Review of Literature

2. REVIEW OF LITERATURE

The review of literature pertaining to the present study on "**Diet and lifestyle of obese children in the selected districts of Kerala and Tamil Nadu and the impact of Medical Nutrition Therapy**" is discussed under the following heads:

A. Childhood: A crucial period in the life cycle of an individual.
B. Childhood obesity: An overview
C. National and global scenario of childhood obesity
D. Causes and Consequences of childhood obesity
E. Medical Nutrition Therapy: Need of the hour.

A. CHILDHOOD: A CRUCIAL PERIOD IN THE LIFE CYCLE OF AN INDIVIDUAL

Childhood begins after babyhood at approximately the age of two years and extends to the time when the child becomes sexually mature at approximately 13 years for the average girl and 14 years for the average boy (Devdas, 1996). Although epidemiologic studies have provided indicators as to which children are at risk of becoming obese, the etiology of childhood obesity is still unknown.

Bhargava et al. (2004) reported that in the study in India, low birth size was associated with early adiposity rebound and impaired glucose tolerance.It was reported that total energy expenditure was lower in 18 infants with overweight mothers than in infants with underweight mothers, however these results were not substantiated by two recent studies of infants of obese mothers (Stunkard, 1999).

Psychodynamic formulations deal with obesity as a symptom of unresolved oral dependency needs. In spite of the common parental concept of the overweight child as healthy or sturdy it is nonetheless true that juvenile obesity is an abnormal condition. The obese child is a handicapped child.

Therefore obesity is the most frequent nutritional disturbance of childhood in the developed countries and can persist into adult life.

The environment that parents create by way of their own dietary and physical activity behavior may have a lasting effect on children's weight and their emerging obesity risk behavior such as the dietary pattern (Davidson *et al.,* 2006). Nutritionist texts recommend breakfast as an important part of healthy eating habits. Despite these recommendation millions of children routinely skip breakfast. There is a growing agreement among expert that an obesogenic environment which encourage excess food intake and idealizes thinness, plays a crucial role in the epidemic of childhood obesity and eating disorders (Golan, 2004).

James and Kerr (2005) suggested that there is an association between obesity and consumption of soft drinks. Initiatives focusing on reducing the consumption of soft drinks may help to prevent further increase in obesity. Children consume sugar sweetened drinks in addition to their normal energy intake and consequently have a total energy intake that exceeds their requirements (Ludwig *et al.,* 2001).

Fried *et al.* (2002) stated that fast food and soft drinks may have detrimental effects on the nutritional status of children and an increased consumption of these food items may lead to obesity and future health problem. In spite of this school system continue to allow these junk foods to be sold in schools.

Food choices are influenced by wide range of economic, social and behavior variables, including food availability. However the desire to select one food over another is more closely linked to taste and other sensory properties of food (Mela, 2001) Recent studies suggest that there may be a taste component in human fat perception, although a specific fat taste receptor in humans has not yet been identified (Mattes, 2001).

The increasing prevalence of obesity in the United States has been paralleled by an increase in energy intake. Two highly palatable dietary

ingredients, sugar and fat account for almost 60 percent of the daily energy content of the typical American diet, sugar accounts for 22 percent and fat accounts for 37 percent (Drewnowski, 1995).

A review argued provocatively that diets high in fat do not appear to be the primary cause of the high prevalence of excess body fat in our society and reductions in dietary fat will not be a solution (Willett, 1998).

A wealth evidence supports a role for decreased physical. activity, increased television time and increased consumption of sugar, sweet and beverage in the current rise in childhood obesity (Malina, 2005).

Less compelling data attribute blame to lack of breast feeding, skipping breakfast, reduced intake of fruits and vegetables and other sources of dietary fiber, fewer family meals and more fast food restaurant dinning (Lairon, 2007).

Fast food restaurants use was associated with greater intakes of soft drinks and lower intakes of fruits, vegetables, grains and milk (Hannan *et al.,* 2001). Snack food consumption showed trends similar to those of fast food consumption in children in the past three decades, the prevalence of snacking has increased as has the prevalence of overweight in children (Ogden, 2000).

Lytle *et al.* (2000) found that the proportion of children consuming soft drinks daily almost tripled, but milk consumption decreased by 10 percent. The role of parental influences on children's food intake may be particularly important in understanding the development of childhood obesity. The rising prevalence of obesity in children has been linked in part of the consumption of sugar sweetened drinks (Karen, 2001).

B. CHILDHOOD OBESITY: AN OVERVIEW

Childhood obesity is a very grave problem found in children nowadays. It generally refers to the age group of 6 – 11 years old. Obesity in childhood is a major public health and economic problem of global significance because it is highly prevalent and is rapidly increasing (WHO, 2000). Overweight and obesity in children is the third most serious risk factor for both developed

countries and low mortality in developing countries (World Health Report, 2002).

Childhood obesity is one of the most prevalent nutrition problems among children exceeding iron deficiency anaemia; the previous leader. Poor food choices are often to blame for obesity. Flirting with excessive snacking, frequent romps to fast food restaurants and "Just-this-one" high fat food choices all contribute to childhood obesity (Williams *et al.,* 2003). Childhood obesity is a complex disease influenced by genetic and environment factors and their interactions. It is a major risk factor for metabolic diseases, each of which is influenced by their own specific genes and environmental factors (Butte, 2006).

A potential emerging public health issue, the increasing incidence of childhood obesity in developing countries may result in socio economic and public health burden faced by these countries in the near future (Kelishadi, 2007). Costal (1997), states that until the later of twentieth century childhood obesity was a rare phenomenon. Several reports showed increasing rates of obesity in developed countries due to urbanization and increased purchasing power when the extent of the problem keeps growing in developing countries (De Onis, 2000).

Kosbi *et al. (*2003) warned that childhood obesity has been estimated that worldwide over 22 million children under the age of five are severely overweight or obese from the late 1990's up to 2003. Current estimates suggest that one in four children is overweight or obese in United States and the scenario is almost becoming the same in India (Sylvia, 2003).

Childhood obesity has reached epidemic levels in developed countries. Twenty five percent of children in United States are overweight and 11 percent are obese (Merchant, 2005). In a National Survey of American Indian children 5 to 18 years old, 39 percent were found to be overweight or at risk for overweight (US Department of Health and Human Services, 2004). The global prevalence of overweight and obesity in children aged 5 to 17 years is

10 percent and it varies from over 30 percent in America to 2 percent in sub Saharan Africa (Swati *et al.*, 2008).

- **Measurement of childhood obesity**

Childhood obesity has increased in both developed and developing countries although pace and pattern differ from country to country. It has been studied that percentage of body fat for the same weight is higher in Indians.

