UNIVERSITY GRANTS COMMISSION

Bahadur Shah Jafar Marg
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Minor Research Project

The Final Report of Work Done on the Project

Submitted to UGC

April – 2017

Title

Prevalence of Obesity in Children: Impact of Diet Counseling on Parents

Submitted by

Dr. Rekha A Lande

Associate Professor & Head
Department of Home Science

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Shri Shivaji College of Arts, Commerce and Science,
Akola – 444 001 (M.S.)

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PROFORMA FOR SUBMISSION OF INFORMATION AT THE TIME OF SENDING THE FINAL REPORT OF THE WORK DONE ON THE PROJECT

1.	**Name of project Investigator**	**:**	**Dr. Rekha Lande**
2.	**Name & address of Institution**	**:**	Shri. Shivaji College of Arts. Commerce & Science, Akola
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13.	**Summary of the Findings**	**:**	Details in Final Progress Report
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15.	**No. of Publications out of the Project (Please attach Re-prints)**	**:**	-

Contents

Introduction

The world is undergoing a rapid epidemiological and nutritional transition characterized by persistent nutritional deficiencies, as evidenced by the prevalence of stunting anemia and iron and Zinc deficiencies. Worldwide, disease profiles are transforming at a rapid pace catching the attention of medical professional and policy makers alike. This is particularly true in low and middle income countries that form the major chunk of global population. Concomitantly, there is a progressive rise in the prevalence of obesity, diabetes and other nutrition related chronic diseases (NRCDs) like obesity[29], diabetes, cardiovascular disease and some forms of cancer. The emerging epidemics of obesity, cardiovascular diseases (CVD) and diabetes form the crux of this phenomenal change. Among these entities, obesity has become a colossal epidemic causing serious public health concern and contributes to 2.6 million deaths worldwide every year[40].

Obesity can be seen as the first wave of a defined cluster of non-communicable diseases called "New Worlds Syndrome," creating an enormous socio-economic and public health burden in poor countries. The World Health Organization has described as obesity as one of the today's most neglected public health problems, affecting every region of the globe[41].

Obesity is an epidemic of 21st century, and is a major causative factor for many other metabolic disorders. According to the Global estimate by the World Health Organization in 2005 there were about 1.6 billion overweight person age 15 years and above and among them at least 400 million adults were obese, The revision of definition of obesity to adjust for the racial differences by the WHO, has resulted in a higher prevalence of 1.7 billion people classified as overweight. The WHO further projects that by 2015 approximately 2.3 billion adults will be overweight and more than 700 million will be obese[41]. The impact of obesity has been considerable in both developed and developing countries. According to a WHO report, obesity has been identified as a major cause of diabetes and premature deaths in less developed countries. This has been attributed to shifts in diet and lifestyle changes[38]. The risk of many diseases including cardiovascular diseases (CVDs), hypertension, hyperlipidemia, diabetes mellitus and certain cancers increases many folds in association with obesity[20]. It has been estimated

that obesity account for 2% to 7% total health care costs. There are also other costs to consider such as reduced quality of life and productivity loss attribute to medical leave[25]. Obesity is an independent respect for CVD. Obesity is associated with an increased risk of morbidity and mortality as well as reduced life expectancy. The last two decades of the previous century have witnessed dramatic increase in health care cost due to obesity and related issues among children[35].

Childhood obesity is one of the most serious public health challenges of the 21st century. The problem is global and steadily affecting many low and middle income countries, particularly in urban settings. The prevalence has increased at an alarming rate. Globally in 2010, the number of overweight children under the age of 5 is estimated to be over 42 million. Close to 35 million of these are living in developing countries[8].

1.1 Definition of childhood obesity:

Although definition of obesity and overweight has changed over time, it can be defined as an excess of body fat (BF). There is no consensus on a cut-off point for excess fatness of overweight or obesity in children and adolescent. A study conducted by Williams et. al. (1992), on 3320 children in the age group of 5-18 years classified children as fat if their percentage of body fat was atleast 25% for male and 30% for female respectively[37]. The center for Disease Control and prevention defined overweight as at or above the 95th percentile of body mass index (BMI) for age and at risk for overweight as between 85th to 95th percentile of BMI for age[11]. European researchers classified overweight as at or above 85th percentile and obesity as at or above 95th percentile of BMI[13].

For children and adolescents overweight and obesity are defined using age and sex specific normograms for body mass index (BMI). Children with BMI equal to or are exceeding the age-gender - specific 95th percentile are defined obese. Those with BMI equal to or exceeding the 85th but are below 95th percentile are defined overweight and are at risk for obesity related to co-morbidities[10].

Childhood obesity is a serious medical condition that affects children and the adolescence. It occurs when a child is well above the normal weight for his/her age and height, childhood obesity is particularly troubling because extra pounds often start children on the path to health problems that once were confined to adults, such as diabetes,

high blood pressure, high cholesterol. Childhood obesity can also lead to poor self-esteem and depression.

Traditionally, a fat child is considered as an 'unattractive' child and is often referred to as a 'healthy' child. However, the adverse and serious consequences of childhood obesity are now proven beyond about[35]. Psychological stigmatization may not be a big problem in our country and severe complications of obesity (such as destructive sleep apnea and pseudotumer cerebrii) are rare. However, obese children have substantial risk for morbidity search has hypertension and dyslipidemia even before they reach adulthood[23]. Type 2 diabetes is beginning to emerge in children[12]. Importantly, 50 to 80% of obese children become obese adults and all complications of adult obesity are made worse if the obesity begins in adulthood.

1.2 Scope of the study:

Childhood obesity has reached epidemic levels in developed as well as in developing countries. Overweight and obese children are likely to stay obese into adulthood and more likely to develop non communicable diseases like diabetes and cardiovascular diseases at a younger age. The mechanism of obesity development is not fully understood and it is believed to be a disorder with multiple causes. Environmental factors, lifestyle preferences and cultural environment play pivotal roles in the rising prevalence of obesity worldwide. Childhood obesity can profoundly affect children's physical health, social and emotional well-being and self-esteem. It is also associated with poor academic performance and a lower quality of life experienced by the child. Many co-morbid conditions like metabolic cardiovascular orthopedic, neurological, hepatic, pulmonary and renal disorders are also seen in association with childhood obesity.

Obesity is a serious health concern for children and adolescents. Results from the 2007-2008 National Health and Nutrition Examination Survey indicated that an estimated 17% of children and adolescent aged 2 - 19 years are obese. Between 1976 - 1980 and 1990 – 2000, the prevalence of obesity increased. Between 1999 - 2000 and 2007 - 2008 there was no significant trend in obesity prevalence.

Obese children and adolescent are more likely to become obese as adults, approximately 80% of children who were overweight at aged 10-15 years were obese adults at age 25 years as well as 25% of obese adults were overweight as children. It was

also found that if overweight begins before 8 years of age, obesity in adulthood is likely to be more severe. The implications of the global phenomenon on future generations will be serious unless appropriate action is taken. The treatment of overweight and obesity in children and adolescents requires a multidisciplinary, multiphase approach, which needs to imparting community education as well as counseling, enriching and reinforcing individual and parent's awareness about their children. Hence, the present study has aimed to

1.3 Aim of the study:

"Prevalence of obesity in children: Impact of diet counseling on parents"

1.4 objectives: The objectives of the present study are as

- To determine prevalence of obesity in children.
- To identify factors associated with childhood obesity.
- To study dietary habits and consumption pattern of obese children.
- To study attitudes of parents towards obesity in children.
- To study impact of counseling on the dietary pattern and nutritional status of obese children.

1.5 Delimitation of the study:

- The study was limited to four districts of Vidarbha only.
- The research study was limited to prevalence and one of the factor, impact of diet counseling on parents towards obesity.
- sample size was limited only to 1000 children randomly.
- samples were taken only from Government and private schools.
- school children under the age of 6 years were taken for study.

1.6 Hypothesis:

- The prevalence of obesity was higher in the age group 0-6 years.
- The prevalence of obesity was maximum in private school children.
- Socio-economic condition and changing lifestyle are associated with obesity.
- Dietary habits and activity pattern are also associated with obesity.
- Counseling of parents; Nutrition education shows significant impact on health status of children.
- Knowledge - Attitudes and Practice shows significant relationship in prevention of obesity.

2. National and International Status:

Childhood obesity affects both developed and developing countries of all socio-economic groups irrespective of age sex or ethnicity. It has been estimated that worldwide over 22 million children under the age of five are obese and 1 in 10 children is overweight (17).

One has often heard the phrase 'the longer the bell the shorter the life span'. Excess weight can be dangerous. It involves inconvenience and also decreases the efficiency of the person besides subjecting the heart to undue stress.

