Association of Body Mass Index, Waist Hip Ratio and Triceps Skin Fold to the Incidence of Diabetes Mellitus and Cardio Vascular Diseases

By

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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

May 1996

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Certified as bonafide research work

Signature of the Head of the Department	Signature of the Dean of the Faculty	Signature of the Guide

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Dedicated to

my dear

Parents

I. INTRODUCTION

As human race is progressing towards 2000 A.D., along with the achievements of man in the varied fields, the sins of civilization are also on the march. The one aspect which knows no discrimination is - disease.

As Hamzeh (1995) has rightly pointed out, "diseases know no frontiers, whether political or geographical and needs no passports or visas to cross them".

Man is gaining mastery over one aspect of living, so does nature impose a burden in the form of another problem. While many milestones have been covered in the form of inventions and discoveries made to improve living standards and control communicable diseases, changes in lifestyle have invited several diseases in themselves in the form of "non communicable diseases like heart diseases, diabetes mellitus, cancer and a range of socially related problems like alcohol and drug abuse" (Viedma, 1988). Also, success in the control of communicable diseases has enabled people to live longer and so contract the non communicable diseases of middle and later life.

Many developing countries including India have faced and are facing a major challenge of adult morbidity and mortality due to diseases with particular reference to cardio vascular diseases and diabetes mellitus.

Raman kutty and associates (1993) surveyed the prevalence of Coronary Heart Disease in the rural population of India and estimated the prevalence rate as seventy four per thousand population. While surveying urban population Chaddha et al., (1990) report that the prevalence rate based on clinical and Electro-Cardio Gram criteria was ninety six per thousand population in India.

Raheja et al., (1991) state that the prevalence of diabetes mellitus has risen over the last decade (greater than three per cent in urban areas and two per cent in rural areas) among Indians.

Considering the high incidence of and prevalence rates of these two diseases - namely cardiovascular diseases and diabetes mellitus, steps have to be taken in preventing the rise by appropriate treatment techniques.

The enormous advances in medical knowledge have led to newer treatment techniques and strategies which can only control the aggravation of diseases, but not in the complete prevention of them. Only a change in the attitude of people to lifestyle factors like diet, smoking and alcohol consumption can help as preventive measures. As Abdel (1988) states, "most of the world's major health problems are preventable through changes in human behaviour".

Obesity as considered by Atkinson et al., (1994) is the number one public health problem due to the morbidity and mortality from obesity alone or from the complications including diabetes mellitus, hypertension, hyperlipoproteinemia, atherosclerotic disease, myocardial infarction, cerebrovascular accidents, sleep apnea, gall bladder disease, gout and certain cancers.

Obesity, thus is one of the modifiable lifestyle factor. Also other factors like smoking, alcohol and drug abuse have their influence to a greater extent on an obese person in the precipitation of non communicable diseases which "emerge from the conditions of life in essentially the same way as communicable diseases. Just as exposure to infected snails and mosquitoes and drinking fecal contaminated water cause the major communicable diseases of

the world, so exposure to cigarettes, excessive consumption of alcohol and fatty foods and other typical features of the industrial society cause the 'modern epidemics' such as Coronary heart disease, lung cancer and diabetes mellitus. (Breslow, 1985).

The prevention of diseases like Diabetes and Cardio Vascular diseases which are of concern due to their increased prevalence and incidence rates, henceforth requires a change in lifestyle. Prevention may consist of decreasing population risk and/or identifying and treating high risk cases.

Persons at risk can be targetted only through prompt identification and preventive measures can be initiated. In order to identify obese persons, a preliminary measure is consideration of body dimensions of people. Anthropometric measurements, when properly interpreted, can help to develop important risk assessment indices.

According to Jensen (1992), nutritional anthropometry has become an indispensable method of evaluating the nutritional status of clinical and non clinical populations.

The anthropometric measurements which predict the extent of obesity are weight and height and a ratio between the two namely Body Mass Index; the ratio between circumference of the waist and hip indicates the extent of abdominal obesity and Triceps skinfold measurement is an indicator of disproportionate fat distribution.

Bray (1992) points out that a relation exists between excess weight and the risk of mortality from diabetes mellitus and cardiovascular diseases. Jensen (1992) is of the view that upper body fat accumulation or

abdominal obesity, indicated by waist-to-hip ratio is more predictive of the metabolic consequences of obesity. Orphanidon et al., (1994) agree that disproportionate fat distribution assessed through Triceps skinfold measurements, play a major role in the development of certain metabolic disorders and can ultimately influence morbidity and mortality.

By measuring these body dimensions certain risk assessment indices can be evolved which may provide guidelines for prevention and control of diseases like diabetes mellitus and cardio vascular diseases.

The present study is towards that direction with the following specific objectives: To

1. elicit information from the diabetic & cardiac patients on socio economic status, medical history, dietary practices and lifestyle from the outpatient departments of diabetology and cardiovascular diseases of selected hospitals.

2. measure body dimensions such as weight, height, circumference of waist and hip and triceps skinfold.

3. estimate the blood glucose and lipid profile values of a subsample of seventy five each of diabetic and cardiac patients respectively.

4. find out the dietary intake of all patients (304 diabetic and 328 cardiac patients) using twenty four hour recall method for three consequetive days.

5. Arrive at possible risk assessment index.

II. REVIEW OF LITERATURE

The available literature on "the association of Body Mass Index, Waist Hip Ratio and Triceps Skinfold to the incidence of Diabetes Mellitus and Cardiovascular diseases" was reviewed under the following heads.

A. Diabetes Mellitus and Cardiovascular diseases - an overview
B. Obesity - a step towards diseases
C. Factors leading to and away from Diabetes Mellitus and Cardiovascular diseases
D. Risk assessment pointers based on body dimensions

A. DIABETES MELLITUS AND CARDIOVASCULAR DISEASES - AN OVERVIEW

There are wide variations in the prevalence of Diabetes Mellitus and Cardiovascular diseases reported from India and elsewhere.

Incidence rate is defined as "the number of new cases occuring in a defined population during specified period of time" (Park and Park, 1986).

The term prevalence refers specifically to all current cases (old and new) existing at a given point in time or over a period of time in a given population (Park and Park, 1986).

Many developing countries including India face a major challenge of adult morbidity and mortality due to noncommunicable diseases especially Cardiovascular diseases like Coronary Heart Diseases and hypertension (Bhatia, 1995).

As per the findings of a survey carried out in different parts of India by Gulabchand and Ajgaonkar (1980),

the incidence of diabetes was 1.9 per cent in villages and 2.1 per cent in cities in persons above the age of twenty which means approximately one crore out of a total population of seventy crores are affected by diabetes.

According to Govindaraj and Das (1984) the incidence of diabetes is 3 million every year in India. Among the diabetics, 5.4 per cent were under 30 years and 94.6 per cent were greater than 30 years.

A 1987 population study done by Ahmad et al., (1987) in Chandigarh for Diabetes Mellitus showed a prevalence rate of 1.53 per cent with the female population being the most commonly affected (1.8 per cent).

Chowdhury et al., (1990) point out the prevalence rate for Diabetes Mellitus as 30.33 in males and 30 per cent in females, showing the almost equal rate of prevalence among men and women.

Patel (1986) reports that the prevalence rate in rural areas of hypertension was 7.82 per cent and the prevalence of glucosuria was 4.06 per cent and combined hypertension and glucosuria was 0.9 per cent. The prevalence of known diabetes was 2.13 per cent and newly detected diabetes was 1.66 per cent and a total of 3.79 per cent.

Epidemiological reports indicate that Indians have increased susceptibility to the development of Non Insulin Dependant Diabetes Mellitus and atherosclerotic heart disease and they develop these at a comparitively younger age. In the last decade, report Raheja et al., (1989), that there has been a steep rise in the prevalence of Non Insulin Dependant Diabetes Mellitus and Atherosclerotic heart disease with greater than 3 per cent in urban areas and 1.5 per cent in rural areas.

Mathur (1960)* studied a mixed group of patients including case records of Coronary Heart Disease, surveyed the general population of Agra and found that the prevalence was 1.05 per cent for Coronary heart disease.

Padmavathi (1962)* in a random population study in Delhi identified Coronary Heart disease prevalence in 1.03 per cent of the population (> 25 years of age).

Savotham and Berry (1968)* reporting from Chandigarh (urban population) identified 66/1000 prevalence of probable and possible Coronary Heart Disease in 1331 persons aged greater than 30 years based on clinical and electro cardiogram data.

Gupta and Malhotra's (1975)* population based survey compared the prevalence of Coronary Heart Disease in a rural and urban community in Rohtah (Haryana) and its adjoining areas and reported rural prevalence of 17.2/1000 and urban prevalence of 45.3/1000.

The age and sex specific prevalence of Coronary Heart Disease done in an epidemiological survey shows that 14.2 of men and 33.79 of women per 1000 population had Coronary Heart Disease, while suspect group figures were 11.21 and 31.96 respectively per 1000 population (Jajoo et al., 1988).

From a population survey from Delhi, Chaddha et al., (1990)* report that in persons between 25 and 64 years of age, having diagnosed as Coronary Heart Disease patients on the basis of clinical and electro cardiogram criteria, the prevalence of Coronary Heart Disease was 96.7/1000 population.

Raman kutty and associates (1993)* surveyed the prevalence of Coronary Heart Disease in the rural population

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* Bhatia, M.L., "Prevalence of Coronary Heart Disease in India: a contemporary view", **Indian Heart Journal**, 47: 339-342, 1995.

of Tiruvananthapuram District in Kerala in a cluster sample of 500 households from five villages. Estimated prevalence rate for persons greater than 25 years of age was 74/1000 population.

With more specific and definitive criteria, the prevalence of Cardiovascular diseases was higher in men and women as per the survey done by Gupta et al., (1995) who surveyed a population in Jaipur (Rajasthan) and found that the prevalence was 76/1000 (men 60/1000 and women 104/1000) in persons aged 20 years or more.

Prevalence of cardiomyopathy in diabetics was in high proportion (22.5 per cent) in Indians.(Tripathy, 1986)

In the world scenario, considering the prevalence of Diabetes Mellitus, Franz et al., (1995), point out that 6-7 million people in the United States are known to have Diabetes Mellitus and 90 per cent of them have Non Insulin Dependant Diabetes Mellitus.

Tinker (1994) points that the prevalence of Diabetes Mellitus is three times higher in persons with body weight more than 140 per cent of their desirable body weight than in persons near their desirable body weight.

Plous et al., (1995) state that despite recent decline, Coronary Heart Disease still claims roughly 550,000 lives annually around the world - more than any other disease and 300,000 are undergoing coronary Artery Bypass Surgery.

Approximately 50 million Americans are at increased risk for morbidity and premature death due to elevated blood pressure (greater than or equal to 140/90 mm Hg) (Levey et al., 1995).

Brady et al., (1995) report that Coronary Heart Disease is an important public health problem that afflicts an estimated 4 million Americans. The incidence (new cases) of Coronary Heart Disease is reported as 4,00,000.

B. OBESITY - A STEP TOWARDS DISEASES

Obesity is considered by Atkinson et al., (1994) as the number one public health problem, due to the morbidity and mortality from obesity alone or from the complications including Diabetes Mellitus, hypertension, hyperlipoproteinemia, atherosclerotic disease, myocardial infarction, cerebrovascular accidents, gall bladder disease, gout and certain cancers.

Obese persons are at increased risk of developing diabetes and cardiovascular diseases to a greater extent. Hyperinsulinemia is a common finding in obesity and sustained hyperlipidemia and atherosclerosis (Slabber et al., 1994).

Napalkov (1995) states that obesity and lack of regular physical exercise lie at the root of increase in Non Insulin Dependant Diabetes Mellitus.

Stating the risk factors for Coronary Heart Disease, Barakat (1993) points out that obese subjects even with normoglycemia have a higher Coronary Heart Disease risk.

Morbidly obese subjects (greater than 35 Body Mass Index) who are hyperinsulinemic but normoglycemic may be at a higher risk of Coronary Heart Disease than normoinsulinemic non obese subjects. This is suggested by the relatively higher lipid profile value.

Body fat distribution is recognised by many authors, Stevenson et al., (1990), Kanaley et al., (1993), Sinha (1993), Wabitsch (1994), as an important predictor of the metabolic complications of obesity. Abdominal obesity of the android type (male type, upper body or central type) is strongly linked with risk factors of Non Insulin Dependant Diabetes Mellitus and Coronary Heart Disease specifically elevated Low Density Lipoprotein cholesterol levels, elevated Triglyceride level, hyperinsulinemia and hypertension.

According to Witt et al., (1992), obese persons had high caloric intakes which were proportional to the degree of obesity. Obese persons also maintained their high caloric intake by consuming mostly foods of high caloric density, with occasional binge eating. They largely avoided low caloric foods.

As stated by Mykkanen et al., (1990), reduction in lean body mass, decreased physical activity and changes in diet favouring low fibre and high fat intake tend to worsen the degree of insulin resistance and thus lead to the impairment of glucose metabolism leading to Diabetes Mellitus and its complications including Cardio Vascular diseases.

Hypertrophic obesity as correlated with an abdominal or android fat distribution is often associated with metabolic disorders such as glucose intolerance, hyperlipidemia, hypertension and coronary artery disease (Bray, 1992).

Obesity has been considered to be an independent risk factor of Coronary Heart Disease according to Vardan (1995). Abdominal obesity, defined as increased Waist-to-Hip ratio (apple obesity) leads to increased frequency of

Coronary Heart Disease. Central obesity, like general body obesity has also been associated with hyperinsulinemia from increased pancreatic secretion and decreased hepatic removal of insulin along with high rate of lipolysis of the abdominal fat. The resulting excess of free fatty acids from this fat is likely to be responsible for hypertriglyceridemia, low High Density Lipoprotein cholesterol and further insulin resistance.

In cross sectional studies, point out kurist et al., (1989) that relationships have been found between the waist to hip circumference ratio and cardiovascular risk factors such as Diabetes, hyperinsulinemia, hypertriglyceridemia and hypertension. Also prospective longitudinal studies in both men & women have shown that android obesity is associated with increased risks of myocardial infarction, stroke and death.

C. FACTORS LEADING TO AND AWAY FROM DIABETES MELLITUS AND CARDIO VASCULAR DISEASES.

In every country in the world today, depending on its stage of epidemiologic transition, non-communicable diseases such as cardiovascular diseases, cancers, diabetes and osteoporosis are either newly appearing, rapidly rising or already established at high levels.

a. Risk factors

Pointing to the risk factors for non communicable diseases, Posner et al., (1995), state the findings of the Adult Treatment panel as follows - smoking prevalence, alcohol consumption, drug abuse, obesity, nutritional behaviours, nutrient intake levels, physical activity level, systolic and diastolic blood pressure, hypertension, elevated serum cholesterol levels, particularly in

combination with high levels of Low Density Lipoprotein cholesterol, age (> 45 years for men and > 55 year for women), low levels of High Density Lipoprotein cholesterol and family history. This view is endorsed by Gey et al., (1991).

1. **Obesity:** Obesity, especially abdominal obesity is recognised as a risk factor by Sinha (1993) who states that obesity has been associated with impaired glucose tolerance, non-insulin dependant diabetes mellitus, hypertension, cardiovascular diseases and other metabolic aberrations through positive correlations between abdominal obesity and well established risk factors for diabetes mellitus and cardiovascular disease such as elevated Very Low Density Lipoprotein, Low Density Lipoprotein, Lipoprotein B1, and hyperinsulinemia.

Alpert et al., (1995) related morbid obesity as one of the risk factor for cardiovascular disease by its positive correlation with the increase in the left ventricular mass index which inturn influences the left ventricular loading conditions over time.

2. **Familial aggregation:** Family history in diabetes is stated as one of the risk factors by Ramachandran et al., (1992), who point out the frequency of diabetes to a positive family history of the disease to be twenty five to fifty per cent. Familial aggregation is higher among Indians compared to Europeans 45 and 38 per cent respectively.

Vardan (1995) is of the same view regarding Cardio Vascular diseases and considers that a positive family history is an independent risk factor.

3. **Diet:** Tsunehara et al., (1990) pinpoint diet as an important environmental variable in the etiology of Diabetes

Mellitus and Cardiovascular diseases by the fact that overconsumption of calories leads to obesity that puts a person at risk. Etiological role of high fat diet is stated in its being frequently linked to diabetes and vascular complications. Diet related obesity chiefly caused by heavier caloric consumption mainly in the form of animal foods, is also stated to be a causative factor.

4. **Urbanisation and age:** Urbanisation is attributed as a significant independent risk factor for Diabetes Mellitus and Cardiovascular diseases increased with age in both men and women - the prevalence in women rising particularly after 45 years of age, whereas in men the rise occured earlier in those greater than 35 years of age as stated by Levitt **et al.,** (1993).

5. **Smoking:** The effect of smoking on the health of people with either Insulin Dependant or Non Insulin Dependant Diabetes Mellitus has been demonstrated by Ford **et al.,** (1994) by several studies in which diabetes and smoking interact to produce excess microvascular and macrovascular morbidity and mortality.

