To Estimate the Prevalence and Assess the Predictive Factors of Obesity in School Children in Bangalore

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Abstract— **Background: Body mass index (BMI) is one of the most commonly used indices to measure the weight status of an individual. However, it takes only height and weight of individual into account. WHO declared obesity as a Global Epidemic in 1997. Objectives: The objectives of the study are(1) To assess the prevalence of obesity among children studying in selected schools in Bangalore urban district. (2)To list out the factors responsible for prevalence of obesity in students in the age group of 12-16 years.(3)To observe if BMI is a predictive tool for assessing body fat or needs to be used in adjunct with other methods of Body fat percentage analysis. Results: The relative body composition can be calculated regardless of height and weight by body fat percentage using under water densitometry, air-displacement plethysmography, dual-energy X-ray absorptiometry etc. Ratio of boys to girl students was 55: 45.The mean BMI (kg/m2) of total students: 19.57±6.93; boys -18.93±5.36; girls-20.35±8.48. Heredity(P=< 0.01) as a factor predisposing to obesity was found to be significant along with low physical activity(P=< 0.01) and TV viewing(P=< 0.03). Conclusion: BMI and BF% analysis by any other method will only reinforce the predictive capability of overweight and obesity. Obesity cannot be attributed to a single causative factor but occurs due to the interaction between various environmental factors.**

I. INTRODUCTION

Obesity is a social problem that has been increasing at an alarming rate across the globe in all age groups. In 1997 WHO declared obesity as a Global Epidemic. In past, when food was scarce Obesity was related to Health and well being [1]. In the 6th Century BC Indian surgeon Sushruta related Obesity to Diabetes and Cardiac disorders [2]. Globally, about 200 million school children are overweight, of which 40-50 million are obese [3].

Obesity is arbitrarily defined as excess adipose tissue in the body. In simple terms, obesity is a mismatch between energy intake and energy expenditure.

Obesity can be measured by Body Mass Index (BMI), Weight for age, Weight for Height, skin fold thickness, waist-hip ratio. Of all these, BMI is agreed upon as a reliable indicator that correlates well with body fat estimation. It is defined as weight (kg) divided by height (m²). People with a BMI of 25 or above have an increased risk of developing comorbidities, which is further increased with BMI values of 30 or more.

Obesity in childhood is an important risk factor for obesity in adulthood. Obesity in children is defined as body weight at least 20% higher than a healthy weight for child of that height or a body fat percentage above 25% in boys or above 32% in girls. Increase in prevalence of overweight and obesity among children and adolescents globally has become a major public health concern.

Socio-economic factors, feeding practices, child rearing skills, environmental and emotional factors etc influence weight at one year of age, in addition to birth weight. Obesity is the expression of complex interaction between genetic and environmental factors including food intake. Parental obesity, especially when both parents are obese, is a strong predictor.

About 80% of obese children will grow up into obese adults [4]. Various studies have shown that there is up to 5-10% increase in obesity per decade in the later quarter of last century. Obesity has been a common problem in developed countries like Great Britain and

USA. One in 10 six year old i.e., 8.5% are obese and one in six 15 year olds are recognised to be obese [5]. Obesity and overweight was rare or merely absent in under developed and developing countries a few decades ago but in present scenario it is becoming an epidemic [6].

In India the situation is quite paradox with under nutrition and obesity both existing together in the society. This can be attributed to urbanization, technology based sedentary life style, high-fat high-sugar junk food, increasing purchasing power, lack of exercise, excessive television viewing etc. Another major cause found is "Programming". Maternal malnutrition begets foetal malnutrition. Intrauterine growth retardation followed by overfeeding and sudden upward shift in growth curve to higher centiles is now identified as an important risk factor for early onset of adulthood diseases.

Obesity has a profound effect on child's health and life. Obesity increases the child's risk of developing numerous health problems. It can also create social and emotional problems. Obese children are more likely to be obese during their adulthood thus enhancing their risk of serious health problems.

Although a number of factors contributing to development of obesity exist, a specific etiology is not yet established. Also not much emphasis was laid on childhood obesity research in the past. Limited data is available on prevalence of obesity in Indian subcontinent. Prior studies have shown that technology based sedentary life style, lack of physical activity [7], excessive television viewing[8], energy rich junk foods and soft drinks all are other risk factors.

