INFLUENCE OF DIETARY HABITS ON ATHEROSCLEROSIS

BY

LEENA P. JOSEPH

THESIS
SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENT FOR THE DEGREE OF
MASTER OF SCIENCE
IN FOOD SCIENCE AND NUTRITION
FACULTY OF AGRICULTURE
KERALA AGRICULTURAL UNIVERSITY

DEPARTMENT OF HOME SCIENCE
COLLEGE OF AGRICULTURE
VELLAYANI TRIVANDRUM

1990

In Loving Memory of

My Father

P L Joseph

DECLARATION

I hereby declare that this thesis entitled "Influence of dietary habits on Atherosclerosis' is a bonafied record of research and that the thesis has not formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

Vellayani,
1/2/91

LEENA P. JOSEPH

CERTIFICATE

Certified that this thesis entitled "Influence of dietary habits on Atherosclerosis is a record of research work done independently by Kum. Leena P. Joseph under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, fellowship or associateship to her.

Dr. V. USHA
Chairman
Advisory Committee
Associate Professor
Department of Home Science

Vellayani,
1 2 91

APPROVED

CHAIRMAN

Dr. V. USHA

MEMBERS

1. Dr L PREMA

2. Dr. ALICE ABRAHAM

3. Smt. S. CHELLAMMAL

EXTERNAL EXAMINER

27 9 91

ACKNOWLEDGEMENT

It is with profound sense of gratitude, I place on record my sincere thanks to the Chairman of my Advisory Committee, Dr.(Mrs.) V. Usha, Associate Professor for her invaluable guidance and sincere help during the course of the investigation and in the execution of the thesis.

I am indebted to Dr.(Mrs.) L. Prema, Professor and Head, Department of Home Science for her excellent suggestions and constant encouragement during the course of this investigation.

I express my indebtedness to Dr.(Mrs.) Alice Abraham, Professor, Department of Soil Science and Agricultural Chemistry and Smt. S. Chellammal, Assistant Professor, Department of Home Science for functioning as members of the Advisory Committee.

I wish to express my thanks to the staff, Department of Home Science, my classmate Mini and friends Karuna and Sreelatha, for all the help they have given.

I also extend my deep gratitude to the staff and patients attending the Cardiac clinic at Medical College, Trivandrum for their co-operation during the study.

I have special pleasure, love and gratitude to my most affectionate parents, brothers, sisters and my uncle

and his family, who were the source of inspiration and support to me and I dedicate this work of mine to them.

Leena PJ

LEENA P. JOSEPH

CONTENTS

LIST OF TABLES

LIST OF TABLES (Contd.)

LIST OF TABLES (Contd.)

LIST OF TABLES (Contd.)

LIST OF FIGURES

LIST OF FIGURES (Contd.)

LIST OF APPENDIX

INTRODUCTION

INTRODUCTION

The incidence of Cardiovascular diseases has increased alarmingly in recent years accounting for over 54 per cent of the deaths of all over the world (Kurup, 1989). A major cause of Cardiovascular diseases is atherosclerosis or arteriosclerosis meaning the sclerotic thickening of the arterial wall. Involvement of the coronary arteries with atherosclerosis is reported to produce occlusion of the vessel and leads to acute ischemia of the regional myocardium and brings about sudden death/acute myocardial infraction. Coronary heart disease is now on increase in India possibly due to the changing life style and dietary habits and is causing grave concern. Atherosclerosis is reported to be the commonest cause, accounting for more than 90 per cent of coronary artery disease (Bhatia, 1985).

Primary risk factors identified are elevated blood lipids, hypertension, cigarette smoking and diabetes mellitus and secondary risk factors are obesity, sedentary living and physical inactivity, familial and genetic factors, personality characteristics and behavioural age attributes and sex (Antonio et al., 1985; Nutrition News, 1986; Bakhuru, 1987, Chandran, 1987, Fazier Eales, 1986). Among the primary risk factors for the development of

atherosclerosis one of the best document is the association between elevated blood lipids and atherosclerosis (Kannel, 1987 and Daniel et al., 1989).

Among the factors which influence serum lipid levels, dietary excesses of five specific food factors viz. cholesterol, saturated fats, carbohydrate especially sucrose, alcohol and total calories are possibly implicated in hyperlipidemia (Clara, 1986).

Through appropriate intervention prevention measures in this trend needs to be reversed urgently. The present study on "Influence of dietary habits on Atherosclerosis" is an attempt on these lines with following objectives:

1. To study the dietary habits of the families of atherosclerotic patients.
2. To study various factors such as social, cultural, economic and educational background of the families of atherosclerotic patients which affect the dietary habits.
3. Impact of Cardiac clinic on the existing dietary pattern of the patients and health conditions.
4. To correlate the dietary pattern and changes in lipid metabolism in atherosclerosis.
5. To impart diet counselling to patients and assess the impact of the modified diet on serum lipid profile.

REVIEW OF LITERATURE

REVIEW

Atherosclerosis was reported to be an aging process which leads to hardening of the arteries, and later to systolic hypertension (Maheshwari, 1985). Coronary atherosclerosis was the most common underlying obstructive coronary artery disease (Hurst et al., 1985). Studies reported by Maheshwari (1985) had revealed that hypertension together with diabetes and hyperlipidaemia will aggrevate atherosclerosis. Lenegre (1971) stated that in almost 90 per cent of cases, Ischaemic heart disease was due to atherosclerosis. According to Scharffenberg (1989) seven out of ten people who die in the United States expire from one of two conditions, hardening of the arteries, which leads to heart attack or stroke. He further reported that Cardiovascular disease kill 48 per cent of these people.

The familial and genetic factors were one of the secondary risk factors leading to coronary atherosclerosis (Kurup, 1989). They reported that hypertension, diabetes mellitus and obesity were primary risk factors and predispose to coronary heart disease. The importance of the body weight, body mass and other measures of adiposity in the prediction of cardiovascular disease had been the

subject of long standing debate (Simopoulous, 1985). Hardinge (1988) opined that over weight was associated with high blood cholesterol and had an increased liability to coronary heart disease and diabetes. Ramani et al. (1986), Ball (1988) and Bierman (1983) reported that obesity was one risk factors of atherosclerosis since it increased the blood cholesterol level. Barbara et al. (1987) found that in obese subjects hyperinsulinemia induces over production of both VLDL apoB and VLDL triglyceride. Only the abdominal type of obesity had been associated with a higher risk of cardiovascular morbidity (Wahrenberg, 1989). Obesity which was a near constant feature of type II diabetics in itself was a risk factor and potentiates its effects on atherosclerosis (Datta, 1990).

Vivien et al. (1984) reported that changes in body weight and plasma glucose were correlated with total cholesterol and LDL cholesterol in blood. Ball (1988) found that Diabetes or glucose intolerance was a risk factor independent of hypercholesterolaemia. Glyn and Kenneth (1988) had shown an association between hyperglycaemia and atherosclerosis, the risk of myocardial infraction, being twice as great in diabetics compared with the rest of the population. Franklin (1989) reported that the glyation of LDL may help to explain the increased

susceptability of diabetic subjects to atherosclerotic complications. Diabetes mellitus was one of the major hormonal disturbance that had profound influences on atherosclerosis (Datta, 1990). Woods et al. (1988) stated that Diabetes mellitus was of sufficient quantitative importance as a risk factor to account for the whole of the observed excess of death from Ischaemic heart disease among Asians in the United Kingdom.

Norman (1989) found that hypertension, and elevated levels of total cholesterol in the plasma were major risk factors for coronary heart disease. Epidemiologic studies in humans provide strong evidence that hypertension promotes the onset and progression of atherosclerosis. Brian et al. (1989) and Ball (1988) found that hypertension appears to accelerate atherosclerosis and a possible mechanism was by increasing intimal permeability.

Kareberg (1989) had stated that the genetic factors in the etiology of Coronary heart disease (CHD) and on lipid levels should be used in attempts to prevent or delay atherosclerotic disease. Ronan et al. (1985) observed a positive family history as an important independent risk factor for coronary heart disease although there may be familial aggregation of subjects with a high susceptibility to the effects of the three primary risk

factors, cigarette smoking, hypertension and hyperlipidaemia.

Aetipathogenesis of coronary heart disease, affecting mankind in their most fruitful years of life was multi-factorial as had been pointed out by Pursani et al. (1987). Lee and Dickerson (1978) had assessed that coronary heart disease accounted for 41 per cent of the deaths in men aged 35-44 years and 52 per cent in men aged 45-54 years. The estimated number of patients with coronary artery disease over the age of 65 were reported to be 3.6 million (National centre for Health Statistics, 1987). Data from the office of population censuses and surveys showed that coronary heart disease was the dominant cause of death in men after the age of 40 (Third report of a Joint Cardiology Committee, 1985). Friedlander et al. (1985) had found that in a random sample of 1044 men aged 40-70 the family history of heart attack before the age of 60 years was an independent risk factor for Coronary heart disease.

Although atherosclerosis occurs both in males and females, males in general were found to be more predisposed to Coronary heart disease since the female sex hormones had an inhibitory effect on Coronary heart disease (CHD) (Antia, 1984). Jacqueline et al. (1989) had reported that when oestrogen production stops either naturally or after removal of both ovaries the risk of atherosclerosis

was increased. Jajoo et al. (1988) reported that the incidence being higher in women than in men. Godsland et al. (1987) had found that the incidence of Coronary heart disease was higher in men than in women due to difference in plasma lipoprotein risk factors between the sexes. According to Chopra and Aggarwal (1989), the major risk factors were smoking and the taking liquor by pregnant women. Man and women had typically different body fat distribution with men being more prone to accumulate fat in abdominal region and women to accumulate fat in the gluteal and fumeral region (Wahrenberg, 1989).

About 67 million Americans were reported to had some potentially dangerous form of heart or blood vessel disease (American Heart Association, 1990). Sharper et al. (1986) reported that United Kingdom had one of the highest death rates for ischaemic heart disease especially in Scotland and Northern Ireland. Ball (1988) revealed that Coronary heart disease and Cerebral vascular diseases were the major causes of death in the western world. Glyn and Kenneth (1988) observed that Cardiovascular disease was the major cause of death in North America and western Europe.

Watts et al. (1988) reported that atherosclerotic coronary heart disease was the main cause of death in

most industrial communities. A screening conducted by Jajoo et al. (1988) to detect the prevalence of Coronary heart disease among 2433 subjects in India aged 30 and beyond, revealed that, the prevalence of Coronary heart disease to be 14.80 per thousand. Bhatia (1985) and Ozario (1988) reported that the prevalence of Coronary heart disease (CHD) in our country in the general population above the age of 40 were 2.5 per cent. Chengappa (1986) stated that 10 per cent of Indians die each year because of heart disease and 12 million Indians were at risk for developing atherosclerosis.

Ramani et al. (1986) reported that the high income groups will never take high amount of fibrous foods in their diets resulting in an increase in their serum cholesterol level. Individuals who belonged to high income group had significantly higher cholesterol levels, while in low income group, the serum cholesterol level was nearer to the accepted normal level. Rajammal et al. (1980) investigated the correlation of diet with serum cholesterol levels in premenopousal women doing sedentary work belonging to the affluent society. Mario et al (1980) reported that the urban dietary intakes were significantly higher in total fat and lower in carbohydrate particularly starch and the average cholesterol intakes

were 83 mg/day higher in urban than in rural men.

Physical exercise reduced the plasma cholesterol, low density lipoprotein and triglyceride concentration and increased high density lipoprotein levels. But vigorous exercise increased the mortality rate from Coronary heart disease (Chave et al., 1978, Gunby, 1983; Gregory et al., 1983, Cambien et al., 1981).

Lehtonen and Viikari (1978) and Carol west Suitor (1980) reported that physical activity increase serum high density lipoprotein cholesterol and free fatty acid concentrations and decreased triglyceride values. Wood et al. (1988) reported comparable increases in high density lipoprotein cholesterol in subjects with increased physical activity. Harley et al. (1986) reported that runners weighed less and had higher plasma high density lipoprotein cholesterol and lower low density cholesterol level than the inactive women.

Studies revealed that the incidence of ischemic heart disease was high among persons leading sedentary life and low among individuals who lead an active life involving considerable amount of physical activity (Swaminathan, 1986). According to Ekelund et al. (1988) physical inactivity was associated with an increased Coronary heart disease risk and mortality in some Cohort

studies. Milton and Pegg (1987) observed that weight loss and increased physical activity decreases the plasma cholesterol levels.

Several recent studies suggested an association between coffee intake and increased levels of serum cholesterol in men and women (Green and Jucha, 1986, Kark et al., 1985 and Thelle et al , 1983). The evidence suggested that coffee intake may be positively associated with serum total cholesterol levels, especially low density cholesterol. The consumption of decaffeinated coffee was found to increase the level of low density lipoprotein cholesterol in blood (Hindu, 1990). Srimathi et al. (1981) reported that both coffee and tea appear to cause an increase in serum lipids and lipoproteins, tea was found to have more beneficial effects than coffee Panda et al. (1979) reported that total cholesterol level in plasma rises with rise in the level of tannic acid in the diet. They further reported that concentration of blood glucose and plasma proteins decreased with increase in the level of tannic acid in the diet.

Shepherd et al. (1987) reported that the three main risk factors of Coronary heart disease were cigarette smoking, high blood lipid concentration and hypertension. Kenneth (1987) found that the combination of smoking and

elevated cholesterol confers greater than additive effects on Coronary heart disease risk. Wendy et al. (1989) observed that the smokers as a group face an average overall excess risk of Coronary artery disease of 70 per cent.

Rabkin (1984) reported a direct relationship between the effect of cigarette smoking on other Cardio-vascular risk factors serum lipids, body weight, blood pressure and blood sugar. According to Arti and Rajeswari (1986), chain smoking had a deleterious effect with regard to cholesterol and blood pressure. Killian et al. (1989) reported that the ex-smokers were at higher risk of acute Coronary disease for at least 15 years after stopping but some immediate reduction in risk was possible. Cigarette smoking was reported to be a major risk factor for Coronary heart disease (Norman, 1989 and American Heart Association, 1990).

Michael et al. (1986) reported that alcohol produce a rise of one per cent in serum high density lipoprotein (HDL) cholesterol probably due to a rise in the high density lipoprotein subfraction. They further reported that alcohol intake in excessive amounts, increased the transport rate of VLDL particles as a result of high LDL activity and this result in the upregulation of HDL_2.

Low or subnormal low density lipoprotein levels were reported to be another characteristic of the lipoprotein pattern in chronic alcoholics (Marja et al., 1987, Willem and John, 1980, Castelli, 1980). Vivien et al. (1984) reported that the dietary, alcohol intake, cigarette smoking and packet count were correlated fairly with total cholesterol and low density lipoprotein cholesterol in blood.

Gerard et al. (1989) found that a positive association between plasma apolipoprotein A and high density lipoprotein markers by tobacco use.

Rajammal et al. (1980) found that Gujarathis exhibited a higher mean serum cholesterol level than the Tamilian vegetarians. Moore et al. (1981) reported that when macronutrients like protein, fat and carbohydrate were used to identify and measure the food sources in the diets, smaller lesions were related to intakes of legumes, grains and vegetables whereas larger lesions were related but to a smaller degree to intakes of beef, milk and fruit. Thorogood et al. (1987) reported a lower cholesterol concentration in vegetarians than in those who eat meat. Vegetarians diets and high intake of fish were found to be associated with reduced risk of Coronary heart disease. Alan et al. (1985) found that a very high fat

intake which accounted for nearly 60 per cent of total energy intake increased the serum cholesterol levels. Lief Ladidus et al. (1986) observed that suboptimal factor in the pathogenisis of ischemic heart disease. Williams (1989) found that the dietary factors responsible for atherosclerosis were the primary dietary constituents (Fat, Carbohydrate, Protein).

Liu et al. (1983) reported that low fat and high carbohydrate diets accentuate the metabolic risk factors for Coronary artery disease that were already present in patients with endogenous hypertriglyceridaemia. Other dietary constituents such as the type of dietary carbohydrate, the intake of dietary fiber, calcium and vitamins such as vitamin A and D should be taken into consideration when studying the effect of manipulation of dietary fat on plasma cholesterol levels (Milton and Pegg, 1987). Glueck et al. (1979) found that the sucrose polyester was an effective cholesterol lowering agent. Gene and Minda (1988) reported that dietary glucose and fructose lowers the secretion of hepatic triglyceride in rats fed marine oil than in those fed tallow or cornil.

Kurup (1989) reported that sucrose producer the higher serum cholesterol when compared to glucose or corn starch. The cereal-rice, wheat, jowar (Sorghum vulgare),

bajra (Pennisetum typhoideum) and ragi (Eleucine coracana) and the tuber tapioca, form the major source of carbohydrates in the different part of India. Starch prepared from these cereals and tapioca differed in their effect on serum and aortic lipid levels (Vijayagopalan and Kurup, 1970). Vijayagopalan et al. (1973) observed that the ragi and tapioca which were least digested had higher cholesterol lowering action, while the more digestible starches showed lower effect.

Tubers form another source of carbohydrates in the diet, particularly among the poorer classes and the tubers commonly consumed in Kerala are colocasia (Colocasia esculenta), tapioca (Manihut esculenta), sweet potato (Ipomoea batatas), dioscorea, Dioscorea alata (Dioscorea esculenta) and arrow root (Maranta arundinacea). Many of these tubers given after cooking was reported to show lower serum and aortic cholesterol and triglycerides when compared to wheat (Prema and Kurup, 1979). The starches isolated from yam and coleus, Parviflorus generally showed serum and aortic cholesterol and triglyceride level between wheat starch and sucrose on one side and glucose on the other. Starch from arrow root, sweet potato, tapioca and dioscorea was reported to show significantly lower levels when compared to the others (Prema et al., 1978).

A comparative study of cooked rice and tapioca, two major sources of carbohydrates in the diet in the population in Kerala in relation to their effect on serum and aortic lipids revealed that under most conditions, tapioca produced significantly lower levels of serum and aortic cholesterol and triglyceride (Premakumari and Kurup, 1980). Kurup (1989) observed the beneficial effect of tapioca was irrespective of the nature of protein (Casein or fish protein) or nature of the fat (coconut oil or groundnut oil) in the diet.

Nalini and Radha (1989) suggested that dietary substitution of plant proteins for animal proteins could be used as a better regimen in combating hypercholesterolemia and hence coronary heart disease (CHD) than the use of restricted fat diets. Susan et al. (1989) found that the consumption of 450 g of backed beans reduced the total plasma cholesterol levels. Scott and Jeffrey et al. (1983) found that the substitution of soyprotein for casein protein produced no consistent change in plasma concentration of cholesterol, triglyceride, low density lipoprotein or high density lipoprotein. Antonio et al. (1985) reported that the addition of soybean protein to a standard low lipid diet was effective in inducing a significant cholesterol decrease in patients with type II hyperlipoproteinaemia. Shorey et al. (1985) found that the diet

containing 25 g soyabean polysacchrides, reduces the total plasma cholesterol than the diet containing 25 g of placebo starch. Jenkins et al. (1983) observed that daily consumption of 140 g of dried beans decreased the serum triglycerides and serum cholesterol levels. Susan et al. (1987) reported that whole legumes were effective cholesterol lowering agents when consumed on a habitual basis. Prina et al. (1981) reported that the increased fecal excretion of cholesterol and bile acids induced by the gluten diet represents the main mechanism of the hypocholesterolemic effect of wheat gluten diet. Bernard et al. (1981) showed that the serum cholesterol and triglyceride concentrations were lowered in a diet based on plant proteins at 13 per cent and 23 per cent respectively than low cholesterol control diet containing mixed protein from meat and dairy products.

The pulses were the major source of dietary protein in the average Indian diet, the effect of different pulses-blackgram (Phaseolus mungo), redgram (Cajanus cajan), horsegram (Dolichos biflorus), bengalgram (Cicer arietinum) and greengram (Phaseolus radiatus) was studied on the serum and aortic cholesterol levels. Blackgram and to a lesser extent redgram were found to cause significantly lower levels of serum and aortic cholesterol while horse-gram had lesser cholesterol lowering effect, when compared

to others. Greengram showed only a small cholesterol lowering effect while bengalgram had no effect (Saraswathy Devi and Kurup, 1970).

The lowest concentration of cholesterol and triglycerides in the aorta was produced by plant proteins (soyabean protein and blackgram protein) while the highest serum cholesterol was caused by beef protein (Saraswathy Devi and Kurup, 1972 and 1973; Prema, L. and Kurup, 1973).

Leelamma et al. (1978) observed that the plant protein (groundnut protein) produced similar high aortic cholesterol as egg albumin or similar high aortic triglycerides as beef protein. Kurup (1989) suggested that the ratio of lysine : arginine of a protein may affect its effect on serum cholesterol levels and atherogenicity. Casein and many of the animal proteins had a high ratio (around 2.0) and this was stated to be associated with their hypercholesterolemic effect while many of the plant proteins had lower lysine . arginine ratio which was attributed to their hypocholesterolemic effect. This view found, support from the fact that the hypocholesterolemic proteins studied had a lysine : arginine ratio of 1.0 or less than 1.0. Kurup et al. (1982) reported that lysine is one of the amino acids which had been reported to be hypercholesterolemic.

Castelli (1986) of framingham fame stated that diet could reverse coronary artery disease in 90 per cent of the cases if cholesterol was attained below 150 mg per cent.

Pritikin (1984), the most outspoken advocate of diet therapy in the management of circulatory disease proved his own death that atherosclerosis was indeed reversible. 25 years ago he learned that his own coronary-arteries were seriously obstructed. Through a vigorous programme of diet and exercise, he was able to reduce his cholesterol level from over 300 mg per cent to between 100-130 mg per cent and to keep it there for 25 years.

Etherton et al. (1988) opine that saturated fatty acids and cholesterol raise the plasma cholesterol levels whereas poly unsaturated fatty acids lowers it. Mono unsaturated fatty acids soluble fibers and vegetarian diets favourably affect plasma lipid levels.

The type and amount of fat in the diet influence the serum cholesterol levels. It was the proportion of saturated to poly unsaturated fatty acids in the total diet consumed that determines the lipid level and consequently the vascular deposition of lipids (Krause, 1984).

Levy (1985) gave striking correlation between average intake of fat and average levels of serum cholesterol

in epidemiological studies comparing western and non-western population. A direct correlation was found between the intake of saturated fat on the one hand and the incidence of Coronary artery disease (CAD) and hyper cholesterolemia on the other.

Mary et al. (1988) found that low fat intakes resulted in lower total cholesterol and lower HDL cholesterol levels. Sommariva et al. (1985) reported that a low fat diet which provided 19 per cent of total energy for one month decreased the level of LDL cholesterol and VLDL cholesterol significantly. Kushi et al. (1988) revealed that total serum cholesterol was positively associated with dietary cholesterol and saturated fatty acids. Mark and Lynne (1988) reported that there was a significant positive correlation between consumption of saturated fat and cholesterol and international mortality from Coronary heart disease. Ehnholm et al. (1982) found that a diet rich in animal fat causes hypercholesterolaemia. Oliver (1987) reported that diets low in polyunsaturated fats might be equally, harmful. Henning and Boissonneault (1988) suggested that oxidized lipids reduce the ability of the endothelium to act as a selectively permeable barrier to plasma components such as cholesterol rich lipoprotein remenants and vitamin E may be a potent

antiatherogenic nutrient, protecting the cells against oxidative injury. Stringer et al. (1989) reported that perioxidised lipids may be important in atherogenesis and its complications and also suggested that perioxidised lipids may provide an index of the severity of atherosclerosis.

Paul (1987) reported that fish oils may modify the cholesterol raising effect of dietary cholesterol. William et al. (1988) reported that small amounts of fish oil can have beneficial effects on plasma triglyceride levels in hypertriglyceridemic patients. Liebman and Bazzarree (1983) reported that in low vegetarians the total cholesterol and triglyceride values were lower and HDL cholesterol values were higher when compared to high fat vegetarians.

Dietary fiber was found in unprocessed cereals legumes, vegetables and fruits contribute bulk to the diet and therefore helps in keeping calorie intake low. The effect of dietary fiber depends in the type. Wheat fiber does not decreased the blood cholesterol but viscous type like pectins and guargums in large doses lowers plasma total cholesterol and LDL cholesterol levels (Nutrition News, 1986).

Gene and Hugh (1983) reported that dietary fiber probably play a role in the metabolism of lipids and in lipid related disorders. Jean and George (1983) reported that the high fiber content in the diet reduced the serum cholesterol level. Morris et al. (1978) reported that cereal fiber reduced the incidence of Coronary heart disease. They also reported that there was no association between intake of dietary fiber from fruits, potatoes, other vegetables, pulses or nuts, and the incidence of CHD. Marianne et al. (1980) and Wolthuis (1980) reported that fiber components from vegetables and fruits, in contrast with bran, had a small favourable effect on the concentration of serum cholesterol. Jean et al. (1987) reported that the combinations of pectins and cereal brans in the diet could be useful in normalizing cholesterol and triglyceride of patients suffering from higher lipidaemia. Lithell et al. (1984) reported that wheat bran in moderately large doses that were convenient to take does not offer a therapeutic alternative for increasing HDL cholesterol level in normocholesterolaemic men. Moore et al. (1985) reported that wheat bran supplementation in the diet increased the HDL cholesterol and decreased the LDL cholesterol. Oat-bran and barely consumption reduce the cholesterol content in blood (Hindu, 1990).

The hypocholesterolemic and antiatherogenic action of dietary fiber was confirmed by study of fiber rich polysaccharides from blackgram, sesame seed and palm kernel. These polysacchrides increased fecal exceretion of neutral sterols and bile acids (Saraswathy Devi and Kurup, 1972; Menon and Kurup, 1974 and 1976). Kurup (1989) showed that the hypocholesterolemic action of this fiber was mostly due to its hemicellulose content. Since removal of hemicellulose by digestion with hemicellulase reduced the activity significantly.

The study conducted by Kurup (1989) found that the fiber component of blackgram and ragi decrease the serum cholesterol and triglycerides, increase the HDL cholesterol and decrease in LDL and VLDL cholesterol in hyperlipidemic patients.

Jenkins et al. (1979) found that the guargum act as a hypocholestrimic agent. David et al. (1980) reported that guar in the crisbread form when consumed by eleven hyperlipidemic patients.

Thomas et al. (1983) reported that dietary fiber from the dehulled soybeans reduces the serumcholesterol level. Neutral detergent fiber of cluster bean and guargum lowered cholesterol levels but the effect did not appear to be additive when these components were present

together in the whole clusterbean (Roopasarathy and Saraswathi, 1983). Lybius et al. (1985) found that intake of pectin, cellulose and lignin significantly altered serum total cholesterol, triglycerides, high density lipoprotein to total cholesterol in healthy normolipidemic subjects over four weeks.

The hardness of drinking water was closely related to the Coronary heart disease (Crombie et al., 1989). John and Lee (1978) reported that the hardness of drinking water had been correlated with Cardiovascular mortality, the softer the water, the higher the death rate. Hardness of water was associated with higher calcium and a lower mortality from Cardiovascular disease (Antia, 1986).

Sudhakaran and Kurup (1974) reported that the deficiency of vitamin A increase the serum and aortic cholesterol levels. Ascorbic acid had been shown to be helpful in decreasing the susceptibility of the vessel wall to injury and also removal of the injurious factors including hyperlipidemia in an effort to reduce the incidence or atherosclerosis (Satinder et al., 1987). Deficiency of ascorbic acid was reported to result in elevated levels of serum and aortic cholesterol. While the administration of vitamin A and ascorbic acid reduce the serum and aortic cholesterol (Jayakumari and Kurup,

1979; Bala Nambeesan and Kurup, 1976). Vijayammal and Kurup (1978 and 1981) observed that the pyridoxine and thiamine deficiency increase the cholesterol level. Thomas Varghese et al. (1982) found that the nicotinic acid deficiency increase the serum cholesterol, triglyceride and LDL cholesterol and it decrease the HDL cholesterol.

Biotin deficiency was induced by feeding raw egg white, also resulted in elevated levels of cholesterol in the serum and aorta particularly in rats fed atherogenic diet (Kurup, 1989).

Babu Philip and Kurup (1978) suggested that the low and high level of Zn^{++} in the diet produce elevated levels of cholesterol and triglycerides. Decreased concentration of cholesterol and triglycerides in the serum was observed in zinc deficiency. Copper deficiency caused hypercholesterolemia and hypertriglyceridemia as well as increased concentration of triglycerides in the aorta (Valsala and Kurup, 1987).

Partial Mg^{++} deficiency produced by feeding a Mg^{++} deficient diet in rats resulted in increase in the concentration of cholesterol and triglycerides in the serum and aorta and increase in LDL and VLDL cholesterol when compared to the animals fed adequate Mg^{++} (Jaya and Kurup, 1987).

Magnesium concentrations had been found to be lower in heart from myocardial degeneration than in muscle from subjects who died from other causes (John and Lee, 1978). The supplementation of Zn and copper shows hypocholesterolemic effect. The study shows that plasma cholesterol levels in women are more influenced by copper than by zinc dietary status (Jeanne et al., 1980). Milton and Pegg (1987) reported that increased intake of dietary calcium reduce the plasma cholesterol levels. Sheela Sidharam (1988) reported that increased sodium intake influence the serum lipids and it leads to Coronary heart disease.