2.1 National status

Indian data regarding current trends in childhood obesity are emerging. Research study conducted among 24000 school children in South India showed that the proportion of overweight children increased from 4.94% of the total students in 2003 to 6.57% in 2005[30]. Social economic trends in childhood obesity in India are also emerging. A study from Northern India reported a childhood obesity prevalence of 5.59% in the higher socio-economic strata when compared to 0.42% in the lower socioeconomic strata[24]. In a recent study by Reddy, et al, more than 28% of adult male and 47% of adult females in urban Delhi were are overweight by WH0 standard[32]. In the same study the corresponding figures for overweight in a neighboring Haryana rural area where 7% in males and 9% in females. Conversely as many as 38% of males and 36% of females in the rural area were actually "underweight" by BMI standards. Such an urban rural drive has been documented in other Indian studies too[5].

In children, the difference between the rich and the poor is fairly evident in recently conducted urban studies. Ramachandran, et al studied children from 6 schools in Chennai 2 each from the high, middle and lower income groups[31]. The prevalence of overweight (including of obese) adolescent ranged from 22 in present 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 fingers for overweight children at 24% in a well off school and 6% in corporation school[19].

National nutrition Monitoring Bureau surveys in 2002 in rural area, reported the prevalence of as little as 0.6%. A similar study done in Hyderabad showed that the

prevalence of overweight was 7.2% among the 12 to 17 years age group. Although some other studies are done in India showed a higher prevalence of overweight and obesity. A study in Delhi on affluent school children showed the prevalence of obesity to be 7.4%. Other study among affluent girls in Delhi reported the prevalence of obesity and overweight to be 5.3% and 15.2% respectively[33].

The prevalence of diabetes CHD and other lifestyle disorders is increasing alarmingly in India and is affecting much younger populations than in the West. A large pool of young Indians demonstrate 'Prediabetics'. The association of these problems with high BMI's and importantly central obesity is now well accepted. In transitional economics such as in India obesity and malnutrition often coexists (double burden of disease) causing confusion in health messages[27].

In fact frank obesity may not be as high in India as in the west, but the body composition and metabolism of Indians make them especially prone to adiposity and in consequences. Moreover recent longitudinal studies in India have highlighted the deleterious effect of accelerated weight gain in childhood 'crossing of centiles' especially in LBW babies[3]. Indices of insulin resistance and cardiovascular risk factors were found to be highest in those that were born 'small' but were big by 8 years in the Pune study, even though they will not obese in absolute terms. The recent Delhi study in young adults showed that an increase of BMI of ISD from 2 to 12 years of age, increased the odds ratio for disease by 1.36[4]. Further, containing cohort studies in Pune suggested that accelerated growth in childhood is associated with early maturation and greater risk of obesity.

The Jaipur Heart Watch (JHW) was a combination of multiple cross-sectional epidemiological studies on obesity and other cardiovascular disease risk factors, performed in India in the rural and urban locations. From these cohorts, subjects aged 20-59 years (men 4102, women 2872) were included. The prevalence of various risk factors: smoking/tobacco, overweight/obese (BMI ≥ 25 kg/m2), truncal obesity (WHR ≥ 0.95 men, 0.85 women), hypertension dyslipidemia, metabolic syndrome and diabetes was determined[16].

2.2 International Status:

According to WHO (2000) at least 50% of adults and 20% of children in UK and USA are currently overweight. Prevalence of overweight amongst Australian children has increased from 11% in 1985 to 20% in 1995. Childhood obesity has tripled in Canada in last 20 years. It has been estimated that in 1995, direct cost of treatment of obesity in USA accounted for $70 million with far greater indirect cost[(06)].

In most of the Asian countries, the prevalence of overweight and obesity has increased manifold in the past few decades and the magnitude varies between countries. Southwest Asia and western Pacific region are currently facing an epidemic of diseases associated with obesity such as diabetes and C.V.[(18)].

The prevalence of overweight and obesity rate in Asian countries are not very different from that in USA. The highest rate of obesity in Asia is in Thailand and lowest in India, followed by Philippines, China which ones had the leanest of populations, is now rapidly catching up with the west in terms of prevalence of overweight and obesity which has occurred in a remarkably short time[(15)]. The National Nutrition and Healthy Survey in Taiwan 1993-1996, showed that the prevalence of overweight and obesity were 22.9% and 10.5% for males and 20.03% and 13.2% for females respectively.

In parallel with the increase in adult obesity, obesity in children is also increasing. Certain ethnic groups such as American Asians, native Americans and Hispanics have the highest risk of childhood obesity. In 2002, it was reported that the rate of childhood obesity has increased 2.3 to 3.3 fold in about 25 years in the USA (BMI ≥ 95th percentile). In Japan, increase in incidence of type 2 diabetes was parallel with the levels of obesity between 1975 to 1995 (BMI ≥ 30 kg/m2)[(25)]. Childhood obesity has reached more than 25% in many developing countries.

Singapore, China, Malaysia (BMI ≥ 95th percentile in both) and other Asian countries has shown arising prevalence of obesity among children. Wang et. al. showed that the rate of obesity among children aged 7 to 17 years in big cities in China was more than 20%. Li et. al. reported a parallel increase of obesity with dietary fat and high energy consumption in Chinese children. The study revealed that the overweight children spent

time on moderate/vigorous physical activities. It also revealed parental obesity to be the most pronounced risk factor for childhood obesity among these children[22].

Obesity does not seem to have spread developing countries either Thailand, Iran, Nigeria and Brazil have all reported unprecedented levels of obesity with trends that are substantially rising every year. The calculated global prevalence of overweight including obesity in children aged 5 - 17 years is estimated by the International Obesity Task Force (IOTF) to be approximately 10% but this is unequally distributed with prevalence ranging from over 30% in Americas to < 2% in Sub-Saharan Africa[23].

Some evidence suggests that lack of physical activity rather than high fat intake is a major determinant of obesity. Studies from developed Western countries, USA and parts Western Europe and UK have estimated that average per capita energy consumption, especially fat consumption has declined in the last two decades. On the other hand, it is also been reported that the average consumption of dietary sugars by American population has considerably increased in the recent years and this is the regard as one of the contributory factors for the increased obesity rate[28]. The rise in obesity has also been correlated well with lack of energy expenditure owing to physical inactivity, which could contribute significantly toward the increasing rate of overweight and obesity.

In Western studies, occurrence of cardiometabolic risk variables and its clustering were reported in obese children. On the contrary, the study in Asian Indian urban children and adolescent (12 - 19 years) showed that nearly 65% of normal weight subjects also had at least one risk factor. The percentage of abnormalities increased to 85% in overweight children. Clustering of abnormality occurred more commonly in them and insulin resistance showed a strong association with the clustering.

Methodology

In children from the same high socio- economic background there exist behavioral, social, psychological, genetic and physiological characteristics that distinguish children who are obese from other normal children. These characteristics may be related to child's own characteristics his/her nutritional habits and child rearing practices by the parents. So the major emphasis of present study is on ascertaining the prevalence of obesity in children and impact of counseling on parents. The methods used for carrying out the study are as follows.

3.1 Locale of the study:

The study will be undertaken in the jurisdiction of four districts of Vidarbha only such as Akola, Amravati, Buldhana and Yeotmal

3.2 Selection of samples

The information required for the study and compliation of research project, involved the study of sample such as obese children. Total 1000 samples both girls and boys between 2 to 6 years of age were selected for the study. 250 samples randomly were selected from the various schools of each district with official permission of schools. Among these 1000 children, obese children were selected for the study, whose weight for height was 10% or more above standard references. Purposive systematic random sampling method will be used.

3.3 Sampling plan:

The present study was conducted over a period of 15 months. At the beginning of the study schools were visited and the prior permission of Head Mistress was taken to conduct study in their schools. The non-probability sampling plan was used for the study in which the selection of units in these samples were based on judgment. The number of respondents and their distribution was internationally selected by the researchers.

3.4 Selection of tools for data collection:

The main tool used for data collection was the 'questionnaire'. The self-administered questionnaire was consisted of a number of questions. The questions were based on the facts which where applicable in day to day life approach. The questionnaire was designed in a simple form to meet the needs for achieving objectives and meet the hypothesis.

A Comprehensive Interview schedule was formulated to collect the relevant information to achieve the objectives of the study. The questionnaire schedule was filled with taking interview by the parents. Information about demographic personal profile of the family, dietary pattern, food habits, school performance of child, awareness regarding nutrition & food, likes and dislikes of food, health awareness by the parents, activity pattern of child, psychological attitudes towards the excess weight and physical problems faced due to obesity. Health status of children was interviewed.

3.5 Anthropometric Data Collection:

Anthropometric measurements of respondents were taken during school hours. The anthropometric measurements of height, weight, triceps fold, mid arm circumference were taken. The body mass index of the children was calculated and they were categorized on the basis of internationally recognized classification.

