DIETARY HABITS, FAT CONSUMPTION PATTERN AND BLOOD LIPID PROFILE OF ADULTS ENGAGED IN MODERATE ACTIVITY

BY

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DECLARATION

I hereby declare that this thesis entitled "**Dietary habits, fat consumption pattern and blood lipid profile of adults engaged in moderate activity**" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the associateship, fellowship or other similar title of any other University or Society.

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CERTIFICATE

Certified that this thesis entitled "Dietary habits, fat consumption pattern and blood lipid profile of adults engaged in moderate activity" is a record of research work done independently by Ms. Lisa. J. Pooppally under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

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INTRODUCTION

INTRODUCTION

Much ambiguity prevails among the scientific community with respect to the cholesterol generating effect of Kerala dietaries with special reference to the nature and quantity of fat consumed. The incidence of hyperlipideamia and related cardiovascular diseases among Keralites has been attributed to animal protein and also to coconut oil which, though of vegetable origin, has more of saturated fatty acids in comparison to other commonly used vegetable oils. There appears to be some controversy on the relationship between the consumption of coconut oil and coconut kernel and the incidence of cardiovascular diseases. Many people including some of the medical fraternity are of the view that consumption of coconut oil predisposes an individual to cardiovascular diseases. However the cholesterol inducing nature of coconut oil has gained much popularity and publicity even among the so called rural population of Kerala, resulting in reduced consumption of coconut oil and replacement of the same partially or fully with refined palm oil or refined vegetable oil. But, it is interesting to note that the quantity of fat consumed in Kerala is much below the optimum level (NNMB, 1984). Studies correlating epidemidological, dietary and biochemical aspects of nature and the quantity of fat consumed with blood lipid profile of human adults are rare with respect to Kerala, and such a baseline study

would help to develop a hypothesis for further detailed analysis of a complex problem of incidence of cardiovascular diseases, and composition of Kerala dietaries with special reference to fat and coconut oil in particular. Hence the present study on the "Dietary habits, fat consumption pattern and blood lipid profile of adults engaged in moderate activity" was undertaken to assess the interaction between food and fat consumption and blood lipid profile.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

Literature available on different aspects related to the present study entitled "Dietary habits, fat consumption pattern and blood lipid profile of adults engaged in moderate activity is furnished under the following headings.

2.1 Recent trends in dietary habits and fat consumption pattern

2.2 Influence of different dietary constituents on blood lipid profile

2.3 Association of non-dietary risk factors to the blood lipid profile

2.1 Recent trends in dietary habits and fat consumption pattern

Anvita et al. (1993) reported that there is a considerable change in the day to day life of an average Indian due to various reasons like urbanisation increase in percapita income and increase in working women population, scarcity of household labourers as well as technological developments. Recent advances in science and technology has revolutionized the field of food production, processing, distribution and storage, and Gopalan (1995) had remarked that the upwardly mobile Indian at this rate may be walking into a coronary trap as he moves away from the traditional gastronomical wisdom to a world of high fat, high animal protein and high junk diet.

Kuchroo (1992) reported an increased trend in the production, acceptance and consumption of ready to eat snack foods. The print and visual media have a role in the fast changes that have occurred in people's living habits, including their dietary habits (Wasir, 1996).

Wasir (1996) further reported that although undernutrition may be a problem for millions of those below the poverty line, a large part of the population, specially the urban inhabitants, suffer from over nutrition. The adverse effects of the "affluent" diet characterised by excess calorie foods rich in fats, refined sugars, and sodium, but deficient in complex carbohydrate (source of dietary fiber) and potassium have resulted in higher incidence of Coronary Heart Disease, hypertension, and Cerebrovascular disease.

Mario et al. (1980) reported that the urban dietary intake were significantly higher in total fat and lower in carbohydrates particularly starch and the average cholesterol intake were 83 mg/day, higher in urban than in rural men. In urban areas middle and upper income groups have daily intakes of visible fat that range from 20-42 g and the average intakes of urban dwellers are much higher than those in rural areas, and such low intakes of fat reflects both the low availability of edible oils and fat and the low purchasing power. (Achaya 1987). The low income groups and the industrial labour class show similarities in fat intake, and perhaps also have a similar total

family income. What is striking however about urban fat consumption is that even slum dwellers in cities have intakes of fat which closely resemble the rural averages for the same state (NNMB 1984).

Guitiman and Gorden (1982) opined that middle income families residing in urban areas were heavy users of processed foods. Families with large income spent more money on foods in general and also on processed foods than did families with smaller income. Remani et al. (1986) reported that high income groups will never take high amount of fiberous foods in their diet resulting in an increase in their serum cholesterol levels.

The particular culinary practice in a region are clearly powerful determinants of fat intake, even overriding the constraints of income (NNMB 1984). Achaya (1987) opines that the oil of choice is strongly regional and that the nature of edible oil used varies from one part of the country to other.

NNMB report of the repeat surveys (1988-90) by ICMR revealed an increase in the daily consumption of fats and oils by about 10 gm, in Kerala during the period between 1975-79 to 1988-90.

NNMB report of the urban Survey-slums (1993-94) revealed that the consumption of nuts and oilseeds, particularly coconut was high (90 g), while in all the major cities of India

the intake was less than 10 g. The report also reveals that the fat consumption in Trivandrum was more than 30% of RDI and the invisible fat intake was six times that of visible fat.

Mortality from Coronary Heart Disease (CHD) is decreasing in a number of western countries, and the main reasons suggested for this decline in the mortality rate is diet, particularly dietary fat intake. Stephan et al. (1994) has reported that the mortality rate from CHD has declined in UK since 1979, where as in USA, mortality from this disease began to fall in 1968 and has continued since that time.

The results of the survey conducted by Cetres for Disease control (CDC), National Centre for Health Statistics in USA (1994) revealed that the average fat consumption has decreased to 34% from 36% of total calories, between 1978 and 1991 and it shows that consumers are cutting fat in their diet.

Stephan et al. (1994) reported that individual fat intake in America has fallen steadily since the mid 1960s. Results of the most recent (1994) National Health and Nutrition Examination Survey (NHANES III Phase I) USA indicate that consumers are eating less fat.

According to the position statement of the American Heart Association, Americans consume an average of 15 per cent of calories as saturated fat (Charles 1992).

A comparative study of fat intake of the population of Scotland and United Kingdom revealed that fat represented 30 per cent or less of dietary energy in the UK until 1930s, and about 40 per cent energy in the late 1950s, with little change until the late 1970s. Trends were similar in all age groups, but less change has occurred recently in Scotland compared with United Kingdom (Stephan et al. 1994).

Survey on Hungarian diets revealed that 40-44% of nutritional energy in Hungary is derived from fats and within this, the proportion of saturated fatty acids is 18-24%. Hungarians consume approximately 34 kg of fat annually with a ratio of 4:1 of animal/plant sources (lard/sunflower oil) which accounts for the high saturated fatty acid intake. The average cholesterol intake in Hungary ranges between 450-600 mg/day (Anonymous . 1994).

Trends in dietary profiles and risk factors of the subjects of Framingham study in 1957-1960, 1966-1969, and 1984-88 as reported by Posner et al. (1995) revealed that there is only a slight change in the macronutrient and fatty acid intake, but levels of cholesterol intake declined considerably. In spite of relatively stable mean fat intake levels, 35% to 60% of Framingham study men and women reported decreased consumption of higher-fat containing animal products between 1974-1978 and 1984-88.

Results of the study by Baghurst et al. (1994) on demographic and dietary profiles of high and low fat consumers in Australia revealed that lower than average fat consumption was more common in women while age was a significant factor determining fat intake in men. Occupation was not related to lower than average fat consumption, but manual work and low occupational prestige were linked to higher than average consumption in men.

An assessment of daily fat consumption of the population of Warsaw (Polish) by Pardo et al. (1992) showed that in men, fat intake covered 38.4% of the total energy, whereas in female population fat constituted 37.7 per cent of the total energy. Mean contribution of SFA and P/S ratio in both sex groups have been 15.8% and 0.285 respectively. Daily cholesterol intake has been 641 mg (224 mg/per 1000 K cal) in males.

Determination of the daily consumption of fat in grams of the population of France by Phaneuf (1994) revealed that the daily fat intake ranged from 26.5 g to 58.5 g with a mean value of 39.5 g/day. The results of the study also confirmed that residents of the more rural zone had a higher fat consumption.

A comparative study tests for ethnic differences in dietary fat consumption in a community - based sample of Hispanic and white adults with low educational attainment illustrated a high diet and fat consumption of whites with low educational

attainment, the increasing fat consumption of Hispanics at higher levels of acculturation. (Winkleby et al. 1994).

Assessment of dietary intake and serum cholesterol trends during the 1980s, in the Minnea polis - St. Paul (Twin cities) metropolitan area by Graves et al. (1993) revealed that the per cent of energy from total fat intake decreased from 39.3 to 38.1% in men and 38.9 to 36.6% in women. The data also suggested that members of this community are on average modifying their fat consumption, and that these dietary changes are resulting in more favourable serum total cholesterol levels.

A nutrition survey conducted as a part of a larger cardiovascular risk study undertaken by the Manitoba Heart Health Project (1993) revealed that the proportion of food energy derived from total fat varied between 35.3% for senior females and 40.2% for young males. Food of Seniors contained a lower proportion of energy from fat than that of either of the two younger age groups. In all different age groups, men consumed diets with a higher proportion of fat than did women. (Seven huysen et al. 1993).

On analysing the household and individual fat and fat containing food consumption trends in Spain, Serra et al. (1993) have observed a decrease in cereals, potatoes, pulses and an increase in diary products and meat. According to this study,

the consumption of fat and saturated fat and other vegetable oils have increased, while olive oil intake has decreased. Individual dietary studies revealed that the intake of fat ranged from 90 to 110 g/person/day, and percentage of total energy from saturated fat from 12 to 15 per cent.

Nutrition trends in Greece as reported by Zilidis (1993) shows that during the period 1961-86, the average percapita consumption of calories increased by 26.6%, while the calories obtained exclusively from animal sources increased by 106%. The average protein intake rose by 29.9%. Animal proteins increased by 90.6% and their proportion reached 51.5%. Lipid intake increased by 62.2%, in particular animal fats went up by 114.3%. It was also confirmed that the most important changes in nutrition in Greece during the study period were an increase in total calorie intake, rise in total fat consumption and especially the vertical increase in consumption of animal fats.

Researchers in Greece studying the relationship between diet and CHD concluded that using margarine as the principal, cooking fat was associated with an increased risk of CHD. The scientists also noted that "Striking ecologic correlations between saturated fat intake and occurrence of CHD and the exceptionally low incidence of this disease in the Greek population which has traditionally consumed high quantities of olive oil," represents powerful evidence for an important effect of fat composition on risk of CHD (Anonymous 1994).

The nutrition situation of the population in the former East Germany as reported by Ulbricht (1992) shows that, trends towards excessive energy intake have continued, resulting, above all, from high fat consumption, and he also reported that a considerable proportion of employed persons have their meals outside the house.

Kaunitz et al. (1992) reported that the average daily Philippine diet is low in total energy about 1800 Kcals as well as in fat which is only about 15% of total calories, excepting Manila with 22.8%. Of the 12 regions of the Philippines, Bicol has the highest intake of fat from coconut, (because they cook most foods in coconut milk) 62.5% of the dietary fat of Bicolanos is from coconut. Despite this, mortality rate in Bicolano from Coronary and Cerebrovascular disease is very low, when compared to other five important regions of Luzon Island, Philippines.

Conrado (1992) reported that the people of Polynasian Puk-Puka and Tokelanan islands are high coconut consumers. However studies of Prior et al. (1981) on this people showed low levels of serum cholesterol (170-176 mg/dl) among Puka - Pukans, despite a high intake of 35% - 40% fat mostly from coconut. But a comparatively higher serum cholesterol levels 208-216 mg/dl. were observed among Tokelanaus whose intake of fat, also mostly from coconut, was even higher 55% of daily calories.

Japan's Ministry of Health and Welfare (1994) has recommended that adults should consume not more than 20-25% of total calories from fat. The latest guidelines left unchanged the recommended Animal/plant/fish consumption ratio as 4:5:1 , the fatty acid ratio of SF/MUFA/PUFA 1:1.5:1 and 4.1 for n-6 VS n-3 fatty acids. They also recommended that the intake of PUFA should be accompanied with vitamin E, vitamin C or carotene consumption to prevent peroxide formation.

Through changes in eating habits, avoiding fats, refined sugars and lowering alcohol and salt consumption, several developed countries like the U.S. and Australia have been able to drastically lower the incidence of heart attacks, stroke and hypertension. This has led to world wide interest in socio-political acceptance of the urgent need for prevention-oriented national health policies on the incidence of diet related cardiovascular diseases.

2.2 Influence of various dietary constituents on blood lipid profile

2.2.1 Effect of dietary carbohydrates and proteins on blood lipid fractions

Among the various factors which influence serum lipid levels dietary factors are the most important. (Kemppainen et al. 1993). The role of dietary factors has been extensively

studied by several workers. It is nearly a quarter of a century since it become clear that elevation of serum cholesterol was one of the factors which carried an increased risk for the development of myocardial infarction (WHO 1982). Devadas (1980) reports that among various factors affecting the development of atherosclerosis and its complications, diet with its close association with socio-economic factors emerge as an important influence.

Today there is a vast body of evidence showing a triangular relationship between habitual diet, blood cholesterol, lipoprotein levels and Coronary Heart Disease (CHD). (WHO 1982). According to the reports of WHO (1982), there is no population in which CHD is common that does not also have a relatively high mean level of cholesterol. Clara (1986) reported that among the factors which influence serum lipid levels, dietary excess of five specific food factors viz, cholesterol saturated fats, carbohydrates especially sucrose, alcohol, and total calories are possibly implicated in hyperlipidiemia. Williams (1989), had found that dietary factors responsible for atherosclerosis were the primary dietary constituents viz. fat, carbohydrates and proteins. Moore et al. (1981) reported that when macro-nutrients like protein, fat and carbohydrates were used to identify and measure the food source in the diets, smaller leisons were related to intakes of legumes, grains and vegetables where as

larger leisons were related but to a smaller degree to intake of beef, milk and fruit.

Hollo (1994) identified the nutrition related cardio-vascular risk factors in Hungary as high energy content, high protein intake with major share of animal proteins, high fat intake with low intake of monosaturates and polysaturates, high cholesterol intake, low dietary fiber, ascorbic acid, magnesium and calcium and high sodium intake and serum lipids indicated frequently higher or moderate risk.. 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 hypertriglyceridemia. Milton and Peggy (1987) had suggested that dietary constituents such as 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.

Kurup (1989) reported that lysine is one of the aminoacids which has been found to be hypercholesterolemic. He had also suggested that the ratio of lysine to arginine of a protein may affect serum levels and artherogenicity. Casein and many of the animal proteins had a high ratio (around 2.0) and this was stated to be associated with their hyper cholesterolemic 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.

Girija Devi (1985) has reported that in populations living on diets containing animal foods and diary products, the serum cholesterol level and the incidence of heart diseases are high. Both these conditions were low in those whose diets are predominantly of vegetable origin. Rajammal et al. (1980) found that Gujarathi vegetarians exhibited a higher mean serum cholesterol levels than the Tamilian vegetarians, as Gujarathi vegetarians used to include much diary products in their diet. Thorogood et al. (1987) reported a lower cholesterol concentration in vegetarians than in those who eat meat, and that a vegetarian diet or a high intake of fish were found to be associated with reduced risk of caronary heart disease.

Nalini and Radha (1989) suggested that dietary substitution of plant proteins for animal proteins could be used as a better regimen in combating hyper cholesterolemia and hence CHD, than the use of restricted fat diets. Bernard et al. (1981) showed that the serum cholesterol and triglyceride concentrations were lowered in a diet based on plant proteins at 13% and 23% respectively than low cholesterol diet containing mixed protein from meat and diary products.

Studies carried out by Prema and Kurup (1973) showed that the lowest concentration of cholesterol and triglycerides in the aorta was produced by plant proteins, while the highest serum cholesterol was caused by beef protein. However Leelamma et al. (1978) observed that the plant protein (groundnut protein) produced similar high aortic cholesterol as egg albumin, or similar high arotic triglycerides as beef protein.

Pulses are the major source of dietary protein in an average Indian diet. Studies carried out by Saraswathydevi and Kurup (1989) on the effect of different pulses such as blackgram, red gram, horse gram, bengal gram, and green gram on the serum and arotic cholesterol levels revealed that blackgram and to a lesser extent red gram were found to cause significantly lower levels of serum and aortic cholesterol while horsegram had lesser cholesterol lowering effect when compared to others. Greengram showed only a mild cholesterol lowering effect while bengal gram had no effect. Susan et al. (1989) found that consumption of 450g of baked beans reduced the total plasma cholesterol levels considerably. According to Scott et al. (1983) substitution of soya protein for casein produced no consistent change in plasma concentration of cholesterol, triglyceride, low density lipo protein or high density lipoprotein. However Antonio et al. (1985) reported that the addition of soyabean protein to a standard low lipid diet was effective in inducing a significant

cholesterol decrease in patients with type II lipoproteinaemia. Shorey et al. (1985) suggested that a diet containing 25g soya-bean polysaccharides, reduces total plasma cholesterol than the diet containing 25g of placebo starch.

Vijayagopalan and Kurup (1970) had found that starches prepared from cereals and tapioca differed in their effect on serum and aortic lipid levels. A comparative study of cooked rice and tapioca, the two major sources of carbohydrates in the diets, of the population of 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 as reported by Premakumari and Kurup (1980). Vijayagopalan et al. (1973) had further observed that the ragi and tapioca, which had low digestability had higher cholesterol lowering action, while more digestable starches showed lesser effect.

Tubers form another source of carbohydrate in the diets, particularly of among the poorer classes. Prema and Kurup (1979) had found that tubers such as Colocasia tapioca, sweet potato, dioscorea and arrow root given after cooking were reported to show lower serum and aortic cholesterol and triglycerides when compared to wheat. Prina et al. (1981) reported that the increased fecal excretion of cholesterol and bileacids induced by the gluten diet represents the main mechanism of the hypocholesterolemic effect of wheat gluten diet.

Kurup (1989) had reported that sucrose produces a higher serum cholesterol when compared to glucose or corn starch. However Glueck et al. (1979) found sucrose polyester as an effective cholesterol lowering agent. Gene and Minda (1988) reported that dietary glucose and fructose lowers the secretion of heapatic triglyceride in rats fed marine oil than those fed tallow . or corn oil.

2.2.2 Effect of dietary fat on blood lipid fractions

Several scientists have reported that the type and amount of fat in the diet influences the serum cholesterol level. Kromhout (1994) states that one of the main reasons for general interest in dietary fat quality is the association between the amount and type of dietary fat on one hand and the morbidity and mortality from specific diseases on the other. Swami (1989) reported that lipids are an important part of the disease process in patients with atheromatous vascular disease and studies have suggested that the disease could occur inspite of very low levels of cholesterol and triglycerides. The exact risk potential of lipids in the atheromatous process has been established in coronary vascular diseases, as these are much more prevalent in areas with high lipid intake. (Grundy, 1981). According to Stamler et al. (1986) epidemiologic data based on a large number of patients has now brought forth the view that the risk potential of lipids is a continuing one and it increases in a linear fashion in all adults with increasing age.

According to the reports of NIN (1985) the type and amount of fat consumed is an important factor in the occurrence of cardiovascular diseases. Rao et al. (1993) reported that the mode of consumption of fat also appears to influence elevation of cholesterol in blood. At the same level of total daily intake, consumption of smaller amounts of fat a number of times (frequently) during a day has been shown to cause less elevation of blood cholesterol compared to consumption of the same total daily fat intake at one time of the day.

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. He reported a direct correlation between the intake of saturated fat on one hand, and the incidence of coronary artery disease and hypercholesterolemia on the other. Kushi et al. (1988) revealed that total serum cholesterol was positively associated with dietary cholesterol and saturated fatty acids. Mensik and Katan (1992) reported a positive correlation between high saturated fat intake and elevated serum cholesterol concentrations. This may be one major cause for the direct relationship between saturated fat in the diet and CHD. Merk and Lynne (1988) reported a significant positive correlation between the consumption of saturated fat and cholesterol and international mortality from CHD.

Mary et al. (1988) had also found that lowfat intakes resulted in lower total cholesterol and lower HDL cholesterol levels.

A seven country study carried out by Kromhout (1994) showed a strong association between the dietary energy percentage derived from saturated fat and CHD mortality among middle aged men from different countries. Braunwald (1988) reported that in patients whose calories are met by fats the chances of developing atheroma appear to be high. However 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.

According to Krause (1984) it is the proportion of saturated to polyunsaturated fatty acids in the total diet consumed, that determines the lipid levels and consequently the vascular deposition of lipids. Hegsted has reported as early in 1965 that when the intake of saturated fat is reduced and replaced by carbohydrate or monounsaturated fat or PUFA the blood cholesterol level drops considerably.

Santhimendis and Kumarasundaram (1990) reported that even when the proportion of total fat in the diet is low, a high intake of linoleic acid lowers both total plasma cholesterol and HDL cholesterol, while a high intake of saturated fat elevates both these lipid fractions and short chain saturated fatty acids have a neutral effect on serum cholesterol levels.

However Girija Devi (1985) opines that the type of fat does not seem to matter when taken in low amounts and that when the diet is rich in saturated fats like ghee, coconut oil, vanaspathy and animal fats it causes an increase in blood cholesterol level, where as poly unsaturated fatty acids like groundnut oil, cottonseed oil, corn, safflower tend to reduce serum cholesterol.

Mensik and Katan (1992) found that substitution of saturated fat for carbohydrate increased the total cholesterol and LDL cholesterol concentration while the concentrations were reduced after substitution of unsaturated fat for carbohydrate. The reduction was more pronounced after feeding trials with PUFA rather than MUFA. A study conducted by Division of Human Nutrition Common Wealth Scientific and Industrial Research Organisation (CSIRO) (1992) in Australia has shown that partially replacing saturated fatty acids of the diet with almonds or walnuts lowered total and LDL cholesterol. Studies showed a seven per cent and ten per cent reduction in total and LDL cholesterol respectively when the diet included MUFA-rich raw almonds. When the diet included PUFA rich walnuts the total and LDL cholesterol levels fell to five and nine per cent respectively. A substitution of dietary fat for carbohydrates irrespective of the degree of saturation caused increased HDL and reduced triglyceride (Mensik and Katan 1992).

Etherton et al. (1988) opined that saturated fatty acids and cholesterol raise the plasma cholesterol levels where as the PUFA lowers it. It is widely documented that a diet rich in saturated fatty acids is atherogenic and is associated with increased plasma cholesterol and LDL levels. (AHA Nutrition Committee 1982). Ehnholm et al. (1982) found that a diet rich in animal fats causes hypercholesterolemia. Liebman and Bazzarree (1983) reported that in low fat vegetarians the total cholesterol and triglyceride values were higher when compared to high fat vegetarians. Weber and Leaf (1994) after conducting experimental studies on animals have indicated that the substitution of omega - 6 (n-6) as well as Omega-3 (n-3) fatty acids for saturated fat in the diet seems to reduce the frequency of episodes of cardiac arrhythmia.

Nestel (1987) has reported that the balance of two essential fatty acids, (linolenic and linoleic) influences the functions of vascular and immune system and that the essential fatty acids play an important role in the transport of cholesterol. Linoleic acid, an essential fatty acid and the major constitutent of PUFA in the diet is inversely associated with risk of CHD with those developing the disease, consuming less and having a lower propotion in adipose and other tissues. (Thompson , 1995). Hassel (1994) reported that linoleic acid can reduce serum cholesterol levels independent of other dietary effects. Oleic acid appears to reduce serum cholesterol levels

when substituted for dietary saturated fatty acids. Fitch (1994) reported that transfatty acids may raise total and LDL cholesterol levels when compared to oleic acid but not to the same degree as when saturated fat is consumed.

Rao (1987) has ascertained that some marine oils, especially sardine oil rich in PUFA has a cholesterol lowering action. Paul (1987) has also reported that fish oils may modify the cholesterol raising effect of dietary cholesterol. William et al. (1988) suggested that small amounts of fish oil can have beneficial effects on plasma triglyceride levels in hypertriglyceridemic patients. Sri Lakshmi (1993) reported that in Eskimos who consume 400 g of fish daily, the incidence of Atherosclerosis is low. Mahmond et al. (1994) reports that in fish oil the longchain n - 3 PUFA namely eicosapentaeonic acid (20:5 n-3) and decosahexanoic acid (22: 6 n-3) are the active components in lowering plasma lipid. They also influence blood coagulation and the production of both thrombogenic and antithrombogenic components by blood platelets and the endothelium of the artery.

Charles (1992) reported that increasing the total fat intake of experimental animals increases the incidence of chemically induced and spontaneous cancer at certain sites, predominentally the mammary gland, pancreas and colon, and increases the growth of transplanted tumors. When total fat

intake is low, but adequate in essential fatty acids, linoleic acid is more effective than saturated fatty acids in enhancing tumerogenesis. According to study by National Cancer Institute (NCI) published in 1993 high fat diet increases the risk of lung cancer. Poly unsaturated fats are also associated with decrease in CHD risk, but they have also been associated with increased risk of mammary cancer. Saturated fat has been associated with increased total cholesterol, increased LDL, increased CHD and increased risk of colon cancer. However Sylianco et al. (1992) reported the inhibitory effect of dietary coconut oil against the formation of mammary tumors, induced by the dimethyl benzanthracene and also against the induction of pancreatic neoplasm by azaserine. They also reported that hydrogenation of coconut oil enhanced its anticarcenogenic effect against dimethyl aminoazobene.

Studies on healthful fats and oils showed monounsaturated fats as the most healthful. Monounsaturated fatty acids, soluble fibers and a vegetarian diet favourably lowers the plasma lipid levels. They are associated with a decrease in serum cholesterol and decreased risk of CHD. A multicentre study directed by researchers from the University of Texas (1994) South Western medical centre has indicated that a diet high in MUFA may be more beneficial for patients with adult onset diabetes than high carbohydrate diet now recommended by the American Diabetes Association.

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The early investigations of factors playing roles in human cholesterol metabolism identified the hypocholesterolemic impact of dietary fats of increasing iodine value. Feeding humans and animals a variety of fats with iodine values greater than 100 produced equally low cholesterol values, for fats with iodine values below 90, the cholesterol content of the serum increased as the iodine value of the dietary fat decreased (Charles 1992).

Concardo (1992) had reported that coconut oil has been misrepresented in its role of producing cholesterol and ASCVD and that coconut oil has an important medical role to play in nutrition, metabolism and health care. Indeed properly formulated and utilised coconut oil may be the preferred vegetable oil in daily diet and the special hospital foods used to promote patient recovery.

Eraly (1992) reported that patients who consume 25-40g of fat, both as kernal and oil do not have high blood cholesterol. He also remarked that average fat consumption in Kerala is low when compared to Westerners or those from other states.

Concardo (1992) also reported that coconut oil, which contains mainly medium chain triglycerides are unique in their metabolic and functional characteristics, that they not only lower the cholesterol, but also lower the cholesterol deposition in the organs such as the liver, arteries and the heart.

Kaunitz (1992) reported a study conducted among 12 regions of the Philippines, Biocol which has the highest intake of fat from coconut (as they cook most food in coconut milk) and that 62.5% of the dietary fat of Bicolanos is from coconut. Despite this, mortality rate in Bicolano from Coronary and Cerebrovascular disease is very low when compared to other five important regions of Lulzon island, Philippine. It is also noticed that a daily coconut fat intake twice that of other regions is associated with only half as much Coronary Heart Disease mortality.

Blackburn (1988) reported that coconut oil appears to be neutral in terms of any effect on serum cholesterol. He found that liver cholesterol levels did not change significantly in those fed coconut oil and opined that coconut oil is not hyper cholesterolemic when consumed as a part of mixed fat diet typical of human dietary pattern.

Concardo (1992) reported that when calorie intake is controlled to reduce total fat intake to about 30% of the calories, coconut oil mixtures significantly contribute to better health, in the U.S. When taken in an impartial and sound scientific light a diet rich in coconut oil with omega-3 and omega-6 fatty acid supplementation through fish and the use of some vegetable oil such as corn oil can be developed into a balanced diet.

Some studies show that a palm oil diet increases the HDL-C resulting in a beneficial LDL/HDL - C ratio of 2-4 . Yasof Basiron (1994) reported that palmoil doesnot demonstrate any deleterious cousequences for health.