Pelletier **et al.,** (1987) brings out the fact that smoking though not associated with total cholesterol levels, is associated with lower High Density Lipoprotein cholesterol, lower High Density Lipoprotein to total cholesterol ratio and higher non high density Lipoprotein cholesterol levels. This fact is confirmed by Parish **et al.,** (1995) Alfredo **et al.,** (1990) and Ball (1986), who point out that smoking is an independent risk factor for Coronary Heart disease and Diabetes Mellitus due also to the dietary habits of smokers who consumed fewer vegetables and high fibre foods and more of meat and alcohol.

6. **Alcohol:** Thomson et al., (1988) state that there is a greater risk of Coronary Heart disease in those with a high alcohol intake and total mortality is higher because in alcohol consumers, the dietary intake varied according to the drinking habits - more alcohol, increased consumption of saturated fat and decreased polyunsaturated fat and fibre. Sadikot (1988) also opines that among diabetics who drink alcohol, there is the habit of eating snacks along with drinks, which are often rich in calories, fried and full of proteins, in addition to the calories derived from alcohol itself.

7. **Blood glucose and lipid profile values:** As per Hughes et al., (1995) individuals prone to developing Non Insulin Dependant Diabetes Mellitus usually display mild modifications in lipid and glucose metabolism in the years preceeding overt diabetic symptoms. Also elevated total and Low Density Lipoprotein cholesterol levels, Low Density Lipoprotein to High Density Lipoprotein ratio have been related to increased risk for heart diseases and regress some atherosclerotic lesions in coronary arteries by Kelley et al., (1994).

8. **Lifestyle factors:** While stating the modifiable risk factors for Diabetes Mellitus and Cardiovascular diseases, Kirkman et al., (1994) point to the factors of lack of exercise, improper dietary habits and obesity as important factors.

b. Complications

In Diabetes Mellitus and Cardiovascular diseases, peripheral vascular disease is the major cause of many serious and disabling complications, as opined by Raheja (1988). Sadikot et al., (1990) point out that peripheral vascular disease comprising both large and small vessel

disease occurs more common in a diabetic and a hypertensive person.

The same authors point out that atherosclerotic vascular disease appears at an early age and progresses more rapidly in both diabetic and cardiac patients.

Relating the morbidity and mortality due to atherosclerosis in long standing diabetes, increase in serum cholesterol level to greater than 200 mg/dl for both sexes, leads to the enhancement of atherosclerosis and also when High Density Lipoprotein cholesterol levels were less than 30 mg/dl (Purohit and Shah, 1994).

Tripathy (1986) points out that there are high proportion of diabetics among patients of established cardiomyopathy and high incidence of congestive heart failure among diabetics providing inexorable pointers to the occurence of the now widely recognised clinico-pathological entity 'Diabetic cardiomyopathy'.

The severity and prevalence of hypertension in the diabetic population, according to Yuan et al., (1991) is related to the duration of diabetes as well as obesity and age.

Juhani et al., (1990) point out that silent disease may contribute to the frequency of abnormal cardiovascular reflexes in diabetics.

Detailing the acute and chronic complications of diabetes mellitus, Lyon et al., (1993), list the acute complications as hyperglycemia, ketoacidosis and hypoglycemia and chronic complications as cardiovascular disease, peripheral vascular disease, nephropathy, neuropathy and vision disorders.

Barnard et al., (1994) feel that microvascular complications including neuropathy are primarily due to the result of lack of glycemic control.

Also nephropathy and retinopathy have been concorded to the duration of diabetes mellitus and the degree of hyperglycemia by Lloyd et al., (1995) and gasteroparesis or delayed gastric emptying is stated as one of the autonomic neuropathies, symptoms of which include early satiety, postprandial bloating, nausea, vomiting, weight loss, eratic blood glucose levels resulting from irregular nutrient absorption.

Bloomgarden (1994) contributes the major source of morbidity and mortality in diabetic individuals as renal disease, particularly associated with nephropathy.

Diabetes is the most frequent cause of blindness, feels Tinker (1994) and is the major cause of end stage renal disease and non-traumatic lower extremity amputation. Raheja (1988) further states that gangrene occurs five times more in persons with Diabetes Mellitus and CVD.

Robbins (1989) is of the view that Diabetes Mellitus is a major risk factor for morbidity and mortality due to CHD and peripheral vascular disease.

c. Treatment modalities

The American Diabetes Association in 1994 has revised its position of medical nutrition therapy for people with Diabetes Mellitus as pointed out by Rosenburg (1994). Goals include:

1. Achievement of nutrition related goals via changes in nutrition and exercise habits and maintanance of as near-optimal blood glucose level as possible.
2. Achievement of optimal serum lipid levels.

3. Provision of adequate calories for maintaining or attaining reasonable weights for adults.
4. Prevention and treatment of both the acute and long term complications of diabetes.

According to Arnolds et al., (1993), diet is the cornerstone of Diabetes management. Yet diet is reported to be the biggest problem experienced by patients with diabetes. Adherence to recommended diets is low and less than half the people with Diabetes report using a written diet as part of their treatment plan.

Tsunehara et al., (1990) also opine the same and further state that a high complex carbohydrate intake has been encouraged for patients with diabetes mellitus and cardio vascular diseases as it increase insulin sensitivity.

Tsai et al., (1987) while pointing the effect of dietary fibre opine that the mechanism by which dietary fibre decreases the post-prandial hyperglycemia or improves glucose tolerance are believed to be due to delayed gastric emptying, altered rate of nutrient absorption and utilization. Addition to a test meal of fibre decreased the rise of plasma glucose level and triglycerides.

Moderate energy restriction and slight changes in the amount and quality of dietary fatty acids, especially in favour of unsaturated fatty acids, can result in weight reduction and improvement in glycemic control and serum lipid profile of patients (Laitinenth et al., 1993).

Perri et al., (1993) while stating physical activity as one of the treatment strategies in Diabetes Mellitus opine that increased physical activity is one of the factors consistently correlated with long term success in the weight management, in addition to increasing energy

expenditure, exercise enhances the rate of fat loss, preserves the loss of lean body mass and creates an increased sense of well being and improvements in mood and self concept.

Pelletier and Baker (1987) further state that the concentration of cholesterol in certain lipoprotein fractions is associated with variations in physical activity. In particular, the HDL-cholesterol of active workers is slightly higher than sedentary workers, supporting a possible hypocholesterolemic effect of physical activity on certain fractions of plasma cholesterol in the context of physical activity variations.

The benefits of exercise in the control of Diabetes Mellitus and Cardiovascular diseases as stated by Wasserman and Zinmah (1994), Wan et al., (1993), Berger et al., (1992) and Walberg et al., (1989) are:

1. Exercise training can play a major role in the primary and secondary prevention or therapies of type II diabetes in younger age groups, by an increase in the body's insulin sensitivity.

2. Regular exercise decreases risk factors for cardiovascular diseases such as hyperlipidemia, coagulation abnormalities, hypertension, glucose intolerance, and obesity also mortality from Cardiovascular disease and increases lean body mass.

3. Exercise increases the binding of insulin to its receptors which act as a site for regulation of insulin, which leads to better glucose uptake by muscle to replete glycogen stores leading to increased glucose tolerance.

Exercise is assessed on the basis of frequency of participation in "... any regular activity similar to brisk walking, jogging, bicycling etc., long enough to cook up a sweat (Wan et al., 1993).

D. RISK ASSESSMENT POINTERS BASED ON BODY DIMENSIONS

Nutritional anthropometry has become an indispensable method of evaluating the nutritional status of clinical and non clinical populations (Jensen, 1992).

According to Raison et al., (1989) indices of body fat distribution, namely, Body Mass Index, Waist Hip Ratio and Fat fold measurements, have been found to be positively related to blood pressure, glycemia, cholesterol and TG levels and negatively to HDL-Cholesterol levels.

Chuang et al., (1991) state that persons in the higher Body Mass Index group, showed more pronounced association between hypertension and glucose intolerance than persons in the lowest Body Mass Index group. Negri et al., (1992) bring about a relationship between Body Mass Index and acute myocardial infarction by stressing the role of higher serum cholesterol levels in the prevalence of diabetes and hypertension among fatter persons. This is confirmed by Bray (1992) who opines that there is a relation between weight and the risk of excess mortality.

Orphanidon et al., (1994) agree that disproportionate fat distribution indicated by measuring Triceps Skinfold, played a major role in the development of morbidity and mortality.

More specifically android fat distribution has been strongly associated with Diabetes Mellitus, hypertriglyceridemia as pointed out by Wadden et al., (1988) who reported a positive correlation between the prevalence of diabetes and the degree of upper body obesity.

Jensen (1992) is of the view that upper body fat accumulation is the more predictive of the metabolic consequences of obesity than total body fat. Also skinfold thickness measurements have been adapted to predict body fat content.

Complications of diabetes mellitus and cardiovascular diseases are also related to body measurements as pointed out by Stuhldreher et al., (1995) who report that WHR were significantly higher in men and women with proliferative retinopathy or nephropathy than in subjects free from these complications. It is suggested that WHR acts as a marker of risk of complications mainly through an influence on other risk factors.

Fat distribution, is an important prognostic indicator of the occurence of metabolic abnormalities, diabetes mellitus, hypertension, CVD, stroke in men and women. This relationship depends on the increased accumulation of intraabdominal fat (Seidell et al., 1987). Waist to hip ratio is related more strongly to the amount of intra abdominal fat than to the amount of subcutaneous fat. This explains the consistent relations between Waist to Hip Ratio and the metabolic aberrations, manifest illness.

Zamboni et al., (1994) and Sinha (1993) opine that abdominal obesity (android, male type, upper body or central) compared to gluteofemoral (gynoid, female type, lower body or peripheral type) is associated with hyperglycemia, hyperinsulinemia and glucose intolerance.

As per Ostlund et al., (1992), the level of HDL-cholesterol is inversely correlated with the ratio of the waist to hip circumference and the plasma insulin level and the presence of glucose intolerance and are not independently associated with sex or total body fat.

III. METHODOLOGY

The methodology of this research included the following steps:

A. Selection of the sample - the patients with Diabetes Mellitus and Cardiovascular diseases.

B. Assessing the profile of the selected patients in terms of
   a. Socio-economic status
   b. Medical history
   c. Dietary practices
   d. Lifestyle

C. Measurement of body dimensions
   a. Height and weight to arrive at Body Mass Index
   b. Circumference of waist and hip to assess Waist Hip Ratio
   c. Triceps skin fold

D. Quantification of mean daily food and nutrient intake.

E. Estimation of blood glucose and lipid profile of a subsample.

F. Development of risk assessment index.

A. SELECTION OF THE SAMPLE - THE PATIENTS WITH DIABETES MELLITUS AND CARDIOVASCULAR DISEASES

Over a period of two months, relevant information was obtained from 304 diabetic and 328 cardiac patients who registered at the outpatient departments of Kuppusamy Naidu Memorial Hospital, K.G. Hospital, Kovai Medical Centre and Hospital, P.S.G. Institute of Medical Sciences and Research Centre and AVM Diabetic Clinic, where consultation, treatment and counselling are provided for diabetic and cardiac patients; the sampling technique being stratified random sampling method (Kothari, 1991).

B. ASSESSING THE PROFILE OF THE SELECTED PATIENTS

Background information from the patients regarding their socio-economic status, medical history, dietary practices and lifestyle was obtained with the help of a well structured interview schedule framed by the investigator, which was pretested.

By referring to the medical records and recent reports, blood glucose values were noted for all the 304 diabetic patients and lipid profile values, if available were taken down for the cardiac patients.

C. MEASUREMENT OF BODY DIMENSIONS

To arrive at nutritional assessment indices such as Body Mass Index, Waist Hip Ratio and Triceps Skin Fold, body measurements such as height, weight, circumference of waist and hip were taken and Triceps Skin fold thickness was also measured for all patients using standardized procedures (Jelliffee, 1991).

Nutritional anthropometry, as stated by Frisancho (1989), has become an indispensable method of evaluating the nutritional status of clinical and non clinical population.

a. Body Mass Index

Height was recorded to the nearest of 0.1 cm, using a stadiometer, the person bare-foot with his heels against the upright bar of the scale standing erect. Weight was measured using a spring balance with the patient in minimum clothing, without shoes, the balance being checked every time before use, with standard weights in the range of 0.5, 1 or 2 kg to ensure accurate measurements (Jeliffe, 1991).

Body Mass Index (BMI) was computed using the formula,

$$BMI = \frac{\text{Weight in kilograms}}{\text{Height in metre square}} \quad \frac{(\ kg\ )}{(\ m^2\ )}$$

Based on the Body Mass Index of the patients, they were graded as normal and obese using the classification given by Garrow (1987).

BMI Class	Presumptive diagnosis
Less than 16	Chronic Energy Deficiency grade III (severe)
16 - 17	Chronic Energy Deficiency grade II (moderate)
17 - 18.5	Chronic Energy Deficiency grade I (mild)
18.5 - 20	Low weight normal
20 - 25	Normal
25 - 30	Obese grade I
Greater than 30	Obese grade II

The relationship between Body Mass Index and Diabetes Mellitus and Myocardial infarction can be explained atleast in part by high serum cholesterol, hyperglycemia and hypertension in fatter persons (Negri et al., 1992).

b. Waist Hip Ratio

Localized distribution of fat can be evaluated by measuring skin fold thicknesses on the extremities, by measuring circumference of the abdomen (waist) and hips to estimate the waist-to-hip ratio (Bray, 1992).

The abdominal or waist circumference is measured with a flexible tape placed in a horizontal plane at the level of the natural waist line or, narrowest part of the torso. The hip circumference is measured in the horizontal plane, at the level of maximal circumference, including the maximum extension of the buttocks posteriorly (Bray, 1992).

Waist Hip Ratio (WHR) was calculated using the formula,

Fig. 1. Sites of Measurement of Waist, Hip Circumference and Triceps Skin Fold

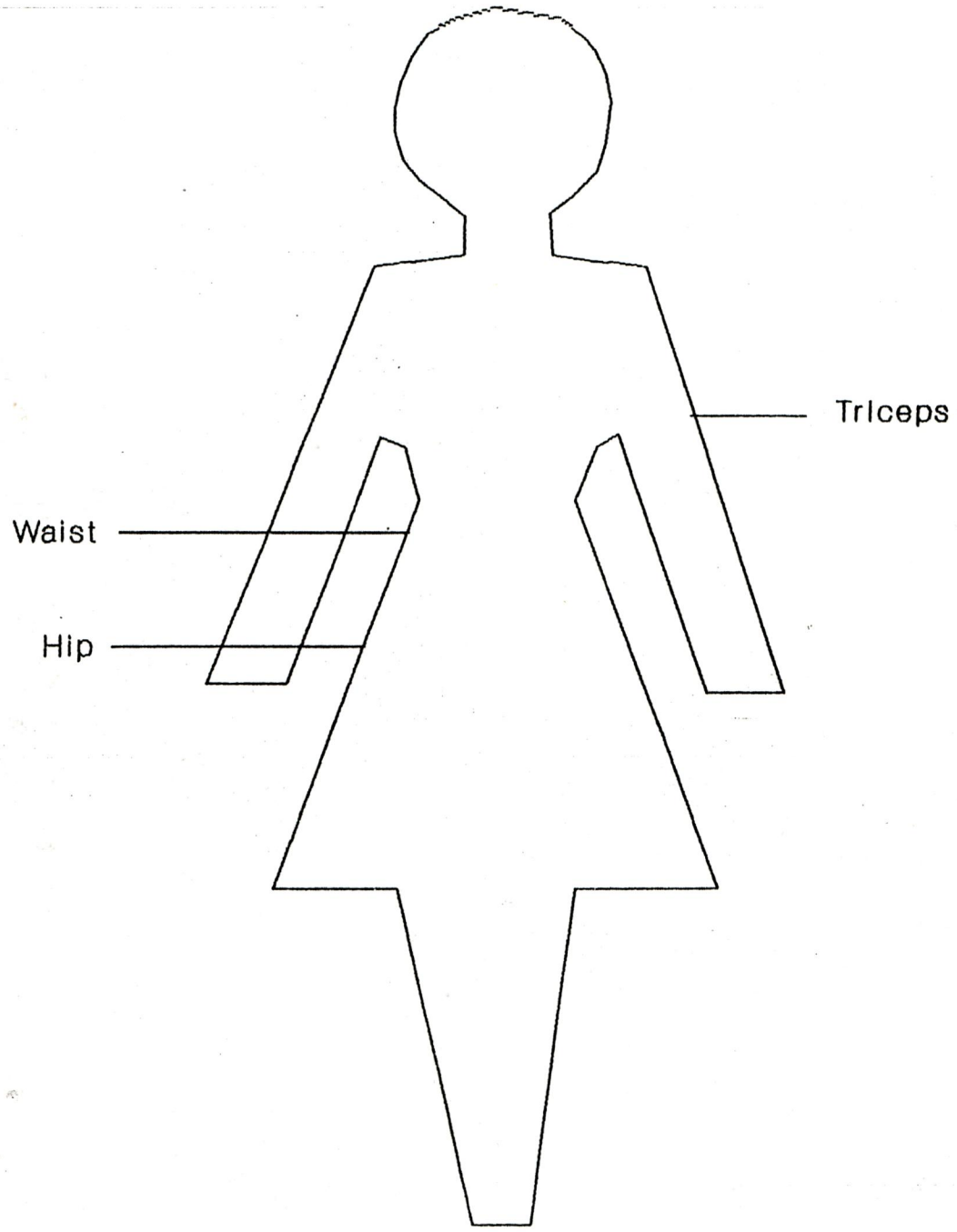


PLATE I: MEASUREMENT OF HIP CIRCUMFERENCE

PLATE II: MEASUREMENT OF WAIST CIRCUMFERENCE

PLATE III: MEASUREMENT OF TRICEPS SKIN FOLD

PLATE IV: TOOLS/INSTRUMENTS USED FOR MEASURING TRICEPS SKIN FOLD, WAIST AND HIP CIRCUMFERENCE

$$WHR = \frac{\text{Waist circumference (cms)}}{\text{Hip circumference (cms)}}$$

A waist hip circumference of greater than 0.85 in women and 1.0 in men is predictive of increased risk for adverse metabolic consequences of obesity (Jensen, 1992).

c. Triceps Skin Fold

Triceps Skin Fold was measured at the level midway between the acromial process of the scapula and the olecranon process of the ulna on the posterior part of the arm over the triceps muscle using a triceps harpender skinfold calipers, which exerted a pressure of 10g/mm² through out the skinfold range (Jelliffe, 1991).

