CHAPTER - 1

INTRODUCTION

Anthropology is the science which deals with the comparative study of man, as a physical and cultural being (Das, 1992). The term anthropology has been derived from the Greek roots 'Anthropos' (meaning man) and 'logos' (meaning science). Anthropology is the most comprehensive of the sciences dealing with man and his works. It cuts across the barriers of time and space. The subject matter of anthropology is vast. It is includes everything that has to do with human beings. It studies man who is anonymous as a group and not a standard and as a whole. It freely borrows organises and integrates knowledge from several diverse disciplines to present a comprehensive and consistent picture of man and his works in his totality (Ramireddy, 1992). Physical anthropology is concerned with man as a physical organism in time and space. The two principal focuses of physical anthropology are human evolution and human variation. The study of growth and it’s related problems is one of the important aspects of physical anthropology. Physical anthropologists prepare growth curves, growth standards and find out the reasons for normal and retarded growth (Das, 1992). The numerous specialised fields of physical anthropology are human population genetics, genetic demography, evolution, human growth and development, forensic anthropogy, ecological or environmental anthropology anthropometry, nutritional anthropology, health genetics, applied physical anthropology, etc. (Ramireddy, 1992).
ANTHROPOLOGICAL APPROACH TO FOOD AND NUTRITION

At the global plane anthropologists have long been interested in food, food ways and nutrition. Their contribution in this area has been substantial.

The anthropologists have also worked as consultants in the formulation of governmental policy on food and nutrition. They have dwelt extensively on the kinds of food to be used in the future. They have also made a study of famine foods in the context of inhospitable environments.

The science of nutrition has been developed by using the combined knowledge of the physical and biological sciences. It's application involves the social sciences related to man's behaviour, i.e., psychology, sociology, anthropology and economics (McDivitt et al., 1973).

Figure-1 : Good nutrition for everyone is dependent on the application of the principles of many sciences and the coordination of many disciplines.
A recognized fact today is that the study of nutrition is a biocultural issue. The consequences of food intake are biological; i.e. individual biological functioning is directly and continuously affected by food intake over the course of a lifetime. But the nature of food intake — what people eat, how, when, where and how much — is heavily influenced by social, economic, political and cultural processes. From assessment of nutrient distribution at the national level to analysis of nutrient distribution within communities and families, social variables are an integral part of nutritional outcomes. The national policy on food has to depend upon and take into consideration the cultural and regional norms of the groups living at the grass root level. The need for analyzing food and nutrition from the social science perspective is much important today than ever (Doshi, 1995).

This phenomenon was recognized several years ago when Richard Barnes contended that in no area of biology is the relationship with the social sciences more inclusive, or more critical, than in the nutritional sciences. Human nutrition is a subject that defies precise definition, and placing boundaries around the subject as a scientific discipline is difficult. Although knowledge of required nutrients and their occurrence in foods is central to the study of human nutrition, the social, economic and cultural factors that are related to food practices determine the food consumed by populations and the ultimate nutritional well being of individuals.
Cravioto views nutrition as more than the adequacy of the food consumed and the physical state of the individual (Sanjur, 1982).

The Meaning of Nutrition and its Scope

Nutrition is recognized as an important determinant of health and development of societies. Nutrition is fundamental to the growth and development from conception of attainment of adult size. It is essential to health and to the quality of life at all ages (Martin and Beal, 1978). Nutrition is the focal point for health and well-being. The subject has global importance but it has special significance in countries which have disadvantages of socio-economic and hygienic standards (Bamji et al., 1998). The science of nutrition aims at providing quantitative and qualitative requirements in diets for maintenance of good health for people of different status including normal adults as well as others requiring specialised diets such as growing children, pregnant women, lactating mothers and people of advanced age.

United Nations International Children Emergency Fund has advocated nutrition as one of the crucial components if basic services geared to the needs of the young child. Reinforced by experience, nutrition has been promoted in the overall context of primary healthcare and in conjunction with other preventive health measures like immunization, improved, midwifery, safe water, sanitation etc. (Gopaldas and Seshadri, 1987). Not only the number of national and international journals devoted to nutrition and dietetics proliferated in the past few years, but the wide-running applications of nutritional
science to other areas of interest and it's importance in allied fields have been increasingly recognized. Articles on nutrition science to other areas of interest and it's importance in allied fields have been increasingly recognized. Articles on nutrition have for many years been published in medical and nursing journals. More recently nutrition related reports have been appearing in publications concerned with such fields as food technology, sociology, anthropology, psychology, ecology, education and toxicology. This is an indication of the fact that as our understanding of the effects of the good and poor nutrition expands, it becomes even more obvious that those effects apply to the total functioning of the individual. His ability to learn, to work, to earn, and to adapt to a changing environment are affected by his nutritional intake during the years of growth and development as well as during his adult life (Martin and Beal, 1978). We may perhaps settle for a simple definition of nutrition science as “the area of knowledge regarding the role of food (dietary inputs) in the maintenance of health.” The frontiers of nutrition sciences had been limited, as it were, to dimensions of health related to growth and development of body tissues during adult hood. The frontiers of nutrition science would now seem to extend for beyond the confines of “growth development maintenance and repair include such other aspects of health as immunocompetance, ageing, mental well being and prevention of degenerative diseases and Cancer (Bamji et al., 1998).

The study of the science of nutrition deals with what nutrients we need, how much we need, why we need these and, where we can get them (Mudambi and Rajgopal, 1990).
Nutrition like many of the preceding factors influences growth and development of the children before and after birth, closely linked to health, along with the latter it contributes to the socio-economic development of an individual member of the society, community and nation as well as under the influence of genetic and non-genetic factors as also culture of the people (Rami Reddy, 1992). The rapid and noteworthy advances made during the last six decades in the science of food and nutrition have convincingly demonstrated that correct and appropriate feeding is essential for healthy life (Doshi, 1995).

Most simply, nutrition is the science of food and its relation to health. A more compete definition from the American Medical Association is that “nutrition is the science of food, the nutrients and other substances therein, their action, interaction and balance in relation to health and disease, and the processes by which organism ingests, digests, transports, utilizes and excretes food substances” Nutrition in its broadest sense is not limited to the biochemistry and physiology of the body (Martin and Beal, 1978). Food, nutrition and health are intimately connected aspects of our life. Food is that which nourishes the body. Food may also be defined as anything eaten or drunk, which can be absorbed by the body to be used as an energy source, building, regulating or protective material. In short, food is the raw material from which our bodies are made. Intake of right kinds and amounts of food can ensure good health, which may be evident in our appearance, efficiency and emotional well-being. Food is a prerequisite of nutrition. Nutrition has been defined as food at
work in the body, i.e., nutrition is the result of the kinds of foods supplied to the body and how the body uses the foods supplied. The word health refers to the condition of the body. Good health not only implies freedom from disease, but physical, mental and emotional fitness as well (Mudambi and Rajgopal, 1990).

The History of Nutrition

History records a number of attempts by man to search for answers to his questions about food and its relation to health. Until world war I the significance of nutrition was recognized by a relatively small group of scientists and physicians. Since that time, a wider awareness was developed of the part that nutrition plays in the health and efficiency of individuals and the economic development of nations. A great number of discoveries and developments have been made which are important in understanding the needs of people and the means of supplying of them (McDivitt et al., 1973). Nutrition has been called a "twentieth-century science". Indeed, application of many earlier nutritional findings came late in history.

Some Important Milestones

Mayow an English physiologist and chemist, was the first to suggest that the air inhaled by animals was taken up by blood in the lungs and transported to different parts of the body. Lavosier, who has been called the "father of nutrition" showed that Oxygen was a part of the air and that there was a relation between breathing and the combustion of substances in the air (1743-1793). Gerrit Jan Mulder (1838) gave the name 'protein' to foods containing nitrogen
meaning to take first place. W.O. Atwater, U.S.A. (1894) investigated the diets of hundreds of people, after analyzing many foods. He prepared the first extensive table of food values in the U.S.A. Frederick Hopkins (1906) postulated that there were accessory food substances which were necessary for growth. Thomas Osborne and Lafayette Mendel, U.S.A. 1909, showed that aminoacids were the limiting factors in the biological value of proteins.

Santorio Sanctorius (1561-1636), of Italy, weighed himself before and after eating and tried to find what happened to the food. He could not find the answer. Perhaps he was the first to attempt experiments on human metabolism. J. Beozelius (1838) showed that iron in the blood enabled it to absorb oxygen. Dr. William Beaumont (1833) U.S.A., carried out experiments on gastric juice and the physiology of digestion.

The search for answers to nutritional problems is still continuing and perhaps will continue as long as man inhabits this planet. We have come a long way from the days of Sanctorius's unsuccessful efforts to understand what happened to the food he ate (McDivitt et al., 1973). Bauman (1896), discovered the high iodine content of the thyroid gland. Goldberger (1900-1930), studied pellagra and protein nutrition in the Southern part of the U.S.A. In 1909 — at approximately this time in many countries research began to be oriented to the nutritional quality of foods and man's need for the several nutrients (i.e. the emphasis was on nutritive quality). David Marine and O.P. Kimball, (1921) U.S.A., after studying the nutrition of
6,000 school children in Akron, Ohio, showed that children given iodine in drinking water did not contract Goiter, where as those not given the element developed the disease. The effectiveness of iodine in curing Goiter was thus demonstrated. In 1940 limited food supplies in Western Europe led to studies of quantities of foods needed for individuals and populations. In 1941, Recommended dietary allowances for specific nutrients were established in the U.S.A. In 1945, the Food and Agricultural Organization of the United Nations was formed. The United Nations International Children Emergency Fund was established by the United Nations, to give relief to children, primarily in war-deviated countries. In 1950, the responsibility of this organization was extended to economically undeveloped countries. In 1948 World Health Organization was formed. It is difficult to set in chronological order of events that showed the development of nutrition. Many aspects developed simultaneously or overlapped each other (McDivitt et.al., 1973). Hundreds of years of nutritional research have led to discovery, progress and improvement in the quality of life for millions of people. This historical overview of nutrition discoveries of the past will serve as a prologue to our study of nutrition today.

**A Brief History of Nutrition in India**

1. The foundation of nutrition research in India was led by Lt. col. McCarrison. He first carried out certain field investigation on Goitre in the research laboratories at Kausali in 1912. The object of this enquiry was to investigate the effect of faulty food on the Thyroid gland.
In 1918, Lt. col. McCarrison started his first investigation on nutrition in the Pasteur Institute, Coonoor. The investigation on which Lt. col. McCarrison worked was designated the "Beri-Beri Enquiry".

2. The real history of uninterrupted nutrition research in Coonoor dates from 1925. Amongst other important contributions by McCarrison's work on the vitamin content of Indian cereals, with particular reference to the problem of Beri-Beri in India stands out even to-day. Apart from specific contributions to science, "Nutrition Research" at Coonoor has since its inception, endeavoured to put nutrition on the map in India and to make the Indian people nutrition minded. Today the importance of nutrition in relation to public health in India is generally realised; but this realisation has been arrived at by slow degrees. From small beginnings the nutrition research laboratories have proceeded apace till today they are a pillar of strength to the government and to the people.

