

**Original Article****STUDY OF SCHOOL ENVIRONMENT AND PREVALENCE OF OBESITY & ITS PREDICTORS AMONG ADOLESCENT (10-13 YEARS) BELONGING TO A PRIVATE SCHOOL IN AN URBAN INDIAN CITY****Mehan Meenakshi<sup>1</sup>, Munshi Aparna<sup>2</sup>, Surabhi Somila<sup>3</sup>, Bhatt Trushna<sup>3</sup>, Kantharia Neha<sup>3</sup>****Financial Support:** None declared**Conflict of interest:** Nil

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**Date of Submission:** 06-06-12**Date of Acceptance:** 31-07-12**Date of Publication:** 01-09-12**ABSTRACT**

**Background:** Recent shift in lifestyle and behavioral patterns in population have caused an obesity epidemic during formative years. Present study evaluated existing health and nutrition policies in a private school in an urban Indian city and assessed prevalence of obesity in adolescent children & their association if any, with predictive behaviors of obesity.

**Methods:** A private coeducational school located in an urban Indian city was selected and its existing health policies were evaluated using CDC's School Health Index (SHI). Further, 5 teachers were assessed regarding their knowledge, attitude and practices (KAP) of healthy dietary & lifestyle practices. Critical evaluation of school canteen services was also done. Total 273 adolescents (10-13 years) were enrolled after taking informed consent. Prevalence of obesity & its relationship with modifiable risk factors (fast food & sweetened beverage intake, physical inactivity, low fruit & vegetable intake and increased television viewing) was found by comparing behaviors amongst obese & non-obese adolescents. Their biochemical profile for assessment of anemia, dyslipidemia and high fasting blood sugar levels was also determined.

**Results:** Current framework of school lacked clear health & nutrition policies. Canteen food service offered unhealthy food. Teachers had insufficient knowledge about healthy behaviors among children. Prevalence of overweight & obesity was 23.5%. Cumulative presence of  $\geq 3$  risk behaviors of obesity was significantly associated with its development (OR 2.07, 95% CI). Mean consumption of sweetened carbonated beverages by overweight and obese subjects was significantly higher ( $p < 0.05$ ) than non-obese.

**Conclusion:** There is a need to sensitize school authorities and teachers about importance of a strong health and nutrition related policies and health promotion programs.

**Key words:** School health, adolescents, health promotion

## INTRODUCTION

Adolescents who form tomorrow's adult population represent one of the most vulnerable age groups, given their specific health and development needs augmented by the many challenges they face, including lack of access to health information & services and unsafe environment. Obesity in children and adolescents is rapidly reaching epidemic proportions globally.<sup>1</sup> In countries undergoing rapid urbanization and economic growth, nutrition transition is observed with rise in obesity and other nutrition-related chronic diseases among adolescent population.<sup>2</sup> Obesity and adverse effects of being over ideal body weight is no longer just a problem of Western countries. This pandemic is also achieving epidemic proportions in India, giving cause for concern.<sup>3,4</sup> Childhood obesity is now a principal 'public health concern' of recent times. The social burden of pediatric obesity, especially during middle childhood and adolescence, may have lasting effects on self-esteem, body image and economic mobility in addition to increasing risk of cardiovascular disease and all-cause mortality.<sup>5</sup> It is possible that successful prevention and treatment of obesity in childhood can reduce adult incidence of cardiovascular disease<sup>6</sup>.

The etiology of obesity is a complex interplay of various ecological and biological factors. While heredity and fetal growth have been shown as major determinants of susceptibility to weight gain<sup>7</sup>, energy balance, determined by calorie intake and physical activity, remains the major modifiable predictors of obesity - one which needs to be targeted for obesity prevention/management. Changes in dietary intake and physical activity levels have fuelled the obesity epidemic in developing countries.<sup>8</sup> Behavioral and lifestyle patterns which have undergone a major transition and have been specifically identified as risk factors in children and adolescents are: increased consumption of sweetened, carbonated beverages<sup>9</sup> and fast food<sup>10</sup>, lack of physical activity<sup>11</sup>, increased TV viewing/playing computer games<sup>12</sup> and low fruit & vegetable intake<sup>1</sup>. These factors have been widely studied around the world in their individualized capacities as risk factors causing obesity. In the present study, efforts have been made to evaluate cumulative effect of these factors in addition to the effect of each individual factor in an Indian setting (school). Given that children and adolescents are at an

impressionable age, school environment has an enormous influence on their lifestyle and eating behaviors. School based approach has been successfully used in past to indicate its effectiveness in promoting healthy behaviors among adolescents.<sup>13,14</sup>

