

# **Fat Intake and Blood Lipid Profile of Selected Obese and Non-Obese Adults in Coimbatore City**

By

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## Introduction

## I INTRODUCTION

Man can live in happiness without many earthly possessions but not without good health. The health and happiness are the outcomes of good nutrition. Good nutrition is an important part of an individual's life and is inseparable from achievement and maintenance of positive health status. This positive health status results in wealth and increased food availability (Gwatkin, 1983).

Even in the underdeveloped and developing countries, due to rapid scientific advancement and industrialisation, several health problems have crept into people's lives. One of such disorders is obesity which is becoming more even in our country.

Obesity is due to excess calorie intake with sedentary type of living or decreased energy expenditure. This condition may be either slight or gross with 10 and 25 per cent above the desirable body weight for age. Obesity is an excess of fat that results from cumulative ingestion of more calories than the body needs to meet average energy expenditure (Garrow et al, 1980).

It is estimated that 40 to 50 percent of adult city dwellers in the technically advanced societies are obese (WHO, 1978). A study conducted by Bray and Gupta (1975) reveal that the prevalence of obesity in North India is about 33 percent in adults.

Obesity is one of the most common and serious nutrition diseases and its association with many other common diseases may enhance morbidity and mortality. It increases the morbidity through the development of hypertension, diabetes mellitus and gallbladder disease (Osion, 1979 and Tobian 1979).

Wenck et al., (1983) also report that excessive weight is closely associated with cardiovascular and renal diseases, diabetes mellitus, arthritis, gout and gall bladder disease. It also entails a respiratory cost in apparently healthy overweight persons by increased work of breathing, decreased lung volume and pulmonary hypertension. Shank (1979) points out that obesity is frequently associated with coronary heart disease, such as elevated plasma cholesterol, blood pressure and leads to lowered fertility.

Whitney(1983) points out that obesity results from eating more calories than the body needs regardless of the source. Since fats are concentrated source of energy eating 50 extra grams of fat will cause weight gain quicker than 50 extra grams of either carbohydrate or protein.

Follick et al (1984) show that men and women with an elevated weight/height ratio are reflective of high level of abdominal fat and were likely to have elevated plasma cholestral, triglycerides and low density lipo-protein levels.

Over eating and eating of foods in wrong combination and obesity are closely related factors. The composition of the tissue formed during wieght gain due to over eating when analysed, revealed that fat accounted for 70 percent of the weight gain in the normal individuals.

In affluent societies highly palatable and calorically concentrated foods i.e. high in fat and sugar and low in fibre and bulk when consumed regularly promote obesity. Eating a diet high in fat and sugar will result in obesity even when the calories consumed are not excessive (Hanmer, 1989).

The dietary fat intake has been shown to have an effect on the serum cholesterol level of individuals. Populations consuming diets high in fat usually have relatively high serum cholesterol levels. Populations with a low fat intake usually have relatively low serum cholesterol levels (Welsh, 1983 ; Mahan, 1984).

Obesity results due to an excessive intake of fats and carbohydrates and leads to rising of lipid fractions in the blood. Elevated cholesterol and lipoprotein levels are the major risk factors in the developments of coronary heart diseases. The review of literature indicated that investigations on the fat consumption pattern of the obese are limited.

Hence, in the present investigation an attempt has been made to analyse the diets of obese adults to find out the intake of total calories, fats, sugars, carbohydrates and other essential nutrients of the obese, and compare the lipid profile of the obese with non-obese and analyse the associated complications.

The specific objectives of the present investigation are:

- A. Survey of the Socio-economic status of the selected sample; of 180 Adult subjects.
- B. To assess the mean daily food and nutrient intake of obese and non-obese population.
- C. To study the consumption pattern of fats and oils of the obese and compute the daily <sup>fat</sup> intake and
- D. To examine the lipid profile of obese and non-obese adults.

It is hoped that this study will bring out the relationship between obesity, fat intake and lipid profile of obese and thus help the population in being cautious in their food selection.

Reviews of Literature

## II. REVIEW OF LITERATURE.

Review of the literature of the study on "Fat intake and blood lipid profile of selected obese and non-obese adults in Coimbatore City" is given under the following headings:

- A. Pattern of fat consumption in India.
- B. Fat intake of obese.
- C. Meaning and incidence of obesity.
- D. Obesity and associated complications.
- E. Lipid profile of obese and non-obese.

### A. Pattern of fat consumption in India.

According to Nutrition News (1985) in an average Indian diet, fats contribute 8 to 10 percent of the total energy at a level of 14 to 10 percent per capita income.

The Indian Council of Medical Research (1981) recommends per capita intakes of 34 grams of fat per day for Indians or about 15 percent of total calories. But current per capita availability of conventional oils and fat has been worked out at only 15.4 grams per day, which is about half of recommended daily allowance (Rukmini, 1985) .

Leisserre et al (1985) have recommended that the optimum dietary intakes for human adults is 5 to 6 per cent of total calorie for linoleic acid and 0.5 to 1 per cent of total calorie for linolenic acid.

According to National Nutrition Monitoring Bureau (1980) the main supplier of invisible fats in India are the staple foods. Their contribution accounts for 88 per cent in Orissa, 60 to 62 per cent in Tamil Nadu and Karnataka and only 31 per cent in Kerala even when tapioca is included.

According to Achaya (1987) the total fat intake which is close to 40 grams per day, 40-60 per cent, that is, 16 to 24 grams per day is made up of invisible fat. Per capita daily consumption of visible fat is 15 grams.

According to the Indian Council of Medical Research (1984) in the 15 grams of fat diets of adults in India about 20 per cent energy may be usefully derived from fats.

Achaya (1987) states that the visible and invisible fat consumption reflects strong income dependence. The visible fat consumption ratio

averaged to 3 between high and low income group. The invisible fat consumption ratio was 2 between the High and Low income group.

According to Ahmed(1985) in India per capita consumption of fat is very low only about 5 kg per year. The consumption of oils and fats in developing countries is much lower than that in the developed countries because of their non availability and high cost.

Chandry and Chouchen(1988) have stated that amount of fat intake by low income families in India is about 8.3g to 35g per day in different age groups. The contribution of invisible fat intake was more (57 percent to 76 percent of total fat.)

Achaya(1987)has found out that fat consumption varies among the different income groups namely low, middle and high income groups. High income groups could be at a risk from over consumption of visible fat. When total fat makes a 30 percent contribution to energy intake. Contributions from 9 to 11 per cent

energy from total fat in low income groups in West Bengal and in all income groups in West Bengal and in all income groups in Uttar Pradesh have also been recorded.

According to Forgerly and Sworones (1987) in affluent Western societies, the per capita intake of dietary fat tends to be high (about 40 per cent of dietary energy) and hence fatty acid and main constituents of fat are a major component of diet, often in excess of 100g per person per day.

Elherton (1988) observed that American diet contains approximately 40 per cent of calories from fat, 13 per cent from saturated fatty acids.

In the study of Reng and Gonlesy (1986) fat intake markedly increased from 42.8g to 71.5g in Singapore. Fat from vegetable products was up by 29 per cent while that from animal products increased by 92 per cent.

According to Robinson et al (1986) people of the orient consume diets that provide around 10 per cent or less of calories from fat whereas

Americans derived about 40 percent of their calories from fat. Fat consumption in India varies from place to place.

B. Fat intake of obese.

According to Asha Kawatra(1989) higher percent of subjects in highest obesity group(30 to 40 percent) were suffering from hypertension, ischemic heart disease and diabetes mellitus. The daily visible fat intake was higher than that of the recommended levels. Higher percentage in the highest obesity group were found consuming hydrogenated vegetable oil than refined oil. There were wide variations in the nutrient intake of the subjects. However, the average intake of almost all the nutrients in both males and females were higher than that of recommended level. The percentage of total calories contributed by fat were increasing and that from carbohydrates were decreasing and increase in percent of obesity.

Oscari(1986) concludes that eating a diet high in fat and/or sugar will result in obesity even when the calories are not consumed excessive.

According to Stern(1984) and Epstein(1980) the comparing the daily physical activity of obese subjects, the non-obese subjects were less active and increasing the amount of sugar and fat intakes were more.

C. Meaning and incidence of Obesity.

Overweight or obesity is a condition of the body in which there is an excessive deposition of fat. A weight that is, 10 percent above the desirable weight in normal individuals is considered over weight (Murthy et al 1979) and a deviation of 20 percent and above is indicative of obesity according to Robinson et al, (1986). Simpoulous (1985) opines that overweight and obesity in adult is based on actual analyses that indicate the weight range for each <sup>height</sup> category which is associated with lowest mortality rate in an insured population.

According to Lakhnopal (1978) obesity is one of the most serious diseases in many affluent societies. It is essentially a disorder of energy balance. Bray (1970) reports obesity as a widespread malady in our society, yet its underlying cause still eludes medical science and its therapy is therefore empirical.

In obesity, there is an excessive intake of calories and unlimited amount of fat can be stored in the storage areas. In addition to fat, dietary excess of carbohydrate and protein are converted to triglycerides and stored in adipose tissues (Lewis, 1978). So it is very important to control the dietary intake of obese persons to prevent the rising of lipid fractions in the blood so that complications like coronary heart disease can be prevented.

Glinsmann et al (1986) states obesity as a syndrome resulting from the deposition of excess body fat generally but not necessarily accompanied by increased body weight. He suggests two methods to estimate overweight or obesity in adults, the calculation of relative weight (Relative weight = measured bodyweight divided by desirable weight from a recommended source such as 1983 Metropolitan Life Insurance Company tables) and calculation of Body Mass Index.

According to Craddock (1973) obesity is a condition caused by an excessive storage of body

fat as occurring when a person's weight is atleast 10 per cent in excess of the normal weight or desirable weight.

Enloe (1980) and Tver (1988) States that obesity is an excessive body fat due to an imbalance between energy intake and expenditure that frequently results in a significant health impairment.

Obesity was more common among women (47.7 per cent) than men (31.7 per cent). In a study conducted by Evers (1987) the proportion obese people increased with age upto sixty years.

Bray et al (1973) and (1975) report that the prevalence of obesity was as high as 33 per cent in adults more than 30 years of age, one third of men and women were obese.

Life Insurnace Corporation (1983) data shows that of 25 to 54 years age groups, there was an increase in the percentage of overweight men and women. Beyond age 54, the percentage of overweight men and women decreased.

According to Gupta et al (1983) in middle class urban population in Delhi every third woman above 40 years tends to be obese.

Canning and Mayer (1966) found a low prevalence of obesity in subjects with high educational status.

According to National Health Association and Nutrition Examination Survey (NHANES) 1976, approximately 30 per cent of middle aged women and 15 per cent of middle aged men are obese.

A study done by Silver Stone et al (1969) revealed that the prevalence of obesity in the lower socio-economic group was 72 per cent as compared to 29 per cent in the high socio-economic group.

It is estimated that approximately 20 per cent of the population in the United States are overweight as a result of imbalances between food calorie intake and calorie expenditure (Krause, 1979).

According to the Health Association and Nutrition Examination Survey (1979) based on triceps skinfold thickness, 14 per cent of men and 24 per cent of women are 20 per cent or more overweight.