A case in point is McCarrison's book "Food" published in 1928. It was a precursor to other important publications on nutrition intended for the people.

3. In 1935, Dr. W.R. Aykroyd took over the duties of the director on the retirement of Col. Sir Robert McCarrison, and the second phase in the history of nutrition in India started.

In 1936, the Nutrition Advisory Committee was constituted under the Indian Research Fund Association, which has continued to meet all its expenditures.
4. A short resume of the activities of the Nutrition Research Laboratories, Coornoor, is given in the following paragraphs.

5. Diet Surveys: In order to obtain a more detailed picture of the extent of malnutrition in the various provinces of India, and the effect of diet deficiency on physique and health, it was considered essential that surveys of diets and nutrition in relation to dietary habits should be carried out in representative areas throughout India. It was further decided to direct particular attention to the investigations of the state of nutrition of school children, with this object in view, a number of diet surveys were carried out in different parts of India, and useful data have been collected about the state of nutrition of the population. The surveys involved the weighing and measuring of school children and the examination of children to detect the presence of food deficiency diseases. The study of the state of nutrition of children in different areas adds to the value of diet surveys, since it throws light on the effect of various diets on health and physique.

The main object of diet surveys has been to discover defects in Indian diets, and to indicate the changes and improvements desirable from the point of nutrition. The surveys revealed the following interesting facts.

(a) The diet of the poor is essentially the same all over India. The staple cereals, which may be wheat, rice, maize, bajra, according to the province, supply anything up to 90% of the total calories; only very small quantities of other foods such as pulses,
vegetables, fruit, milk and meat are taken. A special Health Bulletin on Rice, No. 28, was issued by the Nutrition Research Laboratories on the subject.

(b) The intake of leafy vegetables is generally below the requisite level.

6. Nutritive Value of Indian Food Stuffs: In 1935 the laboratories embarked on a systematic survey of the nutritive values of Indian foodstuffs—an essential preliminary to the satisfactory developments of the public health nutrition work. The results obtained were incorporated in Health Bulletin No. 23; "The Nutrition Value of Indian Food, and Planning of Satisfactory Diets." The book was published by the Government of India press at the low price of two annas. Besides the Nutrition Research Laboratories, Coonoor, other research organisations have also contributed materially to the study of Indian foods, and today, India is by no means behind other countries as regards knowledge on this subject.

7. Training in Nutrition Work: To obtain a complete picture of the general study on nutrition and dietary habits throughout India, it was essential to secure the active participation of the provinces and states with this object in view, special training classes were started in 1937 at the Nutrition Research Laboratory, Coonoor, and since then, classes are being held annually. The education of the people is an essential part of this campaign for improving nutrition. Education and propaganda, to be effective, must be based on exact dietary habits, and be adaptable to local customs and prejudices.
8. **Investigation and Publications**: Over 150 scientific papers have been published from the Nutrition Research Laboratories, Coonoor, since 1918, nearly all in the "Indian Journal of Medical Research".

9. **Nutrition Propaganda**: In addition to basic research, the Coonoor Nutrition Laboratories have taken a considerable part in the education of people in nutrition. From time to time popular lectures are delivered, and press notes issued.

10. **Collaboration with the League of Nations**: In 1939 the Nutrition Research Laboratories undertook the task of collaboration in the work of the Technical Commission on Nutrition of the League of Nations, acting as a link between the Technical Commission and Nutrition Research organisations in Eastern countries. This fact revealed that the contributions made by the Nutrition Research Laboratories are widely recognised outside India. (National Institute of Nutrition, 2000).

11. In 1944, Recommended Daily Allowances for Indians were drawn up by the Nutrition Advisory Committee of the Indian Research Fund Association (These recommendations were revised in 1958).

12. In 1949, Indian Research Fund Association became the Indian Council of Medical Research.

13. The Central Food Technological Research Institute was established at Mysore for studying ways and means of how processing technology and research could alleviate the food problem in India.

14. Iodization of salt started on a pilot scale in India (McDivitt et al., 1973).
FOOD AND NUTRITION

Food plays a particularly important role in health throughout the life-course. Good health is dependent on not only having enough to eat, but also on eating a balanced amount of nutrients. Food consumption is no longer seen as an issue for mainstream social policy, but rather the concern of health educators. Yet undernourishment due to poverty is still with us, raising the issue that lack of money for food is still a present-day social issue. The research suggests that poor families generally have unhealthier diets than their better-off counterparts. Within this context of individual responsibility for health, the poor diet of low-income families is often attributed to three main factors.

1. Inefficient food purchasing and irresponsible budgeting.

2. Preference for unhealthy foods

3. Lack of knowledge concerning the value and composition of a healthy diet.

A number of surveys have shown that families on low income are less likely to eat a healthy diet than families with high incomes. These surveys have shown that low income families are likely to eat less fresh fruit and vegetables, less fresh meat or fish, but more fatty foods, carbohydrate and filler foods, particularly sugar, white bread, jam, cakes and biscuits than high-income families patterns of food intake also vary according to family composition, as well as with households with children. Average food consumption falls as numbers
of children increase. Although this pattern generally remains the same across income groups, any reduction in individual consumption is most significant for low-income families, as their lower intake of food is compounded even further by the presence of children. A lower consumption of food in low-income families with children implies that there will be a corresponding lower dietary intake of essential nutrients, unless low-income families are less likely to consume foods that are rich in essential nutrients, such as vitamins and minerals, or have a diet that is low in fats and sugar and high in dietary fibre, as recommended by the two major nutrition reports of the decade, the NACNE (National Advisory Committee on Nutrition Education), Report and the COMA (Committee on Medical Aspects of oral Diet and Cardiovascular Disease) Reports. Although the NFS (Nutrition Foundation Society), measures only the intake of selected nutrients, it shows lower intakes in low-income families than high-income families for nearly all the nutrients it records, particularly vitamin-C. Food consumption patterns within the family are strongly related to age and gender (Singh, 2001).

**Food Consumption**

1) Nutritional well-being is influenced by the nutrient content of foods consumed in relation to requirements that are determined by age, sex, level of physical activity and health status, as well as the efficiency of nutrient utilization by the body. Infectious diseases, in particular, affect dietary intake and nutrient utilization. The synergistic relationship between inadequate food intake and
infectious disease is so strong that the separate role of each is difficult to assess.

2) A diet is adequate when it provides sufficient energy, protein, fat, carbohydrate, micronutrients (vitamins and minerals) and other essential components, including dietary fibre, to meet the body's needs in a balanced, diversified and culturally acceptable manner. If intakes are too low, nutritional deficiencies may occur, on the other hand, if intakes are excess, other nutrition-related problems may arise. Adequate nutrient intake are needed to meet energy expenditure of metabolism, activity, response to disease and growth.

3) As recently as the 1970s it was widely believed that protein deficiency was the major cause of malnutrition, and considerable efforts were made to increase the consumption of protein-rich foods. Furthermore, emphasis was often placed on promoting "high quality" protein from animal sources. Indeed, energy deficiency is a far more significant problem than protein deficiency among these populations where inadequate food intake results in child malnutrition.

4) Since infants and young children can consume only a limited amount of food at one time, the nutrient and energy density of their food is particularly important.

5) It is estimated by WHO (World Health Organization), that upto 70 percent of all cases of diarrhoea are food borne in origin.
6) Chronic or recurrent diarrhoea can also lead to protein-energy malnutrition, anaemia and vitamin A deficiency particularly in young children, causing growth faltering and impairment of the immune system, weakening resistance to other infectious diseases.

7) Environmental sanitation, water supply and the safety of food are important determinants of nutritional and health status. Improved water and sanitation are associated with decreased diarrhoeal disease, improved nutritional status and lower childhood mortality. The impact of these improvements is dependent on other factors such as income and educational levels.

8) Food contamination leading to infectious disease, such as typhoid and acute diarrhoea, can result in poor nutritional status, especially for those at risk, such as young children (Food and Agricultural Organization Report, 1992).

**Food and Nutrients**

The desire for food is one of the strongest primitive instincts. All living things need food; without it they die. It is well known that food removes hunger and gives a feeling of satisfaction and renewed strength. Nutrition has been defined as food at work in the body. There are several kinds of work done by foods. Some foods can do only one kind; others work in several ways. The foods that we eat actually become a part of us. This is because one of their most important tasks is that of building the body (McDivitt et al., 1973). Food is a basic need of the human race because it contains the nutrients essential to life. Food does make a difference if adequate
amounts of nutritious foods are eaten. A good diet has a tremendous bearing on a person's vitality, health, emotional stability, and enthusiasm for life. One who is well-nourished will reflect this fact in his personal appearance. Generally, his posture is good, his muscles are firm, his complexion is clear, and his eyes sparkle. He is prepared to meet life with equilibrium. Other observations and research have strengthened the proof that good nutrition makes a difference in the health and appearance of people. Robert Mecarrisen, a British physician, studied the health of people in different sections of India. Great differences in the stature and well-being were attributed to the diet.

Thus, the observations and research point to the important conclusion that the kind and amount of food eaten by a person have an influence on his well-being.

Consequently, it is essential to distinguish between food and nutrition. People have the false impression that if they eat just any food, they are nourished. It is not as simple as that. Foods are merely the conveyors of the nutrients necessary to well-being, and the particular food eaten may not contain the required nutrients. The terms well-fed and well-nourished imply receiving adequate food containing the required nutrients for good health. In addition, it is important that the proper proportion of these various essential nutrients be supplied (Fleck, 1981).

Food is a bio-chemical process and product, which sustains life. But it is not merely the source of bio-chemical needs, it also has a
cultural dimension which helps a person to determine his food and nutrition habits and choices. Surely, each human being has certain biological needs which must be fulfilled by some nutrients which are the same for all people. Yet, the foods that supply the nutrients are as different as the nutrient essential for the survival and existence of people as human beings and cultures which they have adapted in accordance with their environments (Doshi, 1995).

**The Concept of Health**

The issue of health is of great importance both from the point of view of the individuals and the nation as well. In any country it is the health status of the people that determines the pace of economic development and the well being of the people. Health is an important problem both in the advanced and developing countries. However, it is a serious problem in the developing countries. Health status of the people determines the average expectation of life, number of people in productive age bracket, production productivity, earning capacity, employment and welfare of the people. On the other hand several economic variables like income, employment, purchasing power, quality and quantity of goods and services available etc, determine the health status of the people.

Health is an important component of human capital. There is indeed a vicious cycle present in the developing countries like India which is as follows:
The concept of health, as defined by the world health organisation is the "state of complete physical, social and mental well being and not merely absence of disease or infirmity". Nutrition and health are not synonymous but without good nutrition, health cannot be at its best. Food has always played an extraordinarily vital role in the rise and growth or the fall and decline of a nation because of its effect on the health efficiency of its populace (Ministry of Human Resource Development Report, 1995).

