CHAPTER-I

Introduction
The prosperity of a nation is reflected in the nutrition of its people. No country can rise to its full stature with a third of its people subsisting on less than a square meal a day. India, with a population of 102.70 crores (Census, 2001) has malnutrition rampant among its low income groups. It is so in urban, rural and remote tribal areas as well as in coastal areas where poor fishermen communities reside. Wherever there is deprivation of food by quantity and quality there malnutrition is likely to prevail.

Nutrition and health are very closely interrelated. 'Nutrition' is the combination of processes by which the living organism receives and utilizes the materials (food) necessary for the maintenance of its functions and for the growth and renewal of its components. Health is defined by WHO as the state of complete physical, mental and social well being and not merely the absence of disease or infirmity. Nutritional status is the condition of health of the individual as influenced by the utilisation of the nutrients. It may be good, bad or poor, depending on the intake of diet and body's ability to utilize them. Nutritional status can be determined by the information obtained through a careful medical and dietary history, a thorough physical examination and appropriate laboratory investigations (Robinson et. al., 1986).

Malnutrition is an impairment of health resulting from a deficiency, excess, imbalance of nutrients. It includes undernutrition - which refers to the deficiency of calories and/or one or more essential nutrients. Overnutrition refers to an excess of one or more nutrients (usually the calories) which creates stress in the body function (Mudambi, 1991).
Adequate, optimum and good nutrition were used to indicate that the supply of the essential nutrients is correct in amount and proportion. It also implies that the utilization of such nutrients in the body is such that the highest level of physical and mental health is maintained throughout the life cycle (Mudambi, 1991). In the biological environment, nutrients provide chemical substances for growth, body maintenance and regulation of metabolism.

Nutritional status and intake may vary with age. For instance, the food habits of the elderly are the result of the life time influences of cultural, social, economic and psychological factors. These are the non-nutritional factors that affect the nutritional status and health of the older persons. These factors influence food selection, knowledge concerning what and how much to eat, inadequate income to buy sufficient quantities of required foods, physical infirmities which may affect mobility and therefore interfere with food purchase and susceptibility to food faddism. Regardless of the past, or inspite of it, intervention with good nutrition at any stage of life may contribute to current and future health (Kreulter, 1980).

Geographic factors, food availability and socio-economic status may all limit the quality of nutrition, particularly proteins, in the diet of people living on fixed or minimal incomes. Organically the brain, endocrine organs, digestive and the cardiovascular systems are pertinent to nutrition due to their role in regulation of food behaviour, homeostasis, metabolism and the transformation and distribution of nutrients in the body. Changes in personality and altered attitudes towards food represent major variables affecting quality and level of nutritional intake (Masaro, 1976; Schiffman, 1993).
There are several physiological functions that gradually decline with age. Various reviews have summarized cardiovascular, endocrine, immune, respiratory, reproductive, gastrointestinal, skeletal, dental and excretory system changes that can affect dietary intake and nutritional status of the elderly (Masaro, 1976; Porta, 1980). Decrements in the senses of taste and smell can have a significant impact on food selection and nutrient intakes. Sedentary life styles, drug therapies, social isolation, physical disabilities and chronic diseases can also substantially affect food choices, interfere with shopping and cooking, and impair nutritional status (Blumberg, 1997).

From 25 years of age the basal metabolism decreases about 2 per cent for each decade owing to the increasing proportion of body fat and the lesser muscle tension. There is a declining need for energy due to a reduction in the amount of lean body mass and a more sedentary life-style. The decreasing energy intake with advancing age has important implications for the diet in terms of protein and micronutrients. Dietary quality becomes difficult to ensure when overall energy intake is low and requires a careful selection of high quality, nutrient dense foods.

Nutritional status surveys of the elderly have shown evidence of subclinical nutrient deficiencies with a direct impact of function (Rosenberg, 1995). The most important micronutrient deficits affecting the elderly subjects are those relating to proteins, iron, zinc, selenium, copper and vitamins B₁, B₆, B₁₂ and D. Malnutrition causes mental impairment, low mood and physical disabilities. Lower nutritional intake produces reduction in body weight, low serum albumin, low calcium, zinc, protein, iron as well as low water and fat soluble vitamins. Infections can adversely affect
nutrition and malnutrition can predispose to infections by adverse effect on immunity (Bhaskaram, 2002).

Vitamin B complex factors are present in sufficient quantity in natural foods. But in the process of purification/preparation for eating, large amount of water soluble vitamins are discarded or lost particularly so in India. Their deficiency causes symptoms like paraesthesia and general aches, pain and lassitude.

