To Study Prevalence Of Overweight And Obesity In Two Different Groups Of School Children Of Age 10-15 Years In Karad Town

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The objective of the present study was to find out the prevalence of overweight and obesity in the school-going children of age group 10-15 yrs from two different schools of different socio-economic status and to study the associated risk factors in overweight and obese children. 470 school-going children from Private English Medium School and 481 school-going children from Nagar Parishad School were interviewed. The prevalence of overweight in the boys was 10.19%, and girls were 9.61%, of the Private English Medium School, and in the boys of the Nagar Parishad School was 1.76%, and in the girls was 2.02%. The prevalence of obesity in the boys 3.5%, and girls was 10.25% of the Private English Medium School was and in the boys of the Nagar Parishad School was 0.7%, and the girls were 0%. The increase in the prevalence of overweight and obesity in these students showed a significant association with high earning parents, having a paid servant in their houses, preference and frequent eating of non-vegetarian food, frequent intake of fast food, eating outside food (hoteling), high intake of milk, consumption of milk additive, television viewing, preference to indoor games than outdoor games.

INTRODUCTION

In most developing societies of our country, being a “thin child” has long been equated with poor health and weakness, thus traditionally, thinness in infants and children has been perceived as an increased risk of illness. Increase in body adiposity has been perceived traditionally as being both, healthy and well-fed and a sign of belonging to wealthy, affluent and a ‘caring’ family. As developing societies industrialized and urbanized and the standard of living improved, consequently, the rate of weight gain in population also increased and now, overweight and obesity are beginning to pose a growing threat to the health of young children.

With the increase in the prevalence of obesity, there is a parallel increase in obesity-associated chronic diseases, and their clinical onset also occurs at a younger age. Obesity has reached an epidemic proportion in the urban Indian population. If this epidemic continues, the Indian population will top the world in diabetes and coronary heart diseases earlier than estimated.

It is observed that 30 % of obese adults were obese as children (Cole et al., 2000). In the Harvard study, morbidity from cardiovascular disease, diabetes, obesity-related cancer and arthritis was higher in obese individuals who were also obese in childhood (Taylor et al., 2000).

Other yardsticks of obesity are skinfold thickness, waist circumference, waist-hip ratio, bioelectrical impedance analysis, dual-energy x-ray absorptiometry (DEXA), and Air displacement plethysmogra-
phy method. These all yardsticks have their unique advantages, but none is standardized as yet (Taylor et al., 2000). Waist circumference/waist-hip ratio has an additional advantage to detect central obesity. It has been documented that the increase in the waist-hip ratio is associated with type 2 diabetes, coronary heart disease and other metabolic complications Capizzi et al. (2011).

Is a statistical measure of the weight of a person scaled according to the height. It was invented between 1830 and 1850 by Belgian veteran Adolph Quetelet while developing “social physics”. It is weight adjusted for the height squared (weight in kg/Height in meter square), a useful index to assess overweight individuals and is a reasonably reliable marker for obesity (Taylor et al., 2000). As a measure, BMI became popular during the early 1980s, as obesity started to become a real issue in prosperous western society. However the limitation of BMI is that it cannot differentiate muscle mass from body fat and cannot locate the site of fat, e.g., “central obesity” may have normal BMIs (Després et al., 2001).

The Waist-hip Ratio (WHR) has been used as a measure of the physical health of a person and as an indicator of risk of developing metabolic and cardiovascular complications (Deckelbaum and Williams, 2001). Research shows that people with “apple-shaped” bodies (with more weight around the waist) face more health risks than those with “pear-shaped” bodies who carry more weight around the hips. WHR is used as a measurement of obesity, which in turn is a likely indicator of other more severe health conditions like insulin resistance and cardiovascular disease (Bharati et al., 2008).

This study was an attempt to screen children in their early ages, i.e. school-going age group, to find out the prevalence of overweight and obesity in those children and to investigate the role of various risk factors of obesity and overweight by comparing the students from two schools belonging to different socio-economic strata so that early and comprehensive action may be carried out.