Davidson et al (1973) reported, in Great Britain that obesity is probably more common among poor women than among rich and gives rise to more ill health than all the vitamin deficiencies put together.

Williams and Caliendo (1984) estimated that 25 to 45 per cent of the United States adult population may be considered to be obese. Furthermore about 3.5 to 10 per cent of women and 3.5 to 6.5 per cent of men are classified as severely obese, the percentages vary with different age groups. Abraham and Johnson (1980) estimated that a higher proportion of women than men were found to be obese. Black women were more often obese than white women.

Prevalence rates of overweight in the Netherlands (1989) are 25-30 per cent for adult (18-65 year males and females) 24 per cent for young adult (19-31 year males and 14 per cent for young adult females).

Hirsh and Leibel (1988) studied South Western American Indians and they had a very high incidence of both obesity and diabetes nearly two thirds of the women about half the men in this population were obese.

The ten-state-Nutrition survey (1969-1970) showed that income level was significant factor in the appearance of obesity for younger women.

Obesity was more prevalent in low socio-economic group.

D. Obesity and associated Complications

According to Bray (1975) obesity is a serious health problem in the world because it increases the risk of mortality and morbidity, hypertension and cardio-vascular diseases, diabetes mellitus, respiratory disorders, Osteoarthritis, surgery and other chronic diseases, complications during pregnancy, labour and delivery.

Donahue et al (1985) and Ducimetiene et al (1986) state that fat distribution was found, to be more strongly related to the risk of total deaths, stroke, heart disease and diabetes mellitus than was Body mass Index or total body fat. The risk double in people with an increased ratio of abdominal to hip fat and showed a graded relationship at higher level.

Burton et al (1985) indicate that obese women have a higher mortality from cancer of the gall-bladder, biliary passages, breast, uterus and ovaries. Among women with marked obesity, endometrial cancer showed the highest relative risk for the obese versus non

obese. The mortality ratio and excess death rate both increased directly with the degree of overweight.

Briggs and Calloway (1979) and Bosello et al (1981) indicate that impairment of carbohydrate metabolism characterized by blood glucose concentrations and decreased sensitivity to insulin are common among obese human subjects.

Rakhuram (1988) opines that the non-insulin dependent diabetes seems to result from degeneration of beta cells as a result of more rapid ageing in susceptible persons than in others. Obesity predisposes to this type of diabetes because larger quantities of insulin are required for metabolic control in obese than in normal persons.

Hypercholesterolaemia and hypertriglyceridemia have been identified as coronary risk factors in a large number of retrospective and prospective studies (Hamed et al, 1982).

Saroja et al (1988) found out that obesity promotes the specific risk factors of hypertension, hyperglycemia and hyperlipoproteinemia. The unusual calories are converted into fat and stored in fat deposits in the body. Increased body mass results in increased requirements of oxygen and increased cardiac rate which in turn leads to cardiovascular disease.

Hubert et al (1983) points out that a strong link between obesity and high blood pressure was also associated with stroke and congestive heart failure.

Rabkin et al (1979) Hubert et al (1983) and Manson et al (1987) indicate that obesity correleates with increased incidence of hypertension, impaired glucose tolerance, increased incidence of hypertension, impaired glucose tolerance, increased plasma insulin levels, gallbladder disease, elevated serum lipid levels, with the exception of high density lipoprotein cholesterol and hyperuricemia. The obese are at increased risk for cardio vascular disease.

According to Weingier et al (1985) obesity and possibly body build are related to risk of hypertension.

#### E. Lipid profile of obese and Non-obese

An accumulation of excess body fat may result in unfavourable serum lipid levels (Matter et al, 1980). Obesity has been found to be associated with changes in lipoproteins especially with reciprocal changes in low density lipoprotein and very low density lipoprotein.

Gandhi et al (1985) found out that very low density lipoprotein which are responsible for lipaemia are derived from adipose tissue. The endogenous synthesis and secretion of low-density lipoprotein are modulated by the plasma concentration of very low density lipoprotein. Plasma high density lipoprotein concentrations have been found to be decreased in various conditions including obesity.

Gainson et al (1980) brings to light the relation between obesity and low-density lipoprotein cholesterol and high density lipoprotein cholesterol. According to them there is a strong association between obesity and low density lipoprotein while there is an inverse relation between obesity and high density lipoprotein.

Awadin et al (1982) point out that serum total lipids, triglycerides and cholesterol were higher in the obese individuals. Mela et al (1987) opine that plasma triglyceride, high density lipoprotein cholesterol levels are found to be inversely correlated in obese and this low level of high density lipoprotein provides the explanation for increased coronary heart disease among the obese.

Kannel (1979) and Bambhole and Jiddewar (1984) report that the obese frequently have elevated levels of blood cholesterol, triglycerides and lipoprotein. They have high ratio of total cholesterol to high density lipoprotein cholesterol than subjects of normal weight.

Pyke (1975) points out that dietary containing only saturated fats (Butter, coconut oil, fat and meat) increase the blood cholesterol levels as much as 40-50 mg per 100ml.

Hence a dietary intake of poly-unsaturated fatty acids such as cotton seed oil, sunflower and saffla oil is essentially lowers serum cholesterol level (Krause et al, 1988).

In obese subjects raising serum cholesterol level is associated with an increase incidence of death due to circulatory failure or stroke or peripheral vascular disease (Tommaso and Kehoe, 1983).

Grundy (1987) states that the hypocholesterolemic effect of polyunsaturated fatty acids is mainly due to decrease in low density lipo protein cholesterol.

## Methodology

### III METHODOLOGY

The methodology pertaining to the present study on "Fat intake and blood lipid profile of selected obese and non-obese adults in Coimbatore City" is presented under the following headings:

- A. Selection of the area
- B. Selection of the sample
- C. Conducting the study
  - a. Survey of the socio-economic and dietary habits of the selected sample
  - b. Recording the anthropometric measurements
  - c. Analysis of the blood lipid profile
- D. Evaluation

#### A. Selection of the Area

In Coimbatore city four different areas namely R.S.Puram, Saibaba Colony, Race Course and pappanaickenpalayam were selected for the study. These areas were selected because they were situated in four corners of the city and thus formed important segments of the city. There were adequate transport facilities to reach these areas.

**B. Selection of the sample**

Review of literature pertaining to obesity (LIC, 1983) indicated that the adult population is more at risk than the other age groups and 45 per cent of the population became obese after the age of 25 to 54 years. Hence it was decided to select adult men between the ages 30 to 50 for the present investigation. The height and weight of the over weight adult population was measured and from that the body mass index was calculated using the formula given by Antia (1989). From this, the subjects having a body mass index more than 24 were selected for the study.

As income influences the type of fat consumed by a family, subjects were selected from the three income groups namely Low income, middle income and high income groups. The criteria specified by the HUDCO (1986) formed the basis for income classification. Thus, a group of 30 obese adult men between 30 to 50 years of age were selected from each income group forming a total number of 90 obese subjects. These 90 obese subjects (30 from each income group) formed the experimental group. An equal number of non-obese adult men in the same age range from the three income groups were selected as the control group for comparison.

For studying the fat consumption pattern in detail, a sum sample of six adult men were selected from each income group, in the obese and non-obese subjects.

C. CONDUCTING THE STUDY

The study was conducted by following the steps given below:

1. Survey of the socio-economic and dietary habits of the selected sample. Study the socio-economic and dietary habits of the selected sample a questionnaire (Appendix I) was prepared by the investigator. It elicited information on the income, type of family, number of members in the family, their educational status, occupation, information on their dietary habits like type of foods consumed, amounts of foods consumed, type of fat used in cooking and the methods of cooking followed.

Apart from this, a 24 hour recall survey was also conducted for the selected sub-sample from each income group (Details of this survey are given in Appendix II), to exactly calculate the fat intake of the obese and non-obese.

2. Recording the anthropometric measurements of the selected sample

The height and weight of all the selected adults were recorded using the spring balance and a fibre glass non-stretch tape.

3. Analysis of blood lipid Profile of the sub-sample

The blood lipid profile was studied for the selected sub-sample of six males in each income group. The parameters studied were blood cholesterol, triglycerides, very low density Lipoprotein (VLDL), low density Lipoprotein (LDL) and High density Lipoprotein (LDL) Cholesterol.

Cholesterol was estimated using the procedure given by Allain (1974).

Triglyceride was estimated by Gpo = PAP method.

The procedure given by Buclo et al (1981). The procedure given by Teitez (1980) was followed in the analysis of LDL and VLDL. The exact procedures followed are presented in Appendix III.

**E. Evaluation**

The data collected from the obese experimental group and non-obese control group were consolidated and statistically analysed. ~~The results thus obtained~~ are presented in the following chapter.

## Results and Discussion

**IV RESULTS AND DISCUSSION**

The results of the investigation entitled "Fat intake and Blood lipid profile of selected obese and non-obese Adults in Coimbatore City" are presented under the following headings and discussed.

- A. Socio-economic status of the selected sample.
- B. Food habits and pallern of fat consumption of the selected sample
- C. Lipid profile of the selected sample

**A. Socio-economic status of the selected sample**

Table I presents the type of family of the selected samples.

**TABLE I**  
**DISTRIBUTION OF THE SAMPLES ACCORDING TO THE**  
**TYPE OF FAMILY**

Type of family	Obese			Non-obese		
	L.I.G. No.%	M.I.G. No.%	H.I.G. No.%	L.I.G. No.%	M.I.G. No.%	H.I.G. No.%
Nuclear family	24 80	23 76	27 90	28 94	26 87	24 80
Joint family	6 20	7 24	3 10	2 6	4 13	6 20
	30 100	30 100	30 100	30 100	30 100	30 100

- L.I.G. - Low Income group
- M.I.G. - Middle Income group
- H.I.G. - High Income group

From Table I it is evident that about 80 per cent of the sample belonged to nuclear families. Only about 6 per cent to 20 per cent of the samples lived in joint families. The type of family did not differ according to the income.

Analysis of the data, on the number of members in the family showed that in majority of the families, the number of members ranged from one to three. Especially in high income group except in 2 families all the other families had only one to three members.

Table II presents the distribution of the sample according to the type of occupation.

TABLE II  
DISTRIBUTION OF THE SAMPLE ACCORDING TO THE OCCUPATION

Occupation	Obese			Non-obese		
	L.I.G.	M.I.G.	H.I.G.	L.I.G.	M.I.G.	H.I.G.
Business	3	13	8	4	10	12
Profession	-	-	14	-	-	12
Agriculture	6	7	3	7	11	6
Office	11	10	5	6	9	-
Labour	10	-	-	13	-	-
Total	30	30	30	30	30	30

From Table II it is evident that the distribution of the type of occupation was similar in obese and non-obese groups. Majority of the sample from low income family were labourers, agriculturists or were working in the office. None were occupied in any profession. Totally seven samples were doing business in the low income group. On the contrary in high income and middle income groups majority were doing business. In both these groups there were no labourers. Apart from business, in high income group majority were in professional jobs.

B. Food habits <sup>and Fat consumption</sup> of the selected sample

Table III shows the distribution of the samples according to the type of foods consumed.

