

Prevalence and Etiology of Diabetes Mellitus and Heart Diseases Among Agricultural Families

By

S. PREMA

A THESIS SUBMITTED TO
THE AVINASHILINGAM INSTITUTE FOR HOME SCIENCE AND HIGHER
EDUCATION FOR WOMEN (DEEMED UNIVERSITY) COIMBATORE-641 043
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE IN FOOD SERVICE MANAGEMENT AND DIETETICS.

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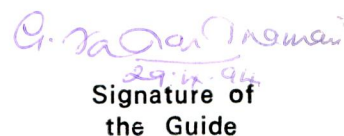
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the Guide

Acknowledgement

ACKNOWLEDGEMENT

The investigator is grateful to PADMASHREE Dr. (Tmt). RAJAMMAL P. DEVADAS , M.A., M.Sc., Ph.D. (Ohio State), D.Sc., (Madras), Vice Chancellor of Avinashilingam Institute for Homescience and Higher Education for Women (Deemed University) Coimbatore for providing the opportunity to conduct this study.

The investigator wishes to express her sincere thanks and heartfelt gratitude to Tmt. G.VASANTHAMANI, M.Sc., M.Phil., Dip.Ed. (Madras), Food Service Management and Dietetics for her valuable guidance, constant encouragement and Keen interest shown throughout the research programme.

The investigator is grateful to Dr. (Tmt.) PARVATHY EASWARAN, M.Sc., (Columbia), Ph.D. (Madras), Head of the Department of Food Service Management and Dietetics for her constant help and timely suggestions during the study.

Sincere thanks to Dr. (Mrs.) LAKSHMI SANTA RAJAGOPAL, M.Sc. (Tenn) Ph.d. (Madras), Dean Faculty of Home Science and Dr. SAROJA PRABHAKARAN, M.A.Dip., In Ed. (Madras), Ph.D. (Mother Teresa) Registrar, Av inashilingam Institute

for Home Science and Higher Education for Women (Deemed University) Coimbatore for the facilities provided for the smooth conduct of the study.

The investigator wishes to record her sincere and heartfelt gratitude to her beloved parents, Sisters, relatives, friends and her village people for their prayers and co-operation.

Above all she thanks God for his manifold mercies to carryout the investigation successfully.

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Introduction

I. INTRODUCTION

The growth of a family, nation and the world depends on the nutrition and health of its people. Nutrition and health of the people are influenced by good nutrition. General resistance to diseases is improved by good nutrition. Poor nutrition reduces the growth and functional capacity of an individual. It lowers a community's resistance to diseases resulting in higher morbidity which has extensive consequences (Devadas, 1986).

Incidence of diseases like diabetes, diseases of heart, respiratory system, liver, kidney and other oncological disorders affect the growth and development of the population. The prevalence of these diseases is increasingly seen in developed countries as well as in developing countries.

India is an agricultural country. Seventy two percent of our population is involved in agriculture. Even though, sedentary life style is not seen much among the agricultural population, the incidence of interrelated diabetes and heart diseases are seen in many places (Diabetic Update, 1992 and Jain, 1993).

According to the data collected by the WHO, diabetes is the third commonest disease in the world next to cardiovascular and oncological disorders. Diabetes is a global health problem afflicting quite a number of people from all walks of life. Surveys carried out in different parts of the world have shown that 1.3% of the general population suffer from this disorder. Every fifth person in the world is suffering today from diabetes directly or indirectly (WHO, 1992).

Diabetes, sugar disease or sweet blood as it is commonly called is a malady familiar to most of us. It is characterised by partial, or complete loss of ability of the body to convert sugar and starch into energy or store them for future use. The incidence of diabetes has been linked to a number of factors like age, sex, obesity, family history of disease (genetic susceptibility), Physical inactivity and food habits (Devadas, 1989). Environmental influences and genetic construction interact to determine the course and complications of the disease (Girija Devi, 1985). Obesity and physical inactivity are the two main causative factors which may be absent among the active agricultural population.

Heart diseases which are also called as cardio-vascular diseases are the most potent killers in advanced countries in the world. It is becoming a major problem in developing countries like India (Nieman, 1993). Saini (1993) says, "Most relatively affluent Indians are sitting on a time bomb. The increasing sedentary life style and stressfulness lead to the development of heart diseases". The tension and worries, the craving for cigarette, the leisurely or hectic mode of travel, overweight, insecurity and poverty all drag the person towards heart diseases (Joshi 1992 and Jain 1993). Many people are affected by cardio-vascular diseases particularly arterial atherosclerosis, that it has been called, "The epidemic of the 20th century". This disease may begin at an early age and go undetected until the middle years or later. Cardio-vascular diseases, once a rare affliction even among the aged is now the leading killing cause of the old and middle aged in many countries and it sometimes takes the lives of the young as well. Most people have it to some degree without troublesome symptoms and live a normal life span (AMA, 1988).

Studies have shown that affluent diet and sedentary lifestyle are contributing to these diseases not only in the

developed world, but also in the cities of the poor countries where diabetes and cardio-vascular diseases are important health problems. The etiology of both diabetes and heart diseases are related with physical inactivity, wrong dietary habits and heredity; (Smolensky, 1982).

Agricultural population constitutes an important sector in our country. Indian economy mainly depends upon the agricultural production. The importance of adequate nutrition and well being for maintaining good health and normal physical efficiency among agricultural workers was realised long back. The incidence of diabetes and heart diseases are astonishingly increasing in developing countries like India which may affect the growth of the nation.

Finding out the percentage incidence of these diseases among the active agricultural workers and exploring the etiology of these diseases among this group of most important segment would be of great help in developing measures to prevent these diseases. This will even improve the agricultural production of our country and enhance affluence. It is with this goal the present investigation was framed.

Review of Literature

II. REVIEW OF LITERATURE

The literature **p**ertaining to the study on "Prevalence and **e**tiology of diabetes mellitus and heart diseases among agricultural families", was reviewed and presented under the following headings.

- A. Diabetes Mellitus - A global health problem
 - 1) Meaning of diabetes mellitus
 - 2) Prevalence of diabetes mellitus
- B. Etiology of diabetes mellitus.
- C. Heart disease - A modern epidemic
- D. Etiology of heart disease
- E. Diabetes mellitus and heart diseases - co-existence
- F. Prevention and treatment - A way to longer life.
 - 1) Diet
 - 2) Exercise
 - 3) Drugs

DIABETES MELLITUS - A GLOBAL HEALTH PROBLEM

1. MEANING OF DIABETES MELLITUS

Willams (1990) reports that diabetes mellitus is an ancient disease. In the first century the Greek physician Aretaeus wrote a maladyⁱⁿ which the body "ate its own flesh" and gave off large quantities of urine. He gave it the name

'diabetes', from the Greek word meaning "Siphon" or "to pass through". Much later in the 17th century "Mellitus" was added because of the sweet nature of the urine. To day the simple term "diabetes" refers to diabetes mellitus.

Diabetes mellitus is a disorder of carbohydrate metabolism in which the body tissues do not oxidise or burn glucose normally (Otto, 1986 and Joshi, 1992) According to the National Diabetes data group (1979), diabetes has been defined as a genetically and clinically heterogenous group of disorders all of which show glucose intolerance.

Diabetes, the puzzling illness is distinctly classified into three types. Type I, Insulin - dependent diabetes mellitus with an etiology of various genetic and acquired factors (Sperling, 1979 Khare et. al., 1993 and The Hindu, 1993) Type II, non - insulin dependent diabetes mellitus is precipitated by genetic and environmental factors (Mukerjee, 1991). Diabetes secondary to other conditions such as pancreatic disease endocrine disorders, infection and certain drug therapy (Raza, 1987).

Ramachandran (1993), Reddy, N.M. (1991) and Williams (1990) State that the classic symptoms of diabetes are polyuria (frequent urination), polydipsia (excessive thirst), polyphagia (increased appetite), loss of weight and Ketonuria (excretion of ketones in urine). Persistent

tiredness, slight headache and exertion are also seen among the diabetic patients (NIN symposium, 1993).

2. PREVALENCE OF DIABETES MELLITUS

One must become aware of the extent of prevalence of diabetes mellitus since it is a major health care problem which reduces life-expectancy by one-third.

According to the data collected by the WHO diabetes is the 3rd commonest disease in the world next to cardiovascular and oncological disorders. Medical statistics collected in the U.S. (1980) indicate that in a medically advanced health conscious country like America, diabetes affects just under 5% of its population. Over one million Britishers are known to be afflicted by diabetes (Mukerjee, 1991, Kitabchi and Fisher, 1991). According to diabetes update (1992) amongst the various ethnic groups Asian Indians seem to be at a particularly greater risk of developing diabetes. The prevalence of diabetes in Urban India may be approximately 5% while in rural population it may be around 2 to 3%. It is estimated that at the term of the century there might be over the 40 million diabetics in India.

A survey conducted by Viswanathan (1992) near Madras city, has shown a higher prevalence rate of 8.2% and lower

rate of 2-3% in the rural area. These figures could mean that in a country with a population of around 800 million there will be about 40 Million subjects by the turn of the century, thus posing a major public health problem.

B. ETIOLOGY OF DIABETES MELLITUS

Diabetes mellitus is a multifactorial disease with multiple risk factors (Ramachandran, 1988). There are two main factors which stand out distinctly in the causation of diabetes.

- 1) Dietary factors
- 2) No -dietary factors

1. DIETARY FACTORS

Kiefer, et. al., (1980) opine that dietary influences tend to act as catalyst for diabetes in individuals. George Cohill (1980) states that the greatest portion of diabetics are due just to over nutrition. Franz (1993) states that diabetes can be induced by a sugar laden diet and increased intake of high fat foods by increasing the incidence of obesity. According to Bhala and Srivatsava (1993), Obesity is the strong predisposing factor in middle-age obesity and obese people secrete more insulin than the normal amount.

Eisentein, (1992) opines that alcoholic consumption impedes weight loss by over wiehgt individual since it is high in calories and decreaes control of appetit~~e~~.

2. NON DIETARY FACTORS.

1. HERIDITY The closer the blood relationship, the greater are the chances of developing the disease (Diabetic Updata, 1992). When both parents are diabetic, the chances of the children getting diabetes are considerably increased (Mohan, 1993). IDDM is more likely to be transmitted to the offspring by a diabetic father than a diabetic mother (Begum, 1989; Warram et.al, 1984; Fitch et.al. 1983 and Whitehouse, 1992).

INFECTION Begum (1989) and Swai, et.al. (1992) opine that Diabetes mellitus also results from the destruction of insulin producing cells due to viral infections such as mumps, coxsackievirus B, cytomegalvirus, chicken - pox, infectious mono-nucleosis, german measles and viral hepatitis. In the view of Jenson et.al (1980). auato immunity following inflammation due to infection may reveal islet cell antibodies in many diabetics.

AGE: The disease occurs at all ages but a greater percentage of the cases occurs in persons over 45 years of

age (Fagons, 1986). Otto et.al. (1986) says the diabetes in children and young adults is severe.

SEX The disease affects both sexes. Men are more prone to diabetes than women (Ramiya et.al. 1990).

