INTRODUCTION
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"To eat is a necessity, but to eat intelligently is an art."

- La Rochefoucauld

Obesity has become the most prevalent nutritional problem in the world, eclipsing under nutrition and infectious diseases and is emerging as the most significant contributor to ill health and mortality. Obesity, a major public health and economic problem of global significance is rapidly increasing and is associated with a wide range of chronic diseases such as diabetes, hypertension, cardiovascular disease and certain types of cancer.

Good nutrition during childhood and adolescence is essential for growth and development, health and well-being and the prevention of chronic diseases. The major nutrition issues among children and adolescents have shifted from nutrient deficiency diseases, common in the first half of the 20th century, to concerns today about overconsumption, poor dietary quality and poor food choices.

Among the nutritional problems, obesity is now reaching epidemic proportions in both developed and developing countries and is affecting not only adults but also children and adolescents (Flynn et al., 2006). Once considered a problem of affluence, obesity is fast growing in many developing countries also.

Even in countries like India, a significant proportion of overweight and obese children now coexist with those who are under nourished. As a result of rapid socioeconomic advancements in the recent decades, the population is undergoing significant lifestyle changes, including changes in dietary and meal patterns, such as increased consumption of fats and oils, decreased intake of complex carbohydrates, eating out and skipping meals. The 'westernization' of global eating habits has also brought about an increase
in the number of fast food outlets in the last decade. In addition, with the advent of motorized transport and easy availability of labor-saving devices, the population has become generally more sedentary.

The rapid progress of urbanization and demographic trends is associated with a cluster of unhealthy lifestyles. Sedentary activities and consumption of calorie-dense foods of low nutritional value might be the most important etiological factors responsible for the very high rate of childhood overweight in developing nations (Kelishadi, 2008). A paradox of childhood underweight or overweight and a rapid increase in childhood obesity and metabolic syndrome exist among children and adolescents living in many developing countries.

*The childhood shows the man*  
*As morning shows the day.*

~*John Milton, Paradise Regained*

Interest in childhood predisposing factors to chronic diseases is increasing because it is well documented that both behavioral and biological risk factors of such diseases persist from childhood into adulthood and that several risk factors including overweight, dyslipidemia and high blood pressure are tracking from childhood to adult life and are linked to adult diseases.

Childhood obesity is one of the most serious public health challenges of the 21st century. The problem is global and is steadily affecting many low and middle income countries, particularly in urban settings. In 2007, an estimated 22 million children under the age of 5 years were overweight throughout the world. More than 75 per cent of overweight and obese children live in low and middle income countries (WHO, 2009).
At present 30-45 million children are classified as obese accounting for 2-3 per cent of world’s population of children (International Obesity Task Force, 2005). The World Health Organisation (2003) has declared overweight as one of the top ten health risks in the world and one of the top five in developed nations with a total of 155 million children, worldwide are overweight.

Obesity rates among children have increased significantly in the past two decades (O’Connor et al., 2006). The rate of unhealthy body weight among children have tripled since 1980’s (Evans, et al., 2005). More than 22 million children under five years of age are obese or overweight and more than 17 million of them are in developing countries. Since 1960’s, obesity rates among school- aged children (6 - 11 years) have more than quadrupled from 4 per cent to 19 per cent and between 1971 and 2004, the rates have tripled among preschool children (Ogden et al., 2006).

The prevalence of obesity in children is rapidly increasing in the United states, and other parts of the world, although the tracking of this phenomenon is somewhat complicated by variability in the definitions for obesity and overweight in children(Janssen et al., 2005). Among children aged six to 19 years, the most recent National Health and Nutrition Examination Survey (NHANES) revealed that the prevalence of overweight is three times greater than the goals, established in “Healthy People 2010” (Hedley et al., 2004).

The proportion of school age children affected by obesity will almost double by 2010, compared with the recently available surveys from the late 1990’s up to 2003 (Kosti et al., 2006).

The prevalence of childhood obesity worldwide is 16.5 per cent and in India it accounts to 12.4 per cent in boys and 9.9 per cent in girls (WHO, 2006). Misra et al. (2006) reported the prevalence of childhood obesity in India to be about 22 per cent.
In urban India, the prevalence of overweight was 15.7 per cent for boys and 12.9 per cent for girls and in the case of obesity 12.4 per cent for boys and 9.9 per cent for girls (Chhatwal et al., 2004). A recent study by the National Institute of Nutrition (NIN) concluded that the prevalence of overweight and obesity among adolescents in Hyderabad was 11 per cent and three per cent (Sudhersan and Subba Rao, 2007).

Obesity is a multifactorial disease and its development is due to multiple interactions between genes and environment. The primary cause for being overweight and obese is unlimited access to food, reduction in physical activity as well as the fulfillment of the genetic responses that the body stores up fat reserves during times of abundance for ‘leaner’ periods later on (Wechsler et al., 2005).

Childhood obesity is partly due to genetic components and due to environmental factors such as lifestyle, socio-economic factors and nutritional habits of the family (Sangha et al., 2006).