The classification was based on the criteria's

- 85^{th} and 95^{th} percentile of body mass index NHANES
- The standard values of ICMR for weight and height for below six years children were used for comparison to assessing the prevalence of obesity. The children who were 120% above the standard weight may come under the category of overweight and obese.

BMI index values of the children higher than the proposed limits of the body mass for obesity according to the classification of obesity were considered to indicate obese. Such as obese medium obese and overweight. BMI was calculated by the formula = Weight/$(\text{Height})^2$

The triceps skin folds measurements were classified on the basis of 85^{th} and 95^{th} percentile of triceps skin fold thickness from NHANES 1.

3.6 Dietary Survey:

A comprehensive interview schedule was formulated to collect data about dietary pattern and food habits of children. This includes dietary history, dietary preference of the child and parents, food pattern, foods likes and dislikes, frequently consumed foods, meals taken outside home, tiffin, habits, snacks, availability of snacks, energy dense ingredients, etc. 24 hours dietary recall method was used to consumption of meals by the child.

3.7 Physical Activity pattern of the child:

The mother was asked whether the child enjoy/ does not enjoy sports activities, to get information about physical activity; frequency, duration and name of activity, indoor games, frequency and duration spent in playing computer games, viewing television, habits of taking meals at viewing television.

The activity pattern of the child throughout the day was noted such as daily activities of getting ready for school, viewing television, duration of play, study time, mode and time spent in travelling by interviewing the mother.

3.8 Strategy Development:

Development of a strategy to create awareness of underlined problems and find solutions to prevent overweight from becoming a disease in adulthood, a nutrition counseling and awareness program was organized for parents of obese children. To develop and create a awareness about health of individuals, nutrition education was given to parents, develop nutrition games for children about good and bad food choices, exercise and problems of overweight. The parents were allowed to discuss about the causes and problems of childhood overweight and thereafter allowed to ask questions or clear any doubts they have. Certain changes were suggested to parents in diet and physical activity of the obese children and their implication was reviewed over a period of 2 - 3 months. For counseling to parents knowledge, attitudes and perceptions test were developed to know about their views and ideas about weight and health status of children about good nutrition. Parents are ready to change the entire dietary pattern & activities of their children because parents involvement in the child eating pattern is significant.

3.9 Tabulation and Statistical Analysis:

All information collected was statistically analyzed and tabulated. Average percentages, standard deviation, chi square and analysis of variance were used for test of statistical significance.

Chapter IV

Results and Discussion

The prevalence of childhood obesity is increasing rapidly worldwide. Due to public health importance the trends in childhood obesity should be closely monitored. The aim of the study to Prevalence of obesity in children: Impact of diet counseling on parents".

4.1 Prevalence of childhood obesity in Vidarbha region

The study was conducted on 1000 children of four districts of Vidarbha region. The values given by ICMR were used for comparison to assess childhood obesity. The age of the children under study ranged from 3 - 6 years. The table 4.1 gives the percentage distribution of overweight and obesity in children according to sex.

Table 4.1: Sex wise distribution of children

Category	N = 1000					
	Boys	%	Girls	%	Total	%
Normal weight	450	45.0	398	39.8	848	84.8
Overweight	73	5.5	22	4.0	95	9.5
Obese	34	3.2	23	2.5	57	5.7

The table 4.1 gives the percentage distribution of boys and girls in all groups. Percentage of overweight was found higher in boys (5.5%) than girls (4.0%). Overall prevalence of overweight and obesity among children was found 15.2%. Percentage of Obesity was found among boys 3.2% and among girls 2.5% respectively.

4.2 Indicators of Body Fitness Measurement Anthropometric data of the children

4.2.1 Anthropometric data of the children

Obesity is not equivalent to overweight. Obesity denotes excess body fat, whereas overweight might related to fat or other tissues in excess with relation to height (Styne 2001). Body weight is reasonably related to body fat. Body weight is also highly correlated to height, but body fat may not be strongly correlated to height. Therefore, weight adjusted for height squared (BMI = kg/m^2) is a useful index with which to assess overweight. This is a reasonable indicator of fatness (Bellizi et. al. 1991). Mean height and weight of the subjects were given in table no. 4.2.

Table 4.2: Mean Height and Weight of children

Category of children	Standard Height in cm		Mean Height in cm		Standard Weight in kg		Mean Weight in kg	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Normal	106.7	105.5	104.6	103.8	21.8	19.9	20.7	20.5
Overweight			105.6	104.0			28.0	28.4
Obese			107.8	104.9			31.9	31.6

Normal children were shorter in height than ICMR standard height in both sexes. A distinct difference in height of normal, overweight and obese children was found in both sexes. Overweight and obese children were found to be markedly taller than their normal weight counterparts. While comparing the pattern observed between boys and girls, boys were found to be taller than the girls in all categories.

The results of the table 4.2 indicate that the mean height of overweight and obese boys was 0.7 to 1% more than their normal weight children respectively. Mean height of overweight and obese girls were 0.4 to 1.28% more than normal weight girls respectively.

The data obtained through the present study is found to be in keeping with the study by Forbes (2007). Obese and overweight children of both sexes tend to be a little taller than their non-obese peers and also had some advancement in skeletal maturation. It was observed that most of them had an increased in weight percentile status once they had become obese.

Table 4.2 shows that the weight of the normal children was less than the ICMR standards. Mark difference was found in weight of the overweight and obese children. Weight of the overweight boys was 67% higher and in obese boys it is 75% higher than the normal counterparts. Similar trend was also found in girls. Weight of overweight and obese girls are near about 75% higher than their normal counterparts. The data clearly indicates that the weight was highly increased in obesity

In the study it was found that those children who are were 120% above the standard weight may come under the category of overweight and obese.

4.2.2 Triceps skin fold thickness:

The other most frequently used index to measure body fatness are triceps and subscapular skin folds and waist circumferences, skinfold thickness correlates well with

percentage body fat but there exist inter-individual and intra-individual differences. Thus evaluation of overweight subjects is difficult to reproduce. Subscapular skin folds values may declined 6-12 months before peak height velocity suggesting fat is distributed during growth (Bellizi et. al. 1999). Goran and Grover (1999) have suggested that waist circumference is a good index of total adiposity in pre-pubertal children. Triceps skin fold thickness of the children was given in table 4.3.

Table 4.3: Triceps skin fold thickness of the children

Category of children	85th Percentile		95th Percentile	
	Boys	Girls	Boys	Girls
Normal				
Overweight	22.8	24.94	25.83	27.39
Obese	25.83	27.39	31.14	32.17

The body mass index of the obese children was also related to the triceps skin fold measurements. The direct measurement of the skin fold thickness is done by skin fold caliper. The midpoint of the back of the left upper arm between tips of the olecranon and acromial process was determined by measurements with arm flexed at 90^0. With the arm hanging freely a fold of skin and subcutaneous fat was grasped firmly with the thumb and forefinger pulled away from the underlying muscular tissue. Measurements where recorded with two seconds of applying force.

Body fat percentage predicted by BMI was significantly more accurate than the fat percentage predicted by the triceps skin fold thickness.

The triceps skin fold measurements were classified on the basis of 85^{th} and 95^{th} percentile of triceps skinfold thickness from NHANES 1 subject aged 6 years.

4.2.3 Mean mid-arm circumference of the children

Mean Mid-arm circumferences of the overweight and obese children were given in table no. 4.4.

Table 4.4 Mean mid-arm circumference of the children

Category of children	Mean Mid Circumference in cm	
	Boys	Girls
Normal	15.0	16.0
Overweight	16.1	16.8
Obese	17.2	17.8

Mean Mid-term circumference of girls was more than boys in each category.

Tracking of BMI:

Body Mass Index (BMI) is a practical measure used to determine overweight and obesity. BMI is a measure of weight in relation to height that is used to determine weight status. BMI is the most widely accepted method used to screen for overweight and obesity in children, as BMI correlates with body fatness. Body weight is reasonably correlated with body fat but is also highly correlated with height. Therefore weight adjusted for height squared (BMI =kg/m^2) is a useful index to access overweight and obesity. BMI also correlates with markers of secondary complications of obesity including current blood pressure, blood lipids and with long term mortality[35]. In spite of several limitations, BMI appears to be the most practical way of measuring and comparing obesity for clinical and epidemiological purposes.

Table 4.5 Mean Body Mass Index of the children

Category of children	Standard BMI	Mean BMI	
		Boys	Girls
Normal	15.5 kg/m^2	16.25	16.27
Overweight	BMI>23	25.45	26.29
Obese	BMI>25	27.98	29.25

BMI changes physiologically (substantially) with age and sex. At birth it is low but increasing at age 1, but then it is decreasing up to age 6 years. Table No. 4.1.3 shows that the BMI of obese children 27.98 in boys and 29.25 in girls which means 95th percentile for obesity in children.