- **Body Mass Index (BMI)**

This is the most widely used index to assess overweight, fairly reliable and practical measure for adiposity for clinical as well as epidemiological purposes. It correlates with other measures of body fatness in children and adolescents an also with markers of secondary complications of obesity including current blood pressures, blood lipids and with long term mortality. A limitation of Body Mass Index (BMI) is that it cannot differentiate an obese individual from muscular one. It also cannot locate the site of fat. For example people with central obesity may have normal Body Mass Index. Children with similar Body Mass Index (BMI) can have wide range of body fat. Fat percentage can range from five to forty nine percent for a Body Mass Index (BMI) of twenty kg/m^2. The sensitivity of Body Mass Index (BMI) for measuring obesity is highly variable. According to World Health Organization (WHO) classification adults whose Body Mass Index (BMI) is greater than twenty five is considered as overweight and more than thirty is considered as obese. WHO classification underestimates obesity in Asians. The International Obesity Task Force (IOTF) classification of obesity for adults is as follows. Body Mass Index (BMI) greater than twenty three is categorized as overweight and more than twenty five is considered as obese.

- **Body Mass Index reference chart for children**

BMI values for adults are age independent for both sexes. In children, BMI changes physiologically with age and sex. The two main BMI charts that can be used as reference are National Centre for Health Statistics (NCHS)

and Centre for Disease Control (CDC) charts. Assessing paediatric obesity is not as straight forward as it may seem, but there is now a consensus that Body Mass Index should be used for clinical practice and epidemiology. Body Mass Index values in children are much lower than in adults, and Body Mass Index changes with age. So Body Mass Index cut offs to define obesity in adults are not appropriate for children. National Body Mass Index reference data are now available and are widely used and recommended (Reily, 2000).

>95th percentiles: obesity

- **Waist Hip Ratio (WHR)**

High Waist Hip Ratio indicates increased central fat distribution and cardio metabolic risks in adults but it is a poor indicator of central fat assessment in pre pubertal children and adolescents compared to waist circumference. Waist Hip Ratio greater than 0.9 is considered as central obesity. The adult cut off for WHR is 0.85 for males and 0.90 for females in Indian context.

- **Waist Circumference (WC):** Waist Circumference is highly sensitive and specific measure of central obesity. Cut off values for risk is 80 cm in adult males, 90 cm in adult females and 71cm in pre pubertal children.

- **Bio Impedance Analysis (BIA)**

This is a non invasive, cheap, reliable estimation of body composition using small portable instrument. It requires trained personnel, standardized conditions and adequate hydration status. However it over predicts fat in lean muscular individuals and under predicts in adults.

- **Dual Energy X ray Absorptiometry (DEXA)**

This method accurately estimates whole body as well as regional bone density, lean mass and fat mass over a wide range of ages and body sizes. It is non invasive with minimum radiation but very expensive.

- **Skin Fold Thickness (SFT) and Mid Arm Circumference**

It has not been validated as a marker of obesity in population studies. Body fat percentage can be calculated from prediction equations using multiple skin fold measurements. The cut offs values for obesity is thirty percentage body fat in girls and twenty to twenty five percent body fat in boys. Skin Fold Thickness is affected by gender and ethnicity which leads to inter and intra observer variations and has no significant advantage over Body Mass Index (BMI).

- **Air Displacement Plethysmography (BOD-POD)**

This is an expensive, sophisticated new technique. It is accurate, non invasive and comfortable. It is not suitable for young children as it needs considerable corporation.

- **Psychosocial and Medical Consequences of Childhood Obesity**

Obesity affects every organ in a child's body and it can do so in a much more profound way than in adults because children are still growing and developing, Ludwig (2003) says. Obesity and associated diseases could become major problems in the future since malnutrition during fetal development and early childhood are predisposing factors. Already overweight is creating an extra burden for countries where malnutrition and nutritional deficiencies are still observed in young children (Maire, 2000).

Looking at the long term consequences, overweight children and adolescents have a 70 percent chance of becoming overweight or obese adults, which increases to 80 percent if one or more parent is overweight or obese(Leann, 2003).

Obesity in childhood is not a benign condition despite the popular belief that overweight children will outgrow their condition. The longer the child has been overweight, the more likely is the child to become overweight during adolescence and adulthood (Goran, 2001). The health consequences of

childhood obesity with reference to Asian Indians indicate that about one-third of obese or overweight urban children have insulin resistance (Misra, 2007).

Childhood obesity is associated with several metabolic and endocrine rearrangements including glucose intolerances, hypertension and dyslipidemia that predispose to early development of type II diabetes, cardiovascular diseases and non alcoholic fatty liver disease (Must *et al.*, 2000). Excess body weight in children dramatically increases the risk of developing heart diseases in adulthood, research shows, including a decade's long study in Denmark (2003).

Sleep apnea is increasingly identified in obese children, it is estimated that sleep apnea occurs in seven percent of obese children and it directly diminishes participation and academic performance. Obese children also have elevated screen levels of cholesterol, triglycerides and glucose intolerance (http://ezinearticles.com/?obese-kids,-facts-prevention-and-solutions and id = 1995733).

In addition to health concerns, the psycho social impact of childhood obesity is great for children. Obese kids usually have poor self images and low self esteem (Jill, 2008). Obese children are subject to considerable psychosocial disadvantages such as ridicule teasing and being ignored or excluded from games and other activities.

Children with obesity experiences significant social and psychological stresses. The difficulties included being frequently harassed, intimidated and excluded from other activities (Nabil, 2001).

Obese kids also may be prone to low self esteem that stems from being teased, bullied or rejected by peers. Kids who are thus unhappy with their weight may be more likely to develop unhealthy eating habits, be more prone to depression, be at risk for substance abuse, develop serious medical problems in their adulthood (http://kidshealth.org/parent/general/body/overweight_obesity.html).

Around 27 percent of children are overweight and research suggests that the main problem is the continual reduction in the amount of exercise children take. Many overweight children have overweight parents – often a matter of family lifestyle (Trisha, 2006). Pai (2004) reported that prevalence of childhood obesity is increasing in India and is estimated to be around 15 to 18 percent in Indian children. Ramachandran (2002) reported that the prevalence of obesity in South Indian children is 3.1 percent and overweight is 16.8 percent.

Obesity is caused by two simple factors - an unhealthy diet (typically too rich in sugar and fats) and not doing enough exercise to burn off the calories consumed. Occasionally, there are other factors, for example in a rare genetic condition called Prader-Willi syndrome there may be problems with controlling hunger. Hypothyroidism and Cushing's syndrome also cause obesity (Macnair, 2007).