The development of fat gain is a complex phenomenon which is regulated and affected by several mechanisms and factors. Childhood obesity results from an imbalance of energy intake and expenditure. The adipose tissue mass is enlarged out of proportion to other body tissues in this condition. In normal growth, the greatest level of fatness (25%) occurs at the age of six months. In lean children, the fat cell size decreases. However, this decrease does not occur in obese children. Obesity prone individuals have an inborn reduction in their catabolic response to glucose, leptin and insulin (Levin, 2005).

An obesogenic environment which encourages excess food intake plays a crucial role in the epidemic of childhood obesity. Factors that contribute to childhood obesity include lack of exercise, excessive consumption of fleshy
foods, fats, sweets, snacks, genetic disposition and lack of worries (Swimburn et al., 2005).

Childhood obesity is influenced by multiple factors including accessibility to energy dense foods and increased sedentary activities (Jeffery and French, 2005). Most of the common reasons of obesity are consuming foods rich in animal–based saturated fats, foods that are rich in sugar and less physical activity. (http://ezinearticles.com/Incidence-of-childhood-obesity&id=357350).

Television, computer and video games are 'global markers' for identifying children who engage in detrimental lifestyle characterized by physical inactivity and unhealthy dietary habits (Ochoa et al., 2007). The environment that parents create by way of their own dietary and physical activity behaviour, may have a lasting effect on children's weight and their emerging obesity risk behavior. Consequences of childhood obesity diagnoses excessive fatness and denote increased risk of adverse health outcomes (Reilly, 2005).

Obesity is not a disease in itself but rather a complex symptom. Increased plasma insulin levels, elevated blood lipid and lipoprotein levels, and elevated blood pressure are the various factors known to be associated with childhood obesity related to adult morbidity and mortality. Obesity is a key factor for many chronic and non communicable diseases (Lau et al., 2007).

Overweight children develop respiratory and orthopaedic problems, diabetes mellitus, arthritis and sleep disturbances and genetic syndrome (Islam, 2005). Ten per cent of the world's school-aged children are estimated to be carrying excess body fat, with an increased risk for developing chronic disease. A quarter of these overweight children are obese, with a significant
likelihood of having multiple risk factors of type II diabetes, heart disease and a variety of other co-morbidities before or during early adulthood (Swinburn et al., 2005). Obesity also causes adverse psychosocial problems such as bullying, discrimination and in older children a low self-esteem. Obesity can be a taunt which can haunt a child for the rest of its life.

Treating obesity in childhood prevents the onset of adult obesity and reduces chronic diseases. Prevention and treatment of obesity and overweight are easier among children than in adults because children are still growing in height (Doak et al., 2006). Children are often considered the priority population for intervention strategies because, at first, weight loss in adulthood is difficult and there are a greater number of potential interventions for children than for adults. Secondly, it is difficult to reduce excessive weight in adults once it becomes established. Therefore it would be more sensible to initiate prevention and treatment of obesity during childhood (Dehghan et al., 2005).

Prevention of nutritional problems is important during childhood, in order to reduce risk during adulthood. Prevention is widely recognized as an indispensable strategy to turn the tide of the global epidemic of obesity. The increasing number of people affected and the difficulty, cost, and low outcome of therapeutic approaches point out to prevention as the premier focus of our efforts to reduce and eliminate obesity. Furthermore, because once established, obesity is a protracted and difficult-to-treat condition, hence it makes sense to focus prevention efforts on the younger generations, when health and nutrition education can shape good dietary practices and avoid excess weight gain.
Obesity prevention requires an evidence-based public health approach to ensure that recommended strategies and actions will have their intended effect. Childhood obesity prevention involves maintaining energy balance at a healthy weight, while protecting overall health, growth and development and nutritional status. Prevention and treatment strategies should include individual treatment goals and approaches based on the child's age, stage of growth and development, degree of overweight and presence of other co-morbidities.

Good habits or lifestyles should be included right from childhood. Good dietary habits together with adequate exercise will play a major role in making a child a healthy adult. Interventions that combine a dietary component, physical exercise and/or behavioural therapy are effective in treating childhood obesity in the short-term.

"Knowing is not enough; we must apply. Willing is not enough; we must do."

- Goethe

Childhood obesity management, treatment and prevention programmes can be implemented in three main settings: family, school and individual care. Childhood obesity is best tackled at home through improved parental involvement, increased physical exercise, better diet and restraint from eating.

Health education can be given to parents, teachers and children regarding dietary habits and sedentary lifestyle. Guidelines and educational tools which can assist the family in improving the health of today's children can be formulated to manage childhood obesity (Daniels, et al., 2005).

Parents have a big role to play not only in making their children healthy but also in making them healthy adults. The family provides a child's major social learning environment. Hence it is important to involve the entire family when treating obesity in children.
Behavioural change is an essential component of both prevention and management programs for childhood obesity. Majority of interventions have followed a model based on social learning theory, aiming at modifying individual, behavioural and environmental factors associated with obesity risk. Intervention should seek to enhance children’s knowledge about diet, physical activity and health and promote their self-efficacy for healthful living.