LACK OF PHYSICAL ACTIVITY Joshi (1992) concludes that physical inactivity is an important risk facator in NIDDM.

METABOLIC AND ENDOCRINE DISTURBANCES Hormones such as ACTH, glucogon and adrenalin are shwon to be diabetogenic since they increase the level of blood sugar.

STRESS Swaminadhan (1986) remarks that severe or prolonged stress may lead to diabetes. Worry and irregular meals may contribute to the development of the disease.

C. HEART DIEEASE - A MODERNM EPIDEMIC

The term "heart - disease" actually applies to a number of different illnesses that affect the circulatory system the heart and blood vessels. A more exact name is cardio-vascular diseases - cardio (heart) and Vasculuar (blood vessel) (AMA, 1986).

Heart disease is a broad term for a group of conditions involving pathological changes in blood vessels supplying the heart (Gurr, 1992). Girija Devi (1985) and NIN (1993) have listed the diseases connected with the heart as follows

1. Aneurism: A point in the heart or a blood vessel that is in danger of rupture.
2. Arrhythmia: An irregular heart beat that may indicate heart disease.
3. Atherosclerosis: Build up fat in the arteries that may lead to their clogging (Fitch et.al. 1993 and Hui, 1985).
4. Cardio myopathies: Various disease of the heart muscle usually of obscure origin.
5. Rheumatic heart disease: Damage to the valve and muscle of the heart resulting from rheumatic fever.
6. Ischaemic (coronary) heart disease: A disability in the heart's functioning because of insufficient blood supply to the heart muscle.
7. Myocardial infarction (Heart Attack): According to Robinson (1984), it is defined as the death of part of heart muscle.
8. Angina pectoris refers to the tight, pressing, burning and sometimes severe pain across the chest that follows exertion.

9. Stroke (Cerebro-vascular accident) refers to the paralysis due to brain haemorrhage or clotting of an artery of the brain (Jain, 1993).

10. Bhaskaran (1989) says that heart failure occurs when cardiac muscle ceasing to be efficient as a pump, is no longer able to maintain an adequate circulation of blood round the body. It may affect the right side or both.

The signs and symptoms of heart disease include prolonged, oppressive pain that may radiate to shoulder, arm, neck or jaw, sweating may accompany discomfort, nausea, vomiting and shortness of breath. The warning signs of stroke include sudden temporary weakness, loss of speech, dimness of vision, unexplained dizziness, change in personality, mental ability or the pattern of headache (Smolensky, 1982).

2. PREVALANCE OF HEART - DISEASE

William Osler, at the beginning of 20th century concluded that heart - disease predominantly affects the better - off members of the society. Gradually from being a disease of the professional and managerial classes, heart-diseases have become one of the semi-skilled and unskilled workers (Jam, 1993).

Bharucha et al, (1988) state that the prevalence ratio for cardiovascular diseases throughout the world is about 500 - 700/100,000. According to the American heart association estimates (1985) 4870,000 were affected with coronary heart disease and 150,000 suffered from heart attacks (Hoeger, 1989). In our country fewer than 1% of the population between the ages of 18 and 24 have definite heart - disease, while 25% of the population at 65 years old suffer from some known form of this disease (Smoiensky, 1982). Bharucha et.al. (1988) state that high prevalence ratio were found among men in Bombay, India. According to National center for health statistics taken in 1987, total percentage of death due to cardio vascular disease 45.4%.

Levy (1980) express that each year 1.5 million Americans experience a heart attack. The Indian population has high incidence of ischaemic heart disease, this has been documented in Indian immigrants in several countries (Zacharia et.al.1993). Developed nations are experiencing a continuing decline in the CHD death rate over the past 15 to 20 years after reaching the peak.

D. ETIOLOGY OF HEART DISEASE

A great deal of research has been undertaken to understand the causes of the heart disease, so that effective preventive measures may be instituted.

1. **DIETARY FACTORS** Eating a heavy diet, rich in saturated and animal fats, sugar and high intake of salt multiply the problems of obesity, hypertension which may lead to heart disease (Shukla, 1987, Berner et.al. 1991, Srivatsava, 1993). Jain, 1993 and Suitor, 1984 stress that drinking alcohol in intoxicating quantities is definitely deleterious to the heart. Excessive intake of coffee and tobacco chewing is associated with increased risk of cardiovascular diseases (NIN 1993, Stanton. 1993, Gorden et.al. 1981, Croix et.al. 1986 and clock and Nair, 1988).

NON DIERARY FACTORS

HERIDITY Hoeger (1989) points out that the genetic predisposition toward heart-disease seen to gain importance each day. If it occurs in a first degree relative at an early age (50 years) is widely accepted as risk factor (Shaper, 1990 and Beigal, 1992).

AGE Neiman (1993) states that the incidence increases with age having peak at middle age around 50 to 65 years. Indians tend to develop coronary heart disease at an earlier age than the people of the West (Antia, 1989). It is probable that aging itself has little effect on ischaemic heart disease (Girija Devi, 1985 and Shaper 1990).

SEX In popular imagination, heart disease is invariably associated with obese male corporate jet-setters addicted to high cholesterol foods and life styles. Women especially after menopause are as susceptible to heart disease as their male counterparts (Jain, 1993). The incidence between the male and female is in the proportion of 9:1 (Srilakshmi, 1993).

ENDOMORPHIC BODY BUILD Endomorphics are more susceptible to heart diseases followed by ectomorphs and mesomorphs. Short, stocky and short-necked subjects are more likely to develop coronary heart disease (Antia, 1987 and Srilakshmi, 1993)

BEHAVIORAL PATTERNS AND PERSONALITY TRAITS

Incidence of cardio-vascular disease is high in people who have type A behaviour who have intense ambition, competitive drive and time consciousness to meet a deadline (Girija Devi, 1985 and Jenkins, 1988).

SEDENTARY LIFE - STYLE Bhaskaran (1989) States that people who lead a sedentary life have 3 times more chances of getting heart diseases than who are hard working.

HIGH BLOOD PRESSURE Henry Lito (1994) and Hui (1985) stress that high blood pressure causes the heart to work harder, increasing the likelihood of heart attack.

DIABETES Diabetes mellitus is also an important risk factor of cardio-vascular diseases (Gowri et.al 1990), Diabetics are prone to develop atherosclerosis and other types of heart diseases (Wenk 1983, Sirdhar et.al. 1992, Winocour, 1991, Reaven 1987 and Rosengren et.al. 1989).

SMOKING Smoking is the prediominant causative factor of cardio - vascular diseases (werner and Hoeger, 1989).

Smoking increaes the production of epinephrine which increases the heart beat rate and blood pressure (Bhaskaran, 1989) Jain (1993) and Chopra (1988) express that smoking is the major risk factor for heart disease in patients below 40. Tobacco abuse is as addictive as alcohol or drugs (Zaechariah et.al. 1993).

STRESS A higher degree of stress due to social isolation leads to a four-fold increase in the risk of d^eath from CHD (Murthy, 1993) Mishra (1993) points out that certain factors such as surgical trauma, burns, emotional arousal, fatigue, fear, loss of blood and mental or physical effort may serve as stressors which may result in coronay hearet disease. Strenuous activity increase the relative risk of heart disease (The Hindu, 1993).

Estrogens found in oral contraceptives and certain other drugs cause an increase in blood pressure and enhancing blood mechanism which may lead to heart disease (Werner and Hoeger, 1989).

DIABETS AND HEART DISEASE - CO -EXISTENCE

Co - existing diabetes mellitus and cardio - vascular diseases, Confer a substantially higher risk of mortality among the population (Muckerjee, 1991). An Indian researcher Dr. Bela Shah currently with the ICMR have linked the occurrence of diabetes and heart and life styles. Muckerjee (1991) and Graeme Bul (1991) opine that genetics play a role in the development of diabetes and heart - diseases. In general the risk of cardio - vascular diseases is increased 2 to 6 fold in diabetic subjects (Pyoraia and Laakso, 1983 and Blankahorn et.at. 1987). The presence of diabetes itself enhances the cardio - vascular risk (Reaven, 1987 and Rosengen, 1989). Knoop et.al. (1984) and Winocour (1991) found that the prevalence of cardio - vascular diseases appears greater among diabetic population.

Liao et.al. (1993) states that the cohort study results showed that the co-existing diabetes and heart disease mortality was significantly lower for women compared with men. By the use of proportional hazards analysis Destifano (1991) found that age, malesex, obesity and physical

inactivity were significantly associated with coronary heart disease mortality among persons with diabetes.

F. PREVENTION AND TREATMENT - A WAY TO LONGER LIFE

The field of prevention of diabetes and heart diseases is full of potential. Considering the preventive aspects it may be seen that there are 3 main levels of prevention.

1. PRIMARY PREVENTION: It refers to the prevention of the onset of the diseases which includes genetic counselling, health promotion and specific protection. It is prudent that marriage between 2 genetic predisposers is not advisable.

2. SECONDARY PREVENTION: It refers to the early diagnosis, identification of high risk groups, uncovering the hidden diseases and treatments of the diseases to prevent complications.

3. TERTIARY PREVENTION: It refers to limiting physical disability resulting from the complications and institution of rehabilitation measures such as providing education regarding the diseases and corrective measures to the patients, their family members and the community in general (Ramana, 1992).

TREATMENT

The treatment of diabetes and heart diseases aims at saving lives and alleviating symptoms. The principles of treatments are

1. Diet
2. Exercise and
3. Drugs

1. DIET

A regulated diet is the cornerstone of diabetic treatment. A calorie restricted, high carbo-hydrate, high-fibre diet with free-sugar being eliminated evolved has been established as ideal for achieving sustained control of diabetes. (Ramachandran, 1993 and Anderson, et.al. 1978). Antia (1987) states that for an average diabetic about 55 to 60% calories are derived from carbohydrates, 25 to 30% from fats and 12 to 15% from proteins. Alcohol intake should be reduced since it may raise the blood sugar level (Harris et.al. 1987 and Guthrie, 1986).

General dietary advice for all types of heart diseases is reduce over-weights, have a lower intake of fats, sugar and carbohydrates and avoid drugs, smoking and alcohol. For an average diet 40 to 45% of calories are derived from

carbohydrates, 20% from proteins and 30 to 35% from fats (RDA, 1989 and Marr, 1983). Greenleafy vegetables, fruits, skimmed milk should be the main items of the diet.

2. EXERCISE

Uniform and regulated exercises like a brisk walk, swimming or a game of golf, utilize carbohydrate and reduce the requirement of insulin and anti-diabetic tablets in diabetic patients (Smith and Casso, 1989, Paige 1988 and Antia 1987).

Physical exercise in moderation is the most vital factor in the prevention of cardiovascular diseases (Mumichoodappa, 1983 Burtz, 1990 and Morris et.al. 1990) Over enthusiastic jogging and lead to sudden death specially in those with coronary heart disease (Buckman 1984).

3. DRUGS

Oral hypoglycaemic drugs and insulin are prescribed for diabetic management. Oral hypoglycaemic drugs are of two types: Sulphonylureas which are more potent with fewer side effects and biguanides which inhibit glucose formation (Ramachandran, 1993).

