International Journal of Applied Home Science
Volume 5 (1), January (2018) : 13-25
Received : 17.11.2017; Revised : 24.11.2017; Accepted : 30.11.2017

RESEARCH PAPER
ISSN : 2394-1413

The prevalence of overweight and obesity in school going children

SWATI SUMAN[1] AND SEEMA DEY*[2]
[1]Research Scholar and [2]Associate Professor
University Department of Home Science, Ranchi University,
Ranchi (Jharkhand) India

ABSTRACT

The obesity has been defined as a condition of abnormal or excessive fat accumulation in adipose tissue, to the extent that health may be impaired. Body mass index (BMI) or Quetelet Index is a statistical measure of the weight of a person scaled according to height. However, the limitation of BMI is that it cannot differentiate muscle mass to body fat and cannot locate the site of fat e.g., people with 'central obesity' may have normal BMIs. The current standard definition of overweight and obesity uses specific BMI cut points. Epidemiological and metabolic studies conducted over the last 15 years have confirmed the notion that a high proportion of abdominal fat (central obesity) is a major risk factor for coronary heart disease, type 2 diabetes mellitus, and related mortality. Present study revealed that there is high prevalence of overweight/obesity amongst subjects those consume junk food and deep fried foods on regular basis. Physical activity is a major factor which leads to a healthy and normal life. Consumption of junk food and deep fried foods remains the main culprit. Parents from business and professional background also add to the factor contributing for overweight and obesity in school children.

Key Words : Overweight, Obesity, School going children

INTRODUCTION

Urbanization and modernization, sedentary life, consumption of oily and junk food and other life style changes has contributed to overweight and obesity. There are more than 300 million obese people worldwide. The global prevalence of overweight (including obesity) in children aged 5-17 years estimated by the World Health Organization (WHO), International Obesity Task Force (IOTF) approximately 10%. Various studies in India have found that the incidence of childhood overweight/ obesity has increased dramatically. Obesity is not an immediate lethal disease itself, but a significant risk factor associated with a range of serious non-communicable diseases and conditions like increased risk of coronary heart disease, hypertension, diabetes mellitus, gallstone etc. In 1950, India faced two major nutritional problems. One was the threat of famine and the acute starvation and the other was chronic energy deficiency. The country adopted a multi- sectarian, multipronged strategy to combat these problems and improve the nutritional status of the population followed by green revolution and industrialization. In 1992 Government of India adopted open market policies, which brought in rapid industrialization throughout the country.

Cite this Article: Suman, Swati and Dey, Seema (2018). The prevalence of overweight and obesity in school going children. *Internat. J. Appl. Home Sci.*, **5** (1) : 13-25.

Review of the situation in 2000/2001 prior to formulation of the Tenth Five-Year Plan (Planning Commission, 2002) showed that although under nutrition and micronutrient deficiencies continue to be major public health problems, over nutrition and obesity are also emerging as a major problem in many states. There is a paradigm shift in the quality of life in urban population resulting in substantial increase in childhood as well as adult obesity in the urban population. It is observed that 30% of obesity begins in childhood and out of that 50% to 80% become obese adults.

In the Harvard study, morbidity from cardiovascular disease, diabetes, obesity related cancers and arthritis was 50 -100% higher in obese individuals who were also obese as children (Must *et al.*, 2002). Thirty years ago, fundamental changes in social and economic situation occurred all over the world, thus leading to the presence of modern conveniences in homes as well as in the work place. These changes have shifted societies from communicable to non-communicable diseases (NCD) (Farooqi and Rahilly, 2007). Overweight and obesity are a serious health problem, since they are associated with other diseases, and they contribute to ill health (Kopelman, 2007). The world Health Organization (WHO) describes overweight and obesity as one of today's most important public health problems, which is escalating as a global epidemic (WHO, 2003). It is also increasingly recognized as a significant problem in developing countries and countries undergoing economic transition (Popkin, 2001). The problem of overweight and obesity is confined not only to adults but also being reported among the children and adolescents of developed as well as developing countries. Since, adolescence is a period of transition from childhood to adulthood; it is assumed as a critical position in the life cycle of human beings, characterized by an exceptionally rapid rate of growth. The prevalence of overweight and obesity among children and adolescents has increased significantly in the developed countries during the past two decades (Chinn and Rona, 2001) and similar trends are being observed even in the developing world (Matorell *et al.*, 2000).