Suitor and Hunter (1980) reported that diet treatment was preferable to exclusive use of drug treatment in atherosclerosis. Kannel (1978) reported that the diet with restriction of cholesterol and fat and increase in cereals, vegetables and fruits as sources of complex Carbohydrate and dietary fiber would be food modification likely to reduce the incidence of Coronary artery disease and atherosclerosis. Ruth et al. (1980) showed that the men with lower serum cholesterol and triglyceride concentrations were consuming significantly more dietary fiber proportionately fewer fat calories. Complex carbohydrates containing soluble fiber such as the guar pectins of

Magnesium concentrations had been found to be lower in heart from myocardial degeneration than in muscle from subjects who died from other causes (John and Lee, 1978). The supplementation of Zn and copper shows hypocholesterolemic effect. The study shows that plasma cholesterol levels in women are more influenced by copper than by zinc dietary status (Jeanne et al., 1980). Milton and Pegg (1987) reported that increased intake of dietary calcium reduce the plasma cholesterol levels. Sheela Sidharam (1988) reported that increased sodium intake influence the serum lipids and it leads to Coronary heart disease.

Suitor and Hunter (1980) reported that diet treatment was preferable to exclusive use of drug treatment in atherosclerosis. Kannel (1978) reported that the diet with restriction of cholesterol and fat and increase in cereals, vegetables and fruits as sources of complex Carbohydrate and dietary fiber would be food modification likely to reduce the incidence of Coronary artery disease and atherosclerosis. Ruth et al. (1980) showed that the men with lower serum cholesterol and triglyceride concentrations were consuming significantly more dietary fiber proportionately fewer fat calories. Complex carbohydrates containing soluble fiber such as the guar pectins of

whole fruits had been shown to reduce LDL cholesterol according to Smith et al. (1987). Ann et al. (1987) reported that the dietary fiber from bengalgram in hypercholesterolaemic diet caused the lowering of plasma as well as membrane cholesterol.

British dietetic association (1979) reported that dietary treatment of familial hypercholesterolaemia in childhood requires either reduction of dietary saturated fat and/or cholesterol lowering drugs, where diet alone was used severe restriction (25 per cent normal dietary fat) was required. The highly unsaturated fats, such as safflower oil, sunflower oil, cornoil and soyaoil are all permitted and limited quantities of a highly unsaturated margarine (50 per cent) is recommended. Aphaines (1989) reported that increased consumption of fruit, vegetables and fish should be advocated together so that replacement of energy from saturated fatty acids by unrefined carbohydrates and unsaturated fatty acids can be ensured.

Aro et al. (1984) studied the effect of guargum on hypercholesterolemia and found that there was a significant decrease of serum total cholesterol which was mainly due to the decrease in low density lipoprotein concentration. The same effect was observed by Agarwal and Pant (1986) with bishoweed or Ajowan seed powder and

with upsaponifiable malt or rice bran oil by Sharma and Rukmini (1987).

Ritchter et al. (1984) suggested that replacement 40 g of animal protein by soyabean protein in a cholesterol lowering diet significantly decreased serum cholesterol. Samman and Roberts (1987) reported that the casein and soyabean diet reduce the plasma cholesterol. Hepner et al. (1979) found that the supplementation of diet with Yogurt may have a helpful hypocholesteremic effect. Anton and Martijn (1985) found that dietary egg increases the serum cholesterol. Pauline and John (1986) reported that dietary n-3 polyunsaturated fatty acids abundant in marine organisms, may reduce the development of Cardiovascular disease. Ann et al. (1983) reported that the intake of fatty fish had a detectable effect on blood lipids.

Premakumari and Sundaravalli (1976) reported a reduction in total serum cholesterol by using sunflower oil in the diet for 6 weeks. Godfrey et al. (1987) found that peanut oil diet reduces the hepatic output of VLDL associated apoprotein B and triglyceride whereas lard increases hepatic secretion of VLDL associated lipids and apoprotein E.

Kurup (1989) studied the effect of different edible oils, coconut oil, groundnut oil, safflower oil,

sesame oil, rice bran oil, corn oil, butter fat and hydrogenated fat on aortic cholesterol. It revealed that there was no strict correlation between the degree of saturation or unsaturation of the fats and their effect on serum and aortic cholesterol. He also observed that the hydrogenated fat and butter fat, coconut oil and groundnut oil produce moderate lesions.

Rice bran oil, sesame oil, corn oil and safflower oil where the iodine number increased from 98 to 140, more or less produced similar cholesterol levels. Fats which were more atherogenic (coconut oil and butter fat) contained lower amounts of tocopherols in the unsaponifiable fraction while fats which were least atherogenic (safflower oil, corn oil) contained higher concentrations of tocopherols (Sreekumar and Kurup, 1978).

Marc (1987) reported that ghee contains cholesterol oxides which is an atherosclerotic risk factor. Baggio et al. (1988) reported that olive oil enriched diet decreases total cholesterol, total apoB, LDL cholesterol and total triglycerides.

Harris et al. (1984) showed that fish oil prevent the rise in plasma triglycerides and VLDL levels that occurs in normal persons after administration of a high carbohydrate diet (75% calories). Nestel et al. (1984)

showed that the daily production of VLDL apolipoprotein B was substantially less in subjects consuming fish oil when compared to safflower oil.

Bordia (1981) reported that inclusion of garlic in the daily diet significantly decreased serum cholesterol and triglycerides and increased high density lipoproteins. Arora and Arora (1981) reported that garlic and onion checked the fat induced decrease of blood fibrinolytic activity. Sheila and Easwaran (1989) showed that the hypocholesterolemic effect of garlic and onion in the raw form.

Thelle et al. (1983) reported that frequent coffee consumption was positively associated with total cholesterol and triglyceride value in both sexes and was inversely associated with HDL cholesterol values in women. Guyvalette et al. (1984) found that the defatted portion of fenugreek seeds induced a hypocholesterolaemic effect. The hypocholesterolaemic effect of fenugreek seeds was also studied by Sharma (1989). It increased the excretion of bile acids and neutral sterols and depletion of cholesterol stores in the liver.

Studies by Giri et al. (1984) showed that ginger was hypocholesterolaemic but needs to be taken in considerable quantities for several days.

Henry et al. (1985) reported that continuous elevations of plasma LDL causes the progression of the atherosclerosis. The LDL has been identified as the most highly atherogenic of the lipoproteins. The inverse relationship between plasma levels of HDL and coronary risk was well established (Castelli, 1986). Jonathan et al. (1987) reported that the plasma LDL-cholesterol concentration was altered by environmental factors such as aging and diet. With aging the plasma LDL-cholesterol level rises, this increase appears to be caused by over production of LDL with cholesterol feeding.

An inverse association of HDLC levels and ratio of CHD incidence and mortality had been observed in prospective epidemiologic studies conducted in several countries (Watkin and Jacob, 1986). Paul (1987) reported that carbohydrate increases apoprotein A_1 and HDL_2 removal, whereas polyunsaturated fatty acids inhibit synthesis, vegetarians show high HDL removal rates. Thus low-fat, low-cholesterol diets generally lead to lower HDL levels. HDL proteins such as apoproteins C and E shows faster turnover rates than A_1 and A_2. Diets with a high content of CHO produce a substantial reduction in serum HDL cholesterol level. Oat bran and bean fiber produce a slight decrease in HDL cholesterol. Pirjo and Jussi (1987)

reported that vegetable protein was found to reduce the diet linked atherogenic risk.

Thompson and Borts (1978) reported that the relationship between elevated blood cholesterol levels in the process of atherosclerotic heart disease is firmly established. He also proved that cholesterol carried in the HDL fraction is not harmful and is protective against the development of atherosclerotic heart disease. Fears et al. (1981) found that serum triglyceride level increased with the intake of sucrose every day, but there were no additional decreases in HDL. The higher levels of total cholesterol to HDL cholesterol ratio appears to be one of the important parameters to as certain the development of Coronary heart disease in cigarette smokers (Tiwari et al., 1989).

Tunstall et al. (1981) reported that the health education programme for industrial workers modified their food related behaviour rather than knowledge and attitudes. Olendzki et al. (1981) conducted a study among patients who attended speciality clinics for diseases like diabetes, hypertension and atherosclerosis and found a 25 pound wt loss in a year when compared to patients who did not attend speciality clinics and who gained about 10 pounds/years. Phillipson et al. (1985) reported that patients with atherosclerosis attending Cardiac clinic received knowledge

about diet control from the doctor and was able to control the serum cholesterol and triglyceride levels. Educational attainment was related positively to eating pattern and thereby a decreased risk of Cardiovascular and other chronic diseases (Lawrence et al., 1988). Dorothy and Rani (1989) reported that, after a period of diet counselling to a group of persons for a period of 6 month, had low risk factors and had good knowledge regarding diet and disease. Thus for the prevention of Cardiovascular disease dietary counselling was one of the vital component for dietary adherence.

MATERIALS AND METHODS

MATERIALS AND METHODS

A study on the influence of dietary factors and atherosclerosis was based on the assessment of

1. The dietary habits of the families of atherosclerotic patients
2. Social, cultural, economic and educational background of the families of atherosclerotic patients which affect their dietary habits
3. The impact of Cardiac clinic on the existing dietary pattern of the patients and their health conditions
4. The correlation between dietary pattern and changes in lipid metabolism
5. Influence of diet counselling on serum lipid profile

Area of study

Patients attending the Cardiac clinic at Trivandrum Medical College, were selected for the study. The patients were mainly from Quilon and Trivandrum districts and were from both urban as well as rural areas.

Selection of samples

In this study the samples were selected from the patients attending the Cardiac clinic of Trivandrum Medical

College. 100 samples were selected through simple random sampling. According to Gupta (1985) simple random sampling refers to that sampling technique to which each and every unit of the population has an equal opportunity of being selected in the sample.

Seven patients were selected to be followed up as case studies by purposive sampling. In such cases the samples were drawn according to the requirement of the investigator (Cochran, 1977). These patients were not attending the clinic regularly and were willing to follow a modified diet for the prescribed period of study. The selection of samples for case studies was based on their body weight for height and catergorizing them as obese, underweight and normal weight patients using the criterion give by Robinson et al. (1987) for obesity and underweight and ICMR classification (1989) for normal weight.

Development of tools

To elicit information regarding the socio-economic and dietary pattern of the families as well as the patients, interview schedules were developed. In order to study the actual food intake of the family members of the patients as well as the patients selected as case studies food weighment survey was also conducted with suitably

structured questionnaires. The schedules are given in Appendix I, II and III. The schedules were formulated in malayalam keeping in mind the fact that this will be more easy for the interviewer as well as for the patients.

Data regarding the activities of Cardiac clinic, and diet counselling imparted in the clinic were collected by interviewing the patients and personnel.

Survey of socio-economic and dietary pattern of the families of atherosclerotic patients

A socio-economic and dietary survey was conducted to collect information regarding the size of the families, occupation, income, educational level and food habits of the family of atherosclerotic patients. Interview method was selected to elicit information from the subjects on socio-economic profile and dietary practices. Gupta (1987) states that an interview is a two way method which permits an exchange of ideas and information. The information received from an interview schedule was more reliable as the accuracy of statements can be checked by supplementary questions wherever necessary.

Dietary pattern of the families of the atherosclerotic patients was collected by 24 hour recall method. Pennington (1988) points out that studies that relate to food and

nutrient intake to measure health or disease are essential for monitoring dietary status, estimating the incidence of diet related disease and 24 hours recall for three consecutive days are best used for quantification of mean daily food intakes of the family. By this method the investigator collected information from the subject about the types and amounts of foods consumed by the family. Information regarding the purchase of the various food items by the families was also collected.

Diet survey of the atherosclerotic patients

By interview method the data regarding the dietary as well as some personal habits regarding the use of liquor, tobacco, betel and others were also collected from the patients. Assessments regarding the body weight and height were also done. By 72 hr recall method the investigator collected information from the patients about the amount and types of foods consumed by them for three consecutive days. Information concerned about the frequency of use of various food items were also collected. Details regarding the cooking methods followed, inclusion of non vegetarian foods, cooking oil used, the pattern of eating food outside and the types of exercise done by the patients were also collected.

Observation of diet counselling imparted in the Cardiac clinic

The investigator studied the impact of Cardiac clinic on the existing dietary pattern of the patients and their health condition. The clinic was a speciality clinic and therefore the patients got more care from this clinic. The Investigator collecting the information from patients as well as personnel through observation and interview.

Dietary pattern of the selected families through food weighment survey

The dietary assessment method by means of 24 hr dietary recall alone is of minimal value in identifying patients' usual food intake (Guthrie and Crocetti, 1985). So a food weighment survey was carried out in selected 10 families (Appendix III).

The investigator weighed the raw foods included in the meal for a day and the cooked weight of each preparation was recorded (Fig. 1). The amount of each food consumed was also weighed, so also the plate waste to get the exact amounts of foods consumed. The nutritive value of the foods consumed was calculated using food composition tables (ICMR, 1989).

FIG-1 FOOD WEIGHMENT

Individual weighment survey was conducted in seven patients who were selected as case studies to get detailed and accurate records regarding their actual food intake. The nutritive value of the food consumed was calculated using food composition table (ICMR, 1989).

Changes in blood cholesterol and Triglyceride levels in the selected patients

From food weighment method the actual consumption of various food items by the patients were calculated using food composition tables. The height and weight of the selected patients were recorded. The type of activity of the patients was also recorded. Using these data the investigator worked out whether the selected patient was over weight or underweight when compared to their ideal body weight.

Estimation of serum cholesterol

Hyper cholesterolaemia is a potentially reversible risk factor. There is a strong association between the level of serum cholesterol and the development of atherosclerosis (International Collaborative Study Group, 1986). In 1990 statistics focus on the risks of heart disease in women. The figures shows that more than half of all women from 55 to 74 years have blood cholesterol

levels above, 240 at which the risk of heart disease increases substantially (Hindu, 1990). Cholesterol was estimated by the method of Abell (1952). The details of the procedure is given in Appendix IV.

Estimation of triglycerides

Hyper triglyceridaemia is positively correlated with an increased risk of CHD (Glyn and Kenneth, 1988). Alan et al. (1989) reported that hypertriglyceridemia increases the risk of atherosclerosis in men and women. Serum triglycerides were estimated by the method of Varhandel and Zilversmit (1957) with the modification that florisil was used to remove phospholipids. The details of the procedure are given in Appendix V.

Diet counselling for the case studies

To change the patients life style dietary counselling were practiced. Clara (1986) reported that diet counselling is necessary to lowering blood lipids and in maintaining the normal levels in atherosclerotic patients. The nutritional advice is very important to reduce the risk of CHD (Jayantha and Mukesh, 1983). The investigator imparted diet counselling as an experimental measure to study its effect in selected seven patients. The patients were contacted individually and convinced them regarding the

importance of a modified diet to maintain good health in atherosclerotic condition. They were made aware of the various food items to be included in the diet, foods to be restricted quantity of foods to be consumed and also the food which will help them to select food items considering their personal choice and to add variety to their modified diets. Instructions were given to them regarding food selection and preparation techniques. They were adviced to use vegetable oils (Fig. 2).

After every month of diet counselling the weight of the patients were recorded by using the spring human weighing balance (Fig. 3).

Planning of one week menu using food exchange list

After imparting diet counselling by the investigator, the patients were convinced and voluntarily followed the modified diet as worked out by the investigator. The investigator planned the menu for one week, (Appendix VII) using food exchange list (Appendix VI). The distribution of energy from carbohydrate, fats and protein were also calculated separately for the case studies.

The distribution of energy for each patient was calculated by considering the height, weight and activity of each individual. The menu was planned to reduce body

Fig.2 Diet counselling

Fig.3 Body weight

weights for overweight patients to increase body weights for underweight patients and to maintain body weight for normal patients. The planned menu was administered to follow for a period of six months.

Before administering the menu, each item included in the menu was prepared quantitatively by the investigator and was then converted into cups and spoon measurements. The quantity of food items in one day's menu for each patient has been given in Appendix VIII. This will help the patient to follow the diet more easily. Measuring cups and spoons were also provided to each patient.

Observation of the biochemical profile of the case studies

After following the prescribed diet for six months the serum of the case studies were analysed for cholesterol and triglycerides as described above. Body weight was also recorded.

RESULTS

RESULTS

A. Socio-economic and food consumption survey conducted in 100 families of the atherosclerotic patients

Socio-economic and dietary habits of the families of the atherosclerotic patients were determined by assessing the (1) socio-economic pattern of the families and (2) food consumption pattern of the families.

1. Socio-economic pattern of the families

The socio-economic pattern of the families of the atherosclerotic patients with particular reference to area of residence, religion, size of family, age and sex of family members, educational level, occupation, income and expenditure pattern of the families were collected.

Among the 100 families surveyed 75 per cent were living in the rural areas and 25 per cent resided in the urban areas. Table 1 shows the religion of the families studied.

Table 1. Religion of the families

Religion	Number of families	Percentage
Hindu	66	66
Christian	17	17
Muslim	17	17
Total	100	100

As shown in Table 1 about 66 per cent of the families surveyed were Hindus, 17 per cent were Christians and 17 per cent belonged to Muslim community. Table 2 reveals the source of income of the families studied.

Table 2. Source of income of the families

Source of income	Number of families	Percentage
Permanent job	29	21.8
Pension	17	12.8
Temporary job	31	23.3
Agriculture	37	27.8
Business/Rent/Interest from bank	17	12.8
Donated by others	2	1.5
Total	133	100

As depicted in Table 2 most of the families (27.8 per cent) depended on Agriculture as their source of income. For 21.8 per cent of the families, the source of income was from permanent government jobs. About 23.3 per cent of the families resorted to jobs like painting, coolie and carpentary which were of temporary in nature. About 12.8 per cent of the families studied depended on pension as their family income. Another

12.8 per cent of the families received their income from business/rent/bank interest etc. 1.5 per cent of the families lived with the help of relatives and other social services and they were not having any source of income.

Table 3 shows the educational status of the family members.

Table 3. Educational status of the family members

Educational status	Number of population	Percentage
Illiterate	29	6.09
Pre-school	25	5.25
Know to read and write	5	1.05
*L.P.S.	85	17.86
**U.P.S.	69	14.50
***H.S.	168	35.29
College	95	19.96
Total	476	100

* Lower Primary School

** Upper Primary School

*** High School

As revealed in the Table 3, 1.05 per cent of the population knew to read and write, while 6.09 per cent

were found to be illiterate. However 35.3 per cent of the population were high school educated and 19.96 per cent had college education. Lower primary and upper primary school levels of education comprised 17.86 per cent and 14.5 per cent of the population respectively. 5.3 per cent of the family members studied were children below school going age.

The economic status of the families was studied and details are given in Table 4.

Table 4. Economic status of the families

Income (Rupees/month)	Number of families	Percentage
Below 500	7	7
Below 1000 (500-999)	41	41
Below 1500 (1000-1499)	23	23
Below 2000 (1500-1999)	11	11
Below 2500 (2000-2499)	7	7
Below 3000 (2500-2999)	1	1
3000 and above	10	10
Total	100	100

As shown in Table 4, majority of the families (41 per cent) surveyed belonged to the income group

between Rs.500/- and 1000/- per month 23 per cent had a monthly income between Rs.1000/- and 1500/-. 11 per cent had monthly income between Rs.1500/- and 2000/-. 10 per cent of the families surveyed belonged to the high income group. 7 per cent of the families were found to have an income below Rs.500/- per month. Another 7 per cent had an income between Rs.2000/- and 2500/-. Only one per cent of the families came under the group with monthly income between Rs.2500/- and 3000/-.

Majority of the families studied (58 per cent) belonged to small families with 3-5 members. Among the total families surveyed most of them were adults (71.2 per cent), of which female population was high (38.2 per cent). Of the 476 members of the 100 families surveyed 159 members (33.4 per cent) had jobs, were economically independent (Economic dependency ratio 1:2).

Table 5 indicates the monthly expenditure pattern of the families.

Table 5. Monthly expenditure pattern of the families

Range of monthly expenditure in percentage	Percentage of families spending on different items								
	Food	Clothing	Shelter	Travel	Education	Entertainment	Health	Saving	Miscellaneous
0-5	-	62	14	55	17	40	21	1	14
6-10	-	24	3	22	13	2	25	10	32
11-15	-	4	3	3	6	-	18	6	19
16-20	3	10	-	-	5	-	13	4	8
21-25	4	-	-	-	3	-	9	6	1
26-30	3	-	-	-	-	-	2	1	-
31-35	6	-	-	-	3	-	5	4	-
36-40	4	-	-	-	1	-	3	1	-
41-45	5	-	-	-	-	-	1	2	-
46-50	17	-	-	-	2	-	1	-	-
51-55	7	-	-	-	-	-	-	-	-
56-60	14	-	-	-	-	-	1	1	-
61-65	8	-	-	-	-	-	-	1	-
66-70	11	-	-	-	-	-	-	-	-
71-75	14	-	-	-	-	-	-	-	-
76-80	1	-	-	-	-	-	-	-	-
81-85	2	-	-	-	-	-	-	-	-
86-90	1	-	-	-	-	-	-	-	-

The monthly expenditure pattern of the families were divided into various range from 0-5 per cent to 86-90 per cent of the total income. Among 100 families 63 per cent of the families spent between 16 to 60 per cent of their income on food while 34 per cent of the families spent between 61-80 per cent of their income on food. Only 3 per cent of the families spent more than 81 per cent for food.

Regarding the expenditure on clothing, majority of the families (86 per cent) spent only upto 10 per cent of their income. 14 per cent of the families spent between 11-20 per cent of their income for clothing. No family spent more than 20 per cent for clothing.

Since majority of the families owned their own houses, expenditure in this regard was found to be less. 14 per cent of the families spent between 0-5 per cent of their income for housing, while 6 per cent spent between 6-15 per cent on housing.

77 per cent of the families spent 10 per cent of their income for travelling (travelling to the work site) and the expenditure for this never exceeded 15 per cent of the total family income.

Among 100 families surveyed 50 per cent of the families had expenditure on education. 30 per cent of

the families spent upto 10 per cent and 14 per cent spent 25 per cent of their monthly income on education. About 6 per cent of the families spent between 31-50 per cent of their income on education.

Most of the families (40 per cent) spent only 0-5 per cent of their income for entertainment.

Majority of the families (86 per cent) spent upto 25 per cent of their income for health, while 13 per cent of the families spent more than 25 per cent of their income for health aspects.

Only 37 per cent of the families had monthly savings of which 27 per cent saved upto 25 per cent of their monthly income. About 8 per cent of the families saved 25-45 per cent of their income. About 2 per cent of the families saved 56-65 per cent of their monthly income.

Table 6 reveals the percentage of income spent on food by the family members.

Table 6. Percentage of income spent on food by families under different income group

Percentage of income expenditure on food	Percentage of families with monthly income						
	Below 500	500-999	1000-1499	1500-1999	2000-2499	2500-2999	3000-above
16-20	-	-	-	-	-	-	3
21-25	-	-	-	1	1	-	2
26-30	-	-	1	-	1	-	1
31-35	1	-	-	1	-	-	4
36-40	-	1	1	1	-	1	-
41-45	-	1	4	-	-	-	-
46-50	1	4	5	3	4	-	-
51-55	-	4	1	2	-	-	-
56-60	1	7	4	2	-	-	-
61-65	1	5	2	-	-	-	-
66-70	2	5	3	-	1	-	-
71-75	1	11	2	-	-	-	-
76-80	-	1	-	-	-	-	-
81-85	-	1	-	1	-	-	-
86-90	-	1	-	-	-	-	-
Total	7	41	23	11	7	1	10

Of the 100 families studied 48 per cent of the families had a monthly income upto Rs.999/-. Among these families 31.25 per cent of the families spent more than 70 per cent of their income on food. Thirty four per cent of the families were having an income range of Rs.1000/- to 2000/-. Among these families of which only 8.82 per cent spent more than 70 per cent of their income on food. However many of the families having a monthly income of Rs.2000/- above (66.66 per cent) spent only upto 35 per cent of their income on food.

Food consumption pattern of the families

Most of the families studied (95 per cent) were habitual non-vegetarians.

Table 7 depicts the frequency of purchase of various food items by the families.

Table 7. Frequency of purchase of various food items

Food items	Percentage of the families purchasing food				
	Daily	Weekly	Monthly	Occa-sionally	Never
Rice	2	75	13	10	-
Wheat	0	50	17	19	14
Other cereals	0	5	6	18	71
Pulses	0	28	26	33	13
Green leafy vegetable	40	36	1	21	2
Roots & tubers	25	46	3	17	9
Other vege-tables	49	28	1	22	0
Fruits	19	22	16	42	1
Milk	90	4	1	0	5
Fish	69	19	1	6	5
Meat	0	18	14	34	34
Egg	10	23	3	36	28
Oilseeds (coconuts)	6	17	54	23	0
Cooking oils	4	18	70	8	0
Sugar & jaggery	0	16	82	2	0
Spices and condiments	4	41	52	3	0
Bakery	1	9	5	29	56

Most of the families studied were in the habit of purchasing food items such as rice (75 per cent), wheat (50 per cent), root and tubers (46 per cent) on a weekly basis. Oilseeds (coconuts) (54 per cent), cooking oils (70 per cent), sugar and jaggery (82 per cent) and spices and condiments (52 per cent) were purchased monthly by most of the families. Daily purchase was limited to the food items such as green leafy vegetables (40 per cent), other vegetables (49 per cent), milk (90 per cent) and fish (69 per cent). 71 per cent of the families were not in the habit of buying cereals other than wheat and rice. While 18 per cent purchased other cereal products like rava, maida etc. occasionally. 29 per cent of the families studied purchased bakery items daily while 56 per cent did not purchase bakery items. 5 per cent of the families did not purchase fish. Out of 95 per cent of non vegetarian families 34 per cent and 28 per cent of the families did not purchase meat and egg respectively.

Table 8 indicates the frequency of use of various food items by the families.

Table 8(a). Frequency of use of various food items by the families

Foods	Percentage of families using different food items					
	Daily	Weekly			Occa-sio-nally	Never
		once	twice	thrice		
Rice	100	-	-	-	-	-
Wheat	44	6	9	7	20	14
Other cereals	2	7	3	1	16	71
Greengram	-	17	36	14	19	13
Bengalgram	-	20	10	7	22	41
Redgram dhal	3	12	18	15	39	13
Blackgram	-	10	29	20	28	13
Cowpea (dry)	-	1	-	-	7	92
Amaranth	-	9	21	53	15	2
Cabbage	-	24	14	8	48	6
Chekkurmanis	-	-	-	-	44	56
Drumstick leaves	-	8	-	-	14	78
Potato	-	7	19	5	27	42
Tapioca	28	12	8	4	32	16
Yam	-	-	-	-	26	74
Carrot	11	8	5	24	43	9
Beetroot	-	33	22	16	20	9
Colocassia	-	-	-	-	18	82
Other vegetables	52	8	6	9	25	-
Fruits	32	5	19	13	30	1

The Table 8(a) indicates that food items such as rice, wheat, green leafy vegetables, root and tubers, vegetables and fruits were included in the daily diet of the majority of the families. 71 per cent of the families did not use cereals other than rice and wheat, 16 per cent of the families used rava and maida occasionally. Majority of the families did not use ragi (93 per cent). Most of the families include pulses such as greengram, bengalgram, redgram and blackgram weekly thrice in their menu. 28 per cent of the families consumed tapioca daily. Other cereals (87 per cent), pulses (overall 57.4 per cent), green leafy vegetables overall (65.75 per cent), roots and tubers (overall 66.33 per cent), other vegetables (25 per cent) and fruit (31 per cent) were not included as an item in the regular menu of the many of the families.

Table 8(b)

Foods	Percentage of families using different food item					
	Daily	Weekly			Occa-sio-nally	Never
		once	twice	thrice		
Milk	90	1	2	0	2	5
Curd	4	11	8	3	18	56
Buttermilk	12	7	6	2	25	48
Fish	69	4	12	8	2	5
Chicken	-	-	-	-	17	83
Duckmeat	-	-	-	-	13	87
Beef	-	17	2	2	45	34
Mutton	-	3	-	-	28	59
Hen's egg	11	8	6	10	37	28
Duck's egg	-	-	-	-	27	73
Oilseeds (coconut)	98	-	-	1	1	-
Fat and oils	99	-	-	1	-	-
Sugar and jaggery	100	-	-	-	-	-
Preserved food	24	1	2	4	20	49
Bakery items	5	3	4	7	81	-

As the Table 8(b) shows that the majority (90 per cent) of the families include milk, coconut, oils and sugar daily in their diet. 69 per cent of the families include fish in their daily diet. Majority of the families consumed meat (45 per cent) and egg (37 per cent) occasionally. Most of the families consumed milk products like curd and buttermilk, but almost all the families were not in the habit of using cheese. Some of the families did not use any non-vegetarian foods. 81 per cent of the families used bakery items occasionally.

Table 9 indicates the inclusion of various food items in the daily menu of the families.