Insulin injections are used to treat individuals with high blood glucose and who do not respond to drug therapy. It is recommended for insulin-dependent and gestational diabetics.

Heart disease patients do not require cholesterol lowering drugs unless appropriate diet therapy is tried. Cholestyramine (Questran) and colestipol (Colestid) are bile acid sequeencing resins that increase fecal excretion of chotesterol and reduse serum cholesterol. Niacin decreases the syntheses of lipoprotein and increases HDL (Antia, 1987).

Methodology

III METHODOLOGY

The methodology involved in the conduct of the study on "Prevalence and etiology of diabetes mellitus and heart diseases among agricultural families" is discussed under the following headings

- A. Selection of the Area
- B. Selection of the sample
- C. Conduct of the study
 - 1. Formulation of interview schedule
 - 2. Conducting the survey
- D. Study of the Sub-sample
 - 1. Food and nutrient intake
 - 2. Anthropometric measurements
 - 3. Bio-chemical assessment

A. Selection of the Area

Kollankoil is one of the important villages in Periyar District in Tamil Nadu. This covers 18 smaller villages with a total number of 6000 - 7000 families. The main occupation of 90% of its population is agriculture. This village was selected to study the incidence of diabetes mellitus and heart diseases among agricultural families

since the investigator was also a native of this village. The study was conducted in those areas of the village, where only agricultural families live.

B. Selection of the sample

A total number of 1000 agricultural families were selected at random for the study. Gupta (1990) points out that a random sample represents the universe in a better way. The sample were selected in such a way that all the families consisted of agricultural workers. At the end of the initial survey, the incidence of diabetes mellitus and heart-diseases was identified and all these diabetics and heart disease subjects were selected as sub-samples for further indepth study on the etiology of the disease. The nutritional and bio-chemical status of all sub-sample were also assessed.

C. Conduct of the Study

1. Formulation of Interview schedule

According to Wilkinson and Bhandakar (1992) and Verma (1988), a schedule refers to a form of questionnaire containing a set of questions. The researcher puts to respondents the questions in the order of these questions are listed and records their replies and schedule is used in direct interview.

Two schedules were designed to elicit information from the diabetic and heart disease subjects. The schedule included questions on the etiological factors of the diseases such as family history of the disease, life-style, socio-economic status, and dietary factors. The schedule also contained questions on treatments undertaken, and other diseases prevailing among the sub-sample. The schedules thus formulated are presented in Appendix I.

1. Conducting the survey

As direct interview method is suitable for intensive study of a limited field (Bhandakar, 1992), the survey was conducted in the selected 1000 families through direct personal interview method. The investigator visited the families personally and interviewed the head of the family or the home-maker and recorded the information. A good cooperation was sought and reliable information was gathered as the investigator was a native of this village and familiar to the families studied.

D. Study of the sub-sample

The diabetics and heart-disease subjects identified from initial survey were selected as the sub-sample. Further investigations were carried out on this sub-sample. The schedules developed were administered to diabetic and heart disease sub sample. The sub sample was further

studied to know the food and nutrient intake, anthropometric measurements and bio-chemical data. The effectiveness of management of the diseases were also studied through analysis of blood glucose and lipid profile.

1. Food and Nutrient intake of the sub-sample

The dietary habits of the sub-sample were recorded with the help of the schedule prepared for the sub-sample. A 24 hour dietary recall survey was done to find out the food and nutrient intake of the sub-sample. The mean food and nutrient intakes were computed and compared with the values of ICMR(1990). The 24 hour recall method has been practiced by many of the workers and is the most easy and reliable method of surveying food and nutrient intake of population groups. The client recalls the food intake for the previous 24 hours by interview. He or she recalls what was eaten, how much food was eaten, how the food was prepared and when it was eaten (Pao and Cypel, 1990 and NRC, 1989).

2. Anthropometric measurement of the sub-sample

The anthropometric measurements namely the height and weight of the sub sample were recorded. The heights were taken with the help of non-stretch fibere glass tape fixed to the wall. The subjects were made to stand on the floor bare footed with their feet and back of the head touching

the wall and the heights were noted. Weights were recorded using a standard bathroom scale weighing balance. Then the body mass index of the sub-sample was calculated using the formula given by Garrow (1993).

$$\text{BMI} = \frac{\text{Weight in Kgs.}}{(\text{Height in Mts})^2}$$

These values were compared with the standard prescribed.

3. Bio-chemical examination

Bio-chemical tests can be employed for assessing the blood constituents (West suitor and Crowley, 1984) Fasting and postprandial blood samples were collected from the diabetic subjects . Blood glucose levels were estimated using glucose oxidase method recommended by Das (1992) and Jarret (1982). Lipid profile was studied for the heart disease subjects. The results obtained were statistically analysed and compared with the standard values and discussed.

The methods that were used for glucose estimation and lipid profile were given in Appendix II, III & IV. and height and weight measurements are showed in plate 1 and 2.

PLATE-1

Height measurement.



PLATE-2

Weight measurement.



Results and Discussion

IV. RESULTS AND DISCUSSION

The results of the study on "Prevalence and etiology of diabetes mellitus and heart diseases among agricultural families" are presented and discussed under the following headings.

- A. Background information of the selected families.
- B. Prevalence of diabetes and heart diseases in the selected 1000 families.
- C. Etiology of the diseases in the selected subjects.
- D. Details on the disease.
- E. Blood glucose and lipid profile of diabetic and heart disease subjects respectively and
- F. Food and Nutrient intake of the subjects.

A. BACKGROUND INFORMATION OF THE SELECTED FAMILIES

One thousand agricultural families were selected from Kollankoil village in Periyar District of Tamil Nadu. The Socio-economic conditions, prevalence of diabetes mellitus and heart diseases among these families and the etiology of these diseases were studied.

The results of the study revealed that all the families consisted of members working in the fields. Analysis of

their communities revealed that all were Hindus, and 77% of the selected families belonged to backward community, 15% most backward community, five percent were scheduled caste and only three percent belonged to forward caste. Seventy five percent of the families were joint families and twenty five percent were nuclear families.

Table I gives the percentage distribution of the families according to income.

TABLE I

PERCENTAGE DISTRIBUTION OF THE FAMILIES ACCORDING TO INCOME

N = 1000

Monthly income in Rupees	Number of families	%
200 - 800	299	30
800 - 1400	665	66
1400 - 2000	26	3
2000 - 4000	10	1

It is evident from Table I that majority of the families belonged to lower middle income group with an income range of Rs. 800 to 1400 per month. Thirty percent of the families were in the low income group (Rs. 200 to 800 per month). Totally only 1% were in the middle income range. All the families selected were from agricultural workers who

did not have much agricultural land of their own. Hence high income families were very much limited.

B. PREVALENCE OF DIABETES MELLITUS AND HEART DISEASES IN THE SELECTED 1000 FAMILIES.

Table II depicts the percentage of diabetics and heart disease subjects present in the selected 1000 families. The prevalence rate is also shown in figure. I

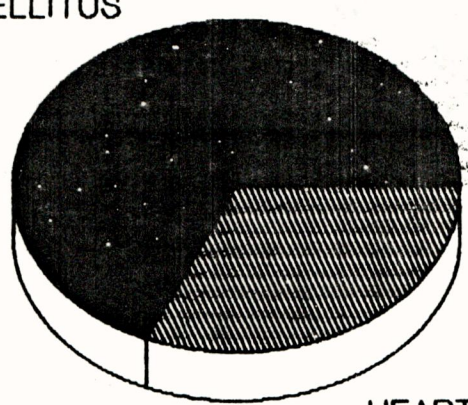
TABLE II
PREVALENCE OF DIABETES MELLITUS AND HEART DISEASES

N=1000		
Diseases	n	Percentage
Diabetes mellitus	26	2.6
Heart diseases	12	1.2

Table II shows that there were 26 diabetics and 12 heart disease subjects in the selected 1000 families with a percentage prevalence of 2.6 and 1.2 respectively. This data is in line with the findings of Viswanadhan (1992) who has indicated that the prevalence of diabetes in rural families is 2 - 3 percent and the prevalence of heart disease is lesser than the prevalence of diabetes mellitus.

**FIGURE - 1
PREVALENCE OF DIABETES MELLITUS
AND HEART DISEASES**

DIABETES MELLITUS
2.6



HEART DISEASES
1.2

The diabetics and heart disease subjects alone were included in the further indepth study. The results and discussions of the investigation are presented below.

1. ECONOMIC STATUS OF THE SELECTED SAMPLE

Monthly income of the subjects is shown in Table III.

TABLE III
DISTRIBUTION OF DIABETIC AND HEART DISEASE SUBJECTS
ACCORDING TO INCOME

Monthly Income Rs.	Diabetics N=26		Heart disease Subjects N=12	
	n	%	n	%
200 - 800	8	31	1	8
800 - 1400	11	42	7	58
1400 - 2000	5	19	2	17
2000 - 4000	2	8	2	17

From Table III it is seen that the income range of the subjects varied from Rs. 200 to Rs. 4000 per month. About 61% of diabetics and 75 percent of heart disease subjects were getting monthly income ranging from Rs. 800 to Rs. 2000 and they belonged to lower middle income group according to the LIC (1991) classification. Eight diabetics and only one heart disease subject were in low income group getting Rs. 200 - Rs. 800 per month.

C. ETIOLOGY OF THE DISEASES IN THE SELECETED SUBJECTS

1. AGE

Table IV presents the distribution of diabetics and heart disease subjects according to age.

TABLE IV

THE AGE RANGE OF DIABETICS AND HEART DISEASE SUBJECTS.

Age in years	Diabetics N=26				Heart disease subjecets. N=12	
	NIDDM		IDDM		n	%
	n	%	n	%		
35 - 45	2	8	1	4	-	-
45 - 55	3	12	3	12	1	8
55 - 65	13	50	--	--	7	58
65 - 75	4	15	--	--	4	33

Table IV shows that the prevalence of non insulin dependent diabetes mellitus was more in the subjects between the age group of 55 to 65. Brown (1987) has reported a maximum prevalence of non-insulin dependent diabetes mellitus in 50 to 60 years of age group. About 15% of the subjects were between 45 to 55 years of age group. Only 12 percent of the subjects were between 45 to 55 years and 8 percent were between 35 to 45 years.

In case of insulin dependent diabetes mellitus three subjects were in the age group of 45 to 55 and only one was in the age group of 35 to 45 years.

All the heart disease subjects were above 45 years of age. Seven heart disease subjects were in the age group of 55 to 65 years. This is in line with the findings of Neiman (1993) who has indicated a peak incidence of heart disease at the age of 50 to 65 years. Four were in the 65 to 75 years age range. It can be noted that the incidence of diabetes and heart diseases were more in higher age group.

2. SEX

Table V gives the distribution of the selected subjects according to sex.

TABLE V
DISTRIBUTION OF THE DIABETIC AND HEART DISEASE SUBJECTS
ACCORDING TO SEX

Sex	Diabetics N=26		Heart disease subjects N=12	
	n	%	n	%
Males	21	81	10	83
Females	5	19	2	17

From Table V it is evident that the prevalence of diabetes mellitus is more among males (about 81%) than females which is only 5%. Ramaiya et al., (1990) also state that men are more prone to diabetes than women.

