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Prevalence and risk factors of obesity among higher secondary school students in urban and rural schools of North Kerala

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ABSTRACT

Background: Childhood overweight and obesity have become an important public health problem. Life style approach is required, and requires political and social commitment in addition to medical management. We investigated the prevalence of obesity and the association with risk factors relating to physical activities, in higher secondary school children of government and private schools.

Methods: In 2015, we surveyed higher secondary students in North Kerala both in government and private sector schools. We measured height, weight and plotted Body mass Index on CDC (Child Developement Centre) charts. Factors affecting obesity like physical and sedentary activities (using Bharathy et al questionnaire) and school-based risk factors were also studied.

Results: Multivariate logistic regression was done to evaluate the significance of these risk factors for overweight and obesity. On the basis of measurements taken in 496 higher secondary school students, the estimated provincial prevalence of overweight was found to be 7%, obesity 3% and malnutrition 18%. Children who studied in private school was found to have increased risk of overweight p=0.02 with odds ratio (OR of 2.97 95% confidence interval CI 1.27-6.97), whereas those who went to school by walking were at decreased risk (OR 2.78, 95% CI 1.16-6.65). Students involved in house hold chores for 4hours or more a week were associated with a decreased risk of overweight (OR 3.96, 95% CI 1.42-11.07) and those with less activity were at increased risk for obesity (OR 6.61, 95% CI 1.91-22.84).

Conclusions: Home and schools provide important opportunities for public health initiatives for reducing childhood overweight and obesity. Children in private schools coming from higher socio-economic background are being less physically active and has thus susceptible to obesity and its consequences.

Keywords: Body mass index, Obesity, Overweight, Physical activity

INTRODUCTION

Overweight/obesity is on the rise at an alarming speed because of physical inactivity and unhealthy dietary habits among adolescents. Till recent times, in India paediatric studies on nutrition were focussed on prevalence of malnutrition. The economic transitions

which have happened in India during the recent decades have changed the scenario.² Since childhood is period in which health behaviour usually start we should start health promotion interventions at an early stage. It has become increasingly important to identify the risk factors predisposing to overweight/ obesity, which results in metabolic syndrome with significant co morbidities and

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health problems such as diabetes mellitus, hypertension, coronary artery disease, orthopaedic problems, impaired quality of life and negative self-esteem.³

Physical activity is decreasing not only in the developed countries but also in the developing countries despite people being aware of its health impacts.⁴ Increases in childhood overweight and obesity have become a major public health problem in industrialized nations. Conditions such as type 2 diabetes mellitus, hypertension and hypercholesterolemia, which were previously seen primarily in adults, are becoming more common among children as the prevalence of obesity increases.⁵

Insufficient physical activity and poor dietary habits are widely acknowledged as the primary mechanisms underlying the rise in excess body weight. Physical activity means any body movement that burns calories and can't be used interchangeably with exercise always.⁶ Watching television could be contributing to the increased incidence of overweight among adolescents in many ways like increase in sedentary behaviour; decrease in physical activity; increased snacking while watching television; disturbance of sleeping pattern; and unhealthy eating patterns influenced by advertisements of junk/fast foods. However, food in urban area has been replaced by high calorie snacks and junk food. Increased television viewing and computer along with decreased outdoor sports has made life sedentary. Being moderately active for at least 30 minutes a day on most days of the week can help lower the risk of chronic disease. But to stay at a healthy weight, or to lose weight, most people will need more physical activity-at least an hour a day-to counteract the effects of increasingly sedentary lifestyles, as well as the strong societal influences that encourage overeating.8 Evidence based medicine suggest that physical activity has beneficial effects on adiposity, musculoskeletal health, cardio vascular health and emotional well-being.⁹

Even though there are a lot of studies on prevalence of obesity in school children studies from India, there are very few studies from Kerala which highlights on the risk factors of obesity among adolescents. This study throws light on the prevalence of obesity among higher secondary school children from urban and rural backgrounds and also correlates obesity with its main risk factor physical inactivity.