Table 9. Inclusion of various food items in the menu

Foods	Percentage of families including different food items			
	Breakfast	Lunch	Evening tea	Dinner
Cereals	100	100	1	100
Pulses	19	12	-	9
Roots	5	26	39	9
Leafy vegetable	-	56	-	11
Other vegetable	65	69	-	81
Fruits	10	1	23	3
Milk and milk products	93	54	93	18
Fish	1	78	-	74
Meat	-	1	-	1
Egg	11	-	1	-
Fat and oil	100	100	-	100
Sugar	100	-	100	5
Preserved foods	3	21	16	13
Bakery items	1	-	13	-

Among the 100 families studied all of them included cereals along with milk, sugar and fat and oil while some families (19 per cent) supplemented the cereal based breakfast with pulses and most of them had other vegetables (65 per cent) during breakfast time. This indicates that majority of the families studied followed a breakfast pattern mainly cereal based supplemented with other vegetables, pulses and milk. Regarding lunch, all the families had rice supplemented mainly with fish and all other food groups. Foods such as fruits and eggs were not used during lunch time (one and zero per cent respectively). For tea time all the families included milk and milk products with sugar and most of the families (39 per cent) consumed roots and tubers 23 per cent of the families consumed fruits, and 16 per cent and 13 per cent families included fried foods and bakery items respectively during tea time. Dinner pattern was same as that of lunch. Many of the families included vegetables and fish preparations along with rice for dinner (81 and 74 per cent respectively). A small percentage of the families took pulses, green leafy vegetables and roots and tubers during dinner time (9, 11 and 9 per cent respectively). 18 per cent of the families took milk during or after dinner. All the families used fats and oils for the preparation of

items during breakfast, lunch and dinner. Pickles were used by some families during lunch and dinner (21 and 13 per cent respectively). Various types of cooking oils used by the families are listed in Table 10.

Table 10. Cooking oils and fats used by the families

Fat/Oil	Number	Percentage
Gingelly oil	-	-
Groundnut oil	1	1
Coconut oil	23	23
Vanaspathi and coconut oil	1	1
Palm oil	31	31
Coconut oil and palm oil	27	27
Sunflower and Sanola	9	9
Refined oil	8	8
Total	100	100

It was seen that majority of the families (31 per cent) used only palm oil for cooking purposes. 27 per cent of the families used coconut oil along with palm oil. 23 per cent of the families used coconut oil alone and refined oil was used by 8 per cent of the families. 9 per cent of the families used sunflower oil along with sanola for cooking. Groundnut oil and vanaspathi each were used by one per cent of the families.

Methods of cooking applied for different foods by the families are revealed in Table 11.

Table 11. Methods of cooking of various food items

Foods	Percentage of families adopting different methods of cooking							
	Boiling			Absorption & straining			Steaming & frying	
	absorption	straining	Steaming		Frying	Curry		Boiling
Cereals	-	79	-	21	-	-	-	-
Pulses	87	-	4	1	-	-	-	-
Roots and tubers	1	3	35	-	1	50	-	-
Leafy vegetables	97	-	-	-	-	-	-	-
Other vegetables	93	-	-	7	-	-	-	-
Fruits	-	-	10	-	12	-	-	-
Fish	-	-	-	-	52	40	-	-
Meat	-	-	-	-	13	58	-	-
Egg	-	-	6	-	31	-	-	-
Milk	-	-	-	-	-	-	-	100
Oilseeds (coconut)	-	-	-	-	-	100	-	-

It was found that most of the families (about 79 per cent) used boiling and straining method for cereal cookery. 87 per cent of the families used the boiling and absorption method for cooking pulses. 50 per cent of the families made curry with roots and tubers. Majority of the families (90 per cent) used boiling and absorption method for cooking leafy vegetables and other vegetables. 52 per cent of the families consumed fish as fried form and 40 per cent made curry. 58 per cent of the families made curry with meat and 13 per cent consumed meat in fried form. 35 per cent of the families used egg both in the boiled and fried forms. 31 per cent used eggs only in fried form.

B. Food consumption pattern of the family members

Dietary intakes of the family members of atherosclerotic patients viz. adult men (5) and adult women (5) was assessed by 3 day weighment method. Comparison of their diets were made with the recommended daily allowance of ICMR (1989).

Table 12 reveals the actual quantity of various food items consumed by the male members of the families of selected atherosclerotic patients.

Table 12. Average quantity of foods consumed by the male family members

N = 5

Food group	*RDA	Amount consumed	Percentage of RDA
Cereals	400	296.2	74.00
Pulses	55	19.56	35.60
Leafy vegetables	100	16.65	16.70
Roots and tubers	75	35.07	46.76
Other vegetables	75	55.90	74.50
Fruits	30	66.33	221.10
Egg	30	6.68	22.26
Fish and meat	30	46.25	154.16
Milk and milk products	100	383.40	383.40
Sugar	30	51.25	170.80
Fat and oil	40	39.75	99.40

* Recommended daily allowances

It was seen that daily consumption of food groups such as fruits, flesh foods, sugar and milk and milk products far exceeded the recommended allowances.

The average nutrient consumption of the male family members of selected atherosclerotic patients was calculated from their food intake and is shown in Table 13.

Table 13. Nutrient consumed by the male family members

N = 5

Nutrients	RDA	Amount consumed	Percentage of RDA
Protein (g)	60	57.65	96.0
Energy (K cals)	2350	2205.06	93.8
Fat (g)	40	95.21	238.0
Calcium (g)	0.4	0.70	175.0
Iron (mg)	30	24.12	80.4
Vitamin A (Retinol g)	600	528.16	88.0
Thiamin (mg)	1.2	1.09	90.8
Riboflavine (mg)	1.4	1.26	90.0
Niacin (mg)	16	12.69	79.3
Vitamin C (mg)	40	62.51	156.3

It was found that energy consumption was 93.8 per cent and protein was 96 per cent of the recommended daily allowance. The consumption of all other nutrient were satisfactory except calcium, vitamin C and fat which exceeded the RDA especially for the intake of fat (238 per cent of RDA).

Table 14 shows the average quantity of foods consumed by the female members of the selected families of atherosclerotic patients.

Table 14. Average quantity of foods consumed by the female family members

N = 5

Food groups	RDA	Amount consumed	Percentage of RDA
Cereals	300	255.55	85.2
Pulses	45	15.55	34.6
Leafy vegetables	125	39.99	31.9
Roots and tubers	50	17.77	35.5
Other vegetables	75	86.65	115.5
Fruit	30	64.98	216.6
Egg	30	23.32	77.7
Fish and meat	30	54.98	183.3
Milk and milk products	100	272.22	272.2
Sugar	30	12.22	40.7
Fat and oil	35	38.30	109.4

The consumption of food groups such as pulses, leafy vegetables, roots and tubers and sugar was found to be very low when compared to RDA consumption of other items such as vegetables, fruits, flesh foods and milk and milk products were very high when compared to RDA.

Table 15 shows the average consumption of nutrients by the female members of selected families of atherosclerotic patients.

Table 15. Nutrient consumed by the female family members

N = 5

Nutrients	RDA	Amount consumed	Percentage of RDA
Protein (g)	50	53.22	106.4
Energy (Kcal)	1800	2027.03	112.6
Fat (g)	35	87.84	251.0
Calcium (g)	0.4	0.59	147.5
Iron (mg)	30	21.31	71.03
Vitamin A (Retinol g)	600	462.07	77
Thiamin (mg)	0.9	1.12	124.4
Riboflavin (mg)	1.1	1.2	109.0
Niacin (mg)	12	14.6	121.6
Vitamin C (mg)	40	88.06	220.15

The nutrient intake of female family members revealed that all the nutrient except iron and vitamin A was above the recommended daily allowance. The fat intake was very high ie. 251 per cent of RDA.

C. Personal characteristics and dietary habits of atherosclerotic patients

The personal characteristics and dietary habits of atherosclerotic patients were analysed and the results are presented in the following tables.

Table 16. Male and female population of atherosclerotic patients surveyed

Sex	Number of patients	Percentage
Male	84	84
Female	16	16
Total	100	100

Table 16 depicts that among the 100 atherosclerotic patients surveyed, 84 per cent were male and 16 per cent were females.

Table 17 reveals the occupational status of the patient.

Table 17. Occupational status of the patients

Status	Number of patients	Percentage
Retired	46	46
Full time job	18	18
Temporary	20	20
Business	4	4
Unemployed housewives	12	12
Total	100	100

About 46 per cent of the atherosclerotic patients were pensioners. 42 per cent of the atherosclerotic patients were employed out of this 18 per cent of the patients had Government jobs. Most of the female patients were unemployed housewives. The educational status of the patient is given in Table 18.

Table 18. Educational status of the patients

Level	Number of patients	Percentage
Illiterate	4	4
Know to reading and writing	-	-
*L.P.S.	34	34
**U.P.S.	19	19
***H.S.	30	30
College	13	13
Total	100	100

*Lower Primary School
**Upper Primary School
***High School

It was found that 13 per cent of the patients were college educated. Whereas 30 per cent were having high school education, L.P.S. and U.P.S. educated patients comprised 34 and 19 per cent respectively. 4 per cent were found to be illiterate.

Table 19 reveals the agewise distribution of the patients studied.

Table 19. Agewise distribution of the patients

Age range	Male	Percentage	Female	Percentage
31 - 35	4	4.76	1	6.25
36 - 40	9	10.71	-	-
41 - 45	7	8.33	3	18.75
46 - 50	9	10.71	-	-
51 - 55	12	14.29	2	12.5
56 - 60	15	17.86	5	31.25
61 - 65	18	21.43	3	18.75
66 - 70	3	3.57	-	-
71 - 75	5	5.95	2	12.5
76 - 80	2	2.38	-	-
Total	84	100	16	100

Majority of the male patients studied (53.58 per cent) belonged to the age group between 51-65. Female patients were also more (62.5 per cent) in the age group 51-60. It was observed that more male patients were seen in the age group from 31-50 (34.51 per cent) when compared to female patients (25 per cent).

Table 20 depicts the age at which atherosclerosis was first diagnosed in patients.

Table 20. Age of incidence of atherosclerosis

Age	Number of patient	Percentage
31 - 35	7	7
36 - 40	10	10
41 - 45	10	10
46 - 50	17	17
51 - 55	16	16
56 - 60	16	16
61 - 65	15	15
66 - 70	5	5
71 - 75	4	4
Total	100	100

Amont 100 patients studied majority of them (64 per cent) developed the disease between the age 46-65, of which 20 per cent developed at the age between 36-45, 7 per cent of the patients developed the disease at a very early age of 31-35. But as the age increased beyond 65, the occurrence was less (9 per cent). The incidence of various disease among the relatives of the

atherosclerotic patients were analysed and the details are given in Table 21.

Table 21. Disease history of relatives of the patients

Disease	Percentage of patients whose relatives having the diseases						
	Father	Mother	Brother	Sister	Father's Brother & Sister	Mother's Brother & Sister	No history
Heart disease	9	4	6	1	-	-	78
Diabetes	8	6	-	2	2	-	82
Obesity	2	5	1	3	-	-	89
Hypertension	7	10	-	7	1	-	75
Kidney diseases	-	1	1	1	-	-	97

22 per cent of the patients reported the incidence of heart disease among their relatives. The incidence was more on paternal side (9 per cent) compared to maternal side (4 per cent). The same pattern seen with brothers (6 per cent) when compared to sisters (1 per cent).

Among the patients with a family history of diabetes (18 per cent), the incidence was more among male members of the family with regard to the family history of obesity (11 per cent) and high blood pressure (25 per cent), the incidence was more among female members of the family. The

incidence of obesity being 5 per cent among mothers and 3 per cent among sisters when compared to fathers and brothers (2 per cent and one per cent respectively). The rate of incidence of high blood pressure among mothers and sisters was also high (10 per cent and 7 per cent respectively) when compared to the incidence among fathers and brothers (7 per cent and zero respectively). Majority of the patients did not have a family history of kidney diseases.

The incidence of other associated diseases among atherosclerotic patients is revealed in Table 22.

Table 22. Incidence of other associated diseases

Diseases	Number of patients	Percentage
Diabetes	25	25
Hypertension	54	54
Kidney disease	1	1
Not having any disease	20	20
Total	100	100

Majority of the patients (54 per cent) were reported to have high blood pressure. 25 per cent of the patients have diabetes and one patient was reported to

have kidney disease. The rest of 20 per cent of the patients were reported to have no associated diseases.

The body weight of the atherosclerotic patients was studied to find out whether they were under weight, normal weight or overweight persons. The results are shown in Table 23.

Table 23. Body weights of the atherosclerotic patients

Group	Number	Per cent	Male	Per cent	Female	Per cent
Underweight	6	6	6	6	-	-
Normal weight	61	61	52	52	8	8
Overweight	33	33	25	25	8	8
Total	100	100	84	84	16	16

Among the 100 patients studied majority (61 per cent) were normal weight patients, 33 per cent of the patients were overweight and 6 per cent of the patients were underweight. 50 per cent of the female patients were found to be obese.

Details regarding the alcohol consumption, tobacco chewing and smoking habits of the atherosclerotic patients were studied and is presented in Table 24.

Table 24. Alcoholism, smoking and tobacco chewing habits of the patients

Group	Alcohol consumption		Smoking		Tobacco chewing	
	Number	Per cent	Number	Per cent	Number	Per cent
Users	5	5	14	14	9	9
Abstainers	30	30	44	44	10	10
Non users	65	65	42	42	81	81
Total	100	100	100	100	100	100

Among the 100 patients studied, at present majority were not in the habit of drinking, smoking and tobacco chewing (65, 42 and 81 per cent respectively). Many of the patients stopped drinking (30 per cent), smoking (44 per cent) and tobacco chewing (10 per cent) after the onset of disease. But few patients were still continuing the habit of smoking (14 per cent), tobacco chewing (9 per cent) and alcohol consumption (5 per cent)

Among the 100 patients studied 71 per cent of them were not in the habit of taking regular exercise. 17 per cent of the patients took walking as regular exercise while the housewives (11 per cent) considered their household chores as regular exercise for them.

The mode of travelling by the patients to their work place was studied and most of the patients (25 per cent) used to walk to their work place.

The initial symptoms as noted by the atherosclerotic patients were studied and the details are given in Table 25.

Table 25. Initial symptoms of atherosclerosis in patients

Symptoms	Number of patients	Percentage
Chest pain	21	21
Suffocation	10	10
Excessive sweating	1	1
Chest pain and suffocation	19	19
Suffocation and excessive sweating	3	3
Chest pain and excessive sweating	18	18
Chest pain, suffocation and excessive sweating	28	28
Total	100	100

The above table indicated that chest pain followed by suffocation and excessive sweating were experienced by the patients (28 per cent) before diagnosing the disease. Some patients (21 per cent) reported chest pain as their

initial symptom. 18 per cent of the patients experienced chest pain and excessive sweating. Chest pain was found to be the major initial symptom for majority of the patients.

All the patients diagnosed the disease through electro cardiogram and their serum lipid profile was found to be very high.

The type of medical care followed by the atherosclerotic patients after diagnosis of the disease was analysed and is given in Table 26.

Table 26. Medical care after diagnosis

Type of medical care	Number of patients	Percentage
Medical practitioner (private)	6	6
Hospital general clinic	2	2
Speciality clinic at Medical College	92	92
Total	100	100

Most of the patients (92 per cent) attended the speciality clinic at Medical College after the diagnosis of the disease. Only 6 per cent of the patients approached private doctors for their treatment. While 2 per cent attended the clinics in general hospitals.

The different methods by which the patients controlled the disease after diagnosis was studied, which is described in Table 27.

Table 27. Control of the disease after diagnosis

Type of treatment	Number of patient	Percentage
Diet control	4	4
Oral Drugs	12	12
Diet control and oral drugs	81	81
Diet control and injection	-	-
Diet control, oral drugs and injection	2	2
Ayurvedic medicine	-	-
Injection	1	1
Homoeopathy	-	-
Naturopathy	-	-
Total	100	100

Majority of the patients (81 per cent) were on diet control and oral drugs, whereas 12 per cent of the patients controlled the disease with oral drugs alone while 4 per cent of the patients controlled their disease, with only dietary modifications.

Majority of the patients (69 per cent) were reported to visit the hospital regularly once in every month. 22 per cent visited the hospital regularly once in every fortnight. They obtained information regarding dietary control of the disease from the hospital's cardiac clinic. Majority of the patients followed the dietary advice from the doctor, but some patients (9 per cent) neglected the medical advice. Few patients (21 per cent) were not satisfied with their modified diets, since coconut, oils and non vegetarian foods especially meat and egg were deleted or neglected in their daily menu.

Other sources which influenced to bring a change in the diet of atherosclerotic patients were studied and presented in Table 28.

Table 28. Other sources of information regarding diet control

Source	Yes		No	
	Number	Per cent	Number	Per cent
Education	9	9	91	91
Medical camp	1	1	99	99
Articles from Newspaper and magazine	14	14	86	86
Radio/TV programme	29	29	71	71
Friends/neighbours/ relatives	28	28	72	72
Other patients	28	28	72	72

It was clear that among the various sources which brought about a change in their dietary habits, the greatest influence was of radio, TV, friends, neighbours, relatives and other atherosclerotic patients.

Patients were asked to list out some foods which according to their knowledge were to be restricted during atherosclerosis. According to the opinion of the patients, oils and fats (54 per cent) were the most important item in the menu to be restricted. A few patients (4 per cent) suggested a restriction in milk. About 17 per cent of the patients were of the view that fish and meat should be restricted in the diet. Most of the patients (73 per cent) knew the importance of restricting alcohol consumption to control their disease.

The patients were asked about specific foods to be included in their diet. About 47 per cent of the patients were not having any definite ideas about the importance of any food groups in their daily diet. 23 per cent of the patients were of the opinion to include large amounts of vegetables in their diet. Leafy vegetables ranked next (15 per cent) followed by fish (8 per cent).

When these patients were asked about food exchange list 5 per cent was aware of it and they followed the diet prescribed by their doctor.

The food habits of the patients were studied in detail. Among the 100 atherosclerotic patients surveyed 92 per cent were habitual non vegetarians and the rest 8 per cent were reported to be vegetarians. Among the 8 vegetarian patients it was found that 3 patients were originally non vegetarians and they stopped taking non vegetarian foods after developing the disease.

Different types of non vegetarian foods consumed by the patients are presented in Table 29.

Table 29. Non vegetarian foods in the diets of atherosclerotic patients

Non vegetarian foods	Number of patients	Percentage
Egg	52	52
1. Hen's egg only	38	38
2. Duck's egg only	1	1
3. Hen's and Duck's egg	13	13
Fish	92	92
1. Marine fish	80	80
2. Marine and fresh water fish	12	12
Meat	58	58
1. Chicken	3	3
2. Beef	4	4
3. Goat	16	16
4. Buffalo	1	1
5. All	3	3
6. Chicken, Beef and Goat	3	3
7. Chicken, Duck, Beef, Goat & Pork	8	8
8. Chicken and Goat	11	11
9. Chicken, Duck, Beef and Goat	7	7
10. Beef and Goat	1	1
11. Chicken, Beef, Goat and Pork	1	1
Egg, Fish and Meat	52	52
Fish and Meat	58	58

Majority of the patients (52 per cent) had used egg, fish and meat and 58 per cent of the patients had used fish and meat. Of the 92 per cent patients who used marine fish, 12 per cent included fresh water fish also in their diets.

Among 100 patients 58 per cent of the patients included meat in their diet. Among these patients, 16 per cent consumed mutton, 4 per cent beef, 3 per cent chicken and one per cent buffalo alone. The rest of the 34 per cent consumed mutton along with other flesh foods.

Different methods of cooking adopted to prepare non vegetarian items in the dietaries of the patients are given in Table 30.

Table 30. Non vegetarian preparations in the dietaries of the patients

Foodstuff	Percentage of patients adopting different method of cooking				
	Steaming	Frying	Steaming and frying	Boiling	Boiling and frying
Meat	-	-	-	40	18
Fish	-	-	-	29	63
Egg	10	25	17	-	-

Table 30 indicated that most of the patients (40 per cent) consumed meat only in the form of curry preparations whereas 18 per cent used meat both in curry and fried form. Of the 92 per cent of the patients who consumed fish, 63 per cent used it in both curry and fried form and 29 per cent of the patients used only fish curry. Most of the patients (25 per cent) used egg in fried form.

Number of major meals taken by the patients are given in Table 31.

Table 31. Daily meal pattern of the patients

Number of times/day	Number of patients	Percentage
1	1	1
2	4	4
3	93	93
4	2	2
Total	100	100

Table 31 revealed that most of the patients (93 per cent) used to take 3 major meals a day viz. breakfast, lunch and dinner. While 4 per cent of the patients had only 2 major meals namely lunch and dinner. Four major meals was taken by 2 per cent of the patients when

they took rich snacks during tea time.

When enquired about their habit of eating in between meals, it was found that 99 per cent of the patients consumed one or two cups of tea in between lunch and dinner. Twenty four per cent of the patients took snacks like fried items in between their major meals. Six per cent of the patients consumed fruits in between their meals.

Frequency of having meals outside the home by the atherosclerotic patients were studied and details are given in Table 32.

Table 32. Meals taken outside by the atherosclerotic patients

Frequency	Number of patients	Percentage
Daily	18	18
Weekly	-	-
Weekly twice or thrice	2	2
Fortnightly	-	-
Monthly	2	2
Occasionally	34	34
Never	44	44
Total	100	100

Among the 100 patients studied majority of the patients (44 per cent) did not take any meals from outside home. Thirty four per cent of the patients had meals outside home only occasionally. However, 18 per cent of the patients took one of their meals daily from outside mainly lunch or breakfast. Very few patients went outside for their meals once in a month (2 per cent) or twice or thrice in a week (2 per cent).

Frequency of inclusion of foods under different food exchange list by the patients were studied and presented in Table 33.

Table 33. Frequency of inclusion of foods under different food exchange list by the patients

Food exchange	Percentage of patients using different foods					
	Daily	Weekly			Occa-sionally	Never
		once	thrice	thrice		
Vegetable exchange A	55	6	21	10	8	-
Vegetable exchange B	30	14	13	12	18	13
Fruit exchange	21	5	4	19	35	16
Cereal exchange	100	-	-	-	-	-
Legume and pulse exchange	9	13	29	12	22	15
Flesh food exchange	65	17	3	5	2	8
Milk exchange	90	2	1	-	1	6
Fat exchange	93	-	-	-	-	7

As indicated in the Table 33 all the patients included cereal exchange mainly in the form of rice and wheat in their daily diet. Daily inclusion of foods coming under flesh food exchange (65 per cent), milk exchange (90 per cent) and fat exchange (93 per cent) was observed in majority of the patient, which supplied about 100 calories per exchange. Only 55 per cent of the patients included food coming under vegetable exchange A where carbohydrates and calories are negligible in the daily diet. About 21 per cent of the patient included vegetable exchange A thrice in a week. Vegetable exchange B was included daily by 30 per cent of the patients while 18 per cent included this exchange only occasionally. Majority of patients (35 per cent) included low calorie food like fruit exchange only occasionally. About 19 per cent of the patients included fruit exchange more than thrice in a week. Inclusion of legume and pulse exchange was observed thrice in a week by 29 per cent of the patients, while in 22 per cent inclusion of this exchange was only occasional in their daily diet.

When enquired about their desire to take fried items 56 per cent reported that they had a craving for fried foods.

Changes in the dietary pattern of the family members due to changes in the diets of atherosclerotic patients were noted. Most of the families (93 per cent) did not change their dietary pattern while 7 per cent of the families changed their dietary habits to adjust to the dietary pattern of the atherosclerotic patients in the family.

The patients habit of taking some indigenous foods which are supposed to have hypocholesterolemic effect was studied and is discussed in Table 34.

Table 34. Use of indigenous hypocholesterolemic agents

Items	Number of patients	Per cent
Bittergourd	4	4
Carrot	2	2
Garlic	9	9
Leafy vegetable	4	4
Not using any	81	81
Total	100	100

The list of items suggested by the patients are given in the Table 34. Majority of the patients (81 per cent) did not take any special foods as

hypocholesterolemic agents. 9 per cent of the patients took garlic boiled with milk as hypocholesterolemic agent. Four per cent took bittergourd and other 4 per cent took leafy vegetables as hypocholesterolemic agent. Two per cent of the patients considered carrot as a hypocholesterolemic agent.

Cooking oils used in the atherosclerotic diets were studied and is presented in Table 35.

Table 35. Use of cooking oils by atherosclerotic patients

Type of oil/fat	Number of patient	Percentage
Groundnut oil	1	1
Coconut oil	18	18
Palm oil	31	31
Palm oil and coconut oil	25	25
Refined oil	8	8
Other oils (sunflower, safflower)	9	9
Vanaspathi and coconut oil	1	1

Majority of the patients studied (31 per cent) used palm oil in preparing their diets. Some patients (25 per cent) used palm oil together with coconut oil in their diet preparation. 18 per cent of the patients used

coconut oil in their dietaries. Other major cooking oils used by the patients were sunflower and safflower oil (10 per cent). 7 per cent of the patients never use the oil for preparations.

Special foods prepared in the family for the atherosclerotic patients were enquired. Among the 100 patients studied, in majority of the families (93 per cent) no special food were prepared for the patients. The patients were taking the common family diet. Seven per cent of the families prepared special foods for the patients, viz. leafy vegetables and other vegetarian food items, prepared without oil, and non vegetarian foods were deleted from the patient's diet except marine fish. They avoided coconut in the diet preparation. The cholesterol free vegetable oils were used as the cooking medium.

Daily use of sugar, salt and oil by the patients were enquired and is presented in Table 36.

Table 36. Daily use of sugar, salt and oils by the patients

g/day/patient	Sugar		Salt		Fat	
	Number	Percentage	Number	Percentage	Number	Percentage
Below 10	7	7	54	54	25	25
10 - 20	32	32	31	31	38	38
20 - 30	26	26	15	15	10	10
30 - 40	16	16	-	-	13	13
40 - 50	5	5	-	-	10	10
above	14	14	-	-	3	3

Regarding sugar consumption majority of the patients consumed 10-30 grams of sugar per day whereas in 14 per cent of the patients the sugar consumption was found to be above 50 grams per day, since refined sugars like sucrose increases serum triglyceride levels. Kuo (1983) in his dietary guidelines for atherosclerotic patients has recommended to completely avoid refined carbohydrates like sugars in their daily diet. In majority of the patients (54 per cent) salt consumption was found to be below 10 grams per day. Since most of the patients were hypertensive moderate sodium restriction, 2-3 g/day is usually recommended (Antia, 1989). Regarding fat consumption 13 per cent of the patients were found to consume more than 40 grams per day whereas for most of the patients (38 per cent) fat consumption was found to be 10-20 g/day.

D. The impact of cardiac clinic on the existing dietary pattern of the patients

Functioning of the cardiac clinic at Medical College and the diet counselling imparted in this clinic was studied by the investigator through observation and by conversing with the personal and the patients.

In the clinic, there was no qualified dietitian, diet counselling was carried out by the doctor himself.

Diet was not calculated based on individual patients requirements. A general diet sheet was prepared for all the patients without considering the body weight or other physiological conditions. The existing dietary habits of the patients were not taken into consideration while planning the diet. However commonly consumed popular items were included in the menu.

Patients did not visit the clinic regularly. Body weight, x-ray, ECG and blood cholesterol and triglyceride levels were recorded during their first visit to the clinic. Blood pressure was noted during every follow up visit to the clinic. When enquired about the patient's co-operation it was informed that all the patients were not co-operative regarding their regular follow up visit to the Cardiac clinic.

By conversing with the patients an assessment of the information obtained from the Cardiac clinic regarding the dietary regulations to be followed by atherosclerotic patients was made. It was found that 81 per cent of the patients were aware of types of foods to be avoided in atherosclerosis. 23 per cent of the patients studied, knew that inclusion of vegetables in the daily diet is having a beneficial effect on atherosclerosis. All the patients knew that fat and oils, meat and coconut should

be strictly restricted. 73 per cent of the patients were aware of the harmful effect of alcohol on atherosclerosis. Only 5 per cent of the patients had heard about food exchange lists in planning daily menu. About 21 per cent of the patients studied did not follow the diet strictly, as the modified diets suggested by the doctor is not according to their existing dietary habits and also due to the difficulty in preparing such modified diets separately for the patient in the family.

E. The impact of diet counselling and a modified diet on blood lipid profile

Seven atherosclerotic patients who were willing to co-operate, were requested to follow the prescribed modified diet for a period of six months. Actual food intakes of these patients were assessed by conducting a 3 day food weighment survey. Initial body weight and blood lipid profile (cholesterol and triglyceride) was also studied. Then diet counselling was imparted to these patients and also the use of food exchange lists, to avoid the monotony of a static diet sheet. The modified diet was asked to be followed for a period of six months. The patients were contacted individually every fortnight by the investigator and convinced them regarding the importance of a modified diet to maintain good health in atherosclerotic condition.