Good health is not just the absence of disease but it is the optimal functioning of body and mind. It is affected by many factors like genetics, environment and lifestyle, with food and nutrition playing a dominant role (The Economic Times, 2001).
**Malnutrition**

Malnutrition means an undesirable kind of nutrition leading to ill health. It results from a lack, excess or imbalance of nutrients in the diet. It includes under-nutrition and over-nutrition. Under nutrition is a state of an insufficient supply of essential nutrients. Over nutrition refers to an excessive intake of one or more nutrients, which creates a stress in the bodily function (Mudambi and Rajgopal, 1990). Malnutrition is any disorder of nutrition and strictly speaking, includes both deficiency or under nutrition as well as excess or over nutrition (Williams, 1991). Malnutrition is a state, which results from a discrepancy between the supply of calories or essential nutrients to the body tissues and the tissues’ need for them. Malnutrition causes impairment of the functional ability of the body, deficiency of it’s structural integrity, or abnormality in development. The term includes both under-nutrition, which results in deficiency symptoms, and over-nutrition, which results in obesity or, for some nutrients, toxicity. Malnutrition may be either primary or secondary, primary malnutrition is caused by inadequate or excessive intake of calories or nutrients in relation to the body’s refreshments and may be due to faulty food selection, lack of money to buy proper foods or actual food shortage. Secondary malnutrition results from any interference with ingestion or absorption or from stress or other factors such as chronic diarrhoea, parasitic infestation, gastric surgery, drug therapy, or infection (Martin and Beal, 1978). Under-nutrition or lack of adequate diet is a form of malnutrition, which is most widespread. The causes
of under-nutrition are many and often interrelated. Poverty resulting in low purchasing power is one of the main causes of under-nutrition because poor families cannot buy adequate food for themselves. In some communities, especially in rural areas, nutritious food such as millet may not available throughout the year. Thus, sometimes even though families can afford to buy nutritious food, non-availability may lead to malnutrition. Ignorance of the relation of foods to health is another reason for the prevalence of malnutrition. Increasing urbanisation is another cause of malnutrition.

Overcrowding, insanitary environmental conditions, poor hygiene, contaminated water supplies are some of the problems encountered. In addition, not having enough food, decreases resistance to infections, and exposes the family members to frequent attacks of diarrhoea and other diseases. This intensifies the problem because what little food is consumed is not absorbed but lost.

In poor communities, because both parents have to work to maintain the family, the children, especially the younger ones, do not have anybody to take care of them and feed them at regular intervals. Often, an elder child, who may only be a few years older than the infant, is left to take care of the young ones. There is thus a vicious circle which encompasses poverty, ignorance. Poor housing, disease and infection and unless this is broken by improving the economic condition of the low socio-economic groups, malnourishment of a huge sector of the population of the world cannot be eradicated.
The following figure illustrates the close relationship between health, economics and social progress. It shows how poverty engenders disease, which in turn engenders more poverty.

![Diagram showing the relationship between poverty, ignorance, malnutrition, and disease]

Figure-3 : Relationship between health, economics and social progress. Source : Mudambi and Rajgopal, 1990.

Malnutrition is a major public health problem in the developing countries. It contributes to child mortality, poor intellectual and physical development of children, and lowered resistance to diseases and consequently stifles development. It's etiologies include low income, uneven household food distribution, poor sanitation, infection, food shortages, inadequate food marketing and preservation, and inadequate nutrition knowledge. Malnutrition is a very complex problem and multifaceted strategies are required to combat (Melville et al., 1988).
The dictionary meaning of malnutrition is imperfect or faulty nutrition. It can be simply defined as a precipitated stage of disproportion between demands of the body for a certain nutrient and its intake. In India under-nutrition is more prevalent and it is only in rare situations that over-nutrition exists. In general usage, therefore, the terms malnutrition and under-nutrition have come to be taken as almost synonymous. Just as some diseases tend to affect some people more than others. Malnutrition (under-nutrition) tends to affect some sections of our society predominantly. Malnutrition being a reflection of unfulfilled dietary demands, it is most likely to occur during the three most demanding periods in human life i) growing age ii) pregnancy and iii) the period of lactation. Therefore, the worst impact of malnutrition is falling within these three groups. Furthermore, it is natural to suppose that malnutrition is more prevalent among the poorer sections of society due to the restrictions of diet imposed upon them by their poverty. As a result of this unfortunate combination of circumstances, the worst sufferers are the infants and children, pregnant and nursing women of the under-privileged classes (Shukla, 1982).

**Poverty-Malnutrition Interaction**

The close association between poverty and malnutrition tends to bring about an aggregation of the vulnerables in small or larger groups. These groups live within our society but are, in reality, segregated and are merely the mute spectators of the wasteful ways of life of the rich.
Figure 4: Poverty - Malnutrition interaction
Source: Shukla, 1982
A set of vicious circles is produced having their common touching point at poverty and malnutrition. Poverty leads to high proportion of work time being required to meet the necessities of life and leave no reserve or surplus money, resulting in insufficient resources to invest in environmental sanitation which brings about persistence of primitive health standards and inadequate and unequal distribution of the available food. The children thereby, get less than their due share of nutrients which leads to low weight gain and malnutrition. Another offshoot is of primitive health concepts persisting and the resultant failure to recognise hygiene requirements and deficient personal hygiene. Thus, in infants leading to increased rate of infectious diseases which further brings about a precipitation of malnutrition. The lack of resources also leads to a different vicious circle which brings about early school leaving leading to illiteracy and diminished opportunity to receive adequate information. Technological backwardness resulting into lower purchasing capacity and persistence of primitive health standards is the result again (Shükla, 1982).

The high rates of infant and maternal mortality in our country stem chiefly from malnutrition. Malnutrition is the direct result of an inadequate or unbalanced diet. In poor rural communities 85% families lose at least one child and 50% lose three or more children most of them due to entirely preventable diseases including malnutrition. The other nutritional disease that plays havoc in our country is blindness due to vitamin A deficiency.
The Indian Situation

Today malnutrition is no longer considered as an outcome of food deficiency or a health problem but at a multi-dimensional problem interfacing all efforts of developing human resources (Ministry of Human Resource Development Report, 1995).

Malnutrition literally means "Bad nutrition" which could be over nutrition or under nutrition. A large majority of our children suffer from under-nutrition and specific deficiency syndromes. The causes of malnutrition are always complex. It is very important to realise this complex etiology because the same type of malnutrition may be caused by very different factors. It is very important to know the detailed causes of malnutrition because without this knowledge it is not possible to plan and carry out curative and preventive programmes relevant to local conditions. Dietary inadequacy due to poverty, unavailability and ignorance is a well-established cause of malnutrition. In recent years the role of infections and infestations in the causation of malnutrition has been well documented. Many infections occur more easily, persist longer and cause much higher mortality in malnourished children, than in normal children. Infectious diseases play an important role in the initiation of malnutrition itself. Deep rooted cultural beliefs and customs and dependence on outmoded and tradition bound methods of treatment play a definite part in the causation of malnutrition (Chandra, 1975).

The causation of all forms of malnutrition, from marasmus to obesity, is always complex, and this is certainly so with malnutrition
in young children in developing trophical regions. This realization is fundamental because, in different parts of the world, the same type of malnutrition may occur with very different causative factors responsible. Three main groups of causative factors are 1. Dietary inadequacy 2. Infections 3. Socio-cultural factors.

**Dietary Inadequacy**

Malnutrition is often in large part directly due to dietary inadequacy, whether this be a lack of nutrients or an imbalance. However, at the same time, “Pure” dietary malnutrition is the exception, and other precipitating causes, such as infections, are usually also present. An inadequate diet may itself be due to a variety of causes

1) Poverty may put various foods beyond the budget of the family, and this is especially the case with regard to expensive animal protein.

2) Certain foods may not be available in adequate amounts in a community because of poor production. Sometimes because of an unsuitable climate or soil, or defective food distribution or marketing.

3) There is usually a lack of knowledge of the best foods for different age groups, and especially the special dietary needs of young children, such as the high requirement for protein during this phase of rapid growth. Without exposure to modern knowledge, it
is impossible for an intelligent but illiterate and uneducated individual to have any awareness of modern nutritional concepts.

4) Lastly, what may be termed “wrong knowledge” may be nutritionally significant. This may form part of the traditional culture pattern or may be a recent importation into the community. In Bengal a study was carried out which showed that, although Kwashiorkar was most usually due to poverty, there were, in fact, a range of locally available protein food, which were not being given to the child for a variety of different cultural reasons.

**Infections**

Much work has been carried out recently on the interaction between nutrition and infections. It has been shown that many infections occur more easily, persist longer, and have a much higher mortality rate in malnourished children, while infectious diseases also play an important role in the initiation of malnutrition itself. Many infections are characterized by poor appetite and sometimes by vomiting and diarrhoea. Apart from this, it has been shown that during even minor infections the need for protein and other nutrients increases. Also, in some communities the diet during infections may be severely restricted, or the child starved, as a misguided part of treatment.

Infections are of particular importance in the production of malnutrition, especially Marasmus, Kwashiorkar, and Avitaminosis. Infections with various parasites also may have nutritional relevance.
Socio-Cultural Factors

Various socio-cultural factors can play a part in the causation of malnutrition, food preparation and meal pattern. The local pattern of eating obviously has significance as far as satisfactory infant feeding is concerned and consequently in the prevention of malnutrition. These patterns will include the methods of cooking, the number and times of meals, and the priorities of distribution of different types of foods within the family.

Malnutrition in School-Age Children

Unless the local availability of food is very poor, school age children do not usually have the severe problems found in the early years of life, and there is little mortality in this group from malnutrition. By this age, children will usually be eating most of the adult foods and will have become, to some extent at least, immune to many important infections and parasites. Nevertheless, school children in tropical regions very frequently show some degree of malnutrition. They are often underweight and below standard height, which may, in part, be due to failure to catch up following some degree of protein calorie malnutrition in early childhood. Evidence of poor current intakes of protein and calories may be indicated by this limbs with only slight subcutaneous fat and poorly developed musculature.

Anaemia may be present in some degree, as judged by a pale tongue and Conjunctiva. This may, in part, be due to Iron deficiency. Various specific signs of dietary inadequacy may be found for example
the enlarged Thyroid (Goiter) due to Iodine deficiency, the cracks and sores at the corners of the mouth that can result from an inadequate intake of Riboflavin, and the dark, scaly areas of skin that occur in Niacin deficiency (Pellagra). The teeth may show signs of dietary abnormality. Growth and nutritional status of school age children can be assessed by taking weights and heights and comparing them with standard weight-for-height-for age tables. As an approximation, it may be noted, that between 5 to 10 years of age the weight increases by 10 percent and the height by 5cms (2 inches) annually.

Although there is a low incidence of severe or killing malnutrition in this age group, nutrition work aimed at school children is important because,

1. In order to derive optimum benefit from the school experience, children must have an adequate dietary intake. Many children walk long distances to school with little or no breakfast and with nothing available for lunch. Under these circumstances, they are often tired, unattentive, and apathetic. Some form of school meal, therefore, must be regarded as an important measure in improving the value of a nation’s educational system.

2. Although school children have passed through many of the infections and parasite diseases that cause much havoc in early childhood, nevertheless, they are still growing, although less fast, and the danger of certain infections is still considerable, especially Tuberculosis.
3. Lastly, and very importantly, school children represent a highly significant "target group" for health education, even though only a percentage of children of this age are, in fact attending school. Their school experience is one of learning, and they are more amenable to new ideas concerning food and health than older people. School children must, therefore, be regarded as a priority group for nutrition education for the coming generation (Jelliffe, 1976).

