Haemoglobin Level in Patients with Hypercholesterolemia

BY

Radhamani. D.

A THESIS SUBMITTED TO THE AVINASHILINGAM INSTITUTE FOR HOME SCIENCE AND HIGHER EDUCATION FOR WOMEN (DEEMED UNIVERSITY) COIMBATORE - 641 043

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE IN HOME SCIENCE FOOD SERVICE MANAGEMENT AND DIETETICS

MAY 1995

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CERTIFIED AS BONAFIDE RESEARCH WORK

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Acknowledgement

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Introduction

I. INTRODUCTION

Twentieth century has witnessed miracles of reaching to the moon, travelling at the speed of sound and medical science has reached heights of transplanting organs. Yet there are millions who are deprived of basic human needs such as food, water and Shelter. Deptrivation of these basic necessities still constitute major factors responsible for the illhealth of mankind.

Today, many people are striving for optimal health. The developing world is faced with the scarcity of resources, chronic under utilisation of the available resources and a growing tempo of population explosion. There is a high incidence of undernutrition, illhealth and infectious diseases associated with scarcity of food. Developing countries like India have a very high prevalence of severe grades of undernutrition and illhealth.

Health is a dynamic force in our daily life that is influenced by our circumstances, beliefs, culture, social, economic and physical environment. It is a part of everyday life, an absolute essential for good quality life and happiness (Raghava prasad, 1994).

India has a national health policy (1982) which professes to aim at improving the health of all people.

A pattern of life that promotes health is not necessarily the easiest way to live. The popular trend is to yield to the desire for immediate pleasure. The healthy person is more optimistic, courageous, happy and keeps pace with his ambitions. According to Webster (1988) health may be defined as the condition of being sound in body, mind or spirit, especially freedom from physical disease or pain.

Malnutrition is attributed to poverty, poor food production, inequitable attribution and faulty consumption, various other economic and social factors and factors of technological development. Malnutrition and other diseases usually reduce the productive capacity of the adults. Malnutrition lowers the community's resistance to disease resulting in higher morbidity, apathy, lethargy, sluggishness and poor working efficiency.

Today, malnutrition and undernutrition bringout an increase in the frequency of new health problems such as coronary heart diseases, hypertension, cancer and diabetes (Park, 1991).

Heart diseases are among the greatest health hazards of modern times. Cardiovascular diseases are common in both developed and developing countries. In India, coronary heart disease is becoming an important cause of morbidity and mortality. Cardiovascular disease is day by

day getting increased in the developing countries. One has to see the preventive measures for attaining the goal of reducing mortality from ischemic heart disease various epidemiological studies all round the globe have shown reduced mortality from coronary heart disease by stopping smoking, reducing cholesterol in the blood, control of hypertension and diabetes mellitus.

Coronary heart diseases had been reported to be on the increase in India. Studies indicate that the incidence of coronary heart disease ranges from 6% to 23% of all heart patients. Coronary heart disease appears a decade earlier in life compared with the age incidence in developed countries and males suffer more than females in the ratio 4:1 except the extremes of life. Hypertension and diabetes accounts for about 40% of all cases. Precocious coronary heart diseases is also common. There is a larger incidence in the higher income groups and it is now reported that the disease is creeping down to the lower income group (Park,1991).

The role of trace elements has been considered to be playing an important role in the longevity. Considerable attention has been directed toward the possible link between the nutritional deficiencies of certain micro elements and the risk of coronary heart disease.

The metabolism of zinc is significantly altered in patients with atherosclerosis as evidenced by abnormally low plasma concentrations of zinc. A marked decrease in the zinc content of the aorta was indicated in atherosclerotic patients.

The correlation studies between chromium in drinking water and cardiovascular disease have suggested that lowered chromium level in water is associated with elevated serum cholesterol and deaths from coronary heart disease.

Certain trace elements influence enzymatic reactions in fat metabolism. Chromium and manganese have been shown to stimulate the synthesis of cholesterol, whereas vanadium has been reported to diminish it.

Trace elements study has been conducted in ischemic heart disease patients and results showed that there is correlation between serum iron and serum cholesterol and serum iron and systolic blood pressure. (Subramaniam, 1994).

Thus trace elements play an important role in cardiovascular system. The deficiency or excess may increase the risk factors such as hypertension, diabetes mellitus and serum cholesterol in coronary heart disease patients.

Iron deficiency anaemia is one of the most important public health nutrition problems in India and in many other parts of the world. Iron deficiency anaemia is a problem of serious public health significance given its impact on psychological and physical development, behaviour and work-performance. It is the most prevalent nutritional problem in the world today affecting more than 700 million persons. (India, 1994).

Anaemia may be diagnosed when the haemoglobin concentration is lower than the level considered normal for the persons age/sex group. It is estimated that about 30% of the World's population of 5000 million people are anaemic (Damaeyer, 1989).

Another bad effect of anaemia is hyperlipidemia and other hyperlevels of different fractions of fat. According to Subramaniam (1994) lipemia that is produced by iron deficiency is characterized by a rise in plasma triglyceride level. Serum cholesterol levels have increased several fold in severely iron deficient subjects. Lecithin cholesterol acyl transferase activity has been found to be depressed in the plasma of iron deficient subjects. This enzyme has an important role in altering lipoprotein composition and its decreased activity has been suggested to be responsible for the hypertriglyceridemia in iron

deficient subjects. Decreased or increased dietary iron level is associated with various aspects of lipid metabolism.

Anaemia is determined by Haemoglobin estimation in selected subjects and the subjects who were found to be anaemic are having cholesterol level ranges from 308 to 404 mg/dl. Therefore it is foundout that there is an interrelationship between anaemia and hypercholesterolemia.

The bad effects of anaemia have already been studied repeatedly by several nutrition scientists. But now the interrelation between anaemia and hyper cholesterolemia which has not yet been confirmed by scientific studies deserves an indepth analysis to really understand the problem. Hence the present study on "Haemoglobin level in patients with hypercholesterolemia" was undertaken. Following are the objectives of the present investigation.

A. Select adult subjects in the age group of 25 to 60 years with elevated cholesterol levels.
B. Analyse the nutritional status of the selected subjects through diet survey, clinical examination and haemoglobin estimation.
C. Evaluate the association of haemoglobin level and elevated cholesterol level of the selected subjects.

Review of Literature

II. REVIEW OF LITERATURE

The review of Literature pertaining to the present study on "Haemoglobin level in patients with hypercholesterolemia" is presented under the following headings.

A. Diet and heart diseases.

B. Trace elements and cardiovascular diseases.

C. Iron and heart diseases.

1. High iron store and heart diseases.
2. Low iron or iron deficiency anaemia and heart diseases.
3. Normal iron status and heart diseases.

D. Antioxidants and heart diseases.

A. Diet and heart diseases.

Therapeutic diet is a modification of normal diet to suit the disease condition. The main purpose of therapeutic diet is to supply the needed nutrient to maintain the nutritional status of the individual patients, to correct deficiency which might have occured due to disease condition, to provide rest to the whole body of the organ which has been strained because of disease condition and to adjust the food intake in such a way that the body can metabolise the nutrient. The distinct features of

therapeutic diet are adequacy, accuracy, economy and palatability.

World Health Organisation expert Committees have pointed out that nutrition is the principal area where action should be taken to prevent coronary heart diseases (Hautvast 1990)

Both epidemiological studies and controlled clinical trials have demonstrated that diet and plasma lipids are positively related. Polyunsaturated and monounsaturated fatty acids, Carbohydrate, Fibres and a vegetarian diet favourably affect plasma lipid levels. (Etherlon, et.al., 1988)

The relation between diet, serum lipoprotein and the progression of coronary lesions was studied by Barth, et.al., (1985). He has concluded that dietary changes were associated with a significant increase in linoleic acid content of cholesterol esters and a significant decrease of body weight, systolic blood pressure, serum total cholesteryl and the ratio of total to High density lipoprotein Cholesterol.

The possibility of a relationship in human subjects between diet and chronic or acute disease has been a major pre-occupation of nutritional and medical scientists through a long period of history. Many national

organisations have attempted to evaluate relationships of particular dietary factors and particular diseases and various constituents of foods have been seen both as preventive and causative factors in the etiogenesis of disease (Diplock, 1986).

The role of diet as a risk factor for Coronary heart disease was investigated and the results of this study reveals that it is possible that a daily diet rich in fruits and vegetables with 27.5% energy from total fat, including 10.2% energy from monounsaturated fat, a p:s ratio of 1.79, dietary cholesterol 1.25mg, dietary fibre 26.5g and magnesium 551mg/1000 kcal, in association with moderate physical activity and weight loss can modulate lipid metabolism without a decrease in High density lipoprotein-C (Singh, et al., 1994).

The effects of dietary changes on physiological parameters showed that a low fat, high fibre diet with good fat quality has a substantial preventive potential, as a number of risk markers are simultaneously affected in a positive direction (Sandstorm 1994).

Hornstra (1991) reviewed the effect of n-3 fatty acids on plasma cholesterol and concluded that they have no effect on plasma cholesterol levels but do lower plasma triglyceride.

According to National Institute of Nutrition (1992), Consumption of 100 to 200 grams of fish 2 to 3 times a week helps to prevent heart disease. As a therapy fish oils containing essential fatty acids, also called Poly unsaturated fatty acid can be recommended under medical supervision. The National Institute of Nutrition findings have shown an inverse relationship between fish consumption and heart disease.

Linking nutritional factors to medical condition involves assessment of dietary intakes of individuals. Metabolic studies have indicated the importance of a high ration of Poly unsaturated fatty acids to satured fatty acids in the diet to lower blood cholesterol levels. Most prospective studies have shown the importance of energy intake in relation to the development of Coronary heart disease (Marr, 1986).

Mattson, et.al., (1986) showed that monounsaturated fat was as effective as Poly unsaturated fatty acid in lowering cholesterol.

Cold water fish may have beneficial effects on heart diseases. It has been found out that omega-3-fatty acid is found in cold water fish (Debakey, et.al.,1986).

Successful reduction of blood lipid levels by diet in those who already had high levels was shown by Arntzenius et.al., (1986).

The blood cholesterol lowering effect of diets high in Poly unsaturated fatty acid is partly attributable to the additional vitamin E. provided (Backer et.al.,1984).

The development of atherosclerosis cannot be linked to only one component of the diet but results from a combination of risk factors. Prevention of atherosclerosis cannot be achieved by reducing cholesterol intake without also reducing the susceptibility of low density lipoprotein to oxidative damage. Diets enriched with monoenoic fatty acids and with a small increase in n-3 fatty acids from fish are recommended. (Mater et.al.,1994).