In India the problem of obesity has been scantily explored even in the affluent population groups. Studies from metropolitan cities in India have reported a high prevalence of obesity among affluent school children (Gupta and Ahmad, 2002). On the other hand some studies reported a high prevalence of under nutrition among rural school children and children in urban slums (Vedavathi *et.al*., 2003). 50-80% of obese children will grow up to become obese adults and it is harder to treat obesity in adults than in children (Park, 2005). In children, the development of obesity is associated with the simultaneous deterioration in chronic diseases risk profiles. Excess weight in this age is the leading cause of pediatric hypertension, and overweight children are at a high risk for developing long-term chronic conditions, including adult-onset diabetes mellitus, coronary heart disease, orthopedic disorders and respiratory diseases (Dietz, 1990). With the increase in obesity prevalence there is a parallel increase in obesity associated chronic diseases and their clinical onset at younger ages. The obesity has reached an epidemic proportion in urban Indian population. If this epidemic is to continue we will top the world in Diabetes and CHD earlier than estimated. The cost of treating diabetes mellitus and associated disorders alone will consume a major chunk of our national resources, which we can ill afford. Only community-based approaches can address such large numbers of affected children.

METHODOLOGY

Overweight / Obesity :

The obesity has been defined as a condition of abnormal or excessive fat accumulation in adipose tissue, to the extent that health may be impaired (WHO consultation on obesity, 2000).

Body mass index (BMI) or Quetelet Index is a statistical measure of the weight of a person scaled according to height. It was invented between 1830 and 1850 by the Belgian polymath Adolphe Quetelet during the course of developing "social physics". It is weight adjusted for height squared (weight in kg/ height in m^2), a useful index to assess overweight and is fairly reliable surrogate for adiposity. Based on large scale population data, WHO has defined overweight / obesity as a measure, BMI become popular during the early 1980s as obesity started to become a discernible issue in prosperous Western society. However, the limitation of BMI is that it cannot differentiate muscle mass to body fat and cannot locate the site of fat e.g., people with 'central obesity' may have normal BMIs. The fundamental definition of obesity in children is not clear (WHO consultation on obesity, 2000). The current standard definition of overweight and obesity uses specific BMI cut points. Some authors use age- and gender-specific 85th and/or 95th percentile BMI for children to define overweight and obesity. Other markers of obesity are; skin fold thickness, waist circumference, waist hip ratio (WHR), bioelectrical impedance analysis, dual energy Xray Absorptiometry (DEXA), and air displacement plethysmograpgy (BODPOP) method. All these markers have their individual advantages but none are really standardized as yet. Waist circumference/ waist hip ratio has an additional advantage for central obesity (Kissebah, 1989). It has been documented that increase WHR is associated with type 2 diabetes, CHD and other metabolic problems. Health hazards of overweight and obesity Epidemiological studies have shown a progressive increase in the incidence of hypertension, diabetes mellitus, and coronary heart disease, sleep apnea syndrome, and certain cancers in obese persons (Baron, 2003). Epidemiological and metabolic studies conducted over the last 15 years have confirmed the notion that a high proportion of abdominal fat (central obesity) is a major risk factor for coronary heart disease, type 2 diabetes mellitus, and related mortality (Keys *et al.*, 1972). Epidemiological studies have mainly used ratio of waist-to-hip circumference (waist: hip ratio) to estimate the proportion of abdominal adipose tissue. Visceral obesity is associated with insulin resistance, hyperinsulinaemia, and glucose intolerance (Hakim, 2002). Apart from this these persons are associated with dyslipoprotenemias and other metabolic derangements.

Non metabolic Hazards associated with obesity are osteoarthritis and gout, reflux oesophagitis, sleep apnea syndrome, cholelithiasis, cancer of the endometrium, ovaries, breast, billiary tract in females and prostate, colon and rectum in males, Poor post surgical risk, abdominal hernia, Depression and anxiety with psychological disability and Poor-body-image and attendant psychological maladjustment.

Reasons for obesity during childhood:

Overfeeding:

A bottle-fed child definitely takes in more milk as compared to a breast-fed infant. Excessive milk intake with little solids has been associated with over-weight babies. Such children up till about two years have been reported with a weight varying from 17 to 20 kg.

Commercial baby foods:

An increasing number of baby foods are being marketed. The media portrays a healthy 'baby' fed on such products, so obviously the parent is lured to feed their child with them. No doubt, they taste good due to the variety of flavors available, but are consumed in excess and for prolonged periods. It is easy for the mother to mix and feed rather than make an effort to prepare home-based diets and feed.

Junk food:

The variety of such products being manufactured and heavily advertised through the media (e.g. pictures of large sodas with snacks etc.) makes the young child compel the parents to procure these items and he keeps munching them anytime and anywhere. Not surprisingly, the child misses regular meals. The temptation of little surprise gifts with the products traps children. Wafers, chocolates, crunches, specially flavored namkeen, kurkure, burgers, pizzas, noodles are easily available in every nook and corner. Most of these items are high on calories or even empty calories since they are devoid of other important nutrients like vitamins, iron, calcium etc. It is postulated that consumption of extra 100 calories per day will result in 5 kg weight gain in one year time (Klesges *et al.*, 1986).