According to Jelliffe (1991), the normal Triceps skin fold value for men is 15mm and for women is 25mm.

According to Thuluvath and Triger (1994), triceps is the most predictive of all body sites to assess fat stores.

Triceps skin fold an indicator of disproportionate fat distribution plays a major role in the development of certain metabolic disorders such as Diabetes Mellitus, hyper triglyceridemia, hypertension and other cardiovascular diseases and can ultimately influence morbidity and mortality (Orphanidon **et al.**, 1994).

D. QUANTIFICATION OF MEAN DAILY FOOD AND NUTRIENT INTAKE

A 24-hour recall of the food intake of the patients was done for 3 consequetive days to find out the mean daily food intake.

Using the Nutritive value of Indian Foods by Gopalan (1991), the nutritive value of the food consumed was

calculated for energy (calories) carbohydrates, proteins and fat.

E. ESTIMATION OF BLOOD GLUCOSE AND LIPID PROFILE OF A SUB SAMPLE

For a subsample of the patients seventy five each of diabetic and cardiovascular patients, blood glucose and lipid fractions such as Total Cholesterol, High Density Lipoprotein (HDL) Cholesterol, Triglycerides were estimated. Blood glucose was estimated by the glucose oxidase method and lipid profile by the enzymatic colorimetric method (Boyer,1993 and Plummer, 1982) (See Appendices II and III).

Other 2 lipid fractions namely Very Low Density Lipoprotein (VLDL) Cholesterol and Low Density Lipoprotein (LDL) Cholesterol were calculated using standard formulae.

$$\text{Very Low Density Lipoprotein Cholesterol (VLDL)} = \frac{\text{Triglycerides}}{5}$$

Low Density Lipoprotein Cholesterol (LDL) =
Total cholesterol - HDL cholesterol - VLDL cholesterol

F. DEVELOPMENT OF RISK ASSESSMENT INDEX

From the results obtained, risk assessment parameters like Body Mass Index, Waist Hip Ratio and Triceps Skin Fold, family history, cigarette smoking, alcoholism, exercise and coffee consumption were derived. Each parameter was scored based on the statistical inference drawn in the present study as well as with the help of related literature and risk assessment index was developed.

IV. RESULTS AND DISCUSSION

The data obtained in the present study are discussed under the following heads:

A. Socio-economic status of the selected diabetic and cardiovascular patients.

B. Medical history of the selected diabetic and cardiovascular patients.

C. Dietary practices of the target group.

D. Lifestyle factors influencing the disease.

E. Profile of the diabetic and cardiovascular patients in terms of selected body dimensions.

F. Mean daily mean food and nutrient intake of the diabetic and cardiovascular patients.

G. Association between the various risk assessement parameters among the subsample.

H. Risk assessment index.

A. SOCIO ECONOMIC STATUS OF THE SELECTED DIABETIC AND CARDIOVASCULAR PATIENTS

1. Age and sex wise distribution of the diabetic and cardiovascular patients

Table I shows the distribution of patients by age and sex.

TABLE I

AGE AND SEX WISE DISTRIBUTION OF PATIENTS

Age in year	Diabetic Patients				Total N=304		Cardiac Patients				Total N=328	
	F		M				F		M			
	N	%	N	%	N	%	N	%	N	%	N	%
20 - 30	14	11.48	4	2.19	18	5.92	6	6.66	6	2.52	12	3.66
31 - 40	16	13.11	34	18.68	50	16.45	20	22.22	28	11.76	48	14.63
41 - 50	42	34.43	46	25.27	88	28.94	12	13.33	58	24.37	70	21.34
51 - 60	32	26.23	50	27.47	82	26.97	26	28.88	72	30.25	98	29.88
61 - 70	16	13.11	32	17.58	48	15.97	20	22.22	42	17.65	62	18.90
71 - 80	2	1.64	14	7.69	16	5.26	6	6.66	16	6.72	22	6.71
81 - 90	0	0	2	1.09	2	0.66	0	0	16	6.72	16	4.87
Total	122	100	182	100	304	100	90	100	238	100	328	100

F - Female M - Male

The perusal of the above table shows that out of 304 diabetic patients and 328 cardiac patients, 170 (55.9 per cent) and 168 (51.2 per cent) respectively belonged to the age group of 41-60 years which is in accordance to the study by Laakso (1985) who stated that the prevalence of Diabetes and Cardiovascular diseases increases from the fourth decade onwards.

This view is further endorsed by Levitt et al., (1993) who state that the prevalence of Non Insulin Dependant Diabetes Mellitus increased with age in both men and women. In women the prevalence rose after 45 years of age, whereas in men the rise occured earlier, in those greater than 35 years of age.

2. Occupational status and activity pattern of diabetic and cardiovascular patients

Table II shows the occupational status of the diabetic and cardiovascular patients.

TABLE II

OCCUPATIONAL STATUS OF DIABETIC AND CARDIOVASCULAR PATIENTS

Type of Occupation	Diabetic Patients F		Diabetic Patients M		Cardiac Patients F		Cardiac Patients M		Total N=632	
	N	%	N	%	N	%	N	%	N	%
Professional	9	7.37	40	21.9	3	3.33	33	13.86	85	13.40
Business	7	5.73	14	7.69	4	4.44	50	21.00	75	11.86
Clerical	15	12.29	60	49.18	6	6.66	60	25.20	141	22.30
Government	5	4.09	12	6.59	7	7.77	10	4.20	34	5.30
Housewife	75	61.47	--	--	58	64.40	--	--	133	21.04
Unemployed	--	--	15	8.24	--	--	22	9.24	37	5.85
Retired	--	--	20	10.98	2	2.22	50	21.00	72	11.39
Mill Worker/ Coolie	6	4.90	11	6.04	10	11.11	13	5.46	40	6.32
Total	**122**	**100**	**182**	**100**	**90**	**100**	**238**	**100**	**632**	**100**

Housewives form a total of 21.04 per cent of the diabetic and cardiac patients and those involved in clerical services form the next largest group with 22.3 per cent.

Except for 21 diabetics and 12 cardiac patients who were engaged in moderate activity, all the rest were sedentary.

3. Distribution of the families by type and size

Among the 632 patients interviewed, 98 per cent belonged to nuclear families, with a maximum family size of five, while in the joint family system, family size ranged from five to eight.

4. Educational status of the diabetic and cardiovascular patients

Table III depicts the educational status of the diabetic and cardiovascular patients.

TABLE III

LEVEL OF EDUCATION OF THE DIABETIC AND CARDIOVASCULAR PATIENTS

Educational Qualification	Diabetic Patients F		Diabetic Patients M		Total N=304		Cardiac Patients F		Cardiac Patients M		Total N=328	
	N	%	N	%	N	%	N	%	N	%	N	%
Illiterate	75	61.48	25	13.7	100	32.89	40	44.00	30	12.60	70	21.30
Primary Education	15	12.29	72	39.56	87	28.62	7	7.77	55	23.10	62	18.90
Secondary	8	6.55	22	12.08	30	9.86	12	13.33	42	17.65	54	16.50
Higher Secondary	7	5.73	13	7.14	20	6.57	16	17.7	57	23.90	73	22.25
Graduate	8	6.55	10	8.19	18	5.92	12	13.3	21	8.80	33	10.06
Professional Qualification	9	7.37	40	21.97	49	16.12	3	3.33	30	12.60	33	10.06
Total	122	100	182	100	304	100	90	100	238	100	328	100

From the above table, it can be deciphered that female illetracy accounts for 61.48 per cent of diabetic and

44 per cent of cardiac patients, eventhough measures to eradicate illetracy have been in vogue for several years.

Illiteracy may be one of the contributary factors for the negligence and progress of the disease.

5. Monthly per capita income of the diabetic and cardiovascular patients

Table IV shows the monthly per capita income of the diabetic and cardiovascular patients.

TABLE IV

PER CAPITA MONTHLY INCOME

Percapita income for a month (in Rs.)	Diabetic Patients		Cardiac Patients		Total N=632	
	N	%	N	%	N	%
< 300	78	25.65	85	25.91	163	51.56
300 - 600	120	39.47	151	46.04	271	85.51
600 - 900	46	15.13	29	8.84	75	23.97
900 - 1200	45	14.80	38	11.58	83	26.38
> 1200	15	4.93	25	7.62	40	12.55
Total	**304**	**100**	**328**	**100**	**632**	**100**

It is clear from the above table that the largest group of 39.47 per cent and 46.04 per cent of diabetic and cardiac patients fall in the monthly per capita income range of 300 to 600.

B. MEDICAL HISTORY OF THE PATIENTS

1. Family history of the disease

Table V shows family history in diabetic and cardiovascular patients.

TABLE V

FAMILY HISTORY OF THE DISEASE

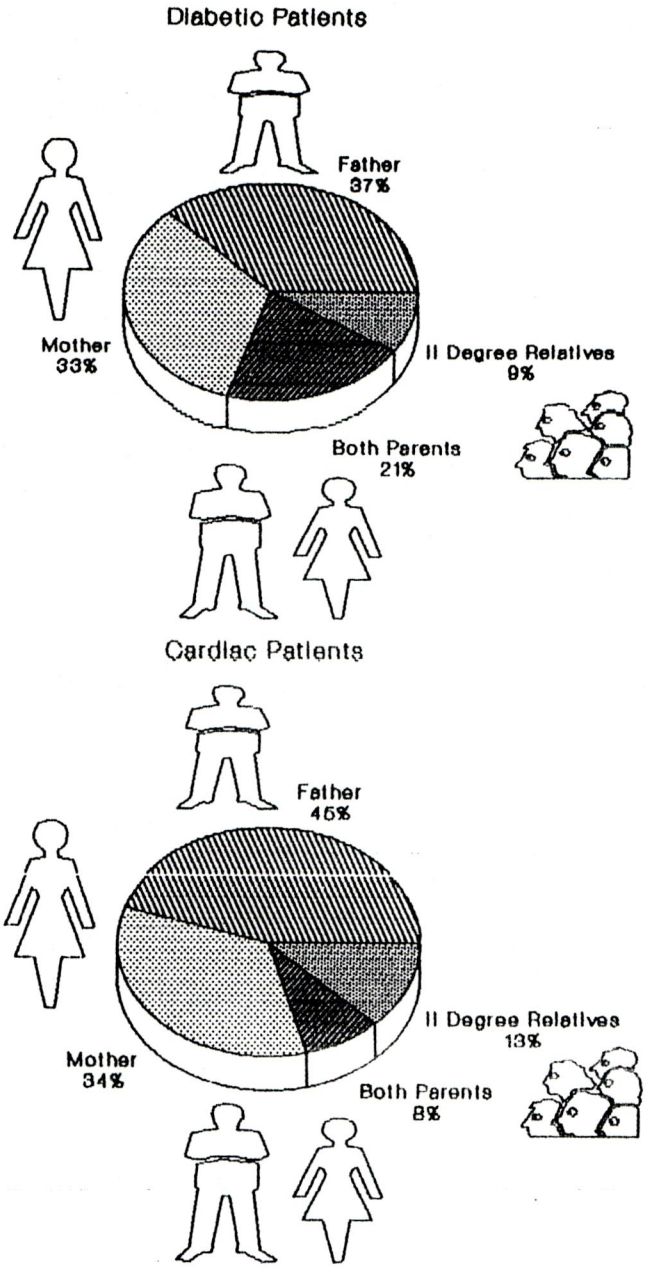
Family history	Diabetic Patient F		Diabetic Patient M		Total N=304		Cardiac Patients F		Cardiac Patients M		Total N=328	
	N	%	N	%	N	%	N	%	N	%	N	%
I Degree relatives												
Father	35	31.8	55	41.6	90	29.6	22	44	85	44.9	107	33.10
Mother	35	31.8	45	34.1	80	26.3	17	34	85	34.4	82	25.30
Both parents	30	27.3	20	15.2	50	16.4	5	10	15	7.9	20	6.19
Sub Total	**100**	**90.9**	**120**	**90.9**	**220**	**72.3**	**44**	**88**	**185**	**87.2**	**209**	**64.59**
II Degree relatives												
Cousins/ Siblings	5	4.5	7	5.3	12	9.8	2	4	8	4.2	10	8.20
Grand parents	2	1.8	3	2.3	5	4.1	3	6	9	4.76	12	10.76
Uncle/Aunt	3	2.7	2	1.5	5	4.2	1	2	7	3.7	8	5.70
Total	**110**	**100**	**132**	**100**	**242**	**100**	**50**	**100**	**189**	**100**	**239**	**100**

F - Female M - Male

Of the 242 diabetic patients who had family history of the disease, 220 (72.37 per cent) had a strong family history with either parent or both being diabetic and the rest 22 had a second degree relative being diabetic.

Among the 239 cardiac patients who had familial aggregation, 209 (63.7 per cent) inherited from first degree relatives, while 30 had second degree relatives.

Fig. 2. Family History of the Diseases



These findings are in accordance with Vardan (1995) and Ramachandran et al., (1992) who state that familial aggregation is an independant risk factor for Diabetes Mellitus and CardioVascular diseases.

2. Symptoms prompting medical advice by diabetic patients

Table VI lists the symptoms mentioned by diabetic patients which prompted medical advice.

TABLE VI

SYMPTOMS PROMTING MEDICAL ADVICE BY DIABETIC PATIENTS

Symptoms	Diabetic Patients	
	N	%
Polyuria	300	98.61
Polydypsia	285	93.75
Polyphagia	272	89.47
Fatique	157	51.64
Body pain	104	34.20
Weight loss	264	87.17
Delayed wound healing	120	39.47
Blurred vision	57	18.75
Skin itching	25	8.20

About 98.6 per cent of the diabetic patients complained of polyuria as a major symptom; others which were told at the time of examination by the physician were polydypsia, polyphagia, fatique, body pain, weight loss, delayed wound healing, blurred vision and skin itching.

3. Symptoms prompting medical advice by cardiovascular patients

Table VII lists the symptoms mentioned by cardiovascular patients which prompted medical advice.

TABLE VII

SYMPTOMS PROMPTING MEDICAL ADVICE BY CARDIOVASCULAR PATIENTS

Symptoms	Cardiac Patients	
	N	%
Chest pain	300	91.46
Palpitation	175	53.35
Breathlessness	107	32.62
Cough/cold	47	14.33
Radiation of pain to the arms	212	64.63
Hypertension	65	19.82
Body pain	40	12.19
Fatique	10	3.04

In cardiac patients, the most commonly reported complaint was chest pain by 300 patients while other symptoms presented at the time of check up were palpitation, breathlessness, cough, cold, radiating pain, hypertension, body pain, and fatique.

4. Complications in diabetic patients

Table VIII shows the complications present in Diabetic patients.

TABLE VIII

COMPLICATIONS IN DIABETIC PATIENTS

Age group (Years)	Disease duration (Years)	Average age of onset of Complications		Cerebro vascular	Peripheral vascular	Eye problems	Nerve pathy	Nephro pathy	Derma topathy	Others*	No Complication
20 - 30	1 - 5	30	F	--	7	--	--	2	--	2	3
			M	5	--	--	5	--	--	2	0
31 - 40	4 - 15	35	F	7	--	--	--	1	--	--	8
			M	17	--	--	3	--	--	--	14
41 - 50	5 - 25	44	F	9	5	3	--	3	--	--	12
			M	31	2	2	5	--	--	2	4
51 - 60	4 - 30	55	F	5	1	--	9	--	1	2	14
			M	18	4	1	13	--	--	2	2
61 - 70	5 - 35	69	F	7	2	--	--	--	1	1	5
			M	3	2	2	2	1	1	2	19
71 - 80	6 - 45	68	F	3	5	3	--	--	--	--	0
			M	4	1	1	2	--	--	--	6
81 - 90	8 - 50	76	M	2	1	--	--	1	1	--	0
Total				100	30	12	39	8	4	13	97

F - Female
M - Male
* Other complications include balanitis, pruritis vulvae and indigestion and elimination problems.

Except 97 patients (31.9 per cent), all the rest suffered from one or more of the complications, the chief among them being cardiovascular diseases pertaining to ischaemic heart disease, hypertension, myocardial infarction and stroke. Peripheral vascular complications include ulcer, gangrene, amputations. Cataract and glaucoma were found to be the chief eye problems. Neuropathy included numbness, polyneuropathy and peripheral vascular disease. Nephropathy included protein in urine while dermatopathy consisted of poor wound healing.