Obesity is a major public health concern with an over increasing prevalence in adult and childhood populations (James *et al.,* 2000) Childhood obesity appears to be increasing rapidly in the developing world. Furthermore several recent studies suggest that the developing world now confirms the dual challenge of competing chronic under nutrition characterized by short stature and over nutrition reflected by a high weight for height, in the same persons (Paton *et al.,* 2005).

Post natal rapid weight gain has been suggested to be a risk factor for later obesity (Kamanika *et al.,* 2003). Parson *et al.* (2003) states that breast feeding protects against obesity. Von kries *et al.* (1999) found in children aged 5 and 6 years a substantial doe's dependent protective effect of breast feeding was associated with a 35 percent reduction in obesity at the age of 5 to 6 years.

Birth weight, parental obesity, sleep duration, television viewing, size in early life (8 months -18 months), weight gain in infancy, catch up growth and early adiposity rebound (before 43 months), and Body Mass Index are associated with the risk of childhood obesity (Dorosty *et al.,* 2000).

Trueth *et al.* (2003) stated that heritability of adiposity may be an important contributing factor to increase the body fatness. Maffeis (2003) suggest that genes involved in weight gain do not directly cause obesity, but they increase the susceptibility to fat gain in obese children.

Genetic predisposition to obesity is high, with the heritability of Body Mass Index estimated to be 50 to 90 percent (Meale *et al.*, 1997). Obesity has an important genetic and familial compound and environmental factors are probably the predominant factor in the current epidemic.

Parental obesity may increase the risk of obesity through genetic mechanisms or by shared familial characteristics in the environment such as food preferences (Francis *et al.*, 2003). Body weight development during childhood may be determined by early development and parenteral and genetic inherences; however behavioral factor, such as attitude towards eating and physical activity may also play an important role (Vogels *et al.*, 2006).

A decrease in energy expenditure through decreased physical activity is likely to be one of the major factors contributing to the global epidemic of overweight and obesity (WHO Technical Report, 2003). Children are satisfied with sedentary life styles, while include too much television viewing and playing video games and not enough physical activity (Ebony, 2006).

Obese children are at increased risk of discrimination. Obese children are less likely to be accepted into schools, less likely to be married and to be economically 'well off' in adulthood. Being overweight or obese is also more likely to have a negative impact on life satisfaction and future life aspirations of young women. This may be because girls are judged specifically on shape more than boys (Gortmarker *et al.*, 2003).

It has been shown that focusing on reducing sedentary behavior and encouraging free play has been more effective than focusing on forced excessive or reducing food intake in preventing already obese children from gaining more weight (Grund *et al.*, 2001).

Risk factor assessment: The following risk factors that contribute to childhood obesity were assessed.

- **Eating and Ingestive Behaviour**

When total calorie intake exceeds total calorie expenditure, it will contribute to excess weight gain. Unhealthy eating pattern, wrong choices of food, peer pressures, presentation of food by parents, interaction with others at meal times rather than hunger driven and thus making it a very complex behaviour. Traditional micro nutrient foods are being replaced by energy dense foods, highly processed with increased portion size, thus affecting the nutritional status of children adversely. Advertisements have a great influence in the snacking, nibbling and junk food consumption of children.

- **Physical Activity Level and Sedentary Pursuits**

Physical activity in children is decreasing due to an increase in the sedentary activities including television and computer viewing, video games, gossip sessions, increased use of telephones and mobiles.

- **Obesogenic Schools and Tuition Classes**

Increased hours spend at schools and home work due to intense competition for admissions to schools and colleges, tuitions right from nursery levels resulted in less time spend in outdoor games. Most schools do not have any play grounds and games classes have been replaced by additional extra classes.

Built Environment

Lack of space, sidewalks, shopping venues not at walking distance, lack of recreational activities nearby homes, living away from friends and other environmental factors are likely to influence the physical activity level of children. Single parent families are on rise in urban areas and thus safety concerns also lead to restrictions of going outdoors.

- **Ethnic Variations**

Asians adults are found to have three to five percent higher body fat content than Caucasians of same BMI, but for the same body fat percent, Asians have three to four units lower BMI compared to Caucasians. Lower BMI cut offs have therefore been suggested for Asian population.

- **Gender Differences**

In a study among Indian children, boys had higher prevalence of overweight than girls. On the other hand adult women are reported to be more overweight than men in low and middle income countries.

- **Biological Determinants**

The current rise in the prevalence of childhood obesity cannot be entirely due to genetic predisposition but genetic factors related to intrauterine programming, maternal health and nutritional status do play a role in making certain individuals more susceptible to weight gain than others.

- **Pubertal Stage**

Accelerated growth in childhood is associated with early maturation and greater risk of overweight not only in adolescence but later in adulthood as well.

- **Socioeconomic status**

Reports suggest that income and Socio Economic Status (SES) is variably associated with obesity in developed and developing countries. Studies from Seychelles and India indicate that urban children from upper and Socio Economic Status (SES) were almost at twice the risk to develop obesity as compared to those from lowest and Socio Economic Status (SES) groups. Being poor in a middle income country may carry more risk of being obese than being richer in the same country.

- **Urban Rural Gradient**

Reports from developing nations suggest a disproportionate rise in childhood overweight prevalence in urban areas over a short span of time. In India reports from urban schools suggested childhood overweight of 7.4 to 10.4 percent with particularly no data from rural areas

- **Prenatal Over-nutrition and Early Feeding Practices**

Gestational Diabetes is common in mothers and its association with high Body Mass Index and central obesity is well accepted. Fat located centrally and around visceral is metabolically more dangerous than peripheral fat. Several longitudinal studies in India have highlighted the deleterious effect of accelerated weight gain in childhood especially in low birth weight babies.

Frequent contact with health professionals from an early age has been identified as an important strategy for effective management of obese children through the provision of advise, encouragement and support for adopting healthy household eating and exercise patterns in an early stage in life (Pronk *et al.,* 1999).

The rapid rise in childhood obesity has been mirrored by an explosion of sedentary leisure pursuits for children such as video games, computers and television watching (Anderson *et al.,* 1998). Fox *et al. (*2004) stated that similar to adult, childhood obesity has recently become a serious threat to public health. Children face the same environmental and life style changes that have made high energy dense food and drink, increasingly available and opportunities for energy expenditure through transport and active play less likely.

Television viewing is associated with childhood obesity. Eating during screen time and eating highly advertised foods are two of the hypothesized mechanisms through which television could affect children's weight (Matheson, 2004).

Television viewing has been suggested to be one of the main contributors to the rising prevalence of childhood obesity. It replaces physical

activity and it reduces resting metabolism. In addition, energy intake indirectly causes an increase of energy intake through adverting effects and or through providing increased opportunities for snacking and grazing behavior (Halfored *et al.,* 2004). Physical activity in the form of structured exercise contributes to the creation of an energy deficit by increasing total energy expenditure and this can promote weight loss. It has been reported that life style approaches to physical activity may result in cardio respiratory fitness and body weight changes that are similar to what is observed with more traditional forms of exercise (Dunn *et al.,* 1999).