MATERIALS AND METHODS

Design of study

This is a comparative cross-sectional

Study samples

The Sampling population includes

English medium school (affluent group) where annual fees exceed Rs10000/-

Nagar Parishad schools (non-affluent group) in Karad town where Primary and secondary education is free.

Sample size

470 children from Private English medium school and 481 children from Nagar Parishad school

Inclusion criteria

1. Age 10-15 years
2. Both sexes
3. School going children

Exclusion criteria

1. Major illness in the previous six month.
2. Any endocrine disease.
3. Children confined to bed for more than one month.
4. Prolonged school absenteeism more than one month.
5. Children with Kyphosis, scoliosis or any other physical abnormality which alters height were excluded from the study.

Consent procedure

Before conducting the study, permission was taken from the ethical committee of Krishna institute of medical science Karad.

Consent was obtained from the school authorities for conducting the research and to interview the students. Consent was also obtained from the parents of all the school children in study.

Statistical method

Mean (x), standard deviation (SD) and frequency (%) were calculated for height, weight, waist circumference, hip circumference, BMI, WHR. Individual t test was applied to compare the mean results of the anthropometrical variables and Chi square was used for comparison of frequencies. A “p” value equal to or less than 0.05 was considered to be statistically significant for a 95% confidence interval.

RESULTS AND DISCUSSION

Age and Sex distribution of students in study

In the Table 1, total 470 students were screened from a Private English Medium School. Out of whom 314 (66.8%) were males and 156 (33.19%) were females. A total of 481 students were screened from a Nagar Parishad School. Out of whom 283 (56.83%)
were males and 198 (41.16%) were females. There were statistically significant (p=0.0133) more number of female students in the Nagar Parishad School as compared to those from Private English Medium School.

**Religion wise Distribution of students in study**

In the Table 2, 470 students were from the Private English Medium School, among whom 382 (81.2%) were Hindu by religion, 50 (10.6%) were Muslim by religion and 38 (8.08%) were of other religion. 481 students from the Nagar Parishad School, among them 223 (46.4%) were Hindu by religion, 191 (39.7%) were Muslim by religion and 67 (13.9%) were of other religion. There was a significantly (p<0.0001) larger number of Hindu population in the Private English Medium School and significant large Muslim population of students in the Nagar Parishad School.

**Age and sex wise distribution of overweight and obese school children in study**

Table 3 The prevalence of overweight from Private English Medium School student was found to be 47 (10%), prevalence of obesity was 27 (5.74%) in them and prevalence of overweight and obesity combined was 74 (15.74%) from Private English Medium School student.

Out of 314 male students, 32 (10.19%) female students 15 (9.61%) were overweight. There was a significant increase (p=0.0124) in the prevalence of obesity in female students.

The prevalence of overweight from the Nagar Parishad School students was 9 (1.87%), prevalence of obesity was 2 (0.41%), and prevalence of overweight and obesity combined was 11 (2.28%) in them. There was no statistically significant difference (p=0.4463) in the prevalence of overweight and obesity according to the age group of students from the Nagar Parishad School.

Out of 283 male students, 5 (1.76%) female students, 4 (2.02%) were overweight and none was obese.

**Family income of students in study**

In present study, out of 100 students having family income ≤25000Rs/month, (3%) were overweight and none was obese. Out of 189 students having family income 25001-50000Rs/month, 11 (5.82%) were overweight and 3(1.58%) were obese. Out of 181 students having family income >50000Rs/month, 33 (18.23%) were overweight and 24(13.25%) were obese. Out of 260 students having family income ≤5000Rs/month, 6 (2.3%) were overweight and none was obese. Out of 221 student having family income >5000Rs/month, 3 (1.35%) were overweight and 2(0.9%) were obese.

**Education of parents of students in study**

Out of 27 students having post graduate fathers, 10 (37.03%) students were overweight and 5 (18.51%) students were obese. Out of 423 students having graduate father, 35 (8.27%) were overweight and 21 (4.96%) were obese. Out of 20 students having under graduate fathers, 2 (10%) students were overweight and 1 (5%) student was obese. Out of 10 student having postgraduate mothers, 3 (30%) students were overweight and 2 (20%) students were obese. Out of 198 students having graduate mothers, 26 (13.13%) students were overweight and 12 (6.06%) students were obese. Out of 262 students having under graduate mothers, 18 (6.87%) students were overweight and 13 (4.96%) students were obese.

