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Prevalence of Overweight and Obesity in School Children Aged 5-12 Years of Kottayam, India

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ABSTRACT

Introduction: Childhood obesity represents a major health problem with potentially devastating consequences and has increased worldwide rapidly in the past two decades. An early detection of overweight and obesity, and lifestyle modifications for its prevention is important.

Aim: The aim of the study was to estimate the prevalence and risk factors of overweight and obesity in school children aged 5-12 years of Kottayam, India.

Methods: 1200 children of both sexes were studied from three private schools and two government schools belonging to the age group of 5-12 years using Cluster sampling technique. A structured questionnaire to elicit the socio-demographic variables, family history, dietetic habits and physical activities were given. Children are also subjected to General physical examination, blood pressure recording and Anthropometric examination. The body mass index in units of kg/m^2 was determined and children were categorized according to age and gender specific criteria as underweight ($<5^{th}$ percentile), normal (5^{th} -85^{th} percentile), overweight (85^{th} – 95^{th} percentile) and obese ($>95^{th}$ percentile). The data were subjected to statistical analysis using appropriate statistical tests.

Results and Conclusions: The proportion of subjects in CDC weight categories were 18% underweight, 72% normal, 7% overweight and 3% obese. Overweight and obesity is significantly related to age, sex, birth weight, physical inactivity and economic status. This study also shows that obesity is unevenly distributed in the community.

Keywords: *Anthropometric, body mass index; inactivity; obesity; overweight*

INTRODUCTION

Obesity represents a major health problem in both developed and developing countries, which has increased rapidly in the past two decades. In the last 20 years, the prevalence of obesity has increased markedly in industrialized and nonindustrialized countries, and it is estimated that there are now more than 500 million overweight and 250 million obese adults in the world [1]. Data obtained from National Population Survey, preliminary 1999-2002 NHANES data, showed that approximately 30% of children and adolescent in United States were overweight or obese [2,3]. In the United Kingdom and Europe, approximately 15 percent of men and 20 percent of women are obese [4]. Childhood obesity is a multi-system disease with potentially devastating consequences. As with adults, obesity in childhood cause hypertension, dyslipidaemia, chronic inflammation, increased blood clotting tendency, endothelial dysfunction and hyperinsuli-naemia. This clustering of cardiovascular disease risk factors known as the insulin resistance syndrome has been identified in children as young as 5 years [3]. Overweight in childhood increases the risk of death from ischemic heart disease in adulthood. Of particular concern, a pre-

diabetic state consisting of glucose intolerance and insulin resistance seems to be highly prevalent among severely obese children. Various risk factors for obesity are genetic predisposition, high calorie intake and sedentary lifestyle. In addition, early-onset obesity is associated with an increased chance of being an obese adult and an increased risk of obesity-related diseases [5,6]. In children television viewing, computer and video games has decreased their physical activity [7].

In a recent study by Reddy, et al., more than 28% of adult males and 47% of adult females in urban Delhi were overweight by WHO standards [8]. Indians, as an ethnic group are particularly at high risk for insulin resistance (syndrome X) and central obesity, both forerunners of diabetes, CHD and other 'life style' disorders. It is now emerging convincingly that these disorders begin in childhood (or even earlier, in fetal life), and manifest due to interactions and accumulation of various risk factors, throughout the life course. Prevention and treatment of obesity involves being more physically active and improving the diet quality. School based and family based measures should be taken to promote physical activity, limit television time, decrease dietary fat consumption and increase consumption of fruits and vegetables. This study is aimed to estimate the prevalence and risk factors of overweight and obesity in school children, and lifestyle modification for its prevention.

MATERIALS & METHODS

This study was of a Descriptive Cross sectional design to estimate the prevalence and risk factors of overweight and obesity in school children of Kottayam district, Kerala, India. Children between age group of 5-12 years attending selected government and private (aided and unaided) schools of Kottayam municipality were included in the study. From a list of all schools of Kottayam town, two strata were made as government schools and private schools using Cluster sampling technique. Within the selected schools one class from each standard was selected using simple random method. All children between 5-12 years (from UKG to Seventh), from the selected classes were studied. From three private schools and two government schools, total of 1200 children were studied.

Body mass index was calculated using the formula weight in kilograms (kg) divided by height in meter square (m^2). The Body Mass Index percentile were plotted according to the age and gender specific BMI charts obtained from CDC (Centre for Disease Control and Prevention) [9]. According to this growth curve, children are classified into 4 weight groups.

I. "underweight" is defined as BMI for age less than fifth percentile;
II. "normal" is defined as BMI for age greater than or equal to fifth percentile and less than 85th percentile;
III. "overweight" is defined as BMI for age greater than or equal to 85th percentile and less than 95th percentile;
IV. "obesity" is defined as BMI for age greater than or equal to 95th percentile.