Listing the chronic complications of Diabetes Mellitus, Lyon et al., (1993) state them as cardiovascular disease, peripheral vascular disease, neuropathy, nephropathy and vision disorders.

Also as the age of the patients and duration of the disease increased, the number of complications were also on the rise, with more number of patients having had complications from 40 years onwards with a disease duration ranging from 5 to 50 years.

5. Complications in cardiovascular patients

Table IX shows the complications present in cardiovascular patients.

TABLE IX
COMPLICATIONS IN CARDIOVASCULAR PATIENTS

Age group (Years)	Disease duration (Years)	Average age of onset of Complications		Cerebro vascular	Peripheral vascular	Nephro pathy	Diabetes mellitus	No complications
20 - 30	1 - 5	30	F	--	--	1	--	5
			M	--				
31 - 40	4 - 15	35	F	--	--	--	12	8
			M	3	--	5	10	30
41 - 50	8 - 15	41	F	--	--	--	6	6
			M	12	--	--	17	29
51 - 60	5 - 12	54	F	--	--	1	10	15
			M	1	2	5	20	70
61 - 70	5 - 25	63	F	--	--	--	7	13
			M	--	2	3	15	22
71 - 80	6 - 40	74	F	--	--	1	3	2
			M	2	--	1	7	6
81 - 90	8 - 50	73	M	2	--	1	10	3
Total				20	4	19	121	210

F - Female M - Male

In cardiac patients, diabetes mellitus formed the major complication with 75 per cent of the patients being diabetic. This is in accordance with Chopra and Aggarwal (1992) who state that diabetes is known to be an independent risk factor for Coronary Artery disease and ischaemia is common among diabetic patients, particularly myocardial infarction.

Also as age and duration of the disease increases, the number of complications and also the persons who are inflicted by complications are on the increase.

6. Drugs taken

Of the 304 diabetic patients, 20 either decreased or increased the dosage of the oral hypoglycemic drugs themselves in accordance with the food intake. However, in cardiac patients, though self-medication was not observed, irregular intake of drugs was noticed in 10 patients.

C. DIETARY PRACTICES OF THE TARGET GROUP

1. Dietary regimentation followed

Out of the 304 diabetic patients, 183 (60 per cent) did not strictly adhere to their dietary regimen, out of whom 25 were newly diagnosed. 121 patients followed modified prescribed diets strictly, which were prescribed

by the physician and diet manual given by the dietitian who also did the counselling using the food exchange list in case of diabetic patients and diet sheet was provided for diabetic and cardiac patients.

The chief dietary guidelines were as per the exchange list for the diabetic patients and fat, salt restriction for cardiac patients..

In case of cardiac patients 200 (60.9 per cent) out of 328 patients did not strictly follow their dietary regimen, as most of the out patients rarely received any written diet sheet. Of the rest, 55 cardiac patients adhered to a modified diet as they had diabetes as a major complication.

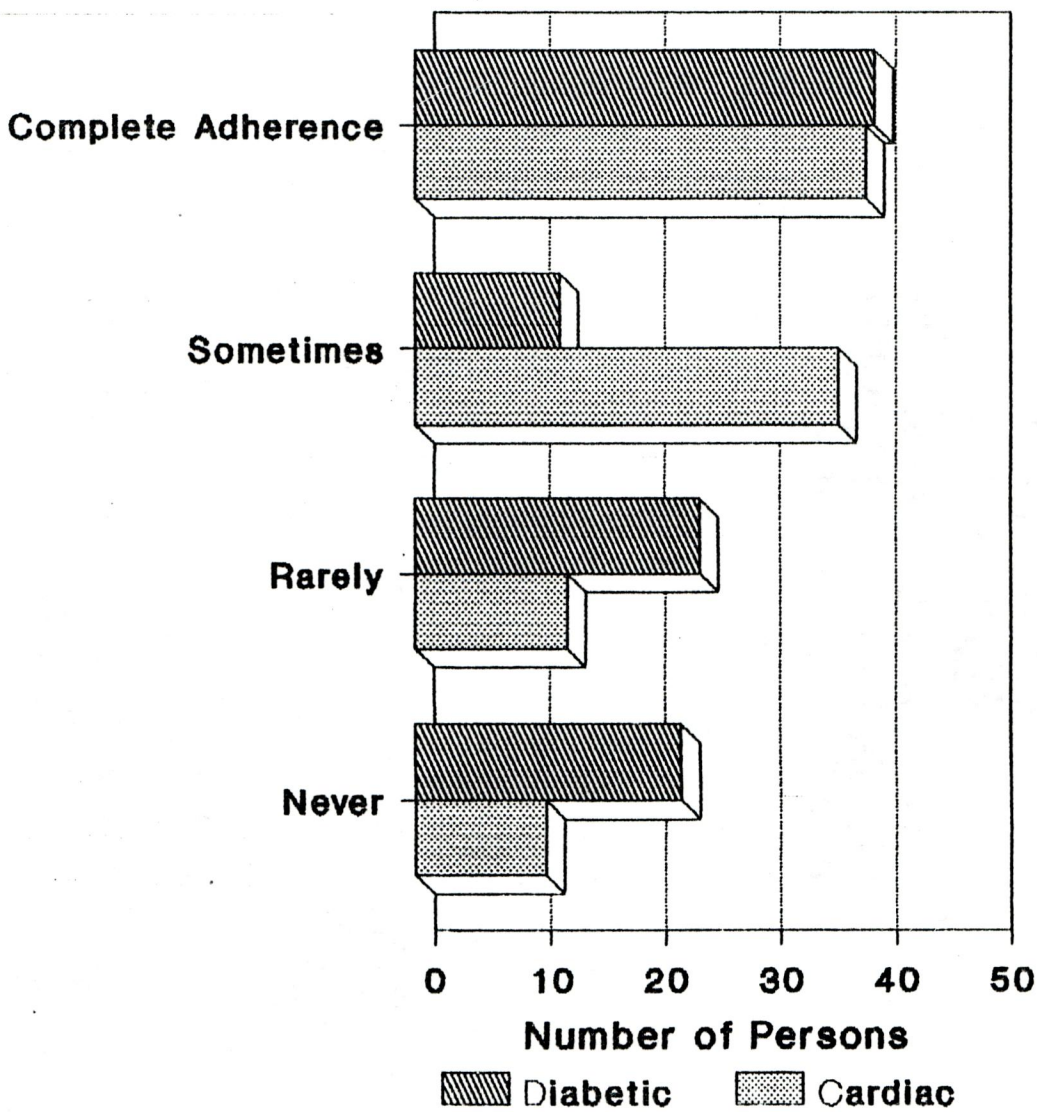
2. Compliance to the prescribed diet by the patients

Table X reflects the extent of complicance to the prescribed diet by diabetic and cardiovascular patients.

TABLE X
COMPLIANCE TO THE DIET PRESCRIBED

Extent of compliance	Diabetic Patients		Cardiac Patients		Total N=632	
	N	%	N	%	N	%
Complete adherence	121	39.80	128	39.02	249	98.82
Sometime	38	12.50	120	36.59	158	49.09
Rarely	75	24.61	43	13.11	118	37.78
Never	70	23.02	37	11.28	107	34.30
Total	304	100	328	100	632	100

Fig. 3. Compliance to the Prescribed Diet



It was encouraging to note that a total of 249 patients (121 diabetic and 128 cardiac patients) had complete adherence to the prescribed diets.

Arnolds **et al.** (1993) had opined that, though diet is the cornerstone of Diabetes management, diet is reported to be the biggest problem experienced by the patients. The present study contraindicates this opinion as the patients who never follow any dietary regimentation form only a total of 34.3 per cent.

The non adherence to the diets may be due to ineffective counselling.

3. Details of specific foods included or avoided to control blood glucose levels

Effective counselling in terms of dietary management has helped 253 patients out of 304(83.2 per cent) to avoid sugar completely, along with other concentrated sources of sugar like sweets, ice cream and other bakery products.

The foods used liberally were whole grains (151 persons), chappathi (225), vegetables (120), and bread (115). Also kazhi and kanji thought to reduce blood glucose levels were used by 155 patients. The foods which were restricted were fruits (200), vegetables (95), rice (121), non vegetarian items (77) and fried foods and snacks (130).

The main reasons stated for the inclusion and restriction of certain foods were to maintain blood glucose level and prevent further complications.

Effective counselling with food exchange lists will help diabetics choose a variety of foods instead of following tailor made diets which will decrease dietary compliance.

4. Details of specific foods included or avoided by the cardiovascular patients

About 175 patients avoided salt and saturated fat due to counselling received and 85 persons restricted unsaturated fat to 20-25g per day. Fried foods and salted foods were restricterd by 174 of them, restriction being due to the high caloric value which might lead to further complications.

The foods used liberally were whole grain cereals (282 persons), idli or steamed foods (175), vegetables (112), fruits (102) and greens (70) due to advice from doctor or dietitian highlighting their hypocholesterolemic effect and reduction calorie density in the diet.

5. Hypoglycemic and hypocholesterolemic agents used by diabetic and cardiovascular patients

Chiefly two substances namely, the juice of alfa-alfa grass (200 ml at a time) and fenugreek seeds in

buttermilk (5g in 100 ml buttermilk) were used by 50 cardio vasuclar and 75 diabetic patients as they were believed to reduce blood glucose level by stimulating insulin secretion and also have hypocholesterolemic effect.

Hypoglycemic effects of gums and pectins are well documented by Upadhyaya et al., (1988) who state that though high doses decrease the bio availability of nutrients, they have hypocholesterolemic and hypoglycemic effect in reduced amounts.

D. LIFESTYLE FACTORS INFLUENCING THE DISEASE

1. Mode of food consumption

Most of the patients(95 per cent) had the habit of consuming food along with their family members or colleagues. Some (39 per cent) stated the fact that this helped them to adhere the modified diets, while the rest (56 per cent) stated that this led them to indulge in liberal intake of foods.

2. Practice of consuming foods outside home

Only 50 persons (7.9 per cent) among the diabetic and cardiac patients had the habit of consuming foods outside, due partly to the dietary restrictions, and also due to lack of opportunity. Those who ate outside did so when they came for regular checkups.

3. Adherence to meal timings

All patients except for five females and 10 males (10 diabetic and 5 cardiac patients) adhered to strict meal timnings. The 15 persons who could not adhere to strict meal timings gave the reason that they where fasting on certain days or had Business engagements.

4. Habits in relation with eating

Many patients (95.5 per cent) reported having the habit of viewing television while consuming food.

Table XI shows the snacking habits present in diabetic and cardiovascular patients.

TABLE XI

SNACKING HABITS IN PATIENTS

Type of disease	Midmorning		Midafternoon		Latenight		Total	
	N	%	N	%	N	%	N	%
DM	112	36.84	102	33.55	25	8.20	230	78.60
CVD	96	29.27	112	34.14	52	15.85	260	79.26

DM - Diabetes Mellitus CVD - Cardiovascular Diseases

Though snacking habit was present, 90 per cent of the patients consumed snacks in the form of sundal, fruit and vegetable salads, whole fruit to bring down the peaks in the blood glucose levels, on advice from the dietitian. Rest 10 per cent were however consuming junk foods which could be eliminated only through effective counselling.

5. Type of exercise performed by diabetic patients

Table XII lists the type of exercise performed by Diabetic patients.

TABLE XII

EXERCISE PERFORMED BY DIABETIC PATIENTS

Age in years		Walking	Jogging	Noexercise	Total N	Total %
20 - 30	F	10	1	3	14	4.60
	M	2	1	1	4	1.31
31 - 40	F	3	1	12	16	5.26
	M	5	5	24	34	11.18
41 - 50	F	7	--	35	42	13.81
	M	14	10	22	46	15.13
51 - 60	F	--	--	32	32	10.52
	M	8	6	36	50	16.44
61 - 70	F	--	--	16	16	5.26
	M	10	--	22	32	10.52
71 - 80	F	--	--	2	2	0.65
	M	2	--	12	14	4.60
81 - 90	M	--	--	2	2	0.65
Total		**61**	**24**	**219**	**304**	**100**

F - Female M - Male

Considering the duration of the exercise performed, patients upto the age of 40 years performed for a time period of 30 to 60 minutes, while patients above 40 could do exercise only for 30 to 40 minutes on a maximum.

Out of 304, 219 patients did not perform any exercise. These patients had high waist-hip ratios. This result reflects the beneficial effects of performing regular exercise. The reason for not performing exercises were

stated as inability to do them, ignorance, and also lack of time.

6. Type of exercise performed by cardiovascular patients

Table XIII lists the type of exercise performed by cardiovascular patients.

TABLE XIII

EXERCISE PERFORMED BY CARDIOVASCULAR PATIENTS

Age in years		Walking	No exercise	Total N	Total %
20 - 30	F	--	6	6	1.82
	M	--	6	6	1.82
31 - 40	F	2	18	20	8.07
	M	4	24	28	8.53
41 - 50	F	--	12	12	3.65
	M	6	52	58	17.68
51 - 60	F	2	24	26	7.92
	M	12	60	72	21.95
61 - 70	F	--	20	20	6.09
	M	2	40	42	12.80
71 - 80	F	--	6	6	1.82
	M	--	16	16	4.87
81 - 90	M	--	16	16	4.87
Total		28	300	328	100

M - Male F - Female

Only 28 cardiac patients performed regular exercise in the form of walking for a duration of 30 to 40 minutes.

The non exercising group, were either advised by the doctor to take strict bedrest or abstain from any straining physical activity. On the contrary to the

diabetic patients, non exercising cardiac patients had lower waist hip ratios ranging from 0.95 to 1, but were significantly higher compared to normal values. But they were inflicted with complications especially diabetes mellitus, at an early age (30 to 40 years).

As per the opinion of Berger (1992) exercise plays a major role in the primary and secondary prevention or therapies and prevents obesity among diabetic and cardiac patients by increasing body's insulin sensitivity and decreasing cholestrol levels.

7. Smoking and related habits present among diabetic and cardiovascular patients

Table XIV states the smoking habits present among diabetic and cardiovascular males.

TABLE XIV

SMOKING HABIT AMONG DIABETIC AND CARDIOVASCULAR MALES

Duration of the habit (Years)	Disease type	Ex Present	Number of cigarettes/d					Total
			<5	5-10	11-15	16-20	>20	N
< 5	DM	E	0	5	3	1	0	9
		P	2	2	2	1	0	7
	CVD	E	1	3	0	2	0	6
		P	0	1	2	1	0	4
5 - 10	DM	E	1	2	0	3	5	11
		P	2	1	2	2	2	9
	CVD	E	0	3	1	4	7	15
		P	0	0	3	1	2	6
11 - 15	DM	E	5	1	1	5	8	20
		P	1	1	1	2	4	9
	CVD	E	2	5	1	4	7	19
		P	2	3	1	1	3	10
16 - 20	DM	E	2	8	0	7	2	19
		P	3	4	3	0	1	11
	CVD	E	2	7	2	5	3	19
		P	1	3	1	1	0	6
> 20	DM	E	1	3	4	6	7	21
		P	0	1	3	0	3	7
	CVD	E	2	2	5	4	10	23
		P	0	0	1	2	2	5
Total			27	55	36	52	66	236

E - Ex
P - Present

DM - Diabetes Mellitus
CVD - Cardiovascular diseases

The habit of smoking is relevantly high in both diabetic and cardiac patients with 76 per cent and 57 per cent respectively being smokers. Only 144 diabetic males and 196 cardiac males were non smokers.

The practice of smoking bidi and using paan was also existent. Among women 57 used paan and one smoked bidi.

Relationship exists between the number of cigarettes smoked and Body Mass Index and Waist Hip Ratio in both diabetic and cardiac males at five per cent significance level.

Of the 76 per cent of the diabetics who smoked, 50 per cent had complications and among the 57 per cent of the smokers among cardiac patients, 45 per cent were inflicted by complications.

Also the progress of the disease was faster in smokers, with more than one complication setting before the age of 50 years.

This concorded with Vardan (1995) who was of the opinion that the risk of developing heart disease and Diabetes Mellitus and their complications is directly proportional to the number of cigarettes smoked per day.

8. Alcohol habit in diabetic and cardiovascular males

Table XV shows the alcohol consumption pattern in diabetic and cardiovascular males.

TABLE XV

ALCOHOL CONSUMPTION PATTERN IN DIABETIC AND CARDIOVASCULAR MALES

Frequency of drinking	Type of Disease	Years of consumption <5	5-10	11-15	>15	Total N	%
Daily	DM	12	8	2	5	27	9.89
	CVD	11	2	1	4	18	6.59
Alternate days	DM	15	7	1	2	25	9.15
	CVD	10	6	0	1	17	6.23
Weekly once	DM	20	5	1	4	30	10.98
	CVD	25	7	2	2	36	13.19
Fortnightly	DM	5	4	3	4	16	5.86
	CVD	6	3	4	5	18	6.59
Monthly once	DM	2	8	2	5	17	6.23
	CVD	4	12	1	7	24	8.79
Occasionally	DM	3	10	6	1	20	7.33
	CVD	2	15	2	6	25	9.15
Total		**115**	**87**	**25**	**46**	**273**	**100**

DM - Diabetes Mellitus CVD - Cardiovascular diseases

About 74 per cent of diabetic and 60.5 per cent of cardiac patients were alcoholics, with the amount consumed ranging from 60 ml in the case of occasional drinkers and 360 ml in the case of heavy drinkers.