More time was spent by the investigator on educating each patient, so that he understood the object of each aspect of his dietary treatment and had sufficient knowledge to undertake the day to day management of the disease. After six months in a modified diet, body weights and blood lipid levels (cholesterol and triglyceride) of these patients were assessed to find out whether they were maintaining a normal metabolic state as given in Fig. V and VI. Each patient was observed as a case study and numbered as I, II, III, IV, V, VI and VII and the results are presented below. The ideal body weights of each case study was found out and obesity was determined by calculating Body Mass Index as suggested by Antia (1989) and is given in Fig. IV

CASE STUDY I

Adult male	- Height 165 cm
Body weight	- 72 kg
Ideal body weight	- 58.5 kg
Body Mass Index	- 26 (obese)
Type of activity	- Sedentary
Regular exercise	- Nil
Age at onset of the disease	- 32
Age at present (in completed years)	- 34

FIG: IV BODY MASS INDEX OF THE PATIENTS AFTER SIX MONTHS OF MODIFIED DIET

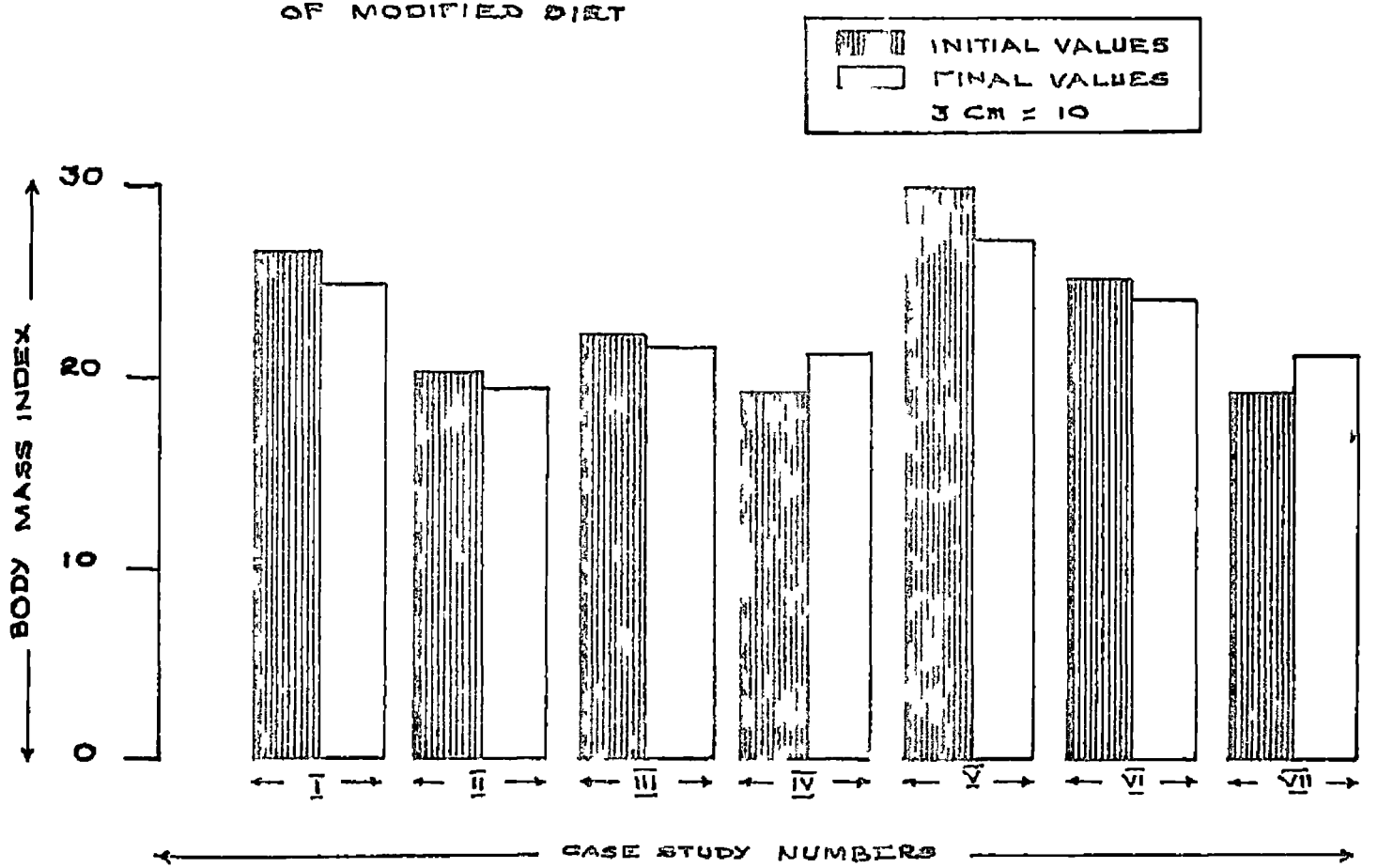


FIG 5 SERUM CHOLESTEROL LEVELS OF CASE STUDIES

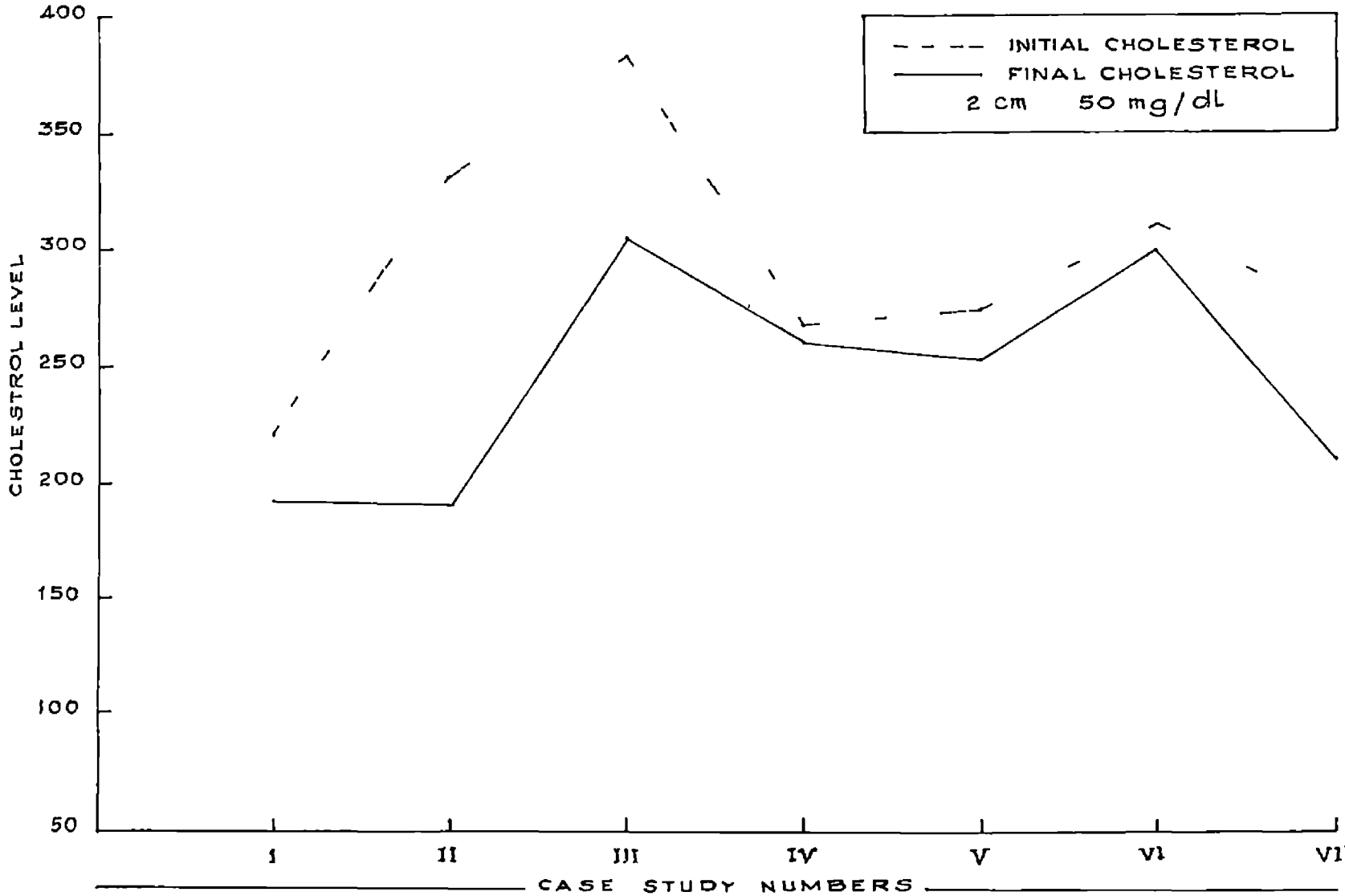
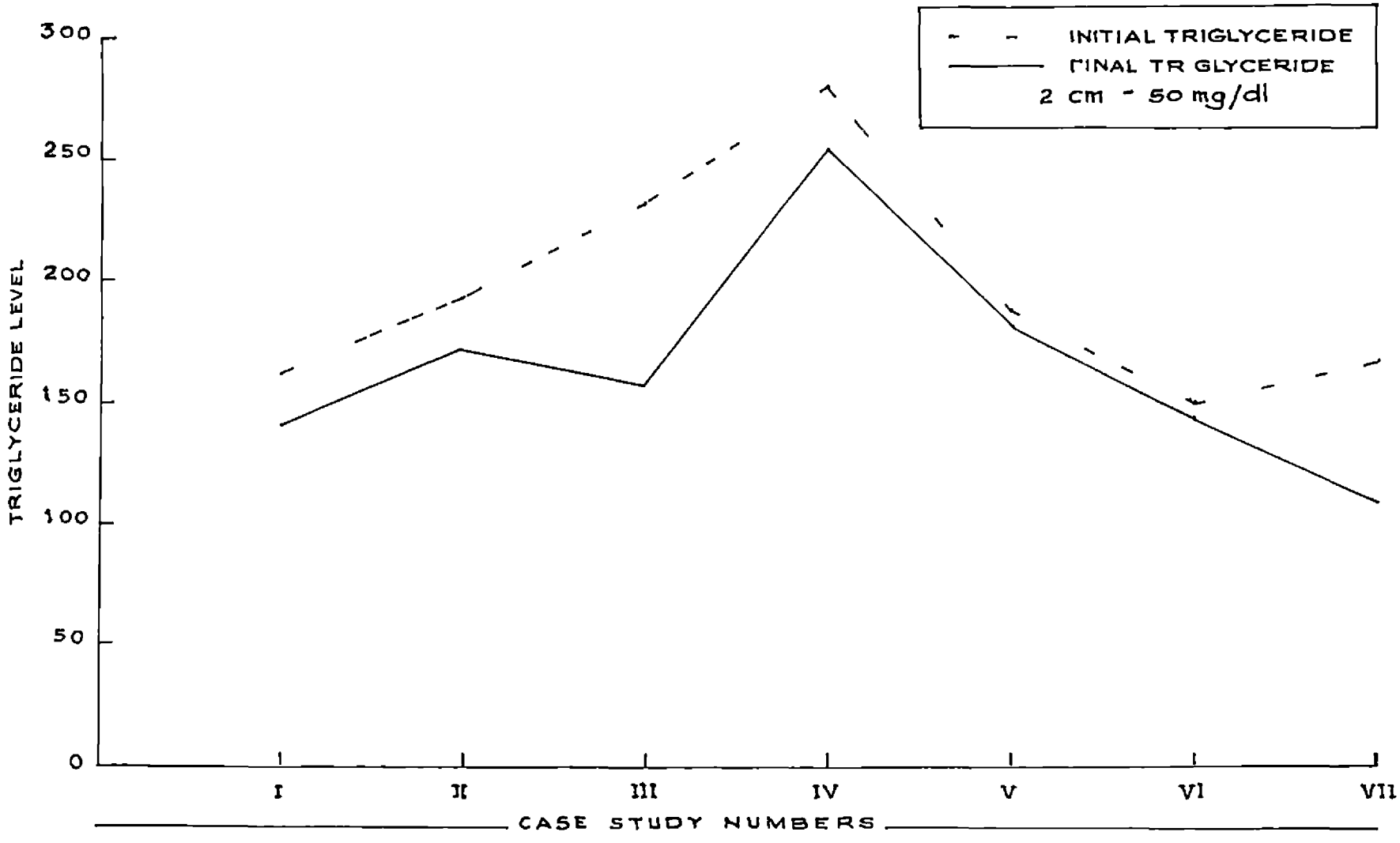


FIG 6 SERUM TRIGLYCERIDE LEVELS OF CASE STUDIES



Dietary pattern

Case study I is a habitual non vegetarian. He used to take three major meals per day consisting of breakfast, lunch and dinner and these three meals were mainly based on rice preparations. He had the habit of eating fried foods and other snacks during evening tea time.

The average actual intake and proportion of major nutrients like carbohydrate, fats and proteins was studied in detail and was compared with the calculated recommended values. The results are given in Table 37 And Shown in Fig VII

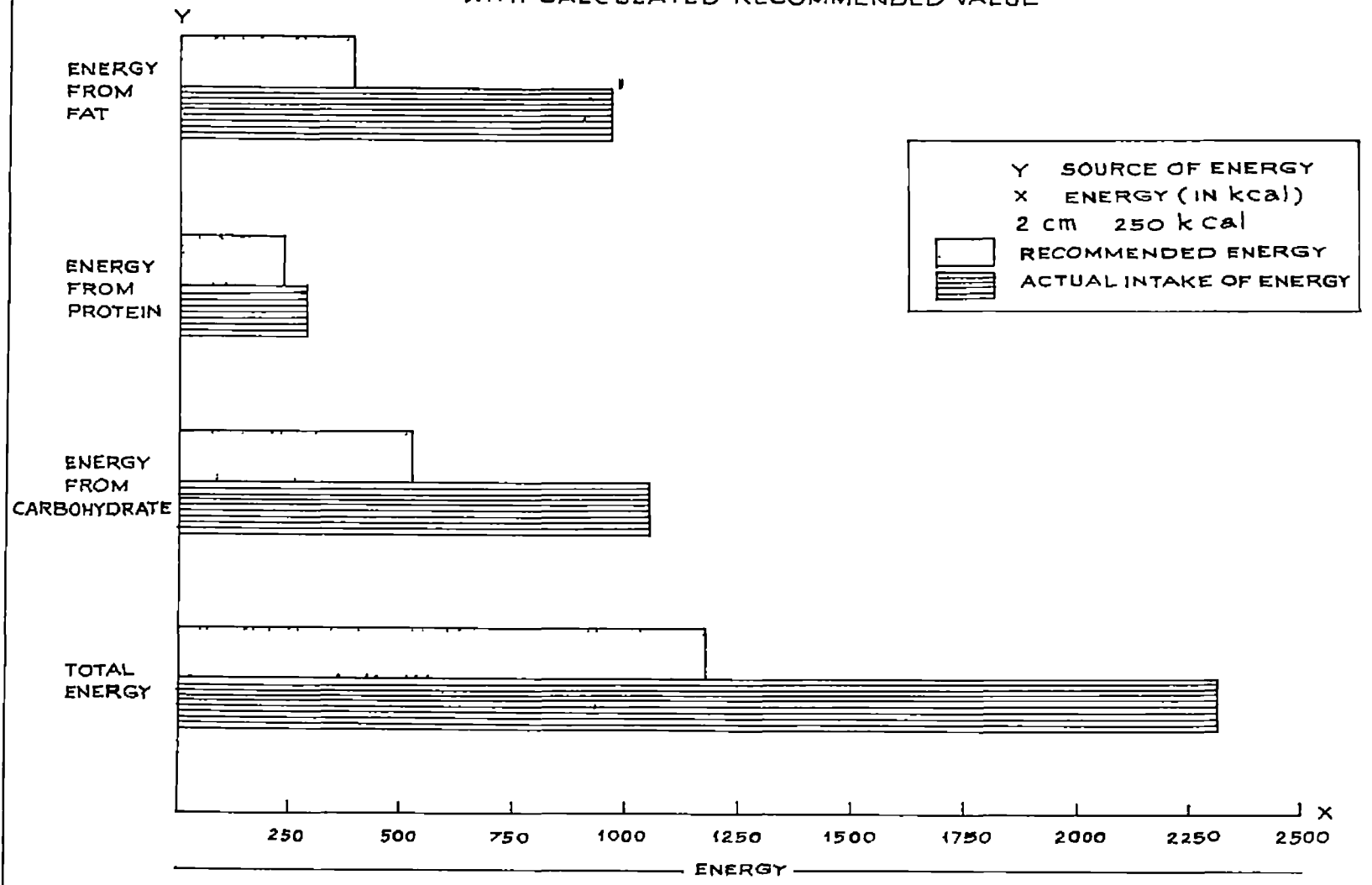
Table 37. Actual intake of major nutrients compared to calculated recommended values of case study I

	*Calculated Recommended value	Average actual intake/day (weighment method)	
		Intake	Percentage of total calories
Total energy (Kcal)	1170	2308	
Energy (Kcal) from Carbohydrate	526	1048	45
Protein	234	288	12
Fat	410	972	42
Amount of Carbohydrate (g)	131.5	262	
Protein (g)	58.5	72	
Fat (g)	45.5	108	

* Total calories - 20 Kcal/kg ideal body weight
Calories from
Carbohydrate - 45 per cent of total calories
Protein - 20 per cent of total calories
Fat - 35 per cent of total calories
(Antia, 1989)

FIG 7

CASE STUDY I COMPARISON OF THE PROPORTION OF ENERGY SUPPLIED BY MAJOR NUTRIENTS WITH CALCULATED RECOMMENDED VALUE



The total calorie intake was higher when compared to the recommended value calculated for an obese patient based on his ideal body weight (Antia, 1989). The proportion of calories supplied by carbohydrate protein and fat was found to be very high than the recommended values.

The initial and final metabolic state of case study I was analysed and is given in Table 38.

Table 38. Initial and final metabolic state of case study I

Parameters	Normal value	Initial value	Final value
Body weight	58.5	72	67
Body Mass Index	20 - 25	26.4	24.6
Cholesterol (mg/dl)	150 - 280	219	194
Triglyceride (mg/dl)	10 - 150	162	143

Table 38 indicates that there was a reduction in the body weight of the patient after 6 months of follow up. The body mass index indicated that the patient maintained normal body weight. A reduction in cholesterol and triglyceride levels after following the modified diet continuously for a period of 6 months.

CASE STUDY II

Adult male	-	Height 159 cm
Body weight	-	51 kg
Ideal body weight	-	57 kg
Body mass index	-	20 (Normal)
Type of activity	-	Sedentary
Regular Exercise	-	Nil
Age at onset of the disease	-	48
Age at present (in completed years)	-	50

Dietary pattern

Case Study II is a habitual non vegetarian. He used to take three major meals per day consisting of breakfast, lunch and supper. These three meals were mainly rice preparations. He had the habit of taking fried foods as snacks.

The average actual intake and proportion of major nutrients like carbohydrate, fats and proteins was studied in detail and was compared with the calculated recommended values. The results are given in Table 39 and shown in Fig VIII

Table 39. Actual intake of major nutrients compared to calculated recommended values of Case Study II

	*Calculated recommended value	Average actual intake/ (weighment method) day	
		Intake	Percentage of actual calories
Total energy (Kcal)	2350	2085	
Energy from (Kcal)			
Carbohydrate	1750	956	46
Protein	240	181	9
Fat	360	948	45
Amount of			
Carbohydrate (g)	438	239	
Protein (g)	60	45.25	
Fat (g)	40	105.3	

* Total energy - ICMR 1989

Calories from

Carbohydrate - 75 per cent of total calories

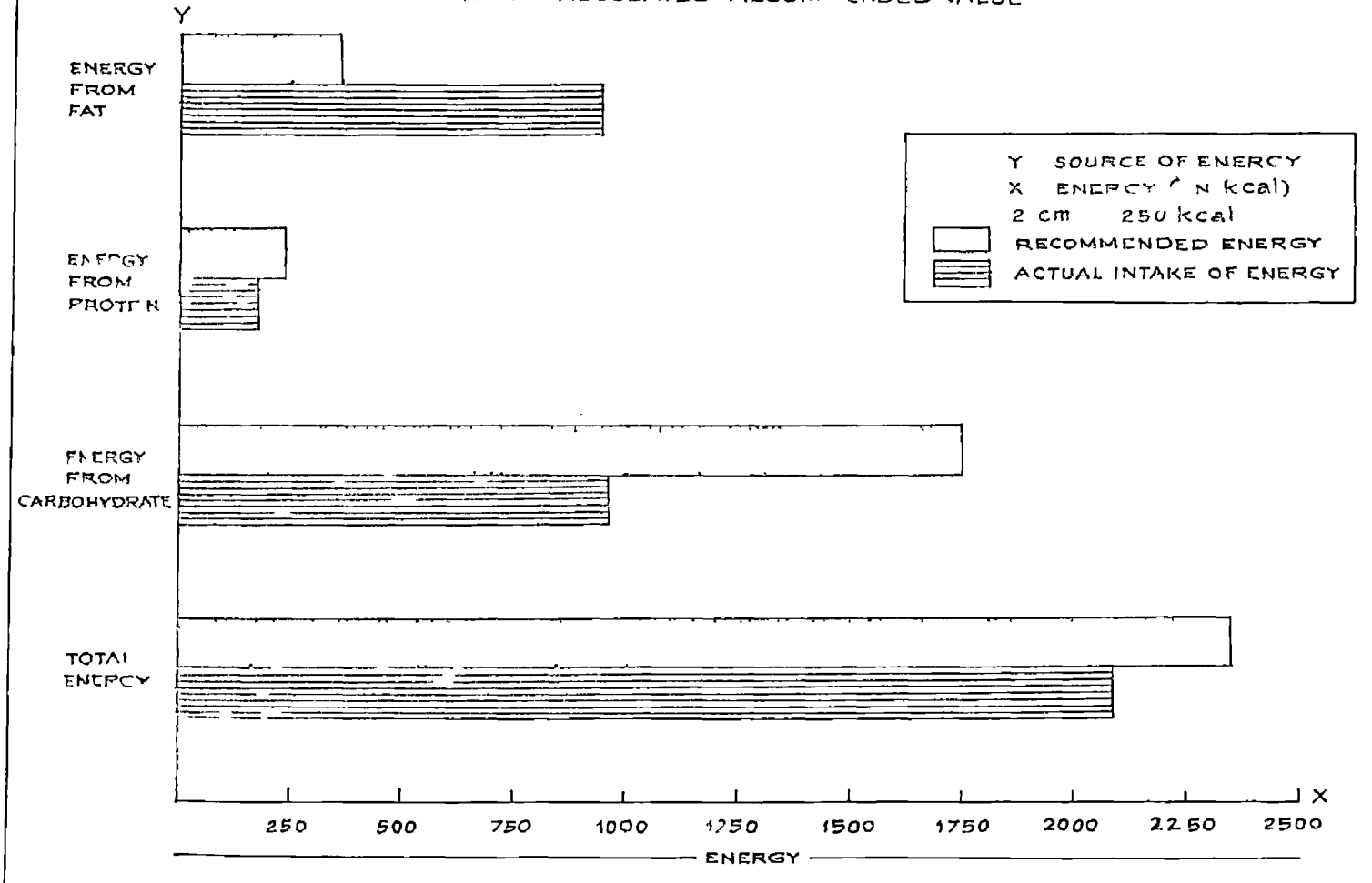
Protein - 10 per cent of total calories

Fat - 15 per cent of total calories

As indicated in Table 39, Case Study II is a normal weight patient and his total calorie intake was found to be low when compared to calculated recommended value as per ICMR (1989). The proportion of total calories supplied

FIG 8

CASE STUDY II COMPARISON OF THE PROPORTION OF ENERGY SUPPLIED BY MAJOR NUTRIENTS WITH CALCULATED RECOMMENDED VALUE



by fat was found to be very high (45 per cent of total calories) whereas from carbohydrate it was only 46 per cent. The quantity of fat was also found to be very high when compared to the recommended values.

The initial and final metabolic state of Case Study II was analysed and is given in Table 40.

Table 40. Initial and final metabolic state of Case Study II

Parameters	Normal value	Initial value	Final value
Body weight (in kg)	57	51	50
Body Mass Index	20 - 25	20.1	19.7
Cholesterol (mg/dl)	150 - 280	331	292
Triglyceride (mg/dl)	10 - 150	192	173

Table 40 found that body weight was maintained with the modified diet for a period of six months. Reduction in cholesterol and triglyceride levels was also observed.

CASE STUDY III

Adult male - Height 168 cm
Body weight - 65 kg
Ideal body weight - 64 kg
Body mass index - 23 (normal)

Type of activity	-	Sedentary
Regular exercise	-	Nil
Age at on set of disease	-	58
Age at present (in completed years)	-	59

Dietary pattern

He is a non vegetarian. Usually he had three major meals per day. For breakfast and lunch he used mainly rice and for supper wheat preparations. He used to take fried foods or fruits during tea time.

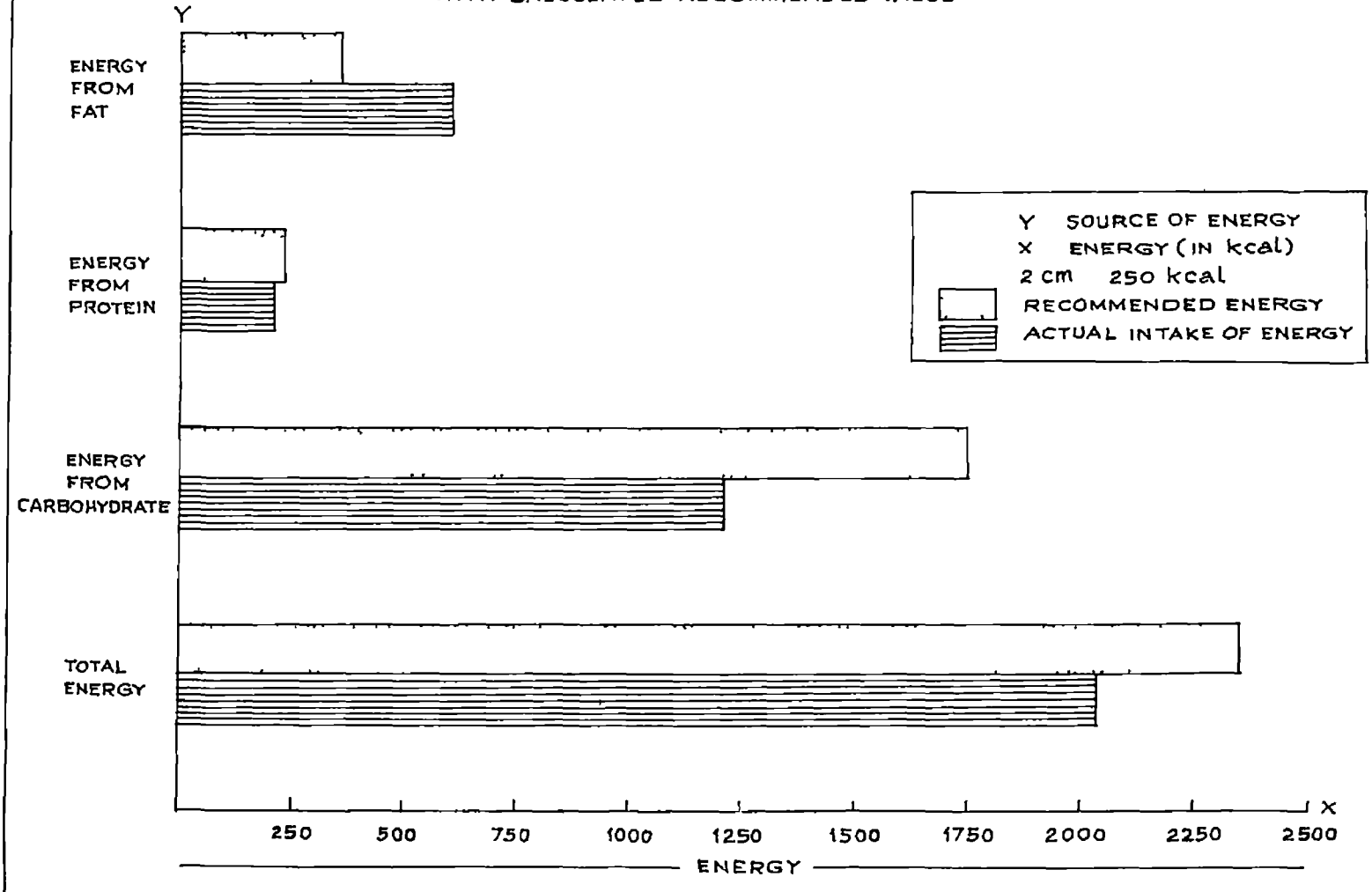
The average actual intake and proportion of major nutrients like carbohydrate, fats and protein was studied in detail and was compared with the calculated recommended values. The results are given in Table 41 and shown in Fig IX

Table 41. Actual intake of major nutrients compared to calculated recommended values of case study III

	Calculated recommended value	Average actual intake/ day (weighment method)	
		Intake	Percentage of total calories
Total energy (Kcal)	2350	2040	
Energy from (Kcal)			
Carbohydrate	1750	1214	60
Protein	240	208	10
Fat	360	621	30
Amount of			
Carbohydrate (g)	438	304	
Protein (g)	60	52	
Fat (g)	40	69	

FIG 9

CASE STUDY III COMPARISON OF THE PROPORTION OF ENERGY SUPPLIED BY MAJOR NUTRIENTS WITH CALCULATED RECOMMENDED VALUE



Regarding the calorie intake of Case Study III, total calorie intake was found to be low when compared to the calculated value (ICMR, 1989). The proportion of calories supplied from fat was found to be twice the calculated recommended value, whereas proportion of carbohydrate calories only 60 per cent. Quantity of fat was also found to be very high whereas carbohydrates and protein were below the recommended values.