Researchers in Greece studying the relationship between diet and CHD concluded that using margarine as the principal cooking fat was associated with an increased risk of CHD. (Anonymous 1994). They noted a striking correlation between saturated fat intake and occurrence of CHD and the exceptionally low incidence of the disease in the Greek population who had traditionally consumed high quantities of olive oil. This represents a powerful evidence showing the effect of fat composition on the risk of CHD (Anonymous 1994).

2.2.3 Influence of antioxidants

Studies carried out by several workers have shown that LDL is extremely well protected against oxidation in plasma or serum by endogenous antioxidants. Also the cumulative Antioxidant Index implies that more antioxidant or less oxidised cholesterol one has in the body the chance of developing coronary heart disease is reduced. Studies done by Balz Frei (1995) supports the oxidation hypothesis of atherosclerosis, implicating oxidative modification of LDL as an important etiologic event in the development of cardio vascular disease. The limitation of

LDL oxidation in vivo by increased dietary intake or supplementation of nutrient antioxidants may be an effective means of lowering the incidence of CHD.

Stampfer (1995) reported a highly significant trend for lower risk of CHD with high intakes of vitamin E. So also vitamin E may delay or prevent heart attacks and alleviate the symptoms associated with Parkinsons disease. Fitch Humann (1994) has quoted several studies linking vitamin C to a decreased risk of cancer, heart diseases and cataracts.

2.2.4 Effect of fiber rich diet on blood lipid profile

Dietary fiber found in unprocessed cereals, legumes, vegetables, fruits contribute bulk to the diet and therefore helps in keeping calorie intake low. Jean and George (1983) had reported that a high fiber diet reduces the serum cholesterol level. The effect of dietary fiber on blood lipids depends on its nature. Wheat fiber does not decrease the blood cholesterol but viscous type like pectins and guargums in large doses lowers plasma total cholesterol and LDL cholesterol levels. (Anonymous, 1990). However Moore et al. (1985) reported that wheat bran supplementation in the diet increased the HDL cholesterol and decreased the LDL - cholesterol. According to Gene and Hugh (1983) dietary fiber probably play a role in lipid metabolism.

According to Robert (1994) factors such as meat, fat, and sucrose consumption, with low fiber intake may also affect

the development of CHD. He has further reported that certain societies consuming high fiber diet and specific groups within United States adhering to a vegetarian diet have lower frequencies of atherosclerosis, when compared to groups consuming western diets, low in fiber.

Moris et al. (1978) reported that cereal fiber reduces the incidence of Coronary Heart Disease, and 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. Jean et al. (1987) had further reported that combinations of pectins and cereal brans in the diet could be useful in normalising cholesterol and triglyceride of patients suffering from hyperlipidaemia. Robert (1994) had shown that dietary supplementation with pectin increases excretion of fecal fat, sterols and bile acids. Oat bran and barley consumption, has been reported to reduce the cholesterol content of blood. Anonymous 1990). Richard et al. (1991) have shown reductions of 3-26% in total plasma cholesterol with an intake of 40-75 gm oat bran/day. Parallel experiments in rats have confirmed that oat bran lowers plasma cholesterol with diets high or low in cholesterol.

Vadhera et al. (1995) reported that fibers from the outerskin of onion and garlic lowered total lipids, total cholesterol and glyceride levels of plasma and tissues in the

rats. The fibers from the onion skin are potentially antiartherogenic as evidenced by increased High Density Lipoprotein cholesterol/LDL ratio.

2.2.5 Influence of stimulating beverages

Several studies have proved with evidences that coffee drinking may be positively associated with serum cholesterol levels, especially LDL cholesterol. Srimathi et al. (1981) reported that both coffee and tea appears to cause an increase in serum lipids, and lipoproteins. However tea was found to have more beneficial effects than coffee. Green and Jucha (1986), Kark et al. (1985) and Thelle et al. (1983) have indicated an association between coffee intake and increased levels of serum cholesterol in men and women. The consumption of decaffinated coffee was also found to increase the level of LDL cholesterol. (Annonymus 1990). Coffee contains tannic acid and Panda et al. (1979) have reported that total cholesterol level in plasma rises with rise in the level of tannic acid in the diet. They have further reported that concentration of blood glucose and plasma proteins decreased with an increase in the level of tannic acid in the diet. Michael (1994) reported that flavanoid intake (tea contains 61%) may reduce elderly men's risk of dying from CHD. In persons with high intake of flavanoid predicted lower mortality from CHD and less strongly, lower incidence of myocardial infarction.

2.3 Association of various risk factors to the blood lipid profile

2.3.1 Influence of lack of physical activity (Sedentary life) and high fat diet on body fat deposits

Recent analysis from prospective studies have confirmed the moderate but significant association between obesity and mortality related to Cardiovascular diseases. (Terry et al. 1992). As a general rule, studies with large cohort sizes and with follow up periods of more than 10 years have reported that obesity is a significant predictor of mortality related to CVD. (Harrison 1985). Among the factors involved in the development of obesity, reduced physical activity and excess calorie intake, especially increased consumption of food, with high content of saturated fat, have been suggested as contributory factors in the increased prevalence of obesity reported in the developed countries. In contrast, the prevalence of obesity has been reported to be low in populations consuming a low fat diet, such as in Japan, thirty years ago. (Lands et al. 1990). According to Despres et al. (1990), obesity is frequently associated with hyperlipidaemia and NIDDM, two conditions closely associated with CVD.

Swaminathan (1986) records that results of several studies had revealed that the incidence of ischaemic heart disease was high among persons leading a sedentary life and low

among individuals who lead an active life, involving considerable amount of physical activity. This fact has been reported by Moris et al. as early in 1978 in London, where they found that the incidence of heart disease was more among drivers than conductors and more among post office clerks than postmen.

Storage triglycerides in the adipose tissue is dependent upon the balance between energy expenditure and energy intake. As the major factor explaining individual differences in energy expenditure is the variation in the level of physical activity, (Poehlman and Horton, 1990), where in a low energy expenditure will increase the probability of being in positive energy balance, for a given energy intake. However it has been suggested that all calories may not be equal. Indeed the works of Flatt (Flatt et al. 1985, Flatt 1987, 1988) followed by careful metabolic studies of Tremblay et al. (1989, 1991), Hill et al. (1992) and Tremblay (1992) suggests that though a raised carbohydrate intake is accompanied by an increase in carbohydrate oxidation, a higher fat intake does not lead to a full compensatory rise in lipid oxidation. The result is a disturbed fat balance, which may be an important correlate of body fat accretion, as explained by Zurlo et al. (1990) and Tremblay (1992). Thus it appears that fat cell hypertrophy and increased flux of freefatty acids, originating from the adipose depot results in obesity. (Schutz et al. 1992).

A high fat intake has been associated with a greater proportion of abdominal adipose tissue after control for levels of total body fat. (George et al. 1990). Thus as reported by Jean and Benoit (1993) the combined effects of a high fat diet rich in saturated fatty acids and of a sedentary life style should contribute to increased risk of abdominal obestiy, insulin resistance, Non Insulin Dependent Diabetes Mellitus (NIDDM) and Coronary artery disease.

2.3.2 Influence of abdominal body fat on blood lipid profile

As a general rule there is a positive correlation between the level of total body fat and that abdominal visceral adipose tissue in both men and women (Jean and Benoit 1993). According to Wahrenberg (1989) men and women had typically different body fat distribution with men being more prone to accumulate fat in the gluteal and fumeral region. However, there are marked individual differences in the change of fat distribution associated with weight gain or loss; this variation being to a significant extent genetically determined.

In both men and women an area of visceral adipose tissue above 100 cm^2 was associated with moderate disturbances in the risk profile where as visceral adipose tissue areas greater than about 130 cm^2 were associated with a further deterioration of metabolic variables predictive of NIDDM and CVD. Waist circumference may be one of the best correlates of visceral

abdominal adopose tissue and may represent a useful alternative for the assessment of the risk associated with abdominal obesity, and waist circumference is a better correlate of total body fat mass and of abdominal visceral adipose tissue accumulation than WHR. (Despres et al. 1991). Variations in waist circumference were also more strongly associated with alterations in plasma lipoprotein levels than WHR as observed by Pouliot et al. (1991).

Leenen et al. (1992) have reported that a high intimal level of visceral adipose tissue was associated with a preferencial mobilization of this depot in response to an energy deficit. Significant associations between abdominal, especially visceral adipose tissue accumulation and metabolic complications have been documented and reported by Sparrow et al. (1986), Fujioka et al. (1987) and Despres et al. (1989). De Franzo and Ferrannini (1991) have reported that abdominal obesity and its related insulin resistant state may represent better correlates of an elevated blood pressure than excess adipose tissue mass per se.

Results from several prospective studies have confirmed that high accumulation of abdominal adipose tissue estimated by circumference or skinfolds was associated with an increased probability of developing CVD and with an increased risk of CVD, related mortality, (Terry et al. 1992). Haffner et al. (1987) has commented that preferential accumulation of adipose tissue in

the abdominal area has been associated with dislipidaemia, which may increase the risk of CVD. High levels of abdominal adipose tissue have been associated with elevated concentrations of plasma triacylglycerols as reported by Foster et al. (1987) and reduced concentrations of plasma high density lipoprotein cholesterol (HDL-C) (Anderson et al. (1988). Despres et al. (1990) reports that the level of abdominal visceral adipose tissue has been reported to be the best correlate of lipoprotein ratios. (HDL-C/LDL-C, HDL_2C/HDL_3-C) used in the estimation of CVD risk.

Accordingly when they compared, obese patients matched for age and total body fatness, but with either low or high levels of visceral adipose tissue, lower plasma concentrations of HDL-C and HDL_2-C were noted in patients with visceral obesity, compared to obese subjects with low accumulation of visceral adipose tissue as observed by Despres et al. (1990). The above authors have also reported that subjects with elevated levels of visceral abdominal adipose tissue also showed significant reductions in lipoprotein ratios predictive of CVD risk. Associations between elevated levels of visceral abdominal adipose tissue and alterations on plasma lipid and lipoprotein concentrations in abdominal obesity may be partly explained by concomitent alterations in the activities of two enzymes that hydrolyse triacylglycerols, lipoprotein lipase and hepatic triacylglycerol lipase, as these two enzymes are significant

determinents of plasma HDL as well as of HDL_2 and HDL_3 concentrations. Levels of visceral abdominal adipose tissue were positively associated with HTGL activity, where as plasma post heparin LPL activity appeared to be negatively correlated with the level of total body fat as found by Pouliot et al. (1991).

The Canadian Consensus Conference on cholesterol (1988) recommended that measurement of LDL - C concentration is commonly used to estimate Coronary Artery Disease risk and high concentrations of plasma LDL-C have been consistently associated with increased risk of coronary artery disease. However, increased concentrations of small, dense cholesterol depleted LDL particles have been frequently observed in patients with coronary astery disease as mentioned by Austin et al. (1990). Despres (1991) writes that as elevated LDL - apoprotein B levels are also associated with increased risk of Coronary artery disease, the ratio of LDL - apo B /LDL-C could be used to estimate coronary artery disease risk in obese patients. They further observed that elevated LDL - apo B levels in the presence of normal LDL - cholesterol concentrations have been associated with increased visceral adipose tissue mass, insulin resistance, high triacylglycerol levels and low HDL - Cholesterol concentrations.

2.3.3 Influence of exercise on body fat and blood lipid profile

Allied Dunbar (1992) opines that as opportunities for physical activity in the work place are reduced by mechanisation,

leisure activity become increasingly important in determining over all activity levels and that one of the most popular reasons for participating in exercise during leisure time is to control or lose weight by increasing energy expenditure. However, a report published by the Department of Health of U.K. (1991) on reference values for energy requirement of adults in the U.K. suggests that the potential of leisure activity to influence energy expenditure is extremely limited.

A negative association has been observed by Bouchard et al. (1993) between level of physical activity (including exercise) and level of body fat. Wood et al. (1988) reported that exercise favourably modifies plasma lipoporotein, lipid concentrations, insulin sensitivity and reduces plasma insulin concentration and also blood pressure.

However, studies on exercise and its effect on body fatness have generally indicated that the net energy deficit that can be produced by exercise is small, and not likely to induce major changes in body weight and adipose mass. (Bouchard et al. 1993 , Jean and Benoit 1993).

Exercise training seems to have beneficial effects on the CVD risk profile, irrespective of changes in body composition. Indeed, favourable changes in lipoprotein profile (Lamarche et al. 1992), in insulin sensitivity, (Oshida et al. 1989 , Lamarche et al. 1992) and in blood pressure (Krotkiewski

and Bjorntorp 1986) have been reported, and these improvements were observed without any reduction in body weight or fat. Many studies have not reported significant changes in LDL-C levels, following exercise training (Weintraub et al. 1989) a variable frequently used to estimate cardiovascular risk.

Chave et al. (1978), Gunby (1983), Gregory et al. (1983) have all reported that physical exercise reduced plasma. cholesterol, LDL and TG concentration and increased HDL - levels. Lehtonen and Viikari (1978) and Suitor and Merrily (1980) have reported that physical activity increases serum high density lipoprotein cholesterol and freefatty acid concentration and it decreases triglyceride values. Milton and Peggy (1987) observed that weight loss and increased physical activity decreases the plasma cholesterol level. Further more, Wood et al. (1988) have reported comparable increase in HDL - cholesterol in subjects with increased physical activity. According to Ekelund et al. (1988) physical inactivity was associated with an increased CHD risk and mortality in some cohort studies.

2.3.4 Influence of smoking on food habits and bloodlipid profile

Rabkin (1984) reported a direct relationship between the effect of cigarette smoking on other cardiovascular risk factors, serum lipids, body weight, blood pressure and blood sugar. Shepherd et al. (1987) reported that the three main risk

factors of Coronary Heart Disease were cigarette smoking, high blood lipid concentration and hypertension.

A uniquely human habit, smoking has been identified as a major CHD risk factor - with several posssible mechanisms - carbon monoxide induced arthenogenesis, nictoine stimulation of adrenergic drive raising both blood pressure and myocardial oxygen demand, lipid metabolism with fall in protective high density lipoprotein as reported by Shaper (1981). Thompson et al. (1995) are of the opinion that the increased risk of CHD in cigarette smokers may be partially explained by their less healthy diets and in particular lower intake of linoleic acid.

Middle aged cigarette smokers have a two to three fold increase in the risk of coronary heart disease compared with life long non-smokers and those who quit smoking, experience a reduction in the excess risk of CHD, approaching 50 per cent within 5 years as reported by Cook et al. (1986) and Doll et al. (1994) compared with those who continue to smoke. One explanation for the decrease in risk of CHD observed after smoking cessation is that cigarette smoking affects food choice and nutrient intake. (Thompson et al. (1995). Cross sectional data show that cigarette smokers consume diets different from those of people who do not smoke as reported by Fulton et al. (1988), Subar et al. (1990), Whichelow et al. (1991) and Margetts and Jackson (1993), Thompson et al., (1992) have further observed

that cigarette smoking is associated with a different food pattern and altered nutrient intake, in particular more saturated fat, less PUFA and lower consumption of antioxidant vitamins.

According to Arti and Rajeswari (1986) chain smoking has a deleterious effect with regard to cholesterol and blood pressure. According to Gala (1988) the chances of getting a heart attack are 3 to 5 times higher in the case of smokers; and smokers are susceptible to myocardial infarction as it lowers the HDL - Synthesis. Wendy et al. (1989) observed that smokers as a group face an average excess risk of coronary artery disease of 70 percentage. Norman (1989), American Heart Association (1990) also had shared the same view that cigarette smoking is a major risk factor of Coronary Heart Disease.

2.3.5 Influence of alcohol consumption on blood lipid profile

Mitchael et al. (1986) reported that alcohol produces a rise of 1% in serum high density lipoprotein cholesterol. 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 results in the upregulation of HDL_2. Marja et al. (1987), Willam and John (1980), Castelli (1980) and Vivien et al. (1984) have all reported that the dietary alcohol intake, cigarette smoking and packet count correlated fairly with total cholesterol and LDL cholesterol in blood.

MATERIALS AND METHODS

3. MATERIALS AND METHODS

An investigation on "Dietary habits, fat consumption pattern and blood lipid profile of adults engaged in moderate activity" was carried out mainly to assess the food and fat consumption pattern of selected moderately active adult males in relation to their blood lipid profile.

3.1 Selection of subjects

Fifty employees of Hindustan Latex Limited, Peroorkada, Trivandrum were selected for the study using purposive sampling technique suggested by Cochran. (1977). As the study envisages to assess the association among food habits, fat consumption pattern and blood lipid profile, care was taken to select persons of unisex, middle aged and those engaged in moderate activity of a uniform type since several studies as those reported by Levy (1985), Ramani et al. (1986), Stamler et al. (1986) and Swami (1989) have proved that factors like food habits, fat intake, age, sex and activity affect the blood lipid profile.

The fifty subjects formed a homogenous group being males, between the age of 25-40 years, free of any identified disease or disorders and were doing moderate activity of uniform type for the past 8-10 years and they take the standard food served to them from the factory canteen three times a day.

3.2 Conduct of the study

The study comprised of the following five aspects:

3.2.1 Socio economic survey.

3.2.2 General dietary survey and assessment of fat consumption pattern.

3.2.3 Assessment of nutritional status by

(a) Anthropometric measurements

(b) Measurement of actual food intake

3.2.4 Assessment of energy requirement, intake and expenditure

3.2.5 Estimation of blood lipid profile

and analysis of the above data to find out the association between dietary and non dietary factors to the blood lipid profile using suitable statistical techniques.

The methods and materials used to study the above aspects are detailed below.

3.2.1 Socio economic survey

Nutritional status is an indicator of social well being of a community (Krishna, 1988) and nutritional status is influenced by factors such as psychological, socio cultural and physiological (Suter and Hunter, 1980) and social factors like religion, occupation, economics, education, beliefs and culture

have important bearing on health. Sirshi (1986) suggests that to assess the socio economic status, details pertaining to the type of family, family size, monthly income and caste are to be ascertained. Accordingly a schedule to assess the socio economic status of the family was designed with the above mentioned details; pretested, modified and used for the initial survey. The schedule contained details to collect information regarding the family size, type of family, occupation, income, educational status, as well as the personal habits of the subjects. (Appendix I).

The information on the socio-economic status was collected using the above schedule by personal interview technique as suggested by Gupta (1987) who remarks that interview is a two way method which permits an exchange of ideas and information and explains that the information received from an interview schedule is more reliable as the accuracy of the statement can be checked by supplementary questions whenever necessary. Hence this method was used to collect information.

3.2.2 General dietary survey and assessment of fat consumption pattern

Diet survey constitutes an essential part of any study on nutritional status of individuals or groups, providing essential information on nutrient intake levels, sources of nutrients, food habits and attitudes towards food as stated by

Swaminathan (1974). Studies done by Mary et al. (1988) have proved an association between dietary habits and blood lipid profile. Pennington (1988) pointed out that studies that relate to food and nutrient intake to measure health or disease are essential for monitoring dietary status, and ascertains that a 24 hour recall for three consecutive days are best used for quantification of mean daily, food intakes of a family.

A suitably structured oral questionnaire which was pretested and modified suitably was used to collect information from all the fifty subjects, about the type and quantity of food consumed. Details pertaining to the frequency of use of various food items, cooking methods and practices followed, inclusion of non-vegetarian foods, type and nature of cooking oil used, and pattern of eating outside the home were also included in the schedule (Appendix II).

The quantity and quality of fat intake directly influences the blood lipid profile and much ambiguity prevails even among the scientific community with respect to the optimum fat intake. Achaya (1987) states that fat consumption in turn is subject to income constraints and many other social and cultural factors, and Rao et al. (1993) is of the opinion that consumption of fat appears to influence the elevation of cholesterol in blood. Hence information regarding the type and kind of fat/oil used in the household, daily oil consumption, frequency of

preparation of fried items, use of reheated oil, seasonal variations in the use of cooking oil were also collected by personal interview using a suitably structured questionnaire designed for the study. (Appendix III).

3.2.3 Assessment of nutritional status by Anthropometric measurements and measurement of actual food intake

Schofield (1985) is of the opinion that assessment of nutritional status could be achieved through one or a combination of several methods. Hence in the present study two methods viz., anthropometric measurements and actual food intake were used to assess the nutritional status of the 50 subjects.

(a) Anthropometric measurements

The pattern of growth and the physical state of the body though genetically determined are profoundly influenced by diet and nutrition (Swaminathan 1974). Frisancho (1974) and Tanner (1976) have also pointed out that body measurements taken are used to assess either physical growth or body composition. Hence anthropometry has been accepted as an important tool for the assessment of nutritional status. Therefore height and weight of the subjects were measured and recorded using standardised techniques to determine physical growth.

Weight was measured using a beam balance. Beam balance scales were used for measuring weight as they are less likely to be inaccurate if carefully looked after. The accuracy of the balance was checked frequently. The person was made to stand on the platform without touching elsewhere. Care was taken to place the balance on a flat surface, and it was checked before use. Measurements were done to an accuracy of upto 0.1 kg. (Jelliffee, 1966).

Height of the respondents were recorded using a stadiometer employing the technique suggested by Jelliffee (1966). The subjects were made to stand on the flat floor, of the scale with feet parallel and with heels, buttocks, shoulders and back of the head touching the up right. The head was held comfortably erect with the lower border of the orbit in the same horizontal plane as the external auditory meatus. The arms were hanging at the sides in a natural manner. The wooden block used as head piece which was gently lowered crushing the hair, making contact with the top of the head. The measurements were done to 0.5 cm accuracy.

Body Mass Index (BMI) of all the persons were computed from the recorded height and weight of the subject. Vandanasen et al. (1980) had pointed out that wt/ht^2 gives a fair estimate of the magnitude of protein calorie malnutrition.

The importance of measuring body composition in relation to problems of nutrition is now becoming more apparent. Measurement of skinfold thickness and abdominal girth were the parameters used in this study to determine body composition. Skinfold thickness is a simple means of measuring subcutaneous fat and therefore of body composition as stated by Swaminathan (1974). Triceps skinfold thickness was determined using a skinfold caliper. As the fat in the region is not uniform in thickness, the site is carefully selected halfway down the arm between the tip of the acromion nerve, and the olecranon process of the ulna. The measurement of skinfold thickness is made with the arm hanging relaxed at the side. The skinfold parallel to the long axis is picked up between the thumb and forefinger of the left hand away from the underlying muscle and measured at this point using fat caliper (Jelliffee 1966). Jean and Benoit (1993) observed a positive correlation between the level of total body fat and that of abdominal adipose tissue in both men and women. Hence the abdominal girth of the subjects were measured around the umblicus using a measuring tape.

(b) Assessment of actual food intake

Kamath (1986) defined nutritional status as the state of health enjoyed as a result of nutrition and it is the state of nutriture of an individual or a specific group according to Simopoulous (1985).

Nutritional status of an individual is the health status as influenced by intake of essential nutrients. (American Dietetic Association (1969). So it is important to have information regarding the diets actually eaten by the individual for assessing the nutritional adequacy. Variations in the intake of different nutrients present in the diet are reflected by changes in the concentration of the corresponding nutrients or metabolites in blood tissues and in urine (Swaminathan 1974).

Schofield (1985) has reported that food consumption surveys provide data on the type and amount of food consumed by a representative sample of the survey population. Marr (1971) also had reported that the actual food intake of the individual can be estimated by household consumption surveys. Guthrie and Crocetti (1985) opines that the dietary assessment by means of 24 hrs. recall alone is of minimal value in identifying a persons actual food intake. Gore et al. (1977) has suggested that weighment method can give accurate values of dietary intake than recall method. According to Visweswara Rao (1975) any single day or two day weighment could be as efficient tool as that of 7 days. Hence a single day food weighment survey was carried out among all the subjects in order to assess the actual food intake, and because all the subjects had taken their food from the canteen three times a day.

The investigator weighed all the raw foods included for the meals. Cooked weight of each preparation was also recorded.

The amount of food consumed by each member for each meal was also weighed and recorded; so also the plate waste was noted to get the exact amount of foods consumed. From the above data the raw equivalent of the foods consumed were computed. The nutritive value of foods consumed were calculated using the food composition tables as given the Nutritive Value of Indian Foods (1989). The nutrient intake thus obtained was compared with the RDA (ICMR 1992).

3.2.4 Assessment of energy requirement, intake and expenditure

According to Poehlman and Horton (1990) storage triglycerides in the adipose tissue is dependent upon the balance between energy expenditure and energy intake and the major factor explaining individual differences in energy expenditure is the variation in the level of physical activity.

Poehlman and Horton, (1990) further reports that low energy expenditure will increase the probability of being in positive energy balance for a given energy intake. So to findout the energy balance, the energy intake, requirement and expenditure of subjects were also determined.

The energy requirement of an individual is the level of energy intake from food, that will balance energy expenditure, when the individual has a body size and composition and level of physical activity consistent with long term good health and that

will allow for maintenance of economically necessary and socially desirable activity. (ICMR 1992). It is also recommended that energy requirement must be assessed in terms of energy expenditure rather than in terms of energy intake. The energy requirement for a moderately active individual was taken as 2875 KCal/day as per the standards suggested by ICMR for moderately active Indian Reference Man.

Total energy intakes of individuals in terms of calories from carbohydrate, protein and fat were computed form the actual daily intake of foods and beverages. Energy supplied by different food groups were calculated from Nutritive value of Indian foods (1989).

For assessing the energy expenditure daily work schedule of the subjects were recorded. Basal Metabolic Rate (BMR) was computed from the body weights based on the factorial method provided by FAO/WHO/UNO Expert Consultation (1985). Employing the factorial approach and the computed BMR from body weights and the recommended BMR factors for Indians for different levels of physical activity, the energy expenditure of the subjects were computed as suggested by ICMR (1992).

3.2.5 Analysis of Blood lipid profile

Today there is a vast body of evidence showing a triangular relationship between habitual diet, blood cholesterol lipoprotein levels and Coronary Heart Disease. Measurement of

various constituents of blood can be used not only to determine the presence of abnormal concentration , but also to evaluate the effects of changes in the diet, and other therapy on the levels of these constituents. Hence blood samples of the fifteen subjects at random were analysed and blood lipid profile with respect to cholesterol, triglyceride, High Density Lipoprotien (HDL), Low Density Lipoprotein (LDL) and Very Low Density Lipoprotein (VLDL) factors were also determined using standard procedures.

(a) Estimation of Serum Cholesterol

Consumption of fat appears to influence the elevation of cholesterol in blood (Rao 1993). It is nearly a quarter of century since it became clear that elevation of serum cholesterol was one of the factors which carried an increased risk for the development of myocardial infarction. A direct correlation has been found between the intakes of saturated fat on one hand and the incidence of CHD and hypercholesterolemia on the other (Levy 1985). The determination of serum cholesterol is considered to be significant in coronary artery diseases, hyperlipoproteinemia hypothyroidism, nephrosis, diabetes mellitus and various liver diseases. The cholesterol level of the blood samples were quantitatively estimated by the standard procedure suggested by Allain (1974).

(b) Estimation of Triglycerides

The type and amount of fat in the diet influences the serum cholesterol and triglyceride levels (Krause 1984). Serum triglyceride values are found elevated in secondary hyperlipoproteinemia, atherosclerosis, glycogen storage diseases and greatly elevated in diabetes mellitus, chronic hepatitis and alcoholism. Serum triglyceride levels of the blood samples were quantitatively estimated using the standard procedure suggested by Fossati (1982).

(c) Estimation of High Density Lipoprotein (HDL)

HDL - cholesterol and Coronary Heart Disease are inversely related. Low concentrations of HDL - cholesterol is associated with high risk of Coronary Heart Disease. Thus HDL - cholesterol in combination with total cholesterol determination is a good index of Coronary Heart Disease. The HDL - cholesterol levels of the blood samples were determined by the standard procedure suggested by Allain (1974).

Coronary Heart Disease (CHD) risk factor can be calculated using total lipid profile as suggested by Castelli et al. (1977). The risk factor gives a most accurate and definite assessment of heart disease risk. The factor can be calculated by the ratio of total cholesterol to HDL - cholesterol and by the ratio of LDL - Cholesterol to HDL - Cholesterol.

(d) Determination of Low Density Lipoprotein (LDL) and Very Low Density Lipoprotein (VLDL)

The levels of LDL and VLDL cholesterol levels were computed from the values obtained for the total cholesterol, Triglyceride and High Density Lipoprotein levels using Friedwald's equation as suggested by Fried wald (1972).