TABLE III  
DISTRIBUTION OF SAMPLE ACCORDING TO THE TYPE OF FOODS  
CONSUMED

Type of food	Obese			Non-obese		
	L.I.G.	M.I.G.	H.I.G.	L.I.G.	M.I.G.	H.I.G.
	No. %	No. %	No. %	No. %	No. %	No. %
Vegetarian	14 47	12 40	9 30	17 57	15 50	10 33
Non-vegetarian	11 36	9 30	13 43	13 43	12 40	15 50
Ovo-Vegetarian	5 17	9 30	8 27	- -	3 10	5 17
Total	30 100	30 100	30 100	30 100	30 100	30 100

The distribution of the samples according to the type of food consumed showed that only in the low income families in obese and non-obese sample there was a slight difference in the type of food consumed. About 17 per cent of the low income families in the obese group were ovo-vegetarians, whereas in non-obese low income group there were no ovo-vegetarians. In general, the number of ovo-vegetarians were very much less. In middle and high income groups the vegetarians and non-vegetarians were almost equal.

Table IV presents per capita food consumption pattern of the selected sample.

TABLE IV  
PER CAPITA FOOD CONSUMPTION OF THE SAMPLE

Food stuffs g/day	Obese			Non-obese		
	L.I.G.	M.I.G.	H.I.G.	L.I.G.	M.I.G.	H.I.G.
<u>Cereals</u>						
100-200	3	3	4	7	5	-
200-300	19	17	10	4	8	11
300-400	5	10	7	15	12	15
400-500	4	-	9	4	5	4
<u>Pulses</u>						
20-40	15	9	8	21	6	8
40-60	7	16	13	6	19	12
60-80	8	5	9	3	5	10
<u>Vegetables</u>						
0-100	17	14	11	23	13	16
100-200	13	16	19	7	7	14
<u>Sugar</u>						
0-50	14	15	8	27	13	8
50-100	16	15	22	3	17	22
<u>Milk</u>						
0-100	9	-	-	24	-	-
100-200	7	3	-	6	3	6
200-300	5	8	-	-	7	19
300-400	9	12	12	-	12	5
400-500	-	7	14	-	8	-
500-600	-	-	4	-	-	-
<u>Fats and oils</u>						
0-20	19	3	-	21	11	-
20-40	11	19	12	9	3	19
40-60	-	8	18	-	6	11
<u>Fleshy foods</u>						
0-25	12	2	-	15	2	-
25-50	3	5	-	2	7	6
50-75	-	2	7	-	3	5
75-100	-	-	4	-	-	2

From Table IV it is evident that the obese low income group consumed from 200 to 300g of cereals while the consumption by middle income and high income groups were more. In non-obese, more number of people consumed 300 to 400 g of cereals. In low income group consumption of cereal by the non-obese was more than the obese and it was same in the high income group also.

With regard to pulses both obese and non-obese low income samples consumed lesser quantities. As income increased quantity of pulse consumption also increased. Vegetable consumption was more in the obese samples.

Milk consumption of the obese low income samples ranged from 0 to 400g. while it was from 0 to 200 by the non-obese group. As the income increased quantity of milk consumed also increased. Milk consumption of the middle income group of the obese and non-obese samples were the same. But in high income groups especially, the obese consumed 300-600g which was very much high.

The consumption of fats and oils was also high in the high-income group. About 19 obese subjects and 21 non-obese subjects in the low income group consumed 0 to 20g of fats and oils whereas it was nil in the high income group. Most of the obese and non-obese high income subjects consumed 20 to 60g of fats and oils.

Majority of the middle income obese subjects consumed 20 to 40g of fats and oils. These figures reveal that the consumption of fats and oils was more by the high income group. The same trend was noticed in the case of flesh foods also. High income groups consumed more quantities of flesh foods (50 to 100 in the case of obese and 25 to 100g in the case of non-obese).

From the above table it is evident that fats and oils and flesh foods consumption of obese high income groups are more than the non-obese, though this difference was not seen in the case of cereal consumption.

In order to further analyse the fats and oils and flesh foods consumption, the type and amount of oils used and the frequency of flesh foods consumption were analysed.

Table V depicts the distribution of families according to the type of oil used.

TABLE V  
DISTRIBUTION OF FAMILIES ACCORDING TO THE TYPE OF OILS USED

Type of oil used	Obese						Non-Obese					
	L.I.G.		M.I.G.		H.I.G.		L.I.G.		M.I.G.		L.I.G.	
	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %
<u>I. Single oils</u>												
Ground nut oil	6	20	4	13	11	37	8	26	4	13	5	16
Gingelly oil	5	17	4	13	-	-	5	17	6	20	7	24
Sunflower oil	-	-	6	20	-	-	-	-	7	24	-	-
Suffola oil	-	-	5	17	-	-	-	-	-	-	3	10
Palmoil	13	43	-	-	-	-	17	57	-	-	-	-
Cocount oil	-	-	-	-	3	10	-	-	3	10	-	-
<u>Combination oils</u>												
Gingelly, ground nut oil and ghee	-	-	-	-	3	10	-	-	3	10	4	13
Palm oil and ghee	-	-	-	-	-	-	-	-	4	13	-	-
Gingelly, sunflower and ghee	-	-	5	17	5	17	-	-	-	-	7	24
Refind, palm oil and ghee	6	20	6	20	4	13	-	-	3	10	4	13
Gingelly and refined oil	-	-	-	-	4	13	-	-	-	-	-	-
<b>Total</b>	30	100	30	100	30	100	30	100	30	100	30	100

When the type of oil consumed was analysed it was evident that in low income families only single oil was used for cooking, 43 per cent of the families used palm oil, 20 per cent used ground oil and 17 per cent used gingelly oil. Only six families (20%) used refined oil and ghee along with palmoil. In non-obese low income families the same trend was seen but here none of the families consumed combined oils.

Majority (63%) of the obese middle income subjects used single oils namely groundnut, gingelly, sunflower and saffola oil. About 37 per cent used gingelly oil, sunflower oil, refined oil, ghee and palmoil. The trend was same in the non-obese middle income group also.

In the high income group about 37 per cent of the obese consumed groundnut oil and 10 per cent consumed coconut oil alone. The percentage of families consuming more than one oil was 43 per cent.

Many families (40%) consumed ghee. The number of non-obese high income families consuming single and combination oils were equal.

From these results it is evident that the consumption of saturated oils like coconut oil and ghee in the case of obese people might have been a causative factor for obesity to certain extent. But there was not much difference in the consumption pattern of the obese and non-obese. May be the amount of fats consumed was different.

Table VI presents the per capita fat consumption pattern of obese and non-obese subjects.

TABLE VI  
PER CAPITA FAT CONSUMPTION OF OBESE AND NON-OBESE SUBJECTS

Fat intake (g)	Obese		Non-Obese			
	L.I.G.	M.I.G	H.I.G.	L.I.G.	M.I.G.	L.I.G.
5-10	4	-	-	10	-	-
10-15	6	-	-	7	4	-
15-20	9	4	-	6	7	-
20-25	6	-	-	7	2	6
25-30	-	3	2	-	1	-
30-35	5	8	5	-	8	4
35-40	-	7	7	-	-	5
40-45	-	5	8	-	4	6
45-50	-	3	6	-	4	4
50-60	-	-	2	-	-	5

From Table VI it is evident that about 28 families consumed 30 to 60g fats and oils in high-income obese subjects whereas in non-obese 30 families consumed 20 to 50g.

Majority (25 families) of the low income group consumed the least quantity (5-25g) of fats and oils.

The intake of obese middle income was 25-50g. From these results it is evident that the consumption of fats and oils was higher in high income obese subjects.

The flesh foods consumption pattern of the non-vegetarians were analys<sup>ed</sup> and the results are presented in Table VII .

**TABLE**  
**FREQUENCY OF FLESH FOOD CONSUMPTION**

Type of flesh foods	Obese						Non-obese													
	L.I.G.		M.I.G.		H.I.G.		L.I.G.		M.I.G.		H.I.G.									
	D	W	M	O	D	W	M	O	D	W	M	O								
Egg	-	-	10	-	4	5	-	-	8	-	-	-	-	5	3	-	10	-	-	-
Meat	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-
Fish	-	-	6	9	-	5	4	-	-	-	8	-	-	-	9	-	-	4	2	7
Chicken	-	-	5	-	-	4	5	-	-	-	5	-	-	-	8	-	-	4	2	-

D = Daily    W = Weekly    M = Monthly    O = Occasionally

From Table VII, it is evident that about 32 families consumed fish, 27 families of the obese, consumed egg, 19 families consumed chicken and only 3 families consumed meat. The low income families did not consume flesh foods daily or weekly. They consumed egg and fish monthly and fish (9 families) and chicken occasionally. But in the middle-income group the frequency of egg and fish consumption was more. In high income families only eggs were consumed frequently. There was no significant difference in the frequency of flesh food consumption of the obese and non-obese subjects.

Table VIII indicates the frequency of the preparation of fried foods.

TABLE VIII

FREQUENCY OF THE PREPARATION OF FRIED FOODS

Frequency of fried foods	Obese						Non-obese					
	LIG		MIG		HIG		LIG		MIG		HIG	
	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %
Weekly	2	7	9	30	17	57	-	-	6	20	10	33
Monthly	12	40	14	47	8	27	4	13	9	30	12	40
Occasionally	16	53	7	23	5	16	26	87	15	50	8	27
	30	100	30	100	30	100	30	100	30	100	30	100

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From Table VIII it is obvious that the frequency of preparation of fried foods was more in the case of obese than the non-obese. In low income obese subjects the fried foods were consumed occasionally whereas in the high income groups the fried foods were prepared frequently. Compared to obese subjects, the frequency of preparation was less in the non-obese group.

TABLE IX  
FREQUENCY OF THE CONSUMPTION OF MEALS OUTSIDE BY THE  
SELECTED SAMPLE

	Obese			Non-obese		
	LIG	HIG	MIG	LIG	MIG	HIG
Consumption of meals outside	4	12	16	-	8	14

From Table IX it is evident that those who consumed the meals outside was high in non-obese high income subjects, as against other groups. The least number of sample: who consume the meals outside were from the low income obese and non-obese subjects.

With regard to both obese and non-obese samples the consumption of meals outside was less in low income as against the midle and high income subjects.

The 24 hour recall diet survey was conducted for the selected sample of 18 obese and 18 non-obese subjects ( 6 from each income group). The results obtained are presented in the following tables.

Table X presents the mean food consumption pattern of the selected samples. The individual values are presented in Appendix IV.

TABLE X  
MEAN DAILY FOOD INTAKE OF THE SELECTED OBESE AND  
NON OBESE SUBJECTS

Food groups	Obese		Non-obese			
	L.I.G. No=6	M.I.G. No=6	H.I.G. No=6	L.I.G. No=6	M.I.G. No=6	H.I.G. No=6
Cereals (g)	257	333.33	400	225	300	350
Pulses (g)	40	58	63	35	52	55
Vegetables (g)	83	102.16	108.32	75	100	125
Fats and Oils(g)	25	38	63	19	28	50
Flesh Foods (g)	39	78	100	25	53	75
Sugar (g)	23	30	55	20	30	40
Milk	150	290	450	75	225	325

The mean food consumption by obese and non-obese subjects showed that the consumption of all foods were more in the case of obese subjects.