Social factors:

Increasing per capita income of the middle income groups has led to an increase in the trend of social gatherings, functions, and celebrations. In school, children celebrate their birthdays by getting sweets, pastries or savories (that are often high calories) for their classmates. In a class of an average 60-70 child, there would be an equal number of such occasions spread out not so far apart.

Lifestyle of family:

In certain families the eating pattern itself is such that meals are rich in fats and consumption of sweets, desserts are a regular feature. Most often, children are given pacifiers in the form of chocolates, biscuits, noodles etc. by parents who leave them back home with the care of baby sitters to make up for the guilt of not being able to devote adequate time to them (Avula *et al*., 2007).

Television/computer:

Most parents have no control over their children watching various television programmers. Children have access to video games and computers also mushrooming cyber joints have made these accessible. This contributes to the child becoming a 'couch potato' rather than spending that time in outdoor activity. Consequently, children are gaining more weight than they should. Parents also tend to exploit availability of video games and television in order to meet their own commitments of partying, socializing etc. by leaving the children at the mercy of the small screen (Robinson, 1999).

Lack of activity:

A significant change responsible for obesity is the lack of exercise that children nowadays get. Earlier, children had more time to play, run about or work out compared to the children of this generation. Long school hours, the ordeal of getting ready for school and tuitions increases inactivity. Without activity, even the recommended calories lead to a positive energy balance, which accumulates as body fat contributing to obesity (Avula *et al.*, 2007).

Inadequate play areas:

Due to unsafe roads (traffic, crime) children are discouraged form walking or cycling to school. Motorized vehicles are popular and they are perceived to be quicker and safer for transport. Erosion of open spaces for exercise and lack of parental time to supervise play are all part of new

lifestyles.

The problem of overweight and obesity is confined not only to adults but also being reported among the children and adolescents of developed as well as developing countries. Since, adolescence is a period of transition from childhood to adulthood; it assumed critical position in the life cycle of human beings, characterized by an exceptionally rapid rate of growth (Tanner, 1978). The prevalence of overweight and obesity among children and adolescents has increased significantly in the developed countries during the past two decades (Chinn and Rona, 2001) and similar trends are being observed even in the developing world (Martorell *et al*., 2000). Studies from metropolitan cities in India have reported a high prevalence of obesity among affluent school children (Gupta and Ahmad, 1990). Obesity has reached epidemic proportions globally, with overweight - at least 300 million of them clinically obese - and is a major contributor to the global burden of chronic disease and disability, affecting virtually all ages and socioeconomic groups.

RESULTS AND DISCUSSION

Global scenario :

There is a strong relationship between childhood obesity and the development of insulin resistance in early adulthood (Steinberger *et al.*, 2001). In Australia, 5% of children are currently obese and an additional 16% overweight (BMI 85th to 95th percentile). This prevalence doubled over the past decade after being nearly stable around 10% from 1969 to 1985 (Booth *et al.*, 2003). It is noteworthy that BMI may underestimate the prevalence of overweight and obesity in young people. Recent analysis of trends in British youth suggest that waist circumference has increased more rapidly than BMI over the past two decades, with 14 and 17% of boys and girls, respectively (McCarthy *et al.*, 2003). These considerations suggest that the phenomenon of increasing type 2 diabetes among children and adolescents may be a result of increasing overweight and obesity and, particularly, increasing central obesity (Steinberger and Daniels, 2003). In a cross-sectional survey of children 9–12 years old in Hong Kong, 38% of girls, but 57% of boys, were overweight, with overweight children of both sexes showing higher systolic blood pressure, triglyceride, and insulin and lower HDL cholesterol than the normal-weight group (Sung *et al*., 2003).

Indian scenario :

In Haryana rural area, overweight were 7% in males and 9% in females. Conversely, 38% of males and 36% of females in the rural area were actually 'underweight' by BMI standards. Such 'urban, rural divide' has been documented in other Indian studies too (Chadha *et al.*, 1997). In children, the difference between the rich and the poor is fairly evident in recently conducted urban studies. In a study, children from six schools, two each from high, middle and lower income groups in Chennai, the prevalence of overweight (including obese) adolescents ranged from 22% in better off schools to 4.5% in lower income group schools. (Ramachandran *et al.*, 2002). In a Delhi school with tuition fees more than Rs. 2,500 per month, the prevalence of overweight was 31%, of which 7.5% were frankly obese. In a similar study in Pune showed prevalence of overweight children in well off school is 24% and 6% in a "corporation" school (unpublished data). The 28% of adult males and 47% of adult females in urban Delhi were overweight by WHO standards (Reddy *et al.*, 2002). National Foundation of India undertook a study found that as against obesity 1% males and 4% females in slums, the corresponding figures in the middle class were 32.3% and 50%. More females than males have been found to be overweight (BMI > 25) in all age groups, 44.5% in

