Prevalence of obesity and hypertension among teenage girls in an emerging metropolitan city of Central Rajasthan

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ABSTRACT

Background: The problem of overweight, obesity, and hypertension is not only limited to adults but also extended to children and adolescents. The increasing prevalence of obesity and hypertension in girls reaching reproductive capacity is particularly disturbing, because untreated obesity contributes to its perpetuation in their offspring through maternal fetal transmission. Aims and Objectives: The aims of the study were as follows: (1) To evaluate the prevalence of overweight, pre-hypertension, and hypertension among teenage girls of Jaipur city and (2) to compare these observations in affluent and non-affluent category girls. Materials and Methods: Design: A school-based, cross-sectional, observational study was carried out from January to June 2011 involving 500 teenage girl students of age 13–17 years. One government and one public school were selected randomly in Jaipur. From each selected school, 250 teenage girls of 13–17 years of age group were examined and asked to fill out a pro forma. Category A: Teenage girls of private school belonging to affluent class; Category B: Teenage girls from government school and belonged to non-affluent class. Each girl height and weight was recorded to calculate body mass index. Blood pressure of each girl was recorded. The collected data were analyzed using SPSS version 11.5 and Chi-square test. Results: The prevalence of overweight among category A girls was 17.6% and in category B was 5.2% of girls (P = 0.0001). About 5.2% of girls were pre-hypertensive and 3.6% were hypertensive in category A while 5.6% were pre-hypertensive and 2.0% were hypertensive in category B (P = 0.416 and 1.00 for hypertension and pre-hypertension, respectively). Conclusion: The prevalence of overweight and hypertension was higher among affluent teenage girls. The prevalence of pre-hypertension was comparable between two categories. The underlying factors for pre-hypertension were different in two categories.

KEY WORDS: Teenage Girls; Obesity; Pre-hypertension; Hypertension

INTRODUCTION

The pandemic of obesity and overweight is recent but it is rapidly becoming one of the most significant global problems. It has involved almost all age demographics. The prevalence of childhood and adolescent obesity is on the rise and can be a major cause of morbidity in the future adult population. Early-onset obesity can be a root cause for multiple non-communicable diseases in a population as well as have an impact on the overall productivity of the population. The current lifestyle and food habits are predisposing factors for overweight as they involve low physical activity and high-fat and cholesterol-based diet. Data from National Health and Nutrition Education Survey 1999–2000 through 2017–2018 showed an increase in incidence of obesity from 13.9% to 19.3% in children aged 2–19 years. The prevalence of severe
obesity also increased from 3.6% to 6.1%. Similar rising trend has been observed in many developing countries in the past years.

Overweight and obesity are established risk factors for hypertension. The incidence of high blood pressure (BP) is nearly double in obese people as compared to the non-obese. High BP in children was uncommon a few decades ago. But recently, the diagnosis of high BP has become uncommonly high among the youth and children. The mean BP of children has in itself increased in comparison to the previous generation. In a study in 1989, 1% of children met the diagnosis guidelines for high BP. Follow-up study in 2002 of the same population illustrated a rise up to 5%. Comparative studies in 2003 have also shown a significant difference in incidence among different socioeconomic strata children with incidence as high as 25% among inner city and minority groups.

Even though both these diseases have isolated trends geographically, many studies have demonstrated that an increase in the average body mass index (BMI) in children is associated with concurrent increase in mean BP. Many subfactors like high cholesterol levels could be related. However, it is clear that reduction of obesity will play an important role in reduction of hypertension in children.

The impact of obesity in women and more importantly in young women can be drastic. It can be associated with multiple comorbidities with complex cause and effect relations. The gynecologic, obstetric impact of obesity in these women is not still completely evaluated. The increasing prevalence of severe obesity in girls of reproductive capacity at younger ages is of concern since this untreated obesity can contribute to the maternal-fetal non-genomic transmission of this disease. For these multiple reasons, it is essential to focus on young women and work on reduction of incidence of obesity among them.

Before that, it is a pre-requisite to analyze the prevalence of obesity and associated disorders in all parts of the country. Various studies have shown an alarming rise in obesity in larger metropolitan cities such as Delhi and Mumbai. Jaipur is an emerging metropolitan city which is facing the danger of these lifestyle-related disorders immediately.

**Aims and Objectives**

The aims of the study were as follows:

1. To estimate the prevalence of obesity, hypertension in teenage girls, its age-wise distribution, and distribution in the two categories
2. To find out dietary factors and role of changed lifestyle in causing obesity and hypertension
3. To understand factors causing the problem and estimating results of the problem.