The food consumption increased as the income increased. The total fat intake was less in the case of low income and as the income increased the fat consumption also increased. From the previous tables, it is evident that the high income groups consumed a mixture of oils and especially added saturated fats along with unsaturated single oils. The increased consumption of cereals, pulses, fats and oils, sugar and jaggery and milk and milk products might have aided increasing the body weight in the case of obese subjects.

Table XI presents the nutrient intake of obese and non-obese subjects. Appendix V presents the individual nutrient consumption.

**TABLE XI**  
**MEAN DAILY NUTRIENT INTAKE OF SELECTED OBESE AND NON-OBESE**  
**SUBJECTS**

Nutrients	Obese			Non-obese			RDA
	LIG	MIG	HIG	LIG	MIG	LIG	
	N = 6	N = 6	N = 6	N = 6	N = 6	N = 6	
Calorie (Kcal)	2087	2495	2750	1253	1987	2127	2800
Protein (g)	43.2	63.9	69.6	36	55.6	63.7	55
Fat (g)	32	49	53	28	38	50	
Crude Fibre(g)	4	5	6	4	6	8	14
Carbohydrate(g)	237	265.7	494.3	219	287	327	51
Iron (mg)	29.26	35.65	46.28	18.3	25.1	31.2	20
Calcium(g)	548	694	1528	347	729	1233	781.60
Vitamin A (ug)	1331	1563	3377	1284	1296	1766	715
Thiamine (mg)	1.36	1.79	1.9	0.9	1.3	1.2	1.2
Riboflavin (mg)	0.14	1.07	1.43	0.5	1.2	1.1	1.4
Niacin (mg)	14.06	15.04	14.50	8.9	14.3	12.6	15.66
Vitamin C (mg)	49	60	73	40	47	59	40

The results of the nutrient consumption as presented in Table XI show that the calorie consumption of all the subjects were below the recommended allowance of adult men. The protein consumption of the low income groups were inadequate whereas the other two income groups met the protein requirements. The fat intake of obese subjects <sup>was from 32 to 53g.</sup> The fibre content was very much low. The requirements of all the other nutrients were met except the vitamin A content.

These results show that the fat intake of obese were more and at the same time the fibre which is an essential hypolipaeamic factor was less. This pattern of consumption might have aided in the development of obesity.

C. Serum Lipid profile of the selected samples

The serum lipid profile namely cholesterol, triglyceride, low density lipoprotein (LDL), very low density lipo protein (VLDL) and high density lipoprotein (HDL) were analysed for the selected male samples of obese and non obese subjects and the results are presented in the following tables and discussed.

Table XII depicts the mean serum cholesterol levels of the obese and non-obese subjects from the three income groups. The individual values are presented in Appendix VI. The values are pictorially represented in Figure 1.

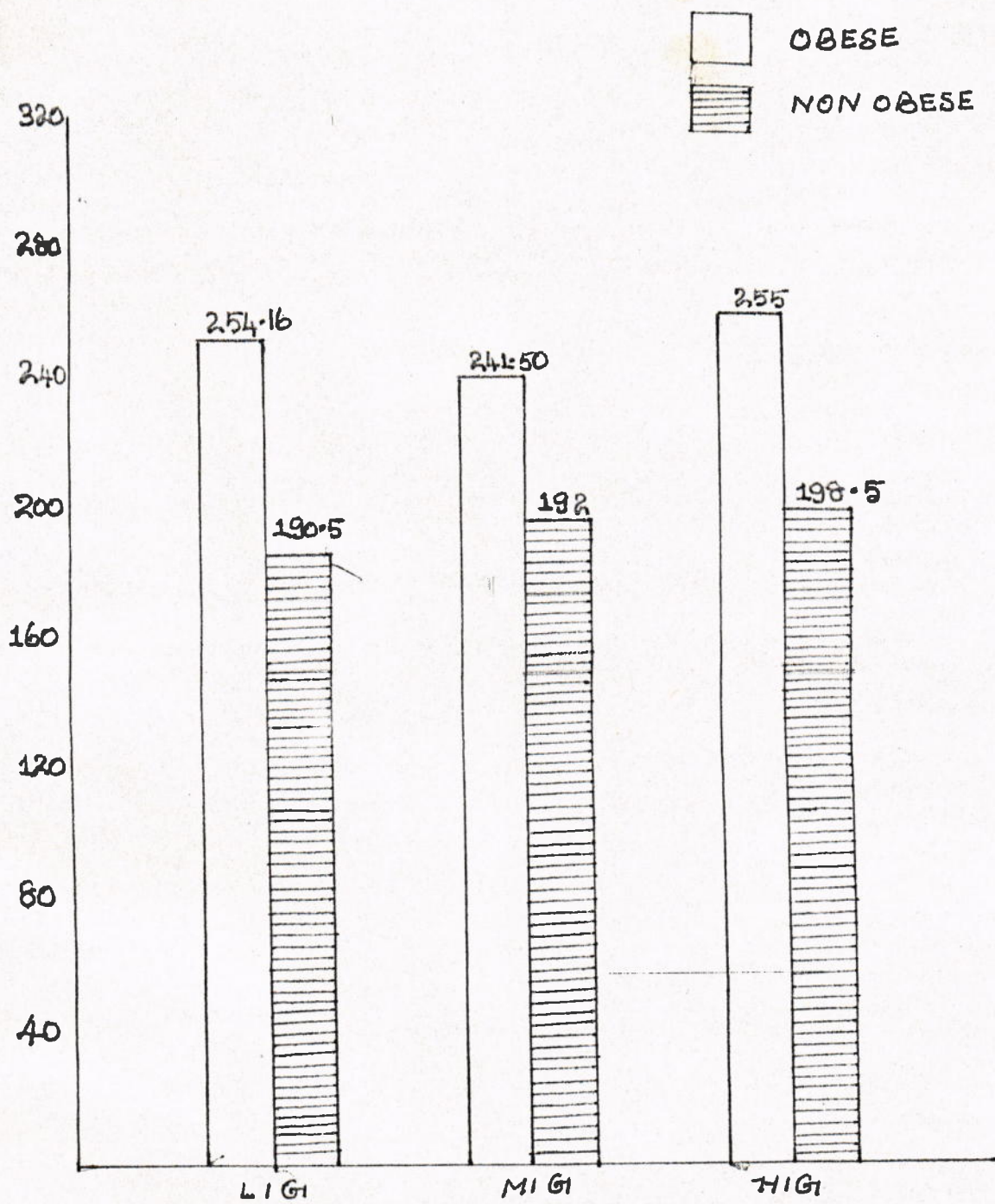
TABLE XII  
MEAN SERUM CHOLESTEROL LEVELS (mg/dl) OF THE SELECTED  
SAMPLES  
(SAMPLE SIZE 6)

Income group	Cholesterol mg/dl	Groups Compared	't' value
LIG	Obese A 254.16 ± 36.08	A vs B	3.4006 **
		A vs C	0.587 1NS
		A vs E	0.032 6NS
LIG	Non-obese B 190.5 ± 15.80	C vs D	2.655*
		C vs E	0.538NS
MIG	Non-obese D 192.00 ± 40.28	E vs F	4.65**
HIG	Non obese F 198.5 ± 20.14		

\*150 - 260 mg/dl

\*\* Significant at 5 per cent level (2.228)

\*\* Significant at 1 per cent level (3.169)



MEAN SERUM CHOLESTROL LEVEL OF THE  
SELECTED SAMPLE

FIG. 1

From Table XII it is evident that the blood cholesterol levels of all the obese subjects from all the three income groups were high. But the values registered by non-obese controls were within the normal range. Statistical analysis revealed that the values of the obese subjects from the three income groups were not significantly different, whereas, the mean cholesterol level of the obese and non-obese from the low income groups were highly significant. In the same way in the other two income groups also the values were significantly different at five per cent level between the obese and non-obese. These results clearly indicate that in obesity the risk for hypercholesterolemia is high.

Table XIII shows the mean serum triglyceride levels (Fig. 2) of the selected samples. The individual values are presented in Appendix VI.

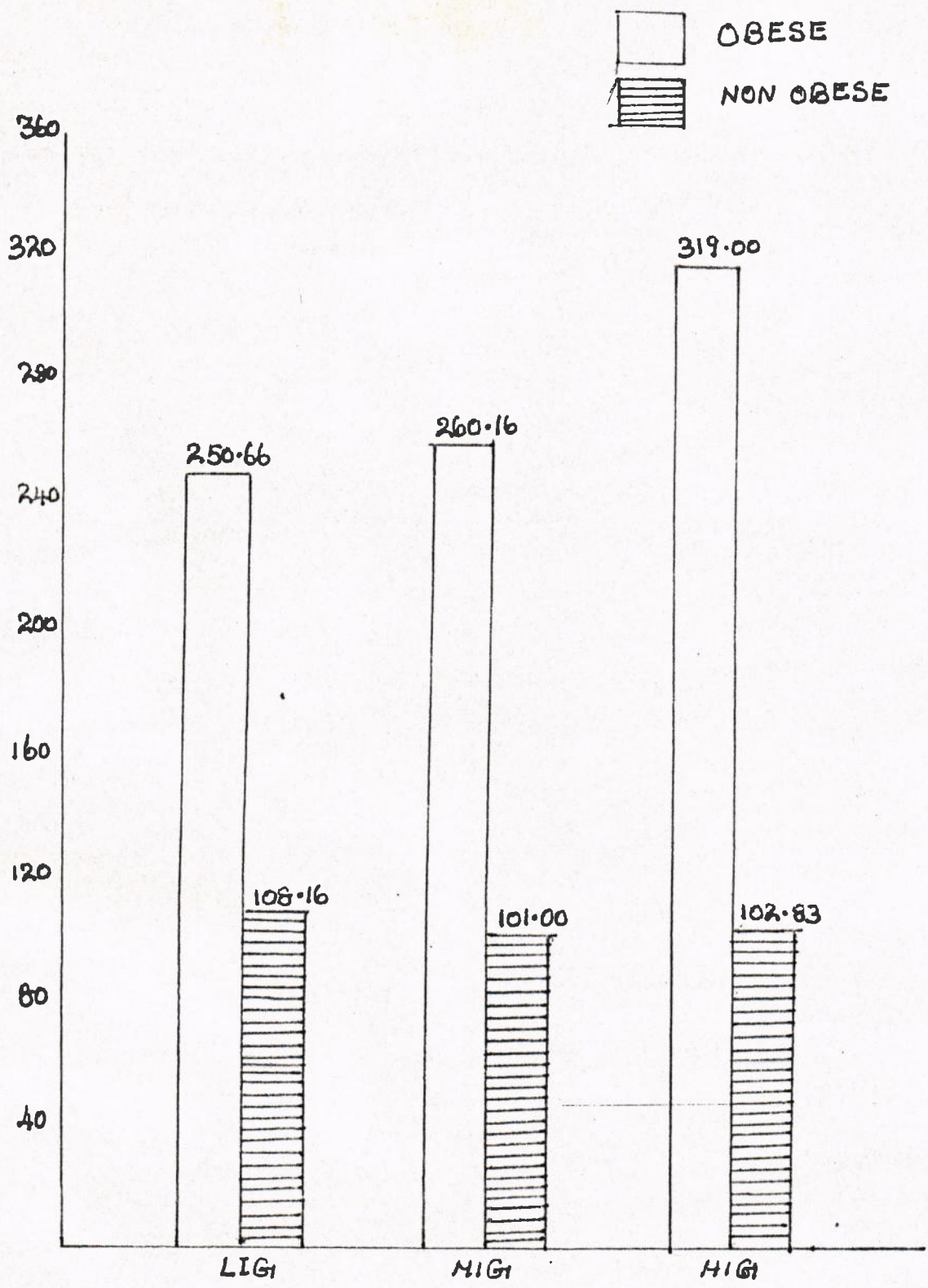
TABLE XIII  
 MEAN SERUM TRIGLYCERIDE (mg/dl) OF THE SELECTED SAMPLES  
 (SAMPLE SIZE 6)