female's vs. 19.6% in males. Incidence of obesity was higher in people above 40 years. The prevalence of obesity (BMI >30) was about 3% in males and about 14% in females above 40 years of age (Toh *et al.*, 2002). In other study from Asian Health Care, Joshi and Joshi (2002) have found obesity as an emerging problem in pre-school, school going, and adolescent children. In fact, frank obesity may not be as high in India as in the west, but the body composition and metabolism of Indians (and Asians in general) make them especially prone to adiposity and its consequences (Yajnik, 2002). The fat is typically located centrally (central obesity), and around visceral organs where it is metabolically more dangerous than peripheral fat. South Asians have at least 3 to 5% higher body fat for the same BMI as compared to Caucasians (Deurenberg, 2002). Several studies have been done in India to assess the prevalence of overweight and obesity among the adolescents. A study conducted among the affluent public school children in New Delhi, revealed prevalence of overweight and obesity of about 25 per cent and 7 per cent, respectively (Kapil *et al.* 2002). The prevalence of overweight and obesity among the affluent adolescent school children in Chennai, Tamil Nadu was about 15 per cent (Subramanyam *et al.*, 2003). Excess weight in children is the leading cause of pediatric hypertension, and overweight children are at a high risk for developing long-term chronic conditions, including adult-onset diabetes mellitus, coronary heart disease, orthopedic disorders and respiratory diseases (Laxmaiah *et al.*, 2007).

According to Goyal *et al.* (2010); Laxmaiah *et al.* (2007); Aggarwal (2007); Khadilkar and Khadilkar (2004); Bharati *et al.* (2008) the prevalence of overweight and obesity was high ranging from 11 per cent to 29 per cent. A study done in Delhi revealed the prevalence of overweight and obesity to be 13 and 9.3 per cent, respectively (Kaur *et al.*, 2008). In a study done in Beijing, China and published in the year 2008 revealed eating junk food is a popular event among children and adolescents between the ages of 8. Dietary habits like frequent consumption of deep fat fried fleshy foods; fast food consumption and soft drinks consumption play a vital role in increasing the number of obese children. So it was concluded that the increasing trend of the modern day epidemic of overweight and obesity in children (Zhu *et al*., 2008). A study on eating habits of American teenagers found a link between the length of time young people spent in front of the television and the quality of what they ate in later life. Teenagers who watch more than five hours of television a day eat more junk food in adult life than those who view less. Researchers chose just under 2,000 pupils at middle schools and high schools in America and surveyed how many hours of television they watched per day. They returned five years later, when the younger volunteers were in their late teens and the older ones were in their early 20s, and analyzed their diets. The scientists found that those who had been watching most television five years before had significantly higher intakes of fried food, sugary drinks and snacks but much lower consumption of vegetables, fruit and fiber. Average, young adults who watched more than five hours a day of television as teenagers had a 10 per cent higher calorie intake than those who had spent less than two hours a day in front of the box. Another study done in Delhi reported a combined overweight and obesity prevalence of 16.6 per cent (Stigler *et al.*, 2011). Overweight (23.8%) and obesity (8.4%) is very high and alarming for both the sex. The prevalence is comparable to other national studies; again there is paucity of data. The study also suggested that under nutrition rates remain high in children. Therefore Special attention has to given for their overall nutrition (Garvita *et al*., 2012). Arya and Mishra 2013 concluded that the incidence of obesity/overweight was found to be significantly higher in those adolescents who ate meals outside home. Anthropometric measurements were taken to calculate BMI, central obesity (WHR) and total body fat percentage. General examination was conducted to exclude acute or long standing problem in a child.

Table 1 : Body fat guidelines from American Dietetic Association as follows

Category	Men	Women
Under nourished	<10%	<15%
Normal	10-20 %	15-25%
Overweight	20-25%	25-30%
Obese	>25%	>30%

Forty-three per cent of the total subjects belong to 13 -14 years age group while more representation was from 14 -15 years age group *i.e.* 57% (Table 2).