Gartside (et al., 1994) study results revealed substantial inverse, protective association between linoleic acid and alcohol intake and strongly positive association of cigarette smoking and coffee intakes with Coronary heart disease. These associations, internally consistent with significant relationship between diet, coffee, alcohol and lipid and lipoprotein cholesterol emphasize the important role of modifiable dietary and behavioral characteristics in the causation and prevention of coronary heart and vascular diseases (et.al., 1994).

The relative effects of dietary fat and cholesterol on fasting serum lipids were tested in healthy men and women with serum total cholesterol 200-300 mg/dl and result of this study showed that altered intake of total fat and saturated fat produces greater changes than dietary egg cholesterol in serum total cholesterol and low density lipoprotein cholesterol. Dietary assessment is crutial to detect small changes in dietary total fat and saturated fat and strategies for Coronary heart disease prevention may not be compromised by study egg ingestion if total fat and saturated fat intake are controlled (Morgan et.al.,1992).

Baba et.al., (1992) pointed out that cocount oil fed rats maintained higher High density lipoprotein Cholesterol levels than cocoa + butter fed rats because cocount oil reduces High density lipoprotein-C level when it replaces butter or Cocoa + butter.

Everhart et.al., (1992) observed a strong positive correlation between energy consumption and ischemic heart diseases, with adjustment for age, energy intake, sex and income. Ischemic heart disease was positively associated with vitamin C and egg intake, variation in mortality from Cardio vascular disease and Common malignancies may be a result of diet or other associated factors.

According to Ruhling et.al., (1985) Vitamin. C increases high density lipoprotein-Cholesterol by stimulating degradation of triglyceride rich lipoproteins. Hepatic lipase, plasma triglycerides and plasma total cholesterol showed no significant change. In men with initially high total cholesterol values more than 6.7 mmol/litre, Vitamin-D significantly decreased low density lipoprotein cholesterol by 9%

Varela et.al., (1985) pointed out that plasma cholesterol and triglycerides increased significantly in rats given lard. The increase was not prevented by the addition of vitamin C to the diet.

Alteration in dietary fatty acid composition can effectively alter the fatty acid distribution of low density lipoprotein and high density lipoprotein in hypercholesterolemic subjects and substitution of monounsaturated rather than saturated fatty acid in the diet might be preferable for the prevention of atherosclerosis (Miller et.al., 1994).

B. Trace elements and Cardiovascular diseases.

Carroll et.al., (1993) studied the effect of dietary minerals on cholesterol metabolism and suggested that a reduction in dietary minerals increases concentration

of low density lipoprotein cholesterol by a mechanism unrelated to the rates of cholesterol and bile acid excretion and trace elements are more likely to be involved than abundant minerals.

Certain trace elements influence enzymatic reactions in fat metabolism. Chromium and manganese have been shown to stimulate the synthesis of cholesterol, whereas Vanadium has been reported to diminish it. Thus trace elements play an important role in cardiovascular system. The deficiency/excess may increase the rest factors such as hypertension, diabetes mellitus, serum cholesterol etc., in coronary heart disease patients (Subramaniam 1993).

Manganese, Chromium, Vanadium, Molybdenum, Silver, Zinc and Bromine had a protective function in cardiovascular disease. Insufficiency of one element could increase the harmful effects of the others. Copper and titanium have a harmful effect on the cardiovascular system (Anan'ev, 1988).

Kok et.al., (1988) suggested that high serum copper levels and probably also low levels may be associated with increased cancer and cardiovascular disease risk. However, a protective effect of high zinc status on the risk of cancer and cardiovascular disease is compatible with the data.

The influence of dietary minerals on apolipoproteins B metabolism in rabbits fed semipurified diets containing casein shows that a reduction in dietary minerals enhances casein - induced hypercholesterolemia (Williams et.al.,1992).

Dahm et.al., (1989) studied the concentration of some trace elements (Se, Zn, Cu, Fe, mg and K) in blood and heart tissues of patients with Coronary heart disease which suggested that there was no association between concentration of Zn,Cu, Fe, mg and K in serum and the corresponding concentration in heart tissue. There was moderately +ve correlation between the concentration of ferritin in serum and that of Fe in tissue. It is concluded that the turnover rate for selenium in tissue is similar to that in serum but greater than that for erythrocytes selenium.

The interactive effects of manganese, iron and lipid on mineral status, manganesedependent superoxide dimutase (MnSoD) activity and lipoprotein composition were studied. The results of this study revealed that the supplementary iron slightly decreased heart manganese-dependent superoxide dimutase activity but had no effect on hacmatocrit or on plasma cholesterol and high density lipoprotein cholesterol values. This study also reveals that rats fed on the high linoleic acid, rather than the

high-oleic acid, diet had increased heart MnSoD activity but unchanged plasma and high density lipoprotein cholesterol values. The decrease in plasma and high density lipoprotein cholesterol values with manganese deficiency seemed not to be a result of increased lipid peroxidation but may have resulted from decreased cholesterol synthesis or secretion or both (Davis et.al.,1990).

Trace elements (Cu, Zn, mg,and Fe) and haemoglobin in blood and alkaline phosphatase (AP) activity was estimated and the results showed that values of lipid fractions changed depending on body weight, but significant correlation between trace elements and body weight were observed. A correlation between cholesterol and zinc was noted. Elevated values of iron in men were related to tea drinking. Changes in systolic blood pressure were affected by blood magnesium values. Diastolic blood pressure was affected by zinc (Sondac et.al.,1994).

Complications of atherosclerosis are the leading cause of morbidity and mortality in most developed countries. The homocysteins theory of atherosclerosis is based on increased synthesis and accumulations of homocysteine from methionine metabolism facilitating the development of atherosclerotic plagues (Mc cully,1993).

Oster (1993) found out that for serum cooper in dilated cardiomyopathy, there was a highly significant inverse relation with the ejection fraction and the cardiac index.

C. Iron and heart diseases.

1. High iron store and heart diseases.

Salonen et.al., (1992) pointed out that only a small proportion of the population, those with high serum ferritin and high serum low density lipoprotein cholesterol had markedly higher risk of heart disease and other trace elements have been associated with higher risk of acute myocardial infarction.

Data from the framingham study (1978) support the view that premenupausal women are safeguarded from severe coronary heart diseases. Menupause either surgical or natural was associated with a substantial increase in incidence of coronary heart disease. The study results also showed that for the small proportion of the population exhibiting high levels of iron and high low density lipoprotein-Cholesterol efforts should be made to lower both serum cholesterol and iron status.

Sempos et.al., (1994) have suggested an association between high body iron stores and risk of coronary heart disease. This study also found out that

there may be an inverse association of iron stores with overall mortality and with mortality from cardiovascular causes.

Ashima et.al., (1993) study results suggested that a high stored iron level, as assessed by elevated serum ferritin concentration is a risk factor for Coronary heart disease. This study also indicates that high dietary iron intake was associated with an increased risk of Coronary heart disease.

Peter (1982) pointed out that even moderately raised levels of circulating haemoglobin are associated with an increased risk of Coronary heart disease.

The effect of increasing levels of dietary carbonyl iron on nonheme iron, lipid peroxidation and DNA content were examined and the results showed that there was a direct correlation between liver nonheme iron and lipid peroxidation (Dunket et.al.,1992).

Miller et.al., (1995) have suggested that iron overload resulting from hemochromatosis or multiorgan hemosiderosis is not associated with an increased prevalence of coronary artery diseases.

Schouw et.al., (1992) reported that serum ferritin and iron values are influenced by the traumatic effect of

the myocardial infarction possibly, these transient changes are an acute effect, as seen in infections.

With an increased risk of myocardial infarction among men with higher intakes of heme iron, which is itself positively associated with iron stores. Results also suggested that high intake of vitamin.E may prevent the hypothetial adverse effect of heme iron, where as diabetes and smoking may enhance it.

Watson et.al., (1994) pointed out that there is a relationship between high iron store and risk of heart disease.

Burt et.al., (1994) study results showed the difference in rates of heart disease between men and women which might be explained by their different concentration of stored iron, iron stores rise steadily in men after adolescence but remain low in women until age of 45 years when iron stores begins to rise.

A severe body iron overload had a high cholesteol related coronary artery blockage of 90% or more. If iron increases the severity of high cholesterol associated coronary artery disease,the one with the high cholesterol value had severe coronary artery diseases (Muller 1994).

Steinberg et.al., (1994) pointed out that high low density lipoprotein cholesterol is relatively harmless, but high iron oxidizes it to the coronary artery damaging oxidized low density lipoprotein-C

Herbert (1994) study results showed that vitamin.C. supplements increases the iron associated oxidation of low density lipoprotein Cholestrol.

Christopher et.al., (1994) suggested an inverse association between serum transferrin saturation and the risk of dying from any cause or from cardiovascular diseases.

Kieffer (1994) reported no association between dietary iron and the risk of coronary heart diseases.

Nomiyama et.al., (1994) found out a possible inverse association between transferrin saturation and the risk of coronary heart disease and also the risk of death from any cause.

2. Low iron or iron deficiency anaemia and heart diseases.

Peter, (1982) has pointed out that anaemia is usually accompanied by a hypolipidemia and a low blood viscosity and inter coronary vessel anastamoses are more common in subjects who have been anaemic.

Hennig (1989) study results showed that nonadrenaline may play a key role in the cardiac hypertrophy of iron-deficiency anaemia.

Mehta et.al.,(1984) studied the effect of iron therapy on electrophysiological abnormalities of heart in iron deficiency anaemia and results of this study showed that correction of electrophysiological abnormalities of the heart in iron deficiency anaemic patients by iron, before the rise of haemoglobin, may be the result of the effect of iron at the tissue level.

The frequency of cardialgia increased with the severity of anaemia and electrocardiography indicated cardiac dystrophy caused by prolonged hypoxia of the myocardium (Volkov. et.al.,1992)

Smith et.al., (1993) study demonstrated that norepinephrine synthesis is not defective in the iron deficient heart but may still be limited in its capacity to match the demands of higher sympathetic activity.

Morrison et.al., (1994) studied serum iron and risk of fatal acute myocardial infarction and an association was found between serum iron and risk of fatal acute myocardial infarction.

3. Normal iron status and heart Diseases.

Beard (1994) has pointed out the role of excess body iron as a risk factor for myocardial infarction. The mean plasma ferritin concentration in the population was high and it is suggested that high-normal iron stores result in heart disease.