Income group		T.G. Triglyceride	Groups compared	't' value
LIG	Obese A	250.66 ± 33.44	A vs B	8.9341 **
			A vs C	0.4771NS
			A vs E	2.9751*
	Non-obese B	108.16 ± 15.10		
MIG	Obese C	260.16 ± 31.10	C vs D	9.8065**
			C vs E	2.5616*
	Non-obese D	101.00 ± 20.10		
HIG	Obese E	319.00 ± 40.62	E vs F	5.3800**
	Non-obese F	102.83 ± 21.74		

\* - Significant at 5 per cent level (2.228)

\*\* - Significant at 1 per cent level (3.169)

normalValue 65-165 mg/dl



MEAN SERUM TRIGLYCERIDE LEVEL OF THE  
 SELECTED SAMPLE  
 FIG. II

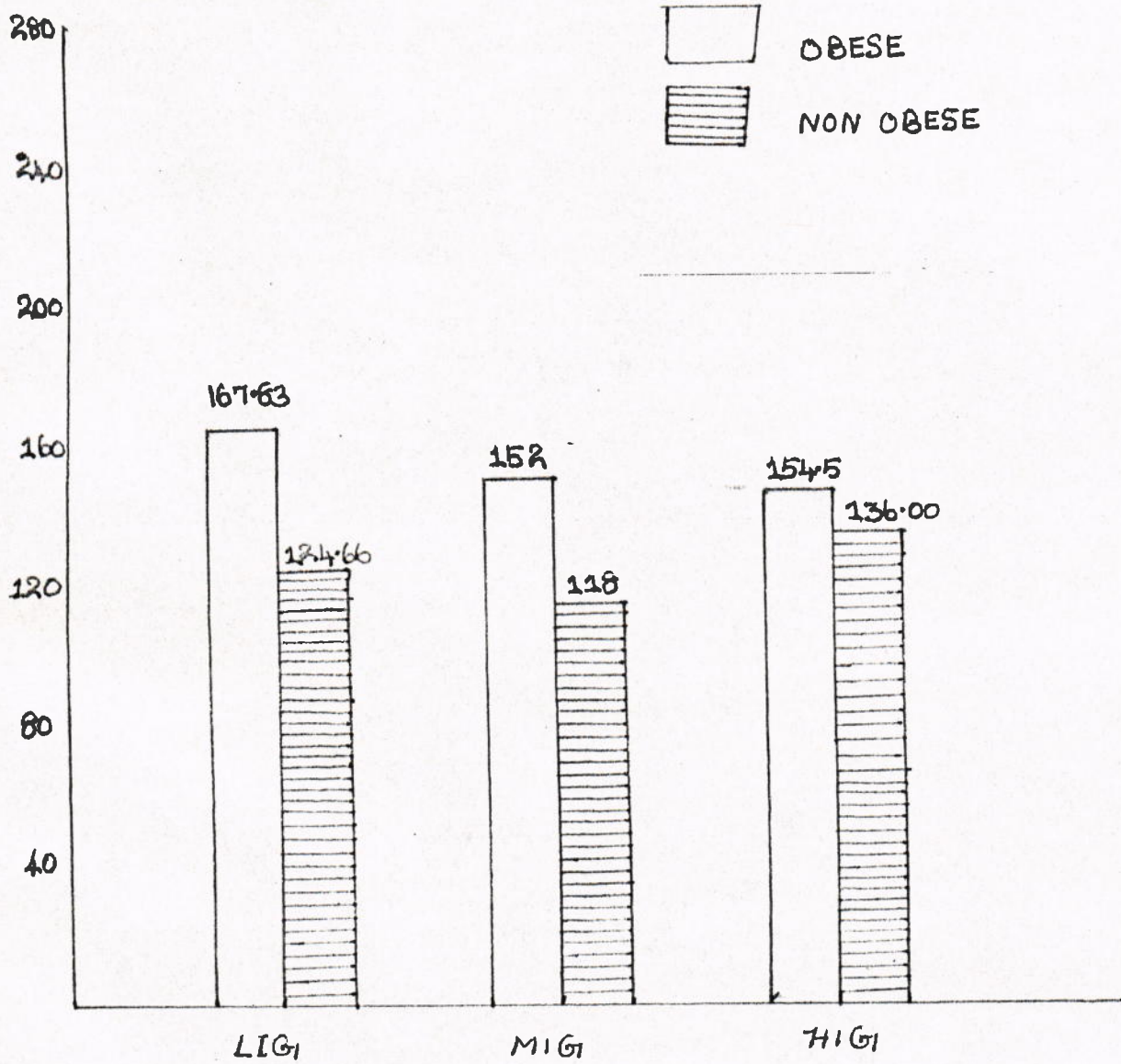
Table XIII indicates that the mean serum triglyceride values of the obese subjects were very much higher than the normal values recommended by Washlefeet et al (1974). The triglyceride value of the obese middle income group subjects were higher (260.16 mg) than the low income obese (250.66mg) group, but the difference was not statistically significant. The value registered by the high income group was very much higher (319 mg) than the other two groups. This value was significantly higher (at 5% level) than the other two values. The non obese subjects had registered normal values. The differences between the values of obese and non-obese in each income group was highly significant at one per cent level. These results indicate that obese individuals are more prone to triglyceridemia.

In Table XIV the low Density Lipoprotein (LDL) values of the obese and non-obese are presented (Figure 3). The individual values are presented in Appendix VI.

TABLE XIV  
 MEAN SERUM LOW DENSITY LIPOPROTEIN (mg/dl) OF SELECTED SAMPLE  
 (SAMPLE SIZE 6)

Income group	LDL	Groups Compared	't' value
Obese A	167.83 ±	A vs B	2.4445 NS
	31.46	A vs C	0.7328 NS
		A vs E	0.6177 NS
LIG Non-obese B	124.66 ±		
	25.21		
Obese C	152.00 ±	C vs D	1.4300 NS
	37.97	C vs E	0.1063 NS
MIG Non-obese D	118.00 ±		
	38.30		
Obese E	154.5 ±	E vs F	2.4445 NS
	37.9		
HIG Non-obese F	136.00 ±		
	27.76		

\* - Significant at 5 per cent level (2.228)  
 \*\* - Significant at 1 per cent level (3.169)  
 Normal value 66-178 mg/dl



MEAN SERUM LOW DENSITY LIPOPROTEIN OF THE  
SELECTED SAMPLE

FIG. III

The LDL values depicted in Table XIV indicate that the values registered by all the subjects both obese and non-obese from all the three income groups were within the normal range. But within the range, the obese subjects have registered higher values than the non-obese in all income groups. The difference was very much less in the high income group. But in all the three income groups the difference between the values of obese and non-obese were not statistically significant. The results of the high income group indicate that as income increases, inclusion of more saturated fats has aided in increasing the LDL values.

. Table XV presents the very low Density Lipoprotein (VLDL) values of the obese and non-obese from the three income groups. Figure 4 also presents the mean values of VLDL.

The individual values are presented in Appendix VI.

TABLE XV  
 MEAN SERUM VERY LOW DENSITY LIPOPROTEIN (mg/dl) OF THE  
 SELECTED SAMPLES  
 (SAMPLE SIZE -6)

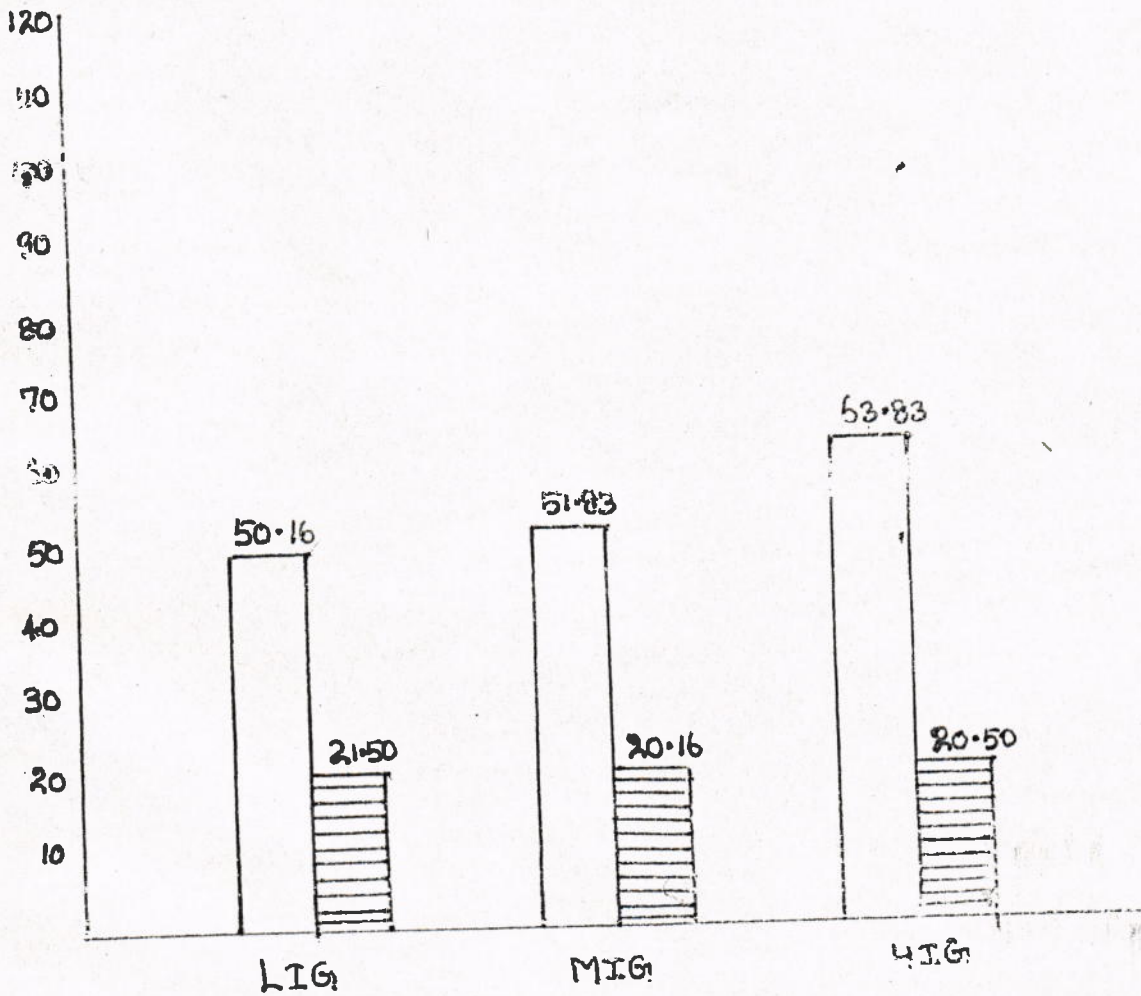
Income group	VIDL	Groups Compared	't' value
LIG	Obese A 50.16 ±	A vs B	9.0410**
	6.55	A vs C	0.4249NS
	Non-obese B 21.50 ±	A vs E	3.0043*
MIG	3.08		
	Obese C 51.83 ±	C vs D	9.8355**
	6.14	C vs E	2.7027*
HIG	Non-obese D 20.16 ±		
	4.02		
	Obese E 63.83 ±	E vs F	10.9253**
	8.08		
	Non-obese F 20.50 ±		
	4.08		

U

Significant at 5 per cent level \* 2.228  
 Significant at 1 per cent level \*\* 3.169

OBESE

NON OBESE



MEAN SERUM VERY LOW DENSITY LIPOPROTEIN OF  
THE SELECTED SAMPLE

FIG. IV

Table XV shows that the VLDL of all the obese subjects from the three income groups had registered higher values. Within the obese subjects, the difference between the means were not significant. But when the values were compared with the values of non-obese subjects of the same groups, the differences were highly significant (P 0.01) in all the three groups.