Table 2 : Age and sex wise distribution of the population

Age group	Boys	Girls	Total
13-14 yrs	28	15	43
14-15 yrs	32	25	57
Total	60	40	100

Twelve per cent respondents were overweight / obese according to the WHO, IOTF criteria based on BMI value (Table 3). Overweight was significantly higher among students. The prevalence of overweight (including obese) adolescents ranged from 22% in better off schools to 4.5% in lower income group schools (Ramachandran, *et al.*, 2002), whereas prevalence of overweight was 31% in better off school, of which 7.5% were frankly obese (Kaur *et al.*, 2008). The calculated global prevalence of overweight (including obesity) in children aged 5-17 years was estimated to be approximately 10%, but "unequally distributed" (WHO, IOTF 2000).

Table 3 : Distribution of population according to BMI

BMI (kg/m^2)	Group	Boys	Girls	Total	Percentage
<15	Starvation	2	4	6	Underweight (56 %)
15- 18.5	Undernourished	26	24	50	
18.5 – 23	Normal	23	09	32	Normal (32 %)
23 – 25	Overweight	08	02	10	Overweight / obese (12 %)
>25	Obese	01	01	2	
Total		60	40	100	

The overweight/obesity prevalence in boys and girls population was 9% and 3%, respectively. According to Mehta *et al.* (2007) on obesity amongst the affluent adolescent girls the prevalence of obesity and overweight was 5.3% and 15.2%, respectively though the criteria were different (BMI $\geq$ 30 obesity and BMI $\geq$ 25 overweight). Similar study was conducted by Reddy *et al.* (2002), where 38% of males and 36% of females were actually 'underweight' by BMI standards.

Table 4 : Total body fat per cent of boys and girls

Gender	Boys(60)			Girls(40)		
Group	Body Fat %	Number	Percentage	Body Fat %	Number	Percentage
Thin	<10%	01	1.66 %	<15%	6	15.0 %
Normal	10 – 20%	48	78.6%	15 -25%	30	75.0 %
Overweight	20 – 25	10	16.7%	25 - 30	03	7.5 %
Obese	>25	01	1.7%	>30	01	2.5 %

* Criteria as per American Dietetic Association

Out of total 60 boys 78.6% were having normal total body fat% while 18.3% of boys lies in overweight/obese group. The percentage of boys lying under thin condition was very low as 1.66 % only.

Seventy five per cent of girls were having normal total body fat % while 15 % of girls were thin. Ten per cent of girls were observed in overweight/ obese category which was comparatively lower than observed in boys. While the percentage of girls in thin category was much higher as compared to the boys of the same category. Among male only 1.66% of boys were overweight / obese according to WHR, where as in girl's 35% were overweight, and 7.5% were obese but 98.33% male and 57.5% female had normal WHR.

Table 5 : Father's occupation verses child's BMI, Total population

BMI (kg/m^2)	Business	Professional	Skilled	Semi- skilled	Labor	Father expired	Total
<15	4	2	0	0	0	0	6
15 – 18.5	31	12	5	0	0	1	49
18.5 – 23	17	12	2	0	2	0	33
23 - 25	5	4	0	0	1	0	10
>25	0	2	0	0	0	0	2
Total	57	32	7	0	3	1	100

There is significant difference between father occupation and BMI status of child. The children of having business /professional parents were significantly obese as compared to others.

Table 6 : Transportation to school versus BMI, Total population

BMI (kg/m^2)	Fuel vehicle		Physical mode cycling and walking		Total
<15	4	UW	2	UW	6
15 – 18.5	29	33 %	20	22%	49
18.5 – 23	12	Normal 12 %	21	Normal 21%	33
23 – 25	7	OW and O	3	OW and O	10
>25	0	7 %	2	5%	02
Total		52		48	100

Five per cent of children using physical mode (Cycling and walking) to their school were overweight /obese whereas 7% of children through fuel vehicle.

Table 7 : Outdoor activities* versus BMI, Total population

BMI (kg/m^2)	Yes		No		Total
<15	06	UW	00	UW	06
15 – 18.5	32	38%	17	17%	49
18.5 – 23	23	Normal 23%	10	Normal 10%	33
23 – 25	07	OW and O	03	OW and O	10
>25	01	8.0%	01	4.0%	02
Total		69		31	100

*Outdoor activities – games like Kho-kho, cricket, foot ball, athletics, cycling, etc.

When outdoor activities of a child were compared with their BMI status, there was significantly higher prevalence of overweight/obese in children with outdoor activities. So outdoor activity in growing age cannot be a determining factor for overweight and obesity because it was observed that almost every subject have some kind of outdoor activity for different period of time and even

school engage students in various sports and yoga classes. So in this study outdoor activity for more than 2 hour was considered.

Table 8 : Watching TV versus BMI, Total population

BMI (kg/m^2)	Yes		No		Total
<15	03	UW	03	UW	06
15 – 18.5	36	39%	13	16%	49
18.5 – 23	19	Normal 19%	14	Normal 14%	33
23 – 25	06	OW and O	04	OW and O	10
>25	02	8.0%	00	4.0%	02
Total		66		34	100

Out of total 66 % of the respondent watched television of various duration (1 to 3 hours) among which 8.0 % were overweight / obese, whereas 4.0 % of those who do not watch television were overweight/obese.