The alcohol consumption was related to the body dimensions namely Body Mass Index, and Waist Hip Ratio and it was observed that as the alcohol amount and the duration of the habit increased, the body dimensions, especially the Waist Hip Ratio increased significantly (five per cent significance) in both diabetic and cardiac males.

Those who drank alcohol occasionally (22.5 per cent) and those who did not smoke while drinking (20 per

cent) were not affected to a greater extent as were heavy smokers (55 per cent), who also smoked while drinking, but the former group had more complications than teetotallers.

Relationship between alcohol intake and coronary heart disease as stated by Thomson et al., (1988) shows a greater risk of coronary heart disease in those with the high alcohol intake and total mortality is higher.

In diabetics, excess alcohol consumption leads to neuropathy, liver damage and leads to low blood glucose levels, which may be quite severe (Sadikot, 1988).

9. Pattern of coffee and tea consumption among diabetic and cardiovascular patients

Table XVI shows the coffee and tea consumption pattern among diabetic and cardiovascular patients.

TABLE XVI

COFFEE AND TEA CONSUMPTION PATTERN AMONG DIABETIC AND CARDIOVASCULAR PATIENTS

Frequency (hours)		< 2		2 - 4		4 - 6		N	%
		C	T	C	T	C	T		
2 - 3	DM	0	7	8	5	45	4	69	22.69
	CVD	0	13	12	1	40	2	68	20.73
3 - 6	DM	0	0	28	4	18	3	52	17.10
	CVD	0	0	32	4	25	1	62	18.90
6 - 9	DM	10	0	12	0	1	5	28	9.21
	CVD	14	0	10	0	0	2	26	7.92
Total		24	20	102	14	129	17	305	100

DM - Diabetes Mellitus CVD - Cardiovascular disease
C - Coffee T - Tea

Out of 305 patients, both diabetic and cardiac consumed coffee and tea, the coffee consumers being more than those consuming tea.

Those who consumed greater than four cups of coffee per day (129 diabetic and cardiac patients) were at a greater risk for heart disease and Diabetes Mellitus due to the increased number of complications present in them. Others were similar to those who consumed tea or consumed neither coffee not tea.

E. PROFILE OF THE PATIENTS IN TERMS OF SELECTED BODY DIMENSIONS

1. Distribution of diabetic and cardiovascular patients (females) according to their Body Mass Index, Waist Hip Ratio and Triceps Skin Fold

Table XVII shows the distribution of diabetic and cardiovascular patients (females) according to their Body Mass Index, Waist Hip Ratio and Triceps Skin Fold.

TABLE XVII

BODY MASS INDEX, WAIST HIP RATIO AND TRICEPS SKIN FOLD OF THE DIABETIC AND CARDIOVASCULAR PATIENTS (FEMALES)

Age in Years	Type of Disease	BMI				WHR			TSF		
		< 18	18-25	25.1-30	> 30	≤ 0.85	0.86-1	> 1	≤ 25	26-35	> 35
20 - 30	DM	--	10	4	--	6	8	--	12	2	--
	CVD	--	3	3	--	2	2	2	4	2	--
31 - 40	DM	1	11	4	--	8	6	2	14	2	--
	CVD	--	14	6	--	14	4	2	16	4	--
41 - 50	DM	2	10	16	14	16	18	8	24	16	2
	CVD	1	1	6	4	4	8	--	6	6	--
51 - 60	DM	--	24	4	4	4	22	6	22	8	2
	CVD	--	6	14	6	12	10	4	11	14	1
61 - 70	DM	--	6	4	6	2	10	4	14	2	--
	CVD	--	10	4	6	6	6	8	12	6	2
71 - 80	DM	--	--	2	--	--	--	2	2	--	--
	CVD	--	2	2	2	--	6	--	2	4	--
Total		**4**	**97**	**69**	**42**	**74**	**100**	**38**	**139**	**66**	**7**

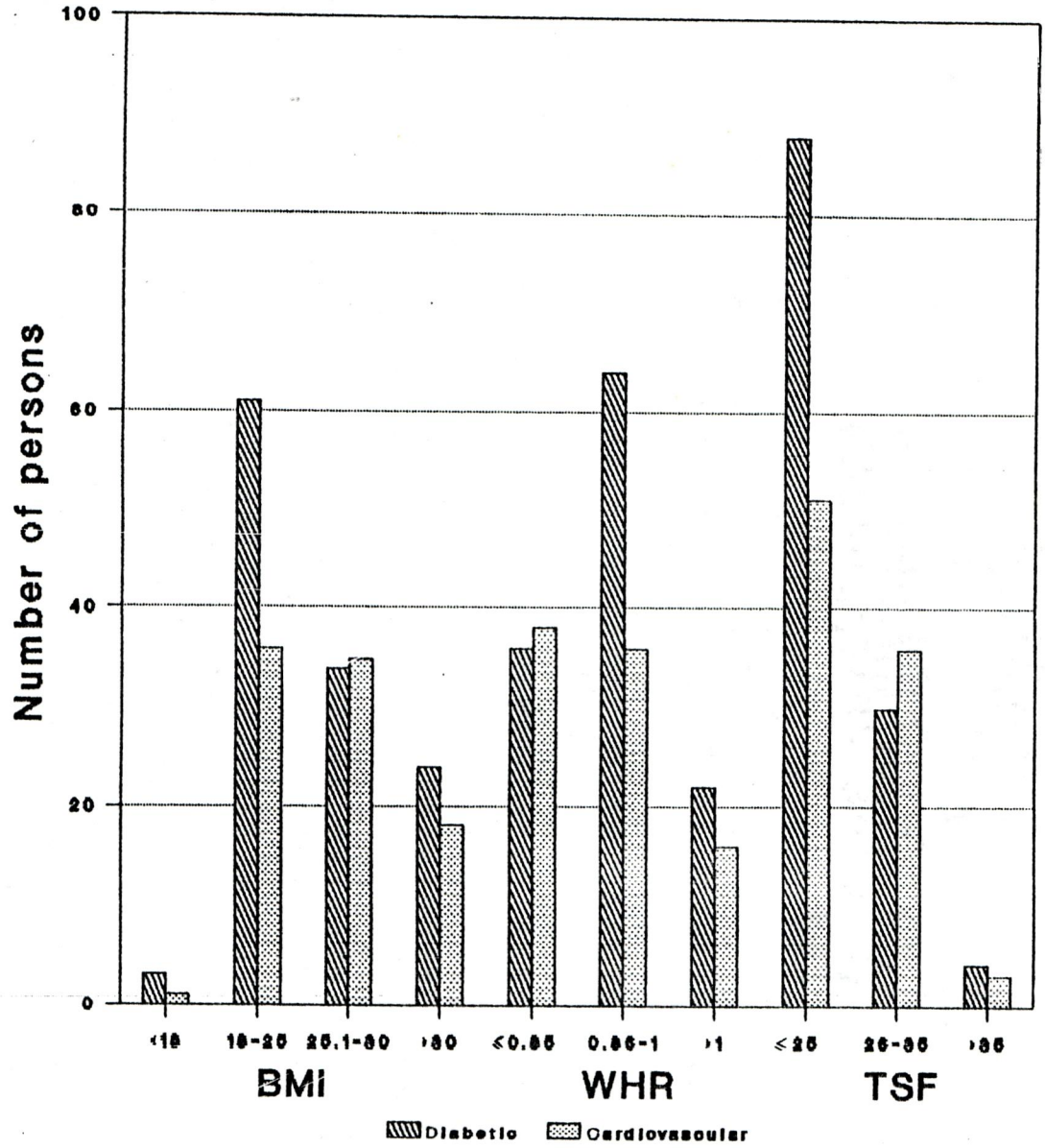
BMI = Body Mass Index WHR = Waist Hip Ratio
TSF = Triceps Skin Fold DM = Diabetes Mellitus
CVD = Cardiovascular Diseases

Considering the individual patients (for values see Appendix IV), the following observations were made regarding body dimensions:

1. As the age of the patients increased, correspondingly their Body Mass Index was not observed to increase in both diabetic and cardiac females.

2. As the age increased, Waist Hip Ratio correspondingly increased and a five per cent signifiance was observed in cardiac females and the signifiance was one per cent in diabetic females.

Fig. 5. BMI, WHR and TSF of Diabetic and Cardiovascular Patients (Females)



BMI - Body Mass Index
WHR - Waist Hip Ratio
TSF - Triceps Skin Fold

3. About 65 per cent of the diabetic and cardiac females fall in the normal range of Triceps Skin Fold. Agewise correlation was not observed in case of Triceps Skin Fold, as high values were found in patients of all age group.

4. Association between Body Mass Index and Waist Hip Ratio showed that in only 25 per cent of the patients both were found to be high while high Waist Hip Ratio (greater than 0.85) alone was observed in 65 per cent and high Body Mass Index (greater than 25) was noticed in 52.35 per cent of the patients.

5. When an association was drawn between Waist Hip Ratio and Triceps Skin Fold, no significance was observed between the two values and this was similar in the case of association between Body Mass Index and Triceps Skin Fold.

6. Of the 78 diabetic and 41 cardiac females who had complications, all of them had atleast one of the body dimensions on the higher side.

2. Distribution of diabetic and cardiovascular patients (males) according to their Body Mass Index, Waist Hip Ratio and Triceps Skin Fold

Table XVIII shows the distribution of diabetic and cardiovascular patients (males) according to their Body Mass Index, Waist Hip Ratio and Triceps Skin Fold.

TABLE XVIII

BODY MASS INDEX, WAIST HIP RATIO AND TRICEPS SKIN FOLD OF DIABETIC AND CARDIOVASCULAR PATIENTS (MALES)

Age in Years	Type of Disease	BMI				WHR			TSF		
		< 18	18-25	25.1-30	> 30	≤ 1.0	1.01-1.5	> 1.5	≤ 15	15-25	> 25
20 - 30	DM	--	4	--	--	4	--	--	2	2	--
	CVD	--	6	--	--	4	2	--	6	--	--
31 - 40	DM	4	16	10	2	22	12	--	22	12	--
	CVD	--	10	10	8	22	4	2	14	13	1
41 - 50	DM	4	20	18	4	20	24	2	31	14	1
	CVD	--	30	22	6	38	18	1	36	20	2
51 - 60	DM	--	30	12	8	24	24	12	40	9	1
	CVD	--	29	35	8	50	20	2	46	23	3
61 - 70	DM	--	22	8	2	20	10	2	46	23	3
	CVD	2	16	16	8	24	16	2	16	16	--
71 - 80	DM	2	8	2	2	4	10	--	9	3	2
	CVD	--	6	10	--	8	8	--	14	1	1
81 - 90	DM	--	--	2	--	--	2	--	--	2	--
	CVD	2	2	--	2	6	--	--	2	3	1
Total		**14**	**199**	**145**	**50**	**242**	**150**	**23**	**284**	**141**	**15**

BMI = Body Mass Index WHR = Waist Hip Ratio TSF = Triceps Skin Fold
DM = Diabetes Mellitus CVD = Cardiovascular Diseases

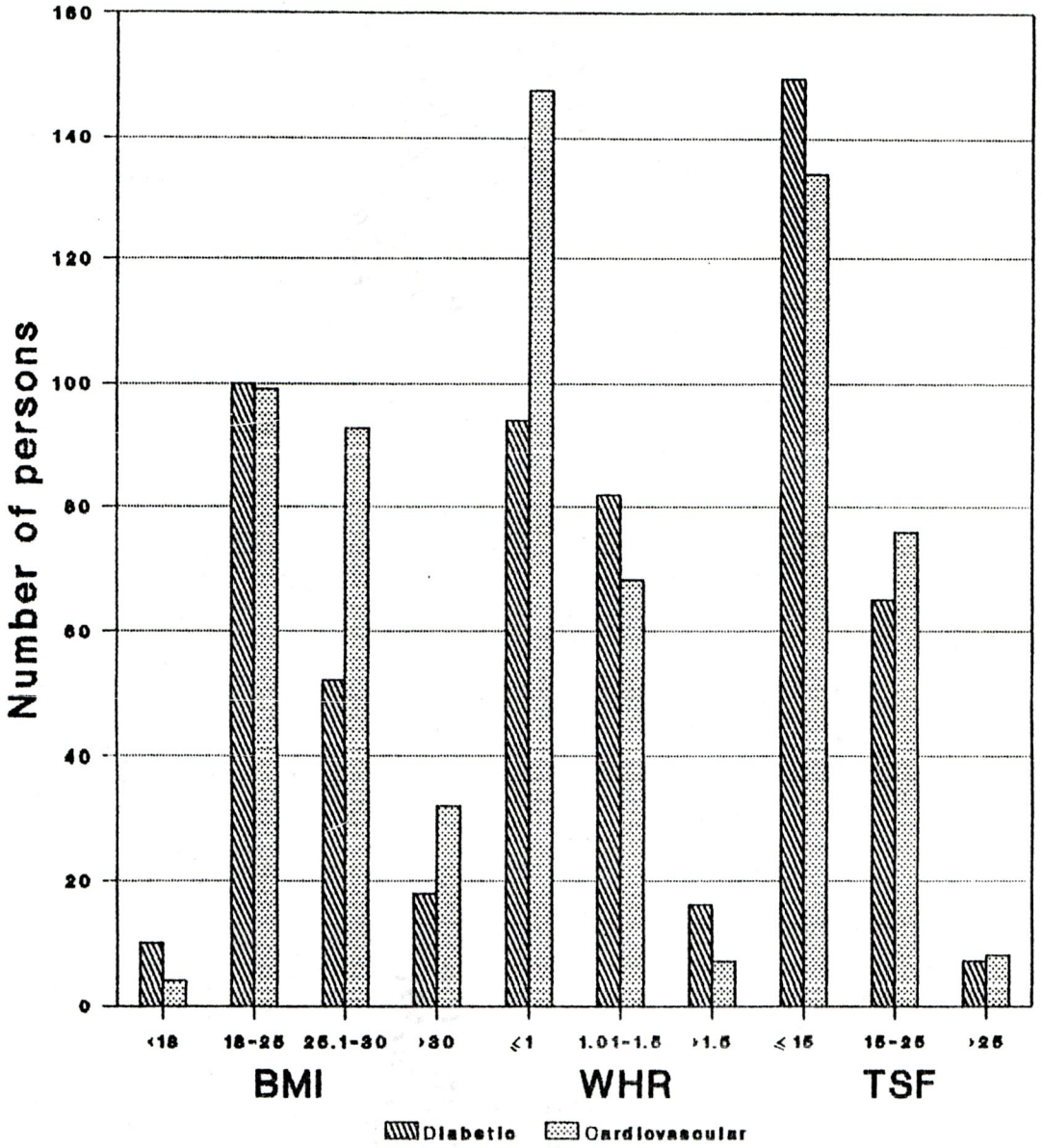
Males tend to have greater abdominal fat, thereby increasing their Waist Hip Ratio, to a greater extent than females.

In males the following observations were made on an individual basis (for values see Appendix IV) with regard to body dimensions:

1. In males, as the age increased Body Mass Index and Triceps Skin Fold were not found to increase significantly.

2. Association between age and Waist Hip Ratio revealed that, as the age increased, Waist Hip Ratio also increased

Fig. 6. BMI, WHR and TSF of Diabetic and Cardiovascular Patients (Males)



BMI - Body Mass Index
WHR - Waist Hip Ratio
TSF - Triceps Skin Fold

in both diabetic and cardiac males and the significance was observed at one per cent level.

3. Association between Body Mass Index and Waist Hip Ratio helps in concluding that both were high in 60 diabetic and cardiac males while only Waist Hip Ratio was high (greater than 1.0) in 41.9 per cent and Body Mass Index alone was high (greater than 25) in 46.42 per cent of the diabetic and cardiac patients.

4. Association between Body Mass Index and Triceps Skin Fold was not significantly observed.

5. Of the 176 diabetic and 123 cardiac males who had complications, all of them had either of the body dimensions on the higher side.

Kissebah **et al.**, (1985) have shown that its not just body fat *per se* that carried increased risk, but also the location or distribution of the fat.

According to Shimokata **et al.**, (1990), waist circumference was greater in men than women and increased with age, hip circumference showed no age or sex differences, sex differences in WHR were totally due to differences in waist circumference, increases in WHR with age occur in both men and women.

F. MEAN DAILY FOOD AND NUTRIENT INTAKE OF THE PATIENTS

1. Mean daily food intake of the diabetic and cardiaovascular patients

Table XIX shows the mean daily food intake of the diabetic and cardiovascular patients.