Malnutrition kills more children than any war, earthquake, flood or any other dramatic disaster. It is the children's most vicious enemy, stalking them daily and secretly. The interrelationship between nutrition, immunity and infection are important determinants of morbidity in both primary and secondary malnutrition. For assessment of health usually indirect measurement is done by the incidence of ill-health i.e., morbidity and mortality (Bhandari et al., 1985).

Malnutrition is the by-product of poverty underdevelopment, and the isolated nutritional programmes target to a segments of the population for improvement in the nutritional status may not be so useful as compared to integrated programmes like education, health and other developmental works (Sur et al., 1997).

Nutrition and infection are the two most important factors that affect growth of the children. Among children, malnutrition especially strikes those, who lack nutritionally adequate diet, not protected from frequent illnesses and do not receive adequate care. Malnutrition, a
public health problem among infants and young children, is associated with a web of factors including insufficient food intake, incorrect feeding practices and frequent infections and literacy status of parents. Vaccine preventable diseases and faulty feeding practices are associated with profound growth retardation (Rasania and Sachdev, 2001). Under-nutrition is one of the major public health problems in India. According to National Nutrition Monitoring Bureau (NNMB), during 1988-90, the percentages of children in normal, grade I, II and III and IV malnutrition were 21.3, 47.4, 27.5 and 3.8 respectively. Inadequate caloric intake has been documented as the primary cause of growth retardation amongst children (Kapil, 2001).

The mortality and morbidity rates amongst Indian children continue to be high, even after 50 years of independence. The health of the children in a given population can be gauged from two important indicators, i.e., the infant mortality rate (IMR) and under five mortality rate (UFMR). The condition of children belonging to poor families living in vulnerable pockets such as slums, tribal areas, remote places, hilly tracts, etc is alarming. For a malnourished child, every infection is potentially fatal (Health for the Millions Trust Report, 2001).

Malnutrition is a condition resulting from the deficiency or excess intake of one or more nutrients. Low income and poverty are the main contributory factors to the wide prevalence of malnutrition. Added to nutritional deficiencies, problems such as traditional belief fads and fallacies aggravate malnutrition. Malnutrition lowers
resistance to diseases, resulting in higher morbidity, apathy, lethargy and reduction of working efficiency. These lead to low-income, low standard of living, poverty and infection (Devadas, 2001).

**Consequences of Poor Nutrition**

1. Under-nutrition and micro-nutrient deficiencies may result in a range of conditions that adversely affect the health and well being of individuals. In severe cases, they can be life threatening. Whether in their mildest or most severe form, the consequences of poor nutrition and health result in a reduction in the overall quality of life and in the levels of development of human potential. In addition, poor health related to malnutrition reduces the resources and earning capacity of households that are already poor, thus increasing their social and economic problems.

2. A number of temporary and permanent disabilities are caused by hunger, malnutrition, nutrition deficiencies and other diet-related diseases. There is much evidence that poor nutrition has a significant impact on reproduction, physical activity, child growth and development, learning capacity work performance and overall quality of life and well-being. In addition, malnutrition lessens an individual’s ability to fight infectious disease, compounding the extent and severity of illness among the poorly nourished.

3. Malnutrition, often resulting from unsuccessful social and economic development efforts, in turn contributes to further declines in the future of human, economic and social development.
4. Among infants and young children severe malnutrition is directly associated with high levels of mortality.

5. In addition to Iron deficiency Anaemia, other micro-nutrient deficiencies can have serious, debilitating or even fatal outcomes. Iodine deficiency in childhood can cause mental retardation, delayed motor development, growth failure, decreased physical activity, muscular disorders and paralysis as well as speech and hearing defects. Vitamin A deficiency is the world's most common cause of preventable childhood blindness. Given the role of vitamin A in regulating the body's immune system, even mild vitamin A deficiency can lead to increased infections, stunted growth and higher rates of child mortality.

6. Nutrition affects the intellectual development, learning capacity and school performance of children. Growth retardation due to under-nutrition affects the development of motor and mental functions while severe under-nutrition affect brain growth as well as activity levels. Results of 20 years follow-up testing of malnourished children from the 1970s indicate early irreversible damage to intellectual development resulting from malnutrition. Malnutrition in pre-school years leads to stunting. Ill health and chronic malnutrition, especially Anaemia, persisting during the crucial early years of education can hinder learning capacity (Food and Agricultural Organisation Report, 1992).
**Manifestations of Undernutrition**

- A major causal factor of malnutrition, particularly among children in India, is consumption of an inadequate amount of food (in quantity as well as quality) leading to deficiency of energy as well as other essential nutrients required to maintain good health, poor health status of the population hampers the capacity to work.

- Severe protein-energy malnutrition (PEM) in young children manifests itself as Kwashiorkor and Marasmus. Sunken lifeless eyes, a large head, pot belly, swollen limbs, extreme growth retardation with an emaciated and skeleton-like body, a wrinkled old-man-like appearance, skin changes and irritability etc., are some of the signs and symptoms which symbolize the severity of malnutrition in children.

- These clinical cases of protein-energy malnutrition (PEM) represent only the tip of the iceberg. Underneath lie the vast majority of children who are silently suffering the onslaught of mild to moderate malnutrition. This is popularly known as "invisible malnutrition" (Thummala et al., 1997).

  Malnutrition has adverse influence on morbidity, mortality and life expectancy (Ramachandrudu, 1997).

  Malnutrition and infectious diseases are co-existent and their close association has been shown to result in increased morbidity and mortality of poor children. The frequent epidemiological relationship between acute infectious diseases and Kwashiorkor has led to the
belief that infection has a deleterious effect on the nutritional status of undernourished poor children (Bhaskaram, 1987).

Malnutrition is another contributing factor as it leads to infectious, and infections in turn increase energy demands and decrease food absorption. So even the food that is available to the child is not absorbed (Ko Ko, 1987).

**Child Growth: Diet, Growth and Development**

Growth is a vital property of all living beings. There should be normal growth and development of the children. The growth is dependent on several factors, which could be placed under to brought heading heredity and environment. Environment includes a large number of variables like climate altitude, food, socio-economic conditions etc. Physical growth, which reflects increase in body size, is determined by genetic and environmental factors. However, the predominant factor that affects exploitation of growth potential that we genetically inherit, is nutrition. It is for the same reason that full growth potential is not realised among children living in poorer communities of the developing world. Poverty, ignorance, insufficient food and frequent childhood infections due to unhygienic living conditions hamper the growth of children living in these disadvantaged situations on the other hand. Children from well-to-do families in all countries grow well and are healthy. This proves the important role of a nutritious diet in the healthy growth of children. Hence, in the assessment of nutritional status, growth status of young children is used as an important indicator.
Child's growth and nutritional status are closely linked. The extent of growth retardation is directly dependent upon the intake of diet. To ascertain these, various methods are being used, varying from the ultra sophisticated laboratory analysis to seemingly over simplified application in the fields. Somatic measurements are indicative of physical growth of a child. Physical growth has intimate relationship to nutritional status.

Growth is a sensitive indicator of nutritional status in children. In developing countries, measurement of weight and height, and their ratio, are primary indices of protein-calorie malnutrition and are especially useful for children whose ages may not be known. The smoothness of growth in the healthy, well-nourished child has been well documented and a number of growth charts are readily available. The pattern of growth over a time period and the child's progress along a consistent channel area the best measures of whether the diet is supplying sufficient nutrients for growth, energy, and physiological needs without the excess which may lead to obesity. In surveys which provide only a single contact with the child, the one available set of measurements will provide a tentative evaluation of growth at least by identifying the child who is very short this, or heavy for his age, so that he may be studied further.

**Postnatal Growth**

However, during adolescence, between 10 and 12 years in case of girls and between 12 and 14 years in case of boys, a sudden growth spurt is observed. Studies carried out in various parts of the world
have confirmed the peak of the adolescent growth spurt early in girls and two years later in boys.

**Growth Standards**

Measurements of weight and height in children are compared with those of their normal counterparts in order to assess nutritional status. However, India being a vast country, any standard developed in one state may not be applicable to another. Therefore, the standard widely used for this purpose in many countries including India, is the one developed by the National Centre for Health Statistics.

In fact, the World Health Organization (WHO) recommends the use of heights and weights compiled by the NCHS as international reference standards. If the actual figures are lower than certain cut-off based on NCHS values, this indicates that the growth of child is not normal or that the child is undernourished.

**Factors Affecting Growth**

1. Dietary inadequacy is the primary cause of growth retardation.

2. Nutritious foods are avoided and dietary intake is restricted during infections because of food fads and false beliefs, arising from ignorance and low literacy levels among women. Low purchasing power of families due to increased unemployment also contributes to poor quality diets (Thummala et al., 1997).

Child development and child nutrition are not confined to pediatrics or health sector alone. Improvement in educational and
social status of the women, adequate healthcare facilities, better environmental sanitation and overall community development together will bring about desired improvement in the nutritional status of the children special health and nutritional programmes have been initiated for women and pre-school children.

However, children belonging to school age group (5 to 15 years) continue to be undeserved by the public health services. Although schools are recognised as an important link between health and education, health departments generally have been slower in developing services for the one-fifth to one-fourth of the population. This is due in part to lack of clear indicators as to what services are necessary and desirable for the school-aged population and to the jurisdictional conflicts.

In India, in the 3rd 5th - year plan, applied nutrition programme (ANP-1962) and mid-day meal programme (MDM-1962) were started, while during the 4th 5- year plan special nutrition programme (SNP-1970) was implemented to benefit the school children in underprivileged rural area and urban slums (Awate et al., 1997).

The school-going children are the most important segment of the society. Good nutrition of the children is an indispensable component of healthy life. It is also a determinant of healthy growth of mind and body. Lack of proper health education, poverty, faulty feeding habits and irrational beliefs aggravate the health and nutritional status of these under privileged children in India (Balgir et al., 2002). Children are the wealth of the nation, children not only
constitute a large part of the population but they are also a "vulnerable" or special risk group. By virtue of their large number they are entitled to a large share of health care (Taneja et al., 1978). It is an accepted fact that children are a national assets and any expenditure on them should be considered an investment than an expenditure. The nurture and solicitude of our children are the responsibility of not only the family but of the community and the state at large (Gupta et al., 1978).

School age children (5 to 15 years) have not received as much attention from health providers/planners as the underfives. In India, several studies have been carried out on the health status of school age children. These have largely been quantitative and the reported morbidity included malnutrition (10.0-98.0%), dental ailments (4.0-70.0%), worm infestation (2.0-30.0%), skin diseases (50.0%) (2-10), However, data on the community's perception about these morbidities are inadequate (Ananthakrishnan et al., 2001). In India children below the age of 15 years form about 42% of population (Khurana et al., 1984).