Table 9 : Food habits (deep fried foods, junk foods and aerated drinks) versus BMI, Boys

BMI (kg/m^2)	Deep Fried Foods (DFF)		Junk Foods (JF)		Aerated Drinks (AD)	
< 15	2	UW	1	UW	1	UW
15 – 18.5	20	36.6 %	9	16.6 %	4	8.3 %
18.5 – 23	18	N 30 %	7	N 11.6 %	7	N 11.6 %
23 - 25	7	OW and O	7	OW and O	5	OW and O
>25	1	13.3 %	1	13.3 %	1	10 %
Total	48		25		18	

Among the male, 13.3 % per cent were in the category of overweight and obese who regularly consume junk foods and deep fried foods.

Table 10 : Food habits (confectionaries and bakery, fries, non-veg and fresh fruits and milk) versus BMI, Boys

BMI (kg/m^2)	Confectionaries and Bakery Products (CABP)		Fries		Non- Veg.		Fresh Fruits And Milk (FF /M)	
< 15	2	UW	1	UW	1	UW	2	UW
15 – 18.5	10	20 %	13	23.3 %	14	25 %	26	46.6 %
18.5 – 23	11	N 18.3%	6	N 10 %	11	N 18.3 %	23	N38.3 %
23 - 25	5	OW and O	5	OW and	6	OW and O	6	OW and O
>25	1	10 %	1	O 10 %	1	11.6 %	1	11.6 %
Total	29 (48%)		26 (43.3%)		33 (55%)		58 (96.7%)	

The 96.7 % of male eat fresh fruits and milk on regular basis which is a good habit for a healthy life. Only 48% and 43.3% of the respondents were overweight and obese who consume confectionaries and fries. These may not be the contributing factor for overweight and obesity. As confectionaries and bakery products contain a large number of variety including brown bread and now available multigrain cookies which are not harmful for health.

As compared with the male, less female consume deep fried foods and junk foods and also

less only 10 % of females were overweight and obese who consume deep fried foods and junk foods. So, it may be concluded that female were more health conscious than male.

Table 11 : Food habits (confectionaries and bakery, fries, non-veg and fresh fruits and milk) versus BMI, girls

BMI (kg/m^2)	Confectionaries and Bakery Products (CABP)		Fries		Non - Veg		Fresh Fruits and Milk (FF /M)	
< 15	3	UW	2	UW	1	UW	4	UW
15 – 18.5	9	30 %	5	17.5%	7	20 %	23	67.5 %
18.5 – 23	3	N 7.5 %	1	N 2.5 %	4	N 10 %	10	N 25 %
23 - 25	2	OW and O	1	OW and O	0	OW and O	2	OW and O
>25	1	7.5 %	1	5 %	0	0 %	1	7.5 %
Total	18		10		12		40	

Hundred per cent female consume fresh fruits and milk regularly which is essential for their daily calcium requirement and other vitamin and minerals for the growing phase. Only 30 % of respondent consume non veg on regular as selected area has major population of "Jains and Marwari "community.

Only 5 % of female are overweight and obese consume fries regularly

Table 12 : Food habits versus BMI, Total population

BMI (kg/m^2)	Non. veg (NV)		Deep fried foods (DFF)		Junk foods (JF)		Aerated drinks (AD)		Confectionaries and bakery products (CABP)		Fries	
< 15	02	UW	04	UW	03	UW	02	UW	05	UW	03	UW
15 – 18.5	21	23 %	34	38 %	13	16 %	05	7.0 %	19	24 %	18	21 %
18.5 – 23	15	N 15 %	27	N 27 %	10	N 10 %	11	N 11 %	14	N 14 %	07	N 7.0 %
23 – 25	06	OW & O	09	OW & O	09	OW & O	06	OW & O	07	OW & O	06	OW &O
>25	01	7.0 %	02	11 %	02	11 %	01	7.0 %	02	9.0 %	02	8.0 %
Total	45		76		37		25		47		36	

There is high prevalence of overweight/obesity amongst subjects those consume junk food and deep fried foods on regular basis. Physical activity is a major factor which leads to a healthy and normal life. Consumption of junk food and deep fried foods remains the main culprit. Parents from business and professional background also add to the factor contributing for overweight and obesity in school children.

REFERENCES

Aggarwal, T. (2007). Prevalence of obesity and over weight in adolescents. *J. Indian Peadiatrics*, **45** : 500-502.