The initial and final metabolic state of case study III was analysed and is given in Table 42.

Table 42. Initial and final metabolic state of case study III

Parameters	Normal value	Initial value	Final value
Body weight (in kg)	64	65	62
Body Mass Index	10-25	23	22
Cholesterol (mg/dl)	150-280	382	301
Triglyceride (mg/dl)	10-150	231	156

Case Study III had also maintained normal body weight with the modified diet. The reduction in cholesterol level was found to be more when compared to triglyceride level

CASE STUDY IV

Adult male	- Height 162 cm
Body weight	- 50 kg
Ideal body weight	- 58 kg
Body mass index	- 19 (under weight)
Type of activity	- Sedentary
Regular exercise	- Nil
Age at onset of the disease	- 46
Age at present (in completed years)	- 50

Dietary pattern

He is a non vegetarian. Meal pattern included three main meals per day. For breakfast and lunch he used mainly rice and for supper wheat preparations. During evening time, he used to take fried foods or bakery items.

The average actual intake and proportion of major nutrients like carbohydrate, fats and proteins of case study IV was studied in detail and was compared with the calculated recommended values. The results are given in Table 43 and shown in Fig X

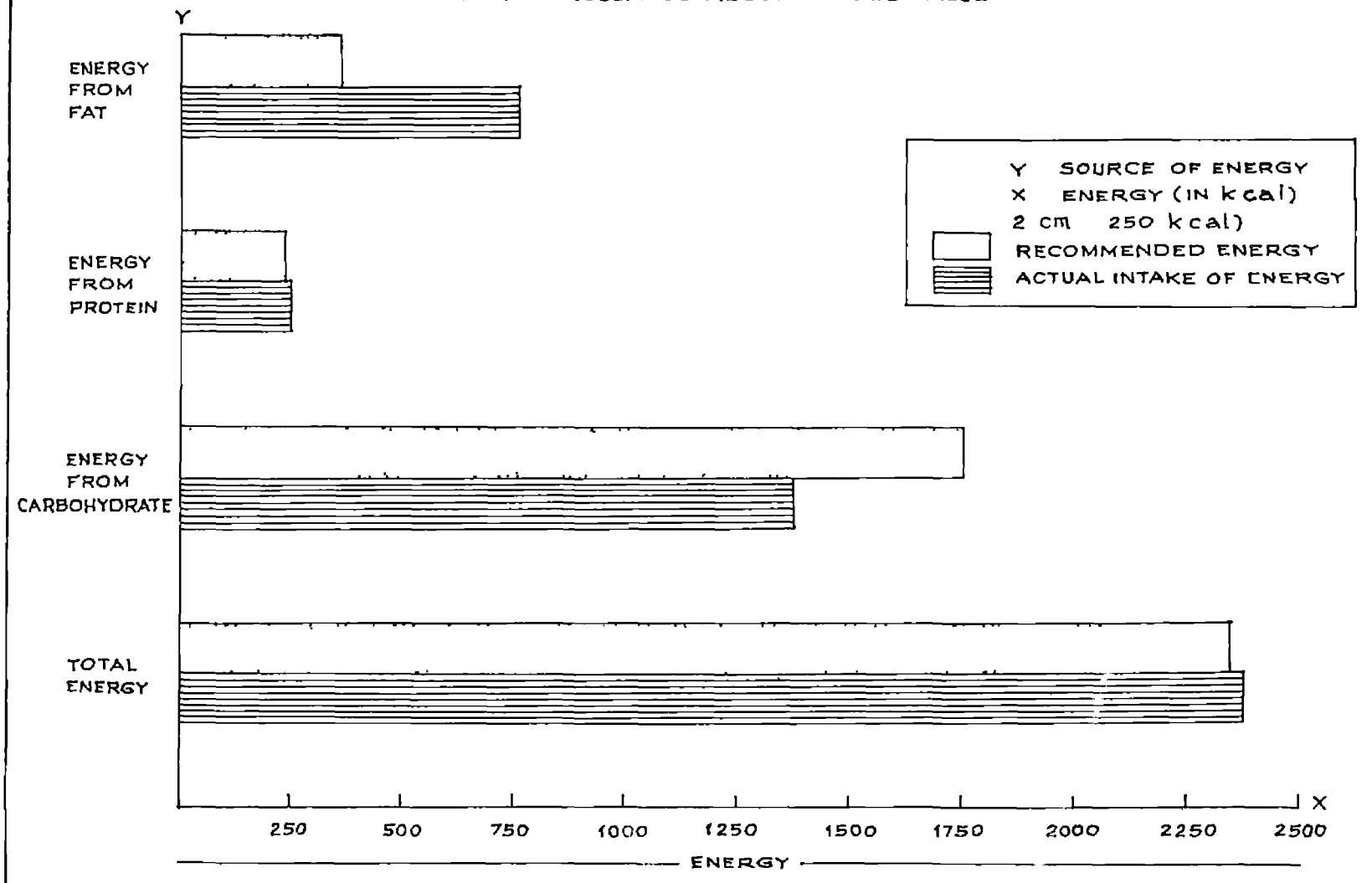
Table 43. Actual intake of major nutrients compared to calculated recommended values of case study IV

	Calculated recommended value	Average actual intake/ day	
		Intake	Percentage of total calories
Total energy (Kcal)	2350	2385	
Energy (Kcal) from			
Carbohydrate	1750	1380	58
Protein	240	244	10
Fat	360	765	32
Amount of			
Carbohydrate (g)	438	345	
Protein (g)	60	61	
Fat (g)	40	85	

Regarding the calorie intake of case study IV, even though he was an underweight patient, he should maintain his calorie intake as per the recommended value since he is an atherosclerotic patient, but total calorie intake was found to be more. Regarding the distribution of calories from carbohydrate, protein and fat, the proportion of calories from protein was found to be adequate whereas the proportion from fat was too high (32 per cent) and carbohydrate too low (58 per cent).

FIG 10

CASE STUDY IV COMPARISON OF THE PROPORTION OF ENERGY SUPPLIED BY MAJOR NUTRIENTS WITH CALCULATED RECOMMENDED VALUE



The initial and final metabolic state of case study IV was analysed and is given in Table 44.

Table 44. Initial and final metabolic state of case study IV

Parameters	Normal value	Initial value	Final value
Body weight (in kg)	58	50	55
Body mass index	20-25	19	21
Cholesterol (mg/dl)	150-280	266	262
Triglyceride (mg/dl)	10-150	288	254

As indicated in Table 44 initially he was an underweight patient, but after six months of modified diet he attain normal body weight for his height. There was not much difference observed in the cholesterol level but a considerable reduction was observed in triglyceride levels after six months.

CASE STUDY V

Adult male - Height 162 cm

Body weight - 78 kg

Ideal body weight - 58 kg

Body mass index - 29.7 (obese)

Type of activity - Sedentary

Regular exercise - Nil

Age at onset of the disease - 56

Age at present (in completed years) - 61

Dietary pattern

He was an non vegetarian. Meal pattern consisted of three main meals per day and was mainly rice preparations. During tea time he used to take steamed banana or fried foods.

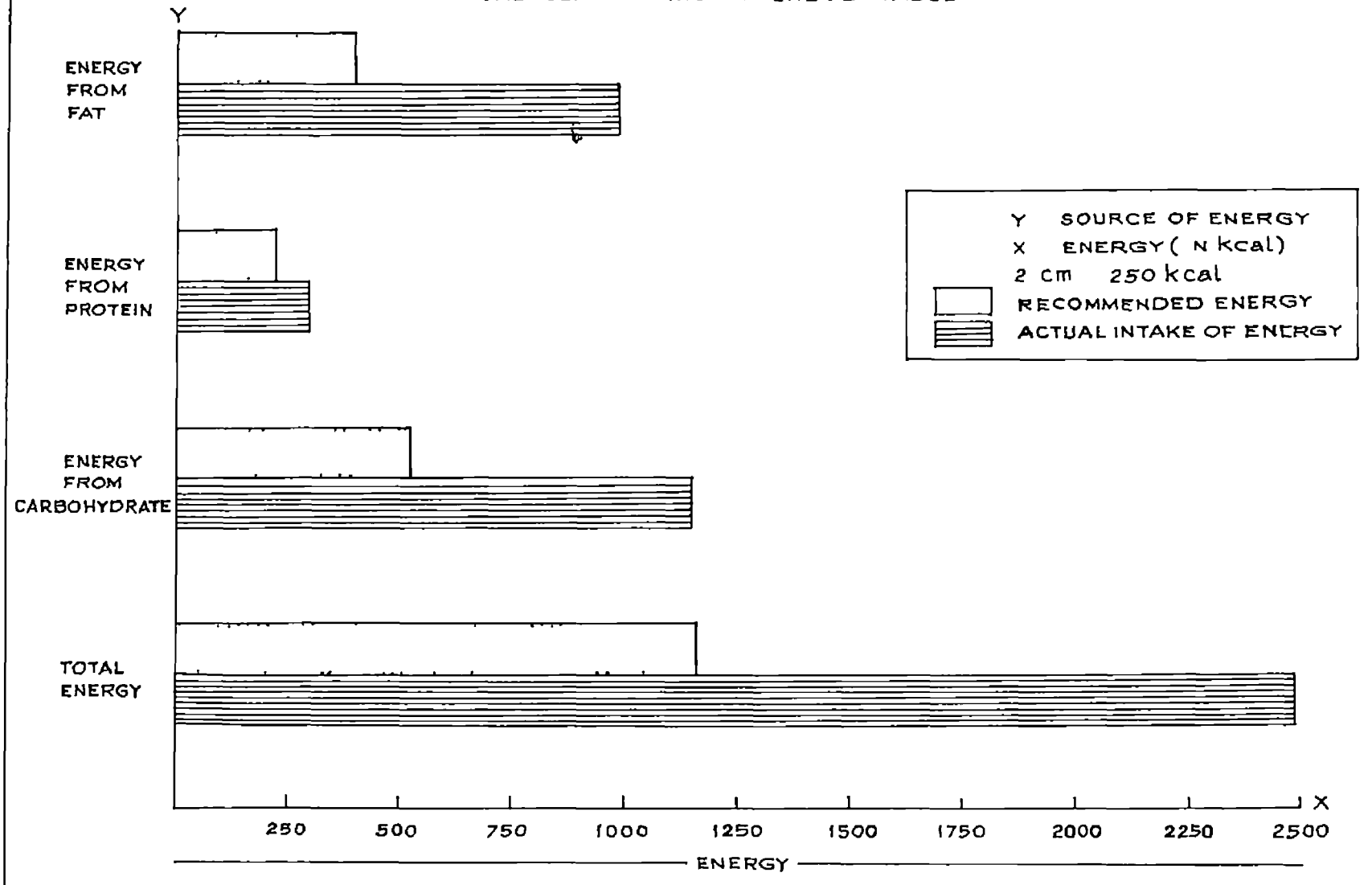
The average actual intake and proportion of major nutrients like carbohydrate fat and protein of case study V was studied in detail and was compared with the calculated recommended values. The results are given in Table 45 and shown in Fig XI

Table 45. Actual intake of major nutrients compared to calculated recommended values of case study V

	Calculated recommended value	Average actual intake/ day (weighment method)	
		Intake	Percentage of total calories
Total energy (Kcal)	1160	2446	
Energy (Kcal) from			
Carbohydrate	522	1144	47
Protein	232	300	12
Fat	406	990	40
Amount of			
Carbohydrate (g)	131	286	
Protein (g)	58	75	
Fat (g)	45	110	

FIG 11

CASE STUDY V COMPARISON OF THE PROPORTION OF ENERGY SUPPLIED BY MAJOR NUTRIENTS WITH CALCULATED RECOMMENDED VALUE



The total calorie intake was higher when compared to calculated recommended value for an obese patient based on his ideal body weight (Antia, 1989). The proportion of fat calories and carbohydrate calories was found to be very high. The quantity of total carbohydrate proteins and fat also far exceeded the calculated value for an obese patient.

The metabolic state of case study V was analysed before and after the six months follow up study. The details are given in Table 46.

Table 46. Initial and final metabolic state of case study V

Parameters	Normal value	Initial value	Final value
Body weight (in kg)	58	78	72
Body mass index	20-25	29.7	27
Cholesterol (mg/dl)	150-280	272	252
Triglyceride (mg/dl)	10-150	187	183

Table 46 showed that there was a reduction in body weight by six kilogram in a period of six months, but still he was obese as indicated by body mass index. There was slight reduction in cholesterol level but there was not much difference in triglyceride level after following the modified diet for period of six months.

CASE STUDY VI

Adult female	-	Height 150 cm
Body weight	-	56 kg
Ideal body weight	-	48 kg
Body mass index	-	25 (Normal)
Type of activity	-	Sedentary
Regular exercise	-	Nil
Age at onset of the disease	-	49
Age at present (in completed years)	-	55

Dietary pattern

Non vegetarian. Meal pattern included three major meals per day consisting of breakfast, lunch and dinner. For breakfast and lunch she used mainly rice and for supper wheat preparations. During tea time she used to take fried snack items.

The average actual intake and proportion of major nutrients like carbohydrate, fat and proteins was studied in detail and was compared with the calculated recommended values. The results are given in Table 47 and shown in Fig XII

Table 47. Actual intake of major nutrients compared to calculated recommended values of case study VI

	Calculated recommended value	Average actual intake/ day (weighment method)	
		Intake	Percentage of total calories
Total energy (Kcal)	1800	1991	
Energy (Kcal) from			
Carbohydrate	1350	1080	54
Protein	180	200	10
Fat	270	630	32
Amount of			
Carbohydrate (g)	338	270	
Protein (g)	45	50	
Fat (g)	30	70	

Total calorie intake was found to be slightly high but the proportion from which the calories were derived was not satisfactory. Fat calories was found to be more (32 per cent) and amount of fat included in the diet was also very high. The calories supplied by protein was satisfactory but that of carbohydrate was very low.

The metabolic state of case study VI was analysed before and after the six months of follow up study the details are presented in Table 48.

FIG 12

CASE STUDY VI COMPARISON OF THE PROPORTION OF ENERGY SUPPLIED BY MAJOR NUTRIENTS WITH CALCULATED RECOMMENDED VALUE

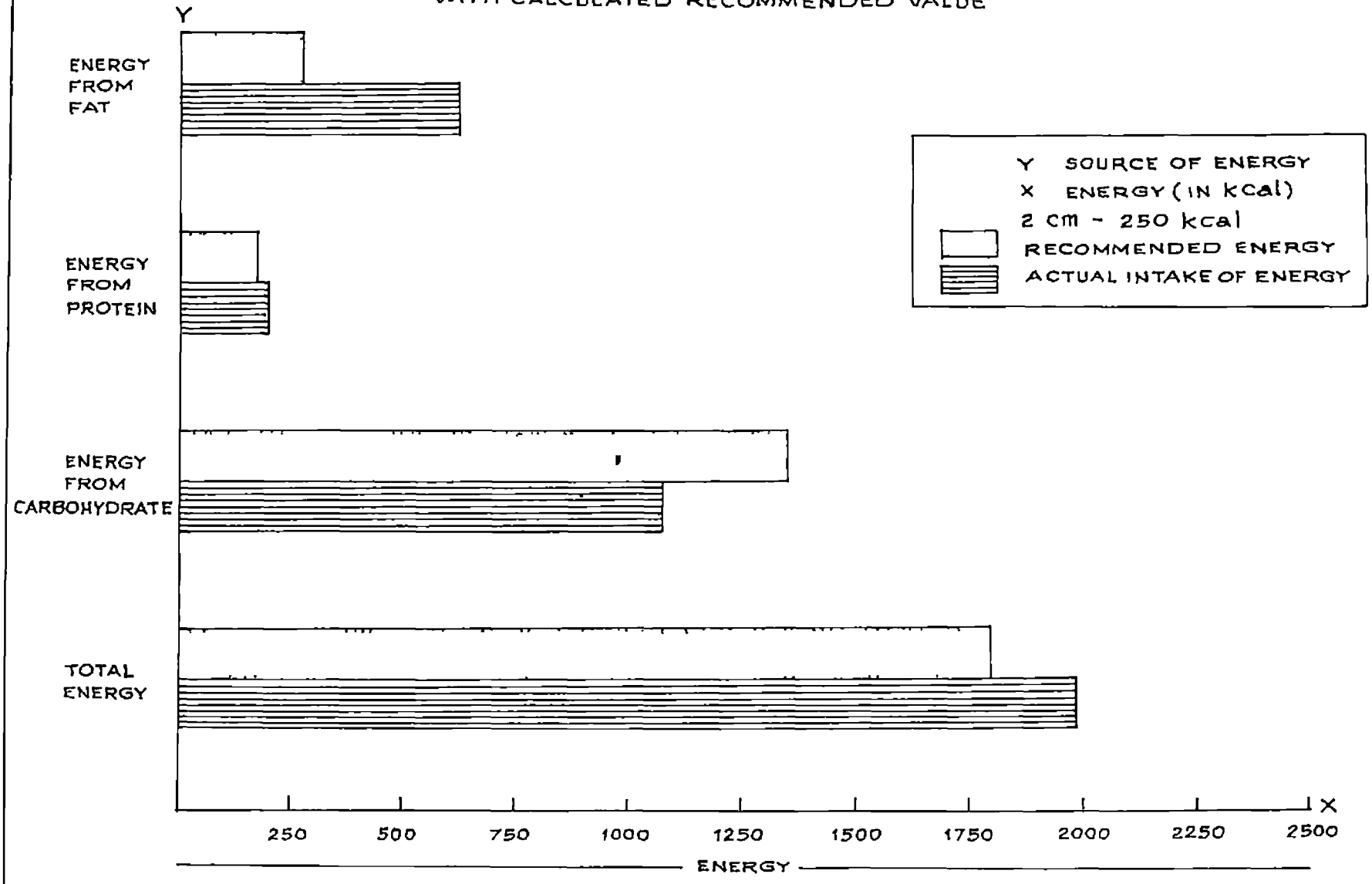


Table 48. Initial and final metabolic state of case study VI

Parameters	Normal value	Initial value	Final value
Body weight (in kg)	48	56	54
Body mass index	19-25	25	24
Cholesterol (mg/dl)	150-280	311	299
Triglyceride (mg/dl)	10-150	150	148

As indicated by the body mass index, of the patient maintained the normal body weight. Reduction in cholesterol and triglyceride level was observed.

CASE STUDY VII

Adult female	-	Height 153 cm
Body weight	-	46 kg
Ideal body weight	-	47
Body mass index	-	19 (Normal)
Type of activity	-	Sedentary
Regular exercise	-	Nil
Age at onset of the disease	-	32
Age at present (in completed years)	-	33

Dietary pattern

She was a non vegetarian. Usually she took three major meals per day based on rice preparations. During evening tea time she was in the habit of taking steamed tapioca or bakery items.

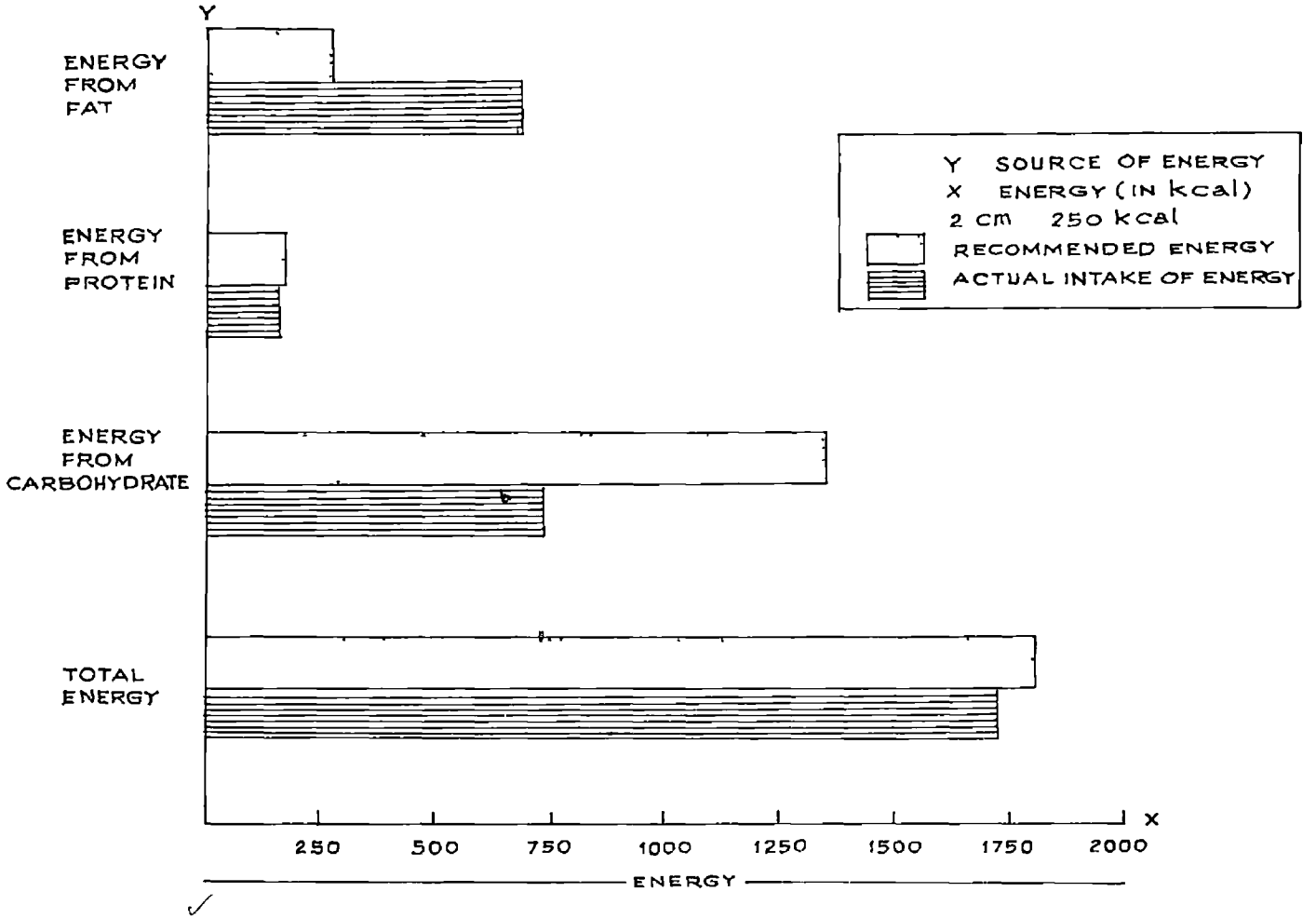
The average actual intake and proportion of major nutrients like carbohydrates, fats and proteins was studied in detail and was compared with the calculated recommended value. The results are given in Table 49 And Shown in Fig XIII

Table 49. Actual intake of major nutrients compared to calculated recommended values of case study VII

	Calculated recommended value	Average actual intake/day	
		Intake	Percentage of total calories
Total energy (Kcal)	1800	1720	
Energy (Kcal) from			
Carbohydrate	1350	744	43
Protein	180	168	10
Fat	270	801	47
Amount of			
Carbohydrate (g)	338	166	
Protein (g)	45	42	
Fat (g)	30	89	

FIG 13

CASE STUDY VII COMPARISON OF THE PROPORTION OF ENERGY SUPPLIED BY MAJOR NUTRIENTS WITH CALCULATED RECOMMENDED VALUE



The total calorie intake was found to be less when compared to calculated recommended value for a sedentary women. Even though the total calorie was low the proportion of fat calories was 47 per cent. The proportion of calories supplied by carbohydrate was 43 per cent instead of 75 per cent. Protein calories was found to be satisfactory and also the quantity of protein.

The metabolic state of case study VII was analysed before and after six months of follow up study the details are presented in Table 50.

Table 50. Initial and final metabolic state of case study VII

Parameters	Normal value	Initial value	Final value
Body weight (in kg)	47	46	49
Body mass index	19-25	19	21
Cholesterol (mg/dl)	150-280	272	211
Triglyceride (mg/dl)	10-150	168	110

Case study VII was able to main normal body weight with a modified diet for a period of six months. A considerable reduction in cholesterol and triglyceride level was observed.

DISCUSSION

DISCUSSION

The present study was carried out to assess the socio-economic and food consumption pattern of the families of atherosclerotic patients, personal characteristics and dietary pattern of the patients and the impact of diet counselling and a modified dietary regime on the blood lipid level of the atherosclerotic patients.

Socio-economic and food consumption pattern of the families of the atherosclerotic patients

Socio-economic and food consumption pattern of the families of the atherosclerotic patients were assessed by conducting a survey among 100 families. The prevalence of atherosclerosis was found to be more common in the rural community than in the urban community.

The economic status of the families revealed that for majority of the families, the main source of income was from temporary jobs and income from agriculture. Most of the families of the atherosclerotic patients had a monthly income ranging between Rs.500/-, Rs.1000/-. Antia (1989) had reported that the mortality from coronary heart disease is increasing in lower social class and also noted to be fairly high among labourers. The results of the present study is also in line with the above findings.

Educational level of majority of the families was also found to be lower. Carlo et al. (1987) found that better educated people experienced substantially lower risks of diabetes, hypertension, heart condition etc. However in the present study around half of the population studied were moderately educated since they reached upto upper primary level and one third of the population were high school educated.

Monthly expenditure pattern of the families indicated that 63 per cent of the families spend between 16 to 60 per cent of their monthly income on food. There were families who spend upto 85 per cent of their monthly income on food, this variation in the amount spent on food was found to be dependent on the family income and the number of family members. Quiogue (1970) found that the lower the income higher was the percentage of income spent on food. It was found that no family spend more than 20 per cent of their income on items like clothing, shelter, entertainment and travel. Since majority of the families had their own houses, expenditure regard on this was found to be less. Regarding expenditure on education 30 per cent of the families spend 10 per cent of their monthly income. Since atherosclerosis is a disease requiring constant treatment and so the expenditure of the

families on health was also considered, it was found that 77 per cent of the families spend upto 20 per cent of their monthly income for maintaining better health.

Food habits of the families revealed that more than 90 per cent of the families were non vegetarians. The frequency of purchase of various food items revealed that since most of them had temporary jobs the general trend was to purchase dry food articles on weekly basis. Fresh food items like green leafy vegetables, other vegetables and fish were purchased daily by most of the families. Since 5 per cent of the families were basically vegetarians they did not purchase flesh foods and eggs. Majority of the families (56 per cent) belonged to low income group, only 29 per cent of the families made occasionally purchase of bakery items.

The frequency of use of various food items by the families indicated that cereals, especially rice was used daily by all the families and 44 per cent of the families included wheat daily in their menu. Only a few families (7 per cent) were found to use millet like ragi which contained more fiber. Most of the families included leafy vegetables, roots and tubers and other vegetables in their daily diet. Daily consumption of pulses among families was not observed while 28 per cent of the families

used pulses occasionally. Thirteen per cent of the families never used pulse in their menu. Pulses are rich sources of plant proteins and dietary substitution of plant proteins for animal protein was reported to be more effective in reducing blood lipid level (Nalini and Radha, 1989). Majority of the families used milk and milk products daily. About 69 per cent of the families included fish daily, while regarding the consumption of other flesh foods, beef was found to be consumed most frequently. The frequency of consumption of egg was only occasional. Sugar, fats and oils and coconut were included in the daily diet by all the families.

The inclusion of various food items in the menu by the families was analysed through a 24 hour recall method. Almost all the families took a cereal based breakfast supplemented with pulses or vegetables or fruits or egg and milk. For lunch rice was supplemented with almost all food groups. Pickles were used by few families but most of the families did not take fruit after lunch. Evening tea consisted of milk with sugar in the preparation of coffee or tea along with boiled tapioca or fruits or fried foods and bakery items, such as bread, biscuits etc. Dinner was almost same as that of lunch. However the inclusion of leafy vegetables, pulses and roots and tubers

were low during dinner time when compared to lunch. Only few family members consumed milk during the bed time.

The cooking oils used by majority of the families were found to be palmoil and coconut oil. Sreekumar and Kurup (1978) reported that coconut oil had more atherogenic effect. A good number of families consumed coconut oil alone or coconut oil along with palm oil. In general the consumption of oil were considerably higher among these families, especially saturated oils.

Various methods of cooking adopted in the families depended on the type of food. Frying was the most commonly adopted method for the preparation of fish which was found to be included in the daily diet of majority of the families. Fried foods have a higher fat content, which leads to excess energy consumption, resulting in obesity, Cardiovascular disease and other related complications (Antia, 1989).

Actual food intake of the family members assessed through food weighment survey

From the food weighment survey results, it was clear that the consumption of various food groups like fruits, flesh foods, sugar and milk and milk products by the male members of the families was in excess when

compared to the recommended values. The consumption of excess fruits was not harmful, but the excess consumption of sugar and flesh foods added to the total calories and will leads to other complications. The consumption of pulses, leafy vegetables and roots and tubers were found to be less when compared to recommended values. This indicates that the inclusion of the various food groups were not in a balanced proportion.