The High Density Lipoprotein (HDL) values of the obese and non-obese subjects from the three income groups are presented in Table XVI, and Figure 5.

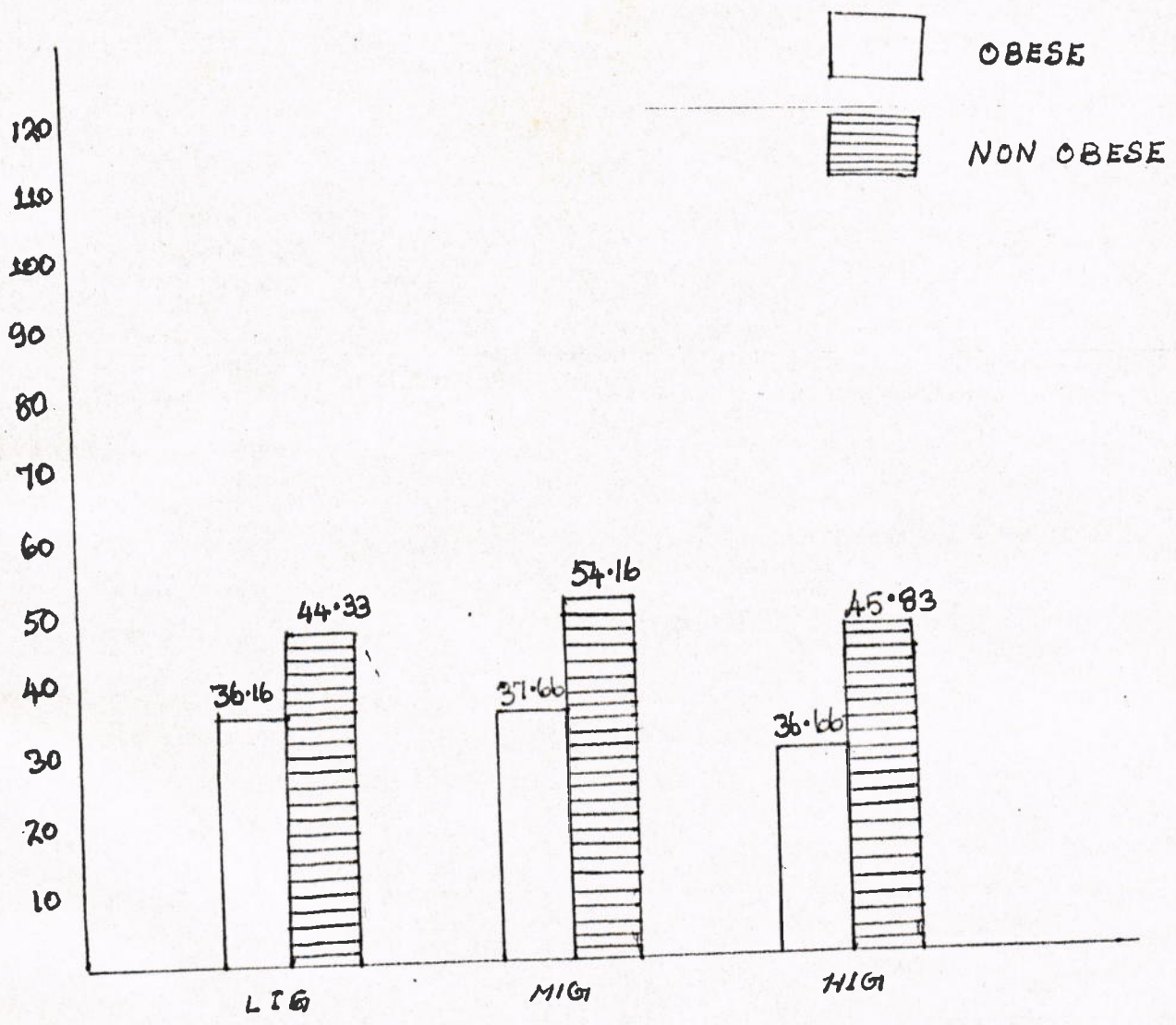
The individual values are presented in Appendix VI

TABLE XVI

MEAN SERUM HIGH DENSITY LIPOPROTEIN OF THE SELECTED SAMPLE  
(SAMPLE SIZE 6)

Income group	HDL	Groups Compared	't' value
LIG	Obese A 36.16 ± 6.99	A vs B	1.7569NS
	Non-obese B 44.33 ± 7.99	A vs C	0.4087NS
	obese C 37.66 ± 4.63	A vs E	0.1030NS
MIG	Non-obese D 54.16 ± 5.56	C vs D	5.2050**
	obese E 36.66 ± 8.59	C vs E	0.2341NS
	Non-obese F 45.83 ± 8.51	E vs F	1.7308NS

Significant at 5 per cent level = 2.228\*  
Significant at 1 per cent level = 3.169\*\*  
Normal value 30-60 mg/dl.



MEAN SERUM HIGH DENSITY LIPOPROTEIN OF THE  
SELECTED SAMPLE

FIG. V

The mean serum level of HDL was within the normal range for the obese and non-obese subjects in all the income groups. But the values were towards the lower limit for the obese and were towards the upper limit for the non-obese subjects. As HDL increases, it reduces the risk of coronary heart disease, In obesity the HDL values decrease very much and thus its protective effect is less.

The pattern of blood lipid profile obtained in the present investigation are in tune with those values obtained by earlier works. The risk of increased incidence of heart disorders more in obesity and hence the need for reducing the body weight is realived.

## Summary and Conclusion

## V SUMMARY AND CONCLUSION

The investigation on "Fat intake and Blood lipid profile of selected obese and non obese adults in Coimbatore city" was undertaken to

1. Calculate the food and nutrient consumption of obese and non-obese adults.
2. Study the nature of fats consumed by the obese and non-obese subjects.
3. Find out the differences that occur in the amount of fats and oils consumed by the obese and non-obese subjects.
4. and Analyse the blood lipid profile of the obese and non-obese subjects to ascertain the effect of obesity on these values.

The investigation was carried out by selecting obese and non-obese adult subjects from four major area of Coimbatore city, namely R.S.Puram, Race Course, Saibaba Colony and pappanaickenpalayam. The subjects were selected by finding out the body mass index of the overweight adult population and then by selecting those whose body mass index was above 24. Thus, a total number of 90 obese adults and 90 non-obese comparable group of adults were selected. The subjects were selected in such a way that they represented the three income groups equally (30 subjects in each income group).

The socio-economic status, dietary pattern and blood lipid profile of the selected samples were then assessed. A questionnaire was developed for eliciting data on the socio-economic status and dietary pattern. The meal pattern was also analysed through a 24 hour recall survey on a selected sample of six subjects. The blood lipid profile in terms of total cholesterol, triglycerides, low density lipoprotein, very low density lipoprotein and high density lipoprotein were analysed for these selected subjects. The results thus obtained were consolidated statistically analysed and discussed. The results revealed the following facts:

1. Majority of the subjects belonged to nuclear families. The type of family did not differ according to the income.
2. The number of members in the family was only one to three in the majority of the families, especially in the high income group.
3. Analysis of the occupational status showed that, the subjects from low income families were labourers, agriculturists or working in an office. But in high income group majority of the subjects were either doing business or in professional jobs.

4. The food habits survey indicated that in all the income groups the number of vegetarians and non-vegetarians were equal, except in obese low income group where about 17 per cent were ovovegetarians.
5. The consumption of cereals, pulses, milk, vegetables and fats and oils by the middle and high income group were more than that consumed by the low income group.
6. In low income families only one oil, mainly a vegetable oil was consumed while in middle and high income groups along with a vegetable oil, saturated oils like vanaspathy and ghee are used. Only three families (10 per cent) in high income obese group consumed coconut oil.
7. The frequency of flesh foods consumption was more in high income families.
8. The frequency of fried food consumption was also more in high income group.
9. The fats and oils consumption of high income groups was more than the low income group.
10. The 24 hour recall diet survey also indicated that the food and nutrient consumption of the subjects were adequate except protein in low income group and vitamin A by all the groups.
11. The blood lipid profile of the obese and non-obese indicated that the cholesterol, triglyceride, LDL and VLDL levels were normal for non-obese whereas for obese they were high. The HDL level was low for the obese subjects.

These results indicated that there was not much difference in the fats and oils consumption of obese and non-obese. The blood lipid profile indicated that the lipid levels were towards abnormality in the obese subjects which will be a predisposing factor to cardiovascular disorders. The study has brought out the fact that reducing the body weight and maintaining the body weight are essential in avoiding heart diseases and achieving health and thereby a happy life.

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Appendix

APPENDIX I

AVINASHILINGAM INSTITUTE FOR HOME SCIENCE & HIGHER EDUCATION  
FOR WOMEN

SOCIO ECONOMIC & DIETARY SURVEY

QUESTIONNAIRE

1. Name of the Investigator :
2. Name of the Interviewee :
3. Name and Address of the Head:  
of the family
  - a) Name :
  - b) Door No. :
  - c) Address :

4. Type of family

Joint

Nuclear

5. Family Background details:

Sl. No.	Name of the members	Relation to the Head of the family	Marital status	Sex	Age in Years	Weight (Kg)	Height (Cms)	Education	Occupation	Activity	Income per Month

Monthly Per Capita Income Rs.