In case of heart disease subjects, about 83% of males had heart diseases and only 17 percent of women had heart diseases. According to Srilakshmi (1993) the incidence of heart diseases is more in men.

3. LEVEL OF ACTIVITY

Table VI depicts the level of activity of the diabetic and heart disease subjects. The activity levels of the diabetic and heart disease subjects are illustrated in Figure 2.

TABLE VI
LEVEL OF ACTIVITY OF THE SELECTED SUBJECTS.

Level of activity	Diabetics		Heart disease subjects	
	N=26		N=12	
	n	%	n	%
Sedentary	18	69	10	83
Moderate	7	27	1	8
Heavy	1	4	1	8

FIGURE - 2
LEVEL OF ACTIVITY OF THE SELECTED
SUBJECTS

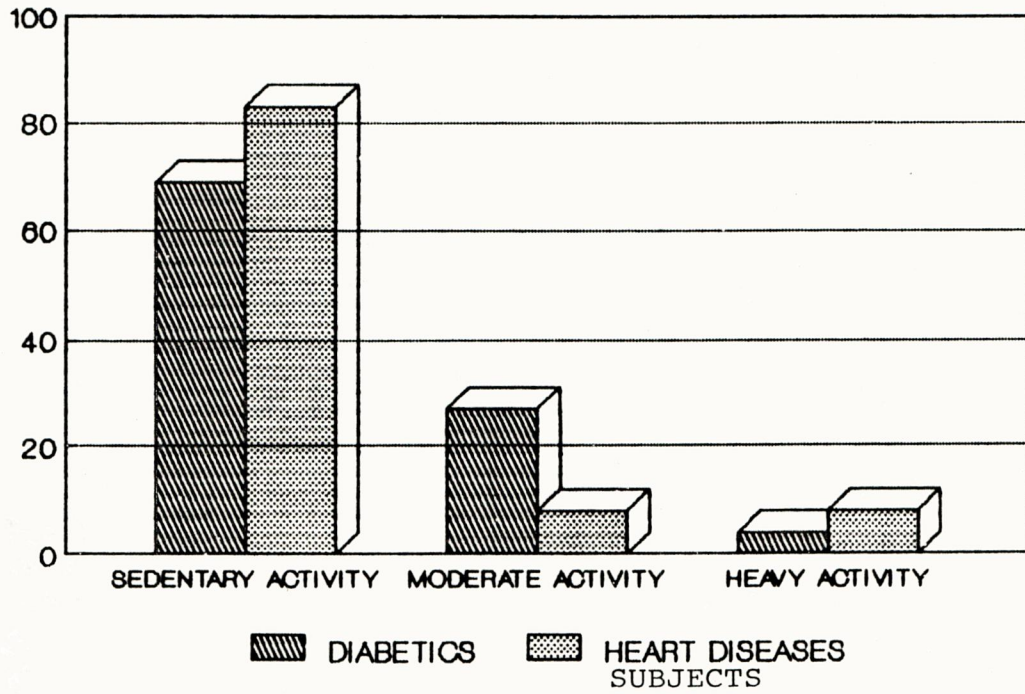


Table VI indicates that 69 percent of diabetics and 83% of heart disease subjects were doing sedentary activity. Moderate level of activity was seen in 27 percent of diabetic subjects and 8 percent of heart disease subjects. Only 4 percent of diabetics and 8 percent of heart disease subjects were heavy workers. Sedentary type of work was observed in majority of the subjects.

Physical activity has an important effect on diabetes and heart disease. Joshi (1992) and Jain (1993) report that a sedentary lifestyle with minimum activity adds to the development of diabetes and heart diseases.

5. HEREDITY

Table VII presents the details regarding the family history of the diseases. Figure 3 illustrates the details regarding the family history of the diseases.

TABLE VII
FAMILY HISTORY OF THE DISEASES

Relationship	Diabetics N=26		Heart disease subjects N=12	
	n	%	n	%
Father	2	8	2	17
Mother	2	8	1	8
Uncle	2	8	1	8
Grand parents	2	8	-	-
None	18	68	8	67

Table VII depicts that out of 26 diabetics 8 subjects had any one of their blood relatives with diabetes, either father, mother, grand parents or uncle. Eighteen subjects did not have any family history of the disease. These results indicated that for about 50 percent of the diabetics heridity plays an important role in the development of the diabetes.

In case of heart disease subjects four subjects had either father, mother or uncle with heart disease. Eight subjects did not have any relatives with the disease.

6. PERSONAL HABITS.

Table VIII shows the personal habits of the selected subjects. Figure 4 depicts the personal habits of the selected subjects.

FIGURE - 3
FAMILY HISTORY OF THE DISEASES

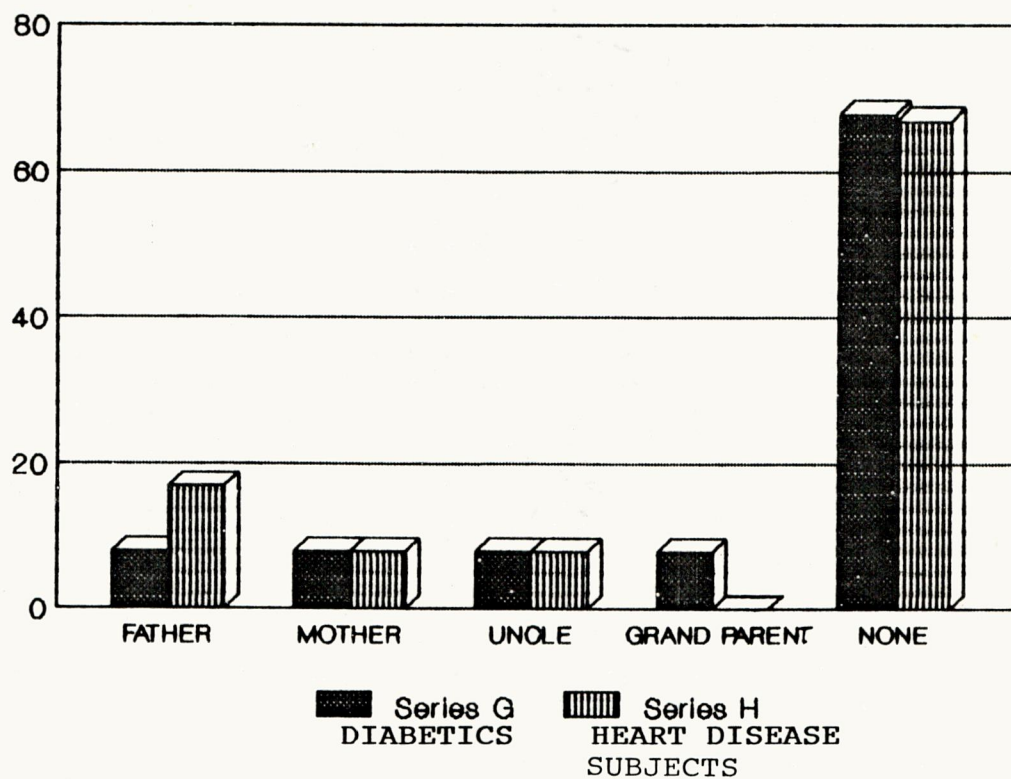


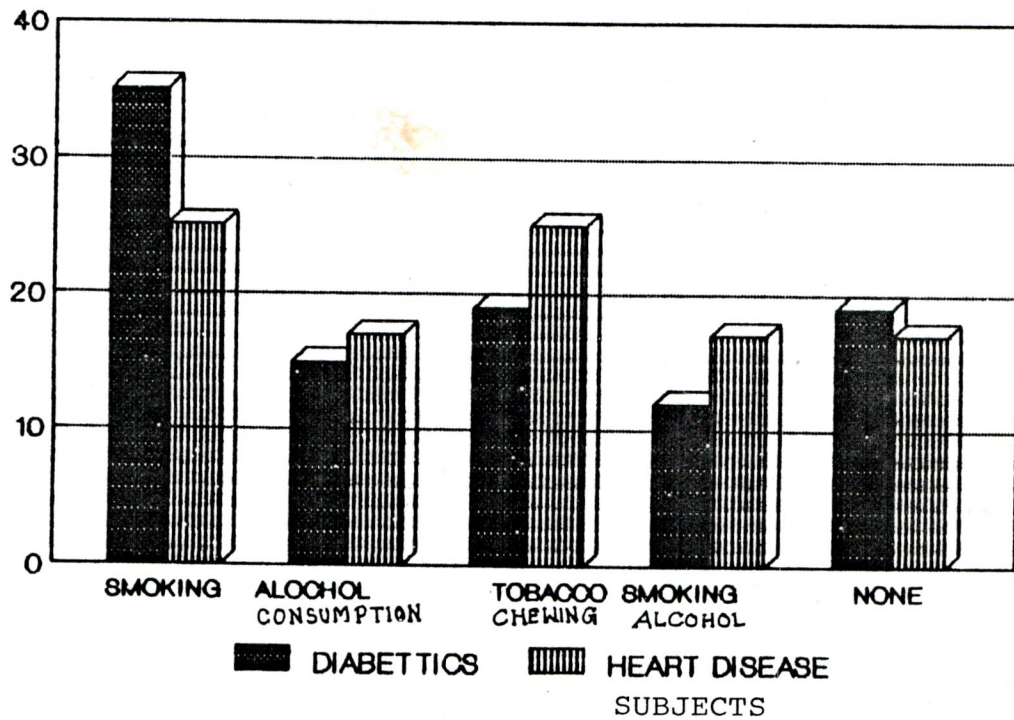
TABLE VIII
PERSONAL HABITS OF THE SELECTED SUBJECTS

Personal habits	Diabetics N=26		Heart disease subjects N=12	
	n	%	n	%
Smoking	9	35	3	25
Alcohol consumption	4	15	2	17
Pan-tobacco chewing	5	19	3	25
Smoking and alcohol consumption	3	12	2	17
None	5	19	2	17

Alcohol consumption is deleterious to diabetes and heart disease subjects (Eisentein 1982 and Jain 1993).

It is evident from Table VIII that of the total 26 diabetic subjects 35 percent were found to be smoking. A minimum of 5 or 6 bidies or 2 to 3 cigarettes were consumed every day. Alcohol consumption was found in 15 percent of the subjects. Pan-tobacco chewing habit was seen in 19 percent and 12 percent of the diabetics were found to be smoking and drinking. Only 19 percent did not have any of the above habits.

**FIGURE - 4
PERSONAL HABITS OF THE SELECTED
SUBJECTS**



In case of heart disease subjects 25 percent of them were smoking which is a predominant causative factor of cardio-vascular diseases (Werner and Hoeger, 1989).

About 17 percent of the heart disease subjects were consuming alcohol once in two days. 25 percent of them were found to be pan-tobacco chewers. Tobacco chewing is associated with increased risk of cardio vascular diseases (Stanton, 1993). seventeen percent of the heart disease subjects were found to have both smoking and drinking habits. Excessive intake of coffee (about 5 to 6 cups per day) was seen among 33 percent of the heart disease subjects Croix et.al (1986) has also pointed out that excessive intake of coffee is associated with the risk of cardio vascular diseases.

