# Prevalence of obesity and overweight in school going children between 6 years to 16 years of age

Suresh Nana Waydande[1*], Sambhaji S Wagh[2]

[1]Assistant Professor, Department of Pediatrics, Bharati Vidyapeeth Deemed University Medical College and Hospital Sangli-416414, Maharashtra, INDIA.
[2]Associate Professor, Department of Pediatrics, Government Medical College, Miraj, Maharashtra, INDIA.
**Email:** snwaydande1960@gmail.com

**Abstract**          **Background:** Obesity is nothing but excess accumulation of fat in subcutaneous tissue and other parts of organs. Asians are more vulnerable to the adverse effects of obesity because Asians have 3 to 5% higher body fat which is centrally located. Indians are facing under nutrition in rural area and urban slums and obesity and overweight in upper and middle class due to wrong eating habits and sedentary life style. BMI appear to be the most practical way of measuring and comparing obesity for clinical and epidemiological purposes. In this study BMI percentile is used, BMI >85 percentile are considered overweight, BMI >95 percentile is considered as obesity**. Aims and Objectives:** To find out prevalence of overweight and obesity in school going children in English medium schools and factors responsible for it. **Materials and Methods:** Two English medium schools from Sangli city are selected and students from 1st to 10th standard (Age group 6-16 yrs) are examined. **Results:** Prevalence of overweight was 15.6% and for obesity it was 5.6% in Boys. And Prevalence of overweight was 12.3 % and for obesity it was 4.0 % in Girls. **Summery and Conclusion:** According to the BMI percentile criteria published for Indian children the prevalence of overweight and obesity is increased in school children of Sangli. Other factors like TV/computer viewing, dietary habit, outdoor game activities and family class also plays role in overweight and obesity.
**Key Words:** Prevalence, Obesity, Overweight.

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## INTRODUCTION

It is said that history of man is only intelligible in the context of the history of food. The current abundance of food in developed countries is the consequence of a multitude of social, political and economical forces that have developed over the centuries."...Food is more than just sustenance; it is cross road of emotion, religion, tradition, and habit". Probably the first major change in eating habits occurred in the prehistoric time at the close of Ice age when man began to produce food, rather than rely on gathering it. Nomadic tribes established permanent settlement and man learned that he could grow crops. Archeological estimates that the change to food production occurred between 40,000 to 10,000BC even this age when food was probably scarce. There were apparently people, who could be considered obese by today's standard. The Venous of Willendorf estimated to be 20,000 years old who has huge breasts, abdomen andthighs. It has even been theorized that *ADAM* was a food gatherer prior to his fall from the Garden of *EDEN* and he became a food producer after tasting the forbidden fruit of the tree of knowledge[6] Obesity is nothing but excess accumulation of fat in subcutaneous tissue and other parts of organs. Obesity has adverse and serious consequences on body and is proved beyond doubt. There is increase in prevalence of overweight and obesity