D. Antioxidants and heart diseases.

The nutrition buzzword for 1994 is antioxidant at the November 1993, Food and Drug administration conference on antioxidant vitamins and minerals in cancer and cardiovascular diseases.

Herbert (1994) reported that in the presence of iron, not only does vitamin C appears to be worthless against cancer, but it increased lipoxidation of relatively harmless low density lipoprotein cholesterol to coronary artery damaging oxidized low density lipoprotein-C.

Epidemiological information indicated that serum vitamin - E standardised aganist cholesterol showed a good inverse correlation with cardio vascular diseases. The best correlation resulting from a multivariate analysis which included serum vitamin-E, serum vitamin A, cholesterol and blood pressure (Conning, 1990).

Bingham, (1992) has pointed out the inverse association between risk of angina pectoris and plasma Vitamin E.

Finnish prospective study (1992) gives further evidence for a protective association between antioxident and cardiovascular disease.

Plasma antioxidant as assayed in epidemiological studies of complementary type consistently revealed an increased risk of ischemic heart disease at low plasma concentration of antioxidants. Decreasing ischemic heart diseases risk through nutrition may be possible when plasma concentration have greater than 27.5 - 300 umol Vitamin E/L, 0.4 - 0.5 umol carotene/L, 40 - 50 umol Vitamin C/L and 2.2 - 2.8 umol Vitamin A/L (Gey,1993).

Ulrich (1993) has pointed out that an optimum status of essential antioxidant should reduce the risk of diseases and thus be a prerequisite of optimum health as defined by the World Health Organisation.

Moses et.al., (1993) study results showed that dietary intake of essential antioxidant such as vitamin C, B Carotene, vitamin-A and E were inversely related to the risk of ischemic heart disease.

Lecithin-cholesterol acyl transferase, the plasma enzyme that catalyses formation of cholesterol esters is absent and the clinical features are anaemia and protein urea (Davidson et.al.,1975).

Rao et.al., (1984) suggested that plasma lecithin cholesterol acyl transferase activity is reduced in rats fed iron deficient diets. The results of this study showed that deficiency of iron also decreased the activity of plasma lecithin cholesterol acyl transferase.

John (1985) has pointed out that lecithin cholesterol acyl transferase deficiency and decreased cholesterol ester formation may be responsible for the inadequate lipid clearance in premature newborn infants.

Vysal (1988) studied the effect of cholesterol feeding on plasma lipid, lipid peroxide levels and lecithing cholesterol acyl transferase activity and this study results stated an increase in plasma lipid peroxide concentration and a decrease in lecithin cholesterol acyl transferase activity and also there was a negative correlation between lipid peroxide concentration and lecithin cholesterol acyl transferase activity in plasma of rabbits given a high cholesterol diet.

Lecithin cholesterol acyl transferase is a central enzyme in lipoprotein metabolism. It regulates the levels of free and esterified cholesterol in lipoprotein and this enzyme is activated by several apolipoproteins (Norum, 1987).

The relation between plasma lecithin cholesterol acyl transferase mass concentrations and lipids, apolipoproteins and a lipoprotein subfraction concentration were studied by Williams et.al., (1993) and results of this study showed a strong correlation between lecithin cholesterol acyl transferase and total cholesterol which may account for lecithin cholesterol acyl transferase's relationship with lipoprotein suftraction, apolipoprotein B and other lipoprotein cholesterol concentration.

Spear et.al., (1992) studied the lecithin cholesterol acyl transferase activity during lipid infusion and the results of this study suggested that intralipid at a rate not exceeding 1 to 2 g/kg/daily does not impair the clearing of intralipid lecithin and the metabolism of cholesterol.

Emile et.al., (1993) studied the lecithin cholesterol acyl transferase activity and results of this

study is that decreased activity of plasma lecithin cholesterol acyl transferase or cholesterol ester transfer protein is accosiated with reduced plasma cholesteryl ester concentrations, abnormal lipoprotein composition and change in cell membrane lipids.

Larko et.al., (1993) has pointed out the decreased lecithin cholesterol acyl transferase activity in the plasma of hypercholesterolemic Pigs, and lecithin cholesterol acyl transferase activity was negatively correlated with total cholesterol in the hypercholesterolemic group.

Methodology

III. METHODOLOGY

The methodology followed in the conduct of the present study on "Haemoglobin level in patients with hypercholesterolemia" is presented under the following heads.

A. Selection of the Hospital and the sample.

B. Assessment of Nutritional status of the selected sample.

   1. Diet Survey.

   2. Clinical Examination.

   3. Estimation of Haemoglobin levels.

C. Correlation between Blood Cholesterol and Haemoglobin levels.

A. Selection of the Hospital and the Sample

A private hospital namely Kugan's hospital situated in the heart of Coimbatore City was selected for the study. As the present study is to be carried out among the elevated cholesterol patients and this hospital specially gives treatment for heart disease patients and since required number of subjects were available, this hospital was selected for the study. People of all levels visit this hospital for their check up and admission. Hence it was possible to carry out the study with subjects from all income groups. Moreover the authorities of the hospital

were very much co-operative and allowed the investigator to conduct the study in their hospital.

The investigator recorded all the patients with high cholesterol levels with the help of the doctor in the out patient and inpatient wards as and when they came for treatment. With great difficulty, patients having cholesterol levels more than 300 mg were identified. Thus a total number of 100 patients were recorded through random sampling method. Random sampling technique is also known as probability sampling or chance sampling where each and every item in the universe has an equal chance of inclusion in the study. It is considered the most trustworthy method of securing representativeness of the whole population (Chaudhary, 1991). The sample thus selected comprised of 50 men and 50 women in the age range of 25 years to 60 years.

B. Assessment of Nutritional Status

The nutritional status of all the selected subjects were assessed through diet survey, clinical examination and haemoglobin estimation.

1. Diet Survey

The dietary practice of the subjects were studied through administration of a questionnaire on food and nutrient intake and 24 hour recall method. The questionnaire was formulated by the investigator to suit the present investigation (Appendix I). A questionnaire is considered as the heart of a survey operation (Kothari 1990). According to Chaudhary (1991), a questionnaire consists of a set of questions printed in order on a form which is distributed to secure responses from the respondents. Direct interview method using formulated questionnaire was used (See Plate 1). The questionnaire formulated elicited information on education, occupational status, income, food habits, dietary practices undertaken by the patients and presence of other diseases.

The questionnaire also elicited information regarding presence of anaemia and factors associated with it such as blood donation, fatigue, shortness of breath, blood loss due to accident, operation and details on menstrual cycle in the case of women.

Wiehl (1988) describes a one-day quantitative diet history which furnished a complete description of all food consumed at each meal and between meals prior to the interview. This one day report was then converted into

Plate - I Collection of data - Interview with formulated Questionnaire

nutrient intake using food tables. Motulsky (1989) defined 24 hour recall method as the method requires that respondents report the types and amounts of foods they consumed over the previous 24 hour period. Information is obtained by face-to-face (in person) interview. Then the nutritive value of the food consumed was computed using the book "Nutritive value of Indian Foods" by Gopalan (1991).

Horwath (1990) has stated that food frequency questionnaire elicit information concerning the frequency of consumption of each of a specified list of food items and drinks and often also include questions on serving size. Therefore food frequency questionnaire (Appendix II) was used to find out the frequency of consumption of various food items by the patients.

2. Clinical Examination

Clinical examination is an important adjunct to dietary and biochemical information as indicators of nutritional status. Using clinical assessment proforma (Appendix III) developed by the investigator, clinical examination was carried out for all the selected subjects. Clinical examination was carried out to find out the signs and symptoms of iron deficiency anaemia among the selected subjects (See Plate 2). Other symptoms of deficiency were also examined.

Plate - II Clinical examination

Plate-III Haemoglobin estimation

3. Estimation of Haemoglobin Levels

Since the objective of the present investigation was to study the interrelation between elevated cholesterol level and haemoglobin content of blood, the haemoglobin content of all the subjects were analysed (See Plate 3). Cyanmeth haemoglobin method was used to analyse the haemoglobin content of blood. The procedure followed is presented in Appendix IV.

C. Correlation between Blood Cholesterol and Haemoglobin Levels

The subjects having different levels of cholesterol were classified and their corresponding haemoglobin levels were tabulated. The correlation coefficient was calculated to find out whether these two factors have correlation.

Results and Discussion

IV. RESULTS AND DISCUSSION

The results of the present study on "Haemoglobin level in patients with hypercholesterolemia" are presented and discussed under the following headings.

A. Socioeconomic profile of the selected subjects.

B. Nutritional status of the selected subjects.

   1. Dietary pattern, food and nutrient intake of the selected subjects.
   2. Clinical picture of the selected subjects.
   3. Haemoglobin level of the selected subjects.

C. Correlation between blood cholesterol and haemoglobin levels.

A. Socioeconomic Profile of the selected subjects.

A total of 100 subjects, 50 males and 50 females with elevated cholesterol were selected for the present investigation. Their socio economic status was assessed through personal interview method. The data thus collected revealed the following results.

1. Family System

Investigation regarding the family system of the selected subjects revealed that majority of the subjects

(69) were living in nuclear families. Only 31 subjects were in joint families. It is evident that Joint family system which is a nest of emotional and economic security had been degenerating in the society. Most of the hyper cholesterlemic subjects were in nuclear families and predominance of nuclear families may be due to scattering of family members in search of better livelihood.

2. Age group of the selected subjects:

All the subjects grouped according to their age is presented in Table I.

TABLE - 1

CLASSIFICATION OF SUBJECTS ACCORDING TO THEIR AGE

(N : 100)

AGE GROUP	SEX	
	MALE	FEMALE
25 - 34	2	13
35 - 44	19	33
45 - 54	25	2
55 - 64	4	2
TOTAL	50	50

were officers. All the female subjects were housewives. It was also found that the housewives and the businessman did not have much physical exertion. This may be the reason for their hypercholesterolemia.

4. Educational status:

Table III depicts the educational status of the selected subjects.

TABLE III

EDUCATIONAL STATUS OF THE SELECTED SUBJECTS

(N : 100)

EDUCATIONAL STATUS	SEX		TOTAL
	MALE	FEMALE	
High School	20	11	31
Higher Secondary	14	32	46
College	16	7	23
TOTAL	50	50	100

From the Table III it is clear that all the selected subjects were educated. Majority were educated upto higher secondary level. Thirty one subjects were educated upto high school level and only 23 had college education.

5. Income

Income is an index of the economic status of the people. Table IV gives the classification of the selected subjects according to their monthly income.