Nutrition education offers a great opportunity to individuals to learn about the essentials of nutrition for health and to take steps to improve the quality of their diets, thus their well-being (Robinson et al., 2004). Nutrition education involves a combination of activities including nutrition information, increasing people’s knowledge about the benefits of specific foods, behaviour, influencing attitudes and beliefs, and motivating the adoption of healthy eating practices (www.FAO.Nutrition education.org).

The goal of nutrition education is to teach children to eat a well-balanced diet that contains a wide variety of foods and that children learn to make wise food choices independently (Poh Bee Koon, 2006).

Exercise is one of the best ways in preventing the rapid growth of obesity

- Lee Haney

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. Increasing physical activity can decrease, or at least slow the increase in fatty tissues in obese children. The World Health Organization (2009) recommends at least 30 minutes of cumulative moderate exercise (equivalent to walking briskly) for all ages and additional 20 minutes of vigorous exercise (equivalent to running) three times a week for children.
According to Nowicka and Flodmark (2007) changes in physical activity with the aim of increasing energy expenditure are usually an important component in the treatment of childhood obesity. Physical activity also has several other aspects that are positive for the health of an obese child.

The role of nutrition in the management of health and disease is of great importance to those who value it. Likely said “As you sow, so shall you reap”. The importance of nutrition in growing children throughout their childhood and in later years clearly indicate the health of one’s country, as today’s children will be the future of tomorrow.

Emphasis should be on nutrition rather than ‘dieting’, hence it is important to maintain healthy components of traditional diets such as micronutrient rich foods like fruits, vegetables and whole grain cereals and guard against heavily marketed energy dense fatty and salty foods and sugared cold drinks. The strategy should be to recognize and eliminate risk factors of high calorie intake such as frequent snacking, frequent eating out and celebrating with food and drink (Bhave et al., 2004).

A high protein, low carbohydrate, unlimited calorie diet was superior to restricted calorie protocol for weight loss in obese school age children (Werthammer et al., 2003). Related to the increased energy needs during growth, a child can achieve reductions in adiposity without reducing energy intake (Doak et al., 2006).

The traffic light diet which is effective in reducing total energy intake, especially from fat rich foods has been used as a family based intervention. Basically, the Traffic Light Diet works by dividing foods into three groups. Low calorie foods are classified as green colour foods, foods with more calories but containing plenty of vitamins and minerals are amber in colour and high calorie foods low in nutritional value are considered to be red (Collins, 2007).
Dietary fiber has important health benefits in childhood and adolescence. Fibre intake is inversely associated with body weight and body fat and it also promotes regular bowel habits and reduces a child’s risk of chronic diseases. It may be useful in preventing and treating obesity and also in lowering blood cholesterol level, both of which may help reduce the risk of future cardiovascular diseases (Williams, 2006).

The most important step towards overcoming a growing obesity epidemic is to acknowledge its existence and create awareness. Being well-rounded does not imply good health or prosperity but heralds the onset of many health related problems with serious deleterious effects. Increasing childhood obesity rates affect not only individuals and their families, but also impose direct and indirect economic costs in the forms of low productivity, disability, morbidity and premature death. Indeed, the great advances in the nation’s health as a result of the decline in nutritional deficiencies and the promise of advances in biomedical discoveries may be offset by the burden of illness, disability and death resulting from metabolic syndrome and co-morbidities. Therefore, it is the responsibility of nutritionists to address this nutritional and social problem within the school-age population.

Until now, most national public health programs and policies, as well as national-level research on children of low and middle-income countries, have focused on under nutrition. Health professionals and policy-makers should focus on primordial/primary prevention of childhood obesity, in low and middle-income countries, which are facing an epidemic of chronic non-communicable diseases in the near future.

In the past, a fat child meant a healthy child, who is likely to survive the rigors of undernourishment and infection. But today, obesity or over weight during childhood is recognised as a major health risk condition developed mainly due
to malnutrition and improper lifestyle, these can further lead to health problems later in adolescence and adulthood. Tackling the problem of the growing numbers of overweight individuals is a major challenge for most of the countries. Hence, close monitoring of overweight and obesity prevalence in children and taking timely preventive measures will be an effective approach in dealing with the problem of obesity.

Potential interventions influencing food intake and physical activity will be the most appropriate set of specific actions that should be undertaken to improve an individual’s life style and from a broader public health perspective, a policy decision at the national level will have a significant impact on the problem of childhood obesity.

With this in view, the present study aims at estimating the prevalence of obesity and developing a framework of intervention strategies to manage childhood obesity with the following objectives:

To

- Assess the prevalence of overweight and obesity among school children (7-12 years) in Coimbatore.
- Study the socio-economic background, dietary habits, food consumption and lifestyle pattern of overweight and obese children.
- Determine the physical activity pattern, energy balance, psychosocial and behavioural adjustment problems and biochemical profile of selected obese children.
- Develop and implement intervention strategies on selected obese children and
- Evaluate the impact of intervention strategies.