6. Are you a - Vegetarian

Non-Vegetarian

7. If Non-Vegetarian, mention the types of food consumed

S.No.	Item	Daily Amount (gm)	Weekly Amount (gm)	Monthly Amount (gm)	Occasionally amount (gm)
1	Egg				
2	Meat				
3	Fish				
4	Chicken				
5	Others				

8. What type of oil do you use for cooking?

- a) Groundnut oil Amount consumed per week/month
- b) Gingelly Oil
- c) Sunflower
- d) Palm Oil
- e) Coconut oil
- f) Ghee
- g) Vanaspathi
- h) Saffloa Oil
- i) Butter

9. Methods of Cookings:

Food Items	Boiling	Steaming	Frying		Stewing	Others
			shallow fat	Deep fat		

10. Meal Pattern:

	Ist Day	2nd Day	3rd Day
<b>Break-fast</b>			
10.00 a.m.			
<b>Lunch</b>			
<b>Tea</b>			
<b>Dinner</b>			

11. Kinds of foods commonly used are:

S.No.	Item	Quantity/Day
1	<u>CEREALS</u>	
	Rice	.. ..
	Wheat	.. ..
	Sooji	.. ..
	Broken Wheat	.. ..
	Ragi	.. ..
2.	<u>PULSES:</u>	
	Black gram dhal	.. ..
	Red gram dhal	.. ..
	Green gram dhal	.. ..
	Bengal gram dhal	.. ..
	Cowpea	.. ..
	Others	.. ..
3.	<u>GREEN LEAFY VEGETABLES</u>	
	Amaranth	.. ..
	Agathi	.. ..
	Drumstick leaves	.. ..
	Fennugreek	.. ..
	Corriander	.. ..
	Others	.. ..
4.	<u>ROOTS AND TUBERS</u>	
	Carrot	.. ..
	Beetroot	.. ..
	Onion	.. ..
	Potato	.. ..
	Others	.. ..
5.	<u>OTHER VEGETABLES:</u>	
	Ash gourd	.. ..
	Bitter gourd	.. ..
	Drumstick	.. ..
	Brinjal	.. ..
	Others	.. ..

11. Kinds of foods commonly used (Contnd):

S.No.	Item	Quantity/Day
6	<u>FRUITS</u>	.. ..
	Guava	.. ..
	Orange	.. ..
	Papaya	.. ..
	Apple	.. ..
	Banana	.. ..
	Others	.. ..
7	<u>NUTS &amp; OIL SEEDS:</u>	
	Coconut Oil	.. ..
	Groundnut Oil	.. ..
	Gingelly Oil	.. ..
	Others	.. ..
8	<u>FLESH FOODS</u>	.. ..
	Meat	.. ..
	Fish	.. ..
	Chicken	.. ..
	Others	.. ..
9	<u>MILK AND MILK PRODUCTS</u>	
	Cow Milk	.. ..
	Bufflalow Milk..	.. ..
	Goat Milk	.. ..
	Others	.. ..
10	<u>SUGAR AND JAGGERY:</u>	
	Palma Jaggery	.. ..
	Sugar	.. ..
	Jaggery	.. ..
11	<u>PREPARED Foods</u>	
	Biscuirs	.. ..
	Pupad	.. ..
	Pickles	.. ..
12	<u>BEVERAGES:</u>	.. ..
	Tea	.. ..
	Coffee	.. ..
	Others (Specify)	.. ..



17. Indicate the edible oils used for item and give reasons for the same:

---

Oil used	Reasons				
	Econo- mical	Status Symbol	Nece- ssity	Availability	Family Practice

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18. Do you remove the fat rich portion before cooking meat?

APPENDIX II

24 HOUR RECALL DIET SURVEY

NAME :

AGE :

ADDRESS :

SCHEDULE FOR RECALL METHOD 1 DAY

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NAME OF THE MEAL	MEDU	RAW EQUIVALENTS CONSUMED BY THE INDIVIDUAL
BREAKFAST		
LUNCH		
TEA		
DINNER		
BED TIME		

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## APPENDIX III

### MANAGEMENT - CHOLESTEROL -500

#### PRINCIPLES OF THE REACTION: (Allain, 1974)

The MANAGENT Cholesterol 500 is a fully enzymatic procedure with colorimetric determination at 500 n.m.

The reaction takes place in three stages.

1. Esterified cholesterol Cholesterol-esterase Cholesterol  
+ fatty acids
2. Cholesterol + O<sub>2</sub> Cholesterol-oxidase Cholesterol-4-enzyme  
- zone + H<sub>2</sub>O
3. H<sub>2</sub>O<sub>2</sub> + Phenol + 4 aminoantipyrine peroxidase  
quinonemine + H<sub>2</sub>O

The optical density read at 500 n.m. is proportional to the concentration of total Cholesterol.

<u>Reagents</u>	<u>Composition</u>	<u>Final Concentration of the reconstituted agent</u>
1	<u>Enzymes:</u>	
	Sodium Cholate	1.2 mmol/l
	4-aminoantipyrine	0.12 mmol/l
	Peroxidase	500 U/I
	Cholesterol Oxidase	35 U/I
	Cholesterol esterase	200/U/I
2	<u>BUFFER:</u>	
	Phosphate buffer	100mmol/l
	Phend	26mmol/l

STORAGE: Store at the package at 2-8°C

SPECIMENS: Use unhemolyzed serum

REAGENT PREPARATION:

Reconstitute a vital of ENGYMES(Reagent 1) with one bottle of BUFFER (Reagent 2).

Mix gently until completely dissolved. Do not shake. Shaking might cause denaturation.

The reconstituted reagent is stable 1 month at 2-8°C

PROCEDURE

	SAMPLE	STANDARD	R. BLANK
Reagent	3 ml	3 ml	3 ml
Serum	0.3 ml	-	-
Standard	-	0.03 ml	-
Distilled water	-	-	0.03ml

Incubate 10 minutes at 3°C. Read the optical Density ( $O_{D}$ ) of the specimen and the standard against the reagent blank.

NOTE:

1. Colour development is stable for 30 minutes at room temperature.

2. Volumes may be modified proportionally

The test is linear up to 500 mg/dl. For higher concentration repeat the test on a specimen diluted in saline solution and multiply the result by the dilution factor.

FORMULA:

Values are calculated with the following formula

$$\text{Cholesterol mg/dl} = \frac{\text{O.D. Specimen}}{\text{O.D. standard}} \times \text{Concentration Standard mg/dl}$$

The standard is available separately.

EXPECTED VALUES:

## II ESTIMATION OF TRIGLYCERIDES, IN SERUM (GPO.PRD) METHOD

### Principle:

Serum triglycerides are hydrolyzed to glycerol and free fatty acids by lipase. In the presence of ATP and glycerokinase, the glycerol is converted to glycerol -3 Phosphate. The glycerol-3 phosphate Oxidase in yield hydrogen peroxide. Hydrogen peroxide reacts in the presence of peroxidases with ESPAS (N-Ethyl)-N-Sulphopropyl-m-aminopyridine and 4-aminopyridine to form a coloured complex. The intensity of the colour developed is proportional to triglycerides concentration and is measured photometrically at 546 nm (530 to 570 nm) or with Green filter.

1. Triglyceride + H<sub>2</sub>O Lipoprotein lipase Glycerol+fatty acids
2. Glycerol + ATP Glycerokinase Glycerol-3 phosphate + ADP
3. Glycerol - 3 - Phosphate + O<sub>2</sub> Glycerol-3 Phosphate Oxidase  
H<sub>2</sub>O<sub>2</sub> + Dihydroxy acetone phosphate
4. H<sub>2</sub>O<sub>2</sub> + Aminoantipyrine + ESPAS Peroxidase Quinamine+H<sub>2</sub>O

### REAGENTS:

#### 1. BUFFER

Store at 2° to 8°C : - Active ingredients  
Pipes suffer  
ESPAS

### REAGENT:

#### 2. ENZYMES

Store at 2° to 8°C - Active ingredients

- Lipoprotein lipase, glycerokinase
- Glycerol - 3 - phosphate oxidase
- Peroxidase
- 4 - aminoantipyrine
- ATP

REAGENT: - 3. STANDARD

Store at 2° to 8°C - (Triglyceride 200 mg/dl)

Ready to use.

WORKING SOLUTION:

Dissolve contents of bottle of REAGENT 2 with contents of one bottle of REAGENT 1 mix well and at 2° to 8°C. This is the chromogen reagent.

PROCEDURE:

A. For automated instrument requiring 1ml volumes:

PIPETTE IN TO TEST TUBES:

	BLANK (B)	STANDARD (S)	TEST (T)
Chromogen Reagent	1.0ml	1.0ml	1.0ml
Standard	-	0.01ml	0.01ml
Sample	-	-	0.01ml

Mix and incubate at 37°C for 5 minutes or at R.T., (25° to 30°C) for 20 minutes. Read absorbance of test ( $A_T$ ) standard ( $A_S$ ) and the reagent blank ( $A_B$ )

against distilled water at 546nm wave length (5.30 - 570nm)  
or with Green filter.

**B For Calorimeter/Spectrophotometers requiring 3ml Volume:**

---

	BLANK (B)	STANDARD (D)	TEST (T)
Chromogen reagent	1.0ml	1.0ml	1.0ml
Standard	-	0.02ml	-
Sample	-	-	0.02ml
Mix and incubate at 37°C for 10 minutes or at R.T. (25-30°C) for 20 minutes.			
Distilled water	2.0ml	2.0ml	2.0ml

---

Mix and read absorbance of the test ( $A_T$ ) standard ( $A_S$ ) and the reagent blank ( $A_B$ ) against distilled water at 546 nm Wavelength (530 to 570 nm) or with Green filter.

**C. For Calorimeters requiring 5.0ml Volume:**

For use in their procedure, dilute 0.4ml of sample and standard by adding 0.4ml of diluted water or normal Saline mix.

PIPPETTE IN TO TESTUBES:

	BLANK (B)	STANDARD (S)	TEST (T)
Chromogen Reagent	1.0ml	1.0ml	1.0ml
Distilled Standard	-	0.2ml	-
Distilled Sample	-	-	0.2ml

Mix and incubate at 37°C for  
10 minutes or at R.T. (25°-30°C)  
for 29 minutes.

Distilled Water	4.0ml	4.0ml	4.0ml
-----------------	-------	-------	-------

Mix and read absorbance of the test ( $A_T$ ) Standard ( $A_S$ ) and the reagent blank ( $A_B$ ) against distilled water of 546 nm wavelength (530-570nm) on with Green filter.

The colour developed in table for 1 hour at room temperature, if protected from direct light.

CALCULATIONS:

Triglycefire Concentration (mg/dl)

$$= \frac{A_T - A_B}{A_S - A_B} \times 200$$

Where  $A_T$  is absorbance of the test.

$A_B$  is absorbance of the reagent blank

$A_S$  is absorbance of the Standard

MANAGENT

CHOLESTEROL HDL

PRINCIPLES OF THE REACTION

MANAGENT CHOLESTEROL HDL allows determination of the lipoprotein HDL factor after precipitation of LDL and VLDL fractions with phosphotungstic acid and magnesium chloride.

REAGENTS:

Composition

REAGENT	ex10ml	Magnesium Chloride 490mmol/l
STANDARD 1	1x5 ml	Phosphotungstic acid 13.9 mmol
STANDARD 2	1x5ml	20mg/dl
		40mg/dl
STANDARD 3	1x5ml	60mg/dl

STORAGE:

Store the package at 25°C

SPECIMENTS:

Serum

REAGENT PREPARATION:

The precipitating reagent (Reagent 1) is ready for use.