Low Density Lipoprotein Cholesterol (LDL) mg/dl

$$= \text{Total cholesterol} - \frac{\text{Triglyceride}}{5} - \text{HDL}$$

Very Low Density Lipoprotein Cholesterol (VLDL) mg/dl

$$= \frac{\text{Triglyceride}}{5}$$

Using the aforesaid methods the blood lipid profile of the subjects were analysed and the correlation between fat intake and blood lipid levels were estimated.

Statistical methods adopted

The data collected were analysed by appropriate statistical techniques or tools viz. frequency distribution, percentage analysis, mean, standard deviation, coefficient of variation, correlation coefficient in order to find out the effect of dietary factors on the Blood lipid profile.

RESULTS

RESULTS

The results of the present study entitled "Dietary habits, fat consumption pattern and blood lipid profile of adults engaged in moderate activity" are presented under the following headings.

4.1 Socio-economic profile of the families and respondents

4.2 Food consumption and fat consumption pattern of the families

4.3 Personal characteristics of the respondents

4.4 Dietary habits and actual food intake of respondents

4.5 Energy requirement, intake and expenditure of respondents

4.6 Blood lipid profile of respondents

4.7 Association of dietary and non dietary factors to blood lipid profile

4.1 Socio-economic profile of the families

The socio economic profile of the families were studied with reference to their social, educational and economic status as these have an influence on the dietary habits and fat consumption pattern.

4.1.1 Social status of the families

Table 1 depicts the religion and caste wise distribution of the families.

Table 1 Religion and caste wise distribution of the families

(a) Religion	No.	(%)
Hindu	45	(90)
Christian	5	(10)
Total	50	(100)
(b) Caste	No	(%)
Forward	21	(42)
Backward	16	(32)
SC/ST	13	(26)
	50	100

As summerised in the table, 90 per cent of the families surveyed were Hindus and the rest were Christians. None belonged to Muslim community. Among the families surveyed 42 per cent belonged to forward class and 32 per cent belonged to backward class. Scheduled castes constituted 26 per cent of the total population studied.

Area of residence of the families is presented in Table 2.

Table 2 Area of residence

Area of residence	No	(%)
Panchayat	29	(58)
Muncipality	2	(4)
Corporation	19	(38)
	50	100

It was found that among the 50 families selected 58 per cent were living in rural area and 42 per cent were residents of urban area. All were original settlers of the respective areas and none were found to be migrants.

Family size in relation to the type of family is presented in Table 3.

Table 3 Distribution of the families in relation to the type and size

Type of family	Distribution of families		Distribution of families according to family size			
	No.	(%)	1-4 members No.	(%)	5-8 members No.	(%)
Nuclear	17	(34)	27	(54)	0	
Joint/Extended	33	(66)	0		23	(46)

* Figures in parenthesis indicate percentages

Out of the 50 families selected, nuclear families with one to four members constituted 34 per cent, while 66 per cent were joint/extended families with five to eight members. The average size of the families was found to be five.

Age and sex wise distribution of the population is presented in Table 4.

Table 4 Age and sex wise distribution of family members

(Age) Category	Distribution within male population		Distribution within female population	
	No.	Per cent	No.	Per cent
Adults (above 18)	86	72.0	83	75.0
Adolescents	5	4.0	3	2.7
Schoolgoing children	9	7.5	11	9.9
Preschoolers	5	4.0	6	5.4
Infants	15	12.5	8	7.0
	120	(100)	111	(100)

The 50 families surveyed had a total population of 231 members. When the age and sex of the selected population were examined in detail, it revealed that, of the total population 37 per cent were adult males, 36 per cent were adult females and the remaining were children. The composition revealed that adults predominated and children formed only 27 per cent.

4.1.2 Educational status of the family members

Educational status of the family members is given in Table 5.

Table 5 Educational status of family members

Level of education	Males		Females	
	No.	(%)	No.	(%)
Illiterate	7	(7.50)	14	(14.29)
Lower primary	14	(14.80)	22	(22.45)
Upper primary	8	(8.50)	7	(7.14)
High school	26	(27.60)	20	(20.41)
College level	39	(41.60)	35	(35.71)
Total	94	(100)	98	(100)

As revealed in the table, 7.5 per cent of male members as well as 14 per cent of female members wer illiterates ie., not having any formal education. About 15 per cent of the male members of the families had attained lower primary level of education, while 8.5 per cent had upper primary level of education. It was also seen that 27.6 per cent and 41.6 per cent had attained high school and College level of education respectively. Among the female members 20.5 per cent had high school education and 35.71 per cent had attained college level of education.

4.1.3 Economic status of the respondents and the family members

The 50 respondents selected were the permanent employees of Hindustan Latex Limited, Trivandrum and their salary

formed the major source of the income of the family. The personal monthly income of the respondents ranged between Rs.3000-4000 as they were of the same grade, doing the same kind of job, the average personal income being Rs.3346 per month. Income earned by the family members also contributed to the total family income. Table 6 represent the income earned by different family members.

Table 6 Monthly income earned by different family members other than respondents

Monthly income (Rs.)	Males		Females	
	No.	(%)	No.	(%)
≥ 500	2	(13.60)	1	(7.20)
501 - 1000	7	(46.60)	2	(14.20)
1001 - 1500	1	(6.60)	3	(21.40)
1501 - 2000	4	(26.60)	5	(35.70)
above 2000	1	(6.60)	3	(21.50)
	15	(100)	14	(100)

Fifteen adult males and fourteen adult females were found to be employed among the 50 families other than the respondents. 26.6 per cent of male members and 35.7 per cent of the female members earned a monthly income ranging between Rs.1500-2000 where as only 6.6 per cent of male members and 21.5 per cent of the female members earned a monthly income of more than Rs.2000.

In addition to this 64 per cent of the families possessed coconut gardens which increased the income levels. The possession of land and coconut cultivation by 64 per cent of the families helped them to have a steady supply of coconut and the mean coconut yield per month was found to be 425 nuts. This in turn has a tendency to increase the household consumption of coconut and coconut oil. Survey also revealed that the mean number of coconut used for household consumption was 70 nuts per month. So also the mean number of coconuts used for extracting oil by a family was found to be about 828 nuts per year. Among the fifty families surveyed only 2 per cent were found to possess sesamum cultivation.

Possession of land, cultivation and the income earned by the members of the family contributed to the total family income and the distribution of the families based on the total monthly income is given in Table 7.

Table 7 Distribution of families according to monthly total income

Income Range (Rs.)	Distribution of families	
	No.	(%)
3000 - 4000	24	48
4001 - 6000	13	26
6001 - 8000	8	16
above 8000	5	10
	50	100

The table indicates that as per cent of the families were found to earn an income between Rs. 3000-4000. Thirteen per cent of the families were in the income range of Rs.4001-6000 and a monthly income above Rs.8000 per month was reported by 10 per cent of the families included in the study.

4.2 Food consumption and fat consumption pattern of the families

Food consumption pattern of the families was assessed with regard to percentage of total income spent on food, expenditure pattern on various food items, frequency of use of varius food items, and cooking practices followed.

4.2.1 Food expenditure pattern

Table 8 Distribution of families according to the amount spend on food

Amount spent on food (Rs.)	No.	(%)
1000 - 1500	19	(38)
1501 - 2000	24	(48)
2001 - 2500	6	(12)
2501 - 3000	1	(2)
Total	50	(100)

It can be noted from Table 8 that 48 per cent of the families spent Rs. 1501-2000 monthly on food, while only 2 per cent of the families spent more than Rs.2500 per month.

Table 9 reveals the food expenditure pattern of the families expressed as a percentage of their total monthly income. As revealed in the table, 36 per cent of the families spent 46-60 per cent of the total family income on food, and 34 per cent spent 31-45 per cent, while 8 per cent spent less than 15 per cent of their income on food.

Table 9 Distribution of families based on the percentage of total income spend on food

% income spent	No.	(%)
Below 15	4	(8)
16 - 30	11	(22)
31 - 45	17	(34)
46 - 60	18	(36)
Total	50	(100)

4.2.2 Frequency of use of various food items by the family

Frequency of using different food items may indicate the nutritional adequacy or inadequacy of a meal and consequently that of the daily diet. Data collected to assess the frequency of use of different food items in the daily diet is presented in Table 10. As it can be seen from table 10 the food items like rice, milk, fat, coconut and sugar, and beverages like coffee/tea were used daily by all the families. Milk and sugar were

consumed only as an ingredient of coffee or tea, on a daily basis.

Most of the families included different types of pulses like bengal gram, blackgram, greengram, horsegram, greenpeas or red gram at least once in a week. On an average 48 per cent of the families included different pulses at least once in a week, while 12 per cent of the families included different pulses twice in a week. Among the different pulses, blackgram was used by 68 per cent of the families at least once a week. But horsegram was found to be the least used pulse, as only 24 per cent of the families were found to include the same at least once in a week in their diet. It was also noted that pulse contributed the major share of protein intake, and invisible fat which increases the caloie density of the diet. Pulses also a good source of fibre, adds to the fibre content of the diet.

Most of the families included leafy vegetables, other vegetables and roots and tubers on a weekly basis in their diet, (ie, 98, 98, 78 per cent respectively). Most of the families used different types of fruits like apple, grapes, orange, plantain and pine apple, at least once in a week depending on their seasonal availability. It was noted that plantain was the most commonly consumed fruit as 18 per cent of the families used to include it thrice a week in their diet, and 52 per cent of the families were found to include it twice a week in their diet.

Flesh foods such as chicken, mutton and beef were not included as an item of regular menu of families, being expensive. Twenty five per cent of the families included flesh foods in their diet occasionally or on a monthly basis. But 76 per cent of the families included fish daily in their diet, may be because of its availability, due to the proximity to coastal areas. So also 48 per cent of the families included egg daily.

Most of the families consumed milk products like curd and butter milk, but none were in the habit of using cheese. Ghee and butter were found to be used occasionally. However milk is used daily as a whitener in tea and coffee.

Coconut was found to be included daily in the diets of all families. Seventy nine per cent of the families used groundnut and gingelly seeds occasionally. While 64 per cent of the families included bakery items like chips, mixture, biscuit etc. at least twice in a week. Processed foods like jam, squash, jelly, noodles and macroni were found to be the least frequently used by 73.6 per cent of respondents.

Table 10 Frequency of use of various food items by the family

		Percentage of families using different food items						
	Food item	Baily	Weekly thrice	Weekly twice	Weekly once	Monthly	Occasionally	Never
Cereals	Rice	100						
	Wheat	0	10	34	44	6	6	0
	Ravai	0	0	2	30	0	62	6
	Ragi	0	0	0	4	4	20	72
	Maida	0	10	20	76	2	2	0
	Bread	0	0	16	76	2	6	0
Pulses	Bengalgram	0	0	14	66	12	8	0
	Blackgram	0	0	14	68	4	14	2
	Greengram	0	16	2	66	4	12	0
	Red gram	0	16	2	46	4	38	2
	Horsegram	0	0	6	24	4	46	20
	Green peas	0	0	2	26	8	42	22
	Tur Dal	0	0	46	40	0	4	0
Leafy vegetables	Amaranthus	0	40	44	14	0	2	0
	Drumstick	0	0	28	58	8	6	0
	leaves	0						
	Cabbage	0	0	38	50	6	6	0
Other vegetables	Bittergourd	0	6	6	46	20	22	0
	Ladies finger	0	2	34	62	0	2	0
	Snakegourd	0	0	22	54	10	12	2
	Beans	0	0	16	80	0	4	0
Roots & Tubers	Potato	0	12	38	28	10	10	2
	Tapioca	0	16	28	44	6	6	0
	yam	0	4	16	48	2	30	0
	Colocasia	0	2	10	56	0	32	0
	Carrot	0	0	22	68	2	8	0
	Beet root	0	0	12	74	2	10	4

Percentage of families using different food in the household

Food group	Food item	Daily	Weekly thrice	Weekly twice	Weekly once	Monthly	Ocassi- onally	Never
Fruits	Apple	0	0	2	12	22	0	0
	Grapes	0	0	0	14	28	0	0
	Orange	0	0	2	46	16	0	0
	Plantain	0	18	52	26	2	0	0
	Pineapple	0	0	8	2	6	0	0
Milk and products	Milk	100	0	0	0	0	0	0
	Curd	16	12	20	28	0	0	0
	Butter milk	12	12	32	22	0	0	0
	Butter	0	0	0	16	0	0	0
	Ghee	0	0	0	2	2	0	0
Flesh Foods	Chicken	0	0	0	8	28	24	20
	Mutton	0	0	0	0	12	36	52
	Beef	0	0	0	38	36	16	10
	Fish	76	0	20	4	0	0	0
Egg	Egg	48	34	14	2	0	0	2
Nuts & Oil seeds	Coconut	100	0	0	0	0	0	0
	Groundnut		0	0	20	6	74	0
	Gingelly seeds		0	0	0	6	84	10
Fat/oil	Coconut	92	0	0	0	0	8	0
	Palm	4	0	0	0	0	0	96
	Gingelly	0	0	0	0	86	14	0
	Sunflower	4	0	0	0	0	0	96
Sugar/ gaggery	Sugar	100	0	0	0	0	0	0
Ranking Items	Banana chips	0	0	0	22	68	10	0
	Mixture	0	0	8	8	74	10	0
	Biscuit	0	0	0	46	22	32	0
	Cake	0	0	0	0	34	66	0
Processed foods	Jam	0	0	0	20	16	64	0
	Squash	0	0	0	0	38	62	0
	Noodles	0	0	0	0	0	80	20
	Macroni	0	0	0	0	0	88	12

4.2.3 Cooking methods practised by the families

It was observed that boiling was the commonly adopted method by all the families for cooking cereals, pulses, other vegetables, egg, milk, roots and tubers. In most of the families, excess water method of boiling was used for cooking rice and the excess water decanted was reused either for drinking as such or for making soups and gravies.

In the case of flesh foods 82 per cent of the families adopted boiling followed by shallow frying while 18 per cent adopted deep fat frying. Boiling was the main method of cooking eggs for 76 per cent of the families while 24 per cent employed shallow frying method.

Table 11 Cooking methods practised by the families

Cooking methods	No.of families adoping differnt methods of cooking for different food							
	Cereals	Pulses	Green leafy vegetables	Other vegetables	Root & tubers	Flesh foods	Egg	Milk
Boiling	-	50(100)	43 (86)	35 (70)	50 (100)	-	38 (76)	50 (100)
Boiling and straining	50 (100)	-	-	-	-	-	-	
Shallow frying	-	-	-	-	-	-	12 (24)	
Boiling and Shallow frying	-	-	7 (14)	15 (30)	-	41 (82)	-	
Deep frying	-	-	-	-	-	9 (18)	-	

Numbers in parenthesis indicate percentage

4.2.4 Fat consumption pattern of the families

The quantity and quality of fat intake directly influences the blood lipid profile, and fat consumption inturn is subject to income constraints and many other social and cultural factors. Hence the fat consumption pattern of the families were assessed with respect to type and kind of oil used for cooking; frequency of purchase of oil, oil of preference in the household; reasons for using a particular oil of choice; details regarding the uniformity in using the oil during the whole year, average quantity of oil used during a month and use of oil during festive seasons and occasions. Details pertaining to the above aspects are discussed below.

4.2.5 Oil of choice in the household

As it can be seen, from Table 12, 92 per cent of the families used coconut oil as the main cooking medium, while 4 per cent used sunflower oil, and the remaining 4 per cent used palmoil.

Table 12 Oil of choice in the family

Oil used for cooking	No.	(%)
Coconut oil	46	92
Sunflower oil	2	4
Palmoil	2	4
Total	50	100

4.2.6 Reasons for using a particular oil for cooking

On assessing the reasons, for the use of a particular oil for cooking, it was found that acceptable taste accounted for using coconut oil as the preferred oil by 46 per cent of the subjects, while availability was the reason for preference by 36 per cent of the subjects. It was surprising to note that reduced price and the low content of cholesterol did not influence the choice of oils.

Table 13 Reason for using particular oil for cooking

Reason for oil preference	No	(%)
Good taste	23	(46)
Easily available	18	(36)
Low in cholesterol	4	(8)
Tradition	3	(6)
Low price	2	(4)
Total	50	(100)

4.2.7 Quantity of oil used per month by the families

The quantity of oil which is used for culinary purposes alone has been taken into account, in this study. All the families under study were found to use the same kind of oil for the past 8-10 years. Assessment of fat consumption pattern,

among 50 families revealed that, 48 per cent of the families followed a uniform pattern in the use of oil, while for 52 per cent, the use of oil was not uniform, as they used to buy extra quantities of oil to celebrate occasions like anniversaries, birthdays, marriages and religious festivals.

As it may be seen from Table 14. The quantity of oil used in the household per month ranged from 1.700 kg to 8.500 kg with an average of 3.55 kgs.

Table 14 Quantity of oil used in the household per month

Oil consumption (kgs)	No.	%
1 - 2	3	6
2.1 - 3	10	20
3.1 - 4	20	40
4.1 - 5	11	22
5.1 - 6	3	6
> 6.1	6	12
	50	(100)

As revealed in Table 14, 40 per cent of the families consumed 3.1 - 4 kg of oil per month, while 22 per cent used 4.1 to 5 kg. However 6 per cent of the families were found to use less than 2 kg of oil and only 2 per cent were found to use more than 8 kg of oil per month.

It was also found that during special occasions and religious festivals like Deepavali, Onam, Christmas, Vishu and Sivarathri 1 to 1.25 kg of oil was used in addition to the monthly quota for cooking by most of the families.

It was also noted that the frequency of purchase of oil was on a biweekly basis by 96 per cent and it was on a weekly basis by 4 per cent of the families.

4.2.8 Frequency of making bulk preparations with oil

In addition to the daily dishes, most of the families were found to make different types of pickles in bulk, using gingelly oil.

Table 15. Frequency of making bulk preparations with oil

Bulk preparation frequency	Item prepared	Oil used	Qty. prepared	Qty. of oil	No.	(%)
Biweekly	Pickle	Gingelly	250 gm	30-50 ml	14	(28)
Monthly	Pickle	Gingelly	500 gm	50-80 ml	26	(52)
Never	-	-	-	-	10	(20)

As it is evident from table 15, 52 per cent of the families used gingelly oil to make pickle on a monthly basis and the quantity of oil used ranged from 50-80 ml, where as 28 per cent used to make pickles on a biweekly basis and they used less than 50 ml of gingelly oil to prepare 250 gm of pickle. However 20 per cent never made any preparations in bulk using oil.

Assessment of the preference of families for different oils for household cooking, showed that 100 per cent of the families, liked to use coconut oil in their daily diet.

4.2.9 Percapita availability of oil in the family per day

As all the respondents used to take food from the factory canteen and because all the family members took regular meals from their house, the per capita availaility of fat among the family members was found to be different from that of the respondents. Hence the percapita availability of fat among the family members were determined and is presented in Table 16.

Table 16 Distribution of families according to the average intake of fat per day

Quantity of fat in gms (Ranges)	No	(%)
below 15	4	(8)
16 - 25	21	(42)
26 - 35	14	(28)
36 - 45	6	(12)
above - 45	5	(10)
Total	50	(100)

The mean daily intake of fat by the family members ranged from 13.54 to 56g with a mean of 29.30 g. From the table it is evident that 8 per cent of the families used less than 15g

of oil, and only 10 per cent of the families used more than 45 g of oil per day. But 42 per cent of the families were found to use 16-25 gms of oil per day. Daily fat intake of the respondents are presented in Table 34.

4.3 Personal characteristics of the respondents

Personal characteristics of the respondents, such as age, educational status weight, height, Body Mass Index (BMI), skinfold thickness, abdominal girth, habit of doing exercise and duration of exercise, smoking habit (in relation to the number of cigarettes smoked) habit of drinking alcohol (in relation to frequency of use and hte quantity consumed) and use of tobacco were the personal details collected from the fifty respondents of the study. Information regarding the mode of transportation, time taken and distance covered by them to reach the factory were also collected and the results are presented below.

4.3.1 Age of the respondents

Age wise distribution of the respondent is presented in Table 17. All the subjects were between the age of 25-40 years and they have been doing the same occupation for the past 8-10 years. Thirty two per cent of the subjects were between the age of 25-30 years and the remaining 68 per cent is equally distributed within the age range of 31-35 years and 36-40 years. However the mean age of the respondents were found to be 33 years.

Table 17 Age wise distribution

Class (years)	No.	(%)
25 - 30	16	32
31 - 35	17	34
36 - 40	17	34
Total	50	100

4.3.2 Educational status of the respondents

Educational attainment of the respondents (Table 18)

Table 18 Educational status of respondents

Level of education	No.	(%)
High school level	2	4.00
SSLC	24	48.00
College level	24	48.00
Total	50	100

reveal that 52 per cent had high school levelof education, while 48 per cent had College level education. In addition to the primary education, 44 per cent also had technical qualification essential for the job.

4.3.3 Anthropometric measurements

Anthropometric measurements are one of the most frequently used methods for assessing nutritional status.

Anthtropometry deals with the comparative measurement of the body. Parameters like height and weight of the respondents were measured and they are compared with the standard values, to find out the deviation and are presented in Appendix.V.

The weight of the subjects ranged between 51 and 75 and the mean weight was found to be 62.76 kg. The heights of the subjects ranged between 150 cm and 195 cm and the mean height was found to be 165 cm. Table 19 represents the mean height and weight of the respondents compared to Indian Standards for different age groups.

Table 19 Mean height and weight of the respondents compared to Indian standards for different age groups

Age (years)	Details of Respondent	Standard *		Mean	
		Height (cm)	Weight (kg)	Height (cm)	Weight (kg)
≤ 30	16 (32)	155	60	165.87	62.31
30-40	34 (68)	155	60	165.29	62.94

* Source : ICMR 1989.

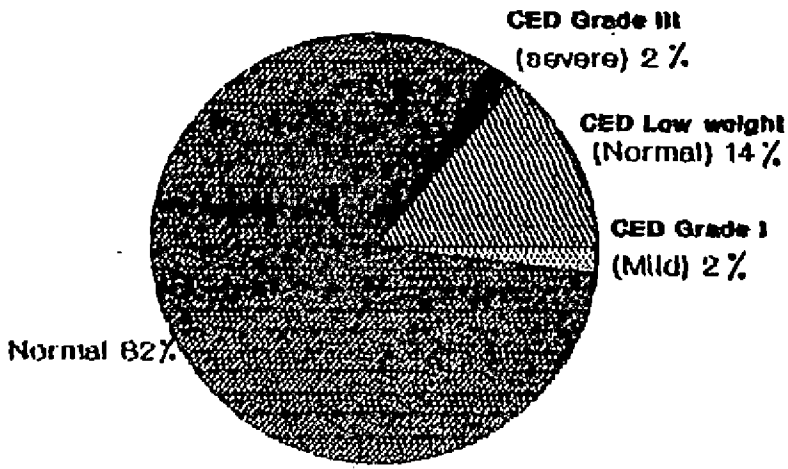
The mean height and weight of the subjects were found to be above the ideal height and weight suggested for a reference man. (ICMR 1989).

4.3.4 Body Mass Index (BMI) of the respondents

Body Mass Index of the respondents were worked out using the formula weight/height^2 (wt/ht^2) and the details are presented in Appendix V.

FIGURE -1

Classification of respondents based on grades of malnutrition



Body Mass Index (BMI) of the subjects according to ICMR classification was worked out and the distribution of respondents according to ICMR classification for BMI is presented in Table 20.

Table 20. Distribution of respondents according to ICMR classification

BMI class	Presumptive diagnosis	Distribution of respondents
< 16.0	CED Grade III (Severe)	1 (2)
16.0 - 17.0	CED Grade II (Moderate)	0 (0)
17.0 - 18.5	CED Grade I (MIld)	1 (2)
18.5 - 20.0	CED Low weight normal	7 (14)
20.0 - 25.0	Normal	41 (82)
Total		50 (100)

Numbers in parenthesis indicates percentage of subjects

It was found that 2 per cent of the subjects suffered from severe energy deficiency, while 82 per cent of the subjects were found to be normal. But 2 per cent of the subjects were in the group of CED I. Though classified as normal 14 per cent of the subjects were found to have lower body weight when compared to reference standards, where BMI was used as the criteria to fix up energy adequacy.

4.3.5 Triceps skinfold thickness (TST) of the respondents

Measurement of skinfold thickness gives an indication of howmuch energy reserves are available in the body. These

reserves are in the form of fat and are available mainly at the subcutaneous layer of the body. The degree of outer fatness and the size of the muscle mass indirectly indicate protein and calorie reserves in the body. (Frisancho and Garn, 1971). Details of Skinfold thickness of respondents are presented in Appendix V.

The general trend, as observed in the present study, Appendix V indicated that mean Triceps Skinfold Thickness was 6.2 mm, ranging from 5 to 7 mms with the mean value of 6.2 mms. No significant deviation in Triceps Skinfold Thickness was observed when compared with the values reported by NNMB (1989-90).

4.3.6 Abdominal girth of the respondents

Abdominal girth of the respondents was measured, as the body fat is deposited as adipose tissue in the abdominal area. It was observed that the abdominal girth in inches ranged from 27.5 to 38 with the mean value of 31.14 inches, as shown in Table 21.

Table 21 Distribution of respondents according to Abdominal girth

Abdominal girth (inches)	Distribution of Respondents (No)	(%)
Below 30	32	(64)
31 - 35	13	(26)
above 35	5	(10)
Average	31.14"	

4.3.7 Mid Upper Arm Circumference of the respondents

The upper arm circumference taken between the acromion process and the elbow is an integrated measure for the skeletal, muscular and the subcutaneous tissue components. This measurement is closely, though not exactly, associated with changes in the subcutaneous tissues much because the tissues easily changes under varying circumferences.

The arm circumference of the respondents are shown in Table 22. In the present study it was observed that mid upper arm circumference of the respondents ranged from 23 to 31 cm on with an average of 25.95cm. Details of mid upper arm circumference of the respondents are given in Appendix.V.

Table 22 Distribution of respondents according to Mid Upper Arm Circumference.

Age (years)	Standard value* (cm)	Observed measurements cm	No.	(%)
25 - 30	25.6 - 25.7	26.1	16	(32)
31 - 35	25.7 - 25.4	25.6	16	(32)
36 - 40	25.4 - 26.2	26.0	18	(36)
			150	(100)

* Source: NNMB 1989-90

Details regarding the personal habits of the respondents like alcohol consumption, Exercise, Smoking habit were collected and are detailed below.

4.3.8 Alcohol consumption habit of the respondents

Consumption of alcohol has a definite influence on the blood lipid profile and hence the frequency of use of alcohol in relation to quantity was recorded as given in Table 23. It was observed that 62 per cent were non users of alcohol, where as 4 per cent were consuming it regularly. But 34 per cent took alcohol only occasionally. Among them 31.57 per cent took more than 200 ml of alcohol.

Table 23 Frequency of use of alcohol and quantity of alcohol intake

Frequency of use of alcohol	No	(%)
Regular	2	(4)
Occasional	17	(34)
Never	31	(62)
Total	50	(100)
Quantity (ml)	**No.**	**(%)**
below 100	6	(31.57)
101-200	7	(36.94)
above 200	6	(31.57)

4.3.9 Smoking habit of the respondents

Cigarette smoking has an important effect on the blood lipid profile. So the smoking habit of the subjects in relation to frequency of use and number of cigarettes smoked were also

recorded. As presented in Table 24, 60 per cent of the subjects were non smokers and 10 per cent were regular smokers. It was also noted that 59 per cent have been using less than 5 cigarettes per day where as 12 per cent of the subjects were in the habit of smoking more than 15 cigarettes per day.

Table 24. Frequency distribution of cigarette smoking and number of cigarettes smoked.

Frequency of cigarette smoking	No.	(%)
Regular	5	(10)
Occasional	12	(24)
Never	33	(66)
Total	50	(100)
Number of cigarettes/day smoked	**No.**	**(%)**
below 5	10	(59)
6 - 15	5	(29)
above 15	2	(12)

4.3.10 Exercise

Storage triglycerides in the adipose tissue is dependent upon the balance between energy expenditure and energy intake, and the major factor explaining individual differences in energy expenditure is the level of physical activity.

The habit of taking exercise can help to burn excess calories, and thus to attain a balance between energy

intake and expenditure. Hence the habit of doing exercises and the duration of doing exercises by the respondents were also recorded. As it is seen in Table 25, 32 per cent of the subjects were in the habit of taking exercise regularly, but 18 per cent never did any exercise. Duration of exercise varied from 30 to 60 minutes as far as 67 per cent of the respondents are concerned.