TABLE XIX

MEAN DAILY FOOD INTAKE OF THE DIABETIC AND CARDIOVASCULAR PATIENTS

Food items (g)	N=304 Diabetic Patients				N=328 Cardiac Patients			
	Male	SD	Female	SD	Male	SD	Female	SD
Cereals	255-360	174.25	242-300	141.01	280-450	120.21	220-420	141.42
Pulses	27-42	10.61	25-38	9.19	20-47	19.09	20-40	14.14
Leafy vegetables	20-55	24.75	27-58	21.92	22-58	25.46	25-60	24.75
Other vegetables	28-80	36.77	21-76	38.89	21-86	45.96	20-85	45.96
Roots and tubers	30-60	21.21	29-58	20.51	30-75	31.82	32-68	25.46
Fruits	20-25	3.54	20-25	3.54	20-30	7.07	20-25	3.54
Egg and fleshy foods	20-45	17.68	28-57	20.51	20-45	17.68	21-40	13.44
Milk (ml)	100-400	212.13	100-400	212.13	100-500	282.84	100-450	247.49
Fats and oils	20-25	3.54	20-25	3.54	5-10	3.54	5-15	7.07
Nuts and oilseeds	5-15	7.07	7-10	2.12	8-10	1.41	7-10	2.12
Sugar and Jaggery	--		--		20-25	3.54	18-20	1.41

SD - Standard Deviation

It was observed that the intake of cereals was 255 to 360 grams in men and 242 to 300 grams in women. Intake of pulses was 27 to 42 and 25 to 38 grams respectively in males and females. A reduction in the intake of fat was observed due to counselling from the dietitian to consume visible fat in the range of 20 to 25 grams of the poly unsaturated form. One significant factor was the reduction of consumption of fleshy foods in both males and females, an effect of counselling.

It was observed that in cardiac patients, the intake of cereals was 280 to 450 grams in males and 220 to 420 grams in females. Pulses were 20 to 47 and 20 to 40 grams respectively in males and females. Sugar and jaggery were consumed as a source of energy by the cardiac patients who reduced the amount of fats and oils to 5 to 10 grams and 5 to 15 grams (males and females respectively).

2. Mean daily nutrient intake of the diabetic and cardiovascular patients

Table XX shows the mean daily nutrient intake of the diabetic and cardiovascular patients.

TABLE XX

MEAN DAILY NUTRIENT INTAKE OF THE DIABETIC AND CARDIOVASCULAR PATIENTS

Nutrients	N=304 Diabetic Patients				N=328 Cardiac Patients			
	Male	SD	Female	SD	Male	SD	Female	SD
Energy (kcals)	1800-3500	1202.08	1960-3850	1336.43	1850-4200	1661.70	1875-4100	1573.31
Protein (g)	35-65	21.21	30-60	21.21	30-67.5	26.51	30-62.5	22.98
Fat (g)	30-75	14.14	35-80	17.67	20-50	21.21	25-50	17.67
Carbohydrates (g)	130-560	304.05	132-520	274.35	125-550	300.52	128-510	270.11

SD - Standard Deviation

From the above table, it can be observed that the energy intake of the diabetic males ranges from 1800 to 3500 KCals while that of females was 1960 to 3850. The

carbohydrate intake in grams was 130 to 560 and 132 to 520 for males and females respectively, while Lyon et al., (1993) give a recommendation of 60 per cent of the daily energy should come from carbohydrate which should be of the complex form, 12 to 20 per cent of the energy from protein and less than 30 per cent of the total energy from fat of the poly unsaturated form.

Among the cardiac patients, the energy intake in KCals was 1850 to 4200 and 1875 to 1400 in males and females respectively. Protein intake was observed to be 30 to 67.5 and 35 to 62.5 for males and females respectively.

G. ASSOCIATION BETWEEN THE VARIOUS RISK ASSESSMENT PARAMETERS AMONG THE SUBSAMPLE

1. Association between body mass index, waist hip ratio, fasting and postprandial blood glucose levels, total energy, carbohydrate and fat in selected diabetic patients

Appendix VI shows the association between the body dimensions, blood sugar levels and nutrient intakes in selected diabetic patients.

A positive correlation (at 5% level of significance) was noticed between WHR and nutrient intake in diabetic females, while in diabetic males an association was found only between Waist Hip Ratio and total energy and fat intake and not with carbohydrate intake. BMI was not positively correlated with nutrient intake in females.

A strong positive correlation (1% significance) was observed between fasting blood sugar and WHR in both males and females.

Central obesity was observed to be associated with hyperinsulinemia according to Vardan, (1995).

2. Association between body mass index, waist hip ratio total cholesterol, high density lipoprotein cholesterol, low density lipoprotein cholesterol, total energy, carbohydrate and fat in selected cardiovascular patients

Appendix VII shows the association between body dimensions, lipid profile and nutrient intake in selected cardiac patients.

Considering the cardiac patients, positive correlation was observed in both males and females between Total Cholesterol, LDL-cholesterol with the total energy and fat intake (5% level of significance) and also between WHR and the lipid fractions, but not with Body Mass Index.

HDL-cholesterol values fell as the WHR increased and it was statistically significant at one per cent level.

As per Ostlund et al., (1992), the level of HDL-cholesterol is inversely correlated with the ratio of the Waist to Hip circumference.

H. RISK ASSESSMENT INDEX

1. Risk assessment parameters

a. Body Mass Index

Males	Females	Marks
18 - 25	18 - 24	0
25 - 30	24 - 30	2
> 30	> 30	4

Obesity, or high body weight in relation to height plays a major role in the development of CHD, hypertension and Diabetes Mellitus. Excess mortality is evident in the case of BMI of greater than 30 (Nissinen et al., 1989).

In the present study BMI is positively correlated (at 5% significant level) to the blood glucose levels and hence to the presence of Diabetes Mellitus.

b. Waist Hip Ratio

Males	Females	Marks
≤ 1.0	≤ 0.85	0
1.01 - 1.5	0.86 - 1.0	2
> 1.5	> 1.0	4

Wadden et al., (1988) reported a positive correlation between the prevalence of diabetes and cardiovascular diseases by a higher fasting plasma triglyceride and glucose levels. However, the level of High Density Lipoprotein (HDL) cholesterol is inversely corelated with age (1% level of significance). Also Waist Hip Ratio (WHR) was positively correlated with the level of Total Cholesterol, Low Density Lipoprotein (LDL) cholesterol, blood sugar and inversely proportional to HDL-cholesterol.

c. Triceps Skin Fold

Males	Females	Marks
≤ 15	≤ 25	0
16 - 25	20 - 30	2
> 25	> 30	4

Orphanidon et al., (1994) state that disproportionate fat distribution indicated by measuring Triceps Skin Fold, plays a major role in the development of certain metabolic aberrations including Diabetes Mellitus and Cardiovascular diseases and ultimately influence mortality.

d. Family History

	Marks
No family history	0
II degree relatives	2
Either parent diabetic/cardiac	4
Both parents	6

Chance of developing diabetes as stated by Viswanathan (1993).

* If someone in the family has diabetes - 20%
* If one parent has diabetes - 40%
* If one parent has diabetes and the other parent is from a diabetic family - 70%
* If both parents are diabetic - 90%

In the present study, family history had a strong influence with 220 diabetics and 229 cardiac patients having I degree relatives as diabetics or cardiac patients.

e. Exercise

	Marks
Doing some exercise	0
Not performing any exercise	2

Regular exercise leads to a greater total weight loss and greater reduction of body fat percentage, decreases hyperlipidemia, hypertension and glucose intolerance (Wan et al., 1993).

In the present study, the 187 diabetic and cardiac patients who performed some form of physical activity had lower lipid profile (except HDL-cholesterol) and fasting blood glucose levels as also healthy WHR and BMI.

f. Smoking

	Marks
Not smoking at all and smoking < 5 cigarettes/day	0
5-10 cigarettes or bidis per day	2
10-20 Cigarettes or bidis per day	4
> 20 Cigarettes or bidis per day	6

Foreman et al., (1986) state that the occurence of health risk behaviours such as cigarette smoking is present more in overweight adults compared with the occurence in adults of average weight. Istvan et al., (1995) state that the number of cigarettes smoked is related to BMI among men and women smokers are also more prove to cardiovascular and non-cardiovascular diseases (Sandvik et al., 1995). In the present study, smoking was positively correlated at 5 per cent level of significance with the BMI and WHR. Also smokers (136 diabetic and cardiac patients) had high total and LDL-cholesterol fasting blood sugar and low HDL-cholesterol.

g. Alcoholism

	Marks
Teetotaller and < 30 ml/day	0
30 - 60 ml/day	2
60 - 120 ml/day	4
> 120 ml/day	6

Alcohol, according to Patel (1984) increases appetite and makes the patient eat more food (calories). It also increases the atherosclerosis of arteries and contributes to vascular complications.

Alcoholics were found to have higher BMI and WHR in both diabetic and cardiac patients. Alcoholism was also positively correlated (5 per cent level of significance) to the total energy and fat intake and also to the total and low density lipoprotein cholesterol and blood glucose levels.

h. Coffee Consumption

Number of cups per day	Marks
Not consuming coffee and	0
2 - 4 cups per day	2
4 - 6 cups per day	4
> 6 cups per day	

Patients consuming greater than 4 cups of coffee per day (129 diabetic and cardiac patients) had greater risk of cardiovascular diseases due to their high total and LDL-cholesterol and fasting blood sugar values and low HDL-cholesterol, in the present study.

2. Scoring of the risk assessment index

Patient A - Diabetic

	BMI A	WHR A	TSF A	Family History A
Exercise B	A + B 4 + 2	A + B 2	A + B 4	A + B 2
Cigarettes B	A + B 4	A + B	A + B	A + B
Alcoholism B	A + B 6	A + B	A + B	A + B
Coffee/day B	A + B 2	A + B	A + B	A + B
TOTAL SCORE = 26				RISK LEVEL = HIGH

Patient B - Cardiac

	BMI A	WHR A	TSF A	Family History A
Exercise B	A + B 2 + 2	A + B 2	A + B 2	A + B 2
Cigarettes B	A + B 4	A + B	A + B	A + B
Alcoholism B	A + B 4	A + B	A + B	A + B
Coffee/day B	A + B 2	A + B	A + B	A + B
TOTAL SCORE = 20				RISK LEVEL = MEDIUM

Patient C - Diabetic

	BMI A	WHR A	TSF A	Family History A
Exercise B	A + B 0 + 2	A + B 0	A + B 2	A + B 0
Cigarettes B	A + B 2	A + B	A + B	A + B
Alcoholism B	A + B 0	A + B	A + B	A + B
Coffee/day B	A + B 0	A + B	A + B	A + B
TOTAL SCORE = 6				RISK LEVEL = LOW

V. SUMMARY AND CONCLUSION

Diabetes Mellitus and Cardiovascular diseases are stated to be the major non communicable diseases of the world. In the etiology of these diseases, obesity plays an important role, which precipitates the disease by interacting with other factors, namely family history, dietary habits and lifestyle.

The main concept was to assess the level of obesity in a person, through body dimensions like height, weight, circumference of waist and hip and Triceps Skinfold and an association was drawn between these and other contributing factors. Back ground information regarding socio economic data, medical history, dietary pattern and life style factors were collected using an interview schedule and lipid profile and blood glucose (for a sub sample of 75 each of cardiovascular and diabetic patients) was done for diabetic and cardiovascular patients. Using the findings a risk assessment index was framed in order to find the level of risk for Diabetes Mellitus and Cardiovascular diseases in a person.

The following observations were made in this study:

1. The presence of Diabetes and Cardiovascular diseases is maximum in the age group of 41 to 60 years, with 170 (54 per cent) diabetic and 168 (50 per cent) cardiac patients out of 304 and 328 respectively.

2. Both the diabetic and cardiac patients belonged to various occupations, of which housewives were predominant among females and males were mostly (22.3 per cent) in clerical jobs.

3. Illiteracy was present at 61.48 per cent among diabetic and 44 per cent among cardiac females, a point to be

stressed even though female literacy is being given such impetus.

4. The monthly per capita income of the patients indicated a majority in the range of Rs.300-600 with 39.5 and 46.0 per cent respectively of diabetic and cardiac patients.

5. As age increased, Body Mass Index and Triceps Skin Fold were not significantly increasing, while a corresponding increase in the Waist Hip Ratio was observed in both diabetic and cardiac patients.

6. Association between Waist Hip Ratio and Body Mass Index was observed (at 5 per cent level of significance) while no significance was observed with Triceps Skin Fold measurements.

7. It was also observed that 254 diabetic and 164 cardiac patients who had either of the body dimensions on the higher side had complications and the age of onset of complications was observed to be less than 50 years.

8. Family history of the disease was observed with 72.37 per cent of diabetic and 63.7 per cent of cardiac patients having strong history of diabetes and cardiac diseases in their parents.

9. Both diabetic and cardiac patients complained of various symptoms at the time of consultation. The chief symptoms told by diabetic patients were polyuria, polydypsia, polyphagia, weight loss and fatigue while cardiac patients complained of chest pain, palpitation, radiation of pain to arms, breathlessness, and cough and cold.

10. The chief complications present among diabetic patients pertained to cerebrovascular diseases while that for cardiac patients was Diabetes Mellitus.

11. It was encouraging to find that 121 diabetic and 128 cardiac patients strictly adhered to their modified diets, prescribed by the physician, and translated into diet sheet by the dietitian. It was found that effective counselling with the help of food exchange lists helps in correct selection of food choices by diabetic and cardiac patients.

12. The two hypoglycemic and hypocholesterolemic agents used by 25 per cent of diabetic and 15 per cent of cardiac patients were fenugreek seeds in buttermilk and juice of alfa-alfa grass (Medicago sativa).

13. Of the lifestyle factors, exercise played a major role, with 85 diabetic and 28 cardiac patients effectively controlling the degree of obesity and also their blood glucose and serum lipid values.

14. Alcoholism and smoking had an adverse effect on the diabetic and cardiac patients as the habits hastened complications and were also associated with high Body Mass Index and Waist Hip Ratio.

15. Coffee consumption to a level of greater than 6 cups per day had an adverse effect on the patients with respect particularly to cardiac patients as the presence of complications were on the increase.

16. In the subsample of 75 diabetics, positive association (at 1 per cent significance) was observed between fasting blood sugar and Waist Hip Ratio in both males and females. Similarly, a positive correlation, at 5 per cent level of significance was noticed between Waist Hip Ratio and intake of proximate principles in diabetic females while in diabetic males association was found only between Waist Hip Ratio and total energy and fat intake.

17. In the subsample of 75 cardiac patients, positive correlation at 5 per cent significance was observed in both males and females between Total Cholesterol, Low Density Lipoprotein Cholesterol with the total energy and fat intake and also between Waist Hip Ratio and the lipid fractions. High Density Lipoprotein Cholesterol values fell as the Waist Hip Ratios increased and it was statistically significant at 1 per cent level.

18. Based on the findings of the present study, a risk assessment index was developed including the associated factors in the precipitation of diabetes mellitus and cardiovascular diseases to facilitate assessing the risk level for these diseases.

IMPLICATIONS OF THE STUDY

The risk assessment index could be used in hospitals as well as in health camps for substantiating further its use.

* Further studies could be directed between normal subjects and diabetic and cardiac patients on the role of body dimensions in the precipitation of these diseases.

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APPENDIX I

AVINASHILINGAM INSTITUTE FOR HOMESCIENCE AND HIGHER EDUCATION FOR WOMEN (DEEMED UNIVERSITY)

ASSOCIATION OF BODY MASS INDEX, WAIST HIP RATIO AND TRICEPS SKIN FOLD TO THE INCIDENCE OF DIABETES MELLITUS AND CARDIOVASCULAR DISEASES

INTERVIEW SCHEDULE TO ELICIT BACKGROUND INFORMATION OF PATIENTS WITH DIABETES MELLITUS/CARDIO VASCULAR DISEASES

BACKGROUND INFORMATION OF THE PATIENT

Name: Age:

Sex:

Narital Status Married/Single
Family type: Nuclear/Joint
Family size:

Old people		Adults		Adolescents		School		Preschool		Infants	
M	F	M	F	M	F	M	F	M	F	M	F

M = Male F = Female

Occupation: Total monthly income:
Monthly per capita income:

Educational status:

ANTHROPOMETRIC MEASUREMENTS

Height (cm):
Weight (Kg): Body Mass Index:

Weight Circumference (cm):
Hip Circumference (cm) : Waist Hip Ratio:
Triceps Skin Fold (mm)

MEDICAL HISTORY

Duration of the disease:

DIABETES MELLITUS/CARDIO VASCULAR DISEASE

Family history of the disease:

Type of relation	Age of onset	Duration	Diabetes Mellitu or Cardio Vascular Disease
I degree relatives			
II degree relatives			

Symptoms which prompted medical advice:

TYPES OF DIABETES MELLITUS

- ☐ Insulin Dependant Diabetes Mellitus
- ☐ Non Insulin Dependant Diabetes Mellitus
- ☐ Malnutrition Related Diabetes Mellitus
  - ☐ Protein Deficient Diabetes Mellitus
  - ☐ Fibre Calculus Pancreatic Diabetes

LIST OF COMPLICATIONS

1. Cerebrovascular
   - ☐ Stroke
2. Peripheral Vascular
   - ☐ Leg pain on exercising
     - ☐ at rest
   - ☐ Gangrene
   - ☐ Amputations

3. Retinopathy ☐ Yes ☐ No

- ☐ Vision affected
- ☐ Other eye problems
- ☐ Cataract
- ☐ Glaucoma

4. Neuropathy

- ☐ Peripheral
- ☐ Automatic
  - ☐ Numbness
  - ☐ Tingling
  - ☐ Infrequent voiding
  - ☐ Frequent voiding
  - ☐ Intermittent diarrhoea
  - ☐ Vomiting
  - ☐ Nausea
  - ☐ Fullness after eating small portions