In the present study, we try to see the relationship of obesity with the feeding practices[9], physical activity levels, heredity, television viewing and socioeconomic status. These being environmental factors have found to contribute considerably to the explosion of obesity especially in urban areas. The present study happens to be unique as it is the first of its kind in Bangalore city and is undertaken with the aim of assessing the prevalence of obesity in school children of the age group 12-16 years in the urban areas of Bangalore city and also to elaborate on the exclusivity of BMI as a valuable tool for measuring body fat percentage [3].

STUDY METHODOLOGY

1. Study design : Cross - sectional
2. Study population : Students in the age group of 12-16 years.
3. Sample size : 100 students
4. Study area : Selected schools in Bangalore
5. Study tool : Self structured questionnaire
6. Study period : 2 months

II. MATERIALS AND METHODS

Questionnaires were prepared for the students of selected schools of Bangalore. Totally 100 students were randomly selected out of the schools in Bangalore were considered for this study. This included 45 girls and 55 boys. The schools were selected to represent two socio-economic groups namely low socio-economic school wherein the annual school fees happened to be less than Rs. 20,000, the other school represent higher socio-economic group wherein the annual school fees happened to be Rs. 20,000. The number of students in both these groups were 51 and 49 respectively.

The questionnaire prepared consists of three sections viz Section A comprising of questions intended to collect personal demographic data; Section B consists of two sub-sections meant for dietary habits and physical activities; Section C comprised of Anthropometric measurements.

Questionnaires were distributed to the students after obtaining permission from the Secretary, Department of Education who in turn informed the school principal to permit me to carry out this study. The data was collected by the investigator herself with the assistance of a qualified medical person. 45 minutes were given to the students to complete these questionnaires. Later the height and weight of each of these individual students was measured using a height pole and a weighing machine.

Care was taken to ensure that the students did not wear footwear or carry any unnecessary items with them while measuring the weight as well as height. Also necessary precautions were taken to prevent all sorts of errors by cross checking the readings twice and also taking the readings by standing in front of the machine. BMI of each individual child was

calculated using the formula weight (kg) / height²(m²)
.

The questionnaire filled in accordingly were reviewed. Scores were given to quantify the levels if physical activity in children and analyzed.

III.   **RESULTS**

The study design is a cross-sectional descriptive study. It was conducted by visiting schools at Bangalore city and collecting the data from randomly selected students aged 12-16 years. A pre-designed questionnaire (as mentioned in 'Materials & Methods' section) was administered to all students which included questions regarding socioeconomic status, family history of obesity, dietary habits, physical activity and television viewing. Their heights and weights were measured and their respective BMI were calculated.

Demographic Profile:

Totally 100 students were included in this study. The demographic profile of students are depicted in table.1.

Table. 1. Demographic profile of students (n=100)

Sex	Number	(%)
Boys	55	55
Girls	45	45

Figure.1 represents the ratio of male to female students considered for the present study. Out of the total 100 students 55 of them happened to be boys while 45 of them were girls.

**Figure.1. Male to female ratio of students (n=100)**
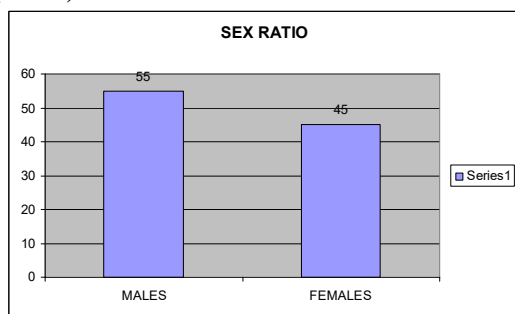
BMI:

The heights and weights of all students were measured and their respective BMI were calculated. The mean BMI of students are depicted in table.2.

Table.2. BMI of students (n=100)

Sex	Number	(%)	BMI (kg/m^2) (mean±SD)	Range
Boys	55	55	18.93±5.36	14.06 - 39.91
Girls	45	45	20.35±8.48	11.42 – 49.38
Total	100	100	19.57±6.93	11.42 – 49.38

Figure.2 represents the mean BMI values of male to female students considered for the present study.