As a first step towards this, present study was conducted to evaluate existing status in nutrition health policies and programs and to know the prevalence of obesity and its various risk factors in a private school located in an urban Indian city.

## MATERIALS AND METHODS

### *Anthropometry, biochemical profile and perceptions of adolescents (10-13 years)*

A private co-educational, school located in an urban Indian city was selected for the study after obtaining permission from school authorities. Ethical Clearance (F.C.Sc./FND/ME/38) for the study was obtained from the Departmental Medical Ethical Committee before the commencement of the study. Data for predictors of obesity, anthropometry and need based biochemical estimations was collected from a total of 273 students belonging to standards 5<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup> (10-13 years of age) whose parents as well as subject himself/herself gave informed consent for enrollment in the study. Hemoglobin was estimated for all enrolled subjects while lipid profile and fasting blood glucose was estimated for the overweight and obese study subjects only. Data on general information, awareness regarding health and nutrition topics, prevalence of modifiable predictors of obesity i.e. risk factors namely; consumption of fast food, fruit and vegetable intake (> 400 gm/day - WHO recommendation)<sup>15</sup>, physical activity (PA) (> 3 days/week) and Television (TV) viewing/playing computer games (<120 min/day) as well as willingness to adopt healthy behaviors was collected from 273 children using a pretested questionnaire adapted from WHO's Global School Health Survey Questionnaire<sup>16</sup>. The questionnaires were distributed to all participants after briefing them properly about each question before responding. Anthropometric measurements (height and weight) of the subjects were recorded using standardized equipment. A fiber glass tape and ruler were used to measure height of the subjects. Standardized bathroom

scale was used for measurement of weight. Hemoglobin and fasting blood glucose (12 hour fasting) estimations were done on whole blood, using finger prick method. Hemoglobin estimation was done by Cyanmethemoglobin method and fasting blood glucose was estimated using Blood Glucose Test Strips. Fasting venous blood samples (12 hour fasting) were collected by standard collection techniques after which serum levels for TC, TG and HDL-C were estimated. Total Cholesterol (TC), Triglycerides (TG) and High Density Lipoprotein Cholesterol (HDL-C) were estimated using standard enzymatic kit. Thereafter, Very Low Density Lipoprotein Cholesterol (VLDL-C) and Low Density Lipoprotein Cholesterol (LDL-C) were calculated using Friedewald's formula<sup>17</sup>. Subjects were identified as being physically active using WHO 2003 physical activity guidelines<sup>18</sup>. Using anthropometric data, BMI was calculated and subjects were classified as per their nutritional status based on WHO 2007 growth reference standards<sup>19</sup>. Subjects exhibiting >3 risk factors were classified as being 'at risk'. WHO standards were used for classifying hemoglobin levels<sup>20</sup> of subjects while, ATP III guidelines<sup>21</sup> to classify Lipid profile. For fasting blood glucose levels WHO 1999 standards<sup>22</sup> were used.

#### *Evaluation of school health policies and canteen evaluation*

A Nutrition Health Team (NHT) comprising of representatives of school authorities (2), teachers (1), parents (1) as well as students (2) in addition to an outside facilitator-researcher (1) was formed to elicit information regarding school nutrition and health policies. Appraisal of school nutrition and health policies by NHT was done, using Centre of Disease Control's (CDC) School Health Index (SHI)<sup>23</sup>. Out of the 8 modules of SHI, 4 relevant modules - Module 1, 2, 3 and 4; pertaining to School Health Policies, Health Education, Nutrition and Physical Activity (PA) respectively were used. Survey of existing canteen services was done to find out about type of food available to students and consumption trends using pretested, standardized questionnaire. Responses of NHT members were ranked as per SHI guidelines to conclude whether according the policy or service was: a) Not in place b) Underdeveloped c) Partially in place or d) Fully in place. The results of entire NHT were then compiled. In case of disparity, results were substantiated by the observations of facilitator.