Table 25 Distribution of respondents according to the frequency and duration of exercise

Frequency of taking exercise	No.	(%)
Regular	16	(32)
Occasional	25	(50)
Never	9	(18)
Total	50	(100)
Time (mts)		
below 30	2	(8)
30 - 60	16	(67)
above 60	6	(25)

4.3.11 Details pertaining to the journey of respondents to their working place

Mode of transport has a bearing on the burning of calories which inevitably influences the fat deposition in the body. Because of the high standard of living, people tend to

depend on motor transport facilities today, compared to their counterparts of the earlier generation. With the sedentary habits on the increase, tendency for accumulation of fat in the body is also likable to increase. Hence details pertaining to the mode of conveyance, distance from residence to working place and also the time taken to cover the distances were also recorded. Table 26 pertains to the details of conveyance of the respondents. As it is evident from the table,only 24 per cent used to walk, while 76 per cent were making use of the motor transport facilities. Distance covered by the respondents daily to the working place, revealed that 20 per cent of the subjects travelled less than 1 km, where as 38 per cent of the subjects had to travel 1-10 kms to reach the work place. But 10 per cent had to travel more than 30 kms. to reach the work place.

Table 26 Frequency of distribution of respondents according mode of transport, distance covered and time taken

(i) Mode of transportation	No.	(%)
Bus	22	(44)
Scooter	15	(30)
Walking	12	(24)
Car	1	(2)
(ii) Distance travelled in Kms.		
> 1	10	(20)
1 - 10	19	(38)
11 - 20	9	(18)
21 - 30	7	(14)
above 30	5	(10)
(iii) Time taken in mts.		
below 15	22	(44)
16 - 30	9	(18)
31 - 45	3	(6)
46 - 60	7	(14)
above 60	9	(18)
Total	50	100

Time taken by different subjects to reach their place of work varied from 15 minutes to 60 minutes.

4.4 Dietary habits and actual food intake of respondents

Dietary habits of the respondents in relation to dietary practice, frequency of meals, habit of taking food

between meals, type of food taken, food preferences of the individual, habit of eating outside the home, frequency of use of various foods were also assessed.

4.4.1 Food habit of the respondents

An enquiry into the eating habits of the respondents under study showed that 98 per cent were non vegetarians and only 2 per cent were vegetarians. Among the non-vegetarians 3 members were found to use milk, fish and meat but no egg. Table 27 represents the main food habit of the respondents.

Table 27 Main food habit of the respondents

Food habit	No.	(%)
Vegetarian	1	2
Non vegetarian	49	98
Total	50	(100)

4.4.2 Meal frequency of respondents

On assessing the meal frequency patterns of the respondents, it was found that a three meal pattern, consisting of breakfast, lunch and dinner was followed by 90 per cent of the respondents, while 10 per cent of the respondents followed a four meal pattern with an additional tea in the evening.

Table 28 Meal frequency of the respondents

Meal frequency	No	(%)
Three meals	45	90
Four meals	5	10
Total	50	100

4.4.3 Eating habit and type of food taken by the respondents

Table 29 Eating habit of respondents in between major meals and the type of food taken.

	Yes	No	Total
Habit of taking food in between major meals	15 (30)	35 (70)	50 100
Type of food eaten	Tea	Tea & Snacks	Total
	(5) (33)	10 (67)	15 100

4.4.4 Frequency of eating outside the home and type of food taken by respondents

All the 50 respondents were in the habit of taking 3 meals of the day from the factory canteen. Other members of the family took the regular meals from their homes. Over and above this 56 per cent of the respondents reported that they had the

habit of taking food out side the home as detailed below. The frequency of eating outside the home showed a wide range; only 18 per cent took food daily from outside, while 32 per cent took food on a weekly basis. However 43 per cent of the subjects took food from outside only occasionally. Among those, who had the habit of eating outside, 61 per cent took lunch, while 25 per cent took non-vegetarian especially chicken and 14 per cent took break fast dishes.

Table 30 Frequency of eating outside and type of foods eaten.

Frequency	Distribution of respondents No.	(%)
Daily	5	(18)
Weekly	9	(32)
Monthly	2	(7)
Occasionally	12	(43)
Total	28	(100)
Types of food items eaten	**No.**	**(%)**
Break fast	4	(14)
Lunch	17	(61)
Non-vegetarian dishes alone	7	(25)
Total	28	(100)

4.4.5 Frequency of use of various food items by the respondents

As all the respondents were the permanent employees of Hinustan Latex Limited, they used to take the standard food

served to them from the factory canteen three times a day. So the frequency of use of various food items by the respondents showed a deviation from the family pattern, in the use of various food items. The details pertaining to the frequency of use of various food items by the respondents were collected and presented in Table 31. Details of one week's menu is presented in Appendix VII.

Table 31 Frequency of use of various food items by the respondents

Food items	Daily	3 times a week	2 times a week	Once in a week	Occas-sionally	Never
Cereals	50(100)					
Pulses		50(100)				
Greenleafy vegetables			13(26)	37(74)		
Other vegetables	50(100)					
Roots and tubers		18(36)	5(10)	27(54)		
Fruits				11(23)	33(66)	6(12)
Nuts/oil seeds (Coconut)		50(100)				
Milk		50(100)				
Milk products			28(56)	16(32)	6(12)	
Fat/oil		50(100)				
Sugar/jaggery		50(100)				
Egg			34(68)	6(12)	6(12)	3(6)
Meat					37(74)	12(24) 1(2)
Fish			44(88)	6(12)		
Beverages		50(100)				
Processed foods						32(64) 18(36)

Figures in paranthesis indicate percentage

Frequency of using different food items may indicate the nutritional adequacy of a diet. As it may be seen from the table 31 food groups like cereals, (rice and wheat) other vegetables, coconut, milk, fat/oil, sugar formed essential part

of their regular menu, of all the respondents. The respondents also had the habit of taking tea with milk 4-5 times a day. Milk products like buttermilk and curd were included in their diet, mostly on alternate days.

Different types of pulses contributed to the major share of their protein intake and it was found that pulses were included in their menu at least three times a week. The commonly used pulses were blackgram, bengalgram, redgram and green gram and dal.

Roots and tubers like potato, yam, colocassia, carrot were included in their diet on a weekly basis. At least 54 per cent of the respondents consumed roots and tubers once in a week. Some persons had an aversion for potato as they believed that it had the tendency to produce gas and thereby gastro intestinal disorders.

Commonly used leafy vegetables like cabbage and amaranthus were included in their diet on a weekly basis. 74 per cent of the respondents included leafy vegetables at least once in a week.

Among the 50 respondents, 68 per cent used to take egg 3 times a week and 6 per cent never used eggs. None was found to use egg daily.

Non vegetarian foods like meat and fish were not included as a regular item of the daily menu served from the

factory canteen. Such dishes like beef curry and fish curry were supplied as a special dish on extra payment. Hence 74 per cent used to have meat only once in a week, while 24 per cent used it only occasionally. Two per cent reported that they never included meat in their diet. But fish was used by 88 per cent of the respondents three times a week and this may be because it is comparatively cheaper than meat.

Processed foods were found to be least used by all the respondents, as 64 per cent were found to have used it occassionally, while 36 per cent never used any processed foods, purchased from shops.

4.4.6 Actual food intake of the respondents

Actual food intake of the respondents were assesed by one day weighment method. This method enables to determine the quality and quantity of foods consumed by an individual and to locate adequacy and inadequacy. From the data obtained by weighment method the raw equivalent of the foods consumed were computed. The nutritive value of foods consumed were calculated using the food composition tables as given in the Nutritive value of 'Indian Foods (1989). The nutrient intake thus obtained was compared with the RDA (ICMR, 1981).

Table 32 Mean food intake of the respondents per day

Food Group	RDA*	Amount consumed (gms)	Percentage of RDA
Cereals	520	474.52	91.25
Pulses	50	58.8	117.60
Leafy vegetables	40	48.3	120.75
Roots and tubers	60	53.12	88.5
Other vegetables	70	117.32	167.6
Fruits	NR	19.4	-
Egg	NR	17.6	-
Fish and Meat	NR	58.3	-
Milk and products	200	300.4	150.2
Sugar/Jaggery	35	30.6	87.42
Fat and oil	45	44.36	98.5

* ICMR (1981) RDA for moderate worker NR = Not Recommended

Among the various food items consumed by the respondents, the intake of pulses, leafy vegetables, other vegetables, milk and products far exceeded the RDA. They consumed 17.6%, 20.75%, 67.6% and 50.2% above the requirements suggested by ICMR (1981) for moderate male worker. The percentage of RDA met with respect to cereals was 91.25 per cent, where as consumption of sugar/jaggery and fats and oils were 87.42 and 98.5 per cent of RDA respectively.

4.4.7 Visible and Invisible fat intake of respondents

While collecting the details of actual food intake, special emphasis was given to collect particulars related to fat consumption. The data pertaining to visible fat intake, invisible fat intake were calculated from the daily food pattern inorder to find out the total fat intake, since it has been reported that, though fat intake in Keralaites are at a lower range compared to populations from other states, then intake of invisible fat is relatively high, and that they have an influence on the blood lipid profile. Table 33 presents the visible and invisible fat intake of the respondents. It was found that the visible fat consumption varies from 16 to 81 g per day, so also invisible fat consumption also showed a wide range varying from 21.9 to 96.9 gms. The mean intake of invisible fat was 56.4 $\pm$ 2.8 g per day and was higher than the mean intake of visible fat which is 45.2$\pm$ 1.85 g per day. Thus it could be seen that the mean intake of fat was 101.64 g per day.

Table 33 Visible and Invisible fat Intake of the Respondents

Sl.No.	Visible fat (gms)	Invisible fat (gms)	Sl.No.	Visible fat (gms)	Invisible fat (gms)
(1)	34	37.4	(26)	64	84.9
(2)	38	24.9	(27)	50	21.9
(3)	16	53.1	(28)	48	51.5
(4)	37	62.6	(29)	37	62.6
(5)	42	90.8	(30)	38	75.1
(6)	43	86.9	(31)	42	84.0
(7)	46	80.4	(32)	59	38.9
(8)	61	45.6	(33)	61	53.3
(9)	52	62.8	(34)	81	40.0
(10)	38	56.6	(35)	54	72.1
(11)	51	42.9	(36)	25	55.9
(12)	41	28.7	(37)	36	52.0
(13)	47	50.8	(38)	38	48.3
(14)	45	55.6	(39)	45	78.0
(15)	36	42.9	(40)	70	96.9
(16)	50	45.1	(41)	70	44.6
(17)	30	64.8	(42)	32	40.2
(18)	51	69.3	(43)	38	86.6
(19)	46	54.3	(44)	39	57.5
(20)	57	33.8	(45)	42	84.0
(21)	58	36.1	(46)	30	66.1
(22)	33	22.2	(47)	42	22.7
(23)	35	80.1	(48)	23	29.5
(24)	43	54.0	(49)	62	30.6
(25)	33	74.7	(50)	71	88.4

As the invisible fat intake was found to be higher than the visible fat intake, contribution of invisible fat from different sources of food was calculated and are presented in Table 34.

Table 34 Contribution of various dietary components to the invisible fat content of the diet

Food item	Mean Amount consumed (gms)	Invisible fat content (gms)
Cereals	474.52	2.2
Pulses	58.80	0.9
Leafy vegetables	48.30	0.4
Roots and tubers	53.12	0.2
Other vegetables	117.32	0.9
Fruits	19.40	0.6
Egg	17.60	8.1
Fish and meat	58.30	3.5
Milk	300.40	13.7
Oil seeds (Coconut)	73.70	26.4
Total		56.9

The above results indicate that the contribution of invisible fat was highest from coconut kernel (26.37 gm) followed by milk (13.7 g) egg (8.1 g) and flesh foods (3. gm). The calorie requirement of the subjects are met due to the high intake of fat as it adds to the calorie density.

4.4.8 Calorie intake of the respondents

Calories supplied by fat (from both visible and invisible) was calculated. Details pertaining to the average calorie intake of the respondents from different sources are presented in Table 35.

Table 35. Daily calorie intake of the respondents

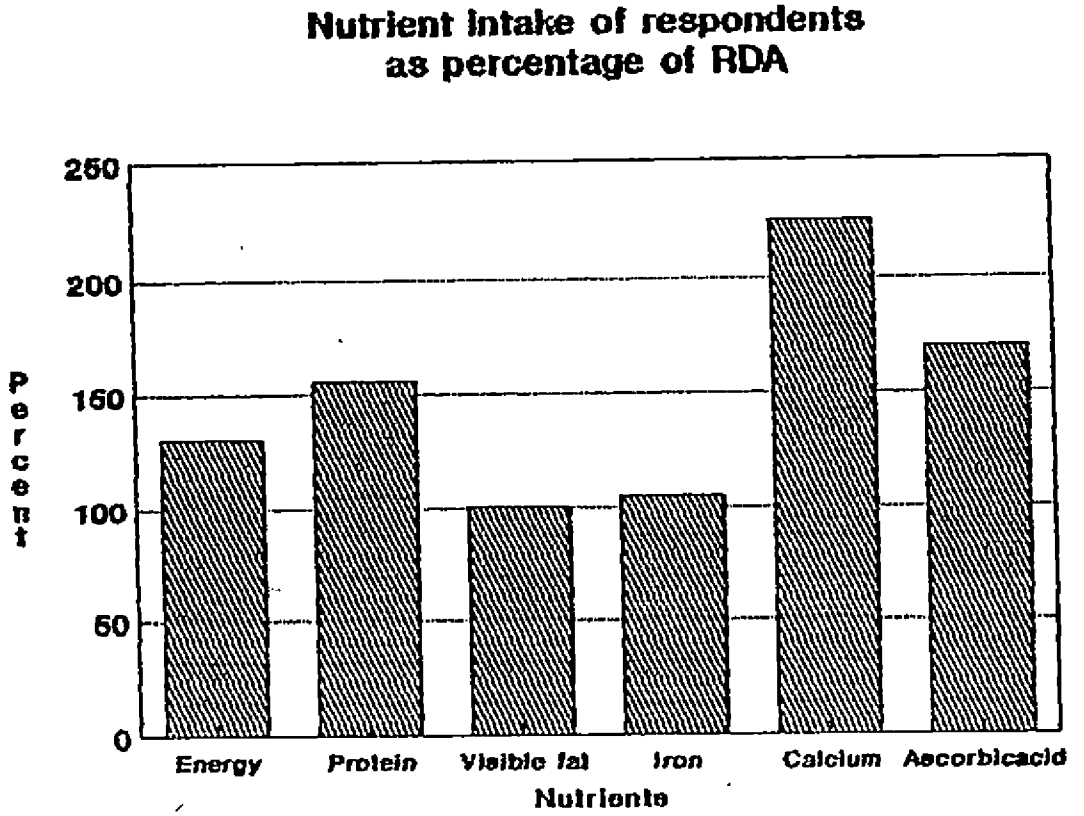
Nutrients	Mean ± SE
Total calories	3755.56±548.96
Calories supplied by fat	914.96
Fat calories as percentage of total calories	24.35

It could be seen that fat contributed 914.76 calories on an average to the total energy intake, which accounted to be 24.35 per cent of the total calories. It was found that the energy intake of the respondents met 30.6% above RDA.

4.4.9 Mean nutrient intake of the respondents

Nutrients supplied by the daily meal was calculated from the actual food intake using the food composition table (Nutritive value of Indian Foods. 1989). The mean nutrient intake of the respondents per day is presented in Table 36.

FIGURE 2


Nutrient intake of respondents as percentage of RDA
250
200
150
100
50
0
Percent
Energy
Protein
Visible fat
Iron
Calcium
Ascorbicacid
Nutrients

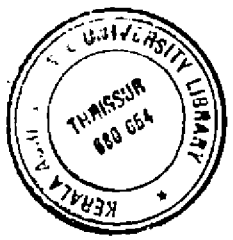


Table 36 Mean Nutrient intake of the respondents per day

Nutrients	RDA	Amount consumed	Percentage of RDA
Protein (gm)	60	93.6 ± 2.8	156
Carbohydrate (gm)		516.0 ±12.4	
Visible fat (gm)	45	45.2 ± 1.8	100.4
Cholesterol (mg)	-	196.68	
Iron (mg)	25	25.2 ± 2.8	105
Calcium (mg)	400	899 ±65	224.75
Ascorbic acid (mg)	40	68 ±10	170

The nutrient intake of the respondents indicate that the diets are rich in protein, calcium and ascorbic acid. The intake of protein, calcium, ascrobic acid and Iron met 56%, 124%, 70% and 5% above the requirements suggested as RDA. The mean fibre content of the diet was found to be 8.497±0.36 gms. while it was found to supply 196 mgs. of cholesterol.

4.5. Energy requirement, intake and expenditure of the respondents

Storage tiglycerides in the adipose tissue is dependent upon the balance between energy expenditure and energy intake. The major factor explaining individual differences in energy expenditure is the level of physical activity and a low energy expenditure will increase the probability of being in positive emergy balance for a given energy intake. So to find

out the energy balance, the energy intake, requirement as per body weight and expenditure of the subjects were also determined, and compared with the RDA for moderately active men.

4.5.1. Energy requirement of the respondents

Energy requirement of an individual is the level of energy intake from food, that will balance energy expenditure, when the individual has a body size and composition and level of physical activity, consistent with long term good health and that will allow for maintenance of economically necessary and socially desirable activity (ICMR 1992).

The energy requirement of the individuals according to body weight is presented in Table 39. As revealed from the Table 39, the energy requirement of the individuals as per body weight ranged from 2576.78 to 3115.24 with a mean value of 2888.43 Kilo calories.

4.5.2 Energy expenditure of the respondents

For calculation of total energy expenditure, as a first step, the work schedule of the respondents over a period of 24 hours, was recorded and time spent for occupational and non-occupational activity and sleep were multiplied by BMR units (for moderate activity) and were totalled up, as suggested by ICMR (1990). Details of energy expenditure according to activity is presented in Table 38.

Table 37, represents the distribution of respondents according to their daily energy expenditure pattern. It was observed that, 14 per cent spent less than 2700 Kilocalories per day for their daily activities, and 46 per cent of the subjects spent 2701 to 2800 kilocalories per day. Highest energy expenditure, which was greater than 2900 kilocalories was observed only among 12 per cent of the subjects.

Table 37 Distribution of respondents according to the daily energy expenditure pattern

Energy expenditure (Kcals)	Details of respondent	
	No	(%)
2600-2700	7	(14)
2701-2800	28	(56)
2801-2900	9	(18)
2901-3000	6	(12)
Total	50	(100)

Table 38 Energy balance of the respondents

Requirement according to Body weight	Expenditure according to activity	Energy intake	Percentage of RDA met	Deviation (intake-expenditure)	RDA for moderately active men
1. 2928.80	2784	2707.8	94.18	-76.2	2875 Kcals
2. 2659.62	2844	2816.9	97.97	-28.1	
3. 2825.30	2784	1933.5	67.25	-850.5	
4. 2825.30	2844	3517.6	122.35	673.6	
5. 2783.88	2844	4251.8	147.88	1407.8	
6. 2825.30	2784	3486.5	121.26	702.5	
7. 2825.30	2964	2831.7	98.49	-132.3	
8. 2990.98	2784	3169.4	110.24	385.4	
9. 3037.82	2820	3315.0	115.30	495.0	
10. 2659.62	2784	3219.7	119.89	435.7	
11. 2783.88	2844	2953.2	102.72	109.2	
12. 2846.01	2784	2924.2	101.71	140.2	
13. 2949.56	2784	3542.7	123.20	758.7	
14. 3115.24	2640	3002.0	104.40	362.0	
15. 2701.04	2844	3083.5	107.25	239.5	
16. 2804.59	2640	3363.8	117.00	963.3	
17. 2783.88	2760	3186.5	110.80	426.5	
18. 3032.40	2784	3634.5	126.40	850.5	
19. 2928.85	2904	3316.3	115.34	412.3	
20. 3032.40	2784	3418.9	118.91	634.9	
21. 2638.91	2664	2873.0	99.93	209.0	
22. 2825.30	2724	2722.8	94.70	-1.2	
23. 2866.72	2676	2683.0	93.32	+7.0	
24. 2638.91	2724	3368.0	117.14	644.0	
25. 2990.98	2904	3107.0	108.06	203.0	
26. 3114.10	2724	4150.8	144.37	1426.8	
27. 2970.27	2760	3112.6	108.26	352.6	
28. 3094.83	2760	3135.6	109.06	375.6	
29. 2804.59	2784	3517.6	122.35	733.6	
30. 2783.88	2904	2617.2	91.00	-286.8	

Requirement according to Body weight	Expenditure according to activity	Energy intake	Percentage of RDA met	Deviation (intake expenditure)	RDA for moderate active men
31. 3094.53	2784	3335.1	116.00	551.1	2875
32. 2804.53	2724	2958.9	103.96	264.9	
33. 2783.88	2760	3403.8+700*	8.39	643.8	
34. 2949.56	2904	3868.0	134.53	964.0	
35. 2949.56	2784	2757.0	13067.00	973.0	
36 3115.24	2784	2671.5	92.92	-112.5	
37. 3073.82	2784	3139.4	109.19	355.4	
38. 2892.56	2664	2570.5	89.40	-93.5	
39. 2659.6	2724	3740.5	130.10	1016.5	
40 2576.78	2640	3828.2	133.15	1228.2	
41. 2743.4	2784	2562.8	89.40	-221.2	
42. 2743.4	2640	3295.5	114.62	655.5	
43. 2908.14	2964	3204.2	111.45	240.2	
44. 3011.69	2696	3336.0	116.00	540.0	
45. 2846.00	2784	3335.1	116.00	567.1	
46 3115.24	2844	3306.5	115.00	462.5	
47. 2866.70	2844	2799.6	2737.00	-44.4	
48. 3115.20	2784	2718.7	94.56	-65.3	
49. 2663.20	2784	3074.9+700*	106.95	290.9	
50. 2990.98	2844	4209.0	146.40	1365.0	

* Energy supplied by alcohol

4.5.3 Distribution of Respondents on the basis of Deviation from actual requirement and RDA for moderately active men

Deviation from energy intake and expenditure was worked out. From the above figures the extent of deviation expressed as percentage deviation from requirement and RDA was calculated and are presented in Table 39.

Table 39 Distribution of respondents on the basis of deviation from their actual energy requirement and RDA.

Energy deviation expressed in percentage	Distribution of respondents according to	
	Deviation from energy requirement according to body weight	Deviation from RDA (for moderate working men)
< -30	1 (2)	2 (4)
-30 - -10	8 (16)	8 (16)
-9 - 1	2 (4)	2 (4)
1.1 - 5	3 (6)	2 (4)
5.1 - 15	13 (26)	13 (26)
15.1 - 30	15 (30)	15 (30)
30.1 - 45	15 (10)	15 (10)
above 45	3 (6)	3 (6)
Total	50 (100)	50 (100)

* Numbers in parenthesis indicate percentage.

As it is seen from the table 39, 24 per cent showed a negative deviation ranging from 1 - 30 per cent, which reveals that they spent more energy than Recommended Dietary Allowances (RDA) for energy intake, where as 78 per cent of the respondents showed a positive deviation ranging from 1-50 per cent, which shows that 78 per cent spent less energy when compared with RDA for moderately activemen.

On assessing the deviation from energy requirement according to body weight it was found that 22 per cent spent more

energy than their requirement. 76 per cent of the respondents showed a positive deviation from energy requirement expressed as percentage, ranging from 1.1 to 50.57 which shows that they are in a positive energy balance. 30 per cent of the subjects showed a positive deviation ranging from 15-30 per cent both from energy requirement and RDA, and 10 per cent showed a positive deviation ranging from 30-45 per cent both from energy requirement and RDA while 6 per cent of the respondents showed a positive deviation of more than 45 per cent, from RDA and requirement according to body weight.

4.6 Blood Lipid Profile of the respondents

To find out the blood lipid profile total cholesterol, triglyceride, HDL cholesterol, LDL cholesterol and VLDL cholesterol of the blood samples collected from 15 respondents were measured and the values are presented in Table 40 and 41.

Table 40 Distribution of respondents according to Blood Lipid Profile

Lipid constituents	Normal values (mg/dl)	Details of subjects
1.5		
Total cholesterol (mg/100)		
Below 220	220	7 (47)
220 - 240		5 (33)
above 240		3 (20
Total		15 (100)
Triglyceride (mg/100 ml)		
Below 100	150	9 (60)
101 - 200		4 (27)
above 200		2 (13)
Total		15 (100)
HDL-Cholesterol		
30-55 mg (100 ml)	55	14 (93)
above 55		1 (7)
Total		15 (100)
LDL-Cholesterol (mg/100 ml)		
Below 150	150	4 (27)
151 - 200		11 (73)
Total		15 (100)

Normal values (Boehringer Mannheim Gmbh, 1980)

Numbers in parenthesis indicate percentage.