Also BMI of overweight children found within the range 25. 45 - 26.29, in boys and girls respectively. It means 85th percentile for overweight. Similar results were reported by Agarwal et. al. in his study BMI and skin folds for affluent Indian school children (37). It was concluded that the children who were 120% above the standard weight may come under the category of overweight and obese.

4.3 Factors Associated with obesity:

Childhood obesity is the result of an imbalance between the calories a child consumes as a food and beverages and the calories a child uses to support normal growth and development metabolism and physical activity. The imbalance between calories consumed and calories used can result from the influences and interactions of a number of factors including genetic, behavioral and environmental factors[36]. It is the interactions

among these factors, rather than in single factor. The impact of such risk factors is moderated by factors such as age, gender, family characteristics, parenting style, parents lifestyle, eating and activity behaviors. Environmental factors such as school policies, demographic and parents work related demands also play a role.

4.3.1 Genetic Factors:

Genetics are one of the biggest factors examined as a cause of obesity. Genetic susceptibility often needs to be coupled with contributing environmental and behavioral factors in order to affect weight. Table 4.6 shows the influence of parents' weight status on the incidence of obesity in children.

Table 4.6: Percentage distribution of children according to parents BMI

S.N.	BMI	Normal Weight %	Overweight %	Obese %
1.	Only mother is overweight/ obese	50.0	35.0	15.0
2.	Only father is overweight/ obese	75.0	15.0	10.0
3.	Both parents are overweight/ obese	32.8	34.8	32.4
4.	Both parents are normal weight	65.4	22.0	12.6

Results of table 4.6 indicate that when both parents are of normal weight a majority of children are of normal weight. This pattern reverses when both parents are found to be overweight or obese. It also shows that the influence of mother's weight on child's obesity is more than the father's weight. It means that genetics is one of the biggest factors examined as a cause of obesity in children.

4.3.2 Behavioral Factors:

Because the factors that contribute to childhood obesity interact with each other, it is not possible to specify one behavior as the "cause of obesity". However, certain behaviors can be identified as potentially contributing to an energy imbalance and consequently to obesity.

4.3.2.1 Energy Intake:

Dietary factors have been studied extensively for its possible contributions to the rising rate of obesity. The dietary factors that have been examined include fast food

consumption, sugary beverages, snack foods, portion size, eating meals away from home, frequency of energy dense foods are often hypothesized as contributing to excess energy intake of children. The percentage distribution of energy derived from carbohydrates and fats in children is given in table 4.7.

Table 4.7: Percentage distribution of energy from carbohydrate and fats.

Category	**Energy derived**	
	Carbohydrates	**Fats**
Normal Children	60-70%	20-30%
Overweight children	50-60%	40-50%
Obese children	40-50%	50-60%

As per recommended dietary allowances mostly 67-70% energy yield by carbohydrates foods and 20% to 30% energy yield by fatty foods. But Table No. 4.7 shows that overweight children takes 40 - 50% calories from fat rich foods and in obese children contain fat rich food 50 to 60%. Result of the table 4.7 shows that obese children showed strong preference for energy dense foods such as fried foods, Dairy Foods, sweets, bakery and confectionery. Also they like fruits like Banana, Sapota, Grapes, Mangoes. They also preferred non-vegetarian foods, roots and tubers and fats foods which are more energy dense and thus an increased calorie intake, contributes to overweight and obesity. These children do not prefer green vegetables, legumes and cereals in the form of normal diet.

Also it was shown that all three categories considered dinner or lunch as their largest meal. The children who had afternoon school would generally skip breakfast and have a lunch before leaving for school. Thus lunch would be the largest meal. Those children who had morning school would mainly have breakfast as tiffin in school lunch would be taken as television viewing and dinner would be the largest meal. Snacking habit in between meals is more common among overweight and obese children when compared to normal children. A marked difference was seen in the consumption of certain foods such as wafers, fast foods, soft drinks, ice creams, fried foods, sweets frequently in obese children and normal weight children. Overweight and obese children consume these items more frequently. It was concluded that overweight and obesity may be associated with energy dense foods.

Davison and Birch (2001) also reported that higher daily energy intake and higher percentage of energy from fat are associated with greater increase in degree of overweight.

4.3.2.2 Physical Activity:

Physical activity is an important determinant in maintaining body weight, it has a profound influence on weight status of the child. Participating in physical activity is important for children, as it may have beneficial effect on body weight. Physically active children are also more likely to remain physically active throughout adolescence and possibly into adulthood. This may be seen clearly from table no. 4.8.

Table 4.8: Percentage of involvement of children in outdoor and indoor activities

Category	Indoor Games duration in hrs		Outdoor Games duration in hrs	
	Boys	**Girls**	**Boys**	**Girls**
Normal Children	1 hr/day	1½ hrs/day	2½ hrs/day	1½ hrs/day
Overweight Children	1½ hrs/day	2 hrs/day	1½ hrs/day	1 hr/day
Obese Children	2 hrs/day	2½ hrs/day	¾ hrs/day	½ hrs/day

Table No. 4.8 shows that physical outdoor activities of the overweight and obese was much less than that of the normal weight children. Sedentary activities such as painting, reading, television watching, video games and other indoor games is high near about 32-40% in obese children. It was concluded that the overweight and obese group had a much lower energy expenditure than the normal weight group. The fact that overweight results due to the positive energy balance. These children did not enjoyed sports activities in school as well as home. Obese children tended to show characteristics favouring excess weight gain with little physical activity and increased intake of energy dense foods. It was found that the children in the Convent and private schools showed similar characteristics, as they were physically inactive and played more indoor games as compared to public school and government school students. Thus there was a significant difference seen between the physical activities performed by the children of all groups. The mothers of the children reported that the odd school timings and workload to be done at home were responsible to an extent for the lack of time and paucity of physical activity.

The physical activity is the most variable component of the daily energy expenditure and can vary greatly within and between individuals to the variable nature of physical activity patterns.

4.3.2.3 Sedentary Behavior:

Utter et. al. (2003) reported about specific sedentary behaviors like television/video/ computer reading, homework and how they are associated with dietary behaviors, physical activity and body mass index. Klesgel et. al. (1993) studied the effects of television on metabolic rate. He reported that T.V. viewing actually decreases REE in both normal weight and obese children. But obese children ended up viewing more television per day than normal weight children. Table 4.9 shows the children spent total hrs/day sedentary activities.

Table 4.9: Children spent hours in Sedentary Activities

S.N.	**Activity**	**Approximate duration in Sedentary Activities, hrs/day**					
		Normal weight children		**Overweight children**		**Obese children**	
		Boys	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**
1.	**Television Viewing**	1 hr	1½ hr	2 hr	1½ hr	2½ hr	2 hr
2.	**Video Games**	½ hr	-	½ hr	-	-	-
3.	**Computer/laptop games**	½ hr	-	½ hr	-	-	-
4.	**Painting**	½ hr	1 hr	½ hr	1 hr	½ hr	1½ hr
5.	**Home Work**	1½ hr	1½ hr	1½ hr	2 hr	1½ hr	2 hr
6.	**Tab**	-	-	1½ hr	1 hr	1½ hr	1 hr

Table 4.9 shows the average time spent with media by children. It was found that children spent 2½-3 hrs per day in watching TV videos, DVDs and Tabs. Television viewing is on factor which competes with being active that influence child development. Three potential mechanisms are linking television viewing and obesity.

- Reduce energy expenditure from television viewing displacing physical activity.
- Increased diatary energy intake while eating during viewing or from effect of food advertisement on T.V.
- Decreased resting metabolic rate during viewing.

While viewing television children are exposed to a lot of advertisement and commercials which emphasis on high caloric food. Energy intake for children of both sexes was positively associated with television video and computer usage. Children who had reported high T.V./video usage consumed almost 400 kcal more per day than those children who viewed them less.

Children who had reported high levels of time spent in reading/ homework consumed markedly less percentage of energy from fat than the one who spent less time doing these activities. It was also noticed that the children specially boys who reported high usage of television/video consumed significantly more soft drinks, fried foods and number of snacks per day than the average or those who used these media less. More obese children were lazy as reported by their mothers and they enjoyed Sedentary activities more. Television viewing per hour/day increased the obesity by 2%. The increased amount of time spent in Sedentary behavior has decreased the amount of time spent in physical activity.

4.3.3 Environmental factors:

Opportunities to be physically active and safe environment to be active is have deceased in the recent years. Home, child care, school and community environments influence children's behavior related to food intake and physical activity. The current environmental conditions are likely to promote obesity, due to availability of ready to eat foods, deep fried foods, chocolates, fast foods, bakery and confectionary foods.