7. TYPE OF DIET CONSUMED

Table IX presents the type of diet consumed by the diabetic and heart disease subjects. Type of diet followed by the diabetic and heart disease subjects is shown in figure 5.

TABLE IX
TYPE OF DIET CONSUMED BY THE SELECTED SUBJECTS.

Type of diet	Diabetics N=26		Heart disease subjects N=12	
	n	%	n	%
Vegetarian	6	23	2	17
Non-Vegetarian	20	77	10	83.0

Table IX points out that 77 percent of the diabetic subjects were non vegetarians and 23 percent of the diabetics were vegetarians.

In case of heart disease subjects 83 percent were vegetarians and 17 percent of the heart disease subjects took vegetarian diet. Though many factors influence the incidence of heart disease, Kiefer et.al., (1980) says that population that eat large quantities of animal fat tend to have higher risk for heart disease. The results of the present investigation is in line with these results.

7. STRESS UNDERGONE

Table X presents the stress conditions undergone by diabetic and heart disease subjects.

FIGURE - 5
TYPE OF DIET CONSUMED BY THE SELECTED
SUBJECTS

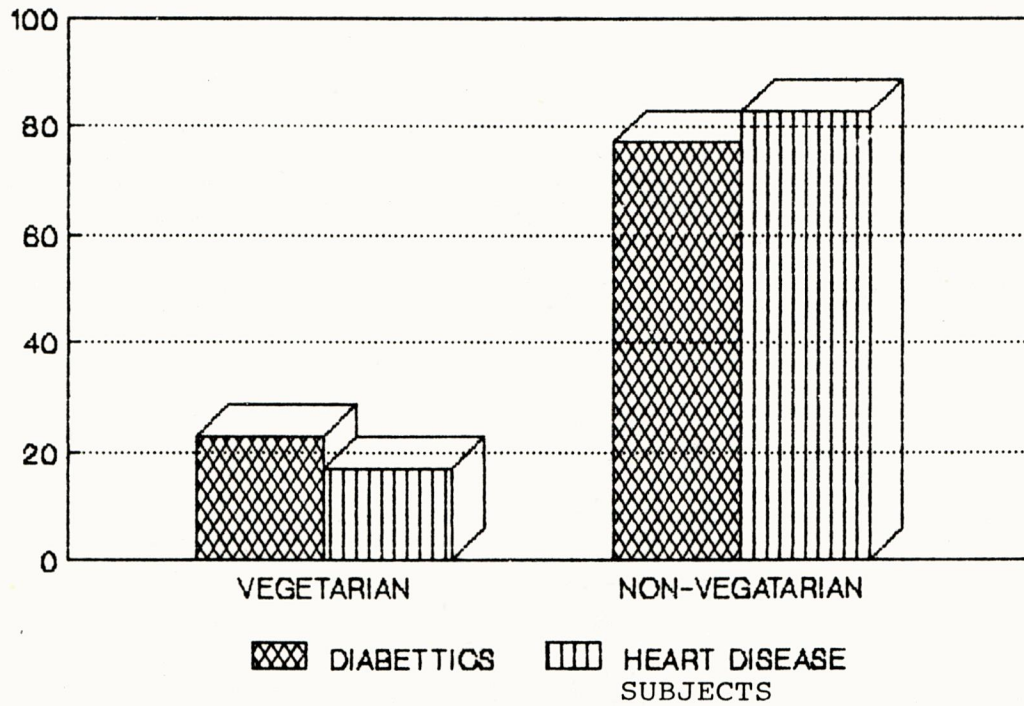


TABLE X
STRESS CONDITIONS UNDERGONE BY DIABETIC AND HEART
DISEASE SUBJECTS

Stress conditions	Diabetics		Heart disease subjects	
	N=26		N=12	
	n	%	n	%
Typhoid	3	12	1	8.3
Pneumonia	2	8	-	--
Chicken-pox	3	12	1	8.3
Mumps	1	4	-	-
Tuberculosis	2	8	1	8.3
Asthma	1	4	2	17.0
Mental stress	3	12	5	33
Physical stress	8	30	2	17

Table X gives that most of the diabetic subjects underwent any one of the stress conditions due to the infectious diseases such as pneumonia, typhoid, chicken pox, mumps and tuberculosis. About 12 percent of diabetics suffered from typhoid or chicken pox before the development of diabetes. Eight percent of them suffered from tuberculosis or pneumonia and 4% of the diabetics suffered from mumps or asthma. Twelve percent of the diabetics were found to be tensed and worried often which leads to mental stress. Physical stress was found in 30

percent of diabetetic subjects. Swai et. al (1992) have stated that diabetes results from the destruction of insulin producing cells due to infections.

8. BODY MASS INDEX

The body mass index calculated using the body weight and height of the subjects selected are presented in Table XI.

Body mass index of the diabetic and heart disease subjects is illustrated in figure 6.

TABLE XI

BODY MASS INDEX OF THE SELECTED SUBJECTS.

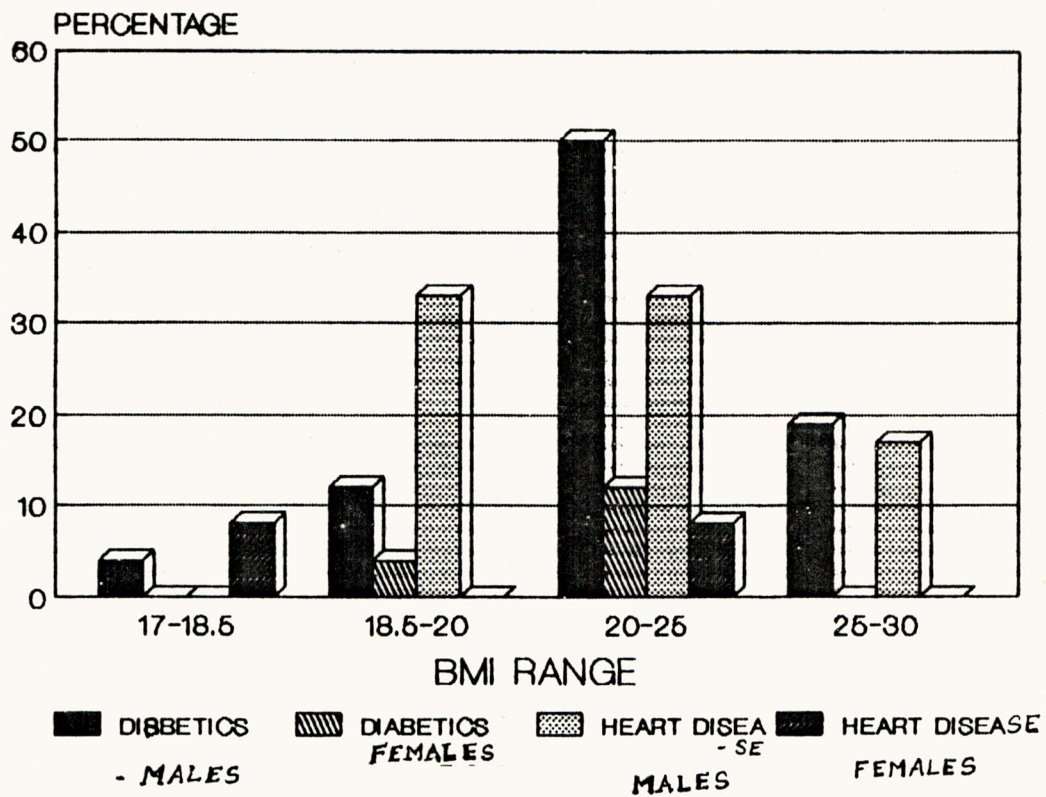
BMI RANGE	Diabetics N=26				Heart disease subjects N=12			
	Male		Female		Male		Female	
	n	%	n	%	n	%	n	%
17 - 18.5	1	4	-	-	-	-	1	8
18.5 - 20.0	3	12	1	4	4	33	--	--
20.0 - 25.0	13	50	3	12	4	33	1	8
25.0 - 30.0	5	19	--	--	2	17	-	-

Garrow (1987)

Diabetes and heart diseases have long been associated with body weight (Beigel, 1992).

FIGURE - 6

BODY MASS INDEX OF THE SELECTED SUBJECTS



From the table XI it could be seen that 50 percent of diabetic males and 12% of females were in the normal body mass index range of 20 - 25. About 15% of males and 4% of female diabetics were underweight. Only 19 percent of diabetic males were found to be overweight.

In case of heart disease subjects, 33 percent of males were found to be in normal range of body mass index and another 33 percent were under-weight. Eight percent of females with heart diseases were underweight and eight percent of them were found to have normal body weight. About 17 percent of males with heart disease were overweight.

D. DETAILS ON THE DISEASE

1. Table XII presents the number of years for which the subjects suffered from diabetes and heart disease.

TABLE XII
DURATION OF THE DISEASE

Duration in years	Diabetics N=26				Heart disease subjects N=12	
	NIDDM		IDDM		n	%
	n	%	n	%		
0 - 2	13	58	2	8	5	42
2 - 4	5	19	1	4	6	50
4 - 6	1	4	1	4	1	8
6 - 8	2	8	--	--	--	--
8 - 10	1	4	-	-	-	-

Table XII indicates that 50 percent of the subjects with non-insulin dependent diabetes mellitus and 8 percent of the subjects with insulin dependent diabetes have had diabetes for the past two years. The reason for a large number of diabetics having the disease for two years may be the improved screening procedure used in the recent past to detect new cases. Nineteen percent of the subjects with NIDDM and 4 percent with IDDM had this disease for a duration of 2 to 4 years. Four percent of the subjects suffered from NIDDM and IDDM for 4 to 6 years, eight percent of the subjects for 6 to 8 years and 4 percent of the diabetic subjects suffered for 8 to 10 years.

In case of the subjects with heart disease, a maximum of 50 percent of subjects were suffering for the past 2 to 4 years. Forty two of the cases had heart disease for a duration of 0 to 2 years and 8 percent of the subjects mentioned that they had the disease for the past 4 to 6 years.

2. TREATMENTS FOLLOWED

Table XIII presents the details regarding the type of treatment followed by the selected subjects.

TABLE XIII

TYPE OF TREATMENTS FOLLOWED BY THE SELECTED SUBJECTS

Type of Treatment	Diabetics N=26		Heart disease subjects N=12	
	n	%	n	%
Diet alone	3	12	1	8
Diet+tablets	11	42	6	50
Diet+injections	4	15	-	-
Homeopathy	8	31	3	25

Table XIII indicates that 12 percent of the diabetics controlled their blood glucose by diet alone, 42 percent controlled with diet and oral hypoglycemic drugs About 15 percent of the diabetics were taking insulin along with

diet. Homeopathic treatment was taken by 31 percent of the diabetic subjects.

The NIDDM subjects were found to follow only dietary control and diet with oral hypoglycemic drugs, where as all the IDDM subjects were taking insulin.