#### *Knowledge Attitude and Practices (KAP) of teachers*

For evaluation of knowledge, attitude and practices (KAP) of teachers regarding healthy dietary & lifestyle behaviors, 5 teachers who dealt with subjects related to health (Science, Physical Activity and Counseling) and hence were most likely to discuss topics of health and nutrition with children were selected. Structured, pretested questionnaire was used for the same.

Data was fed into Microsoft Office Excel 2007 worksheet. Percent responses were calculated for the numerical data. Chi square and Odd's Ratio were calculated to determine significance of associations.

## RESULTS

#### *Anthropometry, biochemical profile and perceptions of adolescents (10-13 years)*

Triple burden of malnutrition comprising of undernutrition (33.4%), over nutrition (23.4%) and anemia (46.3%) existed in the adolescents under study (Table 1). Prevalence of underweight was higher in girls as compared to boys while a higher percentage of boys were overweight and obese. Disturbingly high prevalence of anemia (46.1%) was found in the study population. Gender distribution showed that more boys (47.4%) than girls (43.7%) were anemic. Prevalence of anemia was highest in overweight and obese subjects (49.2%) followed by normal weight subjects (46.1%) and underweight subjects (44.4%). No subject with normal BMI had a high waist circumference whereas 9.5% overweight subjects and 54.5% obese subjects were abdominally obese. Study subjects showed alarmingly high prevalence of unhealthy behaviors: high consumption of empty calorie ridden beverages (16.8%), frequent consumption of outside foods (42.1%), low fruit and vegetable intake (58.2%), physical inactivity (44.7%) and spending an unhealthy amount of time in sedentary activities likes watching Television and playing computer games (41.4%). Subjects who had at least 3 unhealthy behaviors were identified as being 'at risk'. As can be seen from Table 2, it was found that cumulative presence of 3 or more modifiable predictors of obesity was significantly associated with development of overweight and obesity (OR 2.07, 95% CI).

**Table 1: Percent prevalence of underweight, overweight & obesity and anemia in participants**

Nutritional status	Total (n=273) (%)	Boys (n=209) (%)	Girls (n=64) (%)
Underweight	91 (33.4)	68 (32.5)	23 (35.9)
Overweight ± Obesity	64 (23.4)	54 (25.8)	11 (17.2)
Anemia	126 (46.1)	99 (47.4)	28 (43.7)

**Table 2: Prevalence of unhealthy behaviors across BMI status of participants**

Unhealthy behaviors	Underweight + Overweight + Obese		$\chi^2$ Value	Odd's ratio (95 % CI)
	Normal (n=209) (%)	(n=64)N (%)		
High Consumption of Sweetened beverages ( $\geq 2$ days/week)	30 (14.35)	16 (25)	3.96*	1.99(1.0-3.95)
High frequency of eating out ( $\geq 2$ days/week)	86 (41.15)	29 (45.3)	0.35 <sup>NS</sup>	1.18(0.67-2.08)
Low fruits & vegetable intake (<400gm/day)	118 (56.46)	41 (64.1)	1.16 <sup>NS</sup>	1.37(0.77-2.45)
Physical inactivity ( $\leq 3$ days /week)	91 (43.54)	31 (48.4)	0.47 <sup>NS</sup>	1.22(0.69-2.13)
Excessive TV viewing or playing computer games ( $\geq 120$ min/day)	82 (39.23)	31 (48.4)	1.71 <sup>NS</sup>	1.45(0.82-2.55)
"At Risk" subjects (> 3 unhealthy behaviors)	71 (33.97)	33 (51.56)	6.43*	2.07(1.17-3.65)