4.3.3.1 Environment within home

Parent child interactions and the home environment can affect the behavior of children related to calorie intake and physical activity. Family factors have been associated with the increase of cases of obesity. The type of food available in the house and the food preferences of family members can influence the foods that children eat. Family meal time also influence the type of food consumed and the amount thereof. Family habits, whether they are sedentary or physically active influences the child.

4.3.3.2 Environment within child care

Almost 60% of the children aged 3-6 years of working mothers are in child care or day boarding school. Child care providers are sharing responsibility with parents for children during important developmental years.

4.3.3.3 Environment within schools

Majority of the children 3-6 years are enrolled in pre-school, schools provide an ideal setting for teaching children, healthy eating and physical activity behaviors. The majority of the children in the past walked or rode their bike to school. But now, 65% of the parents drove their children to school, because of safety, out of convenience for the child which reduce the physical activity of the child.

4.3.3.4 Environment within community

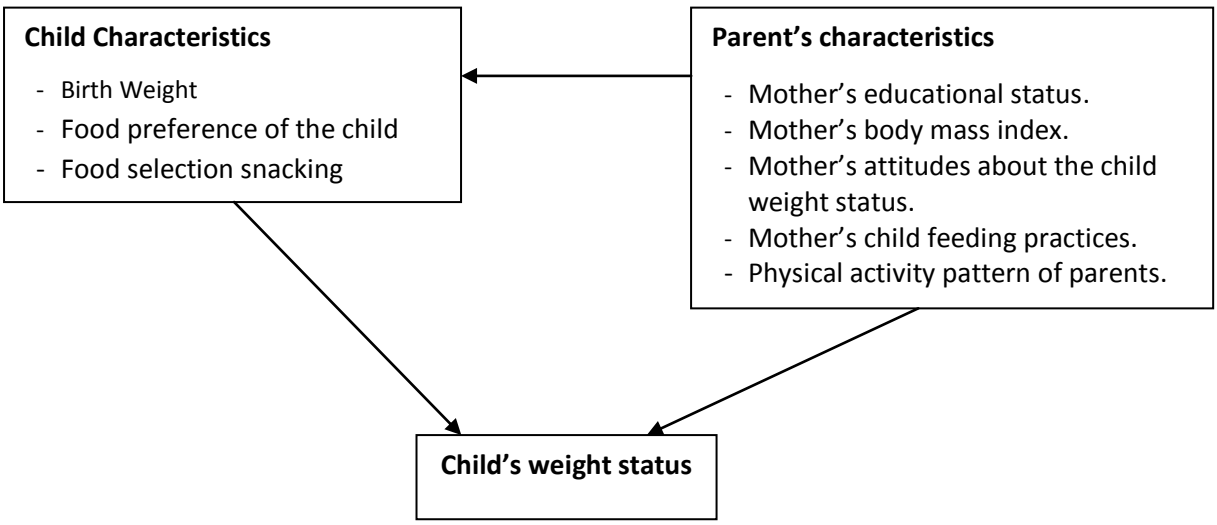
The built environment within communities influences access to physical activity opportunities and access to affordable and healthy foods, e.g. a lack of sidewalks, safe bike paths and parks in neighborhoods can discourage the children from walking or biking, and playing. Additionally, lack of access to affordable healthy food choices in neighborhood food markets can be barrier to purchasing healthy foods.

4.3.4 Socio-cultural factors

Socio-cultural factors were also found to influence the development of obesity. Our society tends to use food as reward, as a means to control others, and as part of socializing. Thus, the food can encourage the development of unhealthy relationships with food thereby increasing the risk of developing obesity.

4.4 Parent's perception of a healthy child

Parent's characteristics may influence on obesity in childhood is given in Fig. 1.



4.4.1 Child Characteristics

4.4.1.1 Age & Birth weight

There was no significant difference in the age of the children.

The birth weight of children was not significantly different in all three groups. But, the birth rate above 3.4 kg was found in 65% obese children. It was also seen that 10% of obese were between 1.15 kg., which were premature births. Premature babies in some cases have been shown to become overweight due to phase of catch up growth. Ong et. al. (2000) showed that children who showed catch up growth in height or length were heavier and taller & had a quarter BMI than other children upto five years of age. Steller et. al. (2002) confirmed that the childhood obesity might be related to high birth weight.

4.4.2.1 Food preference of the child

Children at birth have an ability to regulate their energy intake are responsive to hunger and satiety cues. If parents chronically restrict children's access to palatable snacks, children may learn to eat in the presence of food whether or not they are hungry. Obese children do not prefer of like green leafy vegetables 85% percent of overweight and obese children showed a strong preference for energy dense foods and dislikes cereals, pulses, legumes and vegetables.

4.4.1.3 Food selection – Snacking

The current environmental conditions are likely to promote obesity. Due to the availability of ready to eat foods, deep fried foods, chocolates, chips, pizza, bakery items, namkins, children consume these food items 2-3 times in between meals while watching T.V. or playing indoor games, which are more caloric intake contributes to obesity. It could be concluded that the home environment may play a major role in development of food preference and food selection of the child.

4.4.2 Parents characteristics influencing Obesity in children

4.4.2.1 Mother's educational status

There was no significant difference in the educational status of the parents. The educational status of the mother directly related to income status. Educated mothers doing job, so economic status of the family is good, which consequent increase in purchasing capacity. Thus the life style may have been more sedentary. Educated parents provide many convenience devices and transportation facilities to their child which develops obesity in children.

4.4.2.2 Mothers Body Mass Index

A statistically significant difference was found in between body mass index of the mother and three categories of children. 70% of the obese children's mothers are found to be obese and the BMI of the mother of obese children tended to be similar to the BMI of

their children. This may be attributed to the children may have a genetic constitution which could promote development of obesity, obese mothers also provide a high calories food and low physical activity environment for themselves and their children.

Tanasescu et. al. (2000) found that mothers of the obese children were heavier and had significantly higher BMI than mothers of normal children. It could also be due to the fact that mothers are more involved in the food preparation and share more meals with children.

4.4.2.3 Mothers child Feeding Practices

Mother feed their children or adopt feeding practices according to their perception they have of their child weight and bearing future consequences in mind. Prolonged and excessive breastfeeding is associated with significantly lower rate of obesity. Early introduction of energy dense supplements in infancy has also contributed to childhood obesity. The highest percentage of carbohydrate diet also responsible for weight gain in childhood.

The mothers were asked about the reaction to the child's refusal to eat about home cooked food during meal time. It was seen that 60% of the mother of normal weight children were either forced to eat or feed them only home cooked food. In obese category 40% mothers did not force their child to eat during meal times.

Sherry et. al. (2004) found similar results, stating that mothers controlled children's intake or access to foods.

Once the food preferences set in parents know what foods the childs likes or dislikes, knowingly or unknowingly they are training their children to develop a taste or preference for certain foods which they offer them to the children in the form of reward. A significant number (85.7%) of mothers of obese rewarded the children with fried foods, ready to eat food, fast foods compared to the normal weight children. Mothers of normal weight child rewarded their children with chocolate. A greater percentage (42.9) of parents of obese children rewarded their child with such energy rich snacks, more than twice a week. Sweets were commonly used as rewards.

Due to greater purchasing capacity and influences of media, most of the mothers purchase a fried snacks, biscuits and confectionery for the children. Traditional, micronutrient rich foods are being replaced by energy dense highly processed, micronutrient poor foods by the mother because of lack of time, as most of the mothers are working, such type of foods are given as reward demonstration of love, all these are

parts of new lifestyle. Thus it was concluded that obesity is highly influenced by mother's rearing practices.

4.4.2.4 Mother's attitude about their child weight status

A small percent (20%) of parents of overweight and obese children considered their child to have appropriate weight for age and height. The remaining 80% of the parents know that their child was overweight or obese but were unaware of its cause. Though the majority of overweight and obese children's mothers did feel that their child was overweight or obese. 72% of them said that they did not feel upset about being fat. While 48% of the parents felt that their child experienced certain discomfort because of the overweight. Only 41% of the parents seemed to complaint about problems faced due to the excess weight. Common complaints due to obesity are difficult in physical movement, social embarrassment, lethargy and dullness in study or activity.

It was concluded that though the large percentage of present realize that their children are overweight or obese they were unaware of its causes or a solution to the problems, so counseling is the suitable measures to overcome obesity.

4.4.2.5 Physical activity pattern of parents

One of the factors that is most significantly linked to obesity is a sedentary lifestyle of parents or physical activity pattern of parents. Television viewing among parents specially mothers has increased dramatically in recent years. So mothers are busy in television viewing children are also viewing T.V. laptop games when Mothers are busy in viewing T.V.