The quantity of foods consumed by the female family members of the patients, indicated a rather high consumption of vegetables, fruits, flesh and milk and milk products. The consumption of pulses, leafy vegetables and roots and tubers were found to be very low.

It was found that the energy, and protein consumption of the male members of the families, along with the intake of other nutrients, like vitamin A, thiamin, riboflavin and iron was found to be satisfactory. But daily intake of calcium, vitamin C and fat were found to be in excess of the recommended levels.

The average consumption of nutrients by the female family members of the patients showed that all the nutrients except iron and vitamin A were found to be in excess when compared to recommended daily allowances. Iron and Vitamin A intake was found to be low when compared to recommended daily allowances.

In general it was observed from the dietary habits of the families that total fat consumption was very high among both male and female members and also an excess energy intake by the female members. Excess energy consumption was known to lead to obesity increasing the chances for the occurrence of cardiovascular diseases.

Personal characteristics and dietary habits of the atherosclerotic patients

From the present study it was found that the incidence of Coronary heart disease was higher among men (84 per cent) than women (16 per cent). Godsland et al. (1987) also reported that the incidence of coronary heart disease was higher among men than in women.

In the present study 46 per cent of the patients were pensioners. Only 42 per cent of the patients were working of which 20 per cent were daily wage earners.

The educational status of the atherosclerotic patients were found to be low. Four per cent of the patients were illiterate while the percentage of patients who were educated upto lower primary school and upper primary was around 63 per cent.

The agewise distribution of the patients helped to reach the conclusion that majority of the patients

(74 per cent) belonged to the age group 40 to 65 years. Cardiology committee (1985) reported that Coronary heart disease was the dominant cause of death in men after the age of 40. Another trend observed was that the incidence of atherosclerosis in women was more after the age of 50 years. As reported by Jacqueline et al. (1989) an increase in the incidence of Cardiovascular disease has been observed in post menopausal women.

The age of incidence of atherosclerosis was analysed and it was found that the incidence was higher in the age group of 41 to 65 years (74 per cent). The age group 46-50 was found to be the most prominent period where the incidence of heart disease was highest. As reported by Mary et al. (1980) the average annual incidence of Coronary heart disease during the age group of 45-54 years was estimated as 1.73 per cent.

The genetic factor play a role in the aetiology of Coronary heart disease, in the present study about 22 per cent of the patients had a family history of the disease. This is in line with the observation made by Friedlander et al. (1985) who found that a family history of heart attack before the age of 60 years was an independent risk factor for Coronary heart disease.

According to Levy (1985) high blood pressure was a risk factor for Cardiovascular disease, in the present study also, 54 per cent of the patients had a high blood pressure.

Obesity which was a near constant feature of type II diabetics in itself was a risk factor and potentiates its effects on atherosclerosis (Datta, 1990). In the present study 25 per cent of the patients were diabetic and 33 per cent of the patients were obese.

Alcohol consumption, smoking, exercise pattern etc. are some of the risk factors of atherosclerosis and in the present study it was found that only 5 per cent of the patients were in the habit of consuming alcohol while 30 per cent abstained from its consumption. Michael et al. (1986) reported that alcohol produce a rise of one per cent in serum high density lipoprotein (HDL) cholesterol probably due to a rise in the high density lipoprotein subfraction.

Cigarette smoking produces atherosclerosis or hardening of arteries which results eventually in heart attacks and strokes (Padmavati, 1980). The present study also shows that 14 per cent of the patients were smokers, while 44 per cent abstained from smoking. Tobacco chewing was common among 9 per cent of the patients while 10 per cent abstained.

Reduced physical activity was another risk factor in atherosclerosis. Gregory et al. (1983) found that endurance exercise and training shows antiatherogenic effect. The present study revealed that about 71 per cent did not take any exercise while the rest have some type of exercise.

The initial symptoms which were experienced by the patient before the onset of the disease was found to be varying. The most prominent symptoms reported were chest pain, suffocation and excessive sweating.

Majority of the patients were regular attendants at the speciality clinic. The rest of patients used to visit their own medical practitioners and general clinic (6 and 2 per cent respectively).

Majority of the patients (81 per cent) managed the severity of the disease through diet control and the use of oral drugs, while only 4 per cent controlled the disease through diet alone. Informations regarding the diet control was obtained through friends, neighbours, relatives and through mass media especially TV. Majority of the patients (92 per cent) were non vegetarians. About 34 per cent of these non vegetarian patients were consuming only fish. Fifty eight per cent of the patients consumed both fish and meat especially mutton. Frying

was the most common method of preparation of non vegetarian foods. Non vegetarian foods have greater influence on the blood cholesterol than vegetarian foods. This result is in line with the findings of Thorogood et al. (1987).

In the present study 33 per cent of the patients were found to be obese. For the obese patients it was advisable to take smaller quantities of food as suggested by Antia (1989). But the patients studied were found to take three major meals in a day.

Caffeine containing beverages such as coffee and tea should be restricted because in susceptible heart disease patients caffeine may aggravate irregular heart beats (Antia, 1989). But in the present study tea consumption was more among the patients.

The percentage of patients taking meals outside very often was 18 per cent without any restriction in the quality and quantity. Majority of the patients (56 per cent) had a liking for fried food items and they were in the habit of taking these items as desired. This showed that the dietary restrictions were not strictly followed by the patients.

The study among atherosclerotic patient revealed that food exchanges which supplies more calories was found to be more frequent. Only 55 per cent of the patients

included foods coming under vegetable exchange A where carbohydrates and calories were negligible in their daily diet. Majority of the patients (35 per cent) included fruit exchange very occasionally. Thus it was clear that most of the patients were not in the habit of including high fiber food leafy vegetables, other vegetables and fruits. Kannel (1978) reported that vegetables and fruits were sources of complex carbohydrate reducing the incidence of coronary artery disease and atherosclerosis.

A number of food items were said to act as hypocholestrimic agents few patients (19 per cent) were found to be in the habit of taking some of these regularly. About 9 per cent of the patients were taking garlic regularly. Garlic was reported to be a hypocholestremic agent by Arora and Arora (1981).

The saturated and unsaturated oils were found to have an effect on lipid metabolism. Majority of the patients were in the habit of using palm oil and coconut oil as cooking medium. Coconut oil and palm oil were reported to be rich sources of saturated fats (Hindu, 1990). So its consumption increases the cholesterol level in blood.

Regarding the quantities of sugar, salt and fats consumed daily majority of the patients consumed 10-20 g of sugar per day whereas in 14 per cent of the patient,

sugar consumption was found to be above 50 g per day. Fears et al. (1981) found that serum triglyceride levels increased with the intake of sucrose every day. In majority of the patients (54 per cent) salt consumption was found to be below 10 g per day. Sheela Sidharam (1988) reported that increased sodium intake influence serum lipids and it leads to coronary heart disease. In this present study 54 per cent of patients had hypertension so they consumed less salt as advised by the doctor. Regarding fat consumption about 13 per cent of the patients were found to consume more than 40 g of fat per day. High dietary fat leads to Coronary heart disease (NIN, 1990).

Impact of Cardiac clinic on the existing dietary pattern of the patients

Results of the observations and interview of the personal as well as the patients carried out in the clinic showed that diet counselling in the clinic was done without the help of a dietitian. Jaimala (1989) reported that dietetics was important in the treatment of diseases but role of dietitians in India was not well recognized.

Tunstall et al. (1981) suggested that the health education programme for the atherosclerotic patients modified their food related behaviour rather than knowledge and attitudes. But in this clinic there was only a general

diet sheet for all the patients without taking into consideration their individual likes and dislikes. Hence the patients were not strictly adhering to the diet prescription from the clinic. The importance of small effects of a modified diet on diseases such as hypertension and coronary heart disease has always been overshadowed by effects of drugs. Thus reports on dietary effects are scanty (NIN, 1990).

The knowledge of the patients regarding a modified diet was analysed. It was found that patients were aware of the importance of restriction of fat, coconut and non vegetarian foods like egg and meat and the need for including more leafy vegetables and other vegetables in the daily diet.

The impact of diet counselling and a modified diet on blood lipids

Dietary pattern of the case studies revealed that, in two patients who were obese the total calorie intake was far exceeding the calculated recommended value based on their body weight and height. Findings further indicated that an excessive calorie intake resulted in weight gain and obesity. Bierman (1983) reported obesity as the major risk factor of atherosclerosis, since it increased the blood cholesterol level. Regarding the proportion of

total calories from the energy yielding nutrients namely carbohydrates, protein and fat in the case of obese patients, it was found that the calories supplied from carbohydrates was adequate, from proteins less calories and the major proportion of calories was from fat.

The remaining five patients were having normal body weights as calculated by their body mass index. Among these five patients excess calorie consumption was observed in one patient. The proportion of calories from energy nutrients revealed that calories from carbohydrate was less, from protein adequate and major proportion of calories was from fat. The same trend was observed with the other patients except that the total calorie consumption was less, when compared to calculated recommended value. Thus it was clear from the study that of the total calories fat calorie was found to be more in all the patient studied. Alan et al. (1985) found that a very high fat intake which accounted for nearly 60 per cent of total energy intake increased the serum cholesterol levels which will lead to atherosclerosis.

The blood lipid profile of the patients before following a modified diet was observed with regard to cholesterol and triglyceride levels in blood. In the two obese patients, cholesterol level was found to be within

the normal range but the triglyceride levels were very high. Among the five patients with normal body weights three patients were having increased cholesterol levels. Regarding triglyceride levels, four patients had high triglyceride levels.

After six months in a modified diet, the follow up study among the patients revealed that two obese patients decreased their body weight, of which one patient attained his normal body weight within 6 months, there was a decrease in both cholesterol and triglyceride levels in blood in these patients. But only for one patient, triglyceride level decreased to the normal range. The patients with normal body weights maintained their body weights with the modified diet. In this the cholesterol level was found to be decreasing but none attained the normal range. Triglyceride levels were also decreased and one patient attained the normal triglyceride level. This implies that a well balanced diet with the correct proportion of carbohydrates, proteins and fats according to the patients ideal body weights will bring about a reduction in the blood cholesterol and triglyceride levels. But the modified diet has to be followed continuously at least for a period of one year. Since in the present study there was a considerable reduction in both cholesterol

and triglyceride level but none attaining the normal range within six months. NIN (1990) reported that nutritional modifications was certainly safe and inexpensive for the coronary heart disease patients.

In the present study the obese patients reduced their body weight with a modified diet with 45 per cent of total calories from carbohydrates, 20 per cent of calories from protein and 35 per cent of calories from fat. The normal weight patients maintained their body weight with the same diet which provided 75 per cent of total calories from carbohydrate, 10 per cent of calories from protein and 15 per cent calories from fat.

Coronary atherosclerosis is most common underlying obstructive coronary artery disease and it is one of the major health problems. This disease can be controlled by avoiding excess dietary intake like coffee, flesh food, alcohol and mental tension along with physical exercise. Obesity and atherosclerosis is likely to arise in predisposed persons who eat too much and exercise too little.

SUMMARY

SUMMARY

Coronary heart disease and atherosclerosis have emerged as a prominent health problem. Today it is the most important cause of premature disability and death in industrial countries.

Epidemiological studies have established the significant contribution by the factors such as heredity, smoking and dietary habits in the aetiology of atherosclerosis and Coronary heart disease. Dietary excesses of five specific food factors are possibly implicated in hyperlipidemia. These food factors are cholesterol, saturated fats and carbohydrate especially sucrose, alcohol and kilocalories.

The present study reveals the influence of traditional family diets as a predisposing factor and the role of dietary management in controlling heart diseases. This study on the influence of dietary habits on atherosclerosis was conducted among patients attending the Cardiac clinic at Medical College, Trivandrum.

Data required for the study was collected through a survey of the socio economic and food consumption pattern of the families and on the personal characteristics and dietary pattern of the patients. Also the diet counselling

being imparted in the clinic was observed. Diet counselling was imparted by the investigator to seven patients who were selected as case studies and their blood lipid profile before and after diet counselling and a modified dietary regime for 6 months was assessed.

The survey conducted among 100 families revealed that many of the patients were moderately educated from the rural areas (75 per cent). Major source of income of these families were from temporary jobs and agriculture. Most of the families (41 per cent) of the patients had a monthly income ranging between Rs.500/- to 1000/-.

About 63 per cent of the families spent between 16 to 60 per cent of their monthly income on food. Most of the families (95 per cent) were basically non vegetarians. Regarding the purchase of foods by the families, it was found that various food items like cereals and roots and tubers were purchased on weekly basis, oil seeds (coconuts) cooking oils, sugar and jaggery and spices and condiments were purchased monthly. Cereals, especially rice were found to be the staple food in these families, whereas millets like ragi was consumed only by a very few families. Vegetables, fish, milk, oils, sugar etc. were included in the daily diet by almost all the families. Daily consumption of pulses among families was not observed

while 28 per cent of the families used pulses occasionally. Thirteen per cent of the families never used pulses in their menu. Sixty nine per cent of the families consumed fish daily while the consumption of other flesh foods like beef was most frequently. Palmoil and coconut oil were used by majority of the families. Frying was the most commonly adopted method for the preparation of fish and straining method was adopted for cereal cookery.

The food weighment survey conducted among 10 families indicated that the consumption of quantities of various food groups like milk, milk products, fats and oils, flesh foods, fruits and sugar exceeded the recommended quantities by the family members. However the quantities of roots and tubers, pulses and leafy vegetables were less than the recommended quantities in the case of male members in the families of the patients. In female members a similar trend in the consumption of various food groups was observed, except that the consumption of vegetables was higher than the recommended quantities. The average nutrient consumption in the case of male members of the families indicated that the intake of all the nutrients were satisfactory except calcium, vitamin C and fat which far exceeded the recommended values. In the case of female members in the families, the intake of all the nutrients except iron and

vitamin A were found to be in excess when compared to RDA.

The survey on personal characteristics and dietary pattern of the patients showed that among the 100 patients studied revealed that the occurrence of the disease was more common among male patients (84 per cent) compared to female patients (16 per cent). Among the female patients, most of them (12 per cent) were unemployed housewives. Majority of the patients were in the age between 41-65 years (74 per cent) and no case below 30 years and above 80 years was observed. The age at onset in most of the patients was between 46 to 55 years (33 per cent). The initial symptoms of the disease as experienced by most of the patients were chest pain followed by suffocation and excessive sweating positive family history of heart disease was seen in 22 per cent of the patients, paternal history of disease was found to higher than maternal. Hypertension (54 per cent) and diabetis (85 per cent) were two diseases which were common among the atherosclerotic patients surveyed. About 61 per cent of the patients surveyed were of normal weight, while around 33 per cent of the patients were overweight. Fourteen per cent of the patients were smokers and tobacco chewing was common among 9 per cent of the patients. Only 5 per cent of the patients were in the habit of consuming alcohol. About

71 per cent of the patients did not take any exercise.

Majority of the patients managed the severity of the disease through diet control and the use of oral drugs (81 per cent). Information regarding the diet control was obtained through friends, neighbours, relatives and through mass media especially TV.

Almost all the patients were in the habit of taking three major meals per day. Eighteen per cent of the patients used to take meals outside very often. The inclusion of food exchanges which supplied more calories was found to be more frequent in the daily diets of majority of the families. A good number of the patients had the desire to eat fried items (56 per cent). Nine per cent of the patients were in the habit of taking garlic and bittergourd as a hypocholesterolemic agent. Palmoil and coconut oil were the medium for cooking used by majority of the patients.

Regarding the cardiac clinic attended by the patients, the diet counselling was carried out without the help of a dietitian. The diet planning in the clinic was not individualized.

The food weighment survey carried out in selected 7 patients as case studies indicated that the total calorie

consumption was excess in 3 patients, inadequate in 3 patients and adequate in only one patient. In obese patients the quantity of carbohydrate intake was adequate and fat intake was found to be higher than the recommended. The calories from fat was found to be very high in all patients and the protein calorie was adequate in normal weight patients.

The impact of diet counselling and a modified diet plan for 6 months was found to be effective through the analysis of the blood lipid profile of the patients selected as case studies. Through there was individual variation, a reduction was found in the cholesterol and triglyceride levels. Education of the patients was thus found to have a significant effect in the control of the disease through diet.

REFERENCE

REFERENCES

Abell, L.L., Levy, B.R., Brodie, B.B. and Kendall, F.E. (1952). Estimation of total cholesterol. Journal of Biological Chemistry 195: 357.

Agarawal, N.J. and Pant, M.C. (1986). Effect of feeding Carum Copticum seeds on serum lipids, high density lipoproteins and serum cholesterol binding reserve in the albino rabbits. Indian Journal of Medical Research 83: 93-95.

Alan Silman, Elena Loysen, Wouter De Graaf and Michael Sramek (1985). High dietary fat intake and cigarette smoking as risk factors for ischaemic heart disease in Bangladeshi male immigrants in East London. Journal of Epidermiology and community Health, 39(4): 301-303.

Alan.M. Garber, Harold C. Sox and Benjamin Littenberg (1989). Screening Asymtomatic Adults for Cardiac Risk factors. The serum cholesterol level. Annals of Internal Medicine 10(8): 622-639.

American Heart Association (1990). Heart disease. Hindu. Mar. 25.

Ann Thomas, Giridhari L. Soni and Rattan Singh (1987). Role of dietary fibre from bengal gram as hypocholesterolaemic agent. Human Nutrition : Food Science and Nutrition. 41F (3/4): 193.

Ann M. Fehily, Michael L. Burr, Karin M. Phillips and Michaer Deadma, N. (1983). The effect of fatty fish on plasma lipid and lipoprotein concentrations. The American Journal of Clinical Nutrition. 38: 349.

Antia, F.P. (1984). Clinical Dietetics and Nutrition, 2nd Edition. Oxford University Press. p. 520.

Antia, F.P. (1986). Clinical Dietetics and Nutrition IInd Edition. Oxford University Press. p. 520.

Antia, F.P. (1989). Clinical Dietetics and Nutrition IIIrd Edition. Oxford University Press. p. 340-351, 355, 284, 419.

Anton C. Beynen and Martijn (1985). Reproducibility of the variations Between Humans in the response of serum cholesterol to cessation of egg consumption. Atherosclerosis 57(1): 19-31.

Antonio Verrillo, Assunta De Teresa, Patrizia Carandente Giarrusso and Sebastiano La Rocca (1985). Soybean protein diet in the management of Type II Hyperlipoproteinaemia. Atherosclerosis 54(3): 321-331.

Aphaines (1989). Dietary advice for lowering plasma cholesterol. British Medical Journal 298(6688): 1594-1595.

Aro, A., Voutilennen, E. and Korhonen, J. (1984). Effect of guar gum in male subjects with hypocholestelemia. The American Journal of Clinical Nutrition. 39(6): 911-916.

Arora, R.C. and Arora, S. (1981). Comparative effect of elofibrate, garlic and onion on alimentary hyperlipemia. Atherosclerosis 39(4): 447-452.

Arti Dewan and Rajeswari Rowlands (1986). Effect of cigarette smoking on serum cholesterol and blood pressure. The Indian Journal of Nutrition and Dietetics. 23(10): 294-298.

Babu Philip and Kurup, P.A. (1978). Zinc and metabolism of lipids in normal and atheromatous rats. Indian Journal of Experimental Biology 16(1): 46-50.

Baggio, G., Payanan, A., Muraca, M., Martini, S. and Opportuno, A. (1988). Olive oil enriched diet. Effect on serum lipoprotein levels and biliary cholesterol saturation. The American Journal of Clinical Nutrition 47(5): 960-67.

Bakhru, H.K. (1987). Heart attacks. Herald of Health p. 18.

Balanambeeson and Kurup, P.A. (1976). Ascorbic acid metabolism in rats fed high fat cholesterol diet. Atherosclerosis 25: 63.

Ball, M.J. (1988). The aetiology of atherosclerosis and coronary heart disease. Journal of Applied Medicine. 463-69.

Barbara V. Howard, William, G.H., Abbott, Genshiegosa and Marjaritta Taskinen (1987). Co-ordination of very low density lipoprotein triglyceride and apolipo-protein B metabolism in humans. Effects of obesity an non-Insulin-dependent diabetesmellitus. American Heart Journal 113(2): 522-26.

Bernard M. Wolfe, Patricia M. Glovannetti, Davy, C.H. Cheng, David C.K. Roberts and Kenneth K. Carroll (1981). Hypolipidemic effect of substituting soybean protein isolate for all meat and dairy protein in the diet of hypercholesterolemic men. Nutrition Reports International. 24(6): 1187.

Bhatia, M.L. (1985). Coronary artery disease - Some aspects of medical treatment. Swasth Hind XXIX(7): 153-57.

Bhatia, M.L. (1985). Medical treatment of Coronary artery disease. Yojana. Feb. 16-28. pp. 32-33.

Bierman, E.L. (1983). Atherosclerosis and other forms of atherosclerosis. In Harrison's principles of Internal Medicine. 10th ed. Mc Graw Hill, New York. pp. 1465-1475.

Bordia, A. (1981). Effect of garlic on blood lipids in patients with Coronary heart disease. The American Journal of Clinical Nutrition. 34(10): 2100-2103.

Brian F. O'Kelly, Barry M. Massie, Julio F. Tuban and Jadwiga Szlacheic (1989). Coronary morbidity and mortality, pre-existing Silent Coronary Artery Disease and Mild Hypertension. Annals of Internal Medicine. 110(12): 1017-1026.

Cambien, F., Richard, J.L., Ducimetiere, P., Warnet, J.M. and Kahn, J. (1981). The Paris Cardiovascular Risk factor prevention trial. Effect of two years of intervention in a population of youngmen. Journal of Epidemiology and Community Health. 35(2): 91-97.

Carlo La Vecchia, Evanegri, Romano Pagano and Adriano Decarli (1987). The 1983 italian National Health Survey, Education, Prevalence of disease and frequency of health care utilisation. Journal of epidermiology and community health 41(2): 161-165.

Carolwest Suitor and Merrily Forbes Hunter (1980). Nutrition principles and application in health promotion. Pub. J.B. Lippincott Company. pp. 355.

Castelli, W.P. (1980). Food and Nutrition. Notes and Reviews. 37(1): 18.

Castelli, W.P. (1986). Incidence of CHD and Lipoprotein Cholesterol levels. Journal of American Medical Association. 256: 2835.

Chandran, N.S.S. (1987). Heart Disease in India. Social Welfare. XXXIV(7): 29.

Chave, S.P.W., Morris, J.N. and Susanmoss (1978). Vigorous exercise in leisure time and the death rate: a study of male civil servants. Journal of Epidemology and Community Health. 32(4): 239-243.

Chengappa, R. (1986). Heart disease. Killing the young. India today. XI(21): Nov. 15.

Chopra, H.K. and Aggarwal, K.K. (1989). Unborn babies to suffer heart disease. The Hindu. Feb. 28.

Clara Mixon Lewis (1986). Nutrition and Nutritional Therapy. Appleton century Crafts/Norwalk, Connecticut. p. 434.

Cochran, W.G. (1977). Sampling techniques III Edition. Johnwiley and Sons, New York. p. 10.

Crombie, I.K., Kenicer, M.B., Smith, W.C.S. and Tunstallpedoe, H.D. (1989). Unemployment, socio-environmental factors and Coronary heart disease in Scotland. British Heart Journal 61(2): 172-177.

Daniel, S., Sampath, P., Thomas, P.C., John, C.K. and Joseph, C.W. (1989). Beyond Cholesterol Modification of LDL that increases its atherogenecity. The New England Journal of Medicine. 320(14): 915-916.

Datta, B.N. (1990). Hormones and Atherosclerosis - Current trends in Atherosclerotic Research. Proceedings of the 3rd Annual Conference of the Indian Society for Atherosclerotic Research. p. 132.

David, J.A. Jenkins, David Reynolds, Brenda Slavin, Anthony R. Leeds, Alexandra L. Jenkins and Ewart M. Jepson (1980). Dietary fiber and blood lipids. The American Journal of Clinical Nutrition 33(3): 575-80.

Dorothy Jaganathan and Rani Annie Abraham (1989). Diet counselling for selected obese Cardiovascular patients. Nutrition Society of India (Twentyfirst Annual meeting). p. 33.

Ehnholm, C., Huttunen, J.K., Pietinen, P., Leino, U., Mutanen, M., Kostiainen, E., Pikkarainen, J., Dougherty, R., Iacono, J. and Puska, A. (1982). Effect of diet on serum lipoproteins in a population with a high risk of Coronary heart disease. The New England Journal of medicine. 307(14): 850-855.

Ekelund, L.G., Haskell, W.L. and Johnson, J.L. (1988). Physical fitness as a predictory of cardiovascular mortality in asymptomatic North American men. The New England Journal of medicine. 319: 1379-1384.

Etherton, P.M.K., Krummel, D., Mackey, S. and Wood, P.D. (1988). Nutritional cholesteral education programme. Journal of American Dietetic Association. 88(11): 1373.

Fazier Eales (1986). Determinants of IHD in 7th day Adventists. American Journal of Clinical Nutrition Supplement. 48(3): 833-836.

Fears, R., Glenny, H.P., Tredger, J.A. and Lindsay, R. (1981). Sucrose induced hypertriglyceridaemia : Relation to HDL-cholesterol and to physical Fitness. Nutrition Reports International. 24(5): 909.

Fox, K.M. and Shapiro, L.M. (1988). Heart disease in Asians in Britain. British Medical Journal 297: 311-312.

Frank, G.C., Farris, R.P. and Berenson, G.S. (1978). Dietitions response to knowledge of their own Cardiovascular risk. Journal of Nutrition Education 10: 105-108.

Franklin H. Epstein (1989). Modifications of low density lipoprotein that increase its Atherogenicity. The New England Journal of Medicine. 320(14): 915-922.

Friedlander, Y., Kark, J.D. and Stein, Y. (1985). Family history of myocardial infraction as an independent risk factor for coronary heart disease. British Heart Journal. 53(4): 382-387.

Gene A. Spiller and Hugh J. Freeman (1983). Dietary fiber in human Nutrition. Nutrition update vol. I. p. 169-170.

Gene R. Herzberg and Minda Rogerson (1988). Hepatic fatty acid synthesis and Triglyceride secretion in Rats Fed Fructose or glucose Based diets containing corn oil, Tallow or marine oil. Journal of Nutrition. 118(9): 1061-1067.

Gerard E. Dallal, Elaine Choi, Paul Jacques, Ernst J. Schaefer and Robert A. Jacob (1989). Ascorbic acid, HDL Cholesterol and Apolipoprotein A-1 in an Elderly Chinese Population in Boston. Journal of the American College of Nutrition. 8(1): 69-74.

Giri, J., Devi, T.K.S. and Meerarani, S. (1984). Effect of ginger on Serum cholesterol levels. Indian Journal of Nutrition and Dietetics. 21(12): 433-436.

Glueck, C.J., Mattson, F.H. and Jandacek, R.J. (1979). The lowering of plasma cholesterol by sucrose polyster in subjects consuming diets with 800, 300 or less than 5 mg of cholesterol per day. The American Journal of Clinical Nutrition. 32(8): 1636-44.

Glyn R. Evans and Kenneth G. Taylor (1988). The peadiatric origins of atherosclerosis. Journal of Applied Medicine. 453-60.

Godfrey S. Getz, Patricia A. Soltys, Dee Carey, K., Henry C. Mc Gill and Rick Hay (1987). Nutrition and biogenesis of plasme lipoproteins in non human primates. American Heart, Journal. 113(2): 441.

Godsland, I.F., Wynn, V., Crook, D. and Miller, N.E. (1987). Sex, plasma lipoproteins and atherosclerosis: prevailing assumptions and outstanding questions. American Heart Journal 114(6): 1467-97.

Green and Jucha (1986). Association of serum lipids with coffee, tea and egg consumption in free living subjects. Journal of Epidemiology and Community Health. 40: 324-329.

Gregory W. Heath, Ali A. Ehsani, James M. Hagberg, Judith M. Hinderliter and Andrew P. Goldberg (1983). Exercise training improves lipoprotein lipid profiles in patients with Coronary artery disease. American Heart Journal. 105(6): 889-94.

Grills, N.J. and Bosscher, M.V. (1981). Manual of Nutrition and Diet therapy, Mac Millan Publishing Co., INC New York. pp. 142, 143, 147.

Gunby, R. (1983). Activity HDL levels and post-prandia-llipids. The Journal of the American Medical Association. 249: 1250.

Gupta, S.P. (1985). Statistical methods. 21st edition Sultan Chand and Sons Publishers. pp. E.4.7, E.4.16, A.3.32, A.4.11.

Gupta, S.P. (1987). Statistical methods. Sultan Chand and Sons, New Delhi. p. E-3.8.

Guthrie, H.A. and Crocetti, A.F. (1985). Variability of nutrient intake on 3 day period. Journal of the American Dietetic Association. 5: 325-327.

Guy Valette, Yves Sauvaire, Jean-Claude Baccou and Gerard Ribes (1984). Hypocholesterolaemic effect of fenugreek seeds in dogs. Atherosclerosis 50(1): 105-111.