METHODS

The study is a cross sectional descriptive study conducted over a period of 3 months (August to November) in 2015. Study was conducted in 3 selected Higher secondary schools belonging to Government and private sector in North Kerala. Children studying in the classes XI and XII between the age 14 to 18 years were included under the study. Informed consent was obtained from the Principal and students. Ethical committee approval was obtained. A sample size of 496 students from public and private sector schools were included under the study. Of the three

schools, one was representing government sector and the other two private sectors. Two twenty-eight students participated from the government school and 108,160 respectively from another two private schools. Base line parameters like age, sex and socio-economic status(SES) using Modified Kuppusamy Scale were noted.

Height and weight were also recorded in all of them. Height was recorded using a non-stretchable tape. The tape was fixed to the wall vertically using a cellophane tape. The student was made to stand in such a way that head is in Frankfurt plane with heels and buttocks in contact with the wall and both feet close to each other without any foot wears. The height was measured as a distance between ground and a scale pressed firmly on the child's head and placed horizontal to the ground. Weight was recorded on a digital weighing scale after removing the foot wear.

Body mass index (BMI) was calculated using the formula weight in Kg/height in m². Over-weight was defined as BMI between 85th and 95th centile according to age and gender specific charts by CDC (Child Development Centre). Obesity was defined as BMI more than 95th centile and undernutrition as BMI less than 5th centile according to the same charts. This value was used as a cut off for statistical analysis.¹¹ Students were also grouped according to Agarwal charts.¹²

Those children who were identified as obese or overweight were taken as cases. Another group of students whose BMI fell below 85th centile was allotted as controls. Controls were selected by computer generated random sampling. Students who were not willing to fill the proforma and those who didn't fill the proforma completely were excluded from the study.

A questionnaire prepared for finding out the 'prevalence and determinants of obesity in higher secondary school children' developed by CDC was given to these students. The questionnaire was filled by the students after a brief introduction by the investigator about how to fill the proforma. The questionnaire is a structured one on the determinants of obesity. Socio economic status was assessed using Modified Kuppusamy scale. Physical activity was ascertained by asking about daily physical activity during a typical month in a proforma designed by Bharathy et al.¹³ Any hobbies at home and house hold chores were also assessed. Secondary activities like reading, TV watching, hobbies were recorded.

Students were also asked to report separately the time spent on weekends watching television, reading, doing homework, playing computer or video games. Regular practice of sports corresponds to the frequency of spending at least 20 consecutive minutes in sport activities beyond compulsory school activities. Additionally, we evaluated self-perception of leisure-time activities according to four subjective intensity categories (mainly sitting, mainly standing, active or very active).

Watching Television was also looked into. These variables were given different score.

Data thus collected were coded properly and entered in excel spread sheet. Appropriate data checking measures were used for ensuring quality of data. Physical activities like work, other physical activities like hobbies, sports etc mentioned according to Bharathy and et al questionnaire were given appropriate coding and entered in excel. Statistical analysis was done using SPSS 15.0. Findings were described as mean, median values and properties. Appropriate statistical tests (chi square) and logistic regression were carried out to find the association of variables. Univariate and multivariate analyses were conducted to determine the association between dependent (overweight) and independent (risk factors) variables. Initially, in univariate analysis, a single variable at a time was entered; unadjusted OR and 95% CI were computed for all independent variables. Multivariate analysis with all independent variables entered at the same time was completed to adjust for the effect of confounding, and adjusted OR and 95% CI were computed.

RESULTS

Four ninety-six adolescent students studying in the classes XI and XII from 3 higher secondary schools (one government and 2 private) were examined. Two-twenty-eight students were from government schools and 268 from the two private schools. Out of this 51.8% (257) were girls and 48.2% (239) were boys. Age group ranged from 14 to 18years in the study population. In boys, height ranged from 158.5cm to 181cm, weight from 40 to 82kg and BMI from 15.65 to 30.12. In girl's height ranged from 153.69 to158.5cm, weight from 48.11 to 50kg and BMI from 19.12 to 20.77.

Table 1: Gender distribution of overweight and obesity.

| Sex | Over weight | Obese | % |
|--------|-------------------|-------------------|----------------|
| Male | 23 | 4 | 27/239 (11.23) |
| Female | 12 | 8 | 20/257 (7.8%) |
| % | 35/495 (7.05%) | 12/496 (2.42%) | 47/496 |

Out of 239 boys 72% were having normal nutritional status based on BMI, 18% were undernourished, 7% were overweight and 3% obese. Out of 257 female students 73% were having normal BMI, 18% were undernourished, 5% were overweight and 4% obese (Table 2). Out of 16 obese students 68.6% were girls. This gender difference was statistically significant (3.2%).