Project material (including study protocol and questionnaire) was sent to the institutional ethical committee for approval and permission was obtained. Consent for data collection and examination were obtained from school authorities (principal and PTA) prior to the study. Children included in the study were provided with a structured questionnaire which consists of a consent form and questions about various details like socio-demographic variables, family history, dietetic habits, physical activities and so on. Questionnaire was sent home with the children, questions were requested to be answered by the parents and written consent from the parents was obtained.

A single trained and calibrated examiner performed the comprehensive clinical examination with the assistance of one recorder. Children are subjected to General physical examination, blood pressure recording and Anthropometric examination. Anthropometric measures included weight,

height, mid arm circumference, mid thigh circumference, waist circumference and hip circumference. For assessment, weighing machine (bathroom scale) and non stretchable measuring tapes were used and for Blood pressure recording by using appropriate cuff size.

Data collected were coded properly and entered in excel spread sheet and appropriate data checking measures were used for ensuring quality of data. By appropriate statistical package, findings are descriptively described as proportions and confidence intervals. Appropriate statistical techniques were used to test association between different variables. A *P*-value of <0.05 was considered statistically significant.

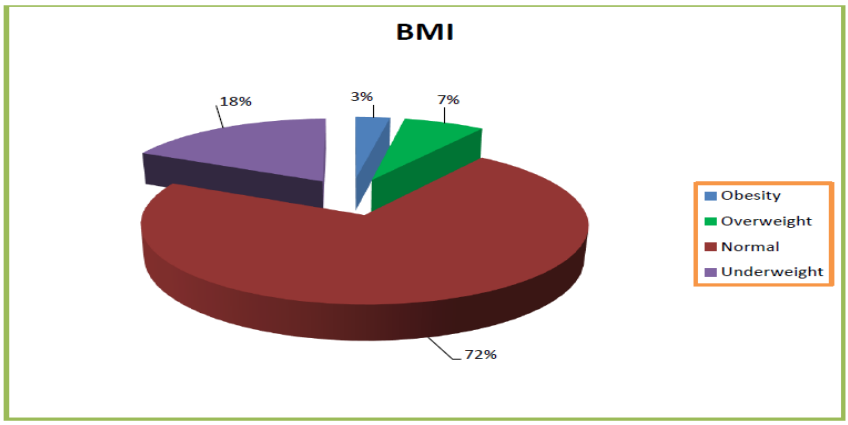
RESULTS

Among the total 1200 subjects from three private schools and two government schools, 657 (54.75%) were girls and 543 (45.25%) were boys. There were 703 (58.6%) private school children and 497 (41.4%) government school children. An age wise distribution of students in government and school categories are shown in Table 1.

Table 1: Age wise summary statistics of Gender distribution and Type of School.

Age	Boys	Girls	Private school	Government School	No. of students
≥ 5<6	78	87	98	67	**165**
≥6<7	79	96	105	70	**175**
≥7<8	75	95	100	70	**170**
≥8<9	71	97	96	72	**168**
≥9<10	81	89	99	71	**170**
≥10<11	76	96	100	72	**172**
≥11<12	83	97	105	75	**180**
Total	**543**	**657**	**703 (58.6%)**	**497(41.4%)**	**1200**

Total number of obese students (BMI more than 95th centile) were 36 (3%), overweight students (BMI 85 - 95th centile) were 87 (7.25%), students with normal weight (BMI 5- 85th centile) were 861 (71.75%) and underweight students (BMI less than 5th centile) were 216 (18%). A comparison of the categories and their distribution was depicted in Figure1.



Graph 1: Comparison categories of Body Mass Index.

Chi square test has been conducted as a test of independence between the different variables. Obesity and Overweight were found to be significantly related to age (p value= 0.000 and 0.001) and gender (p value= 0.000 and 0.041) respectively. It was also found that overweight and obesity is significantly related to school. (P=0.000). When compared with religion, overweight showed statistical significance related to religion (p <0.05), whereas obesity is not significantly related to religion (P= 0.482).

In comparison with family size, overweight is significantly related to family size (P= 0.039), meanwhile obesity is not significantly related to family size (P= 0.076).

Overweight is also positively related to birth weight (P= 0.004), inactivity (P= 0.0001), television viewing (P= 0.022), monthly income of parents. (P= 0.000) and blood pressure (P= 0.001) whereas it is not significantly related to maternal education. (P=0.061) and vegetarian and non vegetarian's diet (P= 0.5). Obesity is positively related to birth weight (P=0.042), inactivity. (P=0.04) and monthly income of parents. (P=0.022). Meanwhile it is not significantly related to vegetarian and non vegetarian diet (P=0.12), television viewing. (P=0.533), maternal education. (P=0.07) and blood pressure (P=0.151).

A significant correlation with Body Mass Index was found with mid arm and mid thigh circumference whereas Waist Hip ratio is significantly associated with only obese and overweight children. An overview of the different categories and their p values are shown in Table 2.

Table 2: Correlation of Body Mass Index with Waist Hip Ratio, Mid Arm Circumference and Mid-Thigh Circumference.