Out of 8 students having graduate fathers, no student was overweight or obese. Out of 472 students had under graduate fathers, 9 (1.9%) students were overweight and 2 (0.42%) students were obese. 1 student had an uneducated father, and the student was neither overweight nor obese. Out of 3 students having graduate mothers, no student was overweight or obese. Out of 398 students having under graduate mothers, 6 (1.5%) students were overweight and 2 (0.5%) students were obese. Out of 80 students having uneducated mothers, 3 (3.75%) students were overweight and none was obese.

**Paid servant in house of students in study**

Showing presence of a paid servant in the house of students from the Private English Medium School. Out of 179 students having a paid servant in their house, 29 (16.2%) students were overweight and 22 (12.29%) student were obese. Out of 291 students having no paid servant in their house, 29 (16.2%) students were overweight and 22 (12.29%) student were obese. Out of 291 students having no paid servant in their house, 29 (16.2%) students were overweight and 22 (12.29%) student were obese.

**Dietary pattern of the students studied**

Out of 108 students who ate vegetarian food, 8 (7.4%) were overweight and 2 (1.85%) were obese. Out of 362 students who ate mixed i.e. veg and non-vegetarian food, 39 (10.77%) were overweight and 25 (6.9%) were obese. Moreover the prevalence of overweight and obesity was high in those children who were eating nonvegetarian food more than once in a week.

Out of 69 students who ate vegetarian food, 1 (1.44%) was overweight and none was obese. Out of 412 students who ate mixed i.e. veg and non-
Table 1: Age and Sex distribution of students in study

| Age (Yrs) | Private English Medium School | Nagar.Parishad School |
|-----------|------------------------------|-----------------------|
|           | Total(%) | Male(%) | Female(%) | Total(%) | Male(%) | Female(%) |
| 10+       | 102      | 59      | 43        | 101      | 50      | 51        |
|           | (27.70)  | (57.84) | (42.15)   | (20.99)  | (49.50) | (50.49)   |
| 11+       | 97       | 60      | 37        | 112      | 61      | 51        |
|           | (20.63)  | (61.85) | (38.14)   | (23.28)  | (54.46) | (45.53)   |
| 12+       | 92       | 61      | 31        | 97       | 51      | 46        |
|           | (19.57)  | (66.30) | (33.69)   | (20.16)  | (52.57) | (47.42)   |
| 13+       | 94       | 61      | 33        | 86       | 59      | 27        |
|           | (20)     | (64.89) | (35.1)    | (17.87)  | (68.60) | (31.39)   |
| 14+       | 85       | 73      | 12        | 85       | 62      | 23        |
|           | (18.08)  | (85.88) | (14.11)   | (17.67)  | (72.94) | (27.05)   |
| Total     | 470      | 314     | 156       | 481      | 283     | 198       |

Table 2: Religion wise Distribution of students in study

| Private English Medium School | Age (Yrs) | Total (%) | Hindu (%) | Muslim (%) | Other (%) |
|------------------------------|-----------|-----------|-----------|------------|-----------|
|                              | 10+       | 102       | (21.7)    | (81.37)    | (8.82)    |
|                              |           |           | (9.8)     |            |           |
|                              | 11+       | 97        | 76        | 12         |           |
|                              |           |           | (20.63)   | (78.35)    | (12.37)   |
|                              |           |           | (9.2)     |            |           |
|                              | 12+       | 92        | 76        | 8          |           |
|                              |           |           | (19.57)   | (82.6)     | (8.69)    |
|                              |           |           |           | (8.69)     |           |
|                              | 13+       | 94        | 76        | 11         |           |
|                              |           |           | (20)      | (80.85)    | (11.7)    |
|                              |           |           |           | (7.44)     |           |
|                              | 14+       | 85        | 71        | 10         |           |
|                              |           |           | (18.08)   | (83.52)    | (11.76)   |
|                              |           |           |           | (47.05)    |           |
| Total                        | 470       | 382       | 50        | 38         |           |
|                              |           |           | (81.27)   | (10.63)    | (8.08)    |