**MATERIALS AND METHODS**

A cross-sectional study was conducted on school and college girls, wherein a total of 500 students of the ages 13–17 years were evaluated. They were divided into two categories.

Category “A” affluent girls studying in private schools and category “B” girls from govt. school. Written consent was obtained from all girls and permission sought from parents and teachers. Age of the girls was obtained from the school registers and confirmed by the volunteer herself.

The study design was presented to the ethical committee and approval was attained.

**Anthropometry and BP Measurement**

**Height**

Height was measured by Harpenden stadiometer, the subjects were asked to stand with their back against the scale, their knees touching, with heels together and feet a 60° angle apart, their palms in, and their chin slightly up.

**Weight**

A calibrated and standardized digital weighing scale having a capacity of 100 kg was used to measure weight.

Both height and weight were recorded twice. If two readings differed more than 0.5 kg and 0.5 cm, a third reading was taken. The mean value between the two closer measurements was used as the final value.

**BMI: Calculated using the formula:**

\[
\text{BMI} = \frac{\text{Weight in Kilograms}}{(\text{Height in meter})^2}
\]

**Overweight:** Subjects with a BMI >85th percentile of reference data

**Obese:** BMI >95th percentile. The reference data are from the CDC 2000 dataset for BMI.

**Hip and Waist**

**Central obesity**

To find out the abdominal obesity, waist–hip ratio (WHR) was used. The mean of two readings was taken in for calculating the WHR.

**BP**

BP was measured using a standard digital BP monitor, in the right arm in a sitting posture, after at least 5 min of rest. Three readings of the BP of each girl were taken, maintaining an interval of 2 min between readings. The mean of three
readings was reported. The weight and height of each girl were recorded. Average systolic or diastolic BP >95th percentile for gender, age, and height was considered as hypertension. Pre-hypertension defined as average systolic BP or diastolic BP that was >90th percentile but <95th percentile.

Statistical Analysis

The variables of two groups were compared with each other and statistical analysis was done by applying Student’s “t-test.” Odds ratio and the corresponding confidence intervals were computed using standard methods. The SPSS (version 11.0) software was used for this purpose.

The girls were asked to fill the pro forma which will include the details about their diet habits, sports and physical activity, menstrual history, and disease keeping their names secret.

The collected data were analyzed using SPSS version 11.5. Chi-square test was used to test the significance of the differences across the groups and \( P < 0.05 \) was considered statistically significant.

The study design was presented to the ethical committee and approval was sought and received.

RESULTS

There were 44 (17.6%) overweight subjects in category A as compared to just 13 (5.2%) in category B out of 250. Overall incidence of overweight in our study was 11.4%. The age-wise distribution pattern of overweight is given in Table 1 and Figure 1. The difference of incidence of overweight was statistically significant (\( P < 0.0001 \)). Out of 250, 22 girls of category A had hypertension and 19 girls of category B had hypertension. The age-wise distribution pattern is given in Table 2 and Figure 2. The difference of incidence of hypertension was statistically not significant (\( P > 0.0001 \)). The mean BMI of category A was 21.34 ± 2.99 kg/m² while that of category B was 18.79 ± 2.68 kg/m². Their difference was statistically significant (\( P < 0.0001 \), as shown in Table 3. The mean BP for category A was systolic = 115.14 ± 9.59 mmHg and diastolic = 70.02 ± 8.23 mmHg. For category B, it was systolic = 114.02 ± 9.82 mmHg and diastolic = 68.69 ± 7.66 mmHg. There was non-significant difference in systolic and diastolic BP [Table 3].

In category A, out of the total overweight/obese, 12 had lifestyle-related predisposing factors such as high fast food diet, less exercise, and sedentary lifestyle (more time spent

| Table 1: Prevalence of overweight in both categories |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| **Age** | **Category A** | **Overweight subjects** | **Category B** | **Overweight subjects** | **\( \chi^2 \)** | **P-value** |
| 13 | 12 | 1 | 19 | 1 | 0.114 | 0.73 |
| 14 | 14 | 3 | 51 | 2 | 4.74 | 0.029* |
| 15 | 34 | 9 | 67 | 4 | 8.45 | 0.003** |
| 16 | 170 | 27 | 66 | 5 | 2.79 | 0.09 |
| 17 | 20 | 4 | 47 | 1 | 6.48 | 0.01* |
| Total | 250 | 44 | 250 | 13 | 19.02 | 0.0001*** |