Primary prevention of obesity must include environmental strategies that address the many societal factors that influence energy imbalance specifically diet and physical activity (Atlanta, 1996). Modern inactive lifestyle is at least as important as diet in the etiology of obesity and possibly represents the dominant factor (Jebb, 1995).

Price may be another incentive that could affect food choices, because it has been reported that when the price of lower-fat or healthy food item is reduced, there is an increase in the purchase of these foods (French. 2003).

C. NATIONAL AND GLOBAL SCENARIO OF CHILDHOOD OBESITY

For the last three decades, prevalence of obesity has nearly quadrupled for 6 to 11 year old children and tripled for 12 to 19 years old. Although rates vary among different ethnic groups, the overall prevalence of childhood obesity is 17.1 percent. In both developed and developing countries, proportionately more girls are overweight than boys, particularly in adolescence (Sandy, 2009).

Obesity occurs when energy intake exceeds energy expenditure. There are multiple etiologies for this imbalance that is genetic and environmental. Some endocrine diseases like hypothyroidism, Cushing syndrome, hypothalamic disorder, growth hormone deficiency, pseudohypo-

parathyroidism and lepton deficiency or resistance may cause childhood obesity, but vast majority of obese children are due to non-endocrine causes like wrong life style preference and cultural environment, the gene pool has not changed in the last 30 years, but the environment has (Sanjeev, 2009).

When compared to the prevalence studies done before two decades or more in Kerala, it was found that the rate of underweight is reducing, but at the same time the rate of overweight and obesity is increasing. Studies done by Ramachandran (2002) in 1000 adolescent children of Thiruvananthapuram and Geetha (2003) on high school girls of Thiruvananthapuram also revealed 5.4 percent and 2.2 percent of obesity respectively. The results of the present study is also consistent with the above studies revealing that obesity and overweight in children are gradually growing like other developed and developing countries of the world. Studies reveal that in India, Kerala is not the only state facing the problem of overweight and obesity; it is also growing in other states too.

In a study conducted in Delhi by Kapil *et al.* (2002) the overall prevalence of obesity was 7.4 percent in children from affluent families and in another obesity study done by Ramnath (2002) in 1500 school children of Meerut Uttar Pradesh (UP), prevalence was nine percent. Yet in another study by Popkin (2003) in all the five metros of Delhi, Mumbai, Chennai, Hyderabad and Kolkata it had been noticed that one out of every five school children or 20 percent are overweight.

Obesity is major public health and economic problem of global significance because it is highly prevalent and is rapidly increasing (WHO, 2000). The highest prevailing rates of childhood obesity have been observed in developed countries, however its prevalence is increasing in developing countries as well (James Positive Therapy, 2004). Obesity is an increasingly prevalent nutritional disorder through out the world (WHO, 1998).

The National references data from Athens, Greece and Vienna, Australia were calculated and compared to determine the prevalence of over weight and obesity in these cities. The results indicate that 27 percent of the

children in Vienna aged 6 to 12 years are overweight and 7.5 percent are obese. In Athens the values were 32.9 percent and 11 percent for overweight and obese respectively (Dietrich, 2006). Prevalence of childhood obesity is increasing in India. It is estimated to be around 15 to 18 percent in Indian children (Pai, 2004). The estimate for Asia as a whole was 2.9 percent with a hyper prevalence of 4.3 percent in Eastern Asia and two to four percent in South East Asia among preschoolers (Deonis and Blossner, 2000).

A national survey conducted by the Journal of Indian Medical Association (Bhattacharjee, 2004) indicates that 25 percent of Indian man and 35 percent of Indian women are overweight above the age of 20 years. Childhood obesity has reached epidemic levels in developed countries. Overweight and obesity in childhood are known to have significant impact on both physical and psychological health (Power *et al.,* 1999). Over weight is the fifth most serious risk factor for morality both in developed countries and developing countries (World Health Report, 2002).

Ramachandran (2002) reported that the prevalence of obesity in South India is 3.1 percent and overweight is 16.8 percent. A study on 707 children in the age group of 10 to 15 years at Chennai revealed that 10 percent of the children were overweight and 6 percent of them were obese (Subramanyam, *et al.,* 2003).

Prevalence of overweight for was 15.7 percent for boys and 12.9 percent for girls in urban India and in the case of obesity 12.4 percent for boys and 9.9 percent for girls (Chatwall *et al.,* 2004). In a study conducted in Kualalampur among 7 to 10 years old children the prevalence of overweight was observed to be 8.4 percent with prevalence among boys are 1.4 times greater than that among the girls (Tee *et al.,* 2002).

Youth and Zhang (2006) suggested that industrialized countries, low socio economic status groups are more likely to be obese than the high socio-economic status counter parts where as high socio-economic status groups are at increased risk in developing countries. In high income countries,

extensive evidence indicates that obesity during childhood is related to adult obesity (Guoss *et al.,* 1999).

The prevalence of overweight increased with the age of children. Overweight at birth was not associated with overweight at 12 years. However over weight at 12 years was related to overweight at seven years (Yoon *et al.,* 2002). Childhood obesity has reached epidemic levels in developed countries. Twenty five percent of children in the United States are overweight and 11 percent are obese (Merchant, *et al.,* 2005).

It is estimated that more than 300 million people worldwide were obese. According to Knoon (2002) prevalence rates of overweight and obesity in India are 12.8 and 10.3 percent respectively. It is a major focus of attention in India (Vijayalakshmi *et al.,* 2003). Concerning childhood obesity, it has been estimated that worldwide over 22 million children under the age of 5 are severely obese from the late 1990's up to 2003 (Kosbi *et al.,* 2003).

The International Obesity Taskforce (IOTF, 2001) identified that in the United Kingdom almost two million children were overweight and 70,00,00 were classified as obese. The Health Survey for England (Sproston and Primatesta, 2003) found 21.8 percent of boys and 27.5 percent of girls aged 2 to 15 years were overweight or obese. It found the prevalence of obesity almost doubled among boys (from 2.9 percent to 5.7 percent) and has increased by over half among girls (from 4.9 percent to 7.8 percent), between 1995 to 2002.

Childhood obesity is one of the most serious problems facing the developed world. It is damaging to the medical and psychological well-being of the child and casts a shadow on their future health, leading to serious illness and ultimately premature death. Management of childhood obesity provides practical, realistic and easily implemented advice on sensitive approaches to children and their families in a very accessible form for all practitioners involved in the care of overweight children. Changes to diet and activity are reviewed in detail but also with the whole spectrum of eating within

the family and community, including sedentariness and the significance of sleep in preventing overweight (Poskitt, 2004).