| Nagar Parishad School        | Age (Yrs) | Total (%) | Hindu (%) | Muslim (%) | Other (%) |
|------------------------------|-----------|-----------|-----------|------------|-----------|
|                              | 10+       | 101       | 42        | 44         |           |
|                              |           |           | (20.99)   | (41.58)    | (43.56)   |
|                              |           |           |           | (14.85)    |           |
|                              | 11+       | 112       | 49        | 48         |           |
|                              |           |           | (23.28)   | (43.75)    | (42.85)   |
|                              |           |           |           | (13.39)    |           |
|                              | 12+       | 97        | 52        | 33         |           |
|                              |           |           | (20.16)   | (53.6)     | (34.02)   |
|                              |           |           |           | (12.37)    |           |
|                              | 13+       | 86        | 44        | 29         |           |
|                              |           |           | (17.87)   | (51.76)    | (34.11)   |
|                              |           |           |           | (15.29)    |           |
|                              | 14+       | 85        | 36        | 37         |           |
|                              |           |           | (17.67)   | (42.35)    | (43.52)   |
|                              |           |           |           | (14.11)    |           |

vegetarian food, 8 (1.94%) were overweight and 2 (0.48%) were obese.

**Frequency of consumption of fast food per week by students in study**

Out of 62 students who were not taking fast food, 4 (6.34%) were overweight and 1 (1.58%) were obese. Out of 284 students who were taking fast food once in a week, 17 (5.98%) were overweight and 5 (1.76%) were obese. Out of 123 students who were taking fast food > once in a week, 26 (21.13%) were overweight and 21 (17.07%) were obese. Out of the 442 students, those who were not taking fast food, 9 (2.03%) were overweight and 2 (0.45%) were obese. Out of the 32 students who were taking fast food once in a week, none was overweight or obese. Out of the 7 students who were taking fast food > once in a week, none was overweight or obese.
Table 3: Age and sex wise distribution of overweight and obese school children in study

| Age (Yrs.) | Total (%) | Sex | Normal BMI (%) | Overweight (%) | Obesity (%) | 'p' value |
|------------|-----------|-----|---------------|---------------|-------------|-----------|
| 10+        | 59        | Male | 46(77.96)     | 9(15.25)      | 4(6.77)     | 0.4228    |
| 11+        | 60        | Male | 54(90)        | 6(10)         | 0(0)        |           |
| 12+        | 61        | Male | 52(85.24)     | 6(9.83)       | 3(4.91)     |           |
| 13+        | 61        | Male | 53(86.88)     | 6(9.83)       | 2(3.27)     |           |
| 14+        | 73        | Male | 66(90.41)     | 5(6.84)       | 2(2.73)     |           |
| Total      | 314       | Male | 271(86.3)     | 32(10.19)     | 11(3.5)     | 0.0124    |

Frequency of the hotel visits per week by students in the study

Out of 40 students who were not eating outside food, 2 (5%) were overweight and 1 (2.5%) was obese. Out of 308 students who were eating outside food only once in a week, 16 (5.19%) were overweight and 7 (2.27%) were obese. Out of 478 students, who were not eating outside food, 19 (7.27%) were overweight and 1 (0.20%) was obese. 1 student who was eating outside food only once in a week, was neither overweight nor obese. Out of 2 students who were eating outside food only once in a week, none was overweight and 1 (50%) was obese.

Intake quantity of milk per day by students in study

Out of 34 students who were not taking milk, 2 (5.88%) were overweight and 2 (5.88%) were obese. Out of 311 students who were taking 250 ml of milk per day, 22 (7.07%) were overweight and 7 (2.21%) were obese. Out of 125 students who were taking >250 ml of milk per day, 23 (18.4%) were overweight and 18 (14.4%) were obese. Out of 254 students, who were not taking milk, 4 (1.57%) were overweight and none were obese. Out of 178 students, those who were taking 250 ml of milk per day, 5 (2.8%) were overweight and 1 (0.56%) were obese. Out of 49 students, who were taking >250 ml of milk per day, none were overweight and 1 (2.04%) was obese.