| Table 2: Prevalence of hypertensive cases in both categories |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| **Age** | **Category A** | **Hypertensive subjects** | **Category B** | **Hypertensive subjects** | **\( \chi^2 \)** | **P-value** |
| 13 | 12 | 0 | 19 | 2 | 1.35 | 0.24 |
| 14 | 14 | 2 | 51 | 3 | 1.09 | 0.29 |
| 15 | 34 | 2 | 67 | 2 | 0.49 | 0.48 |
| 16 | 170 | 16 | 66 | 7 | 0.077 | 0.78 |
| 17 | 20 | 2 | 47 | 5 | 0.0061 | 0.93 |
| Total | 250 | 22 | 250 | 19 | 0.23 | 0.63 |

| Table 3: Comparison of mean BMI, systolic and diastolic BP of both categories |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| **Variables** | **Category A mean (SD)** | **Category B mean (SD)** | **t-value** | **P-value** |
| BMI | 21.34 (2.99) | 18.79 (2.68) | 7.96 | 0.0001*** |
| Systolic BP | 115.14 (9.59) | 114.04 (9.82) | 0.99 | 0.322 |
| Diastolic BP | 70.02 (8.23) | 68.69 (7.66) | 1.47 | 0.142 |

BMI: Body mass index, BP: Blood pressure
on TV and computers), 13 had genetic predisposing factors such as high birth weight and family history of obesity, and 11 girls had both factors. Out of total overweight/obese girls, 13 (29.54%) were pre-hypertensive/hypertensive. Hypertension among normal weight girls was present in 9 (4.33%). Cases of early puberty (between 10 and 12 years) were 16 (36.36%) in obese/overweight while there were 20 (19.04%) such cases in normal weight girls.

In category B, out of the total overweight/obese, three had lifestyle-related predisposing factors such as high fast food diet, less exercise, and sedentary lifestyle (more time spent on TV and computers); one had genetic predisposing factors such as high birth weight and family history of obesity; and five girls had both factors. Out of total overweight/obese girls, 4 (33.3%) were pre-hypertensive/hypertensive. Hypertension among normal weight girls was present in 15 (6.58%). Cases of early puberty (between 10 and 12 years) were 2 (16.67%) in obese/overweight while there were 12 (5.26%) such cases in normal weight girls.

**Lifestyle-Related Observations**

The frequency of fast food eating was very high in girls of category A in comparison to category B. The no. of hours spent on watching television or computers was very high in girls of category A in comparison with category B. The average time spent on walking was very less in category A and much more in category B. The eating habits and exercise time were very different in the two categories. Compared to category A, category B girls are more physically active and take high carbohydrate less cholesterol/fat rich food.

**DISCUSSION**

The percentage of obese/overweight was significantly higher in category A. This indicates that affluent society girls are more prone to this problem than the low socioeconomic category girls. In Table 3, the mean BMI of category A girls was significantly higher than category B girls. Chi-square test carried out age wise indicated significant difference in overweight (including obese) prevalence in the age 14, 15, and 17 years. Thirteen years age did not have significant difference possibly because of a lesser number of subjects. Another possible explanation is that the body undergoes metabolic changes and growth and fat deposition occurs in the female pattern begins at puberty. However, this growth is most marked a few years after puberty, that is, around 14 years of age. This growth is variable according to the amount of exercise and cholesterol richness of diet. Hence, these changes have not yet occurred in this group. Another absence of significance at 16 years could possibly be due to high difference in the number of subjects in the two categories. The number of hypertension cases in the two categories was not found to differ significantly. Furthermore, no significance was found in mean systolic and diastolic BP difference in two categories. This indicates that lifestyle does not affect BP as much as it has a role in causing overweight. Yet, the high percentage of hypertension cases is indicative that both categories face some reason precipitating to hypertension. The reason for A category being a high cholesterol diet and an unhealthy lifestyle. They have hypertension majorly as a precipitator factor of obesity and overweight. While for category B, which included girls of poor background getting higher school education, the reason is possibly more stress. They have to struggle, accommodating studies with housework, arrange expenses for books and other educational needs. This view is strengthened by a greater percentage of normal weight hypertensive girls in category B. The number of underweight girls was insignificant in category A while category B had a significant proportion of underweight girls, showing that this class faced more problems in getting a nutritious and complete food. Lack of adequate food could be one of the reasons for lesser prevalence of obesity. It was seen that early puberty was very high in category A girls. One of the reasons being a higher prevalence of obesity, others could include more exposure to television internet as found in the survey. With regard to lifestyle, fast food eating frequency was found much higher in category A, accounting for the higher fraction of overweight/obese. Furthermore, girls of category A spent a lot more time on TV/computers signifying not only a more sedentary lifestyle but also more exposure to violence and sexual contents, which could be an additional factor for early puberty in this category. The average time spent in walking was higher in category B being a lower socioeconomic group, do not have access to vehicles, and travel most places on foot. Thus, they have a more active lifestyle and hence lesser chances of gaining weight. Cases of early puberty were also more in the overweight/obese in both categories. It supports the fact that increasing obesity is leading to increased precocious puberty among girls.