Worldwide. i.e. global epidemic of obesity during last 25-30 years. With this globalization of economics and rapid international communication these non-communicating diseases have behaved like communicable diseases and they have hit the India and other developing countries also. In year 1998 world health organization designated obesity as global epidemic. Childhood obesity and overweight increases the risk of adult obesity and it also further gives the risk of getting diabetics, coronary heart disease, hypertension etc. It is estimated that in 2025 India alone will have 57 million diabetics and cardiovascular diseases are going to be the leading causes of death. Today also India has maximum number of diabetics in the world[4,13] Asians are more vulnerable to the adverse effects of obesity because Asians have 3 to 5% higher body fat which is more centrally distributed than same BMI of others. This excess of fat was probably due to adaptation mechanism in response to the food scarcity, which our previous generations have faced, but now globalization has changed life styles, decreased physical activities, increased purchasing power, availability of high energy, high fat food and sedentary life style. Old habit to convert fats, is still persisted by our Asian gene[7,4.] Indians are facing under nutrition in rural area and urban slums and on the other hand we are facing obesity and overweight in upper and middle class due to wrong eating habits. Children's are forced to use their playtime in tution classes right from nursery to college level due to intense competition.TV, VCR viewing and Computer game playing do not requires much exertion. The prevalence of overweight and obesity in childrenand adolescents ranges from 22% in better school to 4.5% in lower income schools due to this it has become public health problem[3,18] Body weight is reasonably correlated with body fat but is also highly correlated with height therefore weight adjusted for height squared (BMI=Wt. in Kg /Ht.inm$^2$) is useful index to assess overweight and obesity. It is fairly reliable index. It is also calculated easily from weight and height. In spite of its limitation BMI appear to be most practical way of measuring and comparing obesity for clinical and epidemiological purposes. In order to control the epidemic intervention is required at family or school level which will need to be matched by changes in the social and cultural context. Prevention strategies will require co-ordinate efforts between medical community, health administrators, teachers, parents, food producers, processors, retailers, caterers, advertisers, media, recreations, sport planners, urban architects, city planners, politicians, legislators etc[13,7]. In this study BMI percentile is used which is published by KN Agarwal (2001) BMI >85 percentile are considered overweight, BMI >95 percentile are considered as obesity and BMI <5 percentile are considered for thinness[1.] These age and sex specific BMI cut off values are available from age group of 6 years to 16 years; these values are used in this study.

## MATERIALS AND METHODS

Well reputed private English medium, two schools were selected, where the children from upper and middle socio-economical class are studying. After getting permission from ethical committee of Medical College and school authorities, consent form and semi-structured Proforma was filled by parents, Children of 1$^{St}$ to 10$^{th}$ standard are examined. Kuppuswami's scale was used for calculation of socio-economical class. **Inclusion Criteria**: all the children from 1$^{st}$ to 10$^{th}$ standard are included, except known cases of syndrome with obesity. **Period of study:** The study was carried out from July 2004 to June 2005.

## OBSERVATIONS AND RESULTS

**General information**: Both selected schools are situated in Sangli city area. One school was fallowing CBSC pattern of syllabus and other was fallowing state board pattern of syllabus. One of the school timing was 8 am to 5 pm, where lunch and breakfast was provided in school and other school timing was 7am to 1pm, in that school playground facility was not available.

**Number of students Examined:** In total I have examined 966 students out of that 600 were male students and 366 were female students.

**Table 1:** Age-wise distribution of students

| Age | 6yrs | 7yrs | 8yrs | 9yrs | 10yrs | 11yrs | 12yrs | 13yrs | 14yrs | 15yrs | 16yrs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Male | 89 | 94 | 86 | 45 | 83 | 44 | 53 | 37 | 39 | 29 | 01 |
| Female | 58 | 39 | 57 | 28 | 54 | 33 | 33 | 15 | 21 | 21 | 07 |
| Total | 147 | 133 | 143 | 73 | 137 | 77 | 86 | 52 | 60 | 50 | 08 |

**Table 2:** Socio-economical class of family according to the modified Kuppuswami's scale:

| Sr. No. | Family Class | Males | Females | Total |
|---|---|---|---|---|
| 1 | Upper (U) | 30 | 34 | 64 (6.6%) |
| 2 | Upper Middle(UM) | 453 | 275 | 728 (75.3%) |
| 3 | Lower Middle (LM) | 117 | 57 | 174 (18.0%) |
| 4 | Upper Lower (UL) | Nil | Nil | Nil |
| 5 | Lower (L) | Nil | Nil | Nil |

In this study 6.6% students were from upper class, 75.3% students were from upper middle class and 18.0% students were from lower middle class. In this study upper lower and lower class students were not found.

**Consanguinity of marriage in parents of Examined students**; Consanguinity of marriage in parents of examined students was found only in 3.4% students.