Haradinge, M.G. (1988). Fat makes fat people. Herald of Health. p. 17. June.

Harley Hartung, G., Rebecca S. Reeves, John P. Foreyt, Wolfgang Patsch and Antonio M. Gotto (1986). Effect of Alcohol intake and exercise on plasma High Density Lipoprotein Cholesterol Subfractions and Apolipoprotein A-I in women. American Journal of Cardiology. 58(1): 148.

Harris, R. (1984). Cardiovascular disease in elderly. Medical Clinical North America. 67: 379-394.

Henning, B. and Boissonneault, G.A. (1988). The role of vitamin E and oxidized lipids in atherosclerosis. International Clinical Nutrition Review. 8(3): 134-139.

Henry F. Hoff, Yoshio Yamauchi and Gene Bond, M. (1985). Reduction in Tissue LDL Accumulation During Coronary artery regression in eynomdgus inacaques. Atherosclerosis. 56(1): 51-60.

Hepner, G., Fried, R., St. Jeor, S., Fusetti, L. and Morin, R. (1979). Hypochlolesterolemia effect of Yogurt and milk. The American Journal of Clinical Nutrition. 32(1): 19-24.

Hindu (1990). Percolated coffee affects levels of Cholesterol. Feb. 4.

Hindu (1990). The cholesterol connection. Oct. 7.

Hindu (1990). Does oat fibre reduce cholesterol. May 20.

Hurst, J.W., Becker, A.E. and Wilcox, R.B. (1985). Coronary Heart Disease, Mc Graw Hill Book Company, 6.2,. 6.22.

ICMR (1981). Gopalan, C., Ramasastri, B.V. and Balasubramaniam, S.C. In Nutrive value of Indian Foods. NIN: ICMR Hyderabad. 60-110.

ICMR (1984). Recommended daily allowances. NIN: ICMR Hyderabad.

ICMR (1989). Gopalan, C., Ramasastri, B.V. and Balasubramaniam, S.C. Nutrive value of Indian Foods. NIN: ICMR Hyderabad. 60-110.

International Collaborative Study Group (1986). Metabolic epidemiology of plasma cholesterol mechanisms of variation of plasma cholesterol within populations and between populations. Lancet ii(8574): 91-95.

Jacqueline C.M. Witteman, Diederick E. Grobbee, Frans J Kok, Albert Hofman, Hans A Valkenburg (1989). Increased risk of atherosclerosis in women after the menopouse. British Journal of Medicine. 298 (6674): 642-644.

Jaimala Bhatt (1989). Dietetics How Far in practice. Nutrition Society of India Twenty first Annual meeting. p. 37.

Jajoo, V.N., Kalantri, S.P., Gupta, O.P., Jain, A.P. and Gupta, K. (1988). The prevalence of Coronary heart disease in rural population from central India. Journal of Association Physician of India. 36: 689-963.

Jaya, P. and Kurup, P.A. (1987). Magnesium deficiency and metabolism of lipids in rats fed cholesterol free and cholesterol containing diets. Indian Journal of Biochemistry and Biophysics. 24(2): 92-95.

Jayakumari, N. and Kurup, P.A. (1979). Effect of blackgram fiber on the concentration of cholesterol phospholipids and triglycerides in the serum, liver arota and heart in rats fed high fat cholesterol. Atherosclerosis. 33: 41.

Jayanta Dutta and Mukesh Paul (1983). Nutrition and the elderly, Diet and Heart. Swasth Hind. XXVII(6): 137-140.

Jean Louis Vigne, Denis Lairon, Patrick Borel, Henri Portugal, Anne-Marie Paul, Jacques Christian Hauton and Huguette Lafont (1987). Effect of pectin, wheat bran and cellulose on serum lipids and lipoproteins in rats fed on a low-or-high fat diet. British Journal of Nutrition. 58(3): 405-413.

Jean Weiningar and George, M. Briggs (1983). Water insoluble fibre in the diet have a beneficial effect in the prevention of Atherosclerosis. Nutrition update volume I. 182-185.

Jeanne H. Freeland-Graves, Wu-Hsin Han, Friedman, B.J. and Rose Ann L. Shorey (1980). Effect of dietary Zn/Cu ratios in cholesterol and HDL-cholesterol levels in women. Nutrition Reports International. 22(2): 285.

Jenkins, D.J.A., Leeds, R.A., Slavin, B., Mann, J. and Jepson, E.M. (1979). Dietary fiber and blood lipids. Reduction of Serum cholesterol in type II hyperlipidemia by guar gum. The American Journal of Clinical Nutrition. 32(1): 16-18.

Jenkins, D.J.A., Wong, G.S., Patten, R., Bird, J., Hall, M. and Buckley, G.C. (1983). Leguminous seeds in the dietary management of hyperlipidemia. The American Journal of Clinical Nutrition. 38(4): 567-573.

John, W.T. Dickerson and Lee, H.A. (1978). Nutrition in the clinical management of disease. Pub. Edward Arnold p. 148.

Jonathan B. Meddings, David, K. Spady and John M. Dietschy (1987). Kinetic characteristics and mechanism of regulation of receptor-dependent and receptor-independent LDL transport in the liver of different animal species and humans. American Heart Journal 113(2): 475-81.

Kannel, W.B. (1978). Status of Coronary heart disease risk factors. Journal of Nutrition Education. 10: 10.

Kannel, W.B. (1987). New perspectives on Cardiovascular risk factors. American Heart Journal. 114(2): 10-13.

Kareberg (1989). Role of genetic factors in atherosclerotic disease. The American Journal of Clinical Nutrition. 49(5): 1025-1029.

Kark, J.D., Friedlander and Stein, Y. (1985). Coffee, tea and plasma cholesterol. British Medical Journal. 291: 699-704.

Kenneth A. Perkins (1989). Smoking plus hypercholesterolemia and Coronary risk. American Heart Journal. 114(6): 1527.

Killian Robinson, Ronan M. Conroy and Risteard Mulcahy (1989). When does the risk of acute coronary heart disease in ex-smokers fall to that in non-smokers. A retrospective study of patients admitted to hospital with a first episode of myocardial infarction or unstable angina. British Heart Journal. 62(1): 16-19.

Krause, M.V. (1984). Food Nutrition and diet therapy. VII edition. W.B. Sunder Company. p. 563.

Kuo, P.T. (1983). Hyperlipoproteinaemia and atherosclerosis: Dietary Intervension. American Journal of Medicine. 23: 15-18.

Kurup, P.A. (1989). Nutritional factors and Atherosclerosis. Proceedings of the Nutrition Society of India. 35: 27-37.

Kushi, L.H., Samonds, K.W., Lacey, J.M., Brown, P.T., Bergan, J.G. and Sacks, F.M. (1988). The association of dietary fat with serum cholesterol in vegetarians. The effect of dietary assessment on the correlation coefficient. The American Journal of Epidermiology. 128: 1054.

Lawrence H. Kushi, Aaron R. Folsom, David R. Jacobs, Russell V. Luepker, Patricia J. Elmer and Henry Blackburn (1988). Educational attainment and nutrient consumption patterns. The Minnesota Heart Survey. Journal of American Dietetic Association 88(10): 1230-1235.

Lee, H.A. and Dickerson, J.W.T. (1978). Diet in the management of Cardiovascular disease. Nutrition in the clinical management of Disease. p. 144-145.

Leelamma, S., Menon, P.V.G. and Kurup, P.A. (1978). Nature and quantity of dietary protein and metabolism of lipids in rats fed normal and atherogenic diet. Indian Journal of experimental Biology. 16(1): 29-35.

Lehtonen, A. and Viikari, J. (1978). Serum triglycerides and cholesterol and serum high density lipoprotein cholesterol in highly physically activemen. Acta Medica Scandinavica. 204(1/2): 111-114.

Lenegre, J. (1971). Ischaemic Heart disease. Swasth Hindi XV(1): 35-40.

Levy, R.I. (1985). Cholesterol and Cardiovascular disease - No longer whether but rather than in whom, and how? Circulation No. 72, pp. 686-691.

Liebman, M. and Bazzarre, T.L. (1983). Plasma lipids of vegetarian and non-vegetarian males effect of egg consumption. The American Journal of Clinical Nutrition 38(4): 612-619.

Lief Lapidus, Henrik Anderson, Calle Bengtsson and Ingvar Bosaeus (1986). Dietary habits in relation to incidence of Cardiovascular disease and death in women a 12-year follow up of participants in the population study of women in Gothenburg Sweden. The American Journal of Clinical Nutrition. 44(4): 444-48.

Lithell, H., Ingemar Selinus and Vessby, B. (1984). Lack of effect of a purified bran preparations in men with low HDL cholesterol. Human Nutrition: Clinical Nutrition. 38c(4): 309.

Liu, G.C., Coulston, A.M. and Reaven, G.M. (1983). Effect of high carbohydrate low fat diets on plasma glucose insulin and lipid responses in hypertriglyceridemic humans. Metabolism 32(8): 750-753.

Lybus C. Hillman, Sue G. Peters, Canne Fisher and Eru W. Pomare (1985). The effects of the fiber components pectin, cellulose and lignin on serum cholesterol levels[1-3]. The American Journal of Clinical Nutrition 42(2): 207-213.

Maheshwari, M.C. (1985). Stroke Swath hind XXIX(7): 163-64.

Marc S. Jacobson (1987). Cholesterol oxides in Indian ghee possible cause of unexplained high risk of Atherosclerosis in Indian immigrant population. Lancet 4(8560): 656-658.

Marianne Stasse-Wolthuis, Hugo F.F. Albers, Joke G.C. Van Jeveren and J. Wil De Jong (1980). Influence of dietary fiber from vegetables and fruits, bran or citrus pectin on serum lipids, feeal lipids and colonic function. The American Journal of Clinical Nutrition. 33(8): 1745-1756.

Mario R. Garcia-Palmieri, Paul Sortie, Jeanne Tillotson, Raul Costas, Ednacordero and Maresa Rodriguez (1980). Relationship of dietary intake to subsequent Coronary heart disease incidence : The Puerto Rico Heart Health Programme. The American Journal of Clinical Nutrition. 33(8): 1818-1827.

Marja Riitta Taskinen, Esko A. Nikkila, Matti Valimaki, Timo Kuusi, Y. Antero Kesaniemi and Reinoylikahri (1987). Alcohol Induced changes in serum lipoproteins and in their metabolism. American Heart Journal. 113(2): 458-63.

Mary P. Bowman, Joan Van Doren, L. Janette Taper, Forrest W. Thye and Ritchey, S.J. (1988). Effect of Dietary Fat and cholesterol on plasma Lipids and lipoprotein Fractions in Normolipidemic men. Journal of Nutrition. 118(5): 555-560.

Mary Greig, John Pemberton, Iris Hay and Gilbert Mac Kenzie (1980). A prospective study of the development of coronary heart disease in a group of 1202 middle aged men. Journal of Epidermiology Community health. 34(1): 23-30.

Menon, P.V.G. and Kurup, P.A. (1974). Dietary fibre and cholesterol metabolism. Atherosclerosis 19: 315.

Menon, P.V.G. and Kurup, P.A. (1976). Effect of administration of the polysaccharide fraction from fibre and cholesterol metabolism. Indian Journal of Biochemistry and Biophysics. 13(1): 46-51.

Merk D. Hegsted and Lynne M. Ausman (1988). Diet Alcohol and Coronary Heart disease in men. Journal of Nutrition. 118(10): 1184-1189.

Michael L. Burr, Ann M. Fehily and Barbara K. Butland (1986). Alcohol and high density lipoprotein Cholesterol : a randomized controlled trial. British Journal of Nutrition. 56(1): 81-86.

Milton Z. Nichaman and Peggy Hamm (1987). Low-fat high-carbohydrate diets and plasma cholesterol. The American Journal of Clinical Nutrition. 45(5): 1155-1160.

Moore, D.J., Fiona J. White, Flatt, P.R. and Parke, D.V. (1985). Beneficial short-term effects of unprocessed wheat Bran on Lipid and Glucose metabolism in man. Human Nutrition : Clinical Nutrition. 39c(I): 63.

Moore, M.C., Guzman, M.A., Schilling, P.E. and Strong, J.P. (1981). Dietary-atherosclerosis study on decreased persons. Journal of the American Dietetic Association. 79(6): 668-672.

Morris, J.N., Marr, J.W. and Clayton, D.G. (1978). Dietary fibre from cereals and the incidence of coronary heart disease. Journal of Plant Foods. 3(1&2): 45.

Muraleedhara Kurup, G., Leelamma, S. and Kurup, P.A. (1982). Effect of Lysine and Methionine on Lipid metabolism in Rats. Indian Journal of Biochemistry and Biophysics. 19(5): 347.

Nalini Srinivason and Radha K. Shanmugasundaram (1989). Effect of plant protein substitution in lowering plasma cholesterol, LDL and cholesterol Elimination with high fat diets. Nutrition Report International. 39(2): 253-63.

National Center for Health Statistics (1987). Current estimates from the National Health Interview Study. U.S. Public Health Service. p. 98.

Nestel, J.P., Connor, E.W., Reardon, F.M., Connor, S., Wong, S. and Boston (1984). Suppression by Diets Rich in fish oil of very low Density Lipoprotein Production in Man. Journal of Clinical investment. 74: 82-89.

Norman M. Kaplan (1989). Importance of Coronary Heart disease Risk factors in the management of Hypertension. American Journal of Medicine. 86(1B): 1-4.

Nutrition News (1986). Diet and Atherosclerosis. 7(3): 2.

Nutrition News (1990). Dietary factors in essential hypertension. 11(4): 1-6.

Olendzki, M.C., Tolphin, H.G. and Buckely, E.L. (1981). Evaluating Nutrition intervention in Atherosclerosis : Some Theoretical and Practical considerations. Journal of American Dietetic Association. 79: 9-16.

Oliver, M.F. (1987). Dietary fat and Coronary heart disease. British Heart Journal. 58(5): 423-428.

Ozario (1988). Heart attacks, Developing in developing Countries. World Health, 26-27.

Padmavati, S. (1980). Smoking and circulatory diseases. Swasth hind. XXIV(3 & 4): 64-66.

Panda, N.C., Sahu, B.K., Rao, A.G. and Panda, S.K. (1979). Tannic acid of tea and coffee as incriminating factor for heart disease. The Indian Journal of Nutrition and Dietetics. 16(9): 348-55.

Pasricha, S. (1985). Some theraputic diets. National Institute of Nutrition, Hyderabad. p. 31-36.

Paul J. Nestel (1987). High density lipoprotein turnover. American Heart Journal. 113(2): 518-21.

Paul J. Nestel (1987). Polyunsaturated fatty acids $(n-3, n-6)^{1-3}$. The American Journal of Clinical Nutrition. 45(5): 1161-1167.

Pauline M. Herold and John Ekinsella (1986). Fish oil consumption and decreased risk of Cardiovascular disease : a comparison of findings from animal and human feeding trials. The American Journal of Clinical Nutrition. 43(4): 566-578.

Pennington, J.A.T. (1988). Association between diet and health. The use of food consumption measurements nutrients, data bases and dietary guidelines. Journal of American Dietetic Association. 88(11): 1221-1223.

Petri T. Kovanen (1987). Regulation of Plasma Cholesterol by hepatic low density lipoprotein receptors. American Heart Journal. 113(2): 464-469.

Phillipson, B.E., Rothrock, D.W., Connor, W.E., Harris, W.S. and Illingworth (1985). Reduction of plasma lipids lipoproteins and Apoproteins by Dietary Fish oils in patients with Hypertriglyceridemia. The New England Journal of Medicine. 312(19): 1210-1216.

Pirjo Pietinen and Jussi K. Huttuwen (1987). Dietary determinants of plasma high density lipoprotein cholesterol. American Heart Journal. 113(2): 620-625.

Prema, L. and Kurup, P.A. (1973). Effect of feeding the protein fraction from horsegram at different levels on the lipid levels, faecal sterols and bite salts excretion in high fat high cholesterol diet fed rats. Atherosclerosis. 18: 269.

Prema, P. and Kurup, P.A. (1979). Effect of feeding, cooked whole tubers on lipid metabolism in rats fed cholesterol free and cholesterol containing diet. Indian Journal of experimental Biology. 17(12): 1241-1345.

Prema, P., Saraswathy Devi, K. and Kurup, P.A. (1978). Effect of purified starch from common Indian edible tubers on lipid metabolism in rat fed atherogenic diets. Indian Journal of Biochemistry and Biophysics. 15(5): 423-25.

Premakumari, K. and Kurup, P.A. (1980). Effect of rice and tapioca on lipids concentration in tissues in rats under different condition of dietary intake of protein and fat. Indian Journal of experimental Biology. 18(10): 1119-1122.

Premakumari, S. and Sundaravalli, R. (1976). Influence of dietary sunflower oil on blood cholesterol level in human subjects. The Indian Journal of Nutrition and Dietetics. 13(11): 371-375.

Prina Einav, Shoshana Mokady and Vri Cogan (1981). Effect of wheat Gluten on cholesterol metabolism in growing rats. Nutrition Reports International. 24(5): 1001.

Pritikin, N. (1989). Risk factors in heart disease. Herald of Health. Oct. p. 4.

Pursani, M.L., Goel, U.K., Tyagi, R.P. and Mittal, H.S. (1987). Serum Copper in Coronary heart disease. Swasth Hind XXI: 356-357.

Quioque, E.S. (1970). Comparison weighing and interview methods in food consumption surveys. Phillipine Journal of Nutrition. 23(2): 18-37.

Rabkin, S.W. (1984). Effect of cigarette smoking cessation on Risk factors for Coronary Atherosclerosis A control Clinical trial. Atherosclerosis 53(2): 173-184.

Rajammal P. Devadas, Anuradha, V. and Sheela Ramachandran (1980). Dietary pattern and serum cholesterol levels of selected Tamilian and Gujarathi women. The Indian Journal of Nutrition and Dietetics. 17(5): 159-163.

Ramani, R., Nirmala K. Murthy and Annapurani, S. (1986). Fibre oxalic acid and phytin phosphorus in the diets and blood cholesterol levels of selected adult population of Tamil Nadu. The Indian Journal of Nutrition and Dietetics. 23(11): 309-312.

Richter, W.O., Weisweiller, P. and Schwandt, P. (1984). Effect of soyabean protein on serum lipoprotein. Nutrition Abstracts and Reviews. 54(4): 311.

Robinson, C.H., Lawler, M.R., Wanda, L. and Anu, E. (1987). Normal and Theraputic Nutrition 17th Edition. Macmillian Publishing Company. p. 341.

Ronan M. Conroy, Risteard Mulcahy, Noel Hickey and Leslie Daly (1985). Is a family history of Coronary heart disease an independent Coronary risk factor. British Heart Journal. 53(4): 378-381.

Roopa Sarathy and Saraswathi, G. (1983). Effect of tender cluster beans pods on cholesterol levels in rats. The American Journal of Clinical Nutrition. 38: 295.

Ruth M. Kay, Sabry, Z.I. and Adlee Esima (1980). Multivariate analysis of diet and serum lipids in normal men. The American Journal of Clinical Nutrition. 33(12): 2566-2572.

Samman, S. and Robert, D.C.K. (1987). The importance of the non protein components of the diet in the plasma cholesterol response of rabbits to casein, Zinc and Copper. British Journal of Nutrition. 57: 27-33.

Saraswathy Devi, K. and Kurup, P.A. (1970). Effect of certain Indian pulses on the serum, liver and aortic lipid levels in rats fed a hypercholesterolemic diet. Atherosclerosis 11: 479.

*Saraswathy Devi, K. and Kurup, P.A. (1972). Atherosclerosis 15: 223. Kurup, P.A. Nutritional factors and atherosclerosis. Proceedings of the Nutrition Society of India. 35: 27-37 (1989).

*Saraswathy Devi, K. and Kurup, P.A. (1973). Atherosclerosis 18: 389. Kurup, P.A. Nutritional factors and atherosclerosis. Proceedings of the Nutrition Society of India. 35: 27-37 (1989).

Satinder, A.K., Saskar, S., Majmumdar and Chakravarthi, R.N. (1987). Effect of ascorbic acid deficiency on the development of experimental atherosclerosis. Indian Journal of Medical Research. 86: 351-360.

Scharffenberg, J.A. (1989). Two minute talk - 70% of people die. Herald of Health. July p. 22.

Scott M. Grundy and Jeffrey J. Abrams (1983). Comparison of action of soyprotein and casein on metabolism of plasma lipoprotein and cholesterol in humans. The American Journal of Clinical Nutrition. 38(1): 245.

Sharma, R.D. (1989). Hypocholesterolemic Agents. Proceedings of the Nutrition Society of India. 35: 52-53.

Sharma, R.D. and Ruckmini, C. (1987). Hypocholesterolemic activity of unsaponifiable matter of rice bran oil. Indian Journal of Medical Research. 85: 278-281.

Sharper, A.G., Polcock, S.J., Phillips, A.N. and Walker, M. (1986). Identifying men at high risk of heart attacks: Strategy for use in general practice. British Medical Journal. 293(2): 474-479.

Sheela Sidharam (1988). Consumption pattern of food known to influence serum lipids. Proceedings of Nutrition Society of India. 34: 126.

Sheila John and Easwaran, P.P. (1989). Nutritional aspects of atherogenesis. Current trends in atherosclerosis. Research p. 24.

Shepherd, J., Betteridge, D.J., Durrington, P., Laker, M. and Lewis, B. (1987). Strategies for reducing Coronary heart disease and desirable limits for blood lipid concentrations : guidelines of British Hyperlipidaemic Association. British Medical Journal 295(14): 1245-46.

Shorey, R.L., Day, P.J., Willis, R.A., Lo, G.S., Steinke, F.H. (1985). Effects of soybean polysaccharide on plasma lipids. Journal of the American Dietetic Association. 85(11): 1461-1465.

Simopoulous, A.P. (1985). Nutrition Reviews. 43(2): 33-40.

Smith, A.D., Karmally, W. and Brown, V. (1987). Treating hyperlipidemia. Indian Heart Journal. 42(3): 39-43.

Sommariva, D., Tirrito, M., Bonfiglioli, D., Pogliaghi, I., Cabrini, E., Bellintani, L. and Fasoli, A. (1985). Changes in the serum lipoprotein pattern induced by Two low-fat diets with a different vegetable content in Hypercholesterolemic patients. Atherosclerosis 56(1): 119-124.

Sreekumar, P. and Kurup, P.A. (1978). Degree of unsaturation of dietary fat and metabolism of lipids in rats fed cholesterol free and cholesterol containing diets. Indian Journal of Experimental Biology. 16(7): 785-791.

Srimathi, V., Seshagiri, P.B., Raju, R. and Ramakrishnan, S. (1981). Effect of Coffee and Tea on cholesterol and Triacylglycerol of Blood serum and human and Rats. The Indian Journal of Nutrition and Dietetics. 18(10): 360-364.

Stringer, M.D., Gorog, P.G., Azadeh Freeman, C. and Kakkar, V.V. (1989). Lipid pexnides and atherosclerosis. British Medical Journal. 298(6669): 281-284.

*Sudhakaran, P.R. and Kurup, P.A. (1974). Journal of Nutrition. 104: 871. Kurup, P.A. Nutritional factors and atherosclerosis. Proceedings of The Nutrition Society of India. 35: 27-37 (1989).

Susan M. Shutler, Ann F. Walker and Graham Low, A. (1987). The cholesterol lowering effects of legumes : Effects of the major nutrients. Human Nutrition : Food Science and Nutrition. 41F(2): 71.

Susan M. Shutler, Gemma M. Bircher, Jacki A. Trendger, Linda M. Morgan, Ann F. Walker and Low, A.G. (1989). The effect of daily baked bean (Phaseolus vulgaris) consumption on the plasma lipid levels of young, normo-cholesterolaemic men. British Journal of Nutrition. 61(2): 257-265.

Swaminathan, M. (1986). Advanced Text Book on Food and Nutrition vol. II. Bangalore Printing and Publishing Co. p. 245.

Thelle, D.S., Arnesen, E. and Forde, O.H. (1983). The tromso heart study. Does Coffee raise Serum cholesterol. The New England Journal of Medicine. 308(24): 1454-1457.

The British dietetic association members news letter (1979). Cholesterol lowering diets. Indian Journal of Nutrition and Dietetics. 16(12): 465.

Third report of a Joint Cardiology Committee (1985). Provision of services for the diagnosis and treatment of heart disease in England and Wales. British Heart Journal. 53(5): 477-482.

Thomas J. Moore (1990). Can cholesterol reduction prolong life.. Hindu Jan. 7..

Thomas Varghese, Anila Mathew and Kurup, P.A. (1982). Effect of Nicotinic Acid on concentration of Aortic Glycosaminoglycans in Rats. Indian Journal of Biochemistry and Biophysics. 19(2): 150-151.

Thompson, P. and Borts, W.M. (1978). Significance of high density lipoprotein cholesterol. Journal of the American Genatrics Society. 26: 440.

Thomas F. Schweizer, Abdav R. Bekhechi, Brigitte Koellreutter, Silvia Reimann, Danial Pometta and Blaise Abron (1983). Metabolic effects of dietary fiber from dehulled soybeans in humans. The American Journal of Clinical Nutrition. 38(1): 1-5.

Thoroqood M. Carter, Benefield, R., Mcphesson, L. and Manni, L. (1987). Plasma lipids and lipoprotein cholesterol concentrations in people with different diet in Britain. Indian Journal of Medical Science. 43(2): 48.

Tiwari, A.K., Gode, J.D. and Dabey, G.P. (1989). Effect of cigarette smoking on serum total cholesterol and HDL cholesterol in normal subjects and Coronary heart patients. Indian Heart Journal. 41(2): 137-142.

Tunstall H. Pedoe, Heller, R. and Rose, G. (1981). The effect of health education on knowledge attitudes, behaviour and risk factor levels in the United Kingdom Heart Disease Prevention Project. Journal epidemology and Community Health. 35(2): 150.

Valsala, P. and Kurup, P.A. (1987). Investigations on the mechanism of hyper cholesterolemia in copper deficiency in rats. Journal of Bioscience. 12(2): 137-42.

Varhandel, E. and Zilver Smith, D.B. (1957). Journal of Laboratory and Clinical Medicine. 50: 152.

Vijayammal, P.L. and Kurup, P.A. (1978). Effect of pyridoxine on lipid metabolism in rat. Australian Journal of Biological Science. 31: 20.

Vijayammal, P.L. and Kurup, P.A. (1981). Thiamine and metabolism of glycosaminoglycans in rats fed cholesterol free and cholesterol containing diet. Indian Journal of Biochemistry and Biophysics. 18(2): 134-138.

Vijayagopalan, P. and Kurup, P.A. (1970). Effect of dietary starches on the serum, aorta and hepatic lipid levels in cholesterol fed rats. Atherosclerosis 11: 257.

Vijayagopalan, P., Saraswathy Devi, K., Kurup, P.A. (1973). Effect of dietary fiber on serum cholesterol level. Atherosclerosis 17: 156.

Vivien Reid, Graham, I., Hickey, N. and Mulcahy, R. (1984). Factors affecting dietary compliance in Coronary patients included in a secondary prevention programme. Human Nutrition : Applied Nutrition 38A(4): 279-81.

Wahrenberg, H. (1989). Regional lipolysis. Hopsital Practise. 24(10): 214.

Watkins, L.O. and Jacobs, D.R. (1986). High density lipoprotein level in blood and incidence of coronary heart disease. Circulation 74(6): 1217-1225.

Watts, G.P., Ahmed, W., Quiney, J., Houslton, R., Jackson Ciles, P. and Lewu, B. (1988). Effective lipid lowering diets including Lean meat. British Medical Journal. 296(6674): 235-237.

Wendy Y. Craig, Glenn E. Palomaki and James E. Haddow (1989). Cigarette smoking and serum lipid and lipoprotein concentrations an analysis of published data. British Medical Journal. 298(6676): 784-88.

William E. Stehbens (1989). Diet and Atherogenesis. Nutrition Reviews. 47(1): 1-10.

William S. Harris, Carlos A. Dujovne, Marjorie Zucker and Bruce Johnson (1988). Effect of a low saturated fat, low cholesterol fish oil supplement in Hypertriglyceridemic patients. Annals of Internal Medicine. 109(6): 465-470.

Willem Erkelens, D. and John D. Brunzell (1980). Effect of controlled alcohol feeding on triglycerides in patients with outpatient 'Alcohol hypertriglyceridemia'. Journal of Human Nutrition. 34: 370.

Wood, P.A., Stefanich, M.C. and Dreon, D.M. (1988). Changes in plasma lipids and lipoprotein in over weight men during weight loss through dieting as compared with exercise. The New England Journal of Medicine. 319: 1173-1179.

Wolthius (1980). Influence of dietary fibre from vegetables and fruits, bran citrus pectin on serum lipids. The American Journal of Clinical Nutrition. 33(8): 1745-56.