The majority of children go to school with their parents on a bike, Scooter or car. None of them walked on road. 53% of parents drove their children to schools. 40% of children go by school bus, only 7% of them go to school walking, as their homes are very near to school.

An important factor for obesity is the intense competition for admission to schools with flourishing tuition classes right from nursery. Children have forced to use their play time for additional studies. Also games and physical activity are restricted in many families because children are engaged in other classes such as painting, English speaking. Some parents do not like that their children are playing with other children because of superiority complex.

Most of the parents discourage their children from walking or playing due to unsafe environment. Also erosion of open spaces for exercise or playing and lack of parental time to supervise the child, all these are part of new obesogenic lifestyle. The increased amount of time spent by parents sedentary behaviors has decreased the amount of time spent in physical activity and reduced the opportunities of physical activity their children.

In this way participation in physical activity by parents is important for children, it seems beneficial effect on body weight of children. Involvement of parents with child in the exercise program and supervising the activity on a regular basis to improve compliance. Children typically indulge in sedentary activities. It is a duty of parents to force their child to do moderate intensity regular activities. Parent-child interaction may affect the behavior of children related to calories intake and physical activity, because parents are role model for their children who are likely to develop habit similar to their parents.

4.5 Preventive Strategy for obesity

4.5.1 Awareness and counseling Programme

The ideal preventive strategy for obesity is to prevent children with a normal desirable BMI from becoming overweight or obese. The strategies may be attempted at the individual or community level by counseling to the parents, by imparting community or individual education as well as enriching and reinforcing individual knowledge and skills. Implementation of Nutrition and health awareness programme for counseling the parents in schools, community level, child care centers and at individual approach through KAP (knowledge, attitude and practice) measures. The main purpose of this KAP study is to explore change in Knowledge, Attitude and Practice of the individual or at community level with respect to nutrition and health related knowledge, encouraging family meal or diet in recommended quantity, limiting consumption of energy dense foods, maintaining breakfast, the physical fitness, physical activities related aspects of lifestyle, obesity and its causes, weight control etc. This study has a potential to provide valuable information of the obesity and nutrition related aspects, as well as importance of physical activity in life amongst the parents and creating awareness amongst them.

KAP study measures Knowledge, Attitude and Practice used for counseling and create awareness amongst people. The knowledge possessed by a people refers to the understanding of about obesity. Attitudes refers to their feelings towards the obesity as

well as any preconceived ideas that they may have towards it and practice refers to the way in which the demonstrate the knowledge and attitudes through the implementation or action. It will be a more efficient process of awareness creation as it will allow the program to be tailored more appropriately to the needs of the community.

To see the impact of counseling on parents towards obesity, the data pertaining to nutrition related aspects, weight and obesity physical activity related aspects was collected from the parents of children before and after training program, which was designed for improving the knowledge about obesity and creates awareness and its impact on parents behavior towards obesity. The results obtained are presented herewith.

4.5.1.1 Nutrition and obesity

Table no. 4.10 shows that, there was a low level of knowledge about Nutrition and obesity amongst majority of parents. Therefore level of awareness is also low amongst them. However, after counseling to the parents while training, there was a significant ($P<0.05$) increase in the awareness and concepts was clear about nutrition and obesity. The percent change in the awareness ranged between -13% to 27% (Table 4.10).

Table 4.10: Change in parents knowledge due to counseling Nutrition and obesity development

	Level of Awareness	Category of Parents					
		Normal Children		Overweight Children		Obese Children	
		N = 848	%	N = 95	%	N = 57	%
Pre-Counseling	High	212	25	17	18	11	19
	Moderate	466	55	23	24	18	32
	Low	169	20	55	58	28	49
Pre-Counseling	High	322	38	31	33	25	44
	Moderate	424	50	49	51	28	49
	Low	102	12	15	16	04	07
% change	High		13		15		25
	Moderate		-05		27		-17
	Low		-08		-42		-42
Z calculated			5.5		3.2		4.6
P value			<0.05		<0.05		<0.05

4.5.1.2 Weight of children and obesity

The results indicate that before counseling there was moderate level of awareness regarding the weight of children. Comparatively the level of awareness was high in

educated parents. After counseling there was significant increase P<0.05 in level of awareness. The improvement in knowledge level was more in educated parents. The percent change in the awareness about weight and obesity in between 10-55%.

Table 4.11: Change in parent's knowledge due to counseling – Weight of children and obesity

	Level of Awareness	Category of Parents					
		Normal Children		Overweight Children		Obese Children	
		N = 848	%	N = 95	%	N = 57	%
Pre-Counseling	High	229	27	8	8	02	03
	Moderate	517	61	23	24	12	21
	Low	102	12	64	68	43	76
Post-Counseling	High	467	55	18	19	7	13
	Moderate	364	43	65	69	44	77
	Low	017	02	12	12	06	10
% change	High		28		11		10
	Moderate		-18		45		55
	Low		10		-56		-66
Z calculated			5.1		4.6		2.9
P value			<0.05		<0.05		<0.05

4.5.1.3 Physical activity and obesity

Table Number 4.12 shows that before counseling, there was moderate level of awareness regarding physical activity amongst parents of normal children, but it was found that there was low level of awareness amongst parents of obese children in relation to physical activity and obesity.

Table 4.12 Change in parent's knowledge after counseling- Physical activity & obesity

	Level of Awareness	**Category of Parents**					
		Normal Children		**Overweight Children**		**Obese Children**	
		N = 848	**%**	**N = 95**	**%**	**N = 57**	**%**
Pre-Counseling	High	76	9	04	04	02	03
	Moderate	544	64	26	27	11	19
	Low	228	27	65	69	44	78
Post-Counseling	High	382	45	11	13	14	24
	Moderate	450	53	77	81	33	58
	Low	016	02	07	06	10	18

% change	High Moderate Low		36 -11 25		07 54 -63		21 39 -60
Z calculated			4.6		2.9		3.4
P value			<0.05		<0.05		<0.05

After undergoing counseling, there was a significant (P<0.05) increase in the awareness regarding physical activity. The percent change in the awareness of parents was between >54%. 80% of the parents knew that their child was overweight or obese, but unaware of its cause so they did not feel upset about being fat.

However there was no significant difference in awareness between parents of all categories. But large variation (post counseling) can be attributed to the initial knowledge levels which conclude that counseling showed a positive improvements in the knowledge level of parents in all groups.

4.5.2 Parents Attitudes towards concepts of obesity

Table 4.13: Change in parents attitudes towards concepts of obesity due to counseling

	Level of Awareness	**Category of Parents**					
		Normal Children		**Overweight Children**		**Obese Children**	
		N = 848	**%**	**N = 95**	**%**	**N = 57**	**%**
Pre-Counseling	High Moderate Low	167 573 108	20 67 13	05 22 68	05 23 72	03 16 38	05 28 67
Post-Counseling	High Moderate Low	335 513 00	40 60 00	27 56 12	28 59 13	19 31 07	33 54 13
% change	High Moderate Low		20 07 13		22 34 -59		28 26 -54
Z calculated			1.8		2.3		4.1
P value			<0.05		<0.05		<0.05

Table 4.13 shows the results of change in parents attitudes towards obesity in children due to counseling. While study, it was observed that the parents attitudes towards obesity development in children was not clear or they were unaware about it. Before counseling there was moderate attitudes amongst the parent's of normal children towards

obesity; while low to moderate level of attitudes was observed amongst the parents of overweight & obese children.

Parents of normal children were found to have significantly favourable attitudes towards obesity in children. Furthermore, after counseling, there was a significant ($P<0.05$) increase in the level of attitudes towards overall concepts of obesity & related problems. The percent change towards attitudes was between and 12 to 41. The improvement in the attitude attributes appeared to be more or less uniform, where the parent's showed uniform improvements as a function of focused counseling can be used for changing the attitudes to use as a strategy for prevention of obesity.

4.5.3 Practice of parents

Table 4.14 Change in practice of parents with respect to concept of obesity

	Level of Awareness	**Category of Parents**					
		Normal Children		**Overweight Children**		**Obese Children**	
		N = 848	**%**	**N = 95**	**%**	**N = 57**	**%**
Pre-Counseling	High	229	23	07	07	02	04
	Moderate	517	70	18	19	08	15
	Low	102	07	70	74	47	81
Post-Counseling	High	467	48	21	22	14	25
	Moderate	364	52	55	58	32	56
	Low	017	00	19	20	11	19
% change	High		25		12		21
	Moderate		-18		24		41
	Low		-07		-36		-62
Z calculated			4.1		3.8		2.9
P value			<0.05		<0.05		<0.05

Table 4.14 shows result of the practice of parents in their day to day life with respect to their knowledge of obesity. The study results show that before counseling, significantly high percentage of parents of normal children had moderate level of practice with respect to concept of obesity & overweight. Comparatively there was not remarkable difference in the practice of parents having children of overweight and obese. However, after counseling, there was a significant ($P<0.05$) increase in the percentage of practice amongst all parents, indicated that the parents will use their knowledge in practice while developing their children in day to day life. The percent change with respect to willingness to practice was between 41 to -62. This improvement can be credited to the

counseling programme organized to impact knowledge of obesity related aspects in developing their children.