School meals can no longer be relied on to provide nutritious meal for poor children. Many children are deprived of healthy food through lack of income at a time when their need for nutrients is at its greatest. Poor diet in childhood is associated with a variety of problems including poor physical and intellectual growth and development. Obesity, dental caries and diseases are associated with vitamin and mineral deficiencies, such as Anaemia and Rickets,
Moreover, there is growing body of evidence that suggests the major public health problems of the decade, in particular, coronary heart disease, have their origins in childhood (Singh, 2001).

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In all countries children are loved and have a special place in peoples lives. But a large number of them become a cause for sorrow because of illness or ultimately death. One-tenth or more of these children die before they are one year old and many more die before they reach the age of five. Many of those that survive never reach their full potential because of crippling diseases or malnutrition, adverse environment and poverty. For infants and young children the risk of death is very closely related to the environment in which they live. Death occurs because of lack of facilities to deal with infections, inadequate food and lack of elementary hygiene.

The child is constantly growing and developing. To meet the essential day-to-day needs of children is to ensure their growth and prepare them for the future. The health of the children depends on the quality of the life of the next generation. Supported by the health systems with information and appropriate technologies, families can share much of the responsibility of seeing that child is healthy and is growing up correctly. Improvement of the environment by providing safe drinking water and sanitation is an essential part of that health
care. Given the necessary will and determination with a primary health care approach every child that is born can have a fairer chance of survival and good health.

Children are the nation’s biggest investment for development and harmony. The physical and mental development of today’s children determines the prosperity and peace of tomorrow. Damages incurred during childhood may affect irreversibly the personality of child. Therefore, special attention should be given by all concerned for meeting the needs and problems of children. Among the basic needs, nutrition is interrelated to all aspects of development (Easwaran et al., 1974).

Children constitute the most precious resource for a country and must be given every opportunity to be mentally alert and physically strong. Good nutrition in childhood is of paramount importance to determine the normal growth and development of the individual (Devadas et al., 1978).

A common saying is ‘health is wealth’. Their good health is a national wealth so every possible care should be taken so that the children become healthy. These should be normal growth and development of the children. The growth is dependent on several factors, which could be placed under two broad heading heredity and environment. Environment includes a large number of variables like climate, altitude, food, socio-economic conditions etc.

As the Director General of the World Health Organization, H. Mahler, has said: “The investment in childhealth is a direct entry
point to improved social development, productivity and better quality of life. Since men and women themselves are not only the object, but the most important resource and subject of socio-economic development. The focus on child wealth is a development issue at all times and for all countries. Thus “children’s health is tomorrow’s wealth.”

The nutritional status is outcome of complex and inter related set of factors. The nutritional status of a nation is closely related to food adequacy and its distribution levels of poverty, status of women, rate of population growth and access of its population to health, education, safe drinking water, environmental sanitation hygiene and other social service, while the extent of economic growth forms its bedrock (Ministry of Human Resource Development Report, 1995). Nutritional status depends upon several factors and the causal relationship between malnutrition, mortality, morbidity and health are complex.
REVIEW OF LITERATURE

Studies Conducted in India

Kamalanathan et al., (1970) analysed the effect of a blend of protein foods on the nutritional status on of 25 pre-school children in the age range of 2 to 5 years in a rural Balwadi and concluded that there is scope to improve the diets of the poor people using local food resources.

Singh et al., (1971) analysed the data on growth and development of 7,000 school children of high socio-economic strata and 2,000 school children of low income groups. The analysis of data revealed that Indian boys and girls were as tall and as heavy as their American counter-parts of corresponding ages upto a particular age, suggesting that given the proper nutrition and environment, the growth of Indian children is as good as those of American children.

Devadas et al., (1971) assessed the effect of supplementation of a rural school lunch programme with leafy green vegetables on the nutritional status of 60 children of Pannimadai village (T.N.). Thus, after six months of experimental study, the nutritional status of the children receiving greens had improved significantly particularly with regard to clinical picture.

Pascual, (1971) in his article "social and cultural factors in malnutrition" discussed the prevailing food habits, traditions, customs and beliefs as the most important socio-cultural factors affecting nutritional state and reported that it is unfortunate that the
psychological, social and cultural factors, which create barriers against rapid changes in food habits are less well understood than the impersonal aspects of nutrition and malnutrition.

Swaminathan et al., (1972) in his review, presented a brief account of the available information on protein enriched cereal foods for overcoming malnutrition among pre-school children in India and other developing countries.

Sunderraj, (1972) studied the food intakes of eighty pre-school children (2 to 5 years of age) resident in a village in Tamil Nadu. The diets of the children were found to have adequate protein; however the calorie intakes were low and the intakes of Iron, Thiamine and Niacin were adequate. The diets were markedly deficient in vitamin A, Riboflavin and Ascorbic acid. The Calcium intake was lower than the recommended allowance for this age group.

Rao and Satynarayan, (1974) assessed the nutritional status of 707 pre-school children belonging to seven tribal groups of Andhra Pradesh. The prevalence of protein calorie malnutrition was the highest among the Gonds and the Chenchus. The prevalence of other signs of nutritional deficiency like vitamin A and B complex, was much less among the tribal children compared to those of rural Hyderabad children. The extent and severity of malnutrition among the children of Konda Reddis, Savaras and Yanadi children was similar to that of rural Hyderabad pre-school children.

Chandra, (1975) explored non-nutritional causes of malnutrition by a health and nutrition survey of 607 pre-school
children in six villages in Ramanathapuram district of Tamil Nadu and an opinion survey of what people believed to be the cause of the common diseases, what local remedies adopted, and what type of medical aid they preferred was done in 340 families of the children examined. The survey revealed that, apart from inadequate intake of food, infections and socio-cultural factors also seem to play a major role in the causation of malnutrition.

Devadas et al., (1975) evaluated nutritional background of 300 malnourished pre-school children treated in the pediatric out-patient department of the Coimbatore medical college hospital. The causes for malnutrition were low intake of nutrients, infection, low income, lack of knowledge, improper selection, preparation and consumption of nutritious foods, poor weaning practices and faulty food beliefs. Malnutrition resulted in lowered height, weight and Haemoglobin level in these children.

Easwaran et al., (1976) studied the incidence of malnutrition among a selected groups of rural and urban pre-school children, registered in 3 different medical centres in Coimbatore and the study revealed that the morbidity pattern included large no of nutritional deficiency cases. Among the nutritional disorders in cases registered in medical centres, protein-caloric malnutrition was predominant with vitamin A deficiency ranking next.

Parvati Rau, (1977) in her article "family size and growth and development of the child" reviewed the nutrition and growth status of children, the associated factors and implication of family planning
measures and reported that an important factor having a marked effect on diet in a country like ours is the alarming rate of population growth with almost static incomes and soaring prices, a bigger family limits the availability of food per head. The end result of such dietary deprivation is what we see in a majority of the lower economic groups of population a high degree of discernible malnutrition and associated evils. Thus, a vicious cycle of malnutrition leading to high child mortality, motivates larger families. This results in a further worsening of malnutrition.

Gupta et al., (1978) assessed the nutritional status of 1235 children (1 to 5 years age group) living in and around Bikaner city (Western Rajasthan). The results indicated the presence of P.C.M (Protein Calorie Malnutrition) in 11.52 % of cases, Nightblindness in 2.9 % and Bitot spots in 2.2 % and corneal and Conjunctival Xerosis in 1.13 % and 1.29 % respectively.

Rao, (1978) made an attempt to assess the nutritional status and the related factors on 6,560 rural pre-school children (1 to 5 years of age group). Analysis of the data showed that there was a high prevalence of various forms of nutritional deficiency signs. Growth status as assessed by height and weight was closely associated with the prevalence of protein energy malnutrition. Both vitamin A deficiency and B complex deficiency signs tended to increase in children with better grades of growth. Some of the clinical signs of protein energy malnutrition were also seen to occur in children
having better grades of growth status, which perhaps may be due to non-nutritional factors.

Devadas and Jamala, (1979) evaluated the food supplement of 200 school children of the age group 5 to 8 years from six villages in community development block of Coimbatore district. The findings revealed that the nutritional status could be improved with the supplementation of their diets with the nutritious local low cost foods.

Devadas et al., (1980) conducted a study on the incidence of infection, infestation and its inter-relationship with malnutrition among 700 children (0 to 6 years of age group) showed that socio-economic, conditions were poor, the food intake of the children was imbalanced. The personal hygiene habits were poor and the general nutritional status of the children was below the all India standard. Among the nutritional disorders, Kwashiorkor, Marasmus, Anaemia and vitamin A deficiency topped the list.

Luwang and Singh, (1981) studied protein-energy malnutrition (PEM) amongst 300 Tangkhul hill tribals under five of Manipur. Prevalence of PEM was 42.67 percent. PEM was highest in the 2nd year and lowest in the 6 months of age. PEM had significant association with age of the children. Sex and birth order of the children did not show significant association with PEM. Infections had significant influence in the causation of PEM.

Kanani and Gopaldas (1983) made an exploratory study to investigate the nutritional impact of nutrient and health inputs in a Baroda municipal primary school on 113 boys (5 to 13 years of age
groups) who belonged to families with income of Rs. 200-500 per month. Results indicated that the MDM (Mid Day Meal) food supplement could bridge the deficits of calories and protein in the home diet but not of iron and vitamin A. Requirements of the latter were met only by the addition of specific nutrient inputs. There was a significant increase in Hemoglobin levels and a significant increase in clinical signs of Xerophthalmia in subjects. After intervention the results suggested that addition of specific nutrient/health inputs may enhance the nutritional impact of MDM programme.

Banerji et al., (1983) screened primary school children of rural areas of Jasra block of Allahabad district, numbering 400, studying in I to V classes, to assess their ocular health, particularly for presence of vitamin A deficiency disease. There were 352 males and 48 females. Their age ranged between 5 and 12 year. The findings showed a major proportion of children (33.0 %) suffered from trachoma followed by vitamin A deficiency diseases of eye (20.25%). Most of the children with deficiency disease consumed less than 1400 calories daily in their diet.

Devadas et al., (1983) evaluated the prevalence of nutritional and non-nutritional diseases among 400 (0 to 6 years of age group) children in Coimbatore and found that 296 children were suffering from non-nutritional diseases and 104 were suffering from nutritional diseases. Anthropometric measurements showed that all the children were below the standard measurements.

Choudhry and Rao, (1983) assessed the nutritional status of 215 pre-school children (4 to 5 years of age group) of Sindhi colony of
Jaipur city (urban) and the village Naila of Jaipur district (rural) in
the state of Rajasthan. There was a high prevalence of under-
nutrition in all the children studied with any criteria. The percentage
prevalence of various forms of malnutrition as well as normal children
were different between rural and urban areas. Urban children tended
to be better in nutritional status than rural children. The female
children were found to have higher prevalence of grade III
malnutrition than male children.

Devadas et al., (1984) evaluated the nutritional out comes of
two diets rice based and fingermillet (ragi) based from two feeding
centres, on 50 pre-school children in the age range of 2 1/2 to 3 years
followed over a period of four and half years. The years period
maintained over the four and a half years period indicated that both
rice and fingermillet (ragi) based diets possessed equal potential in
improving the nutritional picture of preschool children as observed
from the increments in anthropometric measurements. Haemoglobin
picture, serum protein levels and improvements in clinical picture
and also showed that when nutrition intervention was given
adequately and longitudinally at this crucial age of pre-school period,
the benefits were significant.