Consumption of milk additives by students in study

Out of 138 students who were taking milk additive, 21 (15.2%) were overweight and 18 (13.04%) were obese. Out of 332 student who were not taking milk additive, 26 (7.83%) were overweight and 9 (2.71%) were obese. Out of 9 students, those who were taking milk additive, none was overweight or obese. Out of 472 students who were not taking milk additive, 9 (1.90%) were overweight and 2 (0.42%) were obese. However there was a significant (p<0.001) increase in the tendency of consumption of milk additives among children from the Private English Medium School than the Nagar Parishad School.

Television Viewing in hours per day by students in study

Out of 15 students who were not viewing TV, 1 (6.66%) was overweight and none was obese. Out of 395 students who were viewing TV for 0-2 hour per day, 29 (7.34%) were overweight and 13 (3.29%) were obese. Out of 60 students who were viewing TV for >2 hours per day, 17 (28.33%) were overweight and 14 (23.33%) were obese. Out of 40 students who were not viewing TV, 1 (2.5%) was overweight and none was obese. Out of 266 students who were viewing TV for 0-2 hour per day, 4 (1.5%) were overweight and none was obese. Out of 175 student who were viewing TV for >2 hours per day, 4 (2.28%) were overweight and 2 (1.14%) were obese.

Videogame playing in hours per day by students in study

Out of 183 students who were not playing videogames, 12 (6.55%) were overweight and 8 (4.37%) were obese. Out of 287 students who were playing videogames for 0-2 hour per day, 35 (12.19%) were overweight and 19 (6.62%) were obese. Out of 466 students, who were not playing
videogames, 9 (1.93%) were overweight and 2 (0.42%) were obese. Out of 15 students who were playing videogames for 0-2 hour per day, none were overweight or obese.

**Indoor games played in hours per day by students in study**

Out of 363 students, who were not playing indoor games, 31 (8.53%) were overweight and 15 (4.13%) were obese. Out of 105 students, who were playing indoor games for 0-2 hour per day, 15 (14.15%) were overweight and 12 (11.32%) were obese. Out of 2 students who were playing indoor games for >2 hours per day, 1 (50%) were overweight and none was obese from the Private English Medium School. Out of 476 students who were not playing indoor games, 9 (1.89%) were overweight and 2 (0.42%) were obese. Out of 5 students who were playing indoor games for 0-2 hour per day, none were overweight or obese.

**Outdoor games playing in hours per day by students in study**

Out of 53 students, who were not playing outdoor games, 11 (20.75%) were overweight and 12 (22.64%) were obese. Out of 349 students who were playing outdoor games for 0-2 hour per day, 35 (10.75%) were overweight and 15 (4.29%) were obese. Out of 68 students who were playing outdoor games for >2 hours per day, 1 (1.47%) was overweight and none was obese from the Private English Medium School. Out of 53 students, who were not playing outdoor games, 2 (3.77%) were overweight and 1 (1.88%) was obese. Out of 162 students who were playing outdoor games for 0-2 hour per day, 3 (1.85%) were overweight and 1 (0.65%) was obese. Out of 266 students who were playing outdoor games for >2 hours per day, 4 (1.5%) were overweight and none was obese from the Nagar Parishad School.

**Mode of transport to school of students in study**

Out of 300 students, who traveled to school by bus (or motorized vehicles), 34 (11.33%) were overweight and 22 (7.33%) were obese. Out of 63 students who were travelling by Bicycle, 4 (6.34%) were overweight and 2 (3.17%) were obese. Out of 107 students who daily walked to school, 9 (8.4%) were overweight and 3 (2.8%) were obese from Private English Medium School.

No student was travelling to school by bus. Out of 127 students who were travelling by bicycle, 2 (1.57%) were overweight and none was obese. Out of 354 students who daily walked to school, 7 (1.97%) were overweight and 2 (0.56%) were obese from the Nagar Parishad School.