	BMI	P Value (WHP)	P Value (MAC)	P Value (MTC)
Obesity	>95th	0.0006	0.000	0.000
Overweight	85-95th	0.0001	0.000	0.000
Normal	5-85th	0.146	0.001	0.000
Underweight	<5	0.312	0.002	0.000

WHP - Waist Hip Ratio
MAC - Mid Arm Circumference
MTC - Mid Thigh Circumference
BMI - Body Mass Index

DISCUSSION

During the past two decades, the prevalence of obesity in children has risen greatly worldwide but this is unequally distributed with prevalence ranging from 30% in United States to <2% in Sub Saharan Africa[10]. In the present study conducted among school children of Kottayam town in the age group 5-12yrs, the prevalence of overweight is 7.25% and of obesity is 3%. It was also found that the prevalence of underweight in the same population is 18% and those with normal weight is 71.7%.

In our study prevalence of overweight and obesity was found to increase with age. In longitudinal studies (The Bogalusa Heart Study) approximately 22% of obese preschool children remain obese as adults, compared to approximately 50% of obese six year old and 80% of obese 10-14 year old[11,13].

In our study, 7.9% girls and 6.4% boys are overweight & 3.34% girls and 2.57% boys are obese and this difference is found to be statistically significant. Girls are more prone than boys to develop persistent obesity during adolescence. This is related to changes in the body composition that occur at puberty, when body fat decreases in boys and increases in girls. Approximately 80% of obese adolescent girls remain obese whereas approximately 30% of obese adolescent males do so.

In the present study prevalence of overweight and obesity in private schools was found to be 10.9% and 4.5% respectively and that of Government schools was 2% and 0.8% respectively. This difference in the prevalence of overweight and obesity among students of private and Govt. schools might be because most of the students coming from upper and middle class families attended private schools. In India there is a tremendous urban/rural and rich/poor divide, prevalence in urban rich being much higher than rural areas and poor communities. Ramachandran et al studied children from six schools in Chennai, two each from high, middle and lower income groups[14]. The prevalence of overweight adolescents ranged from 22% in better off schools to 4.5% in lower income group schools. In a Delhi school with tuition fees more than Rs. 2500 per month, the prevalence of overweight was 31% of which 7.5% were frankly obese[15].

A number of studies have shown that high birth weight is positively related to subsequent fatness but higher prevalence of obesity is also seen in lower birth weights with a U or J shaped relationship[16]. In our

study overweight and obesity are positively related to birth weight. Among Large for Gestational Age babies 25% were overweight & 8.3% were obese. Among Appropriate for Gestational Age babies 7.96% were overweight & 3.4% were obese and among Low Birth Weight babies 16% were overweight and 9% were obese. Prevalence of overweight and obesity among vegetarians and non vegetarians were compared, but was found to be independent for this variable. This is because only 1% of the study population is vegetarian and 99% of the study populations are non vegetarians. Data obtained about other eating habits like junk food and eating outside showed that 99% of the children under study did not consume junk food or did not have the habit of eating outside.

The effect of Television viewing and inactivity on obesity rise is of particular interest. Television viewing is thought to promote weight gain not only by displacing physical activity, but also by increasing energy intake[17,18]. Children seem to passively consume excessive amount of energy dense foods while watching television. Furthermore, television advertising could adversely affect dietary pattern. In our study, prevalence of overweight in children viewing television for less than 2 hours a day is 2.9% while 4.2% of children viewing television for two or more hours a day are overweight. And this findings were similar to the study from Mexico city where obesity risk increased by 12% for each hour per day of television viewing[19]. Also among children obesity risk decreased by 10% for each hour per day of moderate to vigorous physical activity.

Several large epidemiological studies (The Framgham Heart Study) have documented the linear relationship between hypertension and BMI[20,21]. Longitudinal assessment of participants in the Framingham study found that blood pressure increased by 6.5mmHg for every 10% increase in body weight. Approximately 20-30% of obese children have elevated blood pressure. Obese children have a 2.4 fold risk of elevated blood pressure compared with controls. Furthermore, obese adolescent have a 8.5 fold to 10 fold risk for adulthood hypertension[20]. In our study also sharing a similar pattern, 11% of obese children and 13.7% of overweight children were found to have elevated blood pressure.

In our study correlation between BMI and WHR showed that BMI is positively correlated with obesity and overweight. But with normal and underweight, this correlation is not statistically significant. Adult with central obesity are at increased risk for heart disease, diabetes, hypertension and some forms of cancer. Men with WHR of 0.95 or more and women with a WHR of 0.85 or more are considered to be at increased cardiovascular risk. Similar definitions have not been developed for children, although they too are at increased risk of cardiovascular disease if they have abdominal adiposity.

Prevention of obesogenic life style must begin in childhood to reduce the burden and cost of obesity in society. Family based approach will be effective in promoting healthy life style which includes promoting physical activity in the form of outdoor play and limiting television viewing and other sedentary activities to <2 hrs/day. School health checkups should monitor BMI and waist hip ratio along with height and weight annually. A compulsory physical activity should be included in the school curriculum.

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