**Iron Deficiency**

Iron deficiency anaemia is a major public health problem in India and other developing countries. It causes varying degrees of impairment of cognitive performance, lowered work capacity, lowered immunity to infections etc. The prevalence of anaemia in 5 states (Assam, Bihar, Orissa, West Bengal and Tripura) when compared with WHO cut off figures indicated that in various age groups and both sexes it was found to be high (around 20% to 70%) in all the survey areas. Gumla district of Bihar had the worst anaemia situation (Chakravarthy et al., 2000). Mild to moderate anaemia was very high in the females (82.7% and 79.1%) in comparison to males (67.1% and 63.9%) in the age groups of 19-45 years and 45-60 years. Severe anaemia (females 6.4% and 5.9%, males 3% and 5%) also had a similar variation. In those above 60 years of age mild and moderate anaemia was prevalent i.e., about 72.6% in males, and 78% in the females. In this age group severe anaemia was prevalent among both males (4%) as well as females (3.3%). In the surveyed population of the five districts it was found that anaemia was prevalent in all age groups and in both sexes in large percentage indicating it to be a universal problem. Women of reproductive age groups are more vulnerable.
Iron deficiency in the diet is the main etiological factor responsible for nutritional anaemia in the community. Iron deficiency leads to a type of anaemia called hypochromic, microcytic anaemia, more common among women. Mild iron deficiency generally remains dormant and is unrecognised (Nair, 1999).

Poor absorption and insufficient intake of iron from the predominantly vegetarian diets of most people in developing countries are the primary causes of iron deficiency. Other factors that contribute to anaemia are chronic blood loss due to hook worm infestation and malaria.

Although iron stores appears to increase with advancing age, signs of iron deficiency and or low body stores still occur in the elderly in developed countries (USDHHS, 1989; Finch et. al., 1998). Infection and inflammatory diseases such as rheumatoid arthritis that are common in elderly produce biochemical changes that mimic iron deficiency. Iron status as well as ageing process may affect immune function and neurological function.

**Lipid Profile and CHD**

The causal relationship of total cholesterol and more importantly LDL-C to Coronary Heart Disease (CHD) is well established. Lower levels of LDL-C lead to significant reductions in the relative risks of CHD. Reduction of total cholesterol by 10% produces a short term reduction of 10% and long term reduction of 20% in coronary events (Krishnamoorthy, 1999).

There is an inverse relationship between HDL-C and risk for CHD. For every 1 mg/dl increase in HDL, there is a corresponding 2% to 3% decrease in CHD risk and a 4% to 5% decrease in cardiovascular disease mortality (Sainani, 1996). Low HDL-C level in serum has been observed
frequently in young patients (mainly men) with Coronary Artery Disease (CAD), and may be a more important risk factor than high levels of total or LDL-C (Mehta and Obrach, 1999).

Hypertriglyceridemia is often observed with low HDL-C levels and it has been difficult to separate the role of these two factors. There are frequent and marked variations in serum triglycerides level and a carbohydrate rich diet can lead to marked rise in serum triglyceride levels (Mehta and Obrach, 1999).

Certain dietary practices directly result in increased levels of lipids in blood or trigger an underlying genetic tendency to atherosclerosis. The critical dietary factors are fat (quantity and quality) and total calories and cholesterol (Ghafoorunissa, 1986).

Fat

Fat is an important component in diets of human beings and fulfils several functions. High intake of saturated fatty acids promote aggregation of platelets and thus activate the blood coagulation system. Long chain n-6 PUFA are converted to eicosanoids, prostaglandins, thromboxanes and leucotrienes. The eicosanoids synthesized in platelets, promote aggregation of platelets and constrict the blood vessels, whereas eicosanoids formed in blood vessels have an opposite effect. A balance between the two is important for regulating the process of blood clotting. High intake of linoleic acid levels is considered to reduce atherogenesis (Ghafoorunissa, 1996).

The health of an individual depends upon the type and quantity of food stuffs he is able to include in his diet to satisfy his hunger. Dietary habits of populations in different regions of the world have been determined mainly by
the availability of foods locally and local practices. Extensive diet surveys carried out in different parts of our country both in the rural and urban areas indicate that diets are predominantly based on cereals. Diets of poor income groups are deficient in several nutrients namely energy, calcium, iron, vitamin A, riboflavin etc. General deficiency of these nutrients in their diet is reflected in widespread prevalence of deficiency diseases like anaemia, vitamin A and B-complex deficiency etc. Although dietary deficiencies of nutrients are the primary cause of these deficiencies, they are aggravated by infective morbidity among the poor due to bad environmental and personal hygiene. Anaemia can be aggravated by environmental factors which lead to blood loss eg. hookworm infestation. Though the iron consumption is more, the absorption may be less due to the lack of intake factors promoting iron absorption (De Maeyer, 1989).

Fish and sea foods are rich sources of high quality proteins, vitamins (A, D and B-complex), minerals (iodine and bioavailable iron) and are unique in being rich sources of preformed long-chain n-3 PUFA. Fish and other marine foods were one of the primitive man's main food in his earliest days as a hunter-food gatherer. In India fish and fish eating has been widely prevalent. In populations living in the shores of the sea coast who belong to fishing community, consume fish abundantly in their diets.

Nutrition in Fishing Communities

Andhra Pradesh has a coast line of 975 kms along the Bay of Bengal on the South Eastern part of India. There are nearly 482 fishing villages in Andhra Pradesh, among which 93 are in Nellore District (Census, 2001). The fishermen community is an economically weak social group. The literature
available revealed that fisherfolk are at a low socio-economic level and that they lack knowledge with regard to proper food habits. Studies have been conducted among fishermen communities on various socio, economic, psychological, cultural and religious factors, work performance, blood pressure, anthropometry, lipid profiles etc. Very few studies have been conducted on their nutritional, health and iron status.