TABLE - IV

CLASSIFICATION OF SUBJECTS ACCORDING TO INCOME

(N : 100)

INCOME/MONTH (Rs.)	NUMBER OF SUBJECTS
1050 - 2250	8
2250 - 3650	57
Above 3650	35
Total	100

The income status of the selected individuals as depicted in Table IV shows that 57 subjected belonged to middle income group and 35 subjects belonged to high income group. Only a very small number (8) of subjects were in low income groups. As most of the subjects were in middle and high income groups, their purchasing power in the case of food materials is also high.

B. Nutritional Status of the Selected Subjects

The nutritional status of the selected subjects were assessed through dietary pattern, food and nutrient intake, clinical examination and by finding out the haemoglobin levels of the selected subjects.

1. Dietary pattern, food and nutrient intake of the selected subjects:

The dietary pattern of the selected subjects was assessed with the help of the questionnaire developed by the investigator. The food and nutrient intakes of the selected subsamples was assessed by using 24 hour recall method. The data collected revealed that out of 100 selected subjects 65 were non vegetarians and 35 were vegetarians. But after they were diagnosed as hyper, cholesterolemic patients, on the advice of the physician, 97 subjects started eating only vegetarian diet. Three subjects reported that they were consuming non-vegetarian foods occasionally. Such results were also reported by Tench (1987) who had stated that people become vegetarians for various reasons and one of the reasons may be too high cholesterol level of the blood.

The dietary pattern of the selected subjects indicated that all the subjects were following cholesterol free and low fat diet. Since all the selected subjects

were known hypercholesterolemic subjects they already had diet counselling in the hospital.

The frequency of consumption of various foods by the subjects is presented in Table V.

TABLE V

FREQUENCY OF CONSUMPTION OF FOODS BY THE SELECTED SUBJECTS

(N : 100)

Particulars	Frequency of consumption of foods			
	Daily	Weekly	Monthly	Rarely
Cereal & Cereal Products				
Ragi	8	13	42	37
Rice	100	-	-	-
Riceflakes	-	30	70	-
Wheat flour	20	75	4	1
Vermicelli	-	50	26	24
Bread	-	22	30	48
Pulses and Legumes				
Bengal gram dhal	68	30	2	-
Bengal gram dhal-roasted	98	2	-	-
Black gram dhal	51	49	-	-
Cow pea	-	24	36	40

Green gram dhal	12	54	34	-
Red gram dhal	63	37	-	-
Peas	-	-	3	97
Leafy Vegetables				
Agathi	-	37	41	22
Amaranth	-	77	23	-
Sirukeerai	-	21	39	40
Cabbage	-	90	10	-
Coriander leaves	100	-	-	-
Manathakkali	-	56	42	2
Mint		11	29	60
Paruppu Keerai	-	42	49	9
Poonanganni	-	-	31	69
Spinach	-	-	-	100
Roots and Tubers				
Beetroot	-	36	40	24
Carrot	-	80	15	5
Bigonion	85	15	-	-
Small onion	87	13	-	-
Potato	-	75	24	1
Yam	-	-	41	59
Other Vegetables				
Ash gourd	-	36	56	8
Beans	-	94	6	-
Bitter gourd	-	63	32	5

Bottle gourd	-	16	38	46
Brinjal	-	72	28	-
Broad beans	-	6	40	54
Cauliflower	-	18	34	48
Cucumber	-	-	31	69
Ladies-finger	-	81	16	3
Plantain-flower	-	-	2	98
Plantain-stem	-	14	32	54
Ridge gourd	-	16	61	23
Snake gourd	-	33	35	32
Sundakkai	-	2	35	64
Nuts and Oil Seeds				
Coconut fresh	58	-	-	42
Condiments and Spices				
Asafoetida	44	-	-	56
Dry Chillies	69	-	-	31
Green Chillies	91	-	-	9
Cumin Seeds	29	-	-	71
Ginger	21	-	-	79
Turmeric	79	-	-	21
Fruits				
Apple		6	68	26
Banana	-	89	-	11
Dates-dried	-	-	38	62
Grapes	-	-	64	36
Lemon	22	61	9	8

Mango	-	-	68	32
Orange	2	27	59	12
Papaya	-	42	45	13
Tomato	100	-	-	-
Milk & Milk Products				
Milk	100	-	-	-
Butter Milk	100	-	-	-
Sugar & Sugar Products				
Cane Sugar	77	-	-	23
Jaggery	-	-	21	79

Table V shows that all the subjects were consuming rice daily. Ragi and wheat flour were consumed daily by some subjects. It was also evident that all the subjects used wheat and wheat products atleast 3 times a week. The subjects also reported that they have reduced their rice consumption after they were diagnosed as hyper cholestorolemic. Thirty seven subjects reported that they consumed ragi very rarely. Bread and Vermicelli were the other 2 foods which were consumed rarely by the subjects.

In the case of pulses and legumes, roasted bengal gram dhal, bengal gram dhal red gram dhal and black gram dhal were used daily by majority of the subjects. Frequency of consumption of other legumes was low.

In the case of leafy vegetables, none of the subjects consumed green leafy vegetables daily. But all the subjects reported that they used coriander leaves in the preparation daily. Less consumption of greenleafy vegetables may be an important factor in the development of hypercholesterolemia. These subjects need diet counselling for inclusion of more green leafy vegetables and other fibre rich foods in their diet.

Consumption of root vegetables such as potato, yam, beetroot and tapioca were consumed less frequently by the subjects.

All the subjects reported that they consumed other vegetables daily. In the case of nuts and oils, only coconut was consumed by the subjects. Fifty eight subjects reported that they consumed coconut daily and 42 subjects consumed coconut only very rarely.

All the subjects included tomato daily in the diet. Other fruits which contribute Vitamin-C to the diet were consumed less frequently by the subjects. All the subjects consumed milk and butter milk daily. Subjects expressed that they stopped including curds or advice of physician.

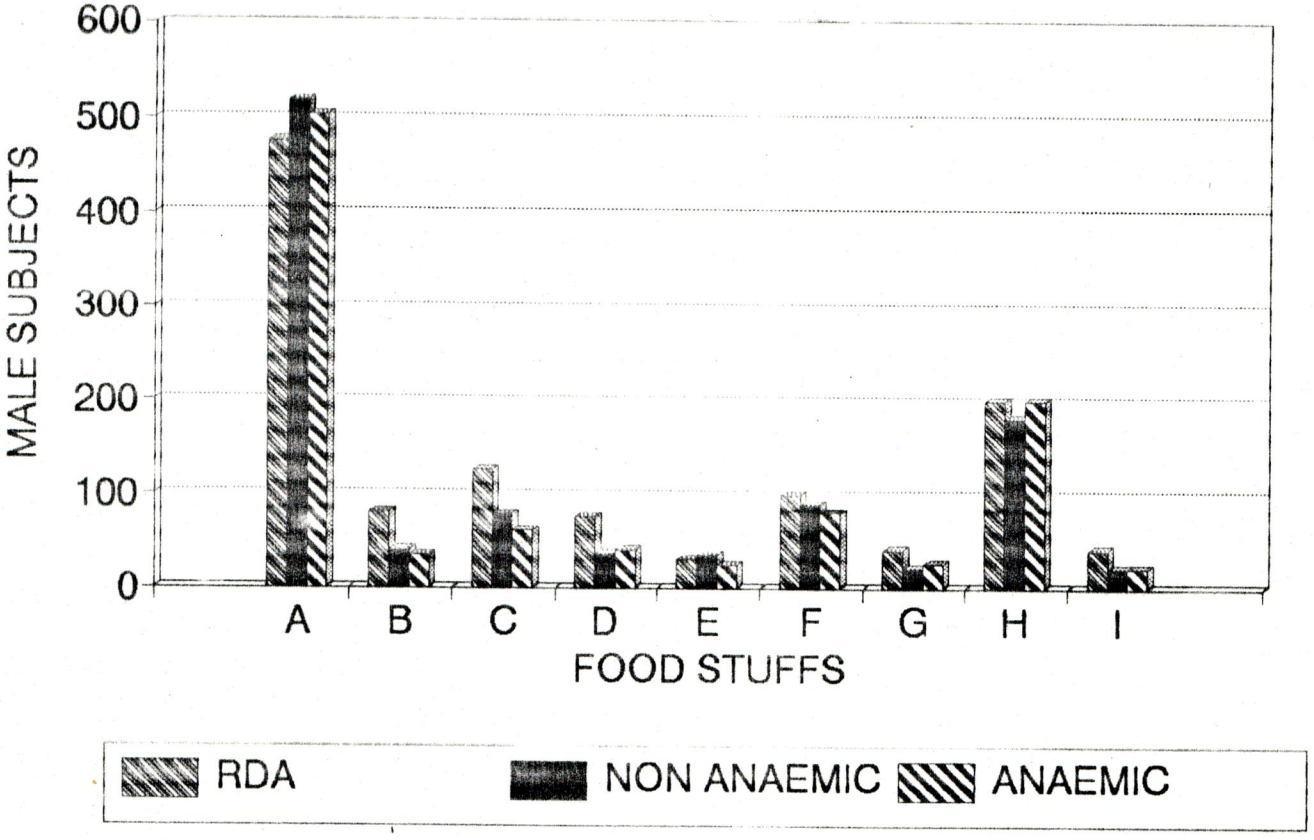
Seventy seven subjects included canesugar daily. As 23 subjects had diabetes they included canesugar rarely. Inclusion of Jaggery was also rare by majority of the subjects.

To findout the amount of food and nutrient consumed by the subjects, a 24 hour recall diet survey was conducted for a subsample of 10 anaemic and 10 non-anaemic subjects. From the volume of Foods consumed by the subjects the raw equivalents of foods were calculated and daily food and nutrient intake of the subjects were assessed.

Table VI presents the mean food intake of the selected subsample. The Food consumption of individual subjects is given in Appendix V & VI. The mean food consumption of the subjects is also depicted in figure 1& 2.