**Table 3:** Diseases observed in parents

| Sr.No. | Diseases Observed in Parents | Affected Parents Father | | Mother | | Affected Parents of Male students Father+ Mother | Affected Parents of female students Father+ Mother |
|---|---|---|---|---|---|---|---|
| | | M | F | M | F | Male Student | Female students |
| 1 | HYPERTENSION | 22 | 16 | 3 | 6 | 25 | 22 |
| 2 | DIABETICS | 10 | 11 | 4 | 9 | 14 | 20 |
| 3 | CORONARY | 1 | - | - | - | 1 | - |
| 4 | CNS VASCULAR | 1 | - | - | - | 1 | - |
| 5 | OTHERS | 2 | 2 | 1 | - | 3 | 2 |
| 6 | 1+2+3+4+5 | 36 | 29 | 8 | 15 | 44 out of 600 | 44 out of 366 |
| | | | | | | **7.33 %** | **12.0 %** |

7.33 % Parents of male students and 12 % parents of female students were suffering. Major diseases were observed in parents of examined students were Hypertension, diabetics, coronary heart disease, CNS vascular Diseases.

**Table 4:** Dietary Pattern of students examined

| Vegetarian Diet | Males | Females | Total | Mixed Diet | Males | Females | Total |
|---|---|---|---|---|---|---|---|
| | 376 | 234 | 610(63%) | | 224 | 132 | 356(37%) |

In this study 610 (63%) students were taking vegetarian diet and 356 (37%) students were. taking mixed type of diet.

**Table 5:** Religion wise distribution of students Examined

| Sr. No. | Religion | Males | Females | Total |
|---|---|---|---|---|
| 1 | Hindu | 458 | 268 | 726 (75.1%) |
| 2 | Jain | 100 | 71 | 171 (17.7%) |
| 3 | Muslim | 40 | 20 | 60 (6.2%) |
| 4 | Christian | 0 | 2 | 02 (0.2%) |
| 5 | Sikh | 2 | 2 | 04 (0.45%) |
| 6 | Other | 0 | 3 | 03 (0.33%) |

In this study 75.1% students were from Hindu community, 17.7% students were from Jain community, 6.2 % students were from Muslim community and remaining less than 1 % was from other communities.

**Table 6:** Habit of TV viewing and outdoor Games activities by students

| Activities | Hours of activities | Males | Females | Total students involved | % |
|---|---|---|---|---|---|
| TV and Computer viewing per day | 1 to 2 hours | 188 | 292 | 480 | 49.6 % |
| | >2 hours | 412 | 74 | 486 | 50.3 % |
| Outdoor games and Exercise | <1 hours | 472 | 312 | 784 | 81.1 % |
| | 1-2hours | 128 | 54 | 182 | 18.8 % |

In this study TV/computer viewing for 1 hour was observed in 49.6% and 1-2 hours TV/computer viewing was observed in 50.3 % students. 81.1 % students were playing for 1 hour of outdoor game activities and 18.8 % students were playing 1-2 hours of outdoor game activities.

**Table 7:** Prevalence of overweight and obesity by BMI criteria in Boys

| Age in years | No. of students | Normal students | | Overweight students | | Obese students | |
|---|---|---|---|---|---|---|---|
| | | BMI By Indian standard <85th | Study group | BMI By Indian standard >85and<95 | Study group | BMI By Indian Standard >95Th | Study group |
| 6 | 89 | <15.9 | 72 (80.8%) | >15.9 | 09(10.1%) | >17.8 | 08 (8.9%) |
| 7 | 94 | <16.4 | 78 (82.9%) | >16.4 | 13(13.8%) | >18.8 | 03(3.1%) |
| 8 | 86 | <17.0 | 62 (72.0%) | >17.0 | 18(20.9%) | >19.7 | 06(6.9%) |
| 9 | 45 | <17.3 | 35 (77.7%) | >17.3 | 09(20.0%) | >21.0 | 01(2.2%) |
| 10 | 83 | <18.5 | 64 (77.1%) | >18.5 | 14(16.8%) | >22.1 | 05(6.0%) |
| 11 | 44 | <19.1 | 31 (70.4%) | >19.1 | 08(18.1%) | >23.4 | 05(11.3) |
| 12 | 53 | <19.8 | 41 (77.3%) | >19.8 | 09(16.9%) | >23.8 | 03(5.6%) |
| 13 | 37 | <20.4 | 29 (78.3%) | >20.4 | 07(18.9%) | >25.3 | 01(2.7%) |
| 14 | 39 | <21.1 | 35 (89.7%) | >21.1 | 04(10.2%) | >26.3 | 00 |
| 15 | 29 | <22.0 | 25 (86.2%) | >22.0 | 03(10.3%) | >27.3 | 01(3.4%) |