**Self impression of student in study**

Out of 70 students who had self impression of thinness, 69 (98.57%) were overweight and none was obese. Out of 368 students who had self impression of average built, 36 (29.78%) were overweight and 12 (3.26%) were obese. Out of 32 students who had self impression of obese child, 10 (31.25%) were overweight and 15 (46.87%) were obese from the Private English Medium School. Out of 233 students who had self impression of thinness, none were overweight and or obese. Out of 244 students who had self impression of average built, 8 (3.27%) were overweight and 1 (0.4) was obese. Out of 4 students who had self impression of obese child, none was overweight and 2 (50%) were obese from Nagar Parishad School.

There is an increase in the prevalence of overweight and obesity worldwide, considered as a global epidemic of obesity during last 10-20 years. Progress in communication has resulted in globalization of social behavior and life style. In addition, migration of people has introduced new eating behaviors and modified food habits at a fast pace and because of these non communicable diseases behave like communicable diseases and they have hit India and other developing countries hard (Bhave et al., 2004).

In this study the prevalence of overweight (10%) and obesity (5.7%) was higher in the Private English Medium School (affluent class) as compared to the Nagar Parishad School in which the prevalence of overweight was (1.87%) and obesity was (0.41%). These prevalence rates were comparable to the result by Mehta M et al. who reported prevalence of overweight (15.2%) and obesity (5.3%) from Delhi affluent school (Mehta et al., 2007) who reported prevalence of obesity (5.74%) from affluent school form Davangere, who reported prevalence of overweight and obesity (12.7%) and (3.4%) respectively in affluent school children (Aggarwal et al., 2008) who also reported prevalence of overweight and obesity combined was (21.9%) in affluent children as compared to government school from Delhi which had prevalence of overweight and obesity combined of only (3.13%) (Stigler et al., 2011). The present study highlights the increase in the prevalence of overweight and obesity in the Private English Medium School representing students mainly from a better socioeconomic class.

This study reports a higher proportion of overweight and obesity in females compared to males in both the schools but the difference was statistically significant only in the Private English Medium School. This is comparable to research by Kumar (Kumar et al., 2007), and who reported...
prevalence of overweight and obesity was higher in females than in males as against reports (Bharati et al., 2008).

Majority of children in the study had mixed diet. The prevalence of overweight and obesity was statistically higher in the children eating mixed i.e. nonvegetarian food once or more in a week from both the schools. These results were comparable to results reported by mohan (Mohan et al., 2004), who also showed nonvegetarian food consumption increases overweight and obesity in children. Above observations supports our previous knowledge about higher contents of saturated and Trans fat present in nonvegetarian foods are responsible for increase overweight and obesity in students. Also fats produces less satiety, are dense and have more chances of deposition in body as compared to protein and carbohydrates. All these factors contribute for increase in prevalence of overweight and obesity in nonvegetarian children.

The students who ate fast food once or more than once in a week showed a statistically significant higher prevalence of overweight and obesity as compared to students who didn’t eat fast food from the English medium school where as there is no statistically significant effect of fast food eating in students from the Nagar Parishad School. These results were comparable to results reported by singh, who also reported statistically significant increase in prevalence of overweight and obesity in fast food eating children. As fast foods are high in calories, fats and are easily available any time anywhere there is increase in tendency of preferring fast food by children over homemade regular meals (Singh et al., 2006). This tendency of eating fast food instead of regular healthy homemade meals behaves like a slow poison in children and ultimately leads to increase in overweight and obesity and its future complications.

These findings were similar to findings reported by Goyal who also showed increased prevalence of overweight and obesity in children who ate outside food on weekend (Goyal et al., 2010).

Laxmaiah reported that children who spent more time in watching TV or on computers had higher BMI and were physically less active and were more prone to overweight and obesity (Laxmaiah et al., 2007). In this study prevalence of overweight and obesity was higher in children who were playing videogames from the English medium school whereas there were only few students who were playing videogame from the Nagar Parishad School. Shah also reported significant association between playing computer/video games and increase prevalence of overweight and obesity in school going students in their studies. Thus video and computer games increase the overweight and obesity by increasing inactivity in children (Shah et al., 2008).