In case of heart disease subjects eight percent of the subjects had only dietary control for the disease, 50 percent were treated with diet and tablets. Homeopathic treatment was taken by 25 percent of the heart disease subjects.

3. SPECIAL FOODS CONSUMED

Table XIV gives information regarding the intake of special foods by the diabetic subjects.

TABLE XIV
SPECIAL FOODS CONSUMED BY THE DIABETIC SUBJECTS

N=26

Special foods	n	%
Bitter gourd	23	89
Wheat	26	100
Neem leaves	1	4
Ragi	3	31

Table XIV indicates that 89 percent of the diabetic subjects consumed bittergourd daily to control their blood glucose levels. Wheat was specially consumed by all the diabetic subjects. Wheat was consumed in the form of chappathi. Neem leaves were consumed only by one diabetic subject. This subject mentioned that the bitter taste of neem leaves would reduce the sweetness of the blood. Ragi was consumed by 31 percent of the diabetic subjects. Ragi was consumed in the form of Ragi porridge.

Majority of the diabetic subjects believed that consumption of wheat and bittergourd will cure the condition.

Table XV shows the special foods consumed by the heart disease subjects.

TABLE XV

CONSUMPTION OF SPECIAL FOODS BY HEART DISEASE SUBJECTS.

N=12

Special foods	n	%
Whole legumes	4	33
Greens	4	33
Wheat	6	50

Table XV indicates that 50 percent of the heart disease subjects consumed wheat to control their lipid levels. 33 percent of the subjects mentioned that greens and whole legumes as beneficial for the control of the disease.

E. BLOOD GLUCOSE AND LIPID PROFILE OF DIABETIC AND HEART DISEASE SUBJECTS RESPECTIVELY

Table XVI presents the fasting and postprandial blood glucose levels of the selected diabetic subjects.

TABLE XVI
MEAN BLOOD GLUCOSE LEVELS OF THE DIABETIC SUBJECTS.
N=26

Blood glucose mg/dl	NIDDM		IDDM	
	n	%	n	%
Fasting level				
110 - 130	5	19	1	4
130 -160	16	62	2	8
160 - 190	1	4	1	4
Post prandial level				
250 - 300	19	73	1	4
300 -350	3	12	2	8
350 -400	-	--	1	4

Normal Values: Fasting blood glucose 70 - 100 mg/dl post prandial blood glucose - 80 to 140 mg/dl (Antia, 1987).

Table XVI depicts the fasting and post prandial blood glucose levels of the 26 diabetic subjects. All the samples had fasting blood glucose levels more than 100 mg/dl. Only 19 percent of the subjects with NIDDM had fasting blood glucose level between 110 - 130 mg/dl. Sixty two percent of subject's values ^{were} between 130 - 160 mg/dl and 4% between ^e 160 -190 mg/dl.

In the case of post prandial glucose, about 13 percent of NIDDM subjects had their values between 250 - 300 mg/dl and 12 percent had between 300 - 350 mg/dl. Most of the subjects had higher fasting blood glucose level than the normal level of 80 to 140mg/dl. All the subjects had higher blood glucose values than normal. Both fasting and post prandial values were very much high. This indicates that the subjects had poor control over their blood glucose.

In the case of IDDM subjects, 8 percent of them had fasting blood glucose between 130 - 160 mg/dl and 12 percent had between 300 - 350 mg/dl. Most of the subjects had higher fasting blood glucose even than the normal level of 80 to 140 mg/dl. All the subjects had higher blood glucose values than normal. Both fasting and post prandial values were very

much high. This indicates that the subjects had poor control over their blood glucose.

In the case of IDDM subjects, 8 percent of them had fasting blood glucose between 130 - 160mg/dl, and post prandial blood glucose between 300 - 350 mg/dl. In the case of IDDM subjects blood glucose levels were very much high. This shows that proper steps should be taken to bring these subjects to normal.

Table XVII presents the lipid profile of the heart disease subjects .

TABLE XVII
LIPID PROFILE OF THE HEART DISEASE SUBJECTS
N = 12

Lipids	Number of heart disease subjects	Normal values (Sri Lakshmi 1993)
TOTAL CHOLESTEROL		
200 - 225	7	150 - 250
225 - 250	5	
TRIGLYCERIDES		
200 - 225	6	50 - 200
225 - 260	6	
VLDL		
40 - 50	7	12 - 40
50 - 60	5	
LDL		
120 - 135	5	
135 - 150	7	50 - 160
HDL		
35 - 45	7	35 - 65
45 - 55	5	

It can be observed from Table XVII that the cholesterol values of the subjects were within the normal range.

Except triglycerides and VLDL, other values like LDL and HDL were normal. This may be because the subjects were

agricultural workers and hence they had a lot of physical activity. This might have resulted in the normal lipid profile.

F. FOOD AND NUTRIENT INTAKE OF THE SUBJECTS

The food intake of the subjects were calculated through 24 recall method. The mean food intake compared with the recommended dietary allowances by the ICMR (1987) are presented in Table XVIII. The individual food and nutrient intakes are given in Appendix - VI-A, VI-B, VII-A and VII-B.

1. MEAN FOOD INTAKE OF THE SELECTED SUBJECTS

Table XIII Presents the mean food intake of diabetic and heart disease subjects of both sexes. The individual food intakes are presented in Appendix VI.A and VI.B

TABLE XIII
MEAN FOOD INTAKE OF THE SELECTED SUBJECTS

Foods	Males			Females		
	Diabetics	Heart disease subjects	RDA	Diabetics	Heart disease subjects	RDA
Cereals (g)	481	490	460	455	435	410
Pulses (g)	39	37	40	33	40	40
Green leafy vegetables (g)	150	105	40	105	100	100
Roots and tubers (g)	41	38	50	44	40	50
Other (g) vegetables	145	115	60	100	125	40
Milk and milk products	150	150	150	120	125	150
Fleshy foods (g)	20	20	30	15	20	30
Fats and oils (g)	25	25	40	20	25	25
Sugar (g)	10	30	30	10	30	20

RDA - Gopalan (1987) (NIN)

Table XVIII shows that the intake of cereals by diabetic and heart disease male subjects were more than the RDA. Intake of cereals by the female diabetic and heart disease subjects were less than the RDA.

Intake of pulses, fruits and fleshy foods were less than the RDA by both diabetic and heart disease subjects. But consumption of green leafy vegetables and other vegetables were more than the recommended allowances. The subjects indicated that the doctor had advised them to consume more vegetables.

Since most of the families had cattles, milk and milk products consumption was not less than the recommended dietary allowances at the same time consumption of fleshy foods and fats and oils was less than the recommended allowance. Both male and female diabetics consumed very little quantity of sugar. In general except vegetables consumption, consumption of all other foods were less than the recommended dietary allowances.

2. MEAN NUTRIENT INTAKE OF THE SELECTED SUBJECTS

Table XIX shows the mean nutrient intake of the diabetic and heart disease subjects. The individual intakes of nutrients are presented in Appendix VII.A and VII.B

TABLE XIX

MEAN NUTRIENT INTAKE OF THE SELECTED SUBJECTS

Foods	Males			Females		
	Diabetics	Heart disease subjects	*RDA	Diabetics	Heart disease subjects	*RDA
Energy (g)	2815	2254	2875	1835	1808	1875
Protein(g)	57	56	60	54	53	50
fats (g)	26	23	20	25	21	20
Calcium (mg)	1673	1572	400	1352	1295	400
Iron (mg)	26	25.5	28	24	21	30
Carotene (μ g)	1920	1616	2400	1840	1820	2400
Thiamine (mg)	0.81	0.9	0.9	0.79	0.82	0.9
Riboflavin (mg)	0.95	0.9	1.1	0.85	0.89	1.1
Vitamine C (mg)	44	48	40	45	47	40

* RDA - NIN (1993)

From Table XIX it is evident that intake of energy by the diabetic subjects was almost equal to the RDA. But both male and female ^{heart} disease subjects consumed less energy protein intake were almost equal to RDA. Consumption of Calcium Iron and other vitamins were almost equal to RDA allowances. Only carotene intake was less than the recommended allowance. Sodium intake by the diabetics was equal to the recommended amounts but the intake of sodium by the heart disease subjects was lesser. Fibre intake of both diabetic and heart disease subjects should be increased.

Summary and Conclusion

V. SUMMARY AND CONCLUSION

The study on "Prevalence and etiology of diabetes mellitus and heart diseases among agricultural families was formulated to estimate the rate of prevalence of diabetes mellitus and heart diseases and to find out the factors responsible for the incidence of these two diseases among the agricultural families.

The investigation was carried out in the village Kollankoil in Periyar District. One thousand families of agricultural workers were selected for the study. By interviewing the head of the family or the home-maker the prevalence of diabetes and heart diseases in these 1000 families was assessed. After identifying the diabetic and heart disease subjects, the etiological factors responsible for the development of the disease, their socio-economic status, blood glucose and lipid levels and the dietary habits were elicited with the help of an interview schedule formulated for this purpose. The results obtained were consolidated and analysed statistically. The results revealed the following

1. One thousand agricultural families selected were Hindus. Ninety seven percent of the families were scheduled

caste, most backward class or backward class. Only three percent were classified as forward community.

2. Ninety nine percent of the families were from low income group. Only 10 families (1 percent) were from middle income group. About 30 percent of the families lived below poverty line.

3. The incidence of diabetes mellitus was 2.6 percent and heart diseases was 1.2 percent, which correlated well with the findings of earlier workers.

4. There were 22 non-insulin dependent diabetics and 4 insulin dependent diabetics. Among the heart disease subjects, a majority of them suffered with atherosclerosis and angina pectoris, ischaemic heart disease and hypertensive stroke were also observed.

5. Sixty nine percent of the diabetes mellitus and 83 percent of the heart disease subjects, were doing sedentary activity. Only one diabetic and one heart disease subject were doing heavy activity.

6. In about 33 percent of the subjects, father, mother or grand parents had diabetes or heart diseases.

7. Except 5 diabetics and 2 heart disease subjects all other had personal habits like smoking , alcohol consumption or tobacco chewing.

8. Majority of the diabetics (77 percent) and heart disease subjects (83 percent) were non-vegetarians.

9. All the diabetics and heart disease subjects reported about incidence of infectious diseases or other conditions involving mental stress. These physical and mental stress were responsible for development of the diseases.

10. None of the subjects were obese. But, there were 4 diabetics and one heart disease subject who had below normal Body Mass Index

11. With regard to the special foods consumed to control diabetes, it was found that bitter gourd, neem leaves, wheat and ragi were specially consumed by diabetics to control the disease. The heart disease subjects consumed whole legumes, greens and wheat.

12. Analysis of the fasting and post prandial blood glucose levels of the diabetic subjects revealed that the levels were very much higher than the normal values. The subjects had a poor control over the disease.

13. The lipid levels of the heart disease subjects were almost in the normal range. Much abnormality was not shown.
14. Analysis of the food intake revealed that the subjects were consuming more cereals. Consumption of other foods was a little less than the RDA. But consumption of green leafy vegetables and other vegetables was high.
15. Except calcium and fat intake, intake of all other nutrients were less than the recommended allowances.