| 16 | 01 | <22.7 | 00 -- | >22.7 | 00 | >27.6 | 01 |
|----|----|-------|-------|-------|----|-------|----|
| **Total** | **600** | **--** | **472(78.6%)** | **--** | **94(15.6%)** | | **34(5.6%)** |

**Pie Diagram of Prevalence of overweight and obesity by BMI criteria in Boys**
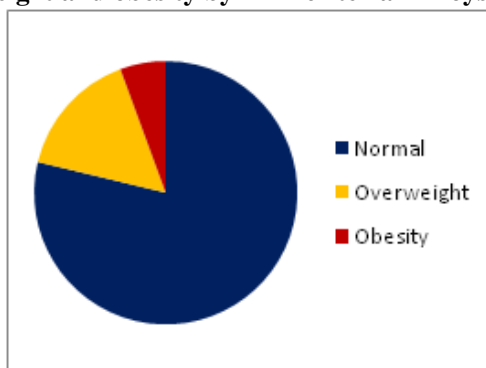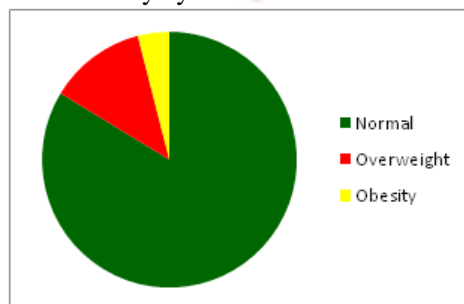


**Figure 1:**

According to the BMI percentile criteria published for Indian children, in this study out of 600 male students, 472 (78.6%) students were normal. 94 (15.6 %) Students were having Overweight and 34 (5.6 %) Students were having obesity.

**Table 8:** Prevalence of overweight and obesity by BMI criteria in Girls

| Age in years | No. of students | Normal students | | Overweight students | | Obese students | |
|---|---|---|---|---|---|---|---|
| | | BMI By Indian standard <85th | Study group | BMI By Indian standard >85and<95 | Study group | BMI By Indian Standard >95Th | Study group |
| 6 | 58 | <16.0 | 44(75.8%) | >16.0 | 11(18.9%) | >18.8 | 03(5.1%) |
| 7 | 49 | <16.6 | 31(63.2%) | >16.6 | 05(10.2%) | >19.7 | 03(6.1%) |
| 8 | 57 | <18.0 | 47(82.4%) | >18.0 | 07(12.2%) | >21.4 | 03(5.2%) |
| 9 | 28 | <18.0 | 20(71.4%) | >18.0 | 08(28.5%) | >21.7 | 00 |
| 10 | 54 | <19.9 | 48(88.8%) | >19.9 | 05(9.2%) | >23.2 | 01(1.8%) |
| 11 | 33 | <20.6 | 28(84.8%) | >20.6 | 04(12.15) | >24.5 | 01(3.0%) |
| 12 | 33 | <21.9 | 29(87.8%) | >21.9 | 02(6.0%) | >25.7 | 02(6.0%) |
| 13 | 15 | <22.6 | 14(93.3%) | >22.6 | 01(6.6%) | >27.1 | 00 |
| 14 | 21 | <23.0 | 20(95.2%) | >23.0 | 00 | >27.4 | 01(4.7%) |
| 15 | 21 | <23.6 | 19(90.4%) | >23.6 | 01(4.7%) | >27.7 | 01(4.7%) |
| 16 | 07 | <23.7 | 06(85.7%) | >23.7 | 01(14.2%) | >27.4 | 00 |
| **Total** | **366** | **--** | **306(83.6%)** | **--** | **45(12.3%)** | | **15(4.0%)** |

According to the BMI percentile criteria published for Indian children, in this study out of 399 female students 306 (83.6%) students were normal. 45 (12.3%) Students were having Overweight and15 (4.0%) students were having obesity.