Table 41 Blood Lipid profile of respondents

Sl.No.	Total Cholesterol mg/100 ml	Triglyceride mg/100	HDL-cholesterol mg/100 ml	LDL-Cholesterol mg/100 ml	VLDL-Cholesterol mg/100 ml	Total Choles-terol/HDL	LDL/HDL ratio	Normal values
1	236	64.80	44.60	178.43	12.96	5.29	4·0	Total cholesterol-220 (mg/100ml)
2	210	72.90	39·00	156.42	14.58	5.30	4·0	HDL cholesterol (mg/100ml) 55
3	201	56.75	34.50	155.15	11.35	5.80	4.4	LDL cholesterol (mg.100ml)-150
4	206	59.45	38·00	156.11	11.89	5.40	4.1	Triglyceride (mg/100ml) -150
5	249	100·00	34·00	195·00	20·00	7.30	5.7	Total cholesterol/HDL-C ratio = 3.8
6	229	83.78	42.45	169.80	16.75	5.30	4·0	
7	158	101.00	31·00	106.80	20.20	5.00	3.4	
8	279	218.90	47.04	188.18	43.78	5.94		
9	193	159.40	32.23	128.90	31.88	5.90	3.9	LDL Cholesterol/HDL Cholesterol ratio 2-4
10	130	64.80	23.40	93.60	12.96	5.50	4·0	
11	233	243·00	58·00	126.40	48.60	4.00	2.1	
12	208	59.45	39.20	156.90	11.89	5.30	4·0	
13	231	67.00	43·00	174.60	13.40	5.30	4·0	
14	235	62.16	44.50	178.06	12.43	5.20	4·0	
15	245	108.10	44.70	178.65	21.62	5.40	3.9	
Mean	216.2±9.20	101.44±14.80	39.70±2.04	156.20±7.46	20±2.95	5.45	3.9	

FIGURE 3

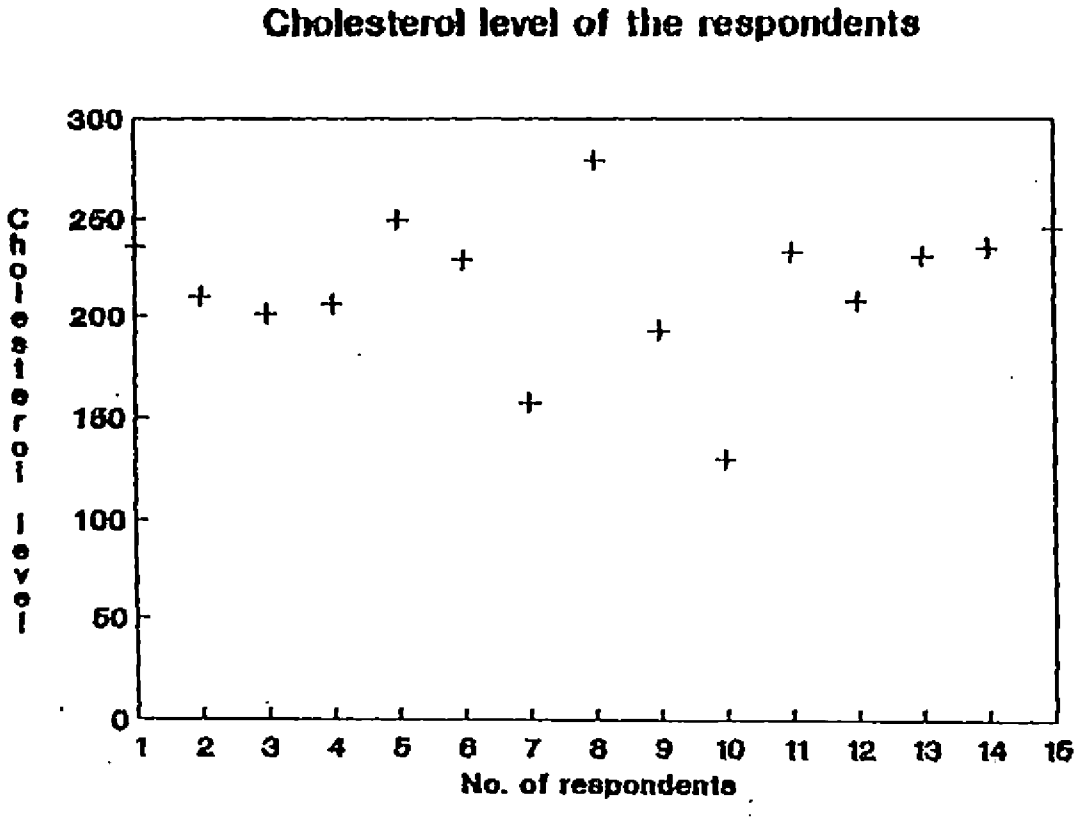

Cholesterol level of the respondents
Cholesterol level
300
250
200
150
100
50
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
No. of respondents

FIGURE 4

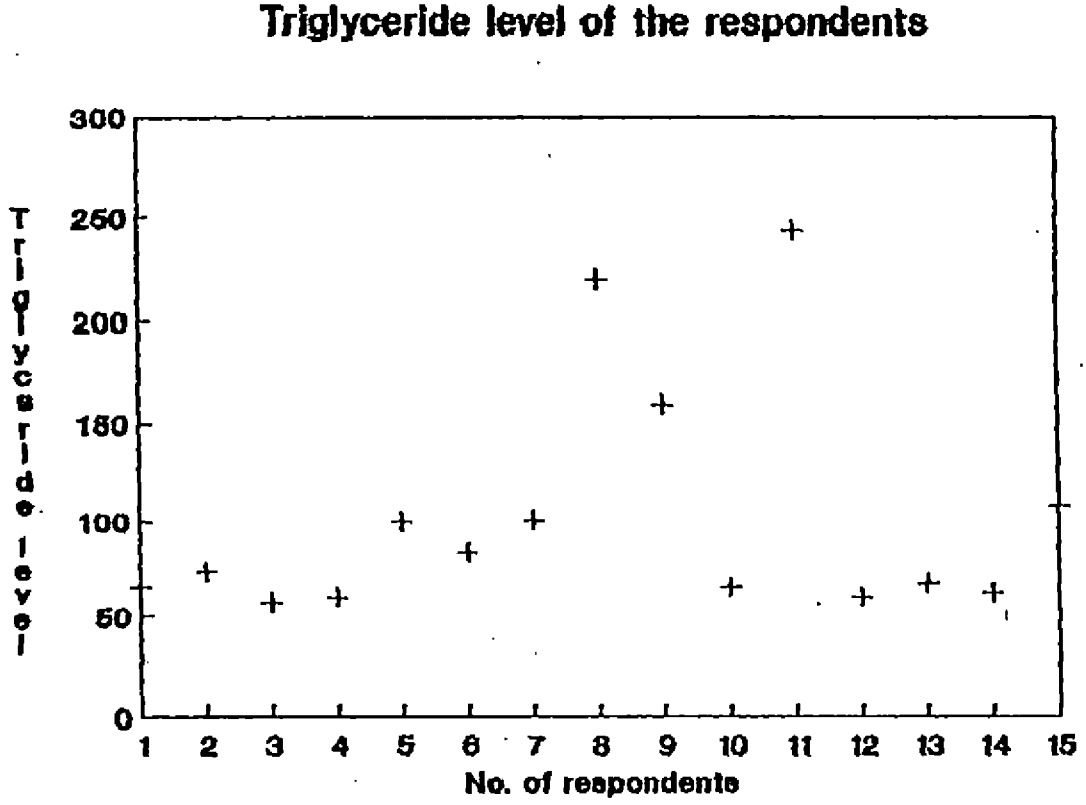

Triglyceride level of the respondents
Triglyceride level
300
250
200
150
100
50
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
No. of respondents

FIGURE 5

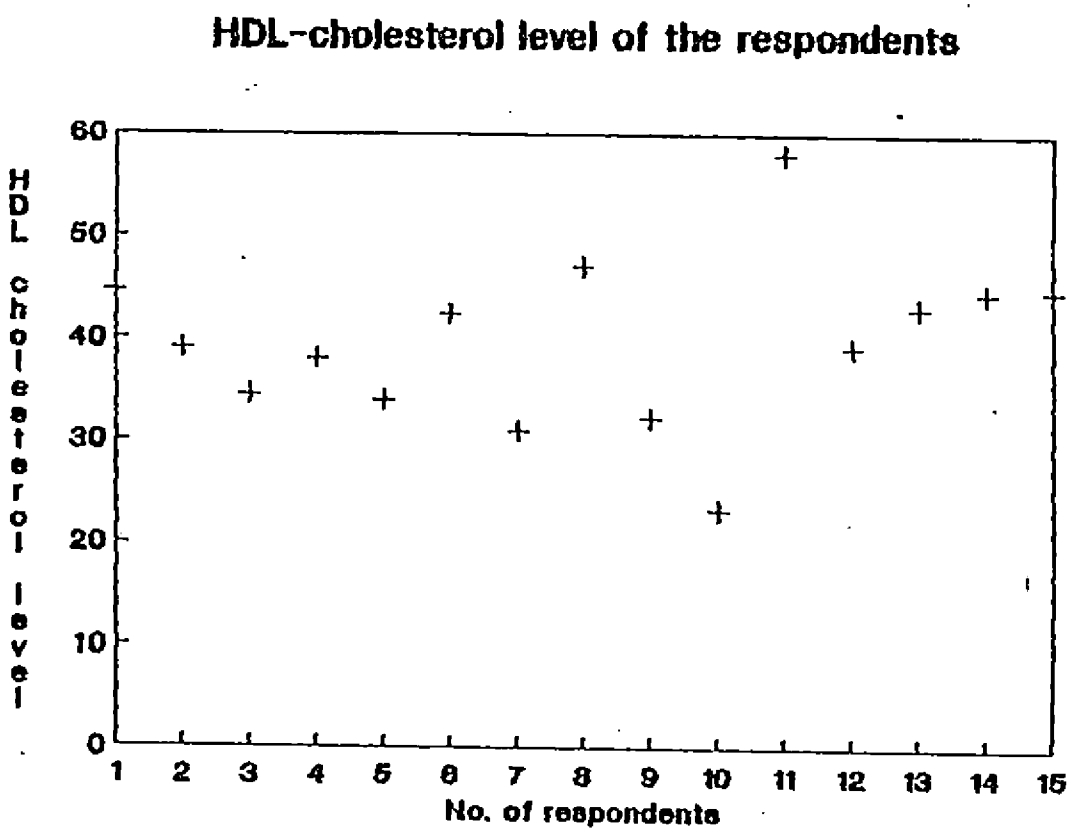
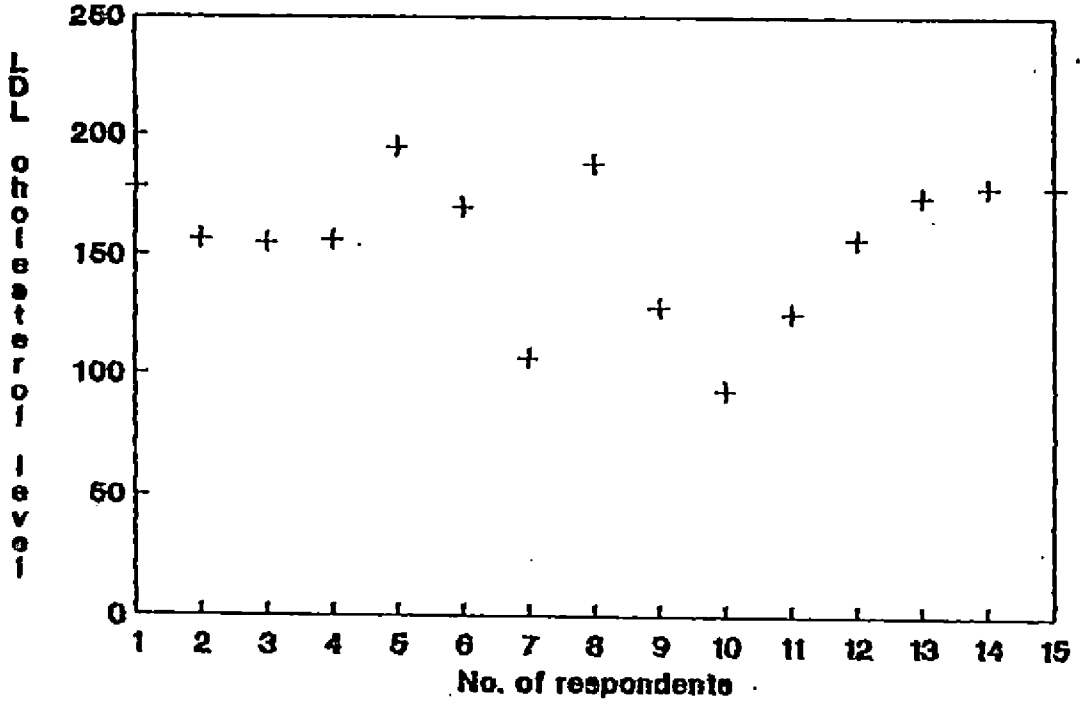

HDL-cholesterol level of the respondents
HDL cholesterol level
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
No. of respondents

FIGURE 6

LDL-cholesterol level of the respondents



4.6.1 Blood lipid profile of the respondents

The results of the blood analysis showed that the total cholesterol level of the respondents ranged from 158 to 279 with the mean value of 216.2 ± 9.2 mg/100 ml which is below the norml level. As it may be seen from the table 40, only 20 per cent had total cholesterol level higher than the normal value.

As presented in Table 41, the triglyceride levels of the respondents ranged from 56.75 to 218.9 with the mean value of 101.44±14.80 mg/100 ml. The mean value of the triglyceride level was much below the normal value. Only 13 per cent had triglyceride levels higher than 200 mg per 100 ml.

HDL-Cholesterol level of the respondents ranged from 23.4 to 58 mg/100 ml. The mean value was found to be 39.7 ± 2.04 where the normal being 55 mg/100 ml. 93 per cent of the respondents had the HDL-Cholesterol level ranging between 30-55 mg/100 ml.

LDL-Cholesterol level of the respondents ranged from 93.6 to 195 mg /100ml with the mean value of 156.20±7.46 where the normal being 150 mg/100 ml. 73 per cent of the respondents had LDL-Cholesterol level ranging from 151-200 mg/100 ml.

The ratio of total cholesterol to HDL Cholesterol was found to range from 4.0 to 7.3 with a mean value of 5.45 ± 2.95 which is higher than the normal value of 3.8. All persons except one had the Total cholesterol to HDL-Cholesterol ratio, more than

5. The ratio of Total cholesterol to HDL-Cholesterol is found to be good predictor of risk for CHD, the desirable ratio being 4.5.

The ratio of LDL cholesterol to HDL-Cholesterol was found out, and the mean of the ratio of LDL Cholesterol to HDL Cholesterol was 3.9 where the desirable ratio is between 2-4.

4.7 Association of dietary and non dietary factors to blood lipid profile

Correlation analysis of the data was done to find out the association between

4.7.1 Personal characteristics and blood lipid profile

4.7.2 Anthropometric characteristics and blood lipid profile

4.7.3 Dietary correlates of fat intake

4.7.4 Food intake and nutrients supplied to the blood lipid profile

4.7.5 Possession of coconut cultivation on the household consumption of coconut kernel and oil

Personal characteristics of the respondents like age, food habit ie (vegetarian or non vegetarian), habit of taking exercise in relation to the duration of exercise, habit of consuming alcohol in relation to quantity of alcohol consumed, smoking habit in relation to the number of cigarettes smoked were correlated with various blood lipid fractions to find out their relationship. As evident from Table 42, food habit of the respondent showed a highly significant positive correlation (0.6464) with the cholesterol fraction, and also a significant

positive correlation was observed with the HDL - Cholesterol (0.5506) and LDL - Cholesterol (0.5990). But an insignificant negative correlation was observed between the food habit and the triglyceride level.

Duration of taking exercise showed a highly significant correlation (0.888) emphasising a direct relationship between duration of taking exercise and the HDL - Cholesterol levels in blood. An insignificant negative association was observed between the duration of exercise and other lipid fractions.

The quantity of alcohol consumed also showed a significant positive association with the total cholesterol level of the blood, (0.5992). But no significant association was observed between the quantity of alcohol consumed and the triglyceride level, HDL cholesterol, LDL cholesterol and VLDL-Cholesterol level of the blood.

The number of cigarettes smoked by the respondents also showed a highly significant positive correlation with triglyceride level, HDL cholesterol level and VLDL cholesterol levels (0.8259, 0.6684, 0.8263) respectively. However the age of the respondents were found to have no significant association with the blood lipid profile.

Table 42 Correlation between the personal characteristics and blood lipid profile

Personal characteristics	Correlation coefficient (r)				
	Cholesterol (mg/100ml)	Triglyceuide (mg/100 ml)	HDL-Cholesterol (mg/100 ml)	LDL-Cholesterol (mg/100 ml)	VLDL Cholesterol (mg/100 ml)
1. Age	0.0281	0.4920	0.2693	0.2343	0.4918
2. Food habit	0.6464**	0.1708	0.5506*	0.5990*	0.1725
3. Duration of exercise	0.1521	0.2931	0.888**	0.0470	0.2939
4. Quantity of alcohol consumed	0.5992*	0.4314	0.4524	0.4439	0.4306
5. Number of cigrettes smoked	0.4875	0.8259**	0.6684**	0.0904	0.8263**

* significant at 5 per cent level
** significant at 1 per cent level

Table 43 Correlation between anthropometric characteristics and blood lipid profile

Anthrompometric measurements	Correlation coefficient (r) Cholesterol (mg/100ml)	Triglyceuide (mg/100 ml)	HDL-Cholesterol (mg/100 ml)	LDL-Cholesterol (mg/100 ml)	VLDL Cholesterol (mg/100 ml)
1. Weight	-0.0768	0.0869	0.3047	-0.2124	0.0859
2. Height	0.0460	0.0605	0.0909	0.0083	0.0600
3. Body Mass Index	-0.1613	0.0407	0.3164	-0.3020	0.0397
4. Abdominal girth	0.1466	0.3049	0.2183	0.0002	0.3046
5. Skinfold thickness	0.0435	0.5344*	0.0651	0.1761	0.5375
6. Midupper arm circumference	0.0275	0.1679	0.1345	-0.0691	0.1704

* significant at 5 per cent level

4.7.2 Association between anthropometric characteristics and blood lipid profile

Anthropometric characteristics of the respondents like, weight, height, Body Mass Index (BMI), abdominal girth, skin fold thickness and midupper arm circumference of the respondents were correlated with the blood lipid profile. Skinfold thickness of the respondents showed a positive significant association with triglyceride levels (0.5344) and VLDL cholesterol levels (0.5375) in blood. But no significant association was observed between height, weight, BMI, abdominal girth, midupper arm circumference to any of the blood lipid fractions.

4.7.3 Dietary correlates of fat intake

Energy, carbohydrate and fiber content of the diet showed a highly significant positive association with grams of total visible fat intake (0.7259^{**}, 0.5758^{*}, 0.6961^{**}). But a insignificant negative association was observed between the protein content and invisible fat intake (-0.0192). But most nutrients, Protein, fiber, energy, carbohydrate (0.1218, 0.0659, $^{-}0.0463$, $^{-}0.1897$) showed an insignificant association with grams of visible fat intake.

4.7.4 Food intake and nutrients supplied to the blood lipid profile

Association between the consumption of various food items like cereals, pulses, leafy vegetables other vegetables,

Table 44 Correlation between the food intake and nutrients obtained

	Food items	Correlation coefficient (r) Protein	Invisible fat	Fiber	Carbohydrate	Total energy
1.	Cereals	0.2522	0.1075	0.0801	0.2913	-0.2103
2.	Pulses	0.2925*	0.2314	0.0294	0.1121	0.0335
3.	Leafy vegetables	-0.0210	-0.0047	0.2495	0.2687	0.2696*
4.	Other vegetables	-0.1506	-0.0884	0.3807**	0.1678	0.0116
5.	Roots and tubers	-0.1149	-0.2404	-0.0286	-0.0658	0.1645
6.	Milk	0.3109*	0.2404	0.0834	0.2088	-0.1259
7.	Meat	0.1408	-0.0252	0.2573	0.0753	-0.0229
8.	Fish	0.5532**	0.0339	0.0009	0.0567	0.1180
9.	Egg	0.3556**	0.0370	-0.3152	-0.2445	0.0884
10.	Sugar	0.3218*	0.1163	0.0454	0.2098	-0.0879
11.	Coconut	-0.0396	0.5813**	0.4273**	0.3615**	0.1158
12.	Oil/fat	0.2868	0.1006	0.2739*	0.2290	0.2403
13.	Fruits	-0.2139	0.3404*	0.0635	-0.0578	-0.0704

* Significant at 5 per cent level
** Significant at 1 per cent level

roots and tubers, milk, meat fish, egg, sugar and coconut kernal, oil/fat and fruits, to their nutrient contribution was worked out and presented in Table 44. As it may be seen from the table 44, the protein content of the diet showed a highly significant positive association with the intake of fish (0.5532), egg (0.3556) milk (0.3109), pulses (0.2925).

Consumption of coconut kernel showed a highly significant positive correlation (0.5813) with the invisible fat content of the diet and a highly significant positive correlation was observed between the intake of coconut kernel to the fibre content (0.4273) and to the carbohydrate content of the diet.

Association between the percentage of energy supplied from different nutrients to the blood lipid profile was found out and presented in Table 45. A significant positive association was observed between the percentage of energy supplied from invisible fat and the triglyceride and VLDL-cholesterol levels. But no significant association was observed between the percentage of energy supplied from protein, carbohydrate and visible fat to the blood lipid profile, ie, total cholesterol, friglyceride, HDL, LDl, VLDL-cholesterol levels. But an insignificant negative association was observed between the visible fat concentration to the triglyceride and VLDL levels.

Table 45 Correlation between the percentage of energy derived from nutrients and bloodlipid profile

Nutrients	Correlation coefficient (r)				
	Cholesterol (mg/100 ml)	Triglyceride (mg/100 ml)	HDL-Cholesterol (mg/100 ml)	LDL-Cholesterol (mg/100 ml)	VLDL-Cholesterol (mg/100 ml)
1. Protein	0.2268	0.0806	0.2543	0.1780	0.0813
2. Invisible fat	0.3932	0.6193*	0.4009	0.1293	0.6167*
3. Carbohydrates	-0.1600	-0.1875	-0.0103	-0.1198	-0.1841
4. Visible fat	0.1453	-0.0580	0.1724	0.1553	-0.0582

* Significant at 5 per cent level

Association between food intake and various blood lipid fractions like cholesterol, triglyceride, HDL, LDL and VLDL were found out. (Table 46). A highly significant negative association was observed between the consumption of fish and triglyceride levels ($^{-}$0.6015) as well as VLDL levels ($^{-}$0.6011). But no significant association was observed between any other food groups with that of blood lipid profile.

Table 46 Correlation between food intake and blood lipid profile

	Cholesterol	Triglyceride	HDL-cholesterol	LDL-Cholesterol	VLDC-cholesterol
(1) Cereal	-0.0003	-0.0243	0.1827	-0.0407	-0.0264
(2) Pulses	-0.0490	-0.0892	-0.1092	0.0045	-0.0914
(3) Leafy vegetables	-0.0741	0.2328	0.2338	-0.2476	0.2369
(4) Other vegetables	-0.3749	0.1090	-0.4385	-0.3856	-0.1076
(5) Roots & Tubers	-0.0266	0.0715	-0.2636	0.0108	0.0684
(6) Milk	-0.4383	-0.2008	-0.2773	-0.3850	-0.2001
(7) Meat	0.0685	0.2334	-0.1129	-0.0228	0.2369
(8) Fish	0.0122	-0.6015*	-0.0842	0.2772	-0.6011*
(9) Egg	0.0641	-0.3203	0.0889	0.1816	-0.3215
(10) Sugar	-0.3603	-0.1888	-0.3197	-0.2822	-0.1892
(11) Coconut kernal	-0.3909	-0.0811	-0.1449	-0.4103	-0.0806
(12) Oil	-0.0532	-0.2964	0.0327	0.0431	-0.2988
(13) Fruits	0.1110	-0.1606	0.1112	0.1701	-0.1608
(14) Fiber	-0.4674	-0.1466	-0.4320	-0.3999	-0.1422

* Significant at 1% level

4.7.5 Possession of coconut cultivation and the household consumption of coconut kernel and oil

An increasing tendency to use more coconut kernel and coconut oil was observed among those families, which possessed coconut cultivation. The possession of coconut garden (0.6580) and a steady yield of coconuts (0.3001) showed a highly significant positive association with the number of coconuts used in the household for culinary purposes and for oil extraction. The quantity of oil used per day also showed a significant positive association (0.3279) with that of the possession of coconut garden which reveals that the quantity of oil used per day was high among those who possessed coconut garden. The number of coconuts used for household consumption showed a significant positive correlation with the triglyceide level (0.5812) and VLDL levels (0.5826).

DISCUSSION

DISCUSSION

The present study entitled "Dietary habits, fat consumption pattern and blood lipid profile of adults engaged in moderate activity" is an attempt to assess the food and fat consumption pattern of selected moderatively active adult males in relation to their blood lipid profile. For this 50 adult male employees comparable in age and doing moderate activity were selected from Hindustan Latex Limited, Peroorkada, Trivandrum. Their dietary habits, food and fat consumption pattern and socio-economic profiles were collected through surveys. Their nutritional status was assessed through actual food weighment, anthropometric measurements and biochemical investigations.

The details of this study are discussed under the following headings:

I (a) Socio-economic profile of the families.

(b) Food and fat consumption pattern of the families.

II (a) Socio-economic characteristics of the respondents.

(b) Anthropometric characteristics.

(c) Personal habits.

(d) Food habits.

(e) Blood lipid profile.

(f) Association between personal characteristics, food intake and blood lipid profile.

I. Socio-economic profile of the families

Socio-economic factors have a definite bearing on the dietary habits of the people and thereby on the dietary intake and nutritional status. Derby (1976) reported that among the various factors affecting the nutritional status of an individual diet with its close association with socio economic factors emerge as an important force of influence. Devadas and Eswaran (1986) had opined that food habits of the people depended on availability of foods and food availability was observed to be influenced by climate, socioeconomic conditions and cultural environment. Sirshi (1985) suggests that to assess the socioeconomic status, details pertaining to the type of family, family size, monthly income and caste are to be ascertained. As reported by Rajammal et al (1980) there is an increasing awareness of the relationship between malnutrition and socioeconomic factors. Ghosh (1989) reported that social factors like religion, occupation, economic status, education, beliefs and culture had important bearing on health. Suter and Hunter (1980) reviewed that nutritional status was influenced by factors such as psychological, sociocultural and physiological influences. Moreover, nutritional status is an indicator of social well being of a community. Baghurst (1994) is of the opinion that high and low fat consumption in a community is related to socio demographic, attitudinal and dietary factors.

[redacted] factors on food and fat intake.

Religion and Caste have a profound influence on the food habits particularly in the use of oil, as certain religious communities were found to use more fried foods and fatty foods. The present study revealed that 90 per cent of the subjects were Hindus, and the rest were Christians. Caste wise distribution showed that 42 per cent belonged to forward class and 32 per cent belonged to backward class. Persons belonging to scheduled castes and tribes constituted the remaining 26 per cent.

But in this study, no significant correlation was observed between the religion/caste of the respondent and the food and fat intake. This is due to the fact that, all the respondents were consuming the same standard food served to them from the factory canteen, thrice a day.

Area of residence of the respondents is an important social factor to be considered while studying the dietary habits and fat intake of people, as regional variations have shown to have a profound influence on food intake, and it holds good with respect to fat intake too. The particular culinary practice in a region are clearly powerful determinants of fat intake even over-riding the constraints of income. Mario et al. (1980) are of the opinion that the urban men had higher total fat and cholesterol

intakes when compared to rural men, who had a high consumption of carbohydrate, particularly starch. They further observed that in the urban areas the daily intake of visible fat ranged between 20-42 g among the middle and high income groups which was much above the levels consumed by those in rural areas.

In the present study coconut oil was found to be the major fat used for culinary purposes, irrespective of urban or rural area of residence, mainly because it is the habitual, and traditionally used oil of the region. Hence no significant relationship was revealed between the place of residence of respondents and their fat intake though 42 per cent of the subjects were residents of urban area. It may be because of the fact that even though the respondents belong to both urban and rural areas they used to take the meals served to them from the factory canteen, which is a standardised one.

In the modern era, type of family comes to bear definite influence on food habits. A nuclear family with lots of freedom on spending habits and time to take care of the health of limited members of family, spend a sizable portion of their budget on food, which invariably results in consuming carbohydrate rich fatty foods. This also results in higher percapita availability of food within the family. So also in a nuclear family where the husband and wife work, they come to depend very often on processed foods resulting in a higher intake

of fatty foods, since majority of processed foods contain fat or allied substances as a principal component.

Among the 50 families selected, nuclear families with one to four members constituted 34 per cent, while 64 per cent were extended families and 2 per cent were joint families with 5-8 members. The average size of the family was found to be five. According to Park (1991) the average family size in India is four.

The 50 families surveyed had a total population of 231 members. Age and sex wise distribution of the selected population revealed that 37 per cent were adult males, and 36 per cent were adult females and the remaining constituted the child population. The general composition shows that adults predominated forming 73 per cent and children formed only 27 per cent. This reflects the changing demographic profile of India in general.

Park (1991) has reported that the demographic profile of India is fast changing and is characterised by adult population forming 60 per cent and young population (below the age of 15 years) forming 40 per cent.

Staflen et al. (1994) reported that transfer of nutrition habit within the family may contribute to the establishment of a high fat diet. Several studies show a

significant correlation in nutrient intake between parents and children living in the same household.

Educational status and literacy rate have been proved to be powerful determinants of nutritional status (Park, 1991) as it may influence the awareness about importance of good nutrition, which can affect food choice. So also those who are well educated will be placed in higher positions, drawing a good salary which will increase the purchasing power of the family.

Educational status of the family members other than respondents revealed that 7.5 per cent of male members as well as 14 per cent of female members were illiterates; however 41.6 per cent of the male members and 35.71 per cent of the females had attained college level of education. The literacy rate was comparatively high among the male population.

The very state of being employed in productive work promotes health; it ensures better purchasing power, which allows flexibility in food choice and better quality of life.

The age of the respondents are also such that they are all young adults. This is the period of life, when one is free to choose foods, both from the point of view of health or income.

In this study, the food consumption and fat consumption patterns of the individuals were judged with the level of education, to find out whether, the level of education had any

influence on food consumption or fat consumption. Though every one was aware of the harmful effects of excess consumption of fat, and the advantages of vegetable oils, their knowledge gained through literacy, did not affect their food choice or selection of fat.

All the respondents are healthy and have a steady income. Hence it is natural that their educational status or level of literacy did not affect food selection or fat consumption.

Both economic and nutritional considerations are relevant to any discussion on fat intake. Income level was found to markedly influence fat intake and also the kind of fat consumed in all states, as revealed in the diet surveys conducted by NNMB (1994). Being an expensive food item fat intake is highly subject to income variations. According to Achaya (1987) the quality of fat consumed clearly parallels the income earned. He has further proclaimed that the low income group and the industrial labour class show similarities in fat intake, which could be attri-buted to their comparable income levels. Rise in income is likely to lead to greater expenditure on edible oil purchase. Hence the total family income of the respondents were ascertained in this study.

The economic status directly or indirectly influences the purchasing power, standard of living quality of life, family

size and pattern of disease and deviant behaviour in the community. Park and Park (1991) reports that Keralites are enjoying high standard of living inspite of low percapita income.

The present study revealed that the respondents and their families had a sizable income. As all the respondents were permanent employees of Hindustan Latex Limited, they had a steady supply of money and their monthly salary formed the major source of income of the family. The personal monthly income of the respondents ranged from Rs.3000-4000 as all the subjects were of the same grade, doing same kind of job.

Most of the families possessed land, and coconut cultivation.

Among the 50 families, 16 adult males and fourteen adult females were found to be employed in the family other than the respondents, and 6.6 per cent of these employed males and 21.5 per cent of the employed females earned monthly income of more than Rs.2000. The income earned by different family members other than the respondents also contributed to the total family income.