The results of the study has brought out the fact that the incidence of diabetes were 2.6 percent and heart disease 1.2 percent. Heredity, wrong personal habits like smoking and alcohol consumption were the causes of the diseases. The subjects did not follow the correct dietary practices and had very poor control over the disease.

Hence, these rural subjects, ignorant about the correct food habits need nutrition education and diet counselling so that they could avoid further complications and lead a healthy normal life. Planners and policy makers should formulate projects to educate these village population to follow correct practices so that incidence of various diseases could be controlled.

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Appendices

11. Indicate the type of diabetes

Insulin dependent :

Non-insulin dependent :

12. Are you suffering from any other diseases other than diabetes?

Yes

No

If yes, please specify

a. Hypertension

b. Heart disease

c. Anaemia

d. Any other (specify)

13. Do you do exercise?

Yes

No

If yes, whether you do

a. Daily

b. Weekly once

c. When time permits

14. Do you take alcoholic drinks?

Yes

No

If yes, mention the amount and frequency.

15. Type of activity performed

- a. Sedentary
- b. Moderate
- c. Heavy

Duration of activity/day:

16. Do you take special diet?

Yes

No

Mention the special foods that are included in the diet in your meal.

17. Do you get often tensed or worried? yes

No

18. What type of treatment are you taking?

Insulin injections

Tablets

Diet alone

Homeopathic medicine

Any other treatment

19. If you are taking tablets, please mention the name:

20. Do you restrict sugar and sweets in your diet?

Yes

No

11. Are you suffering from any diseases other than heart disease?

Yes / / No / /

If yes, Please mention.

- a. Diabetes
- b. T B
- c. Asthma
- d. Any other (Specify)

12. Do you smoke Yes No

If yes, how many cigarettes/bidies per day?

13. Do you take alcoholic drinks?

Yes No

If yes, please mention the amount and frequency of consumption

14. Do you do exercise?

Yes No

If yes, please mention whether you do

- a. Daily
- b. Weekly once
- c. When time permits

15. Type of activity performed:

- a. Sedentary
- b. Moderate
- c. Heavy

Duration of the activity:

16. Are you a

Vegetarian

Non-Vegetarian

17. Are you on salt restricted diet.

Please mention the amount of table salt used per day:

18. Do you get often tensed and worried

Yes

No

19. Amount of salt added to foods during cooking:

20. Do you take into account the sodium content of foods?

Yes

No

21. Do you take special diet?

Yes

No

If yes, who prescribed the diet?

a. Dietitian

b. Doctor

c. Nurse

d. Others (Specify)

22. How closely is the diet followed?

a. Always adhered to

b. Sometimes

c. Rarely

d. Never

23. Do you consume any special food?

Yes

No

24. Please mention the special foods included in the diet

27. LAB DATA

Lipid Profile

Blood cholesterol level

HDL

LDL

VLDL

Triglyceride:

29. Do you have any relatives who have suffered from heart disease?

Yes

No

If yes, specify the relationship?

APPENDIX - II
BLOOD SUGAR ESTIMATION

GLUCOSE OXIDASE METHOD

PRINCIPLE In this method glucose is oxidized by glucose oxidase to gluconic acid with the gluconolactone as intermediate. The overall reaction is (Glucose + H₂O + O₂ → Gluconic acid + H₂O).

The hydrogen peroxide which is also formed is broken down to water and oxygen by a peroxidase in the presence of an oxygen acceptor which is converted to a coloured compound the amount of which can be read calorimetrically.

AUTO ANALYSER METHOD USING GLUCOSE OXIDASE (MARK AND LLOYD - 1993).

These authors describe both macro and micro methods in which proteins are precipitated with zinc sulphate and sodium hydroxide and a micro method without removal of proteins. Here micro method is used. The blood is placed directly into a sodium sulphate, sodium iodoacetate solution. This mixes with a sodium sulphate dilute before entering the dialyzer and dialysis is into sodium sulphate. Then after receiving the enzyme dye reagent, in which O-toluidine is used, the stream passes through a 40 foot coil.

Before entering the calorimeter it is mixed with sulphuric acid and the yellow colour resulting has an extinction at 420 millimicrons upto twice that of the blue colour at 660.

REAGENT

1. Sodium sulphate solution, 16.4 grams of the anhydrous salt per litre of aqueous solution add 0.1 ml. Triton x 100.

2. Stock sodium -iodoacetate, 0.4 gms. in 100 ml. of the 16.4 percent sodium sulphate.

3. Sodium sulphate-iodoacetate diluent, add 1 ml. of the stock idoacetate to 80 ml. of 1.6 percent sodium sulphate and make to 100 ml with the sulphate.

4. Sodium acetate-acetic acid bufffer 0.5M, pH 5.0 Dissolve 475 gms of sodium ace tate in water, add 91 gms (86 ml) of glacial acetic acid and make to 10 l with watter. Check the pH and adjust if necessary.

5. Peroxidase solution, 20 mg of horse radish peroxidase RZ (Hughes and Hughes) in 500 ml. of buffer. Keep in a refrigerator.

6. O- Tolidine solution, 1g Analar reagent in 100 ml absolute ethanol.

7. Ezyme -dye reagent. To 800 ml of acetate buffer add 50 ml of the peroxidase, 10 ml of the O - tolidine and 10ml of Fermcozme 653A (750 units/ml - Hughes and Hughes) mixing after each addition. Make up a litre with buffer keep in the refrigerator in a dark bottle for upto 3 days.

8. Standard glucose solution prepare a stock standard in saturated benzoic acid solution containing 100 mg/100 ml. Dilute to obtain standards for use containing 5, 10, 15, 20, 30, 40, 60, 80 mg per 100 ml. Put through in the same may as the test these correspond to 50, 100, 200, 300, 400, 600, 800 mg per 100 ml.

TECHNIQUE

For general use add 0.1 ml of blood to 0.9 ml of the sodium ^psulhate - iodoacetate. For blood sugar values and for glucose tolerane tests 0.2 ml to 0.8 ml is generally better. The standards will then range from 25 to 400. Run at 40 to 60 samples per hour and read at 420 mm.

Sensitivity with a dilution of 1 - 10 is 4 mg per 100 ml for each percent, 7 between 50 and 100 mg per 100 ml. 6 between 100 and 200, 8 between 200 and 400, 12 between 400 and 600.

APPENDIX III

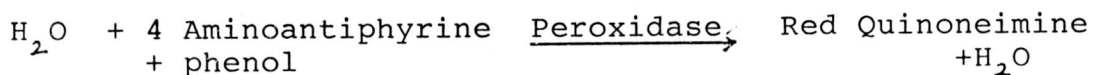
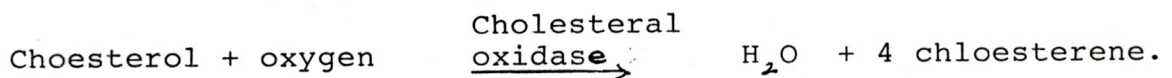
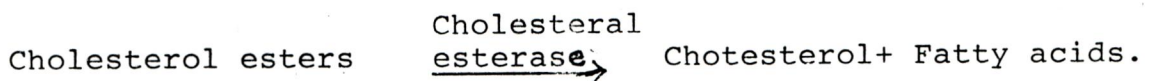
CHOLESTEROL ESTIMATION

ACCUREX - AUTOZYME CHOLESTEROL

ENZYMATIC HIGH PERFORMANCE REAGENT

A reagent system (Cholesterol esterase/cholesterol oxidase/peroxidase) for determination of total cholesterol in serum or plasma.

PRINCIPLE Cholesterol esterase hydrolyses cholesterol esters into free cholesterol and fatty acids. In second reaction cholesterol oxidase converts cholesterol to 4 cholesterolone and hydrogen peroxide. Oxidatively couples with 5 amino antipyrine/phenol to produce red quinoneimine which has absorbance maximum at 510 nm. The intensity of the red colour is proportional to the total cholesterol in specimen.



PREPARATION OF WORKING SOLUTION

Add 10.5 ml of distilled water to one enzyme vial. Mix gently to dissolve and record the date of preparation.

Dilvent Reagent (R) is ready for use. Prepare working solution by mixing equal volumes of enzyme solution (R) and Dilvent Reagent (R).

Specimen collection and preservation

Blood should be collected in a clean dry container. Fasting blood is preferred for cholesterol assay. For plasma separation any of the following anticoagulants can be used.

EDTA	2 mg/ml blood
Citrate	6 mg/ml blood
Heparin	200 IU /ml blood
Oxalate	3 mg / ml blood

Procedure

Reaction type	End point
Reaction time	10 minutes of 37 C.
Wave length	510 nm.

Assay to be performed (2.5 ml procedure)

Working	Serum/plasma	Standard	Blank
Solution	0.02 ml	0.02 ml	--
	2.5 ml	2.5 ml	2.5 ml

Incubation

Incubate the assay mixture for 10 minutes at 37 C. After completion of the incubation measure the absorbance of assay mixture against blank at 510 nm. Final colour obtained is stable for atleast two hours.

Calculation

$$\text{Total cholesterol mg\%} = \frac{\text{Absorbance of Sample}}{\text{Absorbance of standard}} \times 200$$

AZO-KIT - PEG PAP METHOD - HOL - CHOLESTEROL.

PRINCIPLE

Chylomicrons, very low density lipoproteins and low density lipoproteins of serum are precipitated using buffered polyethylene glycol.

After centrifugation high density lipoproteins are in the supernatant. The HDL cholesterol is estimated by enzymatic method using cholesterol esterase, cholesterol oxidase, peroxidase, 4 - amino antipyrine and phenol.

PREPARATION OF WORKING SOLUTION

Dissolve contents of 1 bottle of cholesterol esterase, cholesterol oxidase, peroxidase, 4 - amino antipyrine and sodium cholate with 1 bottle of Reagent -1 (Phenol) Mix well and store at 2 to 8 C

This is the chromogen reagent.

Specimen collection and storage

1. Serum (fasting) is used instead of plasma.
2. Separation of serum is done immediately.
3. No deproteinization of serum is required.

PROCEDURE

1. HDL - Cholesterol separation

Pipette into centrifuge tube.	Quantity
Sample	.3 ml
Precipitating reagent	.3 ml.

Mix well, keep at room temperature for 10 minutes and then centrifuge at 4000 rpm for 10 minutes on at 2000 rpm for 20 minutes to obtain a clear supernatant.

2. HDL-Cholesterol estimation

Pipette into test tubes	Blank (B)	Standard (S)	Test (T)
Chromogen Reagent	1.0 ml	1 ml	1 ml
Standard (50 mg/dl)		.1 ml	--
Samples (supernatant from Step 1)			.1ml

Mix and read absorbance of test (AT) and standard (AS) and the reagent blank (AB) at 500 nm wave length.

The colour developed is stable for 1 hour at room temperature if protected from direct light.