Figure.2. Sex wise BMI values of students
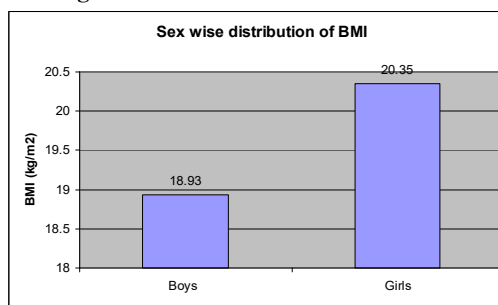
Variables influencing obesity:
a) Socio-economic status:

The criteria for classifying the students into high and low socioeconomic groups was annual school fees with the cut off fees of Rs. 20,000. Figure.3 represents the socioeconomic groups (whether high or low) to which the children belong.

**Figure.3. Socio-economic status of students (n=100)**
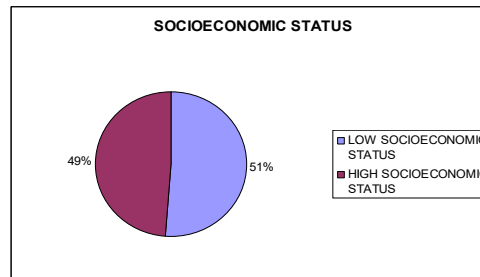
b) Heredity factor:

It was found that 66% of students did not have any first relative in their family as obese whereas the remaining 34% students were found to be at more risk of developing obesity as they had atleast one of their parents or siblings or any first blood relative being obese. Figure.4 shows the percentage of genetic factor influence in causation of obesity.

**Figure.4. Percentage of heredity factor in students (n=100)**
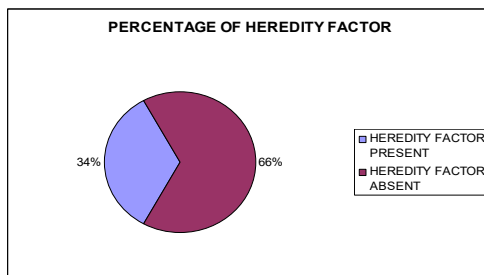
C) Level of physical activity:

The physical activity in these students was assessed by allotting scores to their replies to certain questions in the questionnaire. The questions pertaining to the distance between their home and school and the mode of transport used to travel to the school were considered. The kind of physical activity and games they played after school hours was also taken into account.

Out of the total 100 students considered it was found that 58 of them performed routine activities which did not involve much of energy expenditure. The remaining 42 of them were found to be associated with activities which involved some amount of physical strain. Figure.5 depicts the levels of physical activity performed by the students considered for the study.
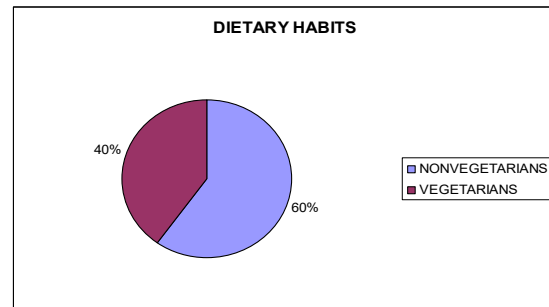
Figure.5. Level of physical activity in students (n=100)
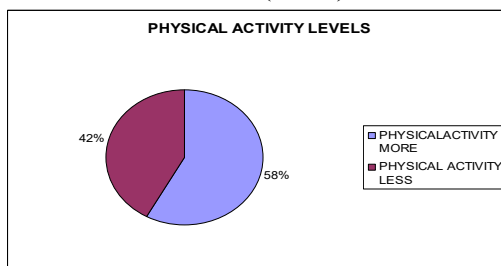
d) Dietary habits:

The students were grouped according to the food habits they followed. It was found that 60% of students were non vegetarians out of the total 100. Figure.6 reveals the dietary habits in the students.

Figure.6. Dietary habits in students (n=100)

e) Television viewing:

It was found that 61% of students had the habit of watching television while having food. It was even evident from their replies that watching television for many of them had become an essential routine activity done at the cost of playing outdoor games. 39% of the remaining students did not or seldom had the habit of watching television. Figure.7 depicts the percentage of school children who have the habit of watching television while having food.

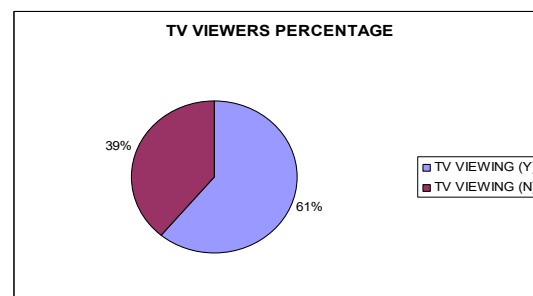**Figure.7. Percentage of television viewing students**

Table.3 summarizes the numbers (and percentages) of students with the various above mentioned parameters.