High educational status, among the family members and the high levels of female literacy rate enabled better placement of these members in the occupational sector and to achieve economic security.

Food and fat consumption pattern of the families

Food consumption pattern of the families revealed that the diets of the members were adequate. This could be attributed to the better economic status of all the respondents, who are permanent employees of Hindustan Latex Limited which enabled them to have a better purchasing power. Furthurmore, the higher educational status of the family members, and better exposure to mass media, might have created greater awareness. Hence they might be more concerned about the health and nutritional status of the family members and this leads them to and they spent a sizable portion of their income on food, to cater to the needs of the family. It was found that 86 per cent spent less than Rs.2000 on food per month. But 14 per cent were found to spent Rs.2001 to 3000 on food. Eight per cent of the total 50 families were observed to spent less than 15 per cent of their total income; but 70 per cent of the families were spending more than 30 per cent of their total income on food.

However, factors like food preferences, availability of food items in the locality, knowledge of nutritional values of certain food items, relative prices of food articles and urgency of non-food expenses were also found to determine the priorities in the food expenditure pattern.

All the families were observed to be habitual non vegetarians with rice as the staple food. NIN (1985). Preet and

Bhavan (1988) and Parvathi and Babitha (1989) found that cereals especially rice continued to be the major staple food item among South Indians.

Rice, being the staple food of Keralites, accounted for the major expenditure on food. It was found that 27 per cent of the total income was spent on cereals; mainly rice. Prema and Menon (1980) in a study in the coastal areas of Trivandrum, found that 76 per cent of the income is spent on carbohydrate rich foods. Godawari et al. (1987) found that around 50 per cent of families in Tamil nadu spent 30-40 per cent of their food expenditure on cereals.

Unlike the earlier studies conducted in Trivandrum district, in the present study, the families were found to spent greater amount on fruits, pulses, milk and milk products, meat, fish, nuts/oil seeds and oil. It was found that on an average, 25 per cent of the total income was spent for purchase of milk; three per cent on fruits; four per cent on pulses; seven per cent each on meat and fish; eight per cent on nuts/oil seeds especially coconuts; five per cent on oil; two per cent on other vegetables and one per cent on leafy vegetables. The main reason for including different food items in higher amounts in comparison with other groups, in the menu of the family members may mainly be because of the awareness, and knowledge about nutritious and protective foods. This could also be attributed to higher income as well as the influence of income that is

steady and regular.

Protein foods like milk, fish and egg were included frequently, almost on all days, but meat being an expensive food item was not included frequently in their regular menu; they used it only once in a week or once in a month.

A study conducted in rural areas of Uttar Pradesh revealed that the consumption of pulses and vegetables was occasional due to ignorance. Godavari et al. (1987) reported that in Tamil Nadu, 4 per cent of the families did not spend any amount on leafy vegetables and others spent less than 6 per cent of their food expenditure on it. Compared to other states the expenditure on nuts and oilseeds was higher in Kerala. The same trend was observed in the studies of Sujatha (1990) and Felsy (1989). This study also is in tune with the above findings as the families spent 8 per cent of the food expenditure on coconuts and 5 per cent of their food expenditure on oil.

Frequency of use of various food items depicted that the daily diet in most of the families comprised of food articles like rice, coconut, fish and sugar and beverages like coffee or tea, pulses, other vegetables and green leafy vegetables.

Earlier surveys conducted in Trivandrum district among women from unorganised sectors found that they consumed pulses, green leafy vegetables and eggs occasionally. The authors further reported that this might be due to high cost, non availability and ignorance. (Sujatha 1990). Similar findings were

observed in surveys conducted in other parts of India. Consumption of pulses and vegetables was reported to be occasional in rural households of Uttar Pradesh (Anonymous, 1987). However, in the present study, it was found that all the families were consuming an adequate diet or a balanced diet which provided all essential categories of food, necessary for good health. However, the food intake of all the family members were not assessed quantitatively because the respondents were found to take at least three meals, from the factory canteen.

On assessing the food consumption pattern of the industrial workers, leads one to understand that, growing urbanisation, braking down of joint family system, high female literacy and improved socio-economic conditions have resulted in a better standard of living. All the families were headed by males, who draw a regular income from their employment. All the employees were also the beneficiaries of the co-operative society under the factory from where they get food items at a subsidised rate. Modern nuclear families cater to the food needs of the individual family members rather than that of the joint family system. High female literacy, and developments in print and visual media has helped a lot in creating awareness even among the poorer segments of rural population, resulting in the consumption of low cost, but nutritionally rich balanced diets, thus enabling them to lead a healthy life.

Assessment of fat consumption pattern of the families revealed that 92 per cent used coconut oil as the main oil for cooking while remaining six per cent used palm oil and sunflower oil. As most of the families possessed coconut gardens, they had a steady supply of coconut, and they used these nuts for household purposes; kernels in curries and also for oil extraction. This may be the reason for them to use coconut oil as the main cooking medium.

In this study, an increasing tendency to use more coconut oil and coconut kernel was observed among families which possessed coconut cultivation, as coconut being an important crop of the homestead gardens of Kerala.

Eventhough 6 percent of the respondents used palm oil, or sunflower oil, all the respondents preferred to use coconut oil as the main oil for cooking because of its acceptable taste and flavour. Pleasant and familiar taste accounted for 46 per cent, while ease in availability accounted for 36 per cent of the respondents for using the particular oil for cooking. This reveals that, the selection of oil seems to be based on sense appeal, rather than the price or health benefits. Though much explanation and controversy had existed, and publicized through the print and visual media about the use of oils this literate mass of Kerala seem to be unaffected and not carried away by such attractions. The customary and tradition based use of coconut

oil, especially among the rural as well as the urban families could have been stabilized in the recent days because of an influx of information favouring the health attributes of coconut oil and kernal. This increased use of coconut oil, could also be attributed to reduction in price of this oil of preference, as well as the non-availability of palmoil, which was supplied generously through public distribution system at a subsidised rate,earlier.

It was interesting to note that all the respondents were found to use the same kind of oil for the past 8-10 years. So also 48 per cent of the respondents followed a uniform pattern in the use of oil, ie., the quantity of oil used per month remained more or less the same. The quantity of oil used per month ranged from 1.700 kg to 8.500 kg with a mean of 3.55 kg. But 52 per cent of the families took extra quantities of oil to prepare special dishes to celebrate occasions like birthdays, anniversaries, marriages and also festivals seasons like Onam, Christmas, Vishu, Deepavali, Sivarathri etc. and the average extra quantity of oil used was found to be 1 to 1.25 kgs.

The quantity of oil used was dependent on the total number of family members and also on the number of coconuts used for oil extraction. The study revealed that higher the coconut yield, more was its utilisation with in the household as kernal as well as for oil extraction. Sixty four per cent of the

selected families had coconut cultivation and the mean coconut yield was found to be 426 nuts, and on an average 70 nuts were used for household purposes. (Kernel for different preparations) per month. So also the average number of coconuts used for oil extraction was found to be 830 per year.

The above factors, such as higher yieldand higher utilisation of nuts for oil extraction might have also led to preferential use of coconut oil, mentioned earlier.

Sixty four per cent of the families made use of the oil extracted from the nuts while 36 per cent of the families were in the habit of purchasing cooking oil from shops and among these families 96 per cent purchased oil on a biweekly basis.

In addition to coconut oil, most of families also used small quantities of other oils/fats like gingelly oil, hydrogenated fat, ghee, palmoil, and sunflower oil. These oils were mainly used for making certain special dishes, rather than for the regular meals; dishes ie, gingelly oil was mainly used for pickles; dalda for making snacks, ghee for making payasam etc. and the quantity of these oils/fats used per month ranged from 100 g to 1000 g depending on certain seasons and occasions their purchase was need based. Lessened use of these oils could be attributed to price, variability in the total family income and their cultural habits.

The average per capita availability of fat among the family members varied on a wide spectrum, ranging from 13.5 to 56g with mean value of 29.3 g. The above data on fat consumption pattern of families reveals that coconut oil is the oil of preference, and is the basic fat medium used in the households for culinary purposes. Inspite of this fact, the percapita intake was found to be about 30 g (visible fat) which is below the standard requirement for fat. It was found that there were families which had less than 15 g as per capita consumption level. This lowered intake found among specific families could be attributed to variations in culinary practices, type of food that is cooked and also food habits. The lowered intake of fat, by Keralites in general have been reported by several workers. (Karuna 1993, Jyothi 1993). NNMB (1988-90) reported that the average fat intake among Keralites is 14 g. Pushpamma et al. (1982) and Geervani et al. (1986) have revealed that fat intake in rural Andhra Pradesh ranged from 10 to 20 g/day.

However, the mean fat intake among the respondents were found to be higher than that of their family members. This is because of the fact that the respondents had their two major meals from the factory canteen; so also they took tea and snacks in between the major meals, which were fried items. Thus the mean visible fat intake of the respondents were found to be 45.2 g and the mean invisible fat intake of the respondents were 56.4 g/day.

Culinary practices with regard to cooking methods practised by the families revealed that all families were following the traditional cooking methods. Boiling was the most commonly adopted method by all the families for cooking cereals, pulses, other vegetables, egg, milk and roots and tubers. However, the excess water used for in boiling was reused as soups or gravies, so that the nutrients in it were fully utilised by family members. Only 18 per cent of the families adopted deep fat frying for cooking flesh foods, while remaining 82 per cent resorted to boiling followed by shallow frying. The calorie density of foods prepared by deep fat frying are high, as the quantity of fat absorbed will be more. Hence those who consume deep fat fried foods would have a higher total fat intake, than others.

The analysis of the characteristic features of the 50 families to which the respondents of the study belonged, revealed that these families had a moderate level of income and educational status, and their diets were more or less adequate with respect to their composition, with minor variations. Their fat consumption however was based on the oil available from the coconut cultivation, and it varied considerably. However it was interesting to note that, the above features of the families, did not reflect the characteristics of the respondents, because their food and fat consumption varied remarkably, from that of the family pattern. This was found to be different, because, all the variation induced by differences

in the individual families were nullified by the fact that the respondents rarely shared the home meals, but they consumed the food served from the factory canteen. Therefore the characteristics of the individual respondents were assessed and analysed in detail to assess the effect of food and fat consumption on blood lipid profile since these characteristics of the respondents and their families were found to move parallally without sequential association and also because the objective of the study was to assess the food and fat consumption pattern of selected moderately active adult males in relation to their blood lipid profile.

II. Socio economic characteristics of the respondents

All the respondents selected for the study were between the age group of 25-40, free of any identified disease or disorders, doing moderate activity for the past 8-10 years. Majority of the respondents were Hindus, drawing a monthly income ranging from Rs.3000-4000. All were moderately educated and most of them also possessed technical qualification essential for their job.

Baghurst (1994) reported age as a significant factor determining fat consumption, of men. Swami (1989) reported that age and weight of the subject appeared to be related to the development of cardiovascular disease irrespective of the exact lipid levels. But in this study no significant association was

observed between the age of the subject with the dietary habits or fat intake which might be because of the fact that all the respondents working in the factory consumed the same type of food served to them. The age of the respondents were also such that they were all young adults specially selected for the study. This is the period of life, when one is free to choose foods both from the point of view of health or income. All the respondents were healthy and had a steady income. Hence it is natural that their income level did not affect their food selection or fat consumption.

In this study the food and fat consumption pattern of the individuals were judged with the level of education to find out whether, the level of education had any influence on food consumption or fat consumption. Though all were educated and everyone was aware of the harmful effects of excess consumption of fat and the advantages of vegetable fats, their knowledge gained through literacy did not affect their food choice or selection of fat.

This could again be due to the fact that they had no choice to make, since they all shared the same standard meal served through the factory canteen during the working hours and the meal, as well as deep fat fried items were available at subsidised cost, which might be an added attraction in using these items liberally.

Anthropometric characteristics

Body measurements are good indicators of growth and health status of an individual. Enumeration of anthropometric measurements revealed that the height of the respondents ranged from 150 cm to 195 with a mean of 165 cm. Their mean height was found to be above the standard height suggested by ICMR (1989) for a reference man. These values were also higher than the mean height reported by NNMB (1994) for male slum dwellers of Trivandrum which ranged between 162.9 to 161.3 for the adult males belonging to the age group ranging from 25 to 40 years. The figures reported by NNMB (1994) for males of the age group of 25 to 40 years, for the state of Kerala is between 5.3 to 54.8 and the respondents were found to have higher values for height, when compared to their counterparts.

The weight of the subjects ranged between 51 and 75 kg and the mean weight was found to be 62.7 kg. which is above the ideal weight suggested for a reference man (60 kg.) (ICMR 1989). The body weight of slum dwellers of Trivandrum belonging to same age group as reported by NNMB (1994) ranged between 57.4 to 54.2 kg. This indicates that the respondents had higher body weights compared to their counterparts. This is a reflection of better nutritional status attributable to the quality of diet that is served from the factory.

This reveals that the subjects selected were normal and healthy, maintaining a good nutritional status, based on the above two parameters viz. height and weight.

Body Mass Index (BMI) of the subjects according to ICMR classification revealed that 2 per cent of the subjects suffered from severe energy deficiency (CED III severe), while 82 per cent of the subjects were found to be normal. However 2 per cent of the subjects fell into group CED I. Though classified as normal 14 per cent of the subjects were found to have lower body weight when compared to reference standards where BMI was used as the criteria to fix up energy deficiency.

The normal BMI levels for adult males are reported to be between 20-25 (ICMR 1989). Studies conducted by NNMB among urban slum dwellers in 1993-94 revealed that only 52 per cent had normal values in their survey conducted in 10 states of India. It also reported chronic energy deficiency among 58 per cent of males from Cuttuk and 28 per cent in Trivandrum. In a random sample of the Canadian population surveyed in 1986-90 (Reeder et al. 1992) 35 per cent of men had BMI values above 27 kg/m^2, in men, which suggests that a significant proportion of canadian population was overweight. In USA, 25.7 per cent of the adult population (34 million) are over weight, as 15 million men have a BMI values above 27.3 kg/m^2 (Kuezmarski 1992).

But in this study, all the 50 respondents selected had BMI values below 25 kg/m^2 which shows that none were over weight.

Measurement of skinfold thickness helps to assess the subcutaneous fat deposits and gives an indication as to how much energy reserves are available in the body, under the skin. The skinfold thickness of all the respondents ranged from 5-7 mm with a mean of 6.2 mm. This is below the values reported by NNMB (1994) where the skinfold thickness ranged from 8.3 mm to 9.1 mm. for men in the age group of 25-40 years, who are slum dwellers of Trivandrum city.

It may be of interest to note that all respondents were engaged in manual work involving both their hands, in the factory. The same activity was repeatedly done for eight hours a day. This indicates that the muscles of the hands are most active, and would contribute to active muscle mass leaving little chance for accumulation of fat.

The Mid Upper Arm Circumference (MUAC) is an integrated measure for the skeletal muscular and subcutaneous tissue components. In the present study it was observed that the Mid Upper Arm Circumference of the respondents ranged from 23 to 31 cm with the mean value of 25.9 cm. The Mid Upper Arm Circumference were comparable to that of the values reported by NNMB (1988-90) in the survey done among Keralites. The values reported by NNMB for the age group 25-40 years ranged from

25.6 - 26.2 cm and it was observed that for 36 per cent of the respondents in the age group of 36-40 the mean mid upper arm circumference was 26 cm.

As all the respondents did their work manually with their hands, they had well developed muscles. Thus the nature of work done in this case seems to have influenced their Mid Upper Arm Circumference and hence would have led to satisfactory muscle development. This also gives an indication of optimum nutrition. When viewed on the basis of Mid Upper Arm Circumference none of the respondents were found to be obese or too lean and they have an optimum status with particular reference to calories and protein. (Ghosh 1989).

Abdominal girth of the respondents was measured as the body fat is deposited as adipose tissue in the abdominal area, also. Preferential accumulation of adipose tissue in the abdominal area has been associated with dyslipidaemia, which may increase the risk of CVD as suggested by Kalkhaff et al. (1989). According to Despres et al. (1990) waist circumference may be one of the best correlates of visceral abdominal adipose tissue and may represent a useful alternative for the assessment of the risk associated with abdominal obesity. The author further suggest that waist circumference is also a better correlate of total body fat mass and abdominal adipose tissue accumulation than Waist Hip Ratio (WHR). Hence waist circumference (abdominal girth) was measured in preference to Waist Hip Ratio for

anthropometric estimation of abdominal adipose tissue deposition and related cardiovascular risk.

In this study it was observed that abdominal girth in inches ranged from 27.5 to 38 inches (64.75 to 96.5 cm) with the mean value of 31.14 (79 cms) inches. All the respondents showed an increasing tendency for a higher accumulation of adipose tissue in the abdominal region, as indicated by the fact that 36 per cent of respondents had an abdominal girth of 31 inch and above.

In both men and women, an area of visceral adipose tissue above 100 cm^2 was reported associated with moderate disturbances in CVD risk profile, where as visceral adipose tissue area greater than about 130 cm^2 were found to be associated with further deterioration of metabolic variables predictive of CVD (Despres 1991).

Personal habits

Inter-Individual variations among respondents in their characteristic and personality depends primarily on two factors one is genetic, and the other is the environmental. With reference to Nutritional status, the genetic as well as the environmental characters have their deciding influence. The genetic influence may reflect more on the anthropometric measurements, while the personal characteristics which are

acquired may have varying influences. Hence the personal habits of the respondents which may have a bearing on the health and nutritional status of the individual, as well as on the lipid profile, as reported in literature were assessed in this study.

Consumption of alcohol, a socio cultural habit, has a definite influence on the blood lipid profile, and alcohol intake also adds to the calorie content of the diet. La Vecchia et al. (1992) reported that alcohol consumption as an important correlate of dietary pattern.

A study on the alcohol consumption pattern of the respondents in relation to frequency and quantity, revealed that 62 per cent of the respondents were non-users. This may be because of the high educational status of the respondents as suggested by La Vecchia et al. (1992), who had reported that alcohol consumption was more common in less educated individuals. Though educated 4 per cent were found to consume alcohol regularly, and 34 per cent were in the habit of consuming it once in a while to celebrate an event or a festival and most of them took only 100 ml at a time.

It is a well known fact that one ml of alcohol supplies the body with 7 K cals of energy. This is reflected in the calorie intake values given in Table 39. Those who had taken alcohol on the days of food inventory survey, had a higher calorie intake. It may also be noted that they had consumed more

than 1000 Kcals, over and above their actual requirement. This habit if continued would lead to obesity, and consequent metabolic changes which may increase the risk of CHD. The consumption of alcohol may be a personal habit or a familial custom, and the steady income that the respondent earns might contribute to the habit of alcoholism, also.

Smoking is another vice, which has been brought to the limelight by the scientific community elaborating its detrimental effect on health and longevity. Cigarette smoking has been reported to have a profound effect on the blood lipid profile. Smoking habit of the respondents in relation to frequency and number of cigarettes smoked revealed that 66 per cent of the subjects were non-smokers. This may be because all are aware of the deleterious effect of smoking on health, since they have been high lighted very widely through the mass media in the recent days. Therefore, many of the respondents have abstained from smoking. Among the regular smokers, 59 per cent have been using less than 5 cigarettes a day, while 12 per cent were in the habit of using more than 15 cigarettes per day.

Maintenance of a healthy body weight results from equating total energy intake to total energy expenditure. The quantity and quality of dietary items and regular exercises have shown to influence all components of total energy as observed by Van Zant (1992). An enquiry on the habit of taking exercises

revealed that 32 per cent were in the habit of taking exercise regularly. Duration of exercise varied from 30 to 60 minutes as far as 67 per cent of the respondents were concerned. Eventhough 18 per cent did not do any regular exercise, all the respondents reported that they engage themselves in household activities of their own, over and above the moderate activity of eight hours in the company. None of them were sedentary or heavy workers.

Physical exercise, would help to burn the excess calories. This would help also to prevent the accumulation of fat on specific areas of the body.

Mode of transport has a definite bearing on the energy expenditure and it inevitably influences the burning of calories. Only 24 per cent of the respondents used to walk to the factory. The employees of the factory were provided with company bus and forty four per cent of the employees made use of this facility, while 30 per cent used their own scooter and 2 per cent travelled in cars. Because of the high standard of living, people tend to depend on motor transport facilities compared to their counterparts of the earlier generation, as this will save time and energy. With the advancement of mechanisation in all fields sedentary habit of the people are on the increase, and tendency for accumulation of fat in the body is also likely to increase. Only 10 per cent of the respondents had to travel more than 30 km to reach their work place.

Regular walking by 24 per cent of the respondents to their place of work provided them with ample opportunity for exercise, which helped them to burn excess calories and also to increase the HDL fractions of their blood resulting on favourable blood lipid profile

Food intake of the respondents

The survey on food habits of the respondents revealed that all the respondents except one were nonvegetarians. This respondent too was originally a non vegetarian who was forced to be a lactovegetarian as per the advice of the doctor, consequent to an incidence of peptic ulcer.

The study revealed that the family dietary habits and patterns were different from that of the respondents, since all the respondents had at least three meals a day from the factory canteen which provided sumptous, rich meals and snacks to the employees at subsidised rate. Hence the food intake of the respondents were based on the memu pattern of the canteen (Appendix) Food weighment survey conducted on all the 50 respondents revealed that cereals formed the bulk of the diet of all the respondents. Cereal intake ranged from 460 to 580 g with a mean intake of 474.5 and it met 91.25 per cent of RDA (520 gm.) (ICMR 1981).

But reports of the survey conducted by NNMB (1994) among 8 cities including Trivandrum revealed that in all cities,

cereals and millets formed the bulk of the diet of the slum dwellers and that the cereal consumption was 22 to 120 g lower than that suggested for balanced diet and the intake met only 74-95 per cent of RDA.

According to the reports of NNMB (1994) the overall level of cereal consumption declined by 14 g/Cu/day from 504 g in 1975-79 to 490 g in 1988-90, and in Kerala the cereal consumption was found to be less than the recommended level. But studies carried out by NNMB, (1984), Pushpamma et al. (1982), Geervani et al. (1986) have revealed that the consumption of cereals in rural Andhra Pradesh population was high as 450-540 g.

But in this study it was found that 36 per cent consumed cereals above their requirement. This may be because of the fact that, though all the respondents were entitled to take the food served from the factory canteen, there are inter-individual variation in the food intake. This variation could be attributed to their eating habit or likes and dislikes and food choice. This inturn would influence their calorie intake also.

Results of the study carried out by Uma et al. (1990) also indicated that the contribution of invisible fat was highest from cereals ranging from 10-12 g followed by milk, oilseeds and biscuits. Achaya (1987) also reported a higher contribution of invisible fat from cereals.

The mean intake of pulses ranged from 26 to 90 g with a mean of 58.8 g which revealed that the major share of vegetable protein intake was contributed by the pulses. But the food consumption survey conducted by NNMB (1994) revealed that the average intake of pulses in Trivandrum is 10 g and that the consumption of pulses when compared to RDI fell short by 30%, while 72 per cent of the workers of Hindustan Latex Limited had high intake of pulses (above 40 g) while 28 per cent were reported to have a low intake (below RDA). However, the average consumption on a weekly basis seems to be adequate when compared to RDA. (50 g/day). But the lower intake of pulses by 28 per cent of the respondents may not affect the protein intake, since fish followed by egg are optional items, which are chosen by the respondents at their will and pleasure, on extra payment (at subsidised rates).

Persons who consume pulses to a greater extent, are at an advantage, from health point of view, since the pulses are reported to be hypocholesterolemic (Kurup, 1989).

Milk was taken along with tea by all the respondents. It was noted that almost all the respondents had the habit of taking 4-5 cups of tea daily. One serving of tea contains approximately 90 ml of milk and so their milk intake contributes a good proportion of protein intake and also that of fat and calcium. Their milk intake ranged from 220 to 525 ml depending

on the number of cups of tea they had. The average milk consumption was found to be 300 ml and it was found to be 50.2 per cent above the RDA of 200 ml. But NNMB (1994) survey reported that the consumption of milk and its products in Trivandrum was deficient by 30 per cent when compared to RDA.

The respondents also included liberal amounts of curds, buttermilk and occasionally ghee also.

Apart from milk and pulses, the major protein source of Keralites seems to be fish. Consuming large amounts of fish is a habit of Keralites being an integral part of their tradition and culture.

The consumption of fish and flesh foods was found to be high. The most commonly used item was fish, it was included in their diet, almost daily or at least on alternate days. This may be because of the availability of fish in Trivandrum, because of its close proximity to coastal areas like Vizhingam, and also because it is cheaper when compared to meat. In this study, it was found that the average consumption of fish as 125 g/day.

Report of NNMB (1994) also is in tune with the above results. They have reported that the intake of flesh foods was high in Trivandrum, (113 g) and it mostly constituted of fish.

Most of the respondents were found to take flesh foods especially beef at least once in a week, as it was served as a

special dish in the factory canteen, and not as an item of regular menu. Some of the respondents also had the habit of taking non-vegetarian dishes especially chicken once in a while, from hotels and restaurants. Being an expensive food item, most of them abstained from consuming meat or chicken on a regular basis.

None was found to use egg daily, but it was consumed thrice a week. On personal discussion it was found that the employees were aware of the fact that consumption of more than three eggs in a week may lead to hypercholesterolemia and related cardiovascular problems. This justifies the self restriction imposed on egg consumption on a daily basis by the respondents. It may be seen that only three out of 15 members, whose blood lipid profile were studied in detail (presented in Table 41) had total cholesterol values more than 240 mg/dl. The reduced consumption of egg and fleshy foods might be one of the reasons for this.

The respondents included all types of vegetables in their diet at least thrice a week. The commonly served vegetable preparations were aviyal, sambar, kuruma, theeyal, koottukari, thoran, and saute, prepared out of locally available seasonal vegetables. The average intake of vegetables ranged from 70 g to 230 g with a mean value of 117.3 g. The per capita consumption of green leafy vegetables ranged from 20 to 200 g with a mean of

48.3 g and it met 20 per cent above the thirty four per cent of the respondents were reported to have a high consumption of green leafy vegetables.

It may also be noted that the green leafy vegetables are rich source of regulatory nutrients, and fibre, being low in fat, carbohydrates and calories. These nutrients as well as fibre have been reported to have significant influence on the blood lipid profile. Moreover the culinary practices followed in processing green leafy and other vegetables minimises the use of fat, when compared to animal foods. Hence those who consume more Green leafy and other vegetables, have the beneficial effect of vitamins, minerals and fibre and they also have low intakes of calories and fat.

Tapioca was the most commonly used tuber, followed by potato, by the respondents. The other roots and tubers used by them included, carrot, yam, and colocassia. The average intake of roots and tubers ranged from 50g to 160g with mean value of 53.12 g and it met 88.5 per cent of RDA. NNMB (1994) has also reported that tapioca is the most commonly used tuber by the population of Trivandrum and the intake of roots and tubers on an average was 69g. The high intake of tubers, especially tapioca would increase the calorie intake substantially without providing other essential nutrients.

Consumption of fruits (seasonal) was 19.4 g. NNMB (1994) has reported that the consumption of fruits was much below the RDA, among the population of Trivandrum. Plantain and banana were the most commonly used fruits by the respondents and all other fruits like apple, pineapple, orange and grapes, were also consumed by them according to the availability in the market. The choice of fruits was also dependent on the price and season. Plantain and banana being a major crop of the homestead gardens of Kerala, would have naturally resulted in increased availability and consumption. However, in the present study, the intake of fruits were below 20g on an average. This could be because of the fact that, fruits were not served as a part of the meals and are also not subsidised.

Sugar was used by all respondents daily as an ingredient of tea and the mean intake of sugar was 30.6 g. The intake of sugar met 87.4 per cent of RDA. NNMB (1994) reported that the intake of sugar and jaggary in Trivandrum was comparable to that of RDA.

All the respondents have been using coconut oil and kernal daily and the intake of kernal ranged from 20 to 130 g with a mean of 74g. From the reports of NNMB (1994) it is noted that the consumption of nuts and oil seeds particularly coconuts, was high in Trivandrum, (90g), while in all the remaining cities, the intake was less than 10g. Most of the

respondents possessed coconut gardens, and the steady supply of coconuts, definitely had lead to increased consumption.

Coconut oil was the main cooking oil used in the factory canteen as well as in their houses of the respondents. The coconut oil intake ranged from 16g - 120g with a mean value of 44.36g and it met 98.5 per cent of RDA.