5. Nephropathy

- ☐ Albumin casts
- ☐ Protein in urine
- ☐ Undergoing dialysis
- ☐ Others

6. Dermatopathy

- ☐ Infections
- ☐ Poor wound healing
- ☐ Xanthelasma

7. Others

- ☐ Pruritis Vulvae
- ☐ Balanitis

8. Indigestion/Elimination problems

- ☐ Ischaemic Heart Disease
  - ☐ Myocardial Infarction
  - ☐ Coronary Artery By-pass Graft
  - ☐ Angina Pectoris
- ☐ Congestive Heart Failure
- ☐ Hypertension

LIST OF COMPLICATIONS

1. Cerebrovascular

- ☐ Stroke

2. Peripheral Vascular

- ☐ Leg pain on exercising
  - ☐ at rest
- ☐ Gangrene
- ☐ Amputations

3. Diabetes Mellitus

Age of onset of complications Diabetes Cardiovascular

DRUGS TAKEN

☐ Prescribed by the physican

☐ Over-the-counter drugs

DIETARY PRACTICES

1. Dietary regimentation followed ☐ Yes ☐ No

   If yes, pinpoint the dietary regimentation

2. Compliance to the diet prescribed by the Doctor/Dietitian

   ☐ Complete adherence ☐ Sometimes

   ☐ Rarely ☐ Never

   Reasons

3. Mention the foods you

Use liberally	Reasons	Restrict	Reasons	Avoid	Reasons

4. Mention the special hypoglycemic or hypocholesterolemic or any other foods used

Foods Used	Reasons

LIFESTYLE

1. Is eating a group activity accompanied by talking?

   ☐ Yes ☐ No

2. How often are you in the practice of consuming foods outside or taking part in social gatherings?

Thrice a day Twice a day Once a day Alternate days Weekly once Fortnightly Once a month Occasionally (mention the period of time)	

3. Do you adhere to

☐ Strict meal timings ☐ Skip meals ☐ Fast

4. Have you got the habit of eating while watching television>?

☐ Yes ☐ No ☐ Sometimes/rarely

5. Do you snack in between meal times?

If yes, whether

☐ Midmorning
☐ Midafternoon
☐ Late night (drink/snack)

6. Type of physical activity

☐ Sedentary ☐ Moderate ☐ Heavy work

7a. Do you exercise

☐ daily
☐ alternate days
☐ weekly
☐ never

b. Type of exercise performed and duration

Exercise performed	Duration
Walking Aerobic exercise Yoga Sports Swimming Cycling Any other	

8. Number of hours spent in a gymnasium or health club and the type of activity done.

9. Smoking, Tobacco and Paan

Are you a smoker? ☐ Yes ☐ No

Are you an ex-smoker ☐ Yes ☐ No

If yes

Type	Number you use/used per day
Cigarette Bidi Tobacco (amount) Paan	

10. Use of Stimulant Beverages

Do you drink alcoholic beverages ☐ Yes ☐ No

If yes, whether it is

☐ Country liquor ☐ Distilled liquor

Frequency of drinking	Amount consumed
Daily Alternate days Once in three days Weekly once Fortnightly Monthly once Occasionally	

Years of consumption

11. Coffee/Tea

	Instant coffee
	Filter coffee
	Tea

Number of cups you drink per day

Frequency of drinking	Amount (in cups)
Every one hour One to five hours Six to twelve hours Greater than twelve hours	

APPENDIX II

ESTIMATION OF GLUCOSE

Estimation of glucose was done by glucose oxidase method.

Principle

β - D glucose + H_2O + O_2 ---------> gluconic acid + H_2O_2

The aldehyde group of β - D glucose is oxidised by glucose oxidase to give gluconic acid and hydrogen peroxide. If an oxygen acceptor is present, it will be converted to a coloured compound which can be measured.

Procedure

Test = pipetted 0.1 ml of the blood into 1.8 ml of sodium sulphate - zinc sulphate reagent in a centrifuge tube. Added 0.1ml to 0.5ml of sodium hydroxide, centrifuged and taken 1ml of the supernatent.

Blank: 1 ml of water.

Standards: 1 ml of a range of glucose solutions suitably diluted.

Added 5 ml of the combined O-tolidine reagent, mixing thoroughly. Left the tubes for 8 minutes exactly and read the colour at 625mm.

APPENDIX III

ESTIMATION OF LIPID PROFILE

1. Estimation of Total Cholesterol

Estimation of total cholesterol was done by enzymatic colorimetric method.

Principle

Cholesterol esters are hydrolysed by cholesterol esterase to free cholesterol and fatty acids. Free liberated cholesterols are oxidised by cholesterol oxidase to produce hydrogen peroxide, which couples with 4-amino antipyrine and phenol in the presence of peroxidase to form a coloured compound. The intensity of the colour developed is proportional to cholesterol concentration and is measured photometrically at 500nm wavelength (490 to 550nm) or with green filter.

$$\text{Cholesterol esters} \xrightarrow[\text{esterase}]{\text{Cholesterol}} \text{Cholesterol} + \text{Fatty acids}$$

$$\text{Cholesterol} \xrightarrow[\text{oxidase}]{\text{Cholesterol}} \text{cholest - 4 -Cn-3-one} + H_2)_2$$

$$H_2O_2 + \text{Phenol} + \text{4-aminoantipyrine} \xrightarrow{\text{Peroxidase}} \text{Red quinone} + H_2O_2$$

Procedure

Pipette into test tubes

	Blank (B)	Standard (S)	Test (T)
Chromogen reagent	1.0 ml	1.0 ml	1.0 ml
Standard	--	--	--
Sample	--	--	0.01 ml

Mix and incubate at 37°C for 10 minutes read absorbance of test and standard against the reagent blank at 550 nm wavelength (490 to 550 nm) or with green filter.

2. Estimation of Triglycerides

Estimation of triglycerides was done by enzymatic colorimetric method.

Principle

Serum triglycirides are hydrolysed to glycerol and free fatty acids by lipase. In the presence of Adinosine Tri Phosphate (ATP) and glycerokinase, the glycerol is converted to glycerol-3-phosphate, which is then oxidised by glycerol-3-phosphate oxidase to yield hydrogen peroxide. Hydrogen peroxide reacts in the presence of peroxidase with ESPAS (N-ethyl-N-sulphopropyl-m-aniside) and 4-amino antipyrine to form a coloured complex. The intensity of the colour developed is proportional to triglycerides concentration and is measured photometrically at 546nm (530 to 570 nm) or with green filter.

$$\text{Triglycerides} + H_2O \xrightarrow[\text{Lipase}]{\text{Lipoprotein}} \text{Glycerol} + \text{Fatty acids}$$

$$\text{Glycerol} + \text{ATP} \xrightarrow{\text{Glycerokinase}} \text{Glycerol-3-phosphate} + \text{ADP}$$

$$\text{Glycerol-3-phosphate} + O_2 \xrightarrow[\text{Oxidase}]{\text{Glycerol-3-phosphate}} H_2O_2 + \text{dihydroxyacetone phosphate}$$

$$H_2O_2 + \text{Aminoantipyrine} + \text{ESPAS} \xrightarrow{\text{Peroxidase}} \text{Quinoneimine} + H_2O$$

Procedure

Pipette into test tubes

	Blank (B)	Standard (S)	Test (T)
Chromogen reagent	1.0 ml	1.0 ml	1.0 ml
Standard	--	0.01 ml	--
Sample	--	--	0.01 ml

Mix and incubate at 37°C for 5 minutes read absorbance of test and standard against distilled water at 546 nm wavelength (530 to 570 nm) or with green filter.

3. Estimation of High Density Lipoprotein (HDL) cholesterol

Estimation of High Density Lipoprotein (HDL) cholesterol is done by enzymatic colorimetric method.

Principle

Concentration of HDL in determined on a seperated, soluble HDL fraction of serum and the equation is

$$\text{Cholesterol} + O_2 \xrightarrow[\text{Oxidase}]{\text{Cholesterol}} \text{Cholest-4-one-3-one} + H_2O_2$$

$$H_2O_2 + \text{Phenol} + \text{4-aminoantipyrine} \xrightarrow[\text{Quinoneimine chromogen}]{\text{Peroxidase}}$$

Procedure

Obtain a conical centrifuge for each serum sample. To each tube add 0.4 ml of serum and 0.05 ml of phosphotungstate precipitating reagent. Mix well centrifuge the tubes for 10 minutes at 2000 rpm. Obtain cuvettes for Blank, Standard and Serum.

Blank 0.05ml of water
Standard 0.05ml of cholesterol aqueous
Standard (50mg/100ml)

Serum 0.05ml of supernatent from centrifugation.

Added 1.0ml of cholesterol precipitating reagent to each cuvette and mixed well. Incubated for 10-15 minutes at 37°C. Added 2ml of saline water and read the absorbance of test and standard against the reagent blank of 510nm wavelength or with a green filter.

APPENDIX IV
BACKGROUND INFORMATION AND BODY DIMENSIONS OF THE PATIENTS

PAGE	DIS	TYPE	SEX	BMI	WHR	TSF	DIDU	COMPLI	OAGB	BI	BDUR	PACT	SM	NCIG	DYR	ALC	OAGB	DYR	NCFD	FRQ
46	dm		f	30.50	0.91	18.00	5	n	0	n	0.00	n	n	0	0.00	n	0	0.00	2	9
65	cvd	a	m	16.40	1.90	18.00	10	n chronic renal failure	50	n	0.00	s	y	15	10.00	n	50	10.00	2	6
37	cvd	b	m	23.14	0.88	12.00	5	n	0	n	0.00	s	n	0	0.00	n	0	0.00	4	3
54	cvd	h	m	27.50	1.01	13.00	1	n	0	n	0.00	s	n	0	0.00	n	0	0.00	5	4
60	cvd	p	m	33.13	1.01	15.00	1	diabetes mellitus and hypertension	60	n	0.00	s	y	20	20.00	y	60	20.00	3	6
60	cvd	r	f	25.70	0.92	22.00	12	hypertension	55	n	0.00	s	n	0	0.00	n	55	0.00	4	3
46	dm		f	30.50	0.90	18.00	5	n	0	n	0.00	s	n	0	0.00	n	0	0.00	2	6
32	dm		m	15.00	0.85	4.00	2	n	0	n	0.00	s	y	3	10.00	n	0	10.00	3	5
49	dm		f	28.20	1.03	28.40	2	n	0	n	0.00	s	n	0	0.00		0	0.00	3	6
57	dm		f	21.80	0.94	25.00	10	neuropathy-numbness	57	n	0.00	s	n	0	0.00	n	57	0.00	2	12
40	dm		f	28.80	0.90	20.00	5	n	0	n	0.00	s	n	0	0.00	n	0	0.00	61	2
72	dm		f	27.00	1.20	17.00	8	gangrene	2	n	0.00	s	n	0	0.00	n	2	0.00	1	12
75	dm		m	15.20	0.94	4.00	8	neuropathy-numbness	1	n	0.00	s	y	301	50.00	n	1	50.00	31	6
61	dm		m	25.00	1.05	21.00	1	neuropathy-numbness	1	n	0.00	s	y	51	37.00	y	1	37.00	21	6
60	dm		f	25.00	1.00	25.40	5	n	0	n	0.00	s	n	0	0.00	n	0	0.00	0	0
26	dm		f	24.00	0.83	18.00	1	n	0	n	0.00	s		0	0.00	n	0	0.00	0	0
33	dm		f	24.00	0.80	23.80	0	n	0	n	0.00	s	n	0	0.00	n	0	0.00	4	3
33	dm		m	25.10	0.97	11.00	0	peripheral-tingling	52	y	30.00	s	n	0	0.00	n	52	0.00	151	2
61	dm		f	40.00	1.20	33.00	5	n	0	n	0.00	s	n	0	0.00	n	0	0.00	3	8
65	cvd	h	f	21.62	1.14	27.00	0	n	0	n	0.00	s	n	0	0.00	n	0	0.00	3	7
54	dm		f	21.46	0.89	18.20	3	hypertension	54	n	0.00	s	n	0	0.00	n	54	0.00	3	6
60	dm		m	19.42	0.89	18.20	8	ihd	58	n	0.00	s	y	401	20.00	y	58	20.00	5	3
64	dm		f	25.00	1.04	20.00	10	ht	64	n	0.00	s	n	0	0.00	n	64	0.00	3	9
49	dm		f	24.70	1.03	18.00	7	amputation r leg	37	n	0.00	s	y	5	15.00	n	37	15.00	3	5
56	dm		m	25.00	0.90	11.20	3	n	0	y	45.00	s	n	0	0.00	y	0	0.00	3	5
30	dm		f	26.19	0.86	25.00	1	gangrene r leg	0	n	0.00	s	n	0	0.00	n	0	0.00	6	3
38	dm		m	24.90	1.00	13.40	2	n	0	y	50.00	s	n	0	0.00	n	0	0.00	2	6
50	dm		m	18.90	1.04	14.00	4	n	0	y	30.00	s	n	0	0.00	n	0	0.00	5	4
65	dm		m	24.80	1.00	14.80	5	peripheral-numbness	63	y	45.00	s	y	201	15.00	y	63	15.00	2	6
36	dm		m	21.62	0.97	14.40	0	n	0	n	0.00	s	y	10	20.00	y	0	20.00	41	5
43	dm		m	23.84	0.90	9.20	6	n	0	n	0.00	s	y	10	15.00	n	0	15.00	51	4
55	dm		m	25.00	1.02	10.00	0	n	0	n	0.00	m	n	0	0.00	n	0	0.00	0	0
69	dm		m	25.78	0.97	13.80	0	ht	55	n	0.00	s	n	0	0.00	n	55	0.00	0	0
47	dm		f	29.00	0.70	29.80	0	n	0	n	0.00	s	n	0	0.00	n	0	0.00	4	3
56	dm		m	23.20	1.07	13.00	0	n	0	n	0.00	s	y	101	40.00	n	0	40.00	2	8
65	dm		f	27.00	0.90	14.00	0	n	0	n	0.00	s	n	0	0.00	n	0	0.00	7	2
50	dm		m	20.90	1.02	6.40	7	cataract	50	y	20.00	s	y	7	20.00	n	50	20.00	2	8
39	dm		m	26.50	1.02	19.40	6	n	0	y	30.00	s	n	0	0.00	n	0	0.00	3	3
54	dm		m	24.12	1.00	8.00	0	ht	54	n	0.00	s	y	101	10.00	n	54	10.00	4	5