Puri et al., (1984) evaluated the extent of impact supplementary
feeding programme in terms of nutritional parameters like growth and
nutritional morbidity was on a sample of 50 children in the age of one
and a half to four years from a creche from a labour colony in
Chandigarh. The results of the study showed that supplementation in
its present form was inadequate to produce the desired beneficial
results of improving the nutritional status of the children. The incidence of various nutritional deficiency symptoms continued to be present, despite supplementation. It was hypothesized that supplementation in increased amounts given for a longer period of time can be expected to correct and improve the nutritional status of children.

Bhandari et al., (1985) assessed 1123 pre-school children (0 to 6 years of age group) of Udaipur district, Rajasthan to study the morbidity pattern and the interaction of morbidity, malnutrition and age. The results indicated that the age of the children had a significant correlation with the present as well as past morbidity and there was a significant correlation between malnutrition and infection in the past and present morbidity.

Geeta and Devadas, (1986) carried out a study of prevalence of malnutrition morbidity and nutritional status of 1246 infants and pre-school children in the age range of 0-6 years of Coimbatore. The results revealed below the normal for anthropometric parameters. The severe forms of malnutrition were found to be more in the age groups of 2 to 3 years. Morbidity pattern showed that greater prevalence of respiratory tract infections, PEM (Protein Energy Malnutrition), Anaemia and vitamin - A deficiency.

Busi et al., (1987) studied the food and dietary intakes and feeding practices of slum dwellers from 5 urban slums of Vishakpatnam by surveying 113 families,. Children of 631 individuals including 152 pre-school children. The results revealed that the
family size, income and occupation seem to have remarkable effects on dietary intake. The dietary intakes were good in small families and also better with increased income. As such, diets were deficient in all nutrients. Thus, it was stated from this study, the dietary intake of slum dwellers of Vishakpatnam was not better than the slum dwellers of other cities in India.

Rao and Sastry, (1987) made an attempt to identify suitable indicators to monitor changes in nutritional status of population by using National Nutrition Monitoring Board (NNMB) database from 1975 to 1980. Conventional indicators in this regard were nutrient intakes, clinical status and growth, particularly of children. Based on the analysis, the results suggested that in the 10 states where NNMB is operating, there has been an increase in average consumption of calories as well as improvement in body weight status of preschool children.

Padmaja Prasad et al., (1987) examined the inter-relationship between diet, anthropometry, Haemoglobin and Riboflavin status among urban school boys studying in class III and IV from low income families in Hyderabad. In conclusion the data reported showed that etiology of Riboflavin deficiency and Anaemia in school children was complex. While income, diet and anthropometry tend to influence Riboflavin status, these parameters did not seem to have any influence on Haemoglobin status.

Bhaskaram, (1987) briefly reviewed the nature, mechanisms and public health importance of the interactions between protein
energy malnutrition (PEM) and infectious diseases. The interactions between malnutrition and infection are mutually adverse. The results of these interactions are of public health importance in developing countries where malnutrition and infection often co-exist. Recent studies highlighted the mechanisms involved in these interactions and indicate the necessity for a comprehensive approach to control malnutrition in poor communities.

Sudha et al., (1987) assessed the nutritional status of 103 boys aged 10 to 12 years and 96 boys aged 7 to 9 years from orphanages run by Hindu, Jain, Muslim and Christian organisations. The analysis of data revealed that the mean weights and height for all age groups were lower than the Indian Council of Medical Research standards in most of the orphanages. On the basis of weight/height, about 25% of the boys aged 10 to 12 years from each orphanage were found to be malnourished whereas 50 to 60% of the boys aged 7 to 9 years were malnourished in all the orphanages except Jain orphanage (36%) and dietary intake of boys aged 10 to 12 years in all the orphanages was inadequate in energy and vitamin A. Intake of vitamin C was adequate only in the Muslim orphanage. Clinical examination revealed, some signs of nutritional deficiency.

A nutritional survey was conducted by Gurvinder and Subhashini, (1987) on 100 pre-school children from low income families in Ludhiana city. The survey revealed that all the children were found to be shorter and lighter than the average Indian child and according to Gomez classification (1955) 3.8% of children of the
younger group were severely malnourished and 1.9 percent were moderately malnourished. In the older group the number of normal children decreased with no severely malnourished case but maximum number (60%) falling in grade I of malnutrition. Their diets were grossly inadequate in terms of energy, Iron, vitamin A, vitamin C, and Niacin.

A study of the preliminary observation on health and nutritional status, in relation to housing condition of 402 pre-school children attending an urban community development Balwadi was carried out by Chitra et al., (1987). These children were from the socio-economically backward area of the city and were given supplementary feeding at the centre. A comparative study of housing condition of Balwadi children of similar socio-economic condition was also carried out. It was observed that in 42.3% children coming from poorly ventilated single room tenements against 12.1% children coming from between better ventilated tenements had one or more signs suggestive of past or present rickets. General nutritional status of children of these two groups based on B.M.I (weight/height$^2$ X 100) was almost similar. This preliminary observation indicated a need for a detailed comprehensive study on rickets, with the support of biochemical and radiological investigations in relation to housing environment.

Vijaylakshmi and Rao, (1988) made an attempt to assess the nutritional status of tribal children (0 to 12 years of age group) living in the hilly areas of Maredomill block, the most interior tribal block under (Integrated Tribal Development Agency) in Andhra Pradesh by
anthropometry. The results were also compared with the reported values for well-to-do Indian children. On the whole it was found that the non-tribal children had better nutritional status than the tribal children assessed by anthropometry. Clinical examination revealed the similar results. However, it was found that the local standards in anthropometric measurement in such specific ethnic groups are very essential and thus these have to be established for evaluation of the nutritional status of tribals.

Thimmayamma et al. (1988) analysed the dietary data collected on a total of 221 pre-school children as part of the diet and nutrition surveys, in different socio-economic groups in urban and rural areas in and around Hyderabad. The meal frequency and socio-economic status were also found to be significantly correlated to energy and protein adequacy in pre-school children. The total calorie intake decreased with a decrease in income.

Sarupriya and Mathew (1988) assessed the nutritional status of tribal adolescents, 60 boys and 49 girls in the age group of 13 to 18 years of village Gogunda, Rajasthan. The criteria used were food consumption, height, weight measurements and clinical deficiency symptoms. The results indicated inadequacy in all nutrients other than protein as compared to the recommended dietary allowances. The adolescents were lighter and shorter and manifested by clinical nutritional deficiency symptoms.

Thakar and Patil, (1990) assessed the nutritional status of 600 anganwadi children (3 to 6 years of age group) from 40 anganwadis of
both the Integrated Child Development Services (ICDS) urban projects I and II in Nagpur city and a sample of 500 non-beneficiaries using food consumption, clinical examination and anthropometric measurements. The results revealed the nutritional status of the beneficiaries of the ICDS programme was relatively better than that of the non-beneficiaries evidently due to the impact of the package services provided to them.

Seth et al., (1990) developed a hypothesis to construct the growth reference standards for developing countries for pre-school children of urban slums. For this purpose, a cross-sectional sample of 2987 children in the age group 1 to 10 years were selected from urban slums of Delhi for measurement of weight and height. Comparision of percentiles drawn from the top 25% of the sample demonstrated that 50th percentile of the present study corresponded to 80% of 50th percentile of the NCHS (National Centre for Health Statistics) of the height for both boys and girls. Also the 50th percentile of ICMR (Indian Council of Medical Research) for weight and height for both the sexes.

Qamra et al., (1990) evaluated the relative efficacy of anthropometric indices for the assessment of nutritional status for school girls and to ascertain more reliable and suitable index for field areas. It was found that the energy protein index was the only reliable and suitable index for evaluating the nutritional level of adolescents and post-adolescents while weight/height$^2$ and arm circumference were more suitable for determining the nutritional status of pre-adolescent girls.
Rohinidevi et al., (1990) conducted a study of dietary pattern among 200 rural malnourished pre-school children in the age group of 1 to 5 years. The children were randomly selected from outpatient department of medical college at Ambajogai, Aurangabad and the civil hospitals at Parbhani and Nanded in the region of Marathwada of Maharashtra state. From the findings it was clear that the diets of children with PEM (Protein Energy Malnutrition) grade I and II were deficient in calories, Calcium, Riboflavin and vitamin C. The severe form of PEM were associated with significantly reduced intake of all food items and nutrients and predicted that the PEM among rural Marathwada children is arising from marked calorie deficiency.

Mohanan et al., (1994) evaluated the relative efficacy of various nutritional assessment indices for pre-school children and found the best method of assessing malnutrition using various anthropometric measurements is weight for age as against body mass index.

Choudhury, (1995) assessed the nutritional status of tribal and non-tribal primary school children of Orissa. The findings revealed that tribal children were nutritionally better but more vulnerable to health hazards. It dispelled the popular belief that tribal children are malnourished.

Choudhury and Begum. (1995) measured a total of 1721 children in the age group of 3 to 10 years from various schools in Guwahati city, in order to identify malnutrition in childhood through anthropometric parameters and to find out the factors contributing to this. The findings concluded that there was a poor correlation...
between the two age independent parameters and therefore it is important to use more criterion in estimating malnutrition in child population.

Prameela et al., (1995) made a comparative study on the nutritional status of 300 adolescent girls and boys from 11 to 18 years of age drawn from rural areas of 3 regions of Andhra Pradesh. The results revealed that the girls were found to have lower Haemoglobin levels and intake of Iron and vitamin A were found to be severely deficient among girls compared to their brothers. Socioeconomic factors of family size and birth order were found to have negatively influence the nutritional status of girls. Anthropometric data showed that values were more closer to the Indian Council of Medical Research standards for the boys than girls.

A comprehensive survey was carried out by Aspatwar and Bapat, (1995) to assess the vitamin A status of pre-school (0 to 6 years of age group) and schoolage (6 to 12 years of age group) children of socio-economically backward families from slums of Bombay and its suburbs. The analysis of data revealed that among 1956 children surveyed 20% of the children showed low serum vitamin levels. 4.8% of the children were suffering from one or other signs of vitamin A deficiency. Due to lack of proper nutrition, the overall growth of children was either retarded or not upto the standard levels as was noted in majority of children.

Tambe et al., (1997) assessed the nutritional status of 4,546 Integrated Child Development Services, children (below 6 years) in
Pune city. The overall prevalence of malnutrition was 63 %. The prevalence was higher among older children (more than 3 years) as compared to younger children. The prevalence of malnutrition was higher among boys than in girls which was statistically highly significant.

Vazir et al., (1998) surveyed a total of 3668 Indian rural children (0 to 6 years of age group) of whom 2212 were well nourished and 1456 were malnourished, to assess the nutritional status, psycho-social development and to identify the micro-environmental factors influencing their growth and development. Results indicated paternal involvement with childcare was found to be important for positive psycho-social development and child's appetite, absence of health problems, parental age and family having own house and electricity were the factors significantly related to better nutritional status of children.