D. CAUSES AND CONSEQUENCES OF CHILDHOOD OBESITY

- **Urbanisation and Socio economic background**

The cause of childhood obesity are multi-factorial , overweight in children and adolescents is generally caused by a lack of physical activity, unhealthy eating habits or a combination of two. Genetics and social factors like socio economics status, race or ethnicity, media, marketing and the physical environment also influence energy consumption and expenditure (Tandon, 2006). Although the causes of childhood obesity are widespread, certain factors are targeted as major contributors to this epidemic which include environment, lack of exercise, heredity, dietary patterns and socio economic status (http://www.obesityaction.org/aboutobesity/childhoodobesity/childhood.php).

Malina (2005) reported that a wealth evidence supports a role for decreased physical activity, increased television viewing and increased consumption of sugar, sweet and beverage in the current rise of childhood obesity. A study by London (2001) points out urbanization as a driving force in the rapid increase of obesity in children. The report concludes that in urban and sub-urban areas the developed environment can create obstacles to being physically active, that's because in urban areas space for outdoor recreation can be scarce, preventing kids from having a protected place to play; neighbourhood crime, and busy traffic also prevents children from walking or jogging to work as a means of daily exercise.

Lack of appropriate play area and limited open space around the home makes it difficult for children to stay physically active (Shah, 2008). The incidence of childhood obesity relates strongly to family variables, including parental obesity, small family size and family patterns of inactivity (Aslam, 2004).

Prabhakar (2004) points out that a small family, lack of friends, lack of activity and junk food brings out obesity in children.It has been shown that family structure, including family size, birth order of the child as well as whether it is a single or joint parent family may have an effect on childhood obesity (Wang *et al.,* 2007). Studies have demonstrated that children in single-parent families are more likely to be overweight or obese than children in two parent families and also the rise in women working outside the home coincides with the rise in childhood weight problems (Rastogi, 2006).

Birch (2001) says that parents of obese children talk less to them during the meals, eat fewer meals together and frequently watch television during meal time. Lakshmi (2004) reports that for most children with working mothers dinner time is the only bonding. William (2003) states that the rate of childhood obesity for highly educated parents is less than half the rate for low-educated parents

Educational levels also contribute to the socio economic issue associated with obesity. Parents with little or no education have not been exposed to information about proper nutrition and healthy food choices. This makes it difficult to instill those important values in their children.

Constraints on parent's time potentially contribute to children's weight problems as working parents probably rely on child care providers who may not provide nutritious and balanced diet to the children (http://www.kidswellbeing.org/childhood_obesity/parents.html). Parents are often overworked and find it easy to let children order fast foods and hardly have any time to oversee balanced nutrition for children (Vikram, 2003).

- **Screen Time**

Gortmaker *et al.* (1996) reported that there is a positive relationship between the time of watching television and prevalence of childhood obesity. Now-a-days more than ever, life is sedentary and kids spend more time playing with electronic devices than activity playing outside. Kids younger than six spend an average of two hours a day in front of a screen watching

television, Digital Video Discs (DVDs) or videos. When computer use and videogames are included, time spent in front of a screen increases to over five and a half hours a day. Kids who watch television more than four hours a day are more likely to be overweight compared with kids who watch two hours or less (http://kidshealth.org/parent/general/body/overweight_ obesity.html).

An increased amount of time spent viewing television, playing video games or surfing the internet appears to correlate with an increased incidence of childhood obesity (Robert, 2004). It was found by a study at the Institute Of Medicine (2005) that children who watched more than five hours of television per day were 4.6 times as likely to be obese as those not watching television or up to two hours daily. It was also demonstrated that reducing television viewing time was associated with reduction in body weight, body fat and obesity prevalence.

Advertising does in fact have an adverse effect on food preferences, purchasing behaviour and consumption among children says Mastings, 2003. Fast food outlets spend three billion dollars in television advertisements targeted to children. A growing body of research suggests that there may be a link between exposure to food advertising and the increasing rates of obesity among children and youth, because the exposure to television advertisements influence the food choices among children enticing them to choose more sugary foods instead of natural options which increase the requests to parents for high sugar foods (Mathur, 2007).

It has been estimated that the average child currently views more than 40,000 commercials on television each year, a sharp increase from 20,000 in the 1970s. Moreover an accumulated body of research reveals that more than 50 percent of television advertisements directed at children promote foods and beverages such as candy, snack foods, sweetened and sugary beverage that are high in calories and fat and low in fiber and other nutrients (United States, Department of Health and Human Services, 2004).

Watching television, using the computer and playing video games occupy a large percentage of children's leisure time influencing their physical

activity levels. This trend is apparent not only because little energy is expended while viewing television but also because of the concurrent consumption of high calorie snacks(Seidel, 2000). A recent report of 6 to 12 years old children found an association between increased television viewing and more meals eaten while watching television (Saelens *et al.*, 2002). In both overweight and non-overweight families, girls who watch more television consume more snacks in front of the television. In families where neither parent is overweight, television viewing is found to be the only significant predictor of girl's increase in Body Mass Index (BMI). Girls who watch more television snacked more frequently especially energy dense snacks (http://www.nature.com/oby/ journal/vll/nl/full/oby200323a.html).

- **Physical Activity**

Inactivity plays a major role in obesity development in children, whether it results from television and computer use, limited opportunities for physical activity and safety concerns that prevent children from enjoying free play outside doors (Shults, 2004).

Brownell (2000) warns that decreased physical activity can lead to an increase in food intake. Moderately increasing the physical activity for about one hour per day is the preferred way to reduce the food intake. A wealth evidence supports a role for decreased physical activity, increased television time and increased consumption of sugar sweet and beverages resulted in the current rise of childhood obesity (Malina, 2005).

High burden of school work and academic competitiveness have led to decreased participation in sports and any other form of physical activity (Gulati, 2008). School aged children spend most of their day in school where their only activity comes during recess or physical education classes. In the past, physical education was followed on a daily basis. Currently only eight percent of elementary schools and less than seven percent of middle schools and high schools have daily physical education (http://www.obesityaction.org/ aboutobesity/childhoodobesity/ childhood.php).

Using automobiles for short trips limits children's opportunities to walk to local destinations, a phenomenon particularly relevant to children in the suburbs (Rabkin, 2003). Obese children and adults more often eat the same amount of food as their normal counterparts but they exercise much less (Glasser, 2000).

- **Hormones**

Obesity in children due to hypothyroidism or other hormonal imbalance occurs in fewer than three percent of obese kids. In hypothyroidism the basal metabolic rate is lower because of a deficiency in thyroid secretion which results in excessive retention of calories that would normally be expended in basal metabolism (Greger. 2000).