Pie Diagram of Prevalence of overweight and obesity by BMI criteria in Girls



**Figure 2:**

**Table 9:** Sex wise distribution of overweight and obesity in students examined

| Female students | | | Male students | | | Total ( Maleand Female students) | | |
|---|---|---|---|---|---|---|---|---|
| Normal | Over weight | Obese | Normal | Over weight | Obese | Normal | Over Weight | Obese |
| 306 | 45 | 15 | 472 | 94 | 34 | 778 | 139 | 49 |
| 83.6% | 12.3% | 4.0% | 78.6% | 15.6% | 5.6% | 80.5% | 14.3% | 5.0% |

In this study out of 966 students 778 students were normal.39 (14.3 %) students were having overweight and 49 (5 %) students were having obesity.

**Table 10:** Overweight and obesity in relation with Family class

| Sr. No. | Family class | Males | | | | | Females | | | | |
|---------|--------------|-------|-----|-----|-------|-------------|--------|-----|-----|-------|-------------|
| | | Normal | Ow. | Ob. | Total | Ow.+ Ob | Normal | Ow | Ob | Total | Ow.+ Ob |
| 1 | Upper (I) | 25 | 03 | 02 | 30 | 16.6% | 25 | 09 | 00 | 34 | 26.4% |
| 2 | Upper Middle (II) | 361 | 66 | 26 | 453 | 20.3% | 227 | 37 | 11 | 275 | 17.4% |
| 3 | Lower Middle (III) | 86 | 25 | 06 | 117 | 26.4% | 46 | 07 | 04 | 57 | 19.2% |
| 5 | Lower (V) | Nil | nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil |

Ow=overweight, Ob= obesity,

In this study overweight and obesity in UPPER class males was 16.6 % and in females was 26.4%. Overweight and obesity in UPPER MIDDLE class males was 20.3%and in females was 17.4%, Overweight and obesity in LOWER MIDDLE class male was 26.4%andin females was 19.2%.

**Table 11:** Overweight and obesity in relation with dietary pattern of students examined

| Dietary pattern | Vegetarian diet | | | Mixed Diet | | | Gross Total |
|-----------------|-----------------|--------|-------|------------|--------|-------|-------------|
| | Male | Female | Total | Male | Female | Total | |
| Total Students | 376 | 234 | 610 | 224 | 132 | 356 | 966 |
| Ow.+OB | 74 | 44 | 118 | 54 | 16 | 70 | 188 |
| %. | 19.6% | 18.8% | 19.3% | 24.1% | 12.1% | 19.6% | 19.4% |

Overweight and obesity was observed 19.3 % in students of vegetarian diet and it was 19.6 % in students of mixed type of diet. Overweight and obesity was more in male students of mixed type of diet.

**Table 12:** Overweight and obesity in relation with TV/ Computer viewing and outdoor games

| Activity | Hours per day | Male | OwandOb.in Males | Females | OwandOb.in females | Total students Examined | Total Ove weight and obesity |
|----------|---------------|------|------------------|---------|---------------------|-------------------------|------------------------------|
| TV and Computer viewing | 1 hour | 175 | 13 | 244 | 48 | 480 | 61 (12.7%) |
| | 2 and>2 hours | 328 | 84 | 62 | 12 | 486 | 96 (19.7 %) |
| Outdoor games and activities | 1 hour | 369 | 103 | 263 | 49 | 784 | 152 (19.3%) |
| | 1 to 2 hours | 103 | 25 | 43 | 11 | 182 | 36 (19.7%) |

In this study overweight and obesity was decreasing as number of TV viewing hours was decreasing. More than 19.0 % students were suffering from overweight and obesity in spite of they were playing outdoor games and outdoor activities[7,9,5].