An earlier study on fishermen communities of Nellore District by this investigator (Venkata Lakshmi, 1986) indicated that the diets of these communities were deficient in various nutrients. Protein energy malnutrition, ariboflavinosis, scurvy, anaemia, blurred vision were some of the common ailments attributable to nutrient deficiencies. Though the dry fish consumption was more, 83 per cent of women folk were found to be anaemic. Similar results in the fisherfolk of Kerala District were reported by Yegammal and Unnithan (1992).

Studies of Bang et. al., (1985), Simonsen et. al., (1987) and Kromhaut et. al., (1989) revealed that the habitual consumption of diet enriched in fish and fish oils by certain populations has been associated with a low incidence of cardiovascular diseases. Heart diseases are low in Eskimos where diet consisted largely of fish. The observations on fish eating populations support the protective role offered by fish (Kromhaut et. al., 1985).

Many epidemiological, interventional and animal studies have concluded that consumption of polyunsaturated fatty acids (PUFA) of marine origin may confer special benefits in reducing CHD mortality rates by different physiological mechanisms (Closas, 1993).
Lean fish intake showed a statistically significant relationship with ω-3 poly unsaturated fatty acids. Habitual fish intake is reflected in the content of Eicosa Pentaenoic Acid (EPA) and Docosa Hexaenoic Acid (DHA) in serum and in the LDL phospholipid and cholesteryl esters fractions. The concentrations of very long chain ω-3 fatty acids are useful biomarkers for dietary intake, mainly lean fish (Amiano, 2001).

The associations between the intake of fish and marine mammals and risk factors for cardiovascular disease studied in 259 adults revealed that marine diet was positively associated with serum high density lipoprotein and blood glucose and inversely with very low density lipoproteins (VLDL) and triglycerides (Bjerregaard et al., 2000).

The fish consuming populations showed lower mean serum cholesterol, triacylglycerols and significantly higher levels of HDL cholesterol and phospholipids. Thus the fish consuming population showed lower risk factors of coronary heart disease when compared to the non-fish consuming population (Bulliyya et al., 1990).

A few studies illustrated a relationship between iron status and lipid profiles. The association between iron levels and coronary artery disease mortality remains a controversial issue (Johnson et al., 1994). In an American study of nearly 400 men and women over 70 years of age, Corti et al., (1997) found that serum iron status was a powerful predictor of death from all causes, particularly from cardiovascular disease. Increased iron stores have been noted to be an independent risk factor for acute myocardial infarction (Salonen et al., 1992; Tuomainen et al., 1998). Finnishmen whose serum ferritin levels were high (>200 μg/l) are the
beginning of the study had a 2.2 fold increased incidence of acute myocardial infarction during the three year followup. The authors hypothesized that free radicals induced by free iron cause increased peroxidation of low density lipoproteins and thereby contribute to atherogenesis.

However, in a recent study (Derstine, 2003) this relationship was not confirmed. It will be interesting to investigate the relationship between the iron status and lipid profiles of people from fishing communities of coastal areas of Andhra Pradesh, India. A few earlier studies carried out among the fishermen communities revealed that 150 to 200 g of fish per day was consumed by the fishermen population. However, not many studies have been conducted to assess the beneficial effect of fish consumption or linking their iron status with the susceptibility to cardiovascular disease in men and women across the later adult years.

Young and middle aged adults show anaemia and depleted stores of iron. But with ageing iron stores have been shown to increase (Garry et. al., 2000). The prevalence of CVD also has been shown to increase with age. This interrelation between iron status and lipid profiles as influenced by other dietary variables and by age and sex have not been studied among Indians and especially those in poor fishing communities.

In view of the foregoing discussion, the present study has been undertaken to find out the interrelationship between the iron nutritional status and lipid profiles among the fishing communities of Nellore District with the following objectives.
Objectives of the Study

1. To estimate Haemoglobin, Packed Cell Volume, Serum Iron, Total Iron Binding Capacity, Per cent Transferrin Saturation and Serum Ferritin levels in order to assess the iron nutritional status and to estimate Serum Total Cholesterol, HDL-Cholesterol and Triglyceride levels (LDL-cholesterol and VLDL-cholesterol levels by calculation), to assess the lipid profiles and also to record anthropometric data (BMI, W/H ratio), blood pressure readings and other relevant information in a sample (n=500) of persons of different age groups (i.e., 21-70 years) and sex groups from the fishing communities of Nellore district.

2. To conduct a diet survey among the subjects of the sample in order to record the dietary patterns and food habits, to calculate the mean nutrient composition of the diets consumed by the subjects of the sample.

3. To study the inter-relationship and associations among the parameters of iron nutritional status, lipid profiles, diet and other relevant data (anthropometric data and blood pressure readings) in the study sample by subjecting the data to appropriate statistical analysis.