\*Significant at  $p < 0.05$

Detailed data regarding prevalence of risk factors across BMI status is presented in Table 2. In spite of relatively lower percentage of underweight and normal subjects falling in "at risk" category, a sizeable proportion of them (31.9% and 35.6% respectively) were found to be "at risk". Fasting blood glucose and lipid profile estimations were done for consenting overweight and obese subjects (n=45). No case of elevated fasting blood sugar was detected. With respect to lipid profile, subjects who had at least one fraction altered were classified as dyslipidemic. According to Adult Treatment Panel III (ATP III) and American Heart Association (AHA) classification for lipid profile, prevalence of dyslipidemia was 42.2% and 33.3% respectively. Though most subjects who were dyslipidemic had just one fraction altered (73.7% by ATP III and 60% by AHA), there were a few (26% by ATP III and 40% by

AHA) with more than 1 fraction altered. By both classifications, a higher percentage of adolescent boys compared to girls (43.7% v/s. 38.4% by ATP III and 34.3% v/s. 30.7% by AHA) were found to be dyslipidemic. Although mean values of fasting blood glucose for adolescent boys as well as girls were within normal limits and no gender difference was seen in it, they were higher for subjects having high waist circumference compared to subjects with normal waist circumference (Table 3). Mean values for all lipoprotein fractions were higher for boys except for TG and VLDL where they were higher for girls. Mean HDL-C levels were also higher for boys than girls ( $50.6 \pm 12.9$  v/s.  $47.4 \pm 7.8$ ). Subjects with elevated waist circumference had higher mean values of all lipoprotein fractions except HDL which was higher for subjects with normal waist circumference.

**Table 3: Lipid Profile and Fasting Blood Glucose levels of participants, by gender and waist circumference**

Variables	Total (n=45)	Boys (n=32)	Girls (n=13)	Subjects with high WC* (n=9)	Subjects with normal WC* (n=36)
Fasting Glucose	87.6 $\pm$ 11.6	87.6 $\pm$ 8.6	87.5 $\pm$ 17.2	89.9 $\pm$ 7.07	87 $\pm$ 12.5
Total Cholesterol	152.8 $\pm$ 28	154.8 $\pm$ 31.2	148 $\pm$ 18	158.3 $\pm$ 35.1	151.4 $\pm$ 23.3
LDL Cholesterol	84 $\pm$ 25.5	86.7 $\pm$ 27.7	77.5 $\pm$ 18.3	90.6 $\pm$ 38.6	82.3 $\pm$ 21.5
Triglycerides	93.9 $\pm$ 37.7	87.1 $\pm$ 35.1	110.7 $\pm$ 39.9	109.9 $\pm$ 44.4	89.9 $\pm$ 35.4
VLDL Cholesterol	18.6 $\pm$ 7.4	17.4 $\pm$ 7	21.4 $\pm$ 7.9	20.9 $\pm$ 6.9	17.9 $\pm$ 7.1
HDL Cholesterol	49.7 $\pm$ 11.6	50.6 $\pm$ 12.9	47.4 $\pm$ 7.8	44.4 $\pm$ 8.7	51.1 $\pm$ 12.3

Values in Mean  $\pm$  S.D. format, \*Waist Circumference

Nearly 41% children brought packed lunch from home. Out of all the subjects who reported bringing lunch from home, less than 4% brought fruits while more than 20% subjects reported bringing snack items as packed lunch. On studying the perceptions of the study subjects, it was found that a majority of them (60.8%) correctly perceived their BMI status and higher

percentage of overweight and obese subjects (76.5%) did so as compared to non-overweight/obese subjects. Similar trend was observed when perceptions regarding importance of healthy weight, benefits of physical activity and harmful effects of excessive TV watching/playing computer games were studied. Detailed results are given in Table 4.