- **Familial Tendency**

A new study warns that the factor that puts children at greatest risk of being overweight is having obese parents. Children whose parents are obese have a much greater chance of becoming obese themselves. The definitive cause of obesity in children is not known to be the genes but heredity probably contributes to the condition. Heredity thus dictates where fat is deposited in the body (Sheeba, 2002).

There is an abundance of evidence that supports genetic susceptibility as an important risk factor for childhood obesity. Biological relatives exhibit similarities in maintenance of body weight and that heredity contributes between five and 40 percent of the risk for obesity in children (Vinita, 2002). Children obesity is also caused by hereditary factors and that is if one or both parents are obese, the child may be prone as well, and also if the child has any other medical condition that can trigger obesity through drugs or specific diet. Other factors are lack of physical activity and bad eating habits (Nabil, 2003).

Fifty to 70 percent of a person's Body Mass Index (BMI) and degree of adiposity is determined by genetic influences and that there is a 75 percent

chance that a child will be overweight if both parents are obese and a 25 to 50 percent chance if just one parent is obese. People in the same family tend to have similar eating patterns, maintain the same levels of physical activity, and adopt the same attitudes toward being overweight (http:// kidshealth.org / parent / general / body / overweight_obesity.html).

- **Dietary Habits**

A study by Kother (2001) and his colleagues showed that there is a strong relationship between problematic childhood eating behaviors and subsequent development of eating disorders in later life. Causes for childhood obesity include overfeeding, providing high calorie beverage tc satisfy thirst, using food to solve problems, relieve stress or as a reward and not providing enough opportunities to exercise (http://ezinearticles. com/?Childhood-obesity,-Are-Parents-Responsible?&id=977915).Factors contributing to excess energy intake for the pediatric population include the food establishments, children making more food and eating decisions, large portion sizes and inactivity (French *et al.,* 2001).

In general children are eating more food away from home, drinking more sugar – sweetened drinks and snacking more frequently (Knopp, 2006). Children who do not consume breakfast tend to eat a large amount of food in the evening and this imbalance could lead to a higher risk of obesity (Dietx *et al.,* 2001).

Children who attend breakfast clubs consume more fat than children who do not attend (Belderson *et al.,* 2003). The availability of vending machine in schools is associated with an obesogenic environment although not all the evidence supports this view (New *et al.,* 2003).

Snacking is gaining prominence as a potential risk factor for childhood obesity as is skipping meals says Lindroos *et al.* (2005). Poor diet is one of the major reasons for childhood obesity. Children who learn to eat properly from the beginning of their lives will keep these habits all of their lives. Parents

should not depend on fast food outlets for feeding their children (http://www.weightlosswand.com/child-obesity/child-adult.html).

Childhood obesity resulting from fast food consumption is an alarming issue among parents, researchers, doctors and fast food companies because of the health risks associated by obesity (www. weightlosswand.com/child-obesity/fast-food-consumption.html). Every day one in three children from age 4 to 19 years of age eat fast food. These fast food products contain higher fats, carbohydrates, sugars and calories than any other products. As a result children are gaining 150 extra calories daily while increasing the risk of obesity.

Children who eat fast food regularly do not receive the recommended nutritional intake needed for proper growth and development. Because of a high-calorie diet and low levels of physical activities, children increase body fat and thus result in excessive build up of weight (Arenz, 2004).

Childhood obesity from fast food has different evidences to show that children who eat fast food meals for two to three times a week consume high calorie intakes, more fat, more saturated fat, excess sugar consumption, more sweet beverages, higher total carbohydrates intake and less consumption of vegetables, fibre and milk (www.weightlosswand.com/child-obesity/fast-food-consumption.html).

Oliveria and her colleagues (2002) reported that parents who ate diets high in saturated fats also had children who ate diets high in saturated fats.

Nandini (2004) discovered that children have other habits that cause obesity – poor intake of drinking water and late dinners – after which they immediately go to bed. Obese children do not sleep more than seven hours than their peer group who sleep for good 8 to 10 hours. Children overeating at night can be caused by boredom, depression, loneliness and anxiety. A night eating pattern may occur in as many as 80 percent of obese children (Barlow and Tilloston, 1995).

- **Breast feeding**

Breastfeeding should be chosen as the exclusive method for feeding infants for the first four to six months of life to avoid weight gain in children (Sloan, 2008). Breast feeding reduces the risk of childhood obesity to a moderate extent. The effect of breast feeding is probably small when compared to other factors that influence childhood obesity such as parental overweight. Nonetheless, it may be of public health significance considering the current epidemic of child overweight (Kathryn, 2003). Breastfeeding seems to have a small but consistent protective effect against obesity in children (http://www.nature.com/ijo/ journal/v28/n10/full/0802758a.html).

Breastfeeding may promote healthier eating habits because breastfed infants may eat until satiated, where as bottle fed babies may be encouraged to eat until they have consumed all of the formula (Gildea, 2000). Breast feeding may help prevent excessive weight gain. Breast fed babies may be more able to control their own intake and follow their own internal hunger (Mary, 2009).

Von Kries *et al.* (2000) found in children aged 5 and 6 years a substantial dose dependent protective effect of breast feeding was associated with a 35 percent reduction in obesity at the age of 5 to 6 years. Infants who were breastfed for at least 12 months are slimmer than infants who are fed formula at one year of age. Mothers who breastfed their infants for 6 months or longer were less likely to restrict their child's food intake when they were one year old. There was no relationship between breastfeeding and mother's pressuring their one year old child to eat more. This may be one factor related to decreased obesity in later life of breastfed infants (Taveras, 2004).

- **Gestational Diabetes**

Maternal diabetes during pregnancy results in offspring with an increased risk of developing childhood obesity (Stephanie and Jarosh, 2008). Children born to mothers with gestational diabetes are more likely to become

overweight or obese than their peers (http:// www.doctorndtv.com/news/detailnews.asp?id=2809).

Babies born to mothers with untreated gestational diabetes have nearly double the normal risk of becoming obese during childhood, but treatment to normalize blood sugar also normalizes risk (Louise, 2007). Offspring of women who have diabetes during pregnancy are overweight or obese. These children are more likely to be obese or overweight and have chances for diabetes in the future (Julie, 2008).High blood sugar during pregnancy results in the baby being overfed in the womb. The result of this over feeding may be that children become metabolically imprinted or programmed to become obese (Teresa, 2007).Treating Gestational Diabetes Mellitus (GDM) during pregnancy may reduce the child's risk of becoming obese. Diabetes in pregnancy is associated with an increased rate of offspring childhood obesity, impaired glucose tolerance and type II Diabetes Mellitus (http://www.medscape.com/ viewarticle/562238).