Arya, Geeta and Mishra, Sunita (2013). Effects of junk food and beverages on adolescent's health – a review article. *IOSR J. Nursing & Health Sci. (IOSR-JNHS)* e-ISSN: 2320–1959.p- ISSN: 2320–1940, **1**, (6) : 26-32 www.iosrjournals.org.

Avula, Laxmaiah, Balakrishna, N., Kamasamudram, V. and Mohanan, N. (2007). Factors affecting prevalence of overweight among 12- to 17- years-old Urban adolescents in Hydrabad, India. *Obesity,* **15** : 1384-1390.

Baron, R.B. (2003). Obesity in chapter on nutrition, edited by Tierney Jr. LM, McPhee SJ, Papadakis MA, Current Medical Diagnosis and Treatment, 42nd Ed, New Delhi, Lange Medical Books/McGraw–Hill; 1224-7.

Booth, M.L., Chey, T., Wake, M., Norton, K., Hesketh, K., Dollman, J. and Robertson, I. (2003). Change in the prevalence of overweight and obesity among young Australians, 1969–1997. *Am. J. Clin. Nutr.,* **77** : 29–36.

Chadha, S.L, Gopinath, N. and Shekhawar, S. (1997).. Urban rural differences in the prevalence of coronary heart disease and its risk factors in Delhi. *Bull. World Health Organ*., **5** : 31-38.

Chinn, S. and Rona, R.J. (2001). Prevalence and trends in overweight and obesity in three cross-sectional studies of British children. Br. Med. J., 197-494; 322 : 24-26.

Deurenberg, P., Deurenberg- Yap, M. and Guricci, S. (2002). Asians' are different from Caucasians and from each other in their body mass index/body fat per cent relationship. *Obes Rev*., **3** : 141- 146.

Dietz, W.H. (1998). Childhood weight affects adult morbidity and mortality. *J. Nutr.,* **128** : (Suppl 2) : 411S-414S.

Farooqi, I.S. and O'Rahilly, S. (2007). Genetic factors in human obesity. *Obesity Review*, **8**(s1) : 37-40.

Gupta, A.K. and Ahmad, A.J. (1990). Childhood obesity and hypertension. *Indian Pediatr.,* **27**: 333-337.

Hakim, A.S. (2002). Medical complications of obesity, SB Gupta (ed), Medicine Update Associations of Physicians of India, Mumbai, **12**: 480-2.

Jain, Garvita, Bharadwaj, S.K. and Joglekar, Abhaya R. (2012). To study the prevalence of overweight and obesity among school children (13-17yrs) in relation to their socioeconomic status and Eating habits. *Internat. J. Scientific & Res. Publications*, **2** (6) : 1-4.

Joshi, S.R. and Joshi, S.S. (2002). Obesity therapeutics – the Indian Consensus. Gupta SB, (ed). API Medicine Update 2002, Association of Physicians of India, **12**: 492-504.

Kapil, U., Singh, P., Pathak, P., Dwivedi, S.N. and Bhasin, S. (2002). Prevalence of obesity amongst affluent adolescent school children in Delhi. *Indian Pediatr.,* **39**: 449-452.

Kaur, S., Sachdev, H.P., Dwivedi, S.N., Lakshmy, R. and Kapil, U. (2008). Prevalence of overweight and obesity amongst school children in Delhi, India. *Asia Pac. J. Clin. Nutr.,* **17**(4):592-6.

Khadilkar, V.V. and Khadilkar, A.V. (2004). Prevalence of obesity in affluent school boys inpune. *Indian Pediatr*., **41** : 857-8.

Keys, A., Fidanza, F., Karvonen, M.J., Kimura, N. and Taylor, H.L. (1972). Indices of relative weight and obesity. *J. Chronic Dis.,* **25**: 329-343.

Kissebah, A.H., Freedman, D.S. and Peiris, A.N. (1989). Health risks of obesity. *Med. Clin. North. Am.,* **73**: 111-38.

Klesges, R.C., Coates, T.J. and Brown, G. (1986). Parental influences on childrens' eating behavior and relative weight. *J. Appl. Behav. Anal.,* **16**: 371-378.

Kopelman, P. (2007). Health risks associated with overweight and obesity. *Obesity Reviews*, **8**(s1): 13-17.

Laxmaiah, A., Nagalla, B., Vijayaraghavan, K. and Nair, M. (2007). Factors affecting prevalence of overweight among 12- to 17-year-old urban adolescents in Hyderabad, India. *Obesity (Silver Spring),* **15**(6):1384-90.

Martorell, R., Kettel, K.L., Hugher, M.L. and Grummer, S.L.M. (2000). Overweight and obesity in preschool

children from developing countries. *Internat. J. Obes. Relat. Metab. Disord.,* **24**: 959-967.