Our study indicates that there is no significant correlation between overweight and hypertension in adolescent girls. Similar conclusions have been seen in anthropometric and BP measurements data obtained from the ENNYS and HUNT cross-sectional study,[8] and obtained by McNiece et al.[9] In contrast, a research by Raj et al.[10] showed significant difference in BP in normal weight and overweight subjects concluding a correlation in obesity and hypertension. When compared to other studies carried out in India, the obesity prevalence is found to be lesser in this research. On observing the results with “Growth pattern and prevalence of obesity in affluent schoolchildren of Delhi,[6]” where obesity was 6% and overweight was 22%, it can be concluded to be comparatively lower in Jaipur. Similarly, our results were lower as compared to Mysuru and Surat.[11,12] This can be explained by the fact that Rajasthan, being an economically backward state of the country facing more food crisis than other states. Nagendra et al. found similar results indicating significant prevalence of obesity in affluent schoolgirls in...
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Surat, India. The prevalence of obesity and overweight among their study subjects was 6.6% and 13.5%, respectively.

Dabade and Dabade concluded that private school-going children found more overweight and obese compared to government school-going children. Their study conducted in Satara district, Maharashtra, had similar incidence of overweight in affluent and non-affluent students compared to our study. When compared to descriptive data of school survey, 2005 of research on “Obesity in Indian children: Time trends and relationship with hypertension,” wherein the time trends in childhood obesity in a representative sample of schoolchildren from Ernakulam District, Kerala, were examined and the relationship of obesity with BP was determined, the mean BMI, Systolic and diastolic BP of category A girls was found higher than the data and that of category B was found lower.

This research, if carried out on a larger scale, can provide more accurate results from which not only qualitative but also quantitative conclusions can be attained. Furthermore, one group of subjects can be asked to eliminate one factor from their lifestyle and long-term effects of such practice can be noted. On the basis of the conclusions, we can estimate the role of each factor predisposing girls to these disorders and suggest measures to eliminate those factors as much as possible.

CONCLUSION

Obesity prevalence is closely linked to the lifestyle habits. It is higher in affluent society girls as compared to low socioeconomic class girls. The major factors responsible for this difference can be attributed to a worse lifestyle of affluent class, more sedentary habits, more cholesterol/fat rich food intake, etc. The prevalence of hypertension is based on both prevalence of obesity/hypertension and psychological stress factors.

Attainment of puberty is directly associated with a higher BMI. It is attained, on an average, earlier in girls of affluent class as compared to low socioeconomic class. Sudden weight gain after puberty is common in girls. The peak incidence of overweight/obesity can be seen just after the average puberty age in both cases. Rajasthan, being an economically backward state, has a lesser incidence of obesity. Yet, it is significant and is lifestyle related and, hence, must be curbed.

This research is an observational study of the cross-sectional type. Through this study, it has been concluded that lifestyle has a significant role in precipitation of obesity. It has also raised significantly in the affluent class teenage girls in Jaipur. Obesity, furthermore, increases the risk of pre-hypertension/hypertension in later stages of life. It is leading to early puberty. Obesity and hypertension among young girls are a serious threat to the society as it can lead to very serious problems during pregnancy parturition, etc. Obesity has a negative impact on female fertility and can result in menstrual disturbances. Many systemic diseases such as diabetes mellitus, osteoarthritis, cardiovascular diseases, and sleep apnea syndrome are related to an increased BMI. Furthermore, multiple malignancies including breast cancer and other reproductive system malignancies cancer of the esophagus have obesity as an established risk factor.

Thus, effective and immediate measures must be taken to curb this rising problem. With further research, these observations can be strengthened and medical officers should suggest adequate solutions.

REFERENCES


Figure 1: Comparison of overweight/obesity prevalence

Figure 2: Comparison of pre-hypertension/hypertension prevalence


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