In addition to the major meals the respondents also took, snacks in between, which are all fried preparations like vadai, and baji which also increased their fat intake. They also consumed papads, fish fry, meat fry, on any such fried items almost on a daily basis. Breakfast dishes like puris, parathas also contributed to high fat intake. Milk fat from repeated consumption of tea and coffee 4-5 times a day also contributed to the total fat intake.

The food intake of the respondents reveals that most of the respondents have a balanced diet. Their daily menu consisted of all the essential constituents of a balanced diet, as recommended by ICMR (1981). However, there were individual variations on the intake of various items, which could be attrited to food choice and the quantity consumed. This again could be due to the influence of personal habits, likes and dislikes and also the practice of thrift by the respondents. It might be noted (from Table 33) that on an average the diet consumed by the subjects were above the recommended intakes with

respect to pulse, leafy vegetables, other vegetables, milk and milk products. Thus the diet is rich in protective foods. This is a rare picture with respect to the general dietary pattern of Kerala.

It may be of interest to note that in a study conducted by Uma et al. (1990) on the food intake of different categories of people like industrial workers, low income group labourers and rickshaw pullers revealed that cereal intake ranged from 441 to 553 g day and the intake was higher in rickshaw pullers, and all the three groups met the requirement. Consumption of pulses ranged from 30 to 36 g/day and no significant difference was observed among three types of families. Intake of milk green leafy vegetables, fruits and oil was low in all the groups. Intake of other vegetables was high among the industrial workers than in the other two groups.

In the current study, the adequacy that is observed in the factory diet could be attributed to the planning that has gone in developing the weekly menu plan. The diet by itself even on a daily basis is adequate and appitising. It could be the additional snacks or dishes, consumed by the individual subjects which might have increased the mean intake much above normal.

The adequacy of diet can be judged further from the nutrients supplied with respect to recommended allowances. The nutrient intake of the respondents have been presented in

Table (39) which revealed that the protein content of the diet of the respondents were contributed mainly by fish, milk, egg and pulses. The intake of proteins ranged from 58 to 146.4g with a mean of 93.6 g, and it was 56 per cent above the RDA. NNMB (1994) has also reported that the average protein intake showed an increase from 46.4 g to 52.9 (6.5 g) between 1975-79 and 1989-90, and a high intake (105% of RDI) was noted among the city dwellers of Trivandrum where the consumption of fish was found to be very high.

The calorie intake of the respondents varied from 2562 Kcals to 4209 Kcals with a mean of 3755 Kcals. The cereals, roots and tubers, fat (visible and invisible) and sugar contributed to total caloire intake. About 24.5 per cent of the total calories was supplied by fat. About 2064 Kcals was supplied from carbohydrates and proteins of the daily diet supplied more than 372 Kcals. The excess quantities of protein, after meeting the metabolic needs of the body will be used to supply energy, or stored in the body as fat deposits.

An increase in the intake of calories (162 Kcals) was noticed in Kerala during the period from 1975-79 to 1988-90. (NNMB - 1988-90). However, the average intake of energy in slum dwellers in Trivandrum was 2249 K Cal which met 96% of RDI. (NNMB. 1994). But Uma et al. (1990) reported that the energy requirement is hardly among the industrial workers.

Quantity of visible and invisible fat consumed by the respondents were given in Table 36. The quantity of visible fat intake showed a wide range varying from 16 to 81 g with a mean of 45.2 g and the invisible fat intake varied from 21.9g to 96.9g with a mean of 56.4 g. It could be seen that the invisible fat content contributed significantly to the total fat intake of the respondents, and the highest contribution of invisible fat was made by coconut kernal (26.3 g) followed by milk (13.7 g) and egg (8.1g).

The average intake of fat (visible and invisible) was 101.64g. NNMB (1994) reports also show that the fat consumption was more than 30 per cent of RDI, in Trivandrum. The invisible fat content of the diet of the city population of Trivandrum was reported to be six times that of the visible fat. Similar trends are seen in this study also. NNMB (1990) had also reported an increase of 10g, (from 4 gm to 14g) in the daily consumption of oil among Keralites when compared to past few years.

In this study, it was found that the fat intake of the respondents met 98 per cent of RDA, and that 24.35 per cent of total calories was contributed by fat, which is below the recommended level of 30 per cent. However, the total intake of fats is much high. Continuous intake of fat rich foods especially saturated fats would increase the blood cholesterol and may lead to cardiovascular risk.

Studies by Uma et al. (1990) among the rural population of Andhra Pradesh revealed that the invisible fat intake ranged from 18 to 19g/day and the invisible fat intake was higher than visible fat intake, ranging from 20-22 g/day. Calories contributed by total fat as percentage of total calories ranged from 14.5 to 17.1 per cent. Achaya (1978) also reported higher consumption of invisible fat than visible fat in other parts of the country among different age groups.

The mean cholesterol intake of the respondents per day was found to be 196.68 mg/day which was much below the recommended level of 300 mg/day. The cholesterol content of the diet was mainly derived from the egg they consumed and also from the daily intake of milk and milk products.

The calcium content of the diet was contributed mainly by milk and milk products, fish and also by the green leafy vegetables consumed by the respondents. The mean calcium intake of the respondents were 889 mg and it was 124 per cent above that of RDA.

NNMB (1990) had reported an increase in calcium intake from 507 to 608 mg (101 mg) among the rural population of Kerala, during the period of 1975-79 to 1988-90, and they further reported that, the intake of calcium in Trivandrum, was almost twice as that of RDA. This trend is reflected in the present study also.

Studies reported by Sri Lakshmi (1993) show that large amounts of calcium lowers cholesterol and triglyceride levels.

The present study also revealed that the mean intake of vitamin C was 68 mg against the requirement of 40 mg/day. According to the report of NNMB (1994) the intake of vitamin C among the slum dwellers of Trivandrum ranged from 35 mg to 54 mg. The high intake of Vitamin C is a matter of significance since Stampfer (1995) had reported a highly significant trend for lower risk of CHD with high intakes of vitamin C and E.

The iron content of the diet was mainly supplied by the green leafy vegetables, and flesh foods. The average intake of iron was found to be 25.2 mg and it was 5 per cent above the RDA. The dietary intake revealed that the consumption of greenleafy vegetables, and flesh foods were above RDA which might have elevated the iron content. NNMB (1990) reports that the iron intake in Trivandrum was comparable to that of RDI.

Elevated levels of iron content is a favourable aspect, as this will increase the Haemoglobin, levels which in turn would increases the working efficiency of these workers. The role of dietary fibre has attracted considerable attention. Fibre absorbs water, increases bulk of the stool and reduces the tendency to constipation by encouraging bowel movements. The cholesterol lowering action of certain types of dietary fibre by binding bile acids are well established.

The fibre content of the diet was supplied by pulses, green leafy vegetables, fruits and other vegetables included in the diet. The mean fibre intake was found to be 8.5g.

Maya et al. (1990) reported a variation in the fibre content of the diet among high income and low income groups. She observed that the fibre content of both urban and rural high income groups were 8g which would have come from cereals, pulses, vegetables and fruits. The fibre content of the diets of the middle income group was 4.8g and 6.3g in rural and urban areas respectively. In low income groups lower intake of fruits provided only 3.4 g of fibre.

However in this study, the mean intake of fibre was 8.5 g which is comparable to that of both urban and rural high income groups as reported by Maya (1990).

A study conducted by Uma et al. (1990) on the food intake of different categories of people like industrial workers, revealed that inspite of high cereal consumption, they were not meeting the requirement of calories, their intake of β - carotene was also low. Though the requirement of protein was met, the quality of protein was found to be low. However their intake of B Complex vitamins and ascorbic acid was satisfactory. In general the nutritional status of the industrial workers was better than the low income groups. This may be due to their higher income, regular employment and better level of education.

In the light of the above study it was found that the average nutrient intake (Table 37) of the respondents who are also industrial workers much above the recommended values. It may be observed that the protein and calcium intakes are much above desirable levels and this has to be reviewed with caution. Higher protein intake if prolonged with special reference to animal protein may bringout undesirable changes in the body, elevating the load of kidneys.

Blood Lipid Profile

Today there is a vast body of evidence showing a triangular relationship between habitual diet, blood cholesterol - lipoprotein levels and CHD, and these relationships are judged to be casual. There is no population in which CHD is common that does not also have a relatively high level of cholesterol ie greater than 200 mg/dl.

Analysis of the fasting blood samples of 15 respondents showed that 47 per cent were hypocholesterolemic since their total cholesterol level was below 220 mg/100 ml; while twenty per cent of the respondents had cholesterol levels above 240 mg/dl, who are considered to be hypercholesterolemic. The cholesterol levels of the individuals showed a wide variation even within the normal range. This could be attributed to interpersonal variation in genetic as well as dietary intake. Girija Devi (1985) has reported that in populations living on diets,

containing animal foods and dairy products, the serum cholesterol level and the incidence of heart disease were high. Both these conditions were low in those whose diets are predominantly of vegetable origin. The higher cholesterol levels of the subjects could be due to their non-vegetarian dietary pattern; Among the subjects all, except one were non-vegetarian. A significant reduction in the cholesterol level was observed in the subject who followed a vegetarian diet. Thorogood et al. (1981) had also reported a lower cholesterol concentration in vegetarians than in those who eat meat.

The 10 years experience of the seven country study done by WHO (1982) had shown that serum cholesterol concentration is an important risk factor in the incidence of CHD at levels perhaps 220 mg/dl or more. Accordingly, 53 per cent of the subjects in this study may be at risk for CVD as they had a cholesterol level above 220 mg/dl.

Epidemiologic data reveal relationships between a number of dietary elements and elevated plasma cholesterol levels with the strongest relationships between dietary fatty acids, plasma cholesterol levels and cardio vascular disease incidence. The data from a variety of epidemiologic investigations both cross sectional and cross cultural indicate that plasma total cholesterol levels are increased by total saturated fat intake and obesity. However in this study, no significant association

was observed between the visible fat intake and blood lipid fractions. But a significant association was observed between invisible fat intake and Triglyceride as well as VLDL levels. This may be because, the invisible fat intake of the subjects were higher than that of the visible fat intake, which might have produced a significant change in the blood lipid fractions. Kushi et al. (1988) revealed that the total cholesterol level was positively associated with dietary cholesterol and saturated fatty acid. Levy (1985) also gave striking correlation between average intake of fat and average levels of serum cholesterol in epidemiological studies comparing western and non western population.

Results of a seven country study done by WHO supported the dietary fat hypothesis - ie, Japanese, who had low fat diet also reported low serum cholesterol and low incidence of CHD, while the people of East Finland were at the other extreme. However studies on individuals have not shown such a relationship. This has been attributed to dietary and genetic difference between individuals. (WHO 1982).

The triglyceride levels of the respondents ranged from 59.5 mg to 218.9 mg/dl. The normal levels of triglyceride ranges from 50-200 mg/dl as reported by SriLakshmi. (1993). Only 13 per cent of the respondents had triglyceride levels above the normal range. However, the mean value of triglyceride was found to be below the normal value.

Vobecky (1995) observed that the serum cholesterol and triglyceride levels were not influenced by the levels of fat intake. However, in this study a significant positive correlation was observed between the levels of invisible fat, intake and triglyceride level of blood. So also, the quantity of fish consumed also revealed a significant negative association with triglyceride levels William et al. (1988) have suggested that small amounts of fish oil can have beneficial effects on plasma triglyceide levels in hypertriglyceridemic patients.

In the present study the average consumption of fish was found to be 125 g/day. This might have helped the subjects to maintain a favourable blood lipid level. SriLakshmi (1993) reported that in Eskimos who consumed 400 g of fish daily the incidence of Atherosclerosis is low. Mahmond et al. (1994) have also reported that in fish oil the long chain n-3 PUFA namely, eicosapentaeonic acid (20:5 n-3) and decosahexanoic acid (22:6 n-3) are the active components in lowering plasma lipid.

High Density Lipoprotein (HDL) cholesterol is reported to have a protective effect against the development of CHD - the higher its level, lower will be the incidence of infarction. The HDL - cholesterol should be more than 30 mg/dl according to Park (1991) and the desirable level should be more than 40 mg/dl as reported by SriLakshmi (1993). In the present study the HDL - level showed a wide variation ranging from 23.4 to 58 mg/dl and

94 per cent of the respondents had HDL - cholesterol level above 30 mg/dl. This may be due to the fact that all the respondents are engaged in physical activity of moderate type, and also that few of the respondents had the habit of taking exercise which increased the HDL - levels. Gregory et al. (1983) and Gunby (1983) has reported that physical activity reduces the plasma cholesterol, LDL and triglyceride concentrations, and increased HDL - levels which scavenges the cholesterol.

The level of LDL - Cholesterol is most directly associated with CHD, while Very Low Density Lipoportein (VLDL) has also been shown to be associated with premature atherosclerosis, (Park 1991). LDL - Cholesterol level of the respondents ranged from 93.6 to 195 mg/100 ml with the mean value of 156.20 mg/100 ml, which is higher than the normal value of 150 mg/dl reported by SriLakshmi (1993). Seventy three per cent of the respondents had LDL - cholesterol level ranging from 151-200 mg/100 ml. The high levels of LDL - cholesterol levels of the respondents could be attributed to their high calorie and high fat intake. A significant reduction in LDL and VLDL cholesterol was noted on a low diet as reported by Sommariva et al. (1985). Mensik and Katan (1992) also reported a higher level of total cholesterol and HDL - cholesterol, on substitution of saturated fats for carbohydrates.

Data from Inter land Intra population studies have clearly demonstrated that as the total and LDL cholesterol levels

increases, cardiovascular disease risk also increases. Elevated plasma LDL - cholesterol levels constitute an independent risk factor for cardiovascular disease as remarked by McNamara (1992).

To further refine CHD risk prediction based on serumlipid levels, a total cholesterol/HDL ratio has been developed. This ratio with a value less than 3.5 has been recomended as a clinical goal for CHD prevention.

In this study all persons except one had the total cholesterol to HDL Cholesterol ratio above 5, which indicates that all persons are liable to develop CAD in future, though other lipid parameters independently in the present state of the individual does not indicate such a probability.

The blood lipid profile of the respondents also shows that though they are having a normal blood lipid profile at present, all are likely to develop hyperlipidaemia in the future, if they continue to follow the same dietary and physical activity regiemen.

The dietary intake of all the respondents were found to be in excess with respect to calories, proteins and visible fat. The calorie intake was about 30 per cent above the RDA. If such a food pattern is continued for a long time all the subjects are liable to become overweight and if not controlled may develop and succumb to cardio vascular diseases.

So it is suggested that the workers should either engage themselves in heavy work or should take regular physical exercise inorder to increase their energy expenditure, by burning more calories or they should reduce their caloie consumption by modifying their food intake, with special reference to composition, and by limiting the use of fried empty calorie foods, or by reducing food intake and fat intake inorder to reduce the risk of developing obesity and cardiovascular disorders in future.

Association between personal characteristics and food intake to blood lipid profile

The personal characteristics of the respondents like food habits (vegetarian/non vegetarian), age, habit of taking exercise with regard to frequency and duration, habit of consuming alcohol in relation to frequency and quantity of alcohol consumed, cigarette smoking in relation to frequency and number of cigarettes smoked were correlated with the blood lipid profile of the respondents.

The age of the subjects appeared to be related to development of CHD, as reported by Swamy (1988). So also Baghurst et al. (1994) have reported that age was a significant factor determining fat consumption. According to Stamler et al. (1986) epidemiologic data based on a large number of patients has

brought forth the view that the risk potential of lipids is a continuing one and it increases in a linear fashion in all adults with increasing age. High and low fat consumption in a community is said to be related to socio-demographic, attitudinal and dietary factors according to Baghurst (1994). However, in the present study no significant association was observed between the age of the respondent with fat consumption pattern or blood lipid profile. This may be because, all the respondents consumed the same type of food served from the factory canteen since they wre all employees of the same factory. According to Baghurst (1994) occupation was not related to lower than average fat consumption, but manual work and low occupational prestige were linked to higher than average fat consumption in men.

National Fitness Survey (1992) revealed that one of the most popular reasons for participating in exercise during leisure time is to control or lose weight, by increasing energy expenditure. A negative association has been reported between the level of physical activity (including exercise) and the level of body fat, by Bouchard et al. (1993).

In the present study, duration of taking exercise showed a highly significant correlation emphasing a direct relationship between duration of exercise and HDL cholesterol levels in blood. But no significant association was observed between any other blood lipid fractions and duration of exercise.

Chave et al. (1978), Gunby (1983), Gregory et al. (1983) has all reported that physical exercise reduced plasma cholesterol, LDL and TG concentration and increased HDL - levels. Suitor (1980) have reported that physical activity increased serum High Density Lipoprotein cholesterol. Increase in HDL cholesterol in subjects with increased physical activity, was also observed by Wood et al. (1988). Similar findings were observed in the present study also.

In this study, a significant positive correlation was observed between the quantity of alcohol consumed and the total cholesterol level of blood. But no significant association was observed between the quantity of alcohol consumed and other lipoprotein fractions in blood. Marja et al. (1987), William and John (1980) Castelli (1980) and Vivien et al. (1984) reported that dietary alcohol intake, cigarette smoking and packet count are correlated fairly with total cholesterol and LDL cholesterol in blood. Mitchael et al. (1986) reported that alcohol produces a rise in serum HDL - cholesterol by one per cent.

La Vacchia et al. (1992) reported that heavy alcohol consumption was more common in less educated individuals. He also reported that heavy alcohol consumption, tobacoo smoking and lower level of education are associated with diet poor in several aspects including lower consumption of fresh fruits and vegetables and higher intake of specific foods, and these associations were reported to be stronger in males.

Mandola et al. (1995) reported that alcohol consumption was negatively associated with fat concentration for men but not for women. In this study also a negative significant association was observed between the alochol intake and invisible fat intake.

Accordig to La Vecchia (1992) calorie intake was directly related to fat consumption, largely reflecting calories provided by alcohol itself. However, alcohol drinking was also directly related to fat consumption. But in this study no significant association was observed between alcohol drinking and fat consumption (0.0281); but a significant negative association was observed between the alcohol consumption and fibre intake (-0.5594).

Alcohol being calorie rich (1 gm of alcohol provides 7 K cals) has a tendency to reduce the appetite, resulting in a comparative reduction in the intake of other fibre rich foods. So in persons, who consume large quantities of alcohol, the empty calories will be supplied by the alcohol, and the diet will be lacking in all other essential nutrients and fibre. Regular intake of alcohol also leads to obesity.

Cross sectional data show that cigarette smokers consume diets different from those who donot smoke as reported by Fulton et al. (1988) and Margetts and Jackson (1993). Thompson et al. (1995) observed that cigarette smoking is associated with a different food pattern and altered nutrient intake, in

particular more saturated fat, less PUFA and lower consumption of antioxidant vitamins. In this study, no such significant associations were observed. However, the cigarette smoking habit showed a negative but insignificant association with the intake of protein, invisble fat, fiber, carbohydrates, energy and visible fat. So also the number of cigarettes smoked per day showed a negative and insignificant association with nutrient intake respect to protein, invisible fat, fiber, carbohydrate, energy and visible fat.

Rabkin (1984) reported a direct relationship between the effect of cigarette smoking on other cardiovascular risk factors, serum lipids, body weight, blood pressure and blood sugar level. According to Arti and Rajeswari (1986) chain smoking had a deleterious effect on cholesterol and blood pressure.

In the present study, a significant positive correlation was found between the number of cigarettes smoked and the triglyceide (0.8259), HDL - cholesterol (0.6684) and VLDL fractions (0.8263) of blood. Experiments indicate that due to nicotene, the secretion of two substances, namely adrenalin and nor adrenalin increases in the blood and consequently, the level of fat in the blood rises, resulting in increased cholesterol and triglyceride levels.

Height, weight, body mass index (BMI), abdominal girth, mid-upper arm circumference of the respondents showed no significant association with the blood lipid profile. Weight showed an insignificant negative association with cholesterol and LDL cholesterol level. Body Mass Index of the respondents showed a insignificant negative association with cholesterol level (r = -0.1613) and LDL cholesterol levels (r = ⁻0.3020). Mid upper arm circumference also showed an insignificant negative association with LDL cholesterol levels (r = 0.0691). The skinfold thickness showed a significant positive association with the triglyceride level (0.5344*) and VLDL cholesterol levels (0.5376*). This may be because changes in skinfold thickness may be sufficient to produce a significant change in the triglyceride levels and VLDL cholesterol levels. Waist circumference may be one of the best correlates of visceral abdominal adipose tissue (Despres, 1991). Waist circumference was a better correlate of total body fat mass and of abdominal visceral adipose tissue accumulation than WHR. Variations in waist circumference were more strongly associated with alterations in plasma lipoprotein levels than WHR. (Pouliot et al. 1992). Despres et al. (1990) reported that obesity is frequently associated with hyperlipidaemia. Kissebah and Peiris (1989) had observed that the regional localization of adipose tissue is more closely related to the metabolic distrubances associated with CVD, and the abdominal visceral obesity (android)

was more frequently associated with atherosclerosis. Kissebah et al. (1982) had reported that high plasma triacyl-glycerol concentration are significant correlates of abdominal visceral obesity and Krotkiewski et al. (1983) confirmed that abdominal obesity is a significant correlate of lipid levels. More recently, results from several prospective studies have confirmed, that a high accumulation of abdominal adipose tissue estimated by circumferences or skinfolds was associated with an increased probability of developing CVD, and with an increased risk of CVD related mortality (Terry et al. 1992). Preferential accumulation of adipose tissue in the abdominal area has been associated with dyslipidaemia, which may increase the risk of CVD. (Haffner et al. 1987). High levels of abdominal adipose tissue have been associated with elevated concentrations of plasma triacylglycerols (Foster et al. 1987) and reduced concentrations of plasma high density lipoprotein cholesterol (HDL-C) (Anderson et al. 1988). The level of abdominal visceral adipose tissue has been reported to be the best correlate of lipoprotein ratios used in the estimation of CVD risk (Despres, 1990). He further reported that subjects with elevated levels of visceral abdominal adipose tissue showed significant reductions in lipoprotein ratios predictive of CVD risk. However in this study no significant association was observed between abdominal adipose tissue and blood lipid fractions, ie. Cholesterol level (0.1466), triglyceride level (0.3049) HDL - cholesterol

(0.2183), LDL cholesterol level (0.1761) and VLDL cholesterol level (0.3046). This might be due to the fact that the levels of abdominal adipose tissue may not be high enough to produce a significant change in the blood lipid profile of the respondents.

Ninety eight per cent of the respondents were found to be non vegetarians and their diet included all animal proteins. Food habit of the respondents showed a significant positive correlation with total cholesterol levels and LDL levels. Girija Devi (1985) has reported that in populations living on diets containig animal foods and diary products, the serum cholesterol level and the incidence of heart diseases are high. Rajammal et al. (1980) found that Gujarathi vegetarians consuming large quantities of diary products exhibited a higher mean serum cholesterol level than Tamilian vegetarians. In this study also, the consumption of diary products, was found to be high due to frequent use of tea with milk. Thorogood et al. (1987) noticed a lower concentration of serumcholesterol in vegetarins than those who eat meat, and a vegetarian diet or a high intake of fish were found to be associated with reduced risk of CHD.

This study also is in tune with the above said results. As 98 per cent of the respondents are non vegetarians, their food habit also had a profound influence on their total cholesterol, HDL and VLDL levels. As animal foods are rich in saturated fatty

acids and cholesterol it will directly influence the lipoprotein fractions as well as the blood cholesterol levels. Kushi et al. (1988) also revealed that serum cholesterol level were positively associated with dietary cholesterol and saturated fatty acids.

The intake of coconut kernal significantly contributed to the invisible fat content. So also, fish meat, egg, pulses and milk also supplied invisible fat to a greater extend. The intake of protein foods were high which subsequently increases the invisible fat intake. However in this study , the invisible fat intake was found to be high enough to produce a significant change in the triglyceride (0.6193) and LVDL cholesterol levels. (0.6167).

Further analysis of the data also revealed a significant positive association between the percentage of energy derived from invisible fat to the VLDL and total cholesterol levels. Epidemiologic data as reported by MC Namara and Howell (1992) revealed a relationship between dietary fatty acids, plasma cholesterol levels and incidence of cardiovascular diseases. Studies conducted by Gonzalez et al. (1995) to assess the relationship between diet, serum lipid and apolipoprotein levels in spanish children revealed that, when compared with children in the lowest tertile, children in the highest tertile

of saturated fat consumption had significant higher mean levels of Total Cholesterol, LDL - cholesterol and Apo-B and lower mean levels of HDL and Apo A, which suggests that diet composition strongly influences lipid profile in children.

However, in this study, the visible fat intake did not show any significant association with the blood lipid profile. This might be due to the fact that the levels of visible fat intake of the respondents, may not be sufficient to produce a significant changes in the blood lipid profile, of the respondents at present. However the visible fat intake was lesser when compared to invisible fat intake.

Lin et al. (1994) reported lower rate of heart disease in Taiwan, where the total fat, saturated fatty acid and cholesterol were lower but higher in PUFA, when compared to Framingham. They also observed a favourable lipoprotein profile in Taiwan which was attributed to the differences in the type of dietary fat. Graves et al. (1993) also reported a favourable serum total cholesterol levels in people who have reduced total fat intake.

The study entitled "Dietary habits, fat consumption pattern and blood lipid profile of adults engaged in moderate activity" has generated information on the above three aspects from a group of male industrial workers. The overall data

revealed the blood lipid profile of the fifteen workers in the age group ranging from 25-40 years. About half of the subjects had cholesterol value above normal levels if 220 mg/100 ml is taken as the cut off point. There were two members who had values below 150 ml/dl which is to be considered as definite cases of hypocholostrolemia. However lower values were recorded for the triglyceride components. Thus there was a profound inter individual variation. The same trend could be observed with reference to other parameters indicative of blood lipid profile. Though the average values are within the prescribed/acceptable normal levels, the variations in individual values are to be examined with caution.

In this, the values of the two components namely HDL and LDL are to be studied sceptically. It may be seen that the HDL levels which indicates favourable health status, 7 out of 15 subjects were below the value of 40, and only one had a value above 55 which is the normal value, while the LDL, which has a negative influence was above normal (150) for 11 (73%) of the subjects. These two when viewed together gives a grim picture. The relationship of the above 2 parameters when expressed as a ratio, all except one had total cholesterol to HDL ratio above 5. Its indication cannot be ignored and is to be taken as a warning signal.

This fact along with higher weight of the subjects, and a tendency for increased abdominal girth and visceral obesity is

to be viewed critically with reference to their implications corroborative with the incidence of metabolic disorders including CVD/CHD.

The picture that has been unvailed through the study however, is inconclusive. They only give certain lines and directions which may be looked upon as indicators or warning signals that may be utilized positively to improve the welfare of the factory workers. These indicators, again cannot be taken as the picture of the entire workers of Hindustan Latex Limited, since the sample size is too small and a wide variation in the age, body weight and eating habits prevails among the subjects itself might influence the relevance of the result obtained.

In a nutshell, it can be said that though the mean values of the blood lipid profile of the fifteen workers, do not much differ from the normal values corraborative with health. This may be primarily due to the interplay between two sets of factors related to food and personal characteristics which might act sinergestically to bring out such a state of affair.

The factors such as cholesterol content of the diet, quantity of fat, protein quality, fat of animal origin, (especially fat from milk and fish), supply of all visible fat by coconut oil, and high calcium intake would be some of the factors related to food that might have tried to elevate the major lipid fractions which favours the CVD/CHD risk.

On the other hand, presence and supply of invisible fat from cereals, pulse, fish contributing to omega 3 fatty acids, use of coconut kernal in large quantities, enhanced supply of fibre and vitamin C, might have helped to reduce the lipid components that protects the body from CVD risk.

Moreover, the personal habits of smoking or nonsmoking, consumption of alcohol, exercise, quantity of foods, supply of calories from fat, working styles, and posture at work, might have also played a role in deciding the blood lipid profile.

Thus though not clearly established the study indicates a relationship between dietary habits, fat intake and blood lipid profile.

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

The study entitled "Dietary habits, fat consumption pattern and blood lipid profile of adults engaged in moderate activity" was carried out to find out the interaction between dietary habits and blood lipid profile of men engaged in moderate activity of uniform type. The study threw light on the socio-economic status, food consumption pattern and blood lipid profile of fifty adult male employees of Hindustan Latex Limited, Peroorkada, Trivandrum, who were engaged in moderate activity of uniform type for the past 8-10 years. The impact of food habits, fat intake and and personal habits on their blood lipid profile were ascertained.