* Original not seen

APPENDICES

APPENDIX I

KERALA AGRICULTURAL UNIVERSITY

Questionnaire to elicit information regarding the socio-economic and food consumption pattern of the families of atherosclerotic patients

1. Name of the patient	:	
2. Age	:	
3. Sex	:	Male/Female
4. Religion	:	Hindu ( )
		Christian ( )
		Muslim ( )
		Any other ( )
		(Please tick( ) for the answer)
5. Residential	:	Rural ( ) Urban ( )
6. Monthly income of the family	:	
7. Sources of income of family	:	Permanent job ( )
		Temporary job ( )
		Agriculture ( )
		Business/Rent/
		Interest from Bank ( )
		Pension and other source ( )

8. Family size and composition

Sl. No.	Relationship with the patient	Sex	Age	Education	Occupation	Monthly income	Health condition

9. Monthly expenditure pattern of the family

Sl. No.	Items	Monthly expenditure in rupees
1.	Food	
2.	Clothing	
3.	Housing/shelter	
4.	Travelling	
5.	Education	
6.	Entertainment	
7.	Health	
8.	Saving	
9.	Miscellaneous	

10. Food habit of the family : Vegetarian/Non vegetarian

11. Frequency of purchase of various food items by the family

	Frequency of purchase			
	Daily	Weekly	Monthly	Occa-sionally
1. Cereals				
2. Pulses				
3. Leafy vegetables				
4. Roots & Tubers				
5. Other vegetables				
6. Fruits				
7. Milk & milk products				
8. Fish				
9. Meat				
10. Egg				
11. Oil seeds				
12. Fats and oils				
13. Sugar/jaggery				
14. Spices & condiments				
15. Bakery items				

12. Frequency of use of various food items

Food items	Frequency of use					
		Weekly				
	Daily	Once	Less than 3	More than 3	Occa-siona-lly	Never
1. Cereals						
Rice						
Wheat						
Rave						
Ragi						
Maida						
2. Pulses						
Bengalgram						
Blackgram						
Cowpea						
Redgram						
3. Roots and tubers						
Potato						
Tapioca						
Yam						
Colacasia						
Carrot						
Beetroot						
4. Leafy vegetables						

5. Other vegetables

6. Fruits

7. Milk & milk products

   Milk

   Curd

   Buttermilk

   Butter

   Cheese

8. Flesh foods

   Chicken

   Mutton

   Duck

   Beef

9. Fish

10. Egg

    Hens

    Ducks

11. Nuts and oil seeds

    Groundnut

    Gingelly seeds

    Coconut

12. Fats/oil

13. Sugar/jaggery
14. Processed foods
15. Bakery items

13. One day meal pattern of the family

Food items	Meals	Time
1. Cereals		
2. Pulses		
3. Roots & tubers		
4. Leafy vegetables		
5. Other vegetables		
6. Fruits		
7. Milk & milk products		
8. Meat		
9. Fish		
10. Egg		
11. Fats/oils		
12. Sugar/jaggery		
13. Processed foods		
14. Bakery items		

14. The use of following items in a day by the family members

Weight in gm

a. Egg

b. Milk

c. Dalda ghee

d. Oil

e. Fish

f. Meat

Chicken

Duck

Beef

Goat

Pork

15. Which oil is used for cooking in your family. Tick ( ) for the correct answer.

1. Gingelly oil ( )

2. Groundnut oil ( )

3. Sanola ( )

4. Coconut oil ( )

5. Vanaspathi ( )

6. Palm oil ( )

7. Any other ( )

16. Methods of cooking of different food items

Food items	Boiling		Steaming	Frying	Any other
	Absorption	Straining			
1. Cereals					
2. Pulses					
3. Roots & tubers					
4. Leafy vegetables					
5. Other vegetables					
6. Fruits					
7. Meat + Fish					
8. Egg					
9. Milk + milk products					
10. Oil seeds					

17. Diet during different physiological conditions

1. Infancy	
2. 3-6 years	
3. School going children	
4. Adolescents	
5. Pregnancy	
6. Lactation	
7. Old age	

18. Diet during special occasi

Occasion	Items
Birthday	
Marriage	
Death	
Religious festivals	

APPENDIX II

KERALA AGRICULTURAL UNIVERSITY

Questionnaire to elicit information regarding the personal characteristics and dietary pattern of the atherosclerotic patients

1. Name of the patient :
2. Age :
3. Sex : Male/Female
4. Food habit : Vegetarian/Non vegetarian
5. Blood group :
6. Amount of cholesterol in blood :
7. Age at onset of Heart disease :
8. History of incidence of the disease in the relatives of the patients (please tick ( ) in the appropriate column)

Diseases	Father	Mother	Father and mother	Sister	Brother	Father's Brother and sister	Mother's Brother/ Sister	No history
Heart disease								
Diabetic								
Obesity								
Hyper-tension								
Kidney disease								
Any other								

9.a. Does the patient have heart disease, hypertension kidney disease etc. Yes ( ) No ( )

b. If so, please specify the diseases

(a)

(b)

(c)

10. In which of the following group are you included?

1. Over weight
2. Under weight
3. Normal

11. Please give the following

1. Height
2. Weight

12.a. Are you in the habit of drinking alcohol?

Yes ( ) No ( )

b. If you have stopped indicate reasons

1.

2.

13.a. Are you in the habit of smoking?

Yes ( ) No ( )

b. If you have stopped indicate reasons

1.

2.

14.a. Are you in the habit of chewing betel leaves?

Yes ( ) No ( )

b. If you have stopped, indicate reasons

i)

ii)

15.a. Do you take coffee/tea daily?

Yes ( ) No ( )

b. If yes, how many times in a day

c. Do you have it with sugar and milk

d. After the onset of the disease have you decreased the number of times in a day of drinking these beverages

Yes ( ) No ( )

e. If so give reason

16. How did you first diagnose the onset of disease?

17. How did you diagnose the onset of the disease?

18. Indicate which type of medical treatment you have been getting

1. Nothing
2. Medical practitioner
3. Hospital general clinic
4. Hospital speciality clinic
5. Ayurvedic treatments
6. Homoeopathic
7. Natural therapy

19. Treatment after diagnosis

    1. No treatment
    2. Diet control
    3. Oral drugs
    4. Injection
    5. Diet control and oral drugs
    6. Diet control and injection
    7. Oral drugs and injection
    8. Diet control, injection and oral drugs
    9. Ayurvedic medicine
    10. Homoeopathic medicine
    11. Natural therapy

20. In connection with this disease, how often do you visit the hospital

21. Do you get any instruction regarding diet control from the clinic?

22. Do you obey these instructions?

    Yes ( ) No ( )

23. If no, please give reason

    i)

    ii)

24. Did the following have any influence in changing your dietary habit (please tick ( )

1.	Your education	Yes/No
2.	Medical class attended	Yes/No
3.	Articles in papers and magazine	Yes/No
4.	Radio/TV programmes	Yes/No
5.	Advertisements	Yes/No
6.	Conversations with relatives, friends, neighbours etc.	Yes/No
7.	Other diabetic patients	Yes/No

25. Do you know what type of foods must be avoided on restricted in the diet of Atherosclerotic patients?

26. If yes, specify the items

i)

ii)

27. Do you know what type of foods are to be included in larger quantities in the Atherosclerotic diet

Yes ( ) No ( )

28. If yes, list out the items

i)

ii)

29. Have you heard about the food exchange list?

Yes ( ) No ( )

30. If yes, what is its importance, from where did you obtain the information?

31.a. Are you in the habit of taking exercise?

Yes ( ) No ( )

b. If yes, how much time in a day do you spend for it

c. Which type of exercise do you follow

32.a. At what time do you go to bed?

b. At what time do you wake up?

33.a. Do you woke up frequently at night?

Yes ( ) No ( )

b. If yes how many time

c. Please give reason

34.a. Do you feel energetic when you wake up in the morning?

Yes ( ) No ( )

b. If no, please specify the type of discomfort experienced

35. Medium of transport to the place of work
(Please tick ( ) for the correct answer)

1. Walking ( )
2. Bus ( )
3. Cycling ( )
4. Scooter by self driving ( )
5. Car by self driving ( )
6. Train ( )
7. Any other ( )

36. How many major meals do you have in a day?

1. ( ) 3. ( )

2. ( ) 4. ( )

5. ( )

37.a. Are you in the habit of taking in between meals?

Yes ( ) No ( )

b. If yes, at which time do you take it

c. What type of food stuffs do you taking

1. 2. 3.

38.a. Do you have the habit of eating meals with the family members?

Yes ( ) No ( )

b. Are you in the habit of eating meals from outside the home?

Yes ( ) No ( )

c. If so, please indicate whether

1. Daily ( )

2. Once in a week ( )

3. Two or three times in a week ( )

4. Fortnightly ( )

5. Monthly ( )

6. Occasionally ( )

39. Do you take the packed lunch to your place of work?

Yes ( ) No ( )

40. If yes, specify the items

i)

ii)

41.a. Do you have the desire to eat fried food items?

Yes ( ) No ( )

b. If yes, do you eat such items

42. According to changes in your dietary pattern is there any change in the family dietary pattern

Yes ( ) No ( )

43.a. Are you in the habit of taking any natural foods, which are known to have a beneficial effect on Atherosclerosis

Yes ( ) No ( )

b. If yes, list out the items

1.

2.

3.

4.

5.

44. What type of oil is used for cooking your food (Please tick ( ) right one)

1. Gingelly oil	4. Coconut oil	( )
2. Groundnut oil	5. Palmoil	( )
3. Sanola	6. Vanaspathi	( )
	7. Any other	( )

45.a. Are there any items which are prepared specially for you

Yes ( ) No ( )

b. If yes, give the details

Items	Boiling		Steaming	Frying	Any other
	Staining	Absorption			

46. Frequency of use of various food items please tick ( ) the suitable column

Food items	Frequency of use of food items					
	Daily	Weekly			Occasionally	Never
		once	twice	3 or more times		
1	2	3	4	5	6	7
1. Cereals						
Rice						
Wheat						
Maida						
Broken wheat						
Ragi						
2. Pulses						
Greengram						
Bengalgram						
Redgram						
Blackgram						

1	2	3	4	5	6	7
3. Roots and tubers						
Potato						
Carrot						
Beetroot						
Tapioca						
Yam						
Colocasia						
Colease						
4. Leafy vegetables						
Amaranthus						
Cabbage						
Drumstick leaves						
Any other						
5. Other vegetables						
Bittergourd						
Ladies finger						
Snakegourd						
Beans						
Any other						
6. Fruits						
7. Milk & milk products						
Milk						
Curd						
Buttermilk						
Cheese						

1	2	3	4	5	6	7
8. Flesh foods						
Mutton						
Chicken						
Beef						
Duck						
9. Fish						
10. Egg						
Hen's						
Duck's						
11. Fats and oils						
12. Sugar						
Jaggery						
13. Processed foods						
Squash						
Jam						
Jelly						
Noodles						
Pickles						
14. Bakery items						

APPENDIX III

KERALA AGRICULTURAL UNIVERSITY

SCHEDULE FOR THREE DAY WEIGHMENT SURVEY

FAMILY DIET SURVEY

1. Name of the head of the family:
2. Name of the patient or patients:
3. Age and sex composition of those who have taken the meal

Age	Adult	12-21	9-12	7-9	5-7	3-5	1-3
M							
F							

4. Food stuff	Weight in gm	Food stuff	Weight in gm

CEREALS

1. Broken wheat
2. Maida
3. Rava
4. Ragi
5. Rice
6. Wheat flour
7. Others

PULSES

8. Bengalgram
9. Blackgram
10. Greengram
11. Kesaridal
12. Lentil
13. Redgram
14. Soybean
15. Cowpea
16. Others

LEAFY VEGETABLES

17. Amaranthus
18. Chekkurmanis
19. Drumstick leaves
20. Others
21. Other vegetables

Food stuff	Weight in gm	Food stuff	Weight in gm
ROOTS AND TUBERS		OTHER FOOD STUFFS	
22. Beet root		43. Betel leaves	
23. Carrot		44. Biscuits, salt	
24. Potato		45. Biscuits, sweet	
25. Tapioca		46. Bread	
26. Raddish		FRUITS	
27. Onion big		47. Amla	
28. Others		48. Apple	
NUTS AND OILSEEDS		49. Banana ripe	
29. Cashewnuts		50. Lime and orange	
30. Coconut dry		51. Mango ripe	
31. Coconut fresh		52. Melon-water	
32. Groundnut		53. Papaya ripe	
33. Others		54. Plantain ripe	
MILK & MILK PRODUCTS		55. Tomato ripe	
34. Milk		56. Others	
35. Curds		FISH	
36. Butter milk		57. Fish fresh	
37. Skimmed milk		58. Fish dry	
38. Cheese		59. Prawns	
FATS AND OILS		OTHER FLESH FOODS	
40. Ghee		60. Meat, beef	
41. Hydrogenated oil		61. Chicken	
42. Cooking oil		62. Mutton	
		63. Any other	

Food stuff	Weight in gm	Food stuff	Weight in gm
64. Liver		70. Alcoholic beverages	
65. Egg		71. Deserts	
66. Sugar		72. Sweets	
67. Jaggery		73. Horlicks	
68. Papad		74. Maltova	
69. Sago		75. Any other	

Dietary information

Meal pattern	Type of preparation	Ingredients used	Raw amount (g/ml)	Total cooked amount (g/ml)
a	b	c	d	e
Early morning				
Breakfast mid morning				
Lunch				
Evening tea & snacks				
Dinner				
Others				

APPENDIX IV

PROCEDURE FOR THE ESTIMATION OF CHOLESTEROL

Total cholesterol was estimated by the method of Abell (1952)

Reagents

1. 33 per cent KOH
2. Absolute ethanol
3. Ethonolic KOH - 6 ml of 33 per cent KOH in water was added to 94 ml of absolute ethanol
4. Petroleum ether (60 to 80°C) (AR)
5. Colour reagent - 20 ml of acetic anhydride was cooled in ice. 1 ml of concentrated H_2SO_4 was added to this with shaking. It was cooled for 10 minutes and 10 ml of glacial acetic acid was added and allowed to attain room temperature.

An aliquot from the lipid extract was pipetted out into a glass stoppered centrifuge tube and evaporated to dryness. 5 ml of ethanolic KOH was added, stoppered and was shaken well. It was then warmed in a water bath at 37 to 40°C for 55 minutes. After cooling to room temperature, 10 ml of Petroleum ether (60 to 80°C) was added and mixed. 5 ml of water was added to this and shaken vigorously for one minute. It was centrifuged at a low speed for 5 minutes. 4 ml of the petroleum ether layer was pipetted out into a test tube and evaporated to dryness at 60°C. A standard (2 mg cholesterol/ml) was also treated in the same manner. 6 ml of colour reagent was added to each tube and kept at 25°C after thorough shaking. 6 ml of colour reagent was taken as the blank. After 30 to 35 minutes, the optical density was read at 620 nm.

APPENDIX V

PROCEDURE FOR THE ESTIMATION OF TRIGLYCERIDES

Triglycerides were estimated by the method of van Handel and Zilversmit (1957) with the modification that florisil was used to remove phospholipids.

Reagents

a) Chloroform - AR

b) Florisil

c) Ethanolic KOH - 0.4%

d) 2 g of KOH was dissolved in 100 ml of ethanol this was then diluted 5 times with ethanol

e) H_2SO_4 - 0.2 N

f) Sodium metaperiodate - 0.05 m

g) Sodium arsenite - 0.5 m

h) Chromotropic acid

2 g of chromotropic acid (or 2.24 g sodium salt) was dissolved in 200 ml distilled water. 600 ml of concentrated sulphuric acid was added slowly to 300 ml of distilled water which was chilled in ice. This chilled and diluted acid was then added to the chromotropic acid solution (0.25 mg/ml).

2 g of florisil was taken in a glass stoppered tube and 3 ml of chloroform was added. An aliquot of the extract was layered on top of florisil and mixed. More chloroform

was then added to this to a total volume of 10 ml. It was then stoppered, shaken intermittently for about 10 minutes and then filtered through a filter paper. 1 ml of the filtrate was pipetted out into each of 3 tubes. 1 ml of working standard of glycerol (9 g/ml) was pipetted out into each of 3 tubes. The solvent was evaporated at 60 to 70°C, 0.5 ml of ethanolic KOH was then added to 2 out of the 3 tubes (saponified sample) and 0.5 ml of ethanol was added to the third tube (unsaponified sample). The tubes were closed and kept at 60 to 70°C for 15 minutes. 0.5 ml of 0.2 n H_2SO_4 was added to each tube and the tubes were then placed in gently boiling water bath for 15 minutes to remove alcohol. They were then cooled to room temperature. 0.1 ml of sodium arsenite solution was then added. An yellow colour of iodine appeared and vanished within a few minutes. 5 ml of chromotropic acid was added to each tube and mixed. The tubes were closed and then heated in a boiling water bath for 30 minutes. They were then cooling and the absorbance was read at 570 nm.

APPENDIX VI

EXCHANGE LISTS Pasricha (1985)

VEGETABLE EXCHANGE A

These vegetables may be used a desired carbohydrates and calories are negligible

Leafy vegetables	Other vegetables
Amaranth	Ash gourd
Bathua	Bittergourd
Brussels sprout	Brinjal
Cabbage	Calabash cucumber
Celery	Cauliflower
Coriander leaves	Cho-cho
Curry leaves	Cucumber
Fenugreek leaves	Drumstick
Lettuce	French beans
Mint	Khol-khol
Rape leaves	Ladies finger
Spinach	Mango green
Soya leaves	Onion stalks
	Parwar
	Plantain flower
	Pumpkin
	Radish
	Rhubarb stalks
	Snake gourd
	Tinda
	Tomato green
	Turnip

VEGETABLE EXCHANGE B

Carbohydrate - 10 g Calories 50

Root vegetables	Quantity
Beet root	75
Carrot	105
Colocasia	45
Onion big	90
Onion small	75
Potato	45
Sweet potato	30
Tapioca	30
Yam (elephant)	60
Yam	45
Other vegetables	
Artichoke	60
Broad beans	90
Cluster beans	90
Double beans	50
Jack tender	105
Jack fruit seeds	30
Leeks	60
Peas	45
Plantain green	75
Singhara	45

FRUIT EXCHANGE

Carbohydrate - 10 g Calories - 50

Fruit	Quantity	Approximate number or size
Amla	90	20 medium
Apple	75	1 small
Banana	30	1/4 medium
Capegoosebery	150	40 small
Cashew fruit	90	6 medium
Custard apple	15	2
Dates	45	1 small
Figs	60	1/4 small
Grapes	105	20
Grape fruit	150	1/2 big
Jack fruit	60	3 medium pieces
Jambu fruit	50	10 big
Lemon	90	1 medium
Loquat	105	6 big
Mango	90	1 small
Mangosteen	75	2 medium
Melon	270	1/4 medium
Orange	90	1 small
Papaya	120	1/4 medium
Peach	135	2 small
Pear	90	1 small
Pineapple	90	1 1/2 slices round
Plum	120	4 medium
Pomegranate	75	1 small
Strawberry	105	40
Sweet lime	150	1 medium
Tomato	240	4 small
Watermelon	175	1/4 small

APPENDIX (Contd.)

CEREAL EXCHANGE

30 g provide calories: 100, Carbohydrates: 20 g, Protein: 2 g

- Bajra
- Barley
- *Bread
- Cholam
- Cornflakes
- Maize dry
- Oatmeal
- Ragi
- Rice
- Rice flakes
- Rice puffed
- **Sago
- Samai
- Semolina (suji)
- Vermicelli (Savian)
- Wheat flour
- Wheat broken (dalia)
- White flour

* To meet carbohydrates and calories and 5 g sugar, requires

** Supplementation with other high protein foods

LEGUME AND PULSE EXCHANGE

30 g provide calories: 100 g, Carbohydrate: 15 g, Protein: 6 g

- Bengalgram
- Bengalgram roasted
- Basan (Bengalgram flour)
- Blackgram
- Cowgram
- Greengram
- Horsegram
- Kabuli channa (whitegram)
- Lentils
- Moth beans
- Peas, dried
- Rajmah
- Rawan
- Redgram

APPENDIX (Contd.)

FLESH FOOD EXCHANGE

Calories: 70 Protein: 10 g

Food	Quantity (g)
Beef	60
Crab	120 nos.
Egg, duck*	2 nos.
Egg, Hen*	2 nos.
Fish, gib	60
Fish, small	60
Fish, vajra	60
Fowl	60
Liver, sheep	60
Mutton muscle*	60
Pigeon	60
Pork	60
prawn	60

* Provides 100 calories

MILK EXCHANGE

Calories - 100 Protein: 5 g

Butter milk	750 ml
Cheese	30 g
Curd	210 g
Khoa	30 g
Milk, Buffalo	90 ml
Milk, cow	180 ml
Milk, skimmed*	260 ml
Milk skimmed, powder*	30 g

* Provides 10 g protein

FAT EXCHANGE

Almonds	15
Cashewnuts	20
Butter	15
Coconut	30
Ghee	11
Groundnuts roasted	20
Hydrogenated fat (Vanaspati)	11
Oil (coconut, mustard)	11
Pistachionut	15
Walnuts	15

FOOD EXCHANGE

Food exchange	Amount g	Protein	Fat	Carbo-hydrate	Calorie
Cereals	30	2.5	0.3	21	97-100
Pulses	30	6	0.5	17	97-100
Flesh foods	30	5	2	-	38-40
Nuts and oilseeds	30	2	12	4	132-135
Fruits	30	-	-	4	16
Leafy vegetables	100	4	0.5	6	45-50
Other vegetables	100	2	-	10	48-50
Milk and milk products	100	3	4	4	64-65

* Grills and Bosscher (1981)
* Pasricha (1985)

APPENDIX VII

ONE WEEK MENU

MEALS	1 DAY	IInd DAY
Early morning	Coffee or Tea	Coffee or Tea
Breakfast	Dosai Sambar Plantain Tea/coffee	Rice puttu Bengalgram curry Red banana Tea/coffee
Lunch	Rice Beans vlathu Fish curry Curd Cabbage thoran	Rice Fish curry Amaranth thoran Cucumber pachadi
Snacks	Tea Steamed tapioca	Tea Aval uppuma orange
Dinner	Chappathi Egg curry (without yolk) Vegetable salad	Wheat Dosai Mixed vegetable curry

MEALS	IIIrd day	IVth day
Early morning	Coffee/Tea	Coffee/Tea
Breakfast	Vegetable uppuma Steamed banana Tea	Appam Peas curry Plantain
Lunch	Rice Fish curry Cabbage thoran Butter milk	Rice Drumstick leaves thoran Fish curry Vegetable salad
Snacks	Tea Bread	Tea Biscuits
Dinner	Chappathi Dhal curry Plantain flower thoran	Rice Aviyal Carrot thoran

MEALS	Vth day	VIth day	VIIth day
Early morning	Coffee/Tea	Coffee/Tea	Coffee/Tea
Breakfast	Iddly Chutney Plantain Tea	Wheat puttu Egg curry (without yolk) Tea	Uppuma Sprouted bengalgram curry Tea
Lunch	Rice Fish curry Amaranth thoran Carrot pachadi	Rice Cabbage thoran Fish curry Bittergourd thoran	Rice Plantain flower thoran Fish curry Beans ulathu
Snacks	Tea Greengram sundal	Tea Grapes, Biscuit	Tea Vadai
Dinner	Chappathi Vegetable curry Onion salad	Kanji Greengram thoran Tomato salad	Chappathi Mixed vegetable curry/ meat curry Tea

APPENDIX VIII

Distribution of the quantity of food items in one day's menu for the case studies

Total recommended calories 1170 Kcals/day

(Obese patients)

CASE STUDY I AND V

Food items	Quantity (g)	No. of exchange	Protein (g)	Fat (g)	Carbohydrate (g)
Cereals	90	3	6.5	0.5	60
Pulses	60	2	12	1	34
Leafy vegetables	110	1.1	4.4	0.55	6.6
Other vegetables	200	2	4	-	20
Fruits	50	1.6	-	-	6.4
Milk and milk product	200	2	6	6	6
Fish	120	2	20	8	-
Nuts and oil seeds	15	0.5	1	6	2
Oil	20	-	-	20	-
Total intake from diet (g)			54	45	137
Percentage of total calorie			19	35	47
Calculated recommended quantity (g)			59	45	131
Percentage of total calories			20	35	45

CASE STUDY II, III and IV (Normal weight male patients)

Total recommended calories 2350 Kcals/day

Foods	Quantity (g)	No. of exchange	Protein (g)	Fat (g)	Carbo-hydrate (g)
Cereals	400	13	32.5	3.9	273
Pulses	60	2	12	1	34
Leafy vege-tables	150	1.5	6	0.75	9
Vegetable exchange B	150	5	-	-	50
Fruits	175	5.8	-	-	23.2
Milk and curd	150	1.5	4.5	6	6
Fish	30	1	5	2	-
Nuts and oilseeds	20	0.7	1.4	8.4	2.8
Sugar	40	-	-	-	40
Oil	20	-	-	20	-
Total intake from diet (g)			61.4	42.05	438
Percentage of total calories			10.5	16	75
Calculated recommended quantity (g)			60	40	438
Percentage of total calories			10	15	75

CASE STUDY VI and VII (Normal weight Female patients)

Total recommended calories 1800 Kcal/day

Foods	Quantity (g)	No. of exchange	Protein (g)	Fat (g)	Carbo-hydrate (g)
Cereals	300	10	25	3	210
Pulses	30	1	6	0.5	17
Leafy vege-tables	100	1	4	0.5	6
Vegetable Exchange B	75	2.5	-	-	25
Fruits	200	7	-	-	28
Milk and curd	150	1.5	4.5	6	6
Fish	30	1	5	2	-
Nuts and oilseeds	10	0.3	0.6	3.6	1.2
Sugar	40	-	-	-	40
Oil	15	-	-	15	-
Total intake from diet (g)			45.1	30.6	333.2
Percentage of total calories			10	15	74
Calculated recommended quantity (g)			45	30	338
Percentage of total calories			10	15	75

INFLUENCE OF DIETARY HABITS ON ATHEROSCLEROSIS

BY

LEENA P. JOSEPH

ABSTRACT OF THE THESIS
SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENT FOR THE DEGREE OF
MASTER OF SCIENCE
IN FOOD SCIENCE AND NUTRITION
FACULTY OF AGRICULTURE
KERALA AGRICULTURAL UNIVERSITY

DEPARTMENT OF HOME SCIENCE
COLLEGE OF AGRICULTURE
VELLAYANI, TRIVANDRUM

1990

ABSTRACT

A study on the influence of dietary habits on atherosclerosis was conducted among patients attending the Cardiac clinic at Medical College, Trivandrum. An assessment of the socio economic and food consumption pattern of the families of atherosclerotic patients, personal characteristics as well as dietary pattern of the patients and the effect of diet counselling which was imparted to selected case studies was also made.

The results of the socio economic and dietary survey conducted in 100 families of the atherosclerotic patients, attending the Cardiac clinic at Trivandrum Medical College, revealed that, most of the patients belonging to the low socio economic group, resided in the rural areas and were habitual non vegetarians (95 per cent).

Around 63 per cent of the families spent upto 60 per cent of their monthly income on food, purchasing staple food articles like cereals and roots and tubers weekly, perishable foods like milk, fish, leafy vegetables and other vegetables daily, and other foods like oilseeds, cooking oils, sugar and spices and condiments monthly. Pulses, fruits, meat and egg were purchased only occasionally by majority of the families. All the families used rice daily but majority of them were not in the habit of using

cereals other than rice and wheat in their daily dietaries. Milk, fish, vegetables and cereals, palm oil, coconut oil, sugar, coconut, spices and condiments etc. were consumed daily by almost all the families.

A comparison of daily food intake with RDA indicated that consumption of fruits, fish and meat, milk and milk products and sugar were in excess. The intake of almost all the nutrients were found to be satisfactory in the case of male members in the family, while the intakes of most of the nutrients was found to be higher among the female members.

The personal characteristics and dietary pattern of the patients showed that the prevalence of the disease was high in men and the age at onset of disease was between 41-65 years. Twenty two per cent of the patients had a family history of the disease. The occurrence of hypertension (54 per cent), obesity (33 per cent) and diabetic (25 per cent) among the patients was found to be prevalent. Alcoholism, smoking and tobacco chewing were also found in few patients.

Fried food items prepared in palm oil or coconut oil were consumed without any restrictions some patients were in the habit of taking hypocholesterolemic agents like bittergourd, garlic etc. Inclusion of food exchanges which

supplied more calories was food to be more frequent in their daily diets.

Diet counselling at Cardiac clinic was imparted without the help of a dietition and the diet planning was not according to the individual needs of the patients. Most of the patients were not satisfied with the modified diet prescribed in the clinic.

Amount of the actual intake of major nutrients by patients through food weighment survey indicated that the proportion of calories from fat was found to be high in all the patients and the proportion of calories from carbohydrate was considerably low.

The present study indicated that educating the patients. With regard to a modified diet suitable to their individual life styles and economic conditions is very important in the control of the disease. The diet counselling which was imparted by the investigator in selected case studies for six months was found to be effective in controlling blood lipid levels of atherosclerotic patients. This implies that a well balanced diet with the correct proportion of carbohydrates, proteins and fats according to the patients ideal body weights will bring about a reduction in the blood cholesterol and triglyceride levels.