Calculations

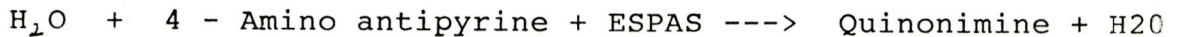
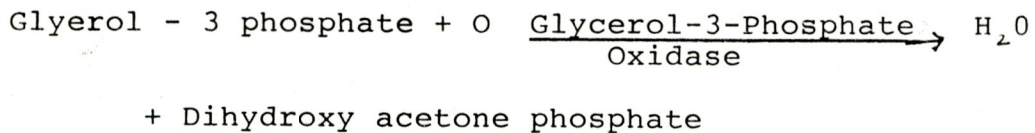
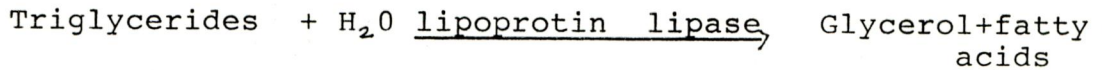
$$\text{HDL - Cholesterol concentration} = \frac{\text{AT} - \text{AD}}{\text{AS} - \text{AB.}} \times 100$$

$$\text{LDL- C} = \text{T.C} - \frac{\text{T.G}}{5} + \text{HDL. C}$$

APPENDIX - IV

QUANTITATIVE ESTIMATION OF SERUM TRIGLYCERIDE USING GPO-PAF METHOD

PRINCIPLE



PRESENTATION

Reagent 1 Pipes Buffer pH 7

N-ethyl -N-Sulfopropyl-n-Anisidine

Reagent 2 * lipo-protein lipase

* Glycerokinase

* Glycerol - 3 phosphate oxidase

* Peroxidase

* Amino. 4 - Antipyrine

* ATP

Reagent 3 Standard Glycerol in Trioleine Standard.

PREPARATION OF WORKING SOLUTION

Contents of 1 bottle of reagent 2 with 1 bottle of reagent are transferred and dissolved. This is the enzyme chromogen reagent.

SPECIEMN COLLECTION

1. Serum from a fasting blood sample is preferred.
2. Plasma is collected with heparin as anticoagulant.

PROCEDURE

A. For instruments with	1.0 ml volume		
Pipette into test tubes	Blank(B)	Standard(S)	Test(T)
Chromogen reagent	1.0 ml	1.0ml	1.0ml
Standard	-	0.01ml	-
Sample	-	-	0.01ml

Mixed and incubated at room temperature (25 -30 C) for 20 minutes. Absorbance of the test (AT), Standard (AS) and the reagent blank (AB) against distilled water are read at 546 nm, wave length (530 to570nm). The colour developed is stable for one hour at room temperature if protected from direct light

Calcuatilons

$$\text{Trighlyceride Concentration (mg/dl)} = \frac{\text{Ar} - \text{AB} \times 200}{\text{AS} - \text{AB}}$$

APPENDIX - V

VLDL and LDL can be calculated using the Fried wald and Fredickson's formula.

VLDL

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

$$\text{LDL-Cholesterol} = \left[\frac{\text{Total Cholesterol} - \text{Triglycerides}/5}{+ \text{HDL cholesterol}} \right]$$

APPENDIX - VI - A

INDIVIDUAL FOOD INTAKE OF THE SELECTED
DIABETIC SUBJECTS

SUBJECTS	CEREALS	PULSES	LEAFY VEGE- TABLES	ROOTS AND TUBERS	OTHER VEGE- TABLES	FLESHY FOODS	MILK AND MILK PRODUCTS	FATS AND IOLS	SUGAR
	g	g	g	g	g	g	g	g	g
MALES									
1	400	35	150	25	100	-	150	30	20
2	450	40	200	50	120	20	200	28	-
3	470	25	100	60	150	40	100	22	-
4	480	40	150	30	140	-	250	25	20
5	490	45	150	40	150	40	150	38	-
6	480	50	100	25	150	-	200	27	10
7	445	40	125	30	140	20	100	20	-
8	495	45	100	40	750	-	250	30	20
9	490	40	125	50	140	40	150	32	30
10	520	35	175	40	150	-	100	20	-
11	525	35	150	50	150	40	750	26	-
12	475	30	120	60	200	20	150	25	10
13	480	35	200	25	150	40	100	20	30
14	475	40	150	30	150	30	125	20	20
15	540	35	125	45	175	-	150	23	-
16	485	45	200	45	130	40	750	30	-
17	500	30	100	25	175	-	250	20	20
18	445	50	150	50	145	30	100	24	10
19	470	40	200	30	205	-	200	32	-
20	535	40	150	30	95	40	75	18	20
21	460	35	180	60	155	20	200	20	-
TOTAL	10110	815	3150	860	3045	420	3150	530	210
MEAN	481	39	150	40.9	145	20	150	25	10
FEMALE									
1	400	40	100	40	100	20	150	20	25
2	500	30	75	40	75	20	100	10	30
3	475	40	150	50	150	-	100	20	35
4	450	25	100	30	75	20	150	20	35
5	450	30	100	60	100	15	100	30	20
TOTAL	2275	165	525	220	500	600	75	100	150
MEAN	455	33	105	44	100	120	15	20	30

APPENDIX -VI. B

INDIVIDUAL FOOD INTAKE OF THE SELECTED
HEART DISEASE SUBJECTS

SUBJECTS	CEREALS	PULSES	LEAFY VEGE- TABLES	ROOTS AND TUBERS	OTHER VEGE- TABLES	FLESHY FOODS	MILK AND MILK PRODUCTS	FATS AND IOLS	SUGAR
	g	g	g	g	g	g	g	g	g
MALES									
1	465	40	150	50	100	-	150	20	25
2	495	30	100	30	150	-	200	20	30
3	475	45	750	40	170	40	200	20	30
4	520	40	125	50	150	-	200	30	20
5	495	40	100	25	75	30	175	25	25
6	455	35	100	30	100	-	250	40	40
7	480	40	755	40	100	-	100	20	30
8	495	25	100	30	75	-	75	25	25
9	470	40	125	30	130	40	100	20	35
10	550	30	100	25	100	-	100	20	30
TOTAL	4900	365	1050	380	1150	150	1500	250	300
MEAN	490	36.5	105.0	38.0	115.0	15.0	150.0	25.0	30.0
FEMALE									
1	470	40	750	40	150	20	150	20	30
2	400	40	125	40	100	-	100	30	30
TOTAL	870	80	200	80	250	20	250	50	60
MEAN	435	40	100	40	125	10	125	25	30

APPENDIX - VII - A

INDIVIDUAL NUTRIENT INTAKE VALUES OF THE SELECTED
DIABETIC SUBJECTS

SUBJECTS	ENERGY kcal	PROTEIN g	FAT g	CALCIUM mg	IRON mg	CAROTENE µg	THIAMINE mg	RIBO- FLAVIN mg	VITAMINE C mg
MALES									
1	2664	60.06	26.69	2399.5	22.38	1840	0.8	1.20	45
2	2585	58.34	28.50	1778.3	21.8	1952	0.91	0.9	48.6
3	2762	54.22	30.1	1762.7	27.41	1789	0.87	0.8	52.4
4	2848	50.85	27	1633.8	35.72	1648	0.825	0.82	50.2
5	2553	53.05	31	1364.4	17.83	2100	0.912	0.98	60.0
6	2893	55.87	32.3	1826.3	26.53	1980	0.8	0.99	40.8
7	2854	54.22	34.2	1652.0	35.09	1796	0.83	0.92	40
8	3000	60.09	34.1	1528.8	31.24	1924	1.092	0.8	42
9	2461	42.51	21.2	1719	27.08	1973	0.9	0.85	48.2
10	2877	60.73	24.5	1620	24.05	2010	0.79	1.07	43.5
11	2853	51.05	30.0	1801.5	22.5	2007	0.8	1.03	48
12	2950	68.53	27.5	1643.5	19.25	1689	0.85	1.23	40.6
13	2842	52.03	21.0	2460	22.05	1769	0.85	1.10	42.8
14	2772	58.6	24.8	1664.4	23.48	2274	0.76	0.93	40.9
15	2692	55.48	22.1	184.2	28.24	2325	0.81	0.75	45.8
16	2920	62.92	22	1752.5	32.68	1532	0.78	0.85	48.2
17	2877	48.95	23	1619.8	31.24	2010	0.6	0.99	45.5
18	2925	61.04	22.9	1824	18.02	1982	0.8	1.2	46.9
19	2875	60.02	22.1	1674	23.82	1893	0.7	0.89	48.6
20	2975	59.82	24.2	1712	23.82	1973	0.8	0.89	39.6
21	2935	64.00	21.9	1517.9	23.54	1880	0.6	0.93	43.0
TOTAL	59108	1212.3	558.19	35138.8	537.09	40320	17.059	20.12	917.2
MEAN	2815	57.7	26.58	1673.3	25.57	1920	0.81	0.95	43.6
FEMALE									
1	1772	60.63	23.3	606.2	23.54	1778	0.89	0.88	40.3
2	1865	44.50	26.9	1061	23.55	1669	0.92	0.96	47.0
3	1870	58.20	28.0	1762	30.42	1952	0.72	0.80	40.2
4	1786	52.32	23.2	1619.8	18.02	1912	0.67	0.70	48.1
5	1882	54.00	125	676.04	119.08	9201	3.95	4.23	220.6
TOTAL	9175	269.7	125	6760.4	119.08	9201	3.95	4.23	220.6
MEAN	1835	53.94	25	1352	23.81	1840	0.79	0.85	44.1

APPENDIX - VII - B

INDIVIDUAL NUTRIENT INTAKE OF THE SELECTED
HEART DISEASE SUBJECTS

SUBJECTS	ENERGY kcal	PROTEIN g	FAT g	CALCIUM mg	IRON mg	CAROTENE µg	THIAMINE mg	RIBO- FLAVIN mg	VITAMINE C mg
MALES									
1	1664	60.6	26.69	2399.5	22.38	1770	0.8	0.87	44.2
2	2585	48.34	23.49	1778.3	21.8	1623	1.02	0.93	50.3
3	1848	70.85	23.4	1517.9	35.72	1610	0.73	0.86	48.6
4	2853	53.05	27.89	1633.8	17.83	1570	0.65	0.96	47.2
5	1872	50.63	23.31	606.2	23.54	1692	1.1	0.85	45.8
6	2054	54.12	28.29	1826.25	25.09	1878	0.92	1.0	49.5
7	2805	69.08	20	1064	22.9	1295	0.94	0.88	50
8	1942	51.05	19.4	1518.2	28.3	1793	1.02	0.85	45
9	2093	55.87	22.3	1364.4	36.53	1447	0.83	0.91	47
10	2828	44.03	18.84	2006	20.6	1520	0.99	0.89	50.2
TOTAL	22544	557.08	233.4	15714.6	254.69	16160	9.02	9.09	477.8
MEAN	2254	55.7	23.3	1571.5	25.5	1616	0.9	48	48
FEMALE									
1	1891	42.51	17.23	1528	19.08	1926	0.91	0.87	51
2	1725	64.2	24.52	1061	23.12	1714	0.73	0.91	43
TOTAL	3616	106.7	41.75	2589	42.28	3640	1.64	1.78	94
MEAN	1808	53.4	20.9	1295	21.1	1820	0.82	0.89	47