4.5.4 Impact of counseling on prevalence of obesity

Table number 4.15 represents the score of knowledge, attitude and practice amongst parents of all children regarding various aspects of obesity. All the levels of parents was determined prior to and after counseling. The effectiveness of the counseling was determined by comparing the score.

Table 4.15 Comparative assessment of effect of counseling on change in parent's knowledge, attitudes and practices

Groups	Score of change in parent's knowledge								
	Normal Children			Overweight Children			Obese Children		
Total knowledge score	70.8 ± 4.1	79.4 5.2	8.6	43.9 ± 3.9	66.9 ± 2.8	23.0	40.8 ± 1.3	69.1 ± 1.8	28.3
Obesity & Nutrition	23.5 ± 2.5	25.2 ±3.1	1.7	15.1 ±1.2	21.2 ± 2.8	6.1	12.2 ± 1.0	23.2 ± 1.3	11.0
Obesity & Weight	21.9 ± 1.7	23.9 ± 2.1	2.0	13.9 ±1.5	23.9 ± 2.5	10.0	14.7 ± 1.1	25.1 ± 0.8	10.4
Obesity & Sports	25.4 ± 2.1	30.3 ± 2.6	4.9	14.9 ± 1.1	21.8 ± 1.9	6.9	13.9 ± 0.7	20.8 ± 0.5	6.9
Total Attitude score	93.8 ± 5.2	107.1 ± 5.0	13.3	56.7 ± 1.8	78.3 ± 1.6	21.6	45.3 ± 0.7	83.1 ± 1.2	37.8
Obesity & Nutrition	32.2 ± 3.4	36.2 ± 4.0	4.0	18.0 ± 2.9	24.8 ± 3.3	6.8	14.8 ± 2.9	26.5 ± 3.2	11.7
Obesity & Weight	33.6 ± 4.8	38.9 ± 4.4	5.3	16.9 ± 2.7	27.1 ± 2.8	10.2	12.5 ± 1.5	28.8 ± 2.9	16.3
Obesity & Sports	28.3 ± 6.2	32.0 ± 6.2	3.7	21.8 ± 1.4	26.4 ± 1.8	4.6	18.0 ± 2.4	27.8 ± 1.7	9.8
Total Practice score	68.4 ± 6.7	70.9 ± 4.5	2.5	46.9 ± 2.8	65.9 ± 5.8	19.0	42.8 ± 4.1	68.6 ± 1.4	25.8
Obesity & Nutrition	22.2 ± 1.8	23.4 ± 2.0	1.2	14.3 ± 1.4	23.4 ± 2.0	9.1	13.2 ± 2.8	23.1 ± 1.2	9.9
Obesity & Weight	23.9 ± 3.5	24.6 ± 1.7	0.7	13.4 ± 2.9	22.1 ± 2.7	8.7	14.4 ± 2.0	24.0 ± 1.5	9.6
Obesity & Sports	22.3 ±2.9	22.9 ±3.0	0.6	19.2 ± 1.8	20.4 ± 2.5	1.2	15.2 ± 1.9	21.5 ± 1.7	6.3

Test score for overall knowledge of parents before and after counseling for parents of normal children was 17.8 ± 4.1 and 79.4 ± 5.2 respectively, overweight children parents score was 43.9 ± 3.9 and 66.9 ± 2.8 respectively. Obese children parent's score was 40.8 ± 1.3 and 69.1 ± 1.8 respectively. The comparison of scores showed significant ($P<0.05$) difference in the change in knowledge levels of all category parents. More

specifically, the change was higher in the overweight and obese children's parents. Subsequently for the overweight and obese children's parents the trend in the change in knowledge levels was moreover similar.

Table 4.15 indicates the result pertaining to the attitude of parents of all category children regarding various aspects of obesity development. For the parent's of normal children, score for overall attitude with respect to obesity was 93.8 ± 5.2 and 107.1 ± 5.0 before and after counseling respectively. Overweight children parents score was 43.9 ± 3.9 and 66.9 ± 2.8 and children's parents score was 40.8 ± 1.3 and 69.1 ± 1.8 respectively before and after counseling. Subsequently, the change in the score was more higher in obese children and followed by overweight parents. The comparison of score showed significant ($P<0.05$) difference in the change in attitude levels of all category parents.

Table 4.15 presents result pertaining to the practice levels of parents of all category of children. For the normal children parents, score for overall practice towards obesity prevention was 68.4 ± 6.7 and 70.9 ± 4.0 before and after counseling respectively. While the score of parents of overweight children was 56.7 ± 1.8 and 78.3 ± 1.6 and for parents of obese children was 46.3 ± 0.7 and 83.1 ± 1.2 before and after counseling respectively. The comparison of the score showed there was higher change in practice of obese children parents and followed by overweight children's parents.

Summary and conclusion

Conclusions obtained after critical analysis of the collected data and the recommendation made their off. The silent findings and the conclusions drawn are as follows.

Highlights of the present study:

Section I

- The data obtained indicated that prevalence of obesity was found amongst 1000 children of 3 to 6 years of age.
- Samples collected from four districts of Vidarbha region.

The percentage of overweight was found higher in boys (5.5%) than girls (4.0%). Prevalence of obesity was found 3.2 boys and 2.5 girls. Total prevalence of obesity and overweight was found 15.2%. Percentage of normal children was 84.8%.

Section II

Results of anthropometric data shows that

- There is distinct difference in height of amongst all category children.
- Overweight and obese children found to be markedly taller than their normal weight counter parts. Mean height of normal weight children was 104.6 cm in boys and 103.8 in girls. In overweight children boys height were 105.6 cm and mean height of a girls was 104 cm. In obese children mean height of boys were 107.8 cm and in girls 104.9 cm.
- Mean weight of overweight and obese boys were 0.7 to 1% more than their normal weight counterparts and in girls it was 0.4 to 1.28% more than their normal counter parts.
- The result indicates that there was a marked difference in weight of all categories. Weight of overweight boys was 67% higher and weight of obese boys was 75% more than their normal counterparts. Similar trend was found also in girls.
- Overall obese and overweight children of both sexes were little taller than there non-obese peers and 65 to 75% weight is more than their normal counterparts.
- It was found that the children whose weight 120% above the standard weight comes under the category of overweight and obese.

- The data clearly indicates that the weight was highly increased in obesity because body weight is reasonably correlated with body fat but is also highly correlated with height.-
- The body mass index (BMI) the obese children were also related to the triceps skinfold measurements.
- According to triceps skinfold measurements, 95 children were overweight and 97 children where obese.
- Triceps skinfold measurement was classified on the basis of 85th and 95th percentile of triceps skinfold thickness.
- Mean mid arm circumference of girls were more than boys in each category.
- BMI changes physiological with age and sex.
- BMI >23 is overweight and BMI<25 is obese.
- BMI of overweight children was within the range of 25.45 to 26.29 boys and girls respectively.
- BMI of obese children was within the range of 27.98 to 29.25 in boys and girls respectively.
- It was concluded that the children whose weight are above the 120% may come under category overweight and obese.

Section III

- Childhood obesity is the result of an imbalance between the calories, child consume as a food and beverages and the calories spent by child for growth and development, metabolism and physical activity.
- Genetic comedy and environmental factors influences on the imbalance of calories.
- These factors are moderated by age, gender, family characteristics, parenting style, lifestyle and activity behaviors.
- Factors such as school policies, demographic and parents work related aspects also play a role.
- Influence of mother's weight is more than the father's weight on weight of children.
- If both parents are overweight or obese, a majority of children are overweight/obese.
- Overweight and obese children takes 40-50% and 50-60% calories respectively from fats.
- Obese and overweight children showed strong preference for energy dense foods.
- They dislikes green vegetables, legumes and cereals in diet.