**Table 4: Percentage of non-overweight and overweight (including obese) adolescents (10-13 years) and their perceptions on BMI status, importance of healthy weight & physical activity, time spent on TV viewing or playing computer games**

Perceptions of Adolescents	Total (n=273) (%)	Normal or below (n=209) (%)	Overweight or Obese (n=64) (%)
Correctly perceived their BMI status	166 (60.8)	117 (55.9)	49 (76.5)
Knew that having healthy weight is important	146 (53.4)	100 (47.9)	46 (71.9)
Thought physical Activity is beneficial to health	160 (58.6)	117 (55.9)	43 (67.2)
Willing to spend less time on TV viewing and playing computer games	129 (47.2)	96 (45.9)	33 (51.5)

#### *Evaluation of school health policies and canteen evaluation*

Policies regarding PA were more or less in place and hence were identified as strengths whereas major weaknesses were observed in policies regarding "Health Education" and "Nutrition Services". The school canteen, run by a contractor was the only source of food in the school. It primarily offered precooked and pre packed snacks which were high in trans fats, and sugars. A study of sales trends of these snacks showed high sales of unhealthy, high calorie, trans-fat containing snack items such as puff (192 pc/day), samosa (137 pc/day) and vegetable roll (47 piece/day) as well as sweetened beverages such as pepsi (60 glasses/day), fruity (8 packs/day) and appy fizz (1 pack/day). School authorities played no role what so ever in planning canteen menu (or other foods available in canteen) wherein nutrition was not even considered. As per SHI, the NHT found no nutrition policy to be in place.

Average amount of money spent on canteen food by a child per week was higher for overweight and obese children as compared to non-overweight/obese were Rs.17.7 v/s Rs.14.5/week respectively. As can be clearly seen from Figure 2, a higher percentage of overweight and obese children indulged in unhealthy behaviors compared to their 'non overweight/obese' counterparts. This trend was consistent for all five modifiable predictors of obesity. High consumption of sweetened carbonated beverages (> 2 days/week) was

found to independently increase risk of obesity (OR 1.99, 95% CI). Mean consumption of sweetened carbonated beverages by overweight and obese subjects was significantly higher ( $p < 0.05$ ), than non-overweight/obese.

#### *Knowledge Attitude and Practices (KAP) of teachers*

Knowledge of teachers pertaining to 'healthy diet' was found to be inept. Though they correctly identified faulty behavior patterns which could lead to obesity in children and also supported teaching about these in school, their outlook regarding the same was limited because their main concern was effect of these behaviors on scholastic performance of children with no thought about the health consequences. It was also found that in spite of teachers being able to distinguish unhealthy behaviors from healthy ones, they depicted lack of knowledge about reasons for them e.g. though all teachers agreed that sweetened carbonated beverages did not impart any health benefit, none were able to put across an explanation for the same other than suggest that they were 'chemicals' and 'toxins'.

## DISCUSSION

Normal weight children constituted less than half the study population indicating widespread malnutrition. In addition to this, there was co-existence of underweight and overweight (including obesity) along with widespread anemia in the study population demonstrating

presence of Triple Burden of Malnutrition. Study population showed considerably high prevalence of anemia (46.3%), making it a public health concern. While more girls than boys were found to be underweight, also, the prevalence of overweight (including obesity), in the present study was higher in boys as compared to girls, a trend contrary to literature<sup>24,25,26</sup>. A higher percentage of boys were anemic which points out to the need for paying equal attention to boys' iron status along with that of girls.

Iron deficiency anemia is known to impair physical and cognitive development, reduce the work capacity of individuals and entire populations, bringing serious economic consequences and obstacles to national development<sup>27</sup>. In addition to this, in girls, anemia translates into poor pregnancy outcomes resulting in intergenerational cycle of malnutrition. In case of anemic boys, impaired cognition, poor scholastic and academic performance as well as reduced work capacity affects professional progress. As a result of this, they are unable to procure well-paying good jobs resulting intergenerational cycle of poverty which in turn leads to low spending capacity causing poor nutritional status. This vicious cycle is a threat to individual and national growth and development. In spite of the high prevalence of anemia, there are no strategies in place for its control and prevention in adolescents belonging to middle and high income groups and attending private schools in urban areas.

While one segment of the population suffered from undernutrition, nearly 1/4<sup>th</sup> of the study subjects were overweight and obese. In spite of the fact that unhealthy behaviors were more prominent in the over nourished segment of the population, underweight subjects also reported unhealthy lifestyle behaviors. Nearly 40-50% of the population exhibited unhealthy behavior patterns in terms of excessive TV viewing/playing computer games, consumption of fast foods, sweetened beverages, physical inactivity and inadequate fruit and vegetable intake. The findings of present study conclusively link presence of 3 or more predictors of obesity with occurrence of overweight and obesity. It is disturbing to see that children from the same age group, belonging to similar economic, social and cultural backgrounds all showed malnutrition ranging from undernutrition to overnutrition in addition to micronutrient deficiency (anemia).