## DISCUSSION

There is increase in prevalence of overweight and obesity Worldwide. i.e. global Epidemic of obesity during last 25-30 years.. In year 1998 world health organization designated obesity as global epidemic. Childhood obesity and overweight increases the risk of adult obesity and it also further gives the risk of getting diabetics, coronary heart disease, hypertension etc[14]. Today India has maximum number of Diabetics in the world. India has more vulnerable to the adverse effects of obesity due to centrally distributed body fat in Asian. Indians are facing under nutrition in rural and urban slum area on the other hands we are facing overweight and obesity in upper and middle class of families. Overall the economies of the industrialized countries and traditional countries such as China and India are also improving. Many household things are available for the convenience of the life. So life has become comfortable. Physical exertion has

diminished. While food consumptions as well as wrong food eating habits are increased, as a result overweight and obesity is also increased[7,4]. In this study I have examined two English medium schools and I have examined 966 students in that 6oo Males and 366 females were there. Out of 600 males 472 (78.6%) students were normal, 94 (15. 6 %) students were having overweight and 34 (5.6%) students were having obesity. And out of 366 Females, 306 (83.6%) students were normal, 45(12.3%) students were having overweight, and 15 (4%) students were having obesity. Vaman Khadilkar *et al* (2004) have studied the prevalence of obesity in affluent school Children in Pune city, (Maharashtra).Prevalence of overweight was 19.9 % and obesity was 5.7 % by using International cut off points of (BMI) criteria. But when he has used Indian Standards published by Agarwal *et al*. then the prevalence of overweight was 25.1 % and obesity was 8.1 % [2].but in our study these values are less

probably because Sangli is semi urban type of small city. It is alarming that overweight and obesity increasing in small city like Sangli also. In this study 63 % students were vegetarians out of that 19.3 % students were having overweight and obesity and 37% students were taking mixed type of diet out of that 19.6 % students were having overweight and obesity. David L Yeung USA (2005) studied role of fruits and vegetables in life styles associated diseases[10]. Limiting of hours of TV viewing, increasing physical activities and alteration of dietary habit in the form of accepting vegetarian diet and avoiding junk food, should be followed. Further studies are required for the same in India. In this study Prevalence of overweight and obesity in relation with family class: Upper Class Family 26.4% females and 16.6% males were having overweight and obesity, upper middle class 17.4% females and 20.3% males were having overweight and obesity, lower middle class 19.2% females and 26.4 % males were having overweight and obesity. In this study upper class females and upper middle and lower middle class males were having more overweight and obesity. No students from lower class were observed in this study. Overweight and obesity was observed 12.7% in children who were having habit of TV/computer viewing for 1 hour but this overweight and obesity was increased up to 19.7 % when habit of TV/computer viewing was increased for 1-2 hours. In this study 784 (81.1%) students were playing out door games for 1 hour, out of that 152 (19.3%) students were having overweight and obesity. Also 182 (18.8 %) students were playing outdoor games for 1-2 hours, out of those 36 (19.7%) students were having overweight and obesity. There was no significant decrease in overweight and obesity number, with 1-2 hours increase in outdoor games.

## SUMMARY AND CONCLUSION

According to the BMI percentile criteria published for Indian children, in this study Prevalence of overweight was 15.6% and for obesity it was 5.6 % in Boys. And Prevalence of overweight was 12.3 % and for obesity it was 4.0 % in Girls. Prevalence of overweight and obesity was high in girls of UPPER class and Boys of UPPER MIDDLE and LOWER MIDDLE class. Prevalence of overweight and obesity was high in male students of mixed type of diet (24.1%) than strict Vegetarian diet (19.6 %). Habit of TV/computer viewing more than 1 hour increases the risk of getting more overweight and obesity. And also habit of playing outdoor games/activities decreases the risk of becoming overweight and obese. The prevalence of hypertension, diabetics, cardiac or neurological complications are relatively high in Parents of female students (11.4%) as compared to the parents of male students (6.8%). Overall at least one of the parents was affected by above mentioned diseases

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