Das, (1998) in her article "Nutrition and sanitation important determinants of health" reported that malnutrition is a multifaceted problem and poor hygiene and sanitation are the main factors responsible for infectious diseases which in turn lead to malnutrition creating awareness about various aspects of nutrition and sanitation is, therefore, critical in improving the health of the people.

Ray et al.,(1999) studied nutritional status of 435 underfive children belonging to pavement dweller families of Calcutta city. The study indicated overall prevalence of Protein Energy Malnutrition was found almost similar (about 70 %) to that among other 'urban poor'
children viz, slum dwellers etc. but about 16% of them found severely undernourished.

Mahapatra et al.,(2000) conducted a community – based cross-sectional study of nutritional status of 751 children (0 to 5 years of age group) in drought affected Kalahandi district of Orissa. It revealed that malnutrition is still a leading problem among pre-school children of Kalahandi district and this has not improved in spite of nutrition intervention programmes which are currently in operation.

George et al.,(2000) studied the pattern of Anaemia and its relation to nutritional status and dietary habits among 3633 pre-school children in rural areas of Kerala state. Moderate undernutrition and Anemia showed a significant association. Dietary survey revealed that, consumption of Iron sources, whether haem or non-haem was below the recommended level.

Jood et al.,(2000) investigated the nutritional status of 90 rural pre-school children (1 to 3 years of age group) in summer and winter from arid (Bhiwani), semi-arid (Hisar) and wet (Kurukshetra) zones of Haryana state, India. Mean daily food intake of cereals, pulses, green leafy vegetables, other vegetables, roots and tubers, milk products, fats and oils, sugar and jaggery and fruits was found lower than their respective recommended dietary intake in summer season. Whereas, in winter season mean daily food intake of milk and milk products provided 6.7 and 32 percent more than Recommended Dietary Intake in the diets of pre-schoolers of Hisar, Bhiwani and Kurukshetra zones, respectively. Similar trend was also found in nutrient intakes.
Mean height and weight of few children were found lower in Hisar and Bhiwani and higher in Kurukshetra compared to their reference values on the basis of weight for age and height for age criteria as well as clinical examinations, majority of children were found normal in Kurukshetra.

Kapur et al., (2000) screened 545 children, 9 to 36 months of age for Iron-deficiency Anaemia in an urban slum Integrated Child Development Services project in North-East Delhi. Approximately 64% and 53% children were found to be Anaemic, based on Haemoglobin and Haematocrit estimation, respectively using World Health Organization cut off-values. It was concluded that simple finger-prick method is more effective and useful for Anaemia among children.

Usha Reddy, (2000) in her article "Nutritional significance of breakfast" reported that breakfast is supposed to replenish the stock of all vital nutrients after a long gap of rest and children and adolescents, in particular, need to take a nutritious breakfast regularly as they have to support the growing phase of their lives. The studies conducted in several parts of India including the National Institute of Nutrition Hyderabad, reveal that most young children belonging to underprivileged sections of the society are susceptible to varied forms of malnutrition. Breakfast foods play an important role in giving a soundstart to a child in the morning. A nutritious breakfast taken in the morning ensures a productive day. As a regular breakfast provides a goodbase for our physical as well as mental health, helps both in play and studies.
Sunita Kumari, (2000) assessed the nutritional status of scheduled caste pre-school children in Samastipur district of North Bihar. Anthropometric measurements showed that they were underweight as Body Mass Index was below 18.5. Protein Energy Malnutrition, Night Blindness, Angular Stomatitis, enlargement of liver, Anaemia, spongy bleeding gum and a few cases of bow legs, Polio and Keratomeelacia etc., were observed. The Haemoglobin level was below World Health Organization standard. Dietary survey showed that intake of protective foods and nutrients such as energy, Calcium and Iron were less than respective Recommended Dietary Allowances. Socio-economic environment was responsible for poor nutritional status of scheduled caste pre-school children.

Khadi et al., (2001) made a comparative study of heights and weights of 3512 rural children of 6 to 18 and 20 years (Selected from 32 villages) from four agroclimatic regions of Northern Karnataka. Results revealed that there were significant zonal differences in the height and weight of rural children in certain age groups. Boys from transitional zone were significantly lower in weight than boys from dry, coastal and hilly zone. Significant differences were observed between coastal and hilly zones in heights in the age groups of 8 and 13 years, whereas, in boys of hilly zone had higher heights than the boys of coastal zone. Among girls the weight in age groups 11 to 14 years of transitional zones were significantly lower than the weights of girls of dry and coastal zone.
Rasania and Sachdev, (2001) made an attempt to assess the nutritional status and breast feeding practices among 354 children under fives) attending Maternal Child Health Centre, Mehrauli, Delhi and to correlate the findings with some potential determinants. Results revealed 71.5% children were under weight as per weight for age while 70.1% and 62.7% of children had deficit in height for age and weight for height (wasting) respectively. Children who were not breastfed were found to be significantly more underweight and stunted. Prevalence of malnutrition was higher in bottle fed children (83%) than children on Katori/cup feeding (55.1%). The mother's report on breast feeding revealed that 92.37% children were breastfed.

Balgir et al., (2002) conducted the clinical assessment of health and nutritional status of 224 ashram school Gond (tribal) children (6 to 14 years of age group) in Kalahandi district of Orissa. It was found that the health and nutritional status of children on the whole was very poor and dental caries and contagious diseases like Scabies were common in these children due to lack of personal hygiene.

Studies Conducted Abroad

A quantitative study was undertaken by Rowland et al., (1977) to quantify the contribution of different infections in determining the nutritional status in 152 children (0.6 to 3 years of age) in Keneba, a rural Gambian village. There was a significant negative relationship between Gastroenteritis and both weight gain and height gain. The only other disease category having a similar relationship was Malaria,
but in this instance only with weightgain over-all growth in weight and height was considerably below the standard values.

Martorell et al., (1979) tested the hypothesis that the effects of malnutrition on growth in bodysize are greater than those on skeletal maturation by analyzing longitudinal data from birth to 3 years of age in four rural Guatemalan villages. The analysis of data showed most of the effect on bodysize of the food supplementation program was independent of changes in maturity. It will seem therefore, that malnutrition, by affecting bodysize to a greater extent than maturation, in effect hinders the possibility of catch-up growth and thereby accounts to a large degree for the smaller body size characteristic of adults of malnourished populations.

Morgan et al., (1981) assessed the breakfast consumption patterns of 657 American children (5 to 12 years of age group) and related to average daily nutrient intake patterns. Results indicated that few of the children skipped breakfast and that breakfast consumption made a significant contribution to the average child's daily nutrient intake. Comparision of the average nutrient composition of the three types of consumed breakfasts revealed that the average breakfast containing presweetened or non-sweetened ready to eat cereal had a higher content of sixteen nutrients and a lower content of five nutrients than did the average breakfast including no ready-to-eat cereal.

Jenkins, (1981) in his study "patterns of growth and malnutrition among pre-schoolers in Belize" presented selected
results of an anthropometric survey conducted among 750 pre-school age children during 1979 in Belize, to assess the nutritional status in two districts one coastal and one inland. Survey results indicated that about 25% of the children, birth to 5 years old, showed evidence of stunting, while 2.5% showed evidence of wasting and the frequency of Diarrhoea and age at introduction to solid foods were significantly related to growth retardation among pre-schoolers. Analysis of 24-hour-diet recalls corroborated the patterning of malnutrition among ethnic groups.

Nabarro, (1981) discussed the social, economic, health and environmental determinants of nutritional status of children. The initial focus was on the relationships between nutrient consumption, body function, and physical size in the individual child. The child is dependent on an adequate supply of nutrients if he is to be capable of operating at his full potential. Many different influences acting both inside and outside the child's body may prevent him from having the nutrients needed for these functions available for use in his body tissues.

Brown et al., (1982) studied the pattern of physical growth of 197 children (5 to 5 years of age groups) in two rural villages of Bangladesh. Comparisons of village standards with the international reference population showed the period of poorest nutritional status of the village children persisted from shortly after birth to approximately 2 year of age.
Mutie et al., (1982) made an attempt to study the effect of chronic childhood malnutrition by comparing pubertal growth and development in 342 privileged, urban children and 347 impoverished rural adolescents from Kenya. Derived estimates of body fat as well as direct anthropometry revealed that the onset of puberty is not size related under the circumstances of chronic childhood malnutrition.

Malina et al., (1981) in his study on growth of 1,410 rural and urban school children (6 to 14 year of age group) in the valley of Oaxaca, Mexico found that children in the rural, indigenous communities in the valley of Oaxaca were relatively undernourished compared to children in Ladinoised and urban communities, and that rural-to-urban migration does not necessarily result in improved growth status.

Buschang and Malina, (1983) carried out a study of growth in height and weight of mild to moderately undernourished, 285 Zapotech school children (6 to 13 years of age group) and when compared with well-nourished children from North and Meso-America, the Zapotech boys and girls showed moderate growth deficits that accumulate throughout the childhood and data confirmed that the health and nutritional status of Zapotech school children, though sub-optimal showed relative improvement after the preschool years.

Johnston et al., (1987) studied interaction of nutritional and socio-economic status as determinants of cognitive development in 459 urban Guatemalan children (4 to 9 years of age group) from a
disadvantaged community showed that mild to moderate protein-energy malnutrition prevalent among children was significantly related to cognitive development. However, in the poorest homes, socio-economic status is seen as a more important determinant of cognitive development than stature.

Bogin and Macvean, (1987), investigated the relationship of physical growth status (height weight and body composition), grade in school, and age to school continuation, for a sample of Indian children living in a village near Guatemala city. The study revealed that physical growth status, a reflection of health and nutritional status did not predict school continuation and a child's age and current grade in school do predict continuation. Most children left school after reaching 9 years of age or after completing the second grade. Also, the child's economic value to his or her family may be a significant reason for school dropout.

Frisancho and Tracer, (1987) evaluated the standards of arm muscle by stature for the assessment of nutritional status of children, this sample was derived from the combined data sets of the first and second National Health and Nutrition Examination Surveys of 1971-1974 and 1976-80. Based on means, z-score units, and percentile ranges of upper arm muscle are by stature, five operational categories of nutritional status were established. It was recommended that these standards and classification system could be used to supplement the current standards of weight for age and weight for height in order to obtain a complete assessment of body composition and nutritional status.
Melville et al., (1988) investigated the various socio-economic, demographic and biological factors that might influence the nutritional status of 445 children (4 to 35 months old) in Cornwall country, Jamaica. The study supported the general consensus that protein energy malnutrition is a problem of poverty.

Walker and Golden, (1988) examined linear growth of 369 children treated for severe malnutrition, at university hospital of the West Indies. Mean age was 12.6 months and 58 percent of the children were oedematous on admission. A subgroup of 108 children, who did not differ in age or sex from the total sample but contained a greater proportion of non-oedematous children, began to show catch-up growth in length. The results indicated the absolute rate of linear growth was similar to oedematous and non-oedematous children. Change in length for age during recovery was significantly less in children who were oedematous on admission. Two-thirds of the children attained at least 85 percent weight for length before they began to increase in length. Thus, in most cases linear growth followed replenishment of body weight.