In private schools 17% were undernourished and in government school 19% were undernourished. Seventy-two percentage students from both sectors were having normal BMI, 7% from private and 6 % from government

sector were overweight. Obesity was observed in 3% of government school students and in 4% of private school children.

Table 2: NCHS and Agarwal classification of obesity.

| Category | NCHS | Agarwal | |
|-------------|------------|-------------|--|
| Underweight | 89 (18%) | 45 (>06%) | |
| Normal | 35.7 (73%) | 394 (79.4%) | |
| Overweight | 34 (5%) | 35 (7.05%) | |
| Obese | 16 (4%) | 12 (2.42%) | |

Fifty obese/overweight students were selected and physical activity questionnaire was given to them. Two students were not willing to fill the proforma and 4 proformas were incomplete and thus excluded. So, a total of 44 obese or overweight children were compared with 52 randomly selected normal children with BMI less than 85th centile.

Table 3: Risk factors for obesity.

| Risk factors | Significance 95% CI | | | |
|-------------------------|---------------------|---------------|------|-------|
| | P value | Odds ratio | 95% | CI |
| House hold chores | 0.02 | 3.71 | 1.23 | 11.2 |
| Sedentary (TV watching) | 0.013 | 5.33 | 1.43 | 19.89 |

Out of these 96 students 51% were males and 45% were females. Out of 52 controls 26 were males and 26 females. Out of 44 cases 25 were males and 19 females. Eighty-seven (90.6%) students were class XI and 9(9.4%) were from the class XII. Thirty-three (63.5%) controls, 19 (43.2%) cases were of birth order 1, only 2(3.8%) of controls and 7(15.9%) of cases were of birth order 2. Out of controls 63.5% and 32.7% belong to upper and lower socio-economic class(SES) respectively. Out of cases 88.6% and 6.8% belong to upper and lower SES respectively. But this was not statistically significant (value???).

Univariate analysis was done being in a private school, mode of transportation to school, house hold chores less than 4hours per week, and sedentary activities like TV watching less than 2hours per day was done and were statistically associated with obesity and overweight.

Univariate analysis of variables like private or government school(p=0.02) mode of transportation to school (p value=0.022), house hold chores less than 4hours per week (p=0.009) and sedentary activities like TV watching less than 2hours per day(p=0.013) were also done and found to have statistically significant association with obesity and overweight.

Out of controls 51.9% and cases 75% used vehicle for transportation to school. Whereas only 25% of cases and 48% of controls go to school by walking. This was statistically significant with a p value of 0.022, odds

ratio(OR) of 2.78 and 95% confidence interval (CI) of 1.16 to 6.65. Physical activities in the form of games and sports (less than 4 hours in a week) were observed in 69.2% of controls and 75% of cases. Physical activities of more than 4 hours in a week were observed in 30.8% of controls and 25% of cases. But this was not found to be statistically significant.

Hobbies for more than 4 hours a week were observed in 9.6% of cases and controls. In contrast to 38.5% of normal children only 13.6% of obese children were doing house hold chores for more than 4 hours per week (statistically significant with a p value of 0.009, odds ratio of 3.96 and 95% CI of 1.42 to 11.07). When sedentary activities like TV watching was assessed, 65.4% of controls and 36.4% of cases were doing it less than 2 hours per day (14hours per week). This had a p value of 0.003 with odds ratio of 6.61 and 95% CI (1.91-22.84). Logistic regression and univariate analysis were also done.

Multivariate analysis was done to rule out confounding factors which can affect the result. House hold factors and sedentary activities were found to be significant.

DISCUSSION

Overweight/obesity among children is progressing towards epidemic level. Even relatively small increase in body weight, has its influence on cardio cerebral morbidity and mortality. Till now in India the priority of paediatric studies were focussed on prevalence of ??malnutrition. Hat pata from National Health survey has shown that approximately 30% children from US were overweight and obese which is greater than the prevalence in India (10%) as shown by IOTF (Indian Obesity Task Force). A similar study from North Kerala was showing the prevalence of overweight as 7.5% and obesity as 3% almost comparable to our study. The prevalence of overweight (24.4%) and obesity (8.9%) was reported at age 15 according to a study done by Abdul Rahman et al in Jordan.