McCarthy, H.D., Ellis, S.M. and Cole, T.J. (2003). Central overweight and obesity in British youth aged 11–16 years: cross sectional surveys of waist circumference. *BMJ,* **326**:624–627.

Mehta, M., Bhasin, S.K., Agrawal, K. and Dwivedi, S. (2007). Obesity amongst affluent adolescent girls. *Indian J. Pediatrics,* **74** (7) : 619-622.

Must, A., Jacques, P.F., Dallal, G.E., Bajema, C.J. and Dietz, W.H. (1992). Long-term morbidity and mortality of overweight adolescents. A follow-up of the Harvard Growth Study of 19 1922 to 1935. *N. Engl. J. Med.,* 327: 1350-1355.

Park, K. (2005). Park's textbook of Preventive and Social Medicine: Banarsidas Bhanot Publishers, 18th Edition. 316- 319.

Popkin, B.M. (2001). the nutrition transition and obesity in the developing world. *Nutri. J.,* **131** : 871 s- 873.

Ramachandran, A., Snehalatha, C., Vinitha, R., Thayyil, M., Kumar, C.K., Sheeba, L., Joseph, S. and Vijay, V. (2002). Prevalence of overweight in urban Indian adolescent school children. *Diabetes Res. Clin. Pract.,* **57** : 185-190.

Reddy, K.S., Prabhakaran, D., Shah, P. and Shah, D. (2002). Differences in body mass index and waist: hip ratios in north Indian rural and urban population. *Obes. Rev.,* **3**: 197-202.

Robinson, T.N. (1999). Reducing children's television viewing to prevent obesity. A randomized controlled trial. *JAMA,* **282** : 1561- 1567.

Steinberger, J. and Daniels, S.R. (2003). Obesity, insulin resistance, diabetes, and cardiovascular risk in children: an American Heart Association scientific statement from the Atherosclerosis, Hypertension, and Obesity in the Young Committee (Council on Cardiovascular Disease in the Young) and the Diabetes Committee (Council on Nutrition, Physical Activity, and Metabolism). *Circulation,* **107**:1448–1453.

Steinberger, J., Moran, A., Hong, C.P., Jacobs, D.R. Jr and Sinaiko, A.R. (2001). Adiposity in childhood predicts obesity and insulin resistance in young adulthood. *J. Pediatr.,* **138** : 469–473.

Stigler, M.H., Arora, M., Dhavan, P., Shrivastav, R., Reddy, K.S. and Perry, C.L. (2011). Weight-related concerns and weight-control behaviors among overweight adolescents in Delhi, India: a cross-sectional study. *Internat. J. Behav. Nutr. Phys. Act,* **8** : 9. doi: 10.1186/1479-5868-8-9.

Subramanyam, V., Jayasree, R. and Mohmad, R. (2003). Prevalence of overweight and obesity in Affluent girls in Chennai 1981 and 1998. *Indian Pediatrics,* **40**(4) : 332-336.

Sung, R.Y.T., Tong, P.C.Y., Yu, C.W., Lau, P.W.C., Mok, G.T.F., Yam, M.C., Lam, P.K.W. and Chan, J.C.N. (2003). High prevalence of insulin resistance and metabolic syndrome in overweight/obese preadolescent Hong Kong Chinese children aged 9–12 years. *Diabetes Care,* **26**:250– 251.

Tanner, J.M. (1978). Fetus into man: Physical growth from conception to maturity. New York wells, open book publishing limited, pp 22-36.

Toh, C.M., Cutter, J. and Chew, S.K. (2002). School based intervention has reduced obesity in Singapore (Letter). *BMJ,* **324** : 427.

Vedavathi, S., Jayashree, R. and Rafi, M. (2003). Prevalence of Overweight and Obesity in Affluent adolescent school girls in Chennai in 1981 and 1998. *Indian Pediatrics,* **40** : 775-779.

WHO/IASO/IOTF (2000). The Asian Pacific Prospective: Redefining Obesity and its treatment. Health Communications Australia Pty Ltd.

WHO Nutrition http: www.who.int/nut/obs/ht, accessed in 2003.

Yajnik, C.S. (2002). The life cycle effects of nutrition and body size on adult adiposity, diabetes and cardiovascular disease. *Obes Rev*., **3**: 217- 224.

Zhu, S.P., Ding, Y.J., Lu, X.F., Wang, H.W., Yang, M., Wang, J.X., Chao, X.D. and Zhao, Z. (2008). Study on factors related to top 10 junk food consumption at 8 to 16 years of age, in Haidian District of Beijing. *Zhonghua Liu Xing Bing Xue Za Zhi*, **29** : 757-762.

****