This clearly points to lack of knowledge and awareness of nutritional needs and importance of healthy behaviors in children as well as the adults who influence and guide their behaviors. KAP evaluation of school teachers provided the required evidence for the same. In a similar study done by Neumark-Sztainer et al in 1999<sup>28</sup> also showed that knowledge of teachers pertaining to "healthy diet" particularly, was found to be inapt and so they pass on in correct unhealthy behaviors probably unintentionally. These calls for sensitizing teachers towards health and nutritional needs of children and validate capacity building of teachers towards nutritional aspects before initiating a school program. It is important to consider that interventions reported in literature, those carried out capacity building and nutrition education have shown positive results<sup>29</sup>.

In addition to the school not having adequate nutrition and health related policies, the school authorities also did not have a say in the canteen menu, resulting in rampant and unchecked consumption of unhealthy, high calorie ridden foods and beverages as corroborated by the sales trend data from the school canteen. Similar results were also reported in various studies done in literature<sup>30,31,32</sup>. Considering that a school canteen is one of the first places outside home which largely influences a child's food choices, a healthier approach here might become a primary step towards eliminating the danger of children getting used to high trans-fat, sugary and pre packed foods – the main pre disposers to obesity in this age group. Though no case of elevated fasting blood glucose was detected, the high mean value of the same is a cause for concern. Alarming high prevalence of dyslipidemia was found among the overweight and obese adolescents enrolled in the study. Predictably, mean lipid profile values were higher for abdominally obese adolescents. Mean values of most of the lipid profile fractions were higher for boys than girls. This may be linked to the fact that more boys were overweight and obese as compared to girls. Poor nutritional status and unhealthy behaviors of adolescents under study seemed to be the result of combination of inadequate nutrition and health policies at administrative level, lack of proper knowledge and incorrect perceptions of teachers about it and easy access of unhealthy junk food to school children. The silver lining in current scenario was the awareness among adolescent school goers regarding their own health. It was

encouraging to see that most (60.8%) of them were aware of their BMI status and more than 3/4<sup>th</sup> of overweight and obese subjects knew of their elevated BMI. Nearly half of the adolescents correctly perceived their own faulty behaviors pertaining to healthy weight, physical activity as well as excessive time spent in front of the TV/computer. Thus, with appropriate care, schools can be used to create an enabling environment for inculcating healthy behaviors in adolescents during impressionable age. Adolescence, being the last window of opportunity to achieve optimum height and weight, is the best time to carry out nutrition health intervention. The best way to improve health and wellbeing of children is to introduce strong school nutrition health policies and programs addressing the underlying causes of malnutrition – all of which are modifiable lifestyle factors.

### PRACTICE POINTS

1. Children who belong to middle and high income group families and study in private schools are also vulnerable to malnutrition. However, there are no health policies in place for these children.

2. School, being a child's second home plays a vital role in shaping his future and teachers possess the ability of molding their minds. Hence, knowledgeable and sensitized teachers, in a health promoting school environment can act as key change agents who inculcate healthy eating and lifestyle habits in adolescent's population, thus building a healthier tomorrow for them.

3. There is a need to reinforce importance of health in early formative years of an individual's life, the lack of which is apparent from the unconcerned attitude of school authorities towards easy availability of unhealthy foods in school premises itself coupled with little importance given to regular PA, further fuelled by apathy of influential figures (school administrators and teachers) in the subject.

4. There is hence, a burning need to sensitize the school community and build their capacities to deal with the emerging risk and prevent its magnitude from further rising.

5. This can be achieved through endeavors such as "Nutrition Friendly School Initiative" which applies the concept and principles of the Baby-

friendly Hospital Initiative (BFHI), where schools that meet a set of essential criteria will be accredited as "Nutrition Friendly Schools".

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