Research found that children born to mothers with gestational diabetes had an 82 per cent chance of becoming obese between the ages of five and seven. Interestingly it was also found that even women who had elevated blood sugars, not quite high enough to be considered gestational diabetes, still had a significantly higher risk of having an obese child than women with blood sugars on the lowest end of normal (www.thedietchannel.com/ childhoodobesitylinkedgestational_diabetes).

If gestational diabetes is untreated a child's risk of becoming obese by ages five to seven nearly doubles. The high sugar levels during pregnancy are believed to cause the foetus to be in an overfed state, which seems to program the baby's metabolism to store more fat, but when gestational diabetes is treated the baby's obesity risk is completely reversed. So it must be ensured that standard blood glucose screens is attained casually between 24^{th} and 28^{th} week, advises Hollies 2007.

A new study has unearthed evidence that childhood obesity can be prevented if expectant mothers are treated for gestational diabetes. Maternal

smoking during pregnancy is also associated with an increased risk of childhood obesity (Jefferis *et al.,* 2002).

- **Pre natal and Post natal Nutritional Status**

High birth weight is associated with an increased risk of later obesity (Oben *et al.,* 2003). Birth weight is positively associated with childhood obesity, with an increased risk of obesity for both the heaviest and highest babies, independent of socio economic status and gestational age, but may be confounded by maternal weight (Power *et al.,* 2001). Post natal rapid weight gain has been suggested to be a risk factor for later obesity (Kamanika *et al.,* 2003).

Numerous parental influences shape the eating habits of youth including the choice of an infant feeding method, the foods they make available and accessible, the amount of time children are left unsupervised and their eating interactions with others in the social context (http:// www.shapeup.org/about/arch_news/n/0209.html).

Most of the attempts at early feeding are culturally derived or based on attitudes of rapid growth progress rather on biologic needs which thus leads to overweight and obesity in kids(Frez, 2007).

- **Weaning**

Many parents unwittingly contribute to the development of childhood obesity by introducing solid foods before four to six months of age, by equating weight gain with good health or by using food as a reward for good behaviour(http://www.3.interscience.wiley.com/journal/ 119402648/abstract?CRETRY=1 & SRETRY=0).

First week of weaning should be from the sixth month of a child's life but unfortunately children are being weaned as early as 12 weeks (http://www.obesity discussion.com/forums/childhood-obesity/childhood-obesity-being treated-early-weaning-3224.html).

Parson *et al.* (2003) states that exposure to complex sugars and fats contained in bottle formula influence obesogenic factors in infants, which predispose them to weight gain later on in life. Uncritical early introduction of high calorie solid foods may lead to rapid weight gain and obesity. Excess fruit juice consumption by pre-school age children has been reported to be associated with obesity (www.ezinearticles.com/?obese-kids,-facts,-preventionandsolutions&id=1995733).

Infants have a preference for sweet and salty tastes and concern has been expressed that early introduction of sweetened beverages and high fat or sweet foods to infants may be major contributors to childhood obesity (Sneddon, 2008).

Heredity has recently been shown to influence fatness, regional fat distribution, and response to overfeeding. Infants born to overweight mothers have been found to be less active and to gain more weight by age of three months when compared with infants of normal weight mothers, suggesting a possible drive to conserve energy (Barbara, 2007). Obese mothers may be more likely to over feed their infants and interact with them less, according to a new research. Obese mothers feed their children more calorie rich food and spend less time feeding and interacting with them than normal weight women (http://www.webmd.com/parenting/ news/20050520/obese-mothers-may-overfeed-infants).

Infants born to overweight mothers have been found to be less active and to gain more weight by the age of three months when compared with infants of normal weight mothers, suggesting a possible inborn drive to conserve energy (http://www.kidsource.com/kidsourse/ content2/obesity.html). Even babies who turn away from the bottle or breast send signals that they are full. If kids are satisfied mothers should not force them to continue eating since overfeeding results in rapid weight gain (www.kidshealth.org/parent/general/body/overweight_ obesity.html).

Repeated and uncritical offering of a bottle as a method of dealing with a fretful or crying infant may establish a habit that leads the infant to seek food whenever experiencing frustration (Khaleel, 2004).

E. MEDICAL NUTRITION THERAPY (MNT): NEED OF THE HOUR

Medical Nutrition Therapy (MNT) is the development and provision of a nutritional treatment or therapy based on a detailed assessment of a person's medical history, psychosocial history, physical examination, and dietary history. It is used to treat an illness or condition, or as a means to prevent or delay disease or complications from diseases. The purpose of the assessment is to determine the persons' need for therapy, set parameters to plan a therapy, develop a therapy plan, determine the best method to initiate the therapy (American Dietetic Association 2000).

Patient education is a critical dimension of Medical Nutrition Therapy, in that patient compliance is essential to the success of any preventive or therapeutic nutritional program. Education in MNT may include task, guideline and meal planning exercises. These exercises help to educate patients regarding proper food choices in the treatment or control of their specific illness or condition. Tasks are usually simple and objective responsibilities agreed upon by the dietician, nutritionist, doctor and the subject (Suominen, 2006).

The purpose of Medical Nutrition Therapy is to identify subjects at risk for major nutrition-related health problems and recommend dietary adjustments leading to better health outcomes and improved quality of life.

According to Anderson (2002) Medical Nutrition Therapy has two phases such as medical management (which included lifestyle modifications, psychological support, drugs and surgery) and nutritional management (which comprised of dietary modifications and nutrition education).

- **Life style and Dietary Modifications**

Physical activity is an important long-term ingredient for children, as studies indicate that inactivity in childhood has been linked to a sedentary adult lifestyle. Every child should get at least 60 minutes of physical activity each day (Katch, 2005).

Nandini (2004) correctly points out that parents have many screamed up ideas only about academic excellence and perfection. Every parent should see to it that their children play daily. Parents should encourage kids to play outdoor games, and should restrict them from playing computer games and videogames. Television viewing and other screen time should be permitted according to a timetable (http://www.weightlosswand.com/child-obesity/child-adult.html).

Parents should cut down on television, computer and videogame time and discourage eating while watching television. They should serve a variety of healthy foods and eat meals together as often as possible. It is the duty of parents to encourage kids to have at least five servings of fruits and vegetables a day, and eat breakfast everyday (Gavin, 2009).

Parents should turn off the television during dinner, switching from soda to milk or water, or taking family walks after dinner at least twice a week (http://www.mayoclinic.com/health/childhood-obesity/fl00058). The most effective techniques used in the behavior modification are the food, weight, and exercise records maintained for the obese child (Johnson *et al.* 1986). Behavior modification for weight loss refers mainly to getting in touch with the reality of what the child is actually eating, how much food, when and why.