Out of obese children 68.6 %were females which was statistically significant. The proportion of overweight and obesity decreased as the age of the girls increased. According to a study by Subhramaniam and et al from Chennai the prevalence of overweight in adolescent girls is 9.6% and obesity is 6%, in our study girls were having a prevalence of 5% overweight and 4% obese which is almost comparable.¹⁷ According to Chhatwal and et al, no significant gender difference for obesity prevalence was seen among children from a less privileged background, however, amongst children from affluent families, significantly more boys were obese as compared to girls. 18 This may be because of the changes that occur in children during the stages of adolescence. In our study children belonged to mid to late adolescence when pubertal hormones can influence the growth. The mean height and weight of students did show a tendency to decrease with increasing age in our study. Prevalence of obesity decreased significantly with age, from 18.5% at 9 years to 7.6% at 14 years, rising at 15 years to 12.1%. As we evaluated a short period of the adolescence course, it is possible that BMI decreases in mid adolescence but a subsequent increase follows in young adulthood. As described before, previous studies with a longer duration of follow-up have shown that adolescent overweight is positively associated overweight in adulthood.

In the present study, the prevalence of obesity and overweight in private schools were found to be 4% and 7% and in government schools 3% and 6% respectively. This was found to be statistically significant. The difference may be due to the fact that the students in the private schools mainly belong to affluent classes belonging to upper and middle SES. In India, there is a tremendous urban/rural and rich/poor divide. Prevalence among urban rich being much higher than rural and poor communities. Ramachandran et al studied children from 6 schools in Chennai, 2 each from high middle and lower income groups and found that the prevalence of overweight ranged from 22% in better off schools to 4.5% in low income schools.¹⁹ In present study this difference was not apparent probably due to socio economic condition in Kerala where there is no much drastic difference between different SES groups unlike other states. In a review article SES has shown to have inverse relationship with obesity in developed countries, which is not consistent with men and children of the same society, but in developing countries it is showing a strong direct relationship¹ which is well reflected in our study. A study done in Nepal by Suneel Piryani, students studying in private schools were 2.1 times more likely to be overweight than students studying in government schools.20

Increasing physical activity has got positive effects on obesity Giammattei et al also reported that children who spent more time watching television had a higher BMI and a higher per cent of body fat and were less physically active. ²¹ A study conducted on adolescent girls in Sri Lanka showed that risk of overweight was three times higher among those who had a screen time of more than 2 h a day. ²²

Another study carried out in India on adolescents reported the risk of overweight was seven times higher among those who had screen time of more than 4 hours a day.²³ In our study 63.6% of obese and 34.6% of normal children were having sedentary activities like TV viewing and reading for more than 2hours.this was statistically significant. Other routine activities like time spent for eating, brushing and bathing were assessed but was not statistically significant. Furthermore, parents report that they prefer having their children watch television at home rather than play outside unattended because parents are then able to complete their chores while assuring their safety. Other associated factors which caused obesity according to our study were method of transportation to

school and level of physical activity in the form of house hold chores (sweeping, cooking and washing) less than 4hours/week. 25% of obese and 48.1% of normal used vehicle for transportation to school which was statistically significant. Other hobbies like gardening and carpentry were also evaluated statistically but were not significant. 9.1% of obese and 6.7% of overweight were doing household chores which was statistically significant. According to Mahshid dehhan the children who were driven to school were found to be more obese.²⁴

There are some limitations in our study, such as the exclusion of some participants due to missing data but the participants excluded were similar to those included in this analysis, except for the type of school they went to. It is a population based study and it was conducted on a comparatively small representative sample of adolescents This cross-sectional study was conducted only in three schools in North Kerala. So, the risk factors identified may not be representative of every urban city in Kerala. The study findings are based on self-reporting by the students, and such findings are likely to suffer from overor under-reporting and recall bias. The main limitation of the study is that objective assessment of physical activity was not done, as it would be difficult to perform in a field situation.

CONCLUSION

Obesity is increasing among school children and demands preventive strategies. Randomised controlled trials of school based primary prevention programmes have all used a prescriptive approach.

This study is one of the few conducted in Kerala that have analysed risk factors associated with overweight among urban and rural adolescent students and it also compares the association of these risk factors with prevalence of obesity and overweight.

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Institutional Ethics Committee

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