Choo, (1990) made an attempt to determine the nutritional status of 104 Indian pre-school children in the rubber plantation sector in Malaysia and whether socio-economic, demographic and health related variables are associated with their nutritional status of the estate pre-school children in Malaysia is low. The major determinants of the nutritional status of educational level of the parents, household income; no of children in the family, duration of
breast feeding and completion of immunization for their children against infectious diseases and this study also indicated that significant associations with nutritional status of the children can be obtained when food data was analyzed at qualitative level.

Abbi et al., (1991) analysed the impact of maternal work status on the nutrition health status of 1,990 rural children (1 to 6 years of age group) from Chandrapur district, Maharashtra. Family income and child's age were significant intervening factors in the adverse effects of maternal work status on all nutrition and health status variable except Pneumonia and vitamin-A deficiency. Poor income appeared to be the major detrimental factor, with the mother's working status being an aggravator.

Victoria et al., (1991) in their study on "The timing of nutritional status determination: implications for interventions and growth monitoring" examined the nutritional status at birth and at average ages of 11,23 and 47 months in a population-based birth cohort of 1226 children in Pelotas, Southern Brazil. The results suggested that, in this population, childhood nutritional status was primarily determined before the end of the first year of life. These findings will have implications for the timing and nature of nutritional interventions and for mechanisms for identifying those children who will suffer from poor nutritional status later in childhood.

inequalities in health in Bangladesh varied significantly according to occupational status, such that the effect of sex was dependent upon occupation and demonstrated both temporal and socio-economic variation in gender inequalities in health.

Donnen et al., (1996) assessed the vitamin A status of 415 preschool age children in the Kivu province in Zaire i.e., in a population where protein-energy malnutrition is endemic. The survey suggested vitamin A deficiency co-exist with protein-energy malnutrition and is a public health problem even with non-malnourished and non-infected children.

Nube and Asenso-Okyere, (1996) found that a considerably lower nutritional status of children who continue to receive breastfeeding into their second and third year in comparision with fully weaned children of the same age. Thus, it was hypothesized that, under conditions where infectious disease pressure was relatively low and where post-weaning child feeding practices were satisfactory, prolonged breastfeeding, either directly or indirectly, contributed to a lower nutritional status of children receiving prolonged breast feeding in comparison with fully weaned children of the same age.

Bristow et al., (1997) attempted to determine the use of nutritional supplements of 15,275 primary school children aged 4 to 12 years in England and Scotland. The results supported the findings of other studies, which showed that children with the least need for supplements as defined by socio-economic variables are more likely to receive them and suggest that cultural background is also an important factor in influencing supplement use.
Globotswang, (1998) surveyed a total of 643 households and 898 pre-school children to determine factors that are associated with the nutritional status of children below the age of 5 years in the North-Western district of Chobe, Botswana. The results showed that the nutritional status of the pre-school children had a strong positive correlation with access to a latrine \((r=0.52)\) and ownership of cattle \((r=0.27)\). Age was negatively correlated with the child's nutritional status \((r=0.02)\).

Goulet, (1998) in his review article on "Assessment of nutritional status in clinical picture" reported that in clinical practice, the analysis should be longitudinal and take into account situations carrying a risk of malnutrition. Preventive use of nutritional assessment allows nutritional support to be introduced in a timely fashion, thereby avoiding morbidity/mortality and limiting the long-term impact of malnutrition of growth and development.

Tompsett et al., (1999) compared the nutritional status of 112 children (under 10 years of age) with various disabilities with their 87 siblings and 112 neighbours. The analysis of data revealed disabled children with neurological impairments and consequent feeding difficulties were nutritionally at risk, but others were no worse off than their non-disabled peers in this area. Haifspans may serve as a useful proxy indicator for estimating height in some children with physical impairments.

Abiodoye and Soroh, (1999) conducted a study on the effects of urbanization on the nutritional status of 328 primary school children
(5 to 10 years of age group) in Lagos, Nigeria. There was a preponderance of malnourished children from single parents were found to be clinically malnourished, 280 of all the children examined had ova and cyst of parasites in their stools and finally, most children spent less than 6 hours contact time with their parents per day.

Oelofse et al., (1999) in their study on the nutritional status of 6 months to 11 year old rural black children and their mothers as a first phase in a nutrition intervention project in Kwazulu-Natal, South Africa, found that the rural community in Kwazulu-Natal, showed a high prevalence of Anaemia, marginal vitamin A deficiency and Iodine deficiency.

Hagel et al., (1999) evaluated the helminthic infection and anthropometric indicators of nutritional status in a group of school-age children from a slum areas of Caracas, Venezuela, and confirmed the relationship between helminthic infection and decreased growth rates in under privileged populations and indicated that children at nutritional risk were more susceptible to such infections, even after a prolonged parasite free period.

Johnson et al., (1999) tested the hypothesis that the participation in the aid to families with dependent children and food stamp programs has a positive impact on children's nutritional status, after controlling for other potentially important household and individual level characteristics on a sample of 246 pairs of low income mothers and children in New Orleans. The study's conclusion were in this low-income setting, aid to families with dependent children and
food stamp benefits were associated with higher food expenditures, higher anthropometric levels, but inferior diets and female-headed households spend more on food expenditures than other households.

Bohler and Wathne, (2000) in their study on malnutrition and infections in children a destructive interplay with global dimensions discussed how nutritional status affects immune defense and vice-versa and interpreted that the interaction between malnutrition and common infections in children causes a considerable fraction of the global burden of disease, yet so far this is not reflected in research, which mainly targets the diseases of the rich.

In a review article on "Technical aspects of feeding the disabled child" by Thomas and Akobeng, (2000) discussed some of the issues involved in the nutritional management of neurologically impaired children under-nutrition is a significant contributory factor to growth failure. Eating may be distressing and the time consuming for the child and caretaker. Aspiration of feeds is common and may predispose to chronic chest infections.

A study was conducted by Sunwoong et al., (2000) to investigate nutrient intake food behaviour and nutrition knowledge of 543 middle school students (13.7 years old) residing in Seoul and Kyunggi-do in Korea Republic. It was concluded that among female students, nutrient intake was lowest in subjects whose nutrition knowledge was very high or very low therefore, nutrient consumption was affected by nutrient knowledge and nutrition knowledge of male students was affected by nutrition knowledge and attitude. The results indicated
that nutrition education and correct information on body image, balanced diets, regular meals and food selection for middle school students were required both at home and in schools.

Harris et al., (2001) carried out a study of nutritional and health status of 2078 Tibetan children (o to 84 months of age) living at high altitudes. Out of 2078 children, 1067 had moderately or severely stunted growth and stunting was not associated with altitude after adjustment for the type of community. Thus, it was concluded that in Tibetan children, severe stunting due to malnutrition occurs early in life and morbidity was high.

A study was undertaken by Corso et al., (2001) using a case-control, prevalence survey design, aimed at verifying the effects of socio-economic environmental and biological morbidity variables on the physical growth of school children from low-income families in Florianopolis, Santa Catarina, Brazil and the author concluded that socio-economic variables are hierarchically superior to other risk factors.

Eunjung et al., (2001) made an attempt to find out the frequency of obesity and eating habits of 292 older elementary school students in Iksan city by some obesity indices. It was found that the rate of skipping breakfast and eating meat or fish were high among obese and overweight girls and rare of not eating sugar was high in obese boys and concluded that nutrition education in adolescent students is important.

Abidoye and Nwachie, (2001) compared the anthropometrics of 297 infants (3 to 24 months old) breastfed in both high and low socio-
economic strata in Lagos, Nigeria. It revealed that malnutrition was considered to be very high and there was a positive correlation between anthropometric measurements and education.

Jinabhai et al., (2001) conducted a community-based cross-sectional study to measure anthropometric indices, micronutrient status and prevalence of parasitic infections in 579 rural South African primary school children (8 to 10 years of age group). It was concluded that micronutrient deficiency, parasitic infestations and stunting remain significant.

In the study of Rozen et al., (2001) on "Calcium intake and bone mass development among 2000 adolescent Israeli Jewish and Arab high school girls (mean age 14.5 years), it was shown that low Calcium intake, other nutritional deficiencies and delayed menarche due to low-energy died in the growing period and in adolescence may prevent the formation of healthy bones. There was no evidence of lower bone mass among the low Calcium intake group in the study population at that stage. There was a strong positive correlation between BMD (Bone Mineral Density) and bone mineral content (BMC) at all sites and body weights.

Suparman et al., (2001), while analysing the relationship between health-center performance and the nutritional status among 254 children (6 to 36 months old) in Bandung district, West Java province, Indonesia, found that the low contribution of health centres to the children nutritional status was due to a low coverage of health services and similar socio-economic status of the households in their study.
Leung et al., (2001) evaluated the growth and nutrition of Chinese vegetarian children (4 to 14 years of age group) in Hongkong, and concluded that growth and BMD (Bone Mineral Density) of the vegetarian children were comparable to the general omnivore population. A Hongkong Chinese vegetarian diet appeared healthy, providing adequate Iron and vitamin B\textsubscript{12} nutrition, but the prevalence of obesity was high.

Hall et al., (2001) examined the association between chronic under-nutrition and educational test scores on a sample of 3055 school children of 81 primary schools in three districts of Northern Vietnam. After controlling for age, sex district and school the results of test scores in both mathematics and Vietnamese were significantly negatively correlated with z-scores of height-for-age (p co. 001) and weight-for-age (p co. 001), but not with weight-for-height (P=0.75). A cross-sectional negative association was observed in Vietnamese primary school children between indicators of chronic under-nutrition and tests of educational achievement.

Beidou et al., (2001) estimated Iodine nutritional status of children and evaluated the development and effect about Iodine deficiency disorders (IDD) elimination in Zhejiang, China, 40 children (8 to 10 years of age group) were selected randomly and a survey on nutritional of Iodine in the 1200 children was carried out in 1999. The results indicated the level of the Iodine nutrition of children in Zhejiang was significantly improved.
Objectives of the Present Study

By keeping the review of literature and other aspects discussed in the introduction, in the present investigation an attempt has been made to study the nutritional status of the children of Dharwad slums, where adverse conditions prevail.

Following are the Main Objectives of the Present Study.

1. To assess the growth status of the slum children by using different anthropometric parameters.
2. To estimate the prevalence of nutritional deficiency disorders and to study their causative and contributory factors.
3. To investigate the Haemoglobin status (level) of slum children. [under biochemical parameter]
4. To assess the dietary pattern nutrient intake of the slum children.
5. To analyse the influence, interrelationship of socio-economic conditions on the nutriture or nutritional status of slum children.
6. To map out the existing level of malnutrition among the slum children.
7. To compare the results of the present study with other similar studies.
8. And to suggest the preventive measures for malnutrition.

Limitations of the present study

For the present study certain biochemical tests like plasma, Serum, 24-hr. urine samples and stool examination and bio physical
methods were not included, because it was difficult for the researcher to collect such samples from the slum children who were against giving the samples and these studies are difficult to conduct in the field.

In the present study, it was not practically feasible for the researcher to cover all the slums of Dharwad city due to shortage of time, money and non-availability of adequate skills etc.

However, whatever procedures and methods adopted in the present study would fulfill in understanding the health and nutritional status of the slum children of Dharwad city.