Parents, especially of those whose children are at risk for obesity at a young age, should promote healthy food and lifestyle choices early in the development (Becque, 2003). The most effective way to treat and prevent childhood obesity is to adopt healthy diet habits for entire family (www.kidshealth.org/parent/general/body/overweight-obesity.html).

The best way to get a child onboard with the new active lifestyle is to commit the parents to the change themselves. Parent's actions teach every child what to eat, how much to eat and when to eat and studies show that the more families eat together, the more likely older children and teens will consume fruits, vegetables, grains and calcium rich foods (Lohman, 2002). When treating an obese child, it is often recommended that parents have a consultation with a nutritionist specialized in children's needs. Dietary modification in younger obese children should be well planned and closely watched so that restriction in energy intake is not too low that results in height diminishment. Moderation in energy intake is important especially in limitation of high fat, high energy foods and beverages (www.reuters.com/article/ healthnews/idusn273977142008 0428).

While parents are the primary role models for their children and their behavior can positively or negatively influence their children's health, it is also essential work to expand access to fruits, vegetable and other healthful foods (http://www.livescience.com/health/090209-obesity-parents.html)

- **Behaviour Modifications**

The goal of treatment for childhood obesity should be to slow the weight gain and allow the child to grow into his or her weight for age. The child's behaviour should be modified to increase activity and decrease the energy intake (Dietz, 2001).

Behaviour modification adds as an important component to treat childhood obesity. One underlying environmental cause of obesity can be parents' attitudes and behaviour toward their child's eating and lifestyle. The family of every obese child should have a proper environment so as to carry out all the weight loss strategies (Roberts, 2000).

There are several ways that children can modify their behavior for healthier outcomes such as increasing physical activity, changing eating habits, becoming educated about the body and how to nourish it appropriately, engaging in support group or extracurricular activity and setting

realistic weight management goals (http:// www.kidsource.com/ kidsource/content2/obesity.html#treatmentofchildhood obesity).

Drug therapy fail to produce more weight loss than that achieved by other means in an extensive review of childhood obesity reports Wing and Jeffrey (1979). Obesity is easier to prevent than to treat and prevention focuses in large measure on parent education. In infancy parent education should center on promotion of breastfeeding, recognition of signals of satiety and delayed introduction of solid foods (http://www.kidsource.com/ kidsources/content 2/obesity.html#problem treatment of childhood obesity).

Early attempts to modify behavior commencing in infancy period, may effectively prevent overeating and obesity. Such attempts include feeding an infant on demand shortly after birth, providing food only at signals of hunger in the first year of life, avoiding crying by showing attractive foods and teaching the child to eat only when hungry (Lori, 2003).

The first thing that adults need to do is to take measures for achieving weight control. Adults providing good example of healthy lifestyles can be the best way for children to learn. If parents have bad lifestyle habits, children will also follow the same (Epstien, 2001).

Treating obesity in children differ from treatment in adults. Involving the family in a child's weight management program is a key element to treatment. As a support system, family is integral in ensuring whether the weight management goals are met (/www.obesityaction.org/aboutobesity/childhood obesity/childhood.php).

- **Nutrition Education**

The American Dietetic Association (2006) suggests that nutrition education is essential for the public to achieve and maintain optimal nutritional health. Nutrition education should be an integral component of all health promotion, disease prevention, and health maintenance programs, through

incorporating into all appropriate nutrition communication, promotion, and education systems.

Diet counseling is the process by which beliefs, attitudes, environmental influences and understandings about food leads to practices that are scientifically sound, practical and consistent with individual needs and available food resources. Nutrition education generally includes how to read food labels, cut back on portions, understand the food pyramid and the ways to feed smaller meals to children (Bouchard, 2003).

Many studies have shown that eating habits are established easily in the life cycles and tend to carry through to adulthood. As a result, the food that children eat now will undoubtedly influence their state of health and later life. Making informed of food choices is an integral part of a child's normal growth and development. It must also be emphasized that nutritionists, dietitian, health workers and teachers need to get trained in the treatment with care. The development of healthy and realistic body images and perception is an important part of an individual's transition from childhood to adolescence (Zimmerman, 2000).

Effective weight management for individuals and groups at risk of developing obesity involves a range of long-term strategies. These include prevention, weight maintenance, management of co-morbidities and weight loss. They should be part of an integrated, multi-sectoral, population-based approach, which includes environmental support for healthy diets and regular physical activity (WHO, 2006).

Children should get at least an hour of exercise every day is unlikely to have much effect if their parents do not exercise at all. Knowledge about healthy weight achievement and maintenance should start during pregnancy and continue throughout life. Healthy habits at the family level include eating foods that are more nutritious and lower in fat and sugar; eating breakfast regularly; getting more physical activity; watching less television; getting enough sleep; and breastfeeding. It's also important to let children's natural appetite dictate how much they eat, especially when they are very young.

Both imposed dieting and force-feeding override a child's natural cues of hunger and satisfaction, and tend to lead to higher energy intake (Halminton, 2008).

Obesity treatment programs for children and adolescents rarely have weight loss as a goal. Rather, the aim is to slow or halt weight gain so the child will grow into his or her body weight over a period of months to years.

Adopting a formal exercise program, or simply becoming more active, is valuable to burn fat, increase energy expenditure, and maintain lost weight. Most studies of children have not shown exercise to be a successful strategy for weight loss unless coupled with another intervention, such as nutrition education or behavior modification (Wolf *et al.*, 1985).

Fasting or extreme caloric restriction is not advisable for children. Not only is this approach psychologically stressful, but it may adversely affect growth and the child's perception of "normal" eating. Balanced diets with moderate caloric restriction, especially reduced dietary fat, have been used successfully in treating obesity (Dietz, 1983). Nutrition education may be necessary. Diet management coupled with exercise is an effective treatment for childhood obesity (Wolf *et al.*, 1985).

Many behavioral strategies used with adults have been successfully applied to children and adolescents such as self-monitoring and recording food intake and physical activity, slowing the rate of eating, limiting the time and place of eating, and using rewards and incentives for desirable behaviors.

Obesity is easier to prevent than to treat, and prevention focuses in large measure on parent education. In infancy, parent education should center on promotion of breastfeeding, recognition of signals of satiety, and delayed introduction of solid foods. In early childhood, education should include proper nutrition, selection of low-fat snacks, good exercise or activity habits, and monitoring of television viewing. In cases where preventive measures cannot totally overcome the influence of hereditary factors, parent

education should focus on building self-esteem and address psychological issues (Agatston, 2000).

The patient care should be compassionate appropriate and effective for the treatment of health problems and the promotion of health. Nutrition education should increase the individual's ability to recognize the importance nutrition and community nutrition services in health promotion, disease prevention and disease management (Deen, 2005).