Socioeconomic background of the families of the respondents revealed that, majority of them were Hindus, belonging to extended type of families with an average family size of five. All the respondents were moderately educated and in addition most of them had technical qualifications too.

The monthly income which came from their employment ranged between Rs.3000-4000, formed the main source of income of the family. In addition to this, income earned by different family members and income from agriculture also contributed to total family income.

All the subjects were in the age group of 25-40 years. Anthropometric measurements of the subjects revealed that the mean height and weight of the subjects were above the ideal weight and height suggested for an Indian reference man by ICMR. All had Body Mass Index below 25, which indicated that none were obese.

Personal habits revealed that majority were non-smokers, and a very small per cent were found to use alcohol regularly. Most of the respondents also had the habit of taking exercise regularly to keep them physically fit.

All respondents were consuming two major meals from the factory canteen. Dietary survey revealed that ninety eight per cent were habitual non-vegetarians. The food served in the factory canteen was found to be an 'affluent' one characterised by high calorie foods comprising of fats and refined sugars. The consumption of pulses, leafy vegetables, other vegetables, milk and milk products far exceeded the RDA; whereas the energy intake met 30.6 per cent above RDA. The consumption of fish was found to be high among the respondents.

Coconut oil was the chief oil used for cooking in the factory canteen as well as in 92 per cent of the families surveyed. The percapita availability of oil in the household showed a wide variation ranging from 13.5 to 5 kg. The intake of visible fat among respondents were found to range from 16g to 81g

and invisible fat consumption also showed a wide range varing from 21.9 to 96.9g. The mean intake of invisible fat was 56.4±2.8g which was higher than the mean intake of visible fat, which was 45.2±1.85 g/day. Fat contributed 914.76 calories on an average to the total energy intake, which accounted to be 24.35 per cent of the total calories.

Computation of the energy balance according to body weight, energy intake and energy expenditure of the respondents revealed that 76 per cent were in positive energy balance, when assessed in terms of energy requirement based on body weight. Calorie intake of all the respondents were found to be much above the requirement when compared to RDA, which shows that the subjects are liable to become overweight and if not controlled, may develop and succumb to cardiovascular diseases or other metabolic disorders.

Blood lipid profile of the respondents revealed that 20 per cent of the respondents had a higher cholesterol level. Triglyceride levels of all the respondents were found to be in the normal range, of 50-200 mg/dl. Seven per cent of the respondents had HDL-C level above 55 mg/100 ml and 73 per cent had LDL - Cholesterol level between 151-200 mg/100 ml, the normal being below 150 mg/100 ml.

The ratio of total cholesterol to HDL - cholesterol is found to be a good predictor of CVD risk. All persons except one

had a total cholesterol to HDL - cholesterol ratio more than 5, which shows that they are at risk, of CVD in future.

Statistical analysis of the data showed a significant association between the personal habits and blood lipid profile. The food habit (vegetarian/nonvegetarian) of the respondents showed a significant positive association with blood cholesterol, HDL-Cholesterol and LDL cholesterol levels. Duration of exercise also showed a positive association with HDL-Cholesterol level, which shows that HDL - level increases with exercise. The quantity of alcohol consumed was positively associated with total cholesterol. Number of cigarettes smoked by the subjects showed a positive association with triglyceride, HDL-Cholesterol and VLDL cholesterol levels.

On analysing the association between food intake and nutrients supplied by the diet, it was found that the protein content of the diet was mainly influenced by the consumption of fish and egg and the invisible fat content of the diet was supplied by coconut kernal, milk and egg. A significant positive correlation was observed between the percentage of energy supplied by the invisible fat and the triglyceride and VLDL cholesterol level of blood.

The food intake of all the respondents were found to be excessive in macronutrients like calories, proteins and visible fat. The adverse effects of an affluent diet characterised by

excess calorie foods, rich in fats, refined sugars and sodium, but deficient in complex carbohydrate and potassium have resulted in higher incidence of Coronary Heart Disease in developed countries.

The blood lipid profile of the respondents also shows that, though they have a normal blood lipid profile, at present, all of them are likely to develop hyperlipidemia in the future, if they continue the same dietary pattern, without changes in their work and personal habits.

So it is suggested that the workers should either engage in heavy work or in regular exercise to increase their energy expenditure, by burning more calories or they should reduce the calorie consumption by avoiding empty calorie foods, or by reducing food and fat intake inorder to reduce the risk of developing obesity and cardiovascular disorders in future.

Recommendations:

* Reduce saturated fat and cholesterol content of the diet by limiting the animal protein foods in the diet. Animal protein foods can be substituted by plant protein foods which will result in favourable lipid levels.

* Use less oils and fats in the diet by reducing the frequency of use and quantity of fried foods.

* Limit the use of tea with milk to one to two cups a day, to reduce the intake of milk fat., (which contributed significantly to the invisible fat). Use skim milk and skim milk products, if necessary.

* Replace part of coconut oil used for culinary purposes with other vegetable oils that contain PUFA.

* Trim fats from meat and choose lean cuts.

* Avoid/reduce the frequency and quantity of calorie rich foods such as jams, chocholates, cakes, sweets and ice creams. Do not replace oils, fats, with calories in terms of sugar, other carbohydrates, since these ultimately get converted into fats in the body, when they are supplied in excess.

* Include raw fruits and vegetables in plenty. Since fiber found in them have hypocholesterolemic action.

* Use part of the pulses in the form of sprouted grams, since it supplies essential nutrients, as well as fibre.

* Nutrition and Health education classes may be organised for the employees to help them to make right choice of food so as to maintain good health and to prevent risk factors.

* Facilities for physical exercise may be provided in the premises and employees may be motivated to participate in sports.

Many premature deaths and disability due to cardiovascular disease are preventable through modification of diet and life style. In view of the prohibitive costs incurred in the treatment of CVD, including the intensive (expensive) coronary care units, primary prevention through dietary measures, and other life style changes is not only a social responsibility, but an economic necessity.

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APPENDICES

APPENDIX I

KERALA AGRICULTURAL UNIVERSITY

COLLEGE OF AGRICULTURE

Department of Home Science, Vellayani

PART-I

Questionnaire to elicit the information regarding socio-economic background

1. Name of the respondent :
2. Address :
3. Residence : Presently urban:
   Migrated from rural area:
   Rural:
4. Educational status :
5. Occupation :
6. Age :
7. Body weight :
   Height :
   Abdominal girth :
   Mid arm circumference:
8. Religion : Caste:
9. Monthly income of the respondent :
10. Type of family
    Nuclear :
    Joint :
    Extended :
11. Family composition

Sl. No.	Relationship with respondent	Sex	Age	Educational	Occupation status	Income	Food habit: Veg.	Food habit: Non veg.

12. Total number of family memebers :

    Number of adult males :

    Number of adult females :

    Number of male children :

    Number of female children :

13 Income from other sources (Monthly/ yearly) specify the source if any :

14. Total income of the family (monthly)

15. * Do you have agricultural land? : Yes/No

16. If you have the following crops, * give details :

Sl. No.	Crop	Yield/ month	No./Qty. used for household purposes	No./Qty. used to make oil
1.	Coconut			
2.	Sesamum			
3.				

17. Does, the respondent have any identified disease? : Yes/No

    If yes, please specify : (a)
    (b)
    (c)

18. Mode of transportation to the place of work :

Distance covered : Time taken:

a) Walking
b) By Bus
c) Cycling
d) By Scooter by self driving
e) By train
f) By car by self driving
g) Any other (specify)

19. Are you in the habit of taking exercise?

Yes / No

If yes occasionally/regularly :

If regular, duration of exercise/day :

20. Do you take alcohol? : Yes / No

Occasionally	Regularly	Daily			Qty./serving
		1	2	3	

21. Do you smoke? Yes / No

Occasionally	Regularly	No. of cigarettes smoked/day

22. Do you use tobacco: Yes/No

Occasionally	Regularly	Daily		
		1	2	3

APPENDIX - II

KERALA AGRICULTURAL UNIVERSITY

COLLEGE OF AGRICULTURE

Department of Home Science, Vellayani

PART-I

QUESTIONNAIRE TO ELICIT INFORMATION REGARDING THE FOOD CONSUMPTION PATTERN

Name of the respondent :

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

   1. ( ) 2. ( ) 3. ( ) 4. ( )

2. a) Are you in the habit of taking food in between meals?

   Yes ( ) No ( )

   b) What type of foodstuffs do you take in between meals?

   c) Do you have a preference for fried food items?

   Yes ( ) No ( )

3. Do you have the habit of eating outside the home?

   a) If so what do you eat?

   b) How often do you take food from outside?

   Daily ( ) Weekly ( ) Monthly ( )

4. Amount of income spent for the food/month

FOOD EXPENDITURE PATTERN

Food item	Qty/month	Amount spent in Rs.
1. Cerelas		
2. Pulses		
3. Roots and tubers		

Food item	Qty/month	Amount spent in Rs.
4. Leafy vegetables		
5. Other vegetables		
6. Fruits		
7. Milk and milk products		
8. Meat		
9. Fish		
10. Egg		
11. Sugar/Jaggery		
12. Nuts and oil seeds		
13. Bakery item		
14. Health drinks		
15. Oils and fat		

FREQUENCY OF USE OF FOODS ITEMS

	Daily	Weekly	Monthly	Occassionaly	Never
1. Cereals					
Rice					
Wheat					
Wheat flour					
Ravai					
Sooji					
Ragi					
Maida					
Others (specify)					
Bread					

	Daily	Weekly	Monthly	Occassionaly	Never
2. Pulses					
Bengalgram					
Bengalgram dal					
Blackgram					
Blackgram dal					
Greengram					
Greengram dal					
Redgram					
Horsegram					
Anyother (specify)					
3. Leafy vegetables					
Amaranthus					
Drumstick leaves					
Cabbage					
Any other (specify)					
4. Other vegetables					
Bittergourd					
Ladies finger					
Snakegourd					
Beans					
Any other (specify)					
5. Roots and Tubers					
Potato					
Tapioca					
Yam					
Colaccasia					
Carrot					
Beet root					
Any other (specify)					

	Daily	Weekly	Monthly	Occassionaly	Never
6. Fruits					
Apple					
Grapes					
Orange					
Plantain					
Any other (specify)					
7. Milk					
Cows milk					
Buffalo milk					
Toned milk (Milma)					
8. Milk products					
Curds					
Butter milk					
Butter					
Ghee					
Cheese					
Any other (specify)					
9. Flesh foods					
Chicken					
Mutton					
Duck					
Beef					
Any other (specify)					
10. Fish (specify)					
11. Egg					
Hen's egg					
Duck's egg					
Any other					

	Daily	Weekly	Monthly	Occassionaly	Never
12. Nuts & oil seeds					
Coconut					
Groundnut					
Gingelly					
Any other (specify)					
13. Sugar					
Jaggery					
14. Processed foods					
Squash					
Jam					
Jelly					
Noodles					
15. Bakery items					
(Specify)					

FOOD HABIT OF THE FAMILY

Sl. No.	Name of family members	Pure vegetarian (not uses milk and milk products	Vegetarian uses milk & milk products	Uses milk, egg, fish and meat	Never uses either milk/ meat/egg/fish or morethan one of the above foods (specify)

APPENDIX III

KERALA AGRICULTURAL UNIVERSITY

COLLEGE OF AGRICULTURE

Department of Home Science, Vellayani

Part-III

Questionnaire to elicit information regaring the Fat consumption pattern of the family

1. Name of the respondent :

2. Address :

3. Frequency of purchase of edible oil

Code No. of oil purchased	Daily	Weekly	Monthly	Occasi-onally	Never	Qty.in kg
1.						
2.						
3.						
4.						
5.						
6.						

4. a) Does your fat consumption pattern remain uniform throughout the year : Yes ( ) No ( )

b) If yes, approximate quantity of fat used during a month

Code No. of oil used	Quantity pro-duced at home	Quantity purchased from outside	Total quantity used in kgs.
1.			
2.			
3.			
4.			
5.			
6.			

4 c) If no, period during which consumption is generally low or high

Category	Occasion	Period/month	Code	Extra quantity in kgs.
Low				
High				

5. Do you make any bulk preparations with oil during the year

Yes ( ) No ( )

If yes, give details

Sl. No.	Products prepared	Qty. prepared	Edible oil used	Qty. oil used in kg.	Frequency		
					daily	weekly	monthly

6. List the ranking order of use of oil in the household

(1)

(2)

(3)

(4)

7. List the ranking order of preference of use of oil in the household

   (1)

   (2)

   (3)

8. What is the reason for using the particular oil

   1. Low price
   2. Easily available
   3. Low in cholesterol
   4. Specify if any other

9. a) Is there any change in oils used during the last 10 years

   b) If yes, what is the reason for changing the oil

   c) Who suggests the change in oil

DETAILS OF NATURE OF USE OF EDIBLE OIL

Food item	Preparation	Frequency of preparation: Daily	Weekly	Monthly	Occasionaly	Never	Code No.	Mode of use of oil in the preparation: Garnishing	Seasoning	Shallow frying	Deep frying	Used as such	Qty./day
Cereal	Puri												
	Chapathi												
	Appam												
	Uppuma												
	Breads												
	Halwa												
	Cake												
	Murukku												
Pulse	Vadai												
	Pappad												
	Pakkavadai												
	Mysore pak												
	Jilabee												
	Boondi												
	Mixture												

		Frequency of preparation						Mode of use of oil in the preparation					
Food item	Prepra-tion	Daily	Weekly	Mon-thly	Occas-ionaly	Never	Code No.	Garni-shing	Seaso-ning	Shallow frying	Deep frying	Used as such	Qty./ day
Cereal & Pulse	Dosai												
	Payasam												
	Pradaman												
Fish	Curry												
	Fry												
Meat	Cutlet												
	Curry												
	Fry												
	Saute												
	Thoran												
Vege-table	Aviyal												
	Curry												
	Chips												
	Vattal												
Fruits	Fritters												
Others	Dosaipodi												

APPENDIX IV

KERALA AGRICULTURAL UNIVERSITY

COLLEGE OF AGRICULTURE

Department of Home Science, Vellayani

SCHEDULE USED FOR ASSESSING THE ACTUAL FOOD INTAKE

(BY FOOD WEIGHMENT METHOD)

Food consumption

Name of the meal	Menu	Weight of the total raw ingredients used by the family (g)	Weight of the total cooked food consumed by the family (g)	Amount of cooked food consumed by the respondent (g)	Raw eqivalents used by the individuals (g)
Breakfast					
Lunch					
Tea					
Dinner					
Others					

APPENDIX - V

Anthropometric measurements of respondents

Sl. No.	Weight (kgs)	Height (Mts)	BMI	Abdominal girth (inches)	Mid Upper Arm circum-ference (cm)	Skinfold thickness (mm)
1	65	1.55	27.05	30.5	26.5	5
2	52	1.52	22.55	31.5	29.0	7
3	60	1.58	24.03	29.0	25.0	7
4	60	1.63	22.58	30.0	25.0	7
5	58	1.60	22.60	30.0	30.0	7
6	60	1.60	23.40	33.0	27.0	6
7	60	1.52	25.97	37.0	26.0	6
8	68	1.63	25.60	28.0	24.0	7
9	72	1.80	22.22	29.5	29.0	6
10	52	1.64	19.33	30.0	23.0	6
11	58	1.64	21.56	29.0	23.0	6
12	61	1.80	18.80	29.0	25.0	6
13	66	1.60	25.78	29.0	24.0	6
14	74	1.87	21.17	30.0	30.0	7
15	54	1.50	24.55	30.0	23.5	7
16	59	1.55	21.30	30.0	27.5	6
17	58	1.65	24.22	27.5	24.0	6
18	70	1.70	23.31	34.0	31.0	7
19	65	1.67	25.71	31.0	27.5	6
20	70	1.65	19.20	29.0	24.0	6
21	51	1.63	22.00	29.5	25.5	7
22	60	1.65	25.15	34.0	30.0	7
23	62	1.57	19.92	29.0	28.0	5
24	51	1.60	24.97	30.0	25.5	6
25	68	1.65	25.6	38.0	26.0	7

Sl. No.	Weight (kgs)	Height (Mts)	BMI	Abdominal girth	Mid Upper Arm circum-ference (cm)	Skinfold thickness (mm)
26	74	1.70	25.60	33.0	27.0	6
27	67	1.68	23.70	30.0	24.0	6
28	73	1.73	24.40	37.0	27.5	7
29	59	1.68	20.90	32.5	26.5	6
30	58	1.60	22.60	29.0	24.0	6
31	73	1.67	26.18	32.0	27.0	7
32	59	1.65	21.67	30.0	25.0	5
33	58	1.71	19,84	29.5	25.0	7
34	66	1.91	17.35	30.0	24.0	6
35	66	1.65	24.24	29.0	23.0	6
36	74	1.65	27.18	38.0	27.0	6
37	72	1.65	26.40	30.0	25.0	6
38	66	1.60	25.70	34.0	28.0	6
39	52	1.58	20.80	32.0	27.0	6
40	48	1.77	15.30	29.0	24.0	6
41	56	1.58	22.40	30.0	25.0	5
42	56	1.68	19.84	30.0	25.0	5
43	64	1.77	20.66	29.0	23.0	6
44	69	1.62	26.29	30.0	26.5	6
45	61	1.63	22.99	33.0	27.0	6
46	75	1.63	28.23	30.0	25.0	7
47	62	1.68	21.97	33.5	28.0	6
48	74	1.73	24.73	36.0	30.0	6
49	53	1.66	19.23	30.0	24.0	6
50	68	1.70	23.53	33.5	27.0	6

APPENDIX - VI

BLOOD LIPID PROFILE OF RESPONDENTS

Sl. No.	Total cholesterol mg/100 ml	Triglyceride mg/100 ml	HDL Cholesterol mg/100 ml	LDL Cholesterol mg/100 ml	VLDL Cholesterol mg/100 ml
1	236	64.80	44.60	178.43	12.96
2	411	27.00	28.50	357.00	25.40
3	215	70.00	40.20	160.80	14.00
4	210	72.90	39.00	156.42	14.58
5	201	56.75	34.50	155.15	11.35
6	326	143.00	41.00	256.40	28.60
7	402	197.00	40.00	322.60	39.40
8	276	178.00	25.05	215.79	35.60
9	206	59.45	38.00	156.11	11.89
10	249	100.00	34.00	195.00	20.00
11	308	118.00	56.88	227.52	23.60
12	370	110.00	44.11	303.89	22.00
13	308	130.00	51.47	230.53	26.00
14	229	83.78	42.45	169.80	16.75
15	439	162.00	40.00	366.60	32.40
16	252	54.00	23.50	217.70	10.80
17	364	116.00	29.40	311.40	23.20
18	357	108.00	38.00	297.40	21.60
19	158	101.00	31.00	106.80	20.20
20	306	130.00	35.00	245.00	26.00
21	279	218.90	47.04	188.10	43.78
22	193	159.40	32.23	128.90	31.88
23	293	227.00	49.52	198.00	45.40
24	395	83.00	34.00	344.40	16.60
25	253	60.00	48.20	192.00	12.00

Sl. No.	Total cholesterol mg/100 ml	Triglyceride mg/100 ml	HDL Cholesterol mg/100 ml	LDL Cholesterol mg/100 ml	VLDL Cholesterol mg/100 ml
26	360	112.00	67.52	270.00	22.40
27	334	100.00	43.00	271.00	20.00
28	327	70.00	43.00	270.00	14.00
29	370	120.00	69.20	276.80	24.00
30	130	64.80	23.40	93.60	12.96
31	233	243.00	58.00	126.40	48.60
32	208	59.40	39.20	156.90	11.89
33	381	92.00	43.00	319.60	18.40
34	329	113.00	44.00	66.60	22.60
35	278	59.00	36.78	229.40	11.80
36	263	73.00	49.68	198.70	14.60
37	190	140.00	32.40	129.60	28.00
38	425	200.00	32.00	353.00	40.00
39	231	67.00	43.00	174.60	13.40
40	233	98.00	42.68	170.70	19.60
41	235	62.16	44.50	178.00	12.43
42	320	87.00	60.52	242.00	17.40
43	246	110.00	44.80	179.20	22.00
44	348	97.00	44.11	284.49	19.40
45	289	140.00	31.00	230.00	28.00
46	410	197.00	40.00	330.60	39.40
47	225	153.00	38.40	156.20	30.40
48	245	108.10	44.70	178.65	21.62
49	278	93.00	51.88	207.50	18.60
50	252	60.00	48.00	192.00	12.00

APPENDIX - VII

ONE WEEK'S MENU SERVED IN THE FACTORY CANTEEN OF HINDUSTAN LATEX

Days	6 AM to 7 AM	7.15 AM to 8.30 AM	10 AM to 11 AM	12 Noon to 1.30 PM	3 PM to 4 PM	5.15 PM to 6 PM	8 PM to 9 PM	12 Noon to 2 AM	4 AM to 4.30 AM
1	Tea/ Coffee	Dosai/Puttu/ Greengram/ Bengalgram/ Curry Sambar Tea/Coffee	Uzhunnu vadai Tea/ Coffee	Rice, Aviyal, String bean saute, Mango pickle, Dal curry, Sambar, Buttermilk, Pappad	Ullivadai Tea Coffee	Puttu/ Green gram, Pappad/ Bengalgram curry, tea/ Coffee	Rice, Aviyal, String bean saute, Mango pickle, Dal curry, Sambar, Buttermilk, Pappad	Ullivadai/ Bun/Tea	Black coffee
2	Tea/ Coffee	Puri/Dosai Egg roast/ Potato curry Chutney, Tea/ Coffee	Ullivadai Tea/ Coffee	Rice, Theeyal, Ladies finger kichedi, Lime pickle, Dal curry, Sambar, Rasam, Pappad	Uzhunnu vada Tea/ Coffee	Idiyappam Egg roast/ Potato cury Tea/Coffee	Rice, Theeyal, Ladies finger kichedi, Lime pickle, Dal curry, Sambar, Rasam, Pappad	Uzhunnu vadai/ Bun,tea	Black coffee
3	Tea/ Coffee	Dosai/Iddali/ egg roast/ Greenpeas curry,Chutney Tea/Coffee	Pazha cake Tea/ Coffee	Rice, Erissery, Chutney, Lime pickle Dal curry, Sambar Pullissery, Papad	Parippu vadai Tea/ Coffee	Dosai/Chutney Rasa vadai/ Bengalgram curry, tea/ coffee	Rice, Erissery, Chutney, Lime pickle Dal curry, Sambar Pullissery, Papad	Parippu vadai/bun tea	Black coffee
4	Tea/ Coffee	Paratta/Iddali Greenpeas curry Potato curry, Sambar, Tea/ Coffee	Cake Tea/ Coffee	Rice, Theeyal, cabbage thoran, Lime pickle, dal curry, Sambar, Rasam, Pappad	Baji Tea/ Coffee	Paratta/ Egg roast/ Greenpeas curry, tea/ coffee	Rice, Theeyal, cabbage thoran, Lime pickle, dal curry, Sambar, Rasam, Pappad	Baji/ Bun Tea	Black coffee

Days	6 AM to 7 AM	7.15 AM to 8.30 AM	10 AM to 11 AM	12 Noon to 1.30 PM	3 PM to 4 PM	5.15 PM to 6 PM	8 PM to 9 PM	12 Noon to 2 AM	4 AM to 4.30 AM
5.	Tea/ Coffee	Dosai/Puttu Greengram, Pappad/ Bengalgram curry/ Sambar,tea/ coffee	Parippu vadai Tea/ coffee	Rice, Aviyal,string beans thoran, pickle, dal curry, Sambar Pulissery, Pappad	Sughiyan Tea/ Coffee	Iddali, Chutney Rasai vadai/ Potato curry/tea/ Coffee	Rice, Aviyal,string beans thoran, pickle, dal curry, Sambar Pulissery, Pappad	Sughiyan/ Bun Tea	Black coffee
6.	Tea/ Coffee	Chappathi/ Idali, potato curry, Bengalgram curry, Chutney, tea/ coffee	Baji Tea/ Coffee	Rice, Aviyal, stringing beans thoran, mango pickle, dal curry, sambar, Pulissery, papad	Baji Tea/ coffee	Iddali, Chutney, Rasavadai/ Potato curry/ Tea/coffee	Rice, Aviyal, stringing beans thoran, mango pickle, dal curry, sambar, Pulissery, papad	Cake/Bun Tea	Black coffee
7.	Tea/ Coffee	Parotta/ Iddali Egg roast/ Greenpeas curry/Sambar tea/ coffee	Parippu vadai Tea/ coffee	Rice, Erissery Ladies finger thoran, Mango pickle, dal curry, Sambar, Butter milk, pappad	Pazhacake Tea/coffee	Chappathi, egg roast/ potatto curry, tea/ coffee	Rice, Erissery Ladies finger thoran, Mango pickle, dal curry, Sambar, Butter milk, pappad	Pazhacake Bun Tea	Black coffee

DIETARY HABITS, FAT CONSUMPTION PATTERN AND BLOOD LIPID PROFILE OF ADULTS ENGAGED IN MODERATE ACTIVITY

BY

LISA J. POOPPALLY

ABSTRACT OF THE THESIS
SUBMITTED IN PARTIAL FULFILMENT OF
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DEPARTMENT OF HOME SCIENCE
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1996

ABSTRACT

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The study entitled "Dietary habits, fat consumption pattern and blood lipid profile of adults engaged in moderate activity" is an attempt to assess the food and fat consumption pattern of selected moderately active adult males in relation to their blood lipid profile.

Fifty adult male employees, between the age of 25-40 years, doing moderate activity for the past 8-10 years were selected for the study. Socio economic back ground of the families revealed that majority of them were Hindus, belonging to extended type of families. All the respondents were moderately educated, and in addition, some of them also possessed technical qualification essential for their job.

The personal monthly income of the respondents were in the range of Rs.3000-4000. In addition to this, income earned by different family members, and income from agriculture also contributed to the total family income.

Anthropometric measurements of the subjects revealed that the mean height and weight of the subjects were above the ideal height and weight suggested for a reference man by ICMR. Body Mass Index (BMI) of all the respondents were found to be below 25 which indicated that none were obese.

Majority of the respondents were non-smokers, and only a very small per cent were found to use alcohol daily. Few of the respondents also had the habit of taking exercise regularly to keep them physically fit.

All the respondents were consuming two major meals from the factory canteen. The dietary survey revealed that ninety eight per cent were habitual non vegetarians. The food served in the factory canteen was found to be an 'affluent' one characterised by energy rich foods, comprising of fats and refined sugars. The consumption of pulses, leafy vegetables, other vegetables, milk and products far exceeded the RDA; where as the energy intake was 30.6 per cent above RDA. The consumption of fish was found to be high among the respondents.

Coconut oil was the chief oil used in cooking in the factory canteen as well as in 92 per cent of the families. The per capita availability of oil in the house hold showed a wide variation ranging from 13.5 - 56 g. The average invisible fat intake of respondents were 56 g, which was higher than the average visible fat intake, of 45 g/day.

Compared with Recommended Daily Allowance, higher energy intake was noticed in majority of the respondents, indicating that they are in a positive energy balance.

Analysis of the lipid profile revealed that 20 per cent had serum cholesterol levels above 240 mg/dl, where as LDL cholesterol level was found beyond 150 mg/dl only in 73 per cent. HDL - cholesterol, which has a protective effect, was found beyond 55 mg/dl only in 7 per cent. All persons except one had the total cholesterol to HDL-cholesterol ratio more than 5, which shows that they are at CVD risk in future.

Personal habits showed a significant association with the blood lipid profile of the subjects. The nonvegetarian food habit also showed a significant positive association with blood cholesterol, HDL-cholesterol and LDL-cholesterol.

Assessment of the food and nutrient intake of the subjects showed that protein content of the diet was mainly contributed by the consumption of fish and egg, while the coconut kernal supplied the invisible fat content of the diet.

A significant positive association was observed between the per cent of energy supplied from invisible fat and the triglyceride and VLDL cholesterol levels.

From the above findings it was revealed that the blood lipid profile in terms of total cholesterol, LDL cholesterol and the ratio between the total cholesterol to HDL cholesterol of the subject was found to be affected by food and fat consumption (especially the invisible fat) and personal habits of the

respondents. All these lipid fractions and the ratio, exhibited an increasing tendency, with the existing dietary and fat consumption pattern and personal habits of the respondents, which could be indicative of a tendency for inpending cardiovascular disease risk.