FIGURE - 1

MEAN DAILY FOOD INTAKE OF SELECTED SUBJECTS



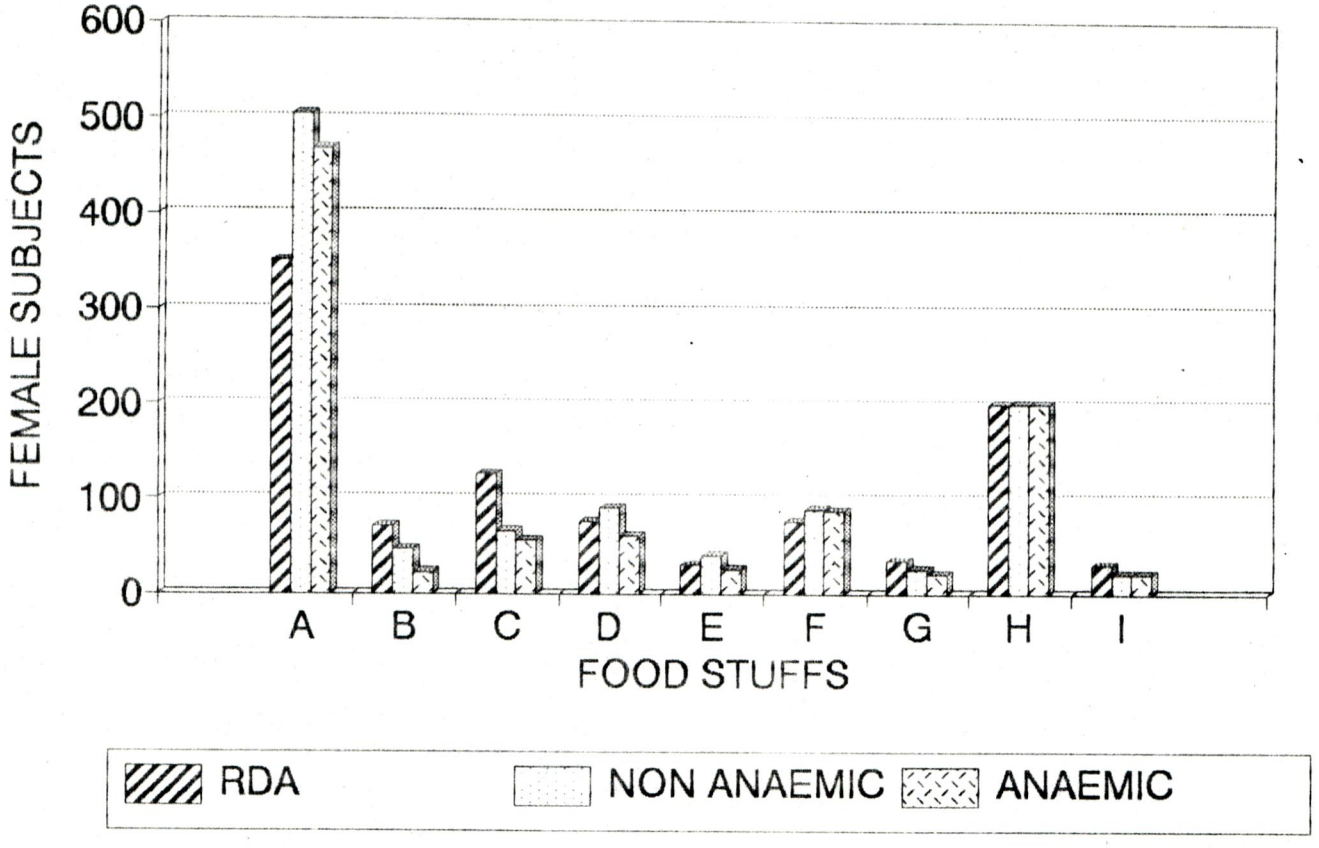
A. CEREALS B. PULSES C. GREEN LEAFY VEGETABLES

D - OTHER VEGETABLES E. FRUITS F - ROOTS AND TUBERS

G - OIL AND FAT H. MILK I. SUGAR

FIGURE - 2

MEAN DAILY FOOD INTAKE OF SELECTED SUBJECTS



A . CEREALS B- PULSES C . GREEN LEAFY VEGETABLES

D . OTHER VEGETABLES E- FRUITS F . ROOTS AND TUBERS

G - OIL AND FAT H. MILK I . SUGAR

TABLE VI

MEAN DAILY FOOD INTAKE OF THE SELECTED SUBJECTS

(N : 10 in each group)

FOOD STUFFS	RDA* (1984)		NON-ANAEMIC SUBJECTS		% DEFICIT (OR) EXCESS		ANAEMIC SUBJECTS		% DEFICIT (OR) EXCESS	
	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Cereals (g)	475	350	519	504	+9.26	+44	502	468	+5.68	+33.7
Pulses (g)	80	70	39.6	45.4	-50.50	-35.1	34.2	21.2	-57.25	-69.7
Green leafy vegetable (g)	125	125	78	65	-37.60	-48	60	55	-52	-56
Other vegetable (g)	75	75	36	90	-52	+20	40	60	-46.7	-20
Fruits (g)	30	30	35	40	+16.6	+33.3	23	25	-23.3	-16.6
Roots and Tubers (g)	100	75	90	88	-10	+17.3	80	86	-20	+14.7
Milk (g)	200	200	180	200	-10	-	200	200	-	-
Oil & Fat (g)	40	35	20	25	-50	-28.57	25	20	-37.5	-42.9
Sugar (g)	40	30	20	20	-50	-33.3	20	20	-50	-33.3

* RDA - RECOMMENDED DIETARY ALLOWANCES

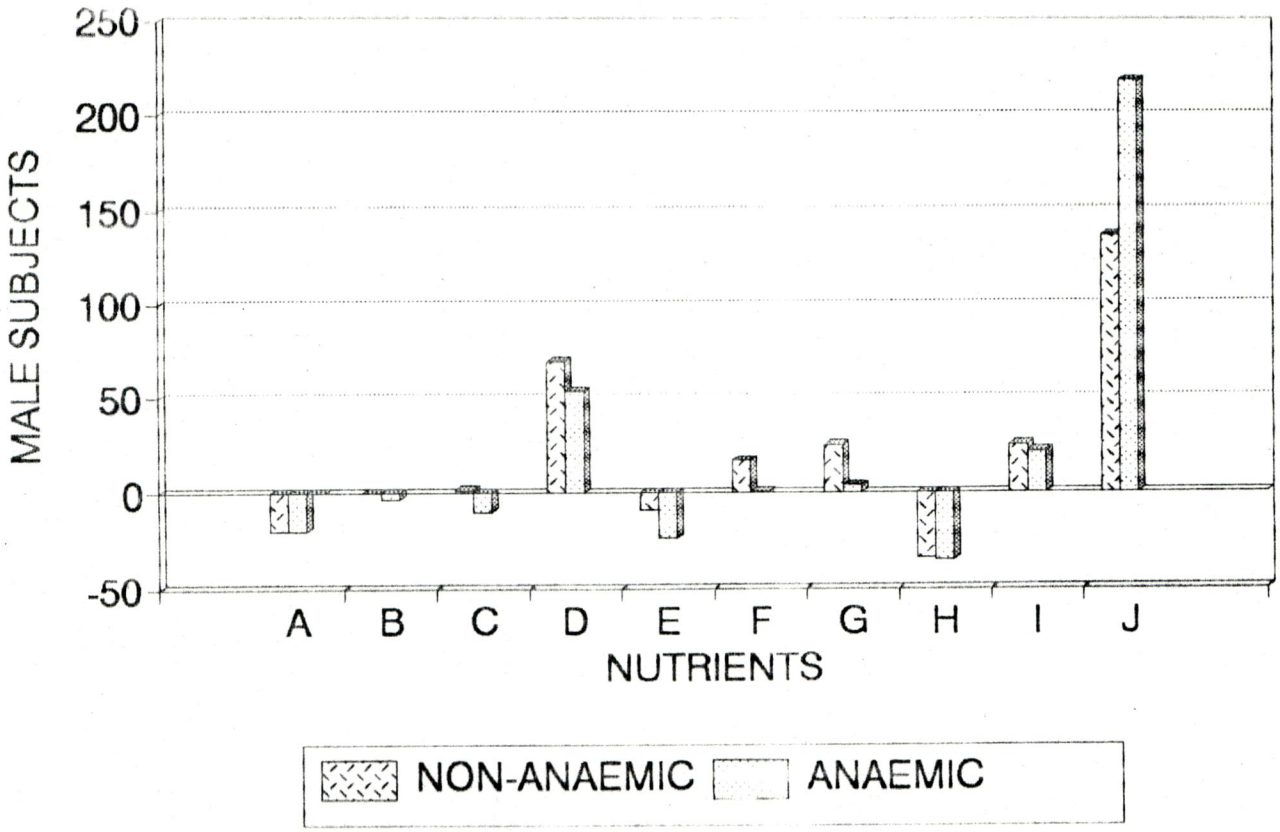
The mean food intake of the anaemic and non-anaemic subjects, depicted in Table VI indicate that the cereal consumption of anaemic subjects were normal. But consumption of pulses was very much less than that of the recommended allowances. Consumption of greenleafy vegetable which is an important source of iron was also inadequate and the % deficit was 52 to 56% for males and females respectively. In the same way consumption of other vegetables was also lesser than the recommended allowances.

Even as all the subjects were consuming plantain, fruit consumption was not adequate. Except cereal consumption, intake of all other foods did not meet the recommended dietary allowances. In the case of non-anaemic subjects, except protein, deficit of all other foods was minimum.

Table VII presents the mean daily nutrient intake of anaemic and non-anaemic subjects. The nutrient consumption of individual subjects is given in appendix VII & VIII. The mean nutrient consumption of the subjects is also is also depicted in figure 3, and 4.