Table.3. Spectrum of prevalence of various parameters in students

Parameters		Number of students	(%)	(Mean±SD)
Socioeconomic status	High	49	49	18.80±5.68
	Low	51	51	20.26±7.95
Heredity factor	Present	34	34	22.67±9.24
	Absent	66	66	17.97±4.71
Level of physical activity	More	58	58	17.82±4.30
	Low	42	42	21.96±8.97
Dietary factor	Vegetarian	40	40	19.60±6.57
	Non-vegetarian	60	60	19.70±7.17
Television viewing	Present	61	61	21.02±8.50
	Absent	39	39	17.80±3.30

Table. 4. Sex wise distribution of various parameters in students

Parameters		Number of Boys	Number of Girls
Socioeconomic status	High	37	12
	Low	18	33
Heredity factor	Present	22	12
	Absent	33	33
Level of physical activity	More	38	20
	Low	17	25
Dietary factor	Vegetarian	30	10
	Non-vegetarian	25	35
Television viewing	Present	31	30
	Absent	24	15

Figure.9 clearly brings out the comparison of various parameters between boys and girls.

Figure.9. Sex wise distribution of various parameters influencing obesity in students.

Sex wise comparison of various parameters influencing obesity

Figure.8. Spectrum of various parameters in students.
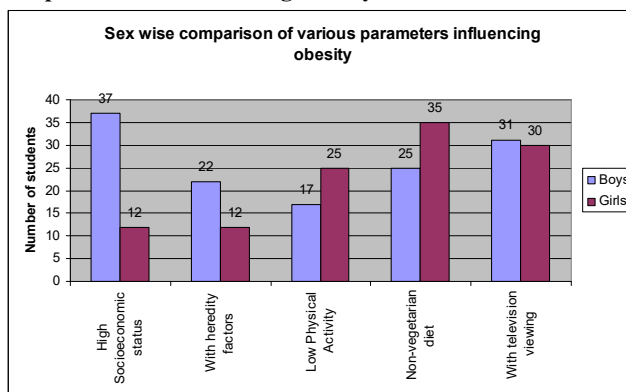

Spectrum of various parameters in students
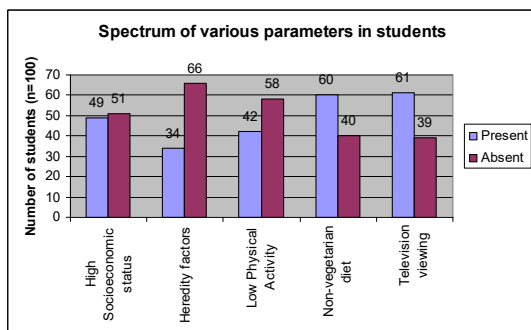
Similarly, table.4 depicts sex wise (boys and girls) distribution of various parameters influencing obesity.

Correlation of various parameters studied with BMI:

In the present study, two groups of students were compared by taking BMI as the criteria. The BMIs of the subgroups of each of the five above

mentioned parameters were compared individually using independent T-test and p values were measured. Table.5. summarizes each of these correlations.

Table.5. Comparisons of BMIs among various parameters in students.

Parameters	Comparisons	P value
Socioeconomic status	High versus Low	0.31
Heredity factor	Present versus Absent	< 0.01*
Level of physical activity	More versus Low	< 0.01*
Dietary factor	Vegetarian versus Non-vegetarian	0.74
Television viewing	Present versus Absent	0.03

*P <0.05 is considered significant.

It was found that socio-economic status was not a significant factor to contribute to obesity. Heredity as a factor predisposing to obesity was found to be significant according to our present analysis. It was also found in the analysis that low physical activity and television viewing are significant variables, thus contributing positively to obesity.

No significant correlation was established between dietary habits and obesity. This can be due to the presence or absence of certain other confounding factors like hereditary influence, consumption of diary products by vegetarians in their snacks, watching television, playing outdoor games, failure in recalling or reporting of diet taken by students etc. Thus it can be concluded that obesity cannot be attributed to a single causative factor but occurs due to the interaction between various environmental factors.

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