PROCEDURE

In a CENTRIFUGE TEST TUBE: Serum 1ml precipitating reagent 0.1ml Mix and let stand 10 minutes at 18-25 C

Centrifuge 15' at 5000-6000 rpm, Remove the supernatant and measure the HDL Cholesterol using Menagent Cholesterol 500

FORMULA:

Calculate the results using the Menagent Cholesterol 500 procedure; multiply the value obtained by 1.1 to allow for the dilution occurring with precipitation.

EXPECTED VALUES:

Men : 30-60 mg/dl

Women : 40-70mg/dl

APPENDIX IV

MEAN DAILY FOOD INTAKE OF SELECTED OBESE AND NON OBESE SUBJECTS IN DIFFERENT INCOME GROUPS

INCOME GROUP	CEREALS	PULSES	VEGETABLES	FATS AND OILS	FLESH FOODS	SUGAR	MILK
<b>OBESE SUBJECTS</b>							
Low Income Group	150	40	75	15	25	20	150
	220	35	68	18	29	25	150
	300	40	106	35	45	28	250
	275	38	65	25	39	25	100
	320	45	130	30	60	27	150
	280	39	80	25	50	23	100
	350	69	105	49	95	30	350
	300	67	95	30	65	30	250
	300	58	100	35	50	45	250
	350	57	115	42	93	25	300
	350	52	115	45	95	30	250
	350	45	102	35	92	30	350
<b>MIDDLE INCOME GROUP</b>							
	425	69	115	68	100	60	450
	425	68	115	65	100	60	500
	400	60	109	65	125	55	550
	350	55	100	58	100	58	425
	350	55	109	53	95	45	375
	350	52	105	55	80	45	350
<b>HIGH INCOME GROUP</b>							

INCOME GROUPS	CERALS	PULSES	VEGETABLES	FATS AND OILS	FRESH FOODS	SUGAR	MILK
CONTROL SUBJECTS	150	40	50	10	20	20	50
	300	30	100	25	40	35	100
	275	32	100	15	20	10	75
LOW INCOME GROUP	140	28	75	15	20	35	50
	300	50	125	30	40	26	100
	260	45	100	19	20	20	75
	300 <sup>n</sup>	55	125	25	60	30	225
MIDDLE INCOME GROUP	350	60 <sup>n</sup>	125	30	75	35	300
	250	30	75	25	50	25	200
	300	50	100	35	50	30	200
	250	40	75	25	40	30	225
	350	60	100	30	45	30	200
	425	60	125	60	125	60	400
	350	45	100	50	100	40	325
	350	60	125	50	75	30	275
HIGH INCOME GROUP	350	35	150	50	50	30	300
	325	50	125	50	50	40	325
	300	55	125	40	80	40	325

APPENDIX V

MEAN DAILY INDIVIDUAL NUTRIENT INTAKE OF THE SELECTED OBSESE AND NON-OBSESE SUBJECTS IN DIFFERENT INCOME GROUPS

INCOME GROUPS	PROTEIN (gm)	FAT (g)	FIBRE (g)	CHO (gm)	ENERGY (Kcal)	IRON (mg)	CALCIUM (mg)	B CA ROTENE	THIAMINE (mg)	RIBOFLAVIN (mg)	NIA-CIN (mg)	VITAMIN C (mg)
OBSESE SUBJECTS	68.0	43	6	24	2055	29.4	596	1495	1.6	1.5	14.6	49
	49.2	38	5.1	100	2120	31.9	424	734	1.0	1.0	10.9	33.3
	36.0	35	4	288	2210	29.4	620	1919	1.09	1.0	14.6	90
	34.0	35	4	365.3	1920	25.6	585	1496	1.5	1.4	15.3	36
LIG	29.0	28.0	4.4	118	2340	44.0	726	1347	2.0	0.93	12.9	49
	42.1	21	2	341	1874	23.1	234	1005	1.0	1.1	16.1	38.0
	80.0	58	5	118	2510	37.3	386	1059	1.4	1.4	16.3	154
	47.0	44	6.3	150	2281	45.0	667	844	1.9	1.9	8.5	59
	60.2	38	6.4	300	2280	34.50	426	734	1.59	1.59	13.3	8
MIG	80.0	84	4.0	369	3220	33.50	1250	2855	1.43	1.43	19.5	55
	51.0	40	6.5	381	2400	34.40	740	3049	1.00	1.00	18.0	82
	62.2	29	5.0	325	2281	28.45	526	815	3.46	3.21	17.0	2
	70.8	50	5.0	305	2890	67.80	1002	3833	1.35	1.15	23.7	20
	68.2	51	6.3	235	2480	32.60	2908	3550	1.50	0.92	16.0	89
	70.9	46	6.4	350	3220	48.30	2202	5275	1.30	0.60	3.2	25
HIG	67.1	57	4.0	275	2635	43.10	958	3010	1.19	2.53	20.50	135
	59.20	49	7.5	417	2510	56.80	1248	1496	2.01	0.30	13.0	78
	6663	50	5.3	346	2950	23.10	798	3203	4.20	3.21	11.0	90

INCOME GROUP	PROTEIN (gm)	FAT (g)	FIBRE (g)	CARBOHYDRATE (gm)	ENERGY (Kcal)	IRON (MgP)	CALCIUM (mg)	B CA ROTENE	THIAMINE (mg)	RIBOFLAVIN (mg)	NIA-CIN (mg)	VITA-MIN'C (mg)
CONTROL GROUP	29	31	1	225	1212	16.50	640	898	1.24	0.50	4.7	49
	46	24	3	210	1372	23.40	285	2833	1.04	0.60	6.1	6.3
	32	35	4	203	1351	16.50	348	974	0.80	0.72	9.2	49
L.I.G.	38	25	2	226	1205	15.05	290	1283	0.50	0.35	11.5	36
	42	32	3	251	145	24.50	158	950	0.79	0.38	15.1	60
	38	24	3	202	1263	16.50	290	794	0.82	0.40	5.0	38
M.I.G.	51	44	7	262	1952	27.4	555	844	1.2	1.6	16.2	33.3
	47	46	5	305	1869	25.7	525	1059	1.5	1.1	14.2	45.0
	56	35	6	267	2064	26.0	750	1503	1.2	1.0	14.6	90.0
	51	41	7	265	2178	21.7	1200	734	1.5	1.1	8.5	38
	68	25	6	272	1820	26.3	740	2250	1.4	1.2	11.4	36
	58	45	6	285	2178	27.0	650	815	1.3	1.4	11.0	44
H.I.G.	62.20	40.20	9	350.01	2060	38.40	963	1800	1.4	1.3	14.50	108
	47.00	48.10	6	118.00	2125	28.30	545	2770	1.2	0.4	10.30	59
	60.20	58.00	9	369.30	2210	22.20	2122	1000	1.5	0.8	13.50	49
	80.00	45.50	8	381.02	2100	28.30	1755	1961	0.8	0.6	16.30	44
	51.00	51.20	9	258.00	2340	28.30	1823	1496	1.0	1.6	9.80	59
	80.00	50.30	8	381.00	1920	37.30	465	1912	1.2	1.8	10.60	39

APPENDIX VI

LIPID - PROFILE OF SELECTED - OBESE SUBJECTS

IN LOW INCOME GROUP

S.NO.	CHOLESTEROL	TRIGLY- CERIDES	VERY LOW DENSITY LIPO+ PROTEIN	LOW DENSITY LIPO + PROTEIN	HIGH DENSITY LIPO+ PROTEIN
1	198	189	38	115	45
2	235	250	50	149	36
3	265	265	53	183	29
4.	245	245	49	169	27
5	285	275	55	191	39
6	297	280	56	200	41
MEAN	254.16	250.66	50.16	167.83	36.16
S.D	36.08	33.14	6.55	31.46	6.99

LIPID PROFILE OF SELECTED NON-OBESE SUBJECTS  
IN . LOW INCOME GROUP

S.NO.	CHOLESTEROL	TRIGLYCERIDES	VERY LOW DENSITY LIPO- PROTEIN	LOW DENSITY LIPO- PROTEIN	HIGH DENSITY LIPO- PROTEIN
1	160	110	22	87	51
2	185	95	19	123	43
3	179	92	18	125	36
4	204	102	20	149	35
5	227	132	26	155	46
6	188	118	24	109	55
MEAN	190.5	108.16	21.5	124.66	44.33
S.D	$\pm$ 22.86	$\pm$ 15.10	$\pm$ 3.08	$\pm$ 25.21	$\pm$ 7.99

LIPID PROFILE OF SELECTED OBESE SUBJECTS IN MIDDLE  
INCOME GROUP

S.No.	CHOLESTEROL	TRIGLYCERIDES	VERY LOW DENSITY LIPO- PROTEIN	LOW DENSITY LIPO- PROTEIN	HIGH DENSITY LIPO- PROTEIN
1	280	270	54	191	35
2	186	307	61	89	36
3	240	260	52	141	47
4	270	220	44	191	35
5	246	272	54	156	36
6	227	232	46	144	37
MEAN	241.50	260.10	51.83	152	37.66
	+	+	+	+	+
S.D	-	-	-	-	-
	33.48	31.10	6.14	37.97	4.63

**LIPID - PROFILE OF SELECTED NON-OBESE SUBJECTS IN  
MIDDLE INCOME GROUP**

S.NO.	CHOLESTEROL	TRIGLYCERIDES	VERY LOW DENSITY LIPO- PROTEIN	LOW DENSITY LIPO.- PROTEIN	HIGH DENSITY LIPO- PROTEIN
1	175	90	18	55	102
2	230	84	17	153	60
3	253	140	28	176	49
4	150	98	20	74	56
5	179	92	18	104	59
6	165	102	20	99	46
<b>MEAN</b>	192	101	20.16	118	54.16
<b>S.D</b>	+ - 40.28	+ - 20.10	+ - 4.02	+ - 38.30	+ - 5.56

LIPID - PROFILE OF SELECTED OBESE SUBJECTS IN  
HIGH INCOME GROUP

S.NO.	CHOLESTEROL	TRIGLYCERIDES	VERY LOW DENSITY LIPO- PROTEIN	LOW DENSITY LIPO- PROTEIN	HIGH DENSITY LIPO- PROTEIN
1	257	285	57	155	45
2	302	345	69	184	49
3	260	290	58	169	33
4	282	335	67	186	29
5	167	279	56	83	28
6	262	300	76	150	36
MEAN	255	319	63.83	154.5	36.66
S.D	+	+	+	+	+
	-	-	-	-	-
	46.38	40.62	8.08	37.9	8.59

NON-  
LIPID - PROFILE OF SELECTED OBESE SUBJECTS IN HIGH  
INCOME GROUP

S.NO.	CHOLESTEROL	TRIGLYCERIDES	VERY LOW DENSITY LIPO- PROTEIN	LOW DENSITY LIPO- PROTEIN	HIGH DENSITY LIPO- PROTEIN
1	204	102	20	158	46
2	170	78	16	105	49
3	183	91	18	109	56
4	227	132	26	168	33
5	197	88	25	120	52
6	210	126	18	156	39
MEAN	198.55	102.83	20.5	136	45.83
	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
S.D	20.14	21.74	4.08	27.76	8.51