings have been studied. Though not all the variables are statistically significant the risk of not becoming obese with increased family members and more siblings has been studied.

## CONCLUSION

The overall prevalence of obesity in our study is within the same range as compared to other studies. If obesity is estimated using only BMI, obesity may be under diagnosed. Major factors which influence the prevalence of obesity are increased number of hours of screen viewing time, number of meals consumed during that time, more indoor activities and late night sleep.

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