CONCLUSIONS

The increase in the prevalence of overweight and obesity in these students showed a significant association with high earning parents, having a paid servant in their houses, preference and frequent eating of nonvegetarian food, frequent intake of fast food, eating outside food (hotelimg), high intake of milk, consumption of milk additive, television viewing, preference to indoor games than outdoor games.

Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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REFERENCES

Aggarwal, T., Bhatia, R. C., Singh, D., Sobti, P. C. 2008. Prevalence of obesity and overweight in affluent adolescents from Ludhiana. Punjab. Indian pediatrics, 45(6):500–500.

Bharati, D. R., Deshmukh, P. R., Garg, B. S. 2008. Correlates of overweight & obesity among school going children of Wardha city. Central India. Indian Journal of Medical Research, 127(6):539–539.

Bhave, S., Bavdekar, A., Otiv, M. 2004. IAP national task force for childhood prevention of adult diseases: childhood obesity. Indian pediatrics, (6):559–576.

Capizzi, M., Leto, G., Petrone, A., Zampetti, S., Papa, R. E., Osimani, M., Spoletini, M., Lenzi, A., Osborn, J., Mastantuono, M., Vania, A., Buzzetti, R. 2011. Wrist Circumference Is a Clinical Marker of Insulin Resistance in Overweight and Obese Children and Adolescents. Circulation, 123(16):1757–1762.

Cole, T. J., Bellizzi, M. C., Flegal, K. M., Dietz, W. H. 2000. Establishing a standard definition for child overweight and obesity worldwide: international survey. Bmj, 320(7244):1240–1240.

Deckelbaum, R. J., Williams, C. L. 2001. Childhood Obesity: The Health Issue. Obesity Research, 9(S11):239S–243S.

Després, J. P., Lemieux, I., Prud’homme, D. 2001. Treatment of obesity: need to focus on high risk abdominally obese patients. Bmj, 322(7288):716–720.
Goyal, R. K., Shah, V. N., Saboo, B. D., Phatak, S. R., Shah, N. N., Gohel, M. C., Raval, P. B., Patel, S. S. 2010. Prevalence of overweight and obesity in Indian adolescent school going children: its relationship with socioeconomic status and associated lifestyle factors. *The Journal of the Association of Physicians of India*, 58:151–158.

Kumar, S., Mahabalaraju, D. K., Anuroopa, M. S. 2007. Prevalence of obesity and its influencing factor among affluent school children of Davangere city. *Indian Journal of Community Medicine*, 32(1):15–15.

Laxmaiah, A., Nagalla, B., Vijayaraghavan, K., Nair, M. 2007. Factors Affecting Prevalence of Overweight Among 12- to 17-year-old Urban Adolescents in Hyderabad, India. *Obesity*, 15(6):1384–1390.

Mehta, M., Bhasin, S. K., Agrawal, K., Dwivedi, S. 2007. Obesity amongst affluent adolescent girls. *The Indian Journal of Pediatrics*, 74(7):619–622.

Mohan, B., Kumar, N., Aslam, N., Rangbulla, A., Kumkarni, S., Sood, N. K., Wander, G. S. 2004. Prevalence of sustained hypertension and obesity in urban and rural school going children in Ludhiana. *Indian heart journal*, 56(4):310–310.

Shah, C., Diwan, J., Rao, P., Bhabhor, M., Gokhle, P., Mehta, H. 2008. Assessment of obesity in school children. *Calicut Medical Journal*, 6(3):2–2.

Singh, A. K., Maheshwari, A., Sharma, N., Anand, K. 2006. Lifestyle associated risk factors in adolescents. *The Indian Journal of Pediatrics*, 73(10):901–906.

Stigler, M. H., Arora, M., Dhavan, P., Tripathy, V., Shrivastav, R., Reddy, K. S., Perry, C. L. 2011. Measuring obesity among school-aged youth in India: A comparison of three growth references. *Indian Pediatrics*, 48(2):105–110.

Taylor, R. W., Jones, I. E., Williams, S. M., Goulding, A. 2000. Evaluation of waist circumference, waist-to-hip ratio, and the conicity index as screening tools for high trunk fat mass, as measured by dual-energy X-ray absorptiometry, in children aged 3–19 y. *The American Journal of Clinical Nutrition*, 72:490–495.