FIGURE - 3

MEAN DAILY NUTRIENT INTAKE OF SELECTED SUBJECTS



A - ENERGY

B - PROTEIN

C - FAT

D - CALCIUM

E - IRON

F - β - CAROTENE

G - THIAMINE

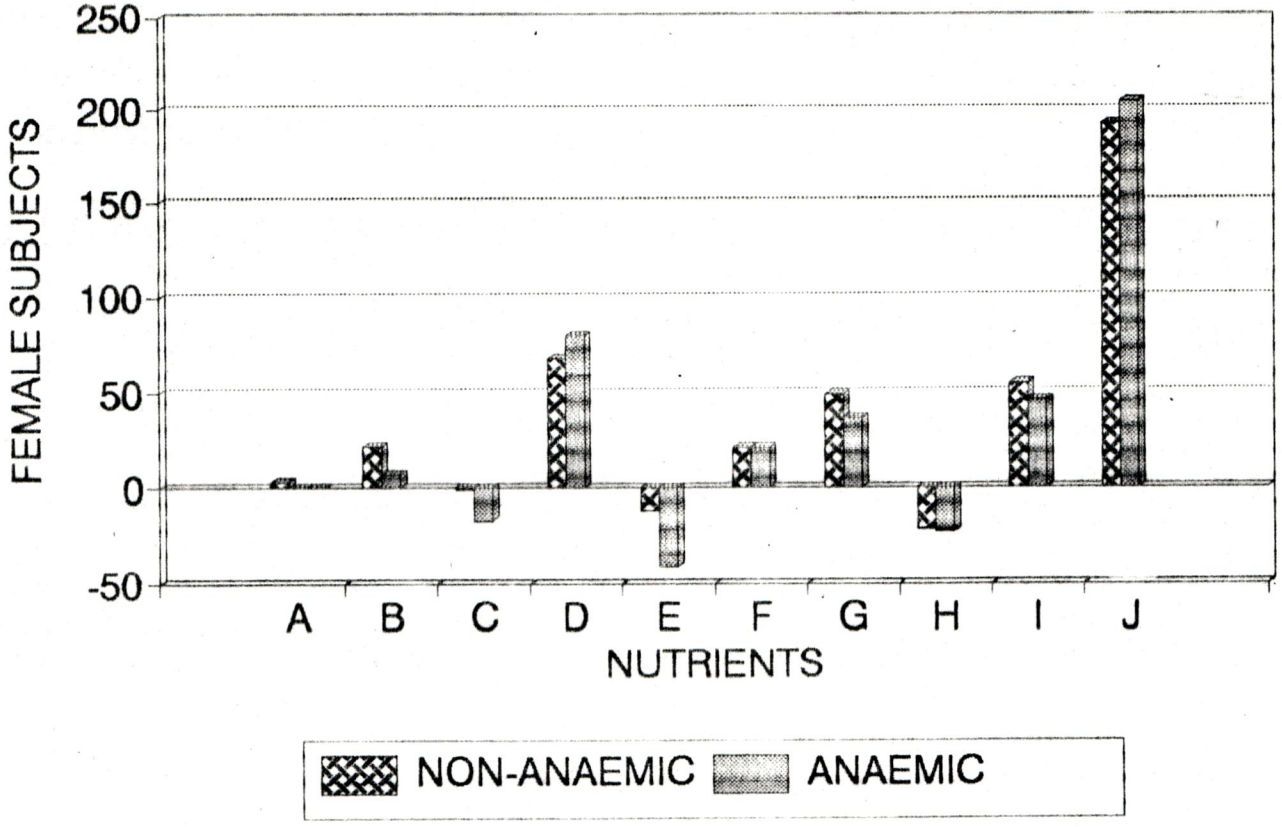
H - RIBOFLAVIN

I - NIACIN

J - VITAMIN-C.

FIGURE - 4

MEAN DAILY NUTRIENT INTAKE OF SELECTED SUBJECTS



A - ENERGY

B - PROTEIN

C - FAT

D - CALCIUM

E - IRON

F - β - CAROTENE

G - THIAMINE

H - RIBOFLAVIN

I - NIACIN

J - VITAMIN C.

TABLE VII

MEAN DAILY NUTRIENT INTAKE OF THE SELECTED SUBJECTS

(N : 10 in each group)

NUTRIENTS	RDA* (1991)		NON-ANAEMIC SUBJECTS		% DEFICIT (OR) EXCESS		ANAEMIC SUBJECTS		% DEFICIT (OR) EXCESS	
	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Energy (K.Cal)	2875	2225	2300	2287	-20	+2.8	2305	2216	-19.8	-0.40
Protein (g)	60	50	60	61	-0.32	+21.9	58	54	-3.7	+7.0
Fat (g)	20	20	20	20	+1.50	-1.1	18	17	-9.7	-17.3
Calcium (mg)	400	400	476	669	+68.90	+67.1	611	718	+52.7	+79.6
Iron (mg)	28	30	25	26	-9.3	-12.3	21	18	-23.9	+41.3
B.Carotene(mg)	2400	2400	2800	2916.17	+16.7	+21.5	2412	2908	+0.5	+21.16
Thiamine (mg)	1.4	1.1	1.74	1.64	+24.3	+49.1	1.45	1.3	+3.8	+36.4
Riboflavin(mg)	1.6	1.3	1.06	1.02	-33.8	-21.50	1.04	1.003	-35	-22.8
Niacin (mg)	18	14	22	22	+24.4	+54.5	22	20	+21.1	+45.7
Vitamin C (mg)	40	40	94	117	+135.8	+192	127	122	+218.3	+204.8

* RDA - RECOMMENDED DIETARY ALLOWANCES

In the case of anaemic subjects there was a deficit in energy, protein, iron and riboflavin intake. Deficit of iron was more than the non-anaemic subjects. The nutrient intakes are well correlated with food intake of both the groups of subjects. Surprisingly both anaemic and non-anaemic subjects consumed vitamin C in excess of the recommended dietary allowances.

Mean daily nutrient intake as depicted in Table VII shows that energy, iron and riboflavin intakes were less than the daily recommended dietary allowances. All the other nutrient intakes were adequate and in some cases more than the recommended dietary allowance. Protein intake of male and female non anaemic subjects met the recommended dietary allowances.

2. Clinical picture of the selected subjects:

Clinical examination was done for all 100 selected subjects. The clinical symptoms of deficiency and signs of anaemia were examined in all the selected subjects. It was found out that out of 100 subjects surveyed, eight subjects showed pale conjunctiva and slight pigmentation in the eyes. Angular stomatitis was present in 8 subjects. Loss of lustre, dryness and roughness of hair and skin were present for only 12 subjects. Majority (78) of the subjects looked healthy and did not showed any symptoms of deficiency.

Those who were reported as anaemic indicated that they donated blood in the previous years and two subjects met with accident where there was blood loss. Thus, symptoms of anaemia were present only in eight subjects.

3. Blood Haemoglobin level of the Selected Subjects:

The blood haemoglobin level of all the subjects were determined and the values are presented in Table VIII

TABLE VIII

BLOOD HAEMOGLOBIN LEVEL OF THE SELECTED SUBJECTS

(N : 100)

Haemoglobin value* (g/dl)	Haemoglobin Level		Total	Anaemic
	Male	Female		
Between 7 and 10	-	20	20	Moderate
Above 10 and 12	10	15	35	Mild
12 to 14	40	15	55	Normal
Total	50	50	100	

* WHO (1989) standards,

Normal - Above 12 g/dl

Mild anaemia - Above 10 and less than 12 g/dl

Moderate anaemia - between 7 and 10 g/dl

Severe anaemia - below 7 g/dl

Table VIII shows that a total number of 20 subjects out of 100 had very low blood haemoglobin levels (between 7 to 10 g/100ml), 25 subjects had low levels of haemoglobin between 10 and 12g. These forty five subjects can be classified as anaemic. Out of the 100 subjects studied 55 subjects had normal haemoglobin levels. Elwood (1992) has found out that hypercholesterolemic patients exhibit low haemoglobin values. The results of the present study are in line with these findings.

C. Correlation between Blood Cholesterol and Haemoglobin levels

Table IX presents the blood cholesterol and mean haemoglobin levels of the selected subjects.

TABLE IX

BLOOD CHOLESTEROL AND MEAN HAEMOGLOBIN LEVELS

OF THE SUBJECTS

(N : 100)

Blood Cholesterol Level (mg/dl)	Mean blood Haemoglobin level (g/dl)	Number of Subjects
300 - 320	12.4	10
320 - 340	13.15	30
340 - 360	12.18	25
360 - 380	10.02	20
380 - 400	9.10	5
400 - 420	8.65	10
Correlation co-efficient - 0.898		

The blood cholesterol level and mean haemoglobin level presented in Table IX indicated that 40 subjects were normal with blood haemoglobin levels above 12 gms. Rest of the 60 subjects had blood haemoglobin levels less than 12 gms. The blood cholesterol level of the subjects were above 340 mg. Statistical analysis was done to findout the correlation between blood cholesterol and haemoglobin levels of all the selected subjects. The correlation coefficient was found out to be negative with the value of -0.898. This indicated that a negative correlation existed between blood

cholesterol and haemoglobin level. In the present study the haemoglobin value started decreasing only in the patients who had blood cholesterol values above 340 mg. The negative correlation existed only when blood cholesterol values were above 340 mg.

These results correlate well with the findings of Rimm et.al., (1994) and cooper and Liao (1994) who have also found out a negative correlation between these two values.

Summary and Conclusion

V. SUMMARY AND CONCLUSION

A study was conducted to elicit information on haemoglobin level in hypercholesterolemic subjects. The main objective of the study was to select subjects with elevated cholesterol levels and to analyse the nutritional status of the selected subjects through dietsurvey, clinical examination and blood haemoglobin level estimation and to evaluate the association between haemoglobin and elevated cholesterol levels. Totally 100 hypercholesterolemic subjects were selected for the study from Kugan's hospital, Coimbatore. Information regarding the socioeconomic condition and dietary habits of these patients were gathered with the help of questionnaires developed by the investigator. All the 100 patients were studied for iron deficiency anaemia and haemoglobin levels. A subsample of 20 patients both male and female belonging to anaemic and non-anaemic group were selected to do the food and nutrient analysis based on the 24-hour recall method. The results of the study were analysed statistically. The findings of the study are presented in the following.

1. Sixty nine per cent of the selected subjects were living in nuclear families and 31 in joint families.

2. The occupational status of the selected subjects showed that majority of the male subjects were businessmen and

labourers. All the female subjects were housewives. The housewives and the businessman did not have much physical work. This may be a reason for hypercholesterolemia.

3. Majority of the subjects were educated upto higher secondary level. Thirty one subjects were educated upto high school level and 23 had college education. All the subjects had some education.

4. About 57 per cent to the subjects had income between Rs.2250 to 3650 and 35 per cent had above 3650 rupees. Only eight subjects had low income. This fact highlights the greater purchasing power in the case of food materials by the subjects.

5. The staple food of selected subjects is rice followed by wheat and ragi. In general they are non-vegetarians. Although they preferred taking foods like mutton, chicken etc, their intake was restricted to rice, pulses, leafy vegetables, other vegetables and roots and tubers, inorder to lower their cholesterol level.

6. The 24-hour recall diet survey indicated that the intake of all the food stuffs were not adequate in the case of anaemic subjects when compare to Indian Council of Medical Research recommendations except cereals. In the case of non-anaemic subjects except cereals, all other foods were

inadequate. The nutrients intake of anaemic subjects were deficient in energy, protein, iron and riboflavin. In non-anaemic subjects, energy, iron and riboflavin intakes were found to be deficient when compare to Indian Council of Medical Research recommendations.

7. Clinical picture of the selected subjects revealed the prevalence of anaemia in some of the subjects. Eight subjects showed pale conjunctiva and slight pigmentation in the eyes. Angular stomatitis was present in 8 subjects. Twelve subjects showed loss of lustre, dryness and roughness of hair and skin.