- Snacking habit is between meals is more common among them.
- Physical activity is an important determinant in maintaining body weight.
- Overweight and obese children do not enjoy sports activity in school or at home.
- They like sedentary activities such as painting, reading, watching T.V. video, tabs and indoor games.
- The mothers of children reported that the odd school timing and work load of study is the main contributing factor to less physical activity.
- Obese and overweight children spent 21/2 to 3 hrs/day in watching TV, video games.
- Children who are watching TV consumed almost 400 calorie more per day.
- More obese children where lazy and enjoyed sedentary activities.
- Home, care, school and community environments influences children's behaviour related to food intake and physical activity.
- The type of food in the family, food preference by family, family meal time, family habits of activity like physical and sedentary influences eating habits of children.
- 60-70% of the children were stay in the child care, or boarding school the environment of it influences the eating and activity pattern of children.
- Schools are the ideal place for teaching children healthy eating and physical activity behavior.
- Lack of sidepaths, bikepaths and park in neighborhood can discourage the children from walking or biking and playing or do the physical activity.
- Socio-cultural factors was also found to influence the development of obesity.
- There was no significant difference in the age of child though the birth weight above 3.4 kg was found in 65% of obese children. Also it was found that 10% of obese children having weight of 1.15 kg.
- Today's children were not like green leafy vegetables. They were show the strong preference for energy dense foods.
- Home environment and play a major role in development of food preference and food selection.
- Mostly educated parents adopt sedentary pattern of life and they provide many convenience devices and transportation facilities which develops obesity in children.
- 70% of the mothers of obese children were heavier and had significantly BMI than mothers of normal children.

- Prolonged and excessive breastfeeding is associated with significantly lower rate of obesity.
- Early introduction of energy dense supplements in infancy has also contributed to childhood obesity.
- A significant number 85.7 of mothers of obese children rewarded the children with fried foods, ready to eat foods, fast foods, etc.
- Due to greater purchasing capacity and influences of media, most of the mothers used ready to eat foods, ready made snacks, sweets and energy dense foods for children.
- 80% of the parents know that their child was overweight or obese but they were unaware of its causes and consequences of obesity. So 72% of them said that they did not feel upset about their child being fat.
- Sedentary life cycle of parents most significant to development of obesity in children. Majority of children go to school with their parents, on car, bike or scooter, 40% of them go by school bus, van or auto.
- An important factor for obesity is the intense competition for admission to school with flourishing tuition classes right from nursery. Children have post to use their play time for additional studies. Also children are engaged in other hobby classes forcefully. So there is no time for playing are doing physical activity. Now a day, parents do not like play our child with others due to superiority complex.
- Participation of parents in physical activity increases the interest of children in physical activity like games and sports. It is duty of parents to force their child to do moderate intensity physical activity regularly.
- Parents are role model for their children who are likely to develop habits similar to their parents.

Section IV

- To see the impact of counseling on parents towards obesity, the data pertaining to nutrition, weight of children, health, obesity related aspects such as physical activity & sports, lifestyle, energy dense foods, dietary pattern. The information was collected from the parents of children before and after counseling.

The conclusions drawn from this program are as follows

- Level of parents' knowledge about Children's nutrition and health of child is low amongst all categories, knowledge level high in parents of normal children than overweight and obese children's parents, before counseling.
-After counseling to the parents, there was a significant ($P<0.05$) increase in the percentage level of awareness and knowledge in all aspects of obesity amongst parents of all category.
- The percent change in the awareness and knowledge about nutrition and obesity ranged between 13% to 27%.
- Before counseling there was low to moderate level of awareness regarding weight of the children and obesity. After counseling there was improvement of knowledge in the range between 10-55%
- There was low to moderate level of awareness regarding physical activity of children and obesity but after counseling the percent change in awareness of knowledge in between 7 to 54%.
- 80% parents knew that their child was overweight or obese but they were unaware of its causes and consequences, so they did not feel upset about being their child fat.
- Above results shows that counseling gives a positive results in improvement in the knowledge level and aware the parents about facts and consequences of obesity.
- Parents' attitudes towards obesity development in children was not clear, before counseling they were not bothered about it or not thinking.
- After counseling there was a significant ($P<0.05$) increase in the level of attitudes towards overall concept of obesity and related aspects. The percent change towards attitudes was in between 12 to 41%.
- It proves that the counseling program can be implemented for changing the attitudes of parents towards obesity.
- Parents were not used their knowledge to practice in their day to day life because they were unaware about the facts and consequences of obesity. But after counseling there was a significant improvement in the knowledge and attitudes towards obesity. So they use their knowledge, to practice while raring their children in day to day life. The percent change in willingness to practice was in between 12 - 41%.
- The effectiveness of the counseling was determined by comparing the score obtained before and after counseling.

- The score for overall knowledge of parents before and after counseling was 70.8 ± 4.1 and 79.4 ± 5.2 respectively of normal children's parents.
- Score for overweight children's parents was 43.9 ± 3.9 and 66.9 ± 2.8 and score for obese children parents was 40.8 ± 1.3 and 69.1 ± 1.8 before and after counseling respectively.
- The score of change was high in the overweight and obese children's parents in knowledge, which was moreover similar.
- The score of overall attitudes of parents of normal children was 93.8 ± 5.2 and 107.1 ± 5.0 before and after counseling respectively, for parents of overweight children score was 43.9 ± 3.9 and 66.9 ± 2.8 and for obese children parents score was 40.8 ± 1.3 and 69.1 ± 1.8 respectively.
- The change in score towards change in attitudes was higher (37.8) in obese children's parents and followed by overweight children's parents (21.6). P the comparison of the score showed significant (<0.05) difference in the change of attitudes.
- The score of overall practice level due to counseling program in parents of normal children was 68.4 ± 6.7 and 70.9 ± 4.0. While score for parents' of overweight children was 56.7 ± 1.8 and 78.3 ± 1.6 and for parents of obese children, the score was 46.3 ± 0.7 83.1 ± 1.2 before and after counseling.

Recommendation and Suggestions

Obesity in children has risen to significant levels globally with serious Public Health consequences. Unless this epidemic is contained at a war footing the implications of this global phenomenon on future generation will be serious. The reversibility of obesity with suitable intervention strategies should be seen as an opportunity and efforts pursued with vigour.

The treatment of overweight and obesity in children requires a multidisciplinary approach with a holistic outlook. The immediate goal is to bring down the rate of weight gain, followed by a period of weight maintenance and finally weight reduction to improve BMI. The long term goal is to improve quality of life and reduction in morbidity as well as mortality associated with overweight and obesity.

For obese children in the same group, weight maintenance is attempted. A minimal weight loss of 0.5 kg/month may be permitted. If the child BMI is more than 99^{th} percentile, a moderate weight loss of not more than 1 kg/week may be attempted.

The components of overweight and obesity treatment include dietary management – a balance diet supplying adequate calories, physical activity enhancement, restriction of sedentary behavior.

Dietary management should aim at weight maintenance or weight loss without compromising appropriate calorie intake and normal nutrition.

Due emphasis should be given to initiate and maintain healthy eating patterns. Due emphasis should be given to reduction of eating outs, fast food, bakery and confectionery items, sweets, junk foods, high calorie and high fat foods.

Planning for healthy snacks, balanced diet, adequate intake of fruits and vegetables, fiber content in diet. It is important to maintain healthy components of traditional diets.

Moderate intensity regular physical activity is essential for the prevention of overweight and obesity, as well as for the treatment of same. Children should engaged in not less than 60 minutes of moderate to vigorous physical activity per day to achieve optimum weight and general well-being. Children should be encouraged to walking or cycling to school and playing with friends in the ground.

Decreasing sedentary behavior is more important. In our country chief sedentary behaviors are television watching, computer, video games telephone conversations, and importantly tuition classes. Every hour of sedentary activity increase the chance of

obesity and failure of weight reduction. Screen time should be restricted to less than two hours per day. Excessive TV viewing is associated with higher energy dense foods. So, TV time restriction is an excellent opportunity to complement dietary management and encourage the child to play outdoor games.

Parents play a crucial role in regulating and developing the eating habits, and lifestyle of children. Parents need to be aware and educate about the importance of balanced diet, physical activity in maintaining a desirable body weight. So the counseling training program is the best strategy for obesity to prevent children from becoming overweight or obese. Community level interventions includes advocacy to increase physical activity at schools, creation of environments that support physical activity. Regular guidance and counseling regarding diet and physical activity will enhance awareness and get positive results. Imparting and implementing training programs to empower parents and school teachers to provide nutrition and physical education.

It is recommended that setting based intervention and multicomponent interventions aimed at diet, physical activity and cognitive change which makes the approach a holistic and efficient one with demonstrable and desirable results.

Suggestions

Any attempt to contain the massive epidemic of childhood obesity will only be fruitful if it is supported by sufficient evidence garnered by appropriate research. Though the evidences growing in this area, significant deficiencies exit in the areas of equity epidemiologic transitions in childhood obesity, correlations of obesity to cardiovascular risk factors, efficacy of locally designed interventional programs, identification and assessment of population determinants of childhood obesity. Research in this field should be done. Early application of such evidence generated to bring in public health policy changes.

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