8. The haemoglobin levels of the selected subjects revealed that, majority (55) had normal haemoglobin level. Forty five subjects had mild to moderate anaemia.

9. Analysis of correlation co-efficient between blood cholesterol and haemoglobin levels of the selected subjects revealed a negative correlation between the two values. As blood cholesterol level increased the haemoglobin levels decreased. The haemoglobin values started decreasing only in those subjects whose blood cholesterol levels were 340 and above.

The finding of the present investigation revealed a negative correlation between elevated blood cholesterol and haemoglobin levels. These results well correlate with the results of the previous workers.

Longterm studies with larger sample can be conducted to further confirm the relationship between iron status and lipid profiles.

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Appendices

VII. APPENDICES

APPENDIX I

Questionnaire of elict information on socio economic background and dietary pattern of the subjects who have elevated cholesterol level.

1. NAME OF INTERVIEWEE :
2. AGE :
3. SEX : MALE FEMALE
4. OCCUPATION :
5. EDUCATION : EDUCATED NON EDUCATED
6. FAMILY PATTERN : JOINT NUCLEAR
7. INCOME/MONTH :

8. WHAT IS YOUR HEALTH PROBLEM

   a. HYPERCHOLESTEROLEMIA b. HYPERLIPOPROTEINEMIA

9. i. IF (a) WHAT TYPE OF DIET CONTROL

   i.FAT FREE ii. CHOLESTROL FREE iii. LOW CALORIE

   ii. IF (b) WHAT TYPE OF DIET CONTROL

   i.FAT FREE ii. CHOLESTROL FREE iii. LOW CALORIE

10. HAVE YOU HAD ANY OF THE FOLLOWING DISEASES

S.NO.	DISEASES	YES/NO	DURATION DAY	FREQUENCY OF OCCURING
1.	TUBERCULOSIS	YES NO		
2.	ASTHMA	YES NO		
3.	MALARIA	YES NO		
4.	MEASLES	YES NO		
5.	OSTEOPOROSIS	YES NO		
6.	DIARRHOEA	YES NO		
7.	ULCER	YES NO		
8.	DIABETES	YES NO		

11. WHEN DID YOU DIAGNOSE AS ANAEMIC

i. LAST YEAR ii. LAST MONTH

iii. RECENTLY iv. NOT ANAEMIC

12. DID YOU FEEL FATIQUE AND SHORTNESS OF BREATH

i. YES ii. NO

13. (a) ARE YOU INTERESTED IN BLOOD DONATION

i. YES ii. NO

13. (b) IF YES, THEN

i. ONCE IN A YEAR ii. TWICE IN A YEAR

iii. THRICE IN A YEAR iv. MORE THAN 3 TIMES IN A YEAR

14. DID YOU MEET WITH ANY ACCIDENT WHICH LEAD TO EXCESSIVE BLOOD LOSS

i. YES ii. NO

15. (a) HAVE YOU UNDERGONE ANY OPERATION RECENTLY

i. YES ii. NO

15. (b) IF YES, MENTION THE TYPE OF OPERATION

16. IS THERE EXCESS BLOOD LOSS DURING MENSTRUAL PERIOD

i. YES ii. NO

17. (a) DO YOU GET YOUR PERIODS REGULARLY

i. YES ii. NO

17. (b) IF MENTION THE TYPE OF TREATMENT DID YOU TAKEN

i. IRON TONIC ii. IRON TABLETS

18. GIVE YOUR FOOD HABITS

19. 24 HOUR RECALL METHOD

EARLY MORNING	BREAK FAST	MID-MORNING	LUNCH	EVENING	DINNER	LATE NIGHT

APPENDIX II

FREQUENCY OF CONSUMPTION OF THE FOLLOWING FOOD ITEMS BY THE SELECTED SUBJECTS

NAME OF THE INTERVIEWEE :

S.NO.	FOOD ITEM	FREQUENCY OF CONSUMPTION			
		DAILY	WEEKLY	MONTHLY	RARELY
I.	CEREAL & CERAL PRODUCTS				
1.	RAGI				
2.	RICE, PARBOILED MILLED				
3.	RICE FLAKES				
4.	WHEAT FLOUR (WHOLE)				
5.	WHEAT SEMOLINA				
6.	WHEAT VERMICELLI				
7.	WHEAT BREAD (BROWN)				
8.	OTHER SPECIFY				
II.	PULSES & LEGMES				
1.	BENGAL GRAM DHAL				
2.	BENGAL GRAM DHAL-ROASTED				
3.	BLACK GRAM DHAL				
4.	COW PEA				
5.	GREEN GRAM DHAL				
6.	RED GRANM DHAL				
7.	OTHER SPECIFY				

S.NO.	FOOD ITEM	FREQUENCY OF CONSUMPTION			
		DAILY	WEEKLY	MONTHLY	RARELY
III.	LEAFY VEGETABLES				
1.	AGATHI				
2.	AMARANTH TENDER				
3.	SIRU KEERAI				
4.	CABBAGE				
5.	CORIANDER LEAVES				
6.	MANATHAKKALI				
7.	MINT				
8.	PARUPPU KEERAI				
9.	PONNANGANNI				
10.	SPINACH				
11.	OTHER SPECIFY				
IV.	ROOTS AND TUBERS				
1.	BEET ROOT				
2.	CARROT				
3.	ONION-BIG				
4.	ONION-SMALL				
5.	POTATO				
6.	YAM				
7.	OTHER SPECIFY				

S.NO.	FOOD ITEM	FREQUENCY OF CONSUMPTION			
		DAILY	WEEKLY	MONTHLY	RARELY
V.	OTHER VEGETABLES				
1.	ASH GOURD				
2.	BEANS				
3.	BITTER GOURD				
4.	BOTTLE GOURD				
5.	BRINJAL				
6.	BROAD BEANS				
7.	CAULIFLOWER				
8.	CUCUMBER				
9.	LADIES FINGER				
10.	PLANTAIN - FLOWER				
11.	PLANTAIN - STEM				
12.	RIDGE GOURD				
13.	SNAKE GOURD				
14.	SUNDAKKAI, DRY				
15.	OTHER SPECIFY				
VI.	NUTS AND OIL SEEDS				
1.	COCONUT - FRESH				
VII.	CONDIMENTS AND SPICES				
1.	ASAFOETIDA				
2.	CHILLIES - DRY				

S.NO.	FOOD ITEM	FREQUENCY OF CONSUMPTION			
		DAILY	WEEKLY	MONTHLY	RARELY
3.	CHILLIES - GREEN				
4.	CUMIN SEEDS				
5.	GINGER				
6.	TURMERIC				
7.	OTHER SPECIFY				
VIII.	FRUITS				
1.	APPLE				
2.	BANANA				
3.	DATES - DRIED				
4.	GRAPES				
5.	LEMON				
6.	MANGO				
7.	ORANGE				
8.	PAPAYA				
9.	TOMATO				
10.	OTHER SPECIFY				
IX.	MEAT, POULTRY AND FISH				
1.	MUTTON				
2.	LIVER (GOAT)				
3.	CHICKEN				

S.NO.	FOOD ITEM	FREQUENCY OF CONSUMPTION			
		DAILY	WEEKLY	MONTHLY	RARELY
4.	EGG				
5.	FISH				
6.	OTHER SPECIFY				
X.	MILK AND MILK PRODUCTS				
1.	MILK (Cow's)				
2.	CURDS (Cow's)				
3.	BUTTERMILK				
4.	OTHER SPECIFY				
XI.	SUGARS				
1.	SUGAR-CANE				
2.	JAGGERY				
3.	OTHER SPECIFY				

APPENDIX III

PROFORMA FOR RAPID CLINICAL ASSESSMENT

1. NAME OF THE INTERVIEWEE :
2. AGE :
3. SEX :
4. EYES
    a. CONJUNCTIVA
        1. DRY AND WRINKLED
        2. PALE CONJUNCTIVA
        3. CONJUNCTIVA VERY DRY AND BITOTS SPOTS
    b. PIGMENTATION
        1. SLIGHT DISCOLORATION
        2. SEVERE EARTHY DISCOLORATION
    c. NORMAL
5. MOUTH
    a. LIPS
        1. ANGULAR STOMATITIS, MILD
        2. ANGULAR STOMATITIS, MARKED
    b. TONGUE
        1. PALE
    c. GUMS
        1. BLEEDING GUMS
    d. NORMAL

6. HAIR

    a. LOSS OF LUSTRE

    b. DISCOLORED AND DRY

    c. SPARS AND BRITTLE

7. SKIN

    a. LOSS OF LUSTRE

    b. DRY AND ROUGH

8. OEDEMA

9. SPOON - SHAPED NAILS

APPENDIX - IV

ESTIMATION OF HAEMOGLOBIN

HAEMOGLOBIN ESTIMATION - CYANMETH HAEMOGLOBIN METHOD

This method is recommended by Tenth International Hematology congress and World Health Organisation Expert Committee on Nutritional Anaemias. This method measures not only oxy Haemoglobin but also carbon monoxide Haemoglobin and methhaemoglobin except sulpha-haemoglobin with filter type photoelectric calorimeters. The single relatively broad band of Cyanmethhaemoglobin in the green spectral region, has a distinct advantage. This method can be modified to determine haemoglobin in dry blood or filter paper also. Only disadvantage is that it involves the use of a solution of cyanide, but the concentration used is 50 mg/litre which is 1/4 the lethal dose. Hence it seems that proper handling of this reagent constitutes a negligible hazard.

Drabkin's Diluent Solution

Sodium Bicarbonate	-	1 g
Potassium cyanide	-	0.05 gm
Potassium ferricyanide	-	0.20 gm

Distilled water to make one litre

This solution should not be used after it forms a precipitate on the bottom of the storage bottle. The

solution is preserved in dark brown bottle and preferably under cold storage. Its preparation and handling should be done with great care.

Procedure

1. Exactly 5 ml Drabkins solution is measured into a dry test tube from burette or a pipette with suction bulb.

2. Exactly 0.02 ml of blood is transferred from a standardised haemoglobin pipette into the diluent solution. Usual care in filling and cleaning of loaded haemoglobin pipette must be observed.

3. The pipette is rinsed three times with the diluent solution without allowing the formation of air bubbles in this solution.

4. The blood and the diluent are thoroughly mixed by rotating the tube.

5. 10 minutes time is allowed for the formation of cyanmeth haemoglobin.

6. 5 ml diluent solution is used as a blank.

7. With green filter No : 540 the readings are taken in a photo-electric calorimeter.

APPENDIX - V

INDIVIDUAL FOOD INTAKE OF SELECTED MALE (NON-ANAEMIC) SUBJECTS

S.NO.	CEREALS (g)	PULSES (g)	GREEN LEAFY VEGETABLES (g)	OTHER VEGETABLES (g)	FRUITS (g)	ROOTS AND TUBERS (g)	MILK (g)	OIL & FAT (g)	SUGAR (g)
1.	600	58	70	70	35	110	200	25	20
2.	450	13	85	20	30	110	100	20	-
3.	600	55	90	40	40	80	200	20	-
4.	505	52	70	20	50	70	200	25	-
5.	440	20	80	30	20	80	200	10	20
MEAN	519	39.6	78	36	35	90	180	20	20
RDA * (1984)	475	80	125	75	30	100	200	40	40
% DEFICIT OR EXCESS	+9.26	-50.5	-37.6	-52	+16.6	-10	-10	-50	-50

* RDA : RECOMMENDED DIETARY ALLOWANCES

APPENDIX - VI

INDIVIDUAL FOOD INTAKE OF SELECTED MALE (ANAEMIC) SUBJECTS

S.NO.	CEREALS (g)	PULSES (g)	GREEN LEAFY VEGETABLES (g)	OTHER VEGETABLES (g)	FRUITS (g)	ROOTS AND TUBERS (g)	MILK (g)	OIL & FAT (g)	SUGAR (g)
1.	470	17	55	15	20	75	200	25	20
2.	480	47	75	40	30	60	150	25	-
3.	480	28	40	50	25	120	200	30	20
4.	540	27	60	45	15	65	250	25	20
5.	540	52	75	50	25	80	200	10	-
MEAN	502	34.2	60	40	23	80	200	25	20
RDA * (1984)	475	80	125	75	30	100	200	40	40
% DEFICIT OR EXCESS	+5.68	-57.25	-52	-46.7	-23.3	-20	-	-37.5	-50

* RDA : RECOMMENDED DIETARY ALLOWANCES

APPENDIX - VII

INDIVIDUAL FOOD INTAKE OF SELECTED FEMALE (NON-ANAEMIC) SUBJECTS

S.NO.	CEREALS (g)	PULSES (g)	GREEN LEAFY VEGETABLES (g)	OTHER VEGETABLES (g)	FRUITS (g)	ROOTS AND TUBERS (g)	MILK (g)	OIL & FAT (g)	SUGAR (g)
1.	500	53	75	110	50	100	200	25	20
2.	490	18	35	80	40	90	200	25	-
3.	540	53	75	70	25	100	200	20	-
4.	500	53	64	120	35	100	200	25	20
5.	490	50	75	70	50	50	200	30	-
MEAN	504	45.4	65	90	40	88	200	25	20
RDA * (1984)	350	70	125	75	30	75	200	35	30
% DEFICIT OR EXCESS	+44	-35.1	-48.0	+20	+33.3	+17.3	-	-28.57	-33.3

* RDA : RECOMMENDED DIETARY ALLOWANCES

APPENDIX - VIII

INDIVIDUAL FOOD INTAKE OF SELECTED FEMALE (ANAEMIC) SUBJECTS

S.NO.	CEREALS (g)	PULSES (g)	GREEN LEAFY VEGETABLES (g)	OTHER VEGETABLES (g)	FRUITS (g)	ROOTS AND TUBERS (g)	MILK (g)	OIL & FAT (g)	SUGAR (g)
1.	530	18	75	50	20	90	200	20	20
2.	490	21	70	50	15	80	200	25	20
3.	420	28	40	70	30	80	250	15	30
4.	470	18	25	50	35	110	200	30	20
5.	430	21	65	80	25	70	150	10	15
MEAN	468	21.2	55	60	25	86	200	20	20
RDA * (1984)	350	70	125	75	30	75	200	35	30
% DEFICIT OR EXCESS	+33.7	-69.7	-56	-20	-16.6	+14.7	-	-42.9	-33.3

* RDA : RECOMMENDED DIETARY ALLOWANCES

APPENDIX - IX

INDIVIDUAL NUTRIENT INTAKE OF SELECTED MALE (NON-ANAEMIC) SUBJECTS

S.NO.	PROTEIN (g)	FAT (g)	FIBRE (g)	CARBOHY-DRATES (g)	ENERGY (K.cal)	CALCIUM (mg)	IRON (mg)	B-CAROTENE (ug)	THIAM-INE (mg)	RIBO-FLAVIN (mg)	NIACIN (mg)	VITAMIN-C (mg)
RDA * (1991)	60.0	20.0	-	-	2875.0	400.0	28.0	2400.0	1.4	1.6	18.0	40.0
1.	47.398	17.152	5.415	416.066	2010.3	563.9	25.853	932.26	1.3696	0.9509	18.588	56.68
2.	62.04	23.065	7.743	435.088	2170.1	539.41	22.562	5008.17	1.8185	1.0574	22.104	106.98
3.	69.27	23.497	7.46	534.4	2595.5	639.4	23.36	1691.89	1.969	1.278	25.65	61.28
4.	46.27	11.6	5.44	396.65	1879.65	472.4	32.7	3151.69	1.46	0.73	19.335	83.8
5.	74.2	26.2	6.98	588.2	2849.2	1110.0	22.4	3617.07	2.07	1.3	26.4	162.8
MEAN	59.81	20.30	6.6076	474.08	2300.0	675.7	25.4	2800.0	1.74	1.06	22.4	94.3
% DEFICIT OR EXCESS	-0.32	+1.5	-	-	-20.0	+68.9	-9.3	+16.7	+24.3	-33.8	+24.4	+135.8

* RDA : RECOMMENDED DIETARY ALLOWANCES

APPENDIX - X

INDIVIDUAL NUTRIENT INTAKE OF SELECTED MALE (ANAEMIC) SUBJECTS

S.NO.	PROTEIN (g)	FAT (g)	FIBRE (g)	CARBOHY-DRATES (g)	ENERGY (K.cal)	CALCIUM (mg)	IRON (mg)	B-CAROTENE (ug)	THIAMINE (mg)	RIBOFLAVIN (mg)	NIACIN (mg)	VITAMIN-C (mg)
RDA * (1991)	60.0	20.0	-	-	2875.0	400.0	28.0	2400.0	1.4	1.6	18.0	40.0
1.	56.51	17.99	6.743	524.488	2493.49	578.08	13.259	3251.87	1.6558	1.1203	22.928	129.08
2.	67.95	20.045	8.753	503.748	2470.49	704.23	23.42	1037.47	1.015	0.8515	23.573	121.68
3.	52.421	17.444	5.919	483.84	2306.29	540.27	17.704	3229.44	1.058	1.058	20.676	101.40
4.	51.889	16.098	7.401	431.244	2084.31	587.26	27.45	1325.32	1.6284	1.0549	20.607	164.83
5.	60.415	18.77	7.138	438.488	2170.39	643.56	24.716	3214.87	1.715	1.0538	21.008	119.18
MEAN	57.8	18.07	7.19	476.36	2305.0	610.7	21.3	2412.0	1.45	1.04	21.8	127.3
% DEFICIT-3.7 OR EXCESS		-9.7	-	-	-19.8	+52.7	-23.9	+0.5	+3.8	-35.0	+21.1	+218.3

* RDA : RECOMMENDED DIETARY ALLOWANCES

APPENDIX - XI

INDIVIDUAL NUTRIENT INTAKE OF SELECTED FEMALE (NON-ANAEMIC) SUBJECTS

S.NO.	PROTEIN (g)	FAT (g)	FIBRE (g)	CARBOHY-DRATES (g)	ENERGY (K.cal)	CALCIUM (mg)	IRON (mg)	B-CAROTENE (ug)	THIAM-INE (mg)	RIBO-FLAVIN (mg)	NIACIN (mg)	VITAMIN-C (mg)
RDA * (1991)	50.0	20.0	-	-	2225.0	400.0	30.0	2400.0	1.1	1.3	14.0	40.0
1.	63.345	22.655	7.123	481.33	2346.34	736.43	31.062	3200.72	1.741	0.7709	22.088	108.81
2.	59.656	20.767	6.797	446.594	2175.48	558.05	22.291	2700.65	1.6941	1.0315	20.916	123.1
3.	65.525	18.805	8.733	512.188	2482.56	584.23	28.748	2709.6	2.1116	1.2219	21.828	119.78
4.	66.12	21.255	8.51	474.448	2402.64	960.39	25.498	2738.11	1.098	1.073	23.253	135.23
5.	50.24	15.418	5.44	421.58	2029.25	503.5	24.798	3231.77	1.561	1.024	20.075	97.25
MEAN	60.97	19.78	7.318	467.228	2287.0	668.5	26.3	2916.17	1.64	1.02	21.63	116.8
% DEFICIT+21.9 OR EXCESS		-1.1	-	-		+2.8	+67.1	-12.3	+21.5	+49.1	-21.5	+54.5	+192

* RDA : RECOMMENDED DIETARY ALLOWANCES

APPENDIX - XII

INDIVIDUAL NUTRIENT INTAKE OF SELECTED FEMALE (ANAEMIC) SUBJECTS

S.NO.	PROTEIN (g)	FAT (g)	FIBRE (g)	CARBOHY-DRATES (g)	ENERGY (K.cal)	CALCIUM (mg)	IRON (mg)	B-CAROTENE (ug)	THIAM-INE (mg)	RIBO-FLAVIN (mg)	NIACIN (mg)	VITAMIN-C (mg)
RDA * (1991)	50.0	20.0	-	-	2225.0	400.0	30.0	2400.0	1.1	1.3	14.0	40.0
1.	51.05	16.152	7.055	425.726	2052.4	914.37	13.273	3226.41	1.7355	0.9469	19.138	121.83
2.	55.693	18.83	8.131	470.228	2273.79	984.16	20.138	2909.6	1.6494	1.0659	21.578	146.0
3.	50.783	15.64	5.838	432.50	2076.39	486.45	26.144	2431.32	1.529	0.8934	18.393	119.03
4.	53.41	15.712	5.555	472.806	2248.85	588.06	13.852	3043.21	1.7558	1.0264	20.476	87.28
5.	56.499	16.43	6.578	511.61	2428.75	671.96	14.49	2931.5	0.8729	1.0832	22.383	135.63
MEAN	53.5	16.55	6.63	462.574	2216.0	718.2	17.6	2908.0	1.5	1.003	20.4	121.9
% DEFICIT OR EXCESS	+7.0	-17.3	-	-	-0.4	+79.6	-41.3	+21.16	+36.4	-22.8	+45.7	+204.8

* RDA : RECOMMENDED DIETARY ALLOWANCES