50	dm		f	25.20	0.87	18.00	5	nephropathy-albumin casts	50	n	0.00	s	n	0	0.00	n	50	0.00	1	8
49	dm		f	28.50	0.88	19.00	2	n	0	n	0.00	s	n	0	0.00	n	0	0.00	3	6
68	dm		n	18.68	0.97	5.00	4	gangrene	68	n	0.00	s	n	0	0.00	n	68	0.00	0	0
50	dm		f	31.27	0.82	33.30	5	n	0	n	0.00	s	n	0	0.00	n	0	0.00	2	7
42	dm		n	24.40	1.05	9.00	6	ht	40	y	10.00	s	n	0	0.00	y	40	0.00	3	8
73	dm		n	21.60	1.01	8.00	0	n	0	y	30.00	s	n	0	0.00	n	0	0.00	31	6
40	dm		n	21.80	0.97	7.40	0	n	0	n	0.00	s	n	0	0.00	n	0	0.00	31	8
43	dm		n	27.09	1.06	19.00	3	n	0	y	30.00	s	n	0	0.00	n	0	0.00	21	8
39	dm		n	22.70	1.02	12.00	3	n	0	n	0.00	s	y	4	21.10	y	0	21.10	2	5
26	dm	g	f	24.28	0.79	19.50	0	n	0	y	30.00	s	n	0	0.00	n	0	0.00	0	0
44	dm		f	27.00	0.90	15.00	10	ht	42	y	30.00	s	n	0	0.00	n	42	0.00	31	6
43	dm		n	17.60	0.90	4.20	2	neuropathy-numbness	41	y	20.00	s	y	8	25.10	y	41	25.10	41	5
43	dm		n	22.36	0.98	7.00	6	gangrene	43	n	0.00	s	n	0	0.00	n	43	0.00	31	7
39	dm		n	23.00	0.95	7.20	8	n	0	y	60.00	s	y	10	20.00	y	0	20.00	4	5
56	dm		n	25.96	1.04	7.00	24	n	0	n	0.00	s	y	10	10.00	n	0	10.00	5	3
47	dm		n	21.60	1.13	9.00	12	n	0	y	30.00	s	n	0	0.00	y	0	0.00	21	4
38	dm		f	23.89	0.99	11.00	4	n	0	n	0.00	s	n	0	0.00	n	0	0.00	2	5
47	dm		f	21.70	1.00	27.00	0	peripheral-numbness=neuropathy	47	n	0.00	s	n	0	0.00	n	47	0.00	3	6
28	dm		f	23.00	0.78	19.00	10	n	0	n	0.00	s	n	0	0.00	n	0	0.00	1	0
58	dm		n	35.78	1.19	18.00	10	ihd	56	y	60.00	s	n	0	0.00	n	56	0.00	1	0
68	dm		f	31.14	0.86	20.00	10	n	0	n	0.00	s	n	0	0.00	n	0	0.00	2	7
31	dm		f	21.90	0.85	19.00	5	pruritis vulvae	31	n	0.00	s	n	0	0.00	n	31	0.00	4	3
52	dm		f	27.60	0.79	22.00	9	neuropathy-numbness	52	n	0.00	s	n	0	0.00	n	52	0.00	3	5
40	dm		f	21.90	1.11	27.00	8	ihd	38	n	0.00	s	n	0	0.00	n	38	0.00	4	4
33	dm		f	19.10	0.83	13.40	4	n	0	n	0.00	s	n	0	0.00	n	0	0.00	3	6
37	cvd	h	n	30.90	1.02	20.00	2	protein in urine,diab	37	n	0.00	s	n	0	0.00	y	37	0.00	5	4
34	dm		f	20.90	0.84	12.00	0	n	0	n	0.00	s	n	0	0.00	n	0	0.00	3	5
55	dm		f	24.69	1.06	28.00	2	n	0	n	0.00	s	n	0	0.00	n	0	0.00	1	0
49	dm		f	28.06	0.78	13.00	7	amputation r leg	48	n	0.00	s	n	0	0.00	n	48	0.00	5	3
44	dm		n	23.14	0.89	10.00	4		0	n	0.00	s	n	0	0.00	n	0	0.00	3	4
30	dm		f	21.85	0.88	29.00	5	n	0	y	30.00	s	n	0	0.00	n	0	0.00	2	6
30	dm		n	23.89	0.96	8.00	0		0	n	0.00	s	n	0	0.00	n	0	0.00	31	5
65	dm		f	20.20	1.00	15.00	7	ht,cataract	64	n	0.00	s	n	0	0.00	n	64	0.00	2	8
57	dm		n	22.30	0.96	7.00	4	n	0	y	30.00	s	n	0	0.00	n	0	0.00	4	4
51	cvd	a	n	23.17	1.05	19.00	20	impaired r fn,ht and dm	47	n	0.00	s	y	30	20.10	n	47	20.10	2	5
78	dm		n	27.20	1.09	13.00	0	n	0	n	0.00	s	n	0	0.00	n	0	0.00	3	6
30	dm		f	28.80	0.93	13.00	0	both feet ulcer	30	n	0.00	s	n	0	0.00	n	30	0.00	6	3
55	dm		n	28.30	0.99	14.20	13		0	y	60.00	s	n	0	0.00	n	0	0.00	4	5
45	cvd	a	n	17.85	0.92	11.00	14	n	0	n	0.00		n	0	0.00	y	0	0.00	0	0
45	dm		n	24.90	1.06	9.00	0	n	0	n	0.00	s	y	20	15.20	n	0	15.20	6	5
63	dm		n	18.20	1.08	9.00	4	n	0	y	40.20	s	n	0	0.00	n	0	0.00	2	5
70	dm		f	18.00	0.80	13.00	0	pruritis vulvae	70	n	0.00	s	n	0	0.00	n	70	0.00	0	0
48	dm		n	29.10	1.00	21.00	5		0	y	20.30	s	y	2	20.30	n	0	20.30	0	0
70	dm		n	27.80	1.05	14.00	5		0	n	0.00	s	n	0	0.00	n	0	0.00	3	4
66	cvd	a	f	32.80	0.96	38.00	5	dm	66	n	0.00	s	n	0	0.00	n	66	0.00	3	6
65	dm		n	23.50	0.94	6.20	0		0	n	0.00	s	n	0	0.00	n	0	0.00	3	6
55	dm		n	27.00	1.00	18.00	10	gangrene r toe	55	n	0.00	s	n	0	0.00	y	55	0.00	6	4

42	dm		f	25.00	0.89	16.00	6	ht	42	n	0.00	s	n	0	0.00	n	42	0.00	0	0
58	dm		f	20.80	0.90	14.00	15	gangrene	58	n	0.00	s	n	0	0.00	n	58	0.00	4	4
50	dm		f	24.89	1.08	22.00	0	n	0	n	0.00	s	n	0	0.00	n	0	0.00	6	3
80	dm		m	23.16	1.00	9.00	24	neuropaty-tingling	80	n	0.00	s	n	0	0.00	n	80	0.00	1	0
50	dm		m	27.90	1.00	18.00	1	ht	50	n	0.00	s	n	0	0.00	n	50	0.00	3	4
64	dm		m	20.50	0.99	8.00	20	n	0	y	30.00	s	n	0	0.00	n	0	0.00	21	4
45	dm		m	26.29	1.20	23.00	4	numbness r toe	45	y	15.00	m	n	0	0.00	y	45	0.00	0	0
52	dm		m	25.50	1.03	13.00	10	usa	52	n	0.00	s	y	40	20.10	n	52	20.10	3	3
45	dm		m	19.48	1.02	6.20	2	ht	41	n	0.00	s	y	12	13.10	y	41	13.10	2	6
58	dm		f	20.90	0.99	16.20	7	polyneuropathy	57	n	0.00	s	n	0	0.00	n	57	0.00	3	5
58	dm		f	28.39	0.89	18.20	8	n	0	n	0.00	s	n	0	0.00	n	0	0.00	3	4
42	dm	m	f	11.64	0.78	2.80	2	n	0	n	0.00	s	n	0	0.00	n	0	0.00	102	4
46	dm		m	25.00	1.00	7.00	7	non healing ulcer	46	n	0.00	s	y	23	20.00	y	46	20.00	2	6
48	cvd	b	m	40.40	1.09	10.20	7	dm	42	n	0.00	s	n	0	0.00	y	42	0.00	4	3
49	cvd	b	m	29.04	1.03	23.00	15	n	0	n	0.00	s	y	15	25.00	n	0	25.00	5	2
63	cvd	a	m	23.00	0.94	20.00	10	dm	58	n	0.00	s	y	23	30.00	n	58	30.00	3	5
58	cvd	h	m	25.88	0.98	27.00	2	mi	57	y	40.00	s	y	20	20.00	n	57	20.00	2	6
56	cvd	h	m	30.34	1.00	13.00	10	dm and mi	50	n	0.00	s	n	0	0.00	n	50	0.00	4	3
70	cvd	r	m	25.90	1.10	12.00	12	dm	60	n	0.00	s	n	0	0.00	n	60	0.00	8	2
58	cvd	h	f	24.60	0.95	20.00	2	n	0	n	0.00	s	n	0	0.00	n	0	0.00	3	5
70	cvd	r	m	25.70	0.93	11.00	10	dm	69	n	0.00	s	y	20	25.01	n	69	25.01	4	5
51	cvd	h	f	33.30	1.00	28.00	5	n	0	n	0.00	s	n	0	0.00	n	0	0.00	6	3
24	cvd	h	f	26.78	1.05	30.00	3	n	0	n	0.00	s	n	0	0.00	n	0	0.00	0	0
74	dm		m	32.44	1.15	18.00	2	ihd	73	n	0.00	s	n	0	0.00	n	73	0.00	0	0
42	cvd	b	m	26.49	0.94	12.50	5	ht	41	n	0.00	s	y	15	25.00	y	41	25.00	1	0
50	cvd	b	m	27.55	1.04	20.00	5	n	0	n	0.00	s	n	0	0.00	n	0	0.00	7	3
62	cvd	p	f	25.54	1.13	23.00	1	n	0	n	0.00	s	n	0	0.00	n	0	0.00	2	5
30	cvd	b	m	21.54	0.97	13.50	1	dm	30	n	0.00	s	n	0	0.00	n	30	0.00	4	3
55	cvd	p	m	33.13	1.02	13.00	4	dm	2	y	20.00	s	y	20	25.00	n	2	25.00	4	3
39	cvd	h	f	23.55	0.82	24.00	2	n	0	n	0.00	s	n	0	0.00	n	0	0.00	2	6
65	cvd	a	m	32.16	1.00	20.00	8	dm	5	n	0.00	s	y	20	40.00	n	5	40.00	3	4
53	cvd	b	m	25.80	0.86	12.00	3	n	0	n	0.00	s	y	13	13.00	n	0	13.00	4	5
59	cvd	m	m	23.50	0.96	12.40	2	n	0	n	0.00	s	y	4	20.00	n	0	20.00	5	3
58	cvd	b	m	23.14	1.00	12.00	2	n	0	n	0.00	s	y	7	25.00	n	0	25.00	4	4
46	cvd	b	m	32.60	1.00	13.00	7	cerebrovascular attack	45	n	0.00	s	y	40	40.00	y	45	40.00	7	3
78	cvd	b	m	27.12	0.90	15.00	15	dm	68	n	0.00	s	y	20	50.00	n	68	50.00	3	6
50	cvd	r	m	36.50	1.50	18.00	7	n	0	y	20.00	s	n	0	0.00	y	0	0.00	5	4
80	dm		m	19.91	1.17	17.00	30	cataract	55	n	0.00	s	y	10	15.01	y	55	15.01	3	7
63	dm		f	36.10	0.89	24.00	15	cataract and leg pain-pvd	55	n	0.00	s	n	0	0.00	n	55	0.00	5	3
64	dm		m	26.95	0.96	20.20	20	renal calculi	60	y	60.00	s	n	0	0.00	n	60	0.00	2	8
42	dm		f	32.90	0.76	31.00	1	ht and redness of eye	42	y	30.00	s	n	0	0.00	n	42	0.00	2	8
35	dm		m	20.40	0.89	8.00	10	n	0	n	0.00	s	y	2	10.00	y	0	10.00	15	2
70	dm		m	22.68	1.07	17.00	14	ht	55	n	0.00	s	y	6	20.03	y	55	20.03	101	3
40	dm		m	31.74	0.95	16.00	5	ht	38	y	60.00	s	n	0	0.00	n	38	0.00	42	4
53	dm		f	24.53	-0.78	13.00	1	neuropathy-numbness	53	n	0.00	s	y	41	12.03	n	53	12.03	4	3
53	dm		f	24.78	1.04	21.00	4	gangrene	53	n	0.00	s	n	0	0.00	n	53	0.00	21	12
45	dm		m	27.60	1.06	20.20	6	chd	43	n	0.00	s	n	0	0.00	n	43	0.00	1	12
46	dm		f	19.21	0.79	15.00	2	n	0	n	0.00	s	n	0	0.00	n	0	0.00	1	0

45	cvd	b	m	25.17	1.17	23.00	0	n	0	n	0.00	s	y	20	16.01	n	0	16.01	6	4
47	dm		m	25.45	1.00	20.00	2	gangrene	46	n	0.00	s	y	20	27.01	y	46	27.01	0	0
66	dm		m	24.69	1.04	20.00	10	ht	64	n	0.00	s	y	10	15.00	n	64	15.00	0	0
58	cvd	a	m	26.42	0.90	17.00	2	pvd	56	n	0.00	s	y	20	20.10	n	56	20.10	0	0
63	cvd	b	m	24.00	0.89	16.00	5	n	0	n	0.00	s	y	20	29.10	n	0	29.10	5	3
49	cvd	a	m	21.37	12.00	12.00	2	dm	47	n	0.00	s	y	15	20.10	n	47	20.10	2	6
59	cvd	b	m	19.48	1.00	11.00	10	dm	58	y	30.20	s	y	7	15.01	y	58	15.01	103	5
52	cvd	a	f	37.30	1.00	18.00	2	n	0	n	0.00	s	y	7	20.02	n	0	20.02	5	5
53	cvd	p	m	25.00	1.00	17.00	10	dm	48	y	40.00	s	y	45	20.10	n	48	20.10	301	4
76	cvd	a	m	26.12	1.10	15.00	10	dm	71	n	0.00	s	n	0	0.00	n	71	0.00	5	3
58	cvd	a	m	25.32	1.00	15.00	5	n	0	n	0.00	s	y	18	28.10	n	0	28.10	6	0
24	cvd	h	f	27.00	0.87	25.00	1	renal transplant	24	n	0.00	s	n	0	0.00	n	24	0.00	0	0
53	cvd	r	f	25.01	1.26	13.00	2	n	0	n	0.00	s	n	0	0.00	n	0	0.00	4	2
63	cvd	r	f	40.00	1.01	27.00	5	dm	60	n	0.00	s	n	0	0.00	n	60	0.00	2	5
49	cvd	h	f	25.72	0.75	12.00	10	dm	41	n	0.00	s	n	0	0.00	n	41	0.00	3	4
61	cvd	b	m	32.43	1.00	20.00	15	dm	55	n	0.00	s	y	23	45.00	n	55	45.00	7	3
56	cvd	h	f	26.94	0.94	15.00	10	n	0	n	0.00	s	n	0	0.00	n	0	0.00	8	2
27	cvd	a	m	22.50	0.92	11.00	0	n	0	n	0.00	s	y	10	6.10	y	0	6.10	71	3
50	cvd	p	m	24.12	0.93	20.00	3	dm	49	n	0.00	s	n	0	0.00	n	49	0.00	12	2
56	cvd	a	m	24.30	1.13	12.00	6	dm	53	n	0.00	s	y	12	13.00	n	53	13.00	2	4
66	cvd	a	f	24.39	0.90	11.00	10	n	0	n	0.00	s	n	0	0.00	n	0	0.00	4	2
45	cvd	b	m	28.00	1.00	25.00	3	n	0	n	0.00	s	y	15	25.11	n	0	25.11	2	5
44	cvd	h	m	24.09	1.00	21.00	3	n	0	n	0.00	s	y	20	20.11	y	0	20.11	3	5
52	cvd	a	f	28.45	0.79	32.00	3	n	0	y	60.00	s	n	0	0.00	n	0	0.00	5	3
55	cvd	r	m	24.70	1.00	20.00	2	n	0	n	0.00	s	n	0	0.00	y	0	0.00	5	3
50	cvd	b	m	25.21	1.02	0.00	1	n	0	n	0.00	s	y	8	27.10	n	0	27.10	3	5
67	cvd	a	m	25.00	1.05	15.00	10	dm	64	n	0.00	s	n	0	0.00	n	64	0.00	5	2
67	cvd	b	m	26.19	1.00	15.00	27	dm	55	n	0.00	s	y	14	18.10	n	55	18.10	7	3
50	cvd	b	m	25.21	1.02	20.20	1	n	0	n	0.00	s	y	8	26.11	n	0	26.11	4	3
67	cvd	b	m	25.00	1.05	15.00	10	dm	62	n	0.00	s	n	0	0.00	n	62	0.00	4	5
32	cvd	a	m	30.50	0.87	13.00	2		0	n	0.00	s	y	20	10.00	y	0	10.00	3	4
34	cvd	r	f	22.42	0.75	21.70	0	n	0	y	20.30	s	n	0	0.00	n	0	0.00	5	4
40	cvd	b	m	27.70	1.04	25.00	3		0	n	0.00	s	y	10	30.00	n	0	30.00	3	4
66	cvd	h	f	29.56	1.09	18.00	10	dm	64	n	0.00	s	n	0	0.00	n	64	0.00	3	2
50	cvd	b	m	28.26	1.04	17.00	2		0	y	25.00	s	n	0	0.00	y	0	0.00	5	2
57	cvd	a	f	28.58	1.06	25.00	0		0	n	0.00	s	n	0	0.00	n	0	0.00	6	3
52	cvd	b	m	20.80	1.07	20.00	0		0	y	20.00	s	y	23	30.00	y	0	30.00	10	3
39	dm		f	22.85	0.95	12.00	16	protein in urine	37	y	30.02	s	n	0	0.00	n	37	0.00	0	0
41	dm		f	27.08	0.87	28.00	3		0	y	25.00	s	n	0	0.00	n	0	0.00	2	0
44	dm		m	26.42	1.13	17.00	2	ht,ketoacidosis	43	y	30.02	s	y	4	20.10	y	43	20.10	5	4
55	dm		m	30.12	1.07	12.00	15	amputation	50	n	0.00	s	n	0	0.00	n	50	0.00	3	6
45	dm		m	25.54	1.00	12.00	8	stroke	40	n	0.00	s	y	6	30.10	n	40	30.10	2	6
50	dm		f	27.57	0.78	26.00	2	glaucoma	48	n	0.00	s	n	0	0.00	n	48	0.00	3	5
47	dm		m	30.70	1.07	16.00	5	gangrene	43	n	0.00	s	y	8	15.00	n	43	15.00	9	3
58	dm		m	24.47	1.37	19.00	6	gangrene	57	n	0.00	s	y	30	35.10	y	57	35.10	8	4
83	dm		m	29.41	1.19	18.00	25	stroke	65	n	0.00	s	y	10	40.10	y	65	40.10	5	4
46	cvd	a	m	21.90	0.92	12.00	2		0	y	25.00	s	y	12	13.10	n	0	13.10	41	3
45	cvd	h	m	26.20	0.89	12.00	2	dm	45	n	0.00	s	n	0	0.00	y	45	0.00	0	0
67	cvd	h	m	25.30	0.80	18.00	1		0	n	0.00	s	y	20	30.11	n	0	30.11	2	0
72	cvd	a	m	25.95	1.13	12.00	5	dm	71	n	0.00	s	y	12	40.11	y	71	40.11	3	5
55	cvd	b	f	30.80	0.83	27.00	5	dm	52	n	0.00	s	n	0	0.00	n	52	0.00	3	3
51	cvd	h	m	25.78	0.94	17.00	15		0	n	0.00	s	y	12	40.03	n	0	40.03	7	2

33	cvd	r	f	29.00	0.78	29.00	1		0	n	0.00	s	n	0	0.00	n	0	0.00	4	2
53	dm		m	22.90	1.01	7.20	2	peripheral-numbness	53	y	30.25	s	y	20	20.10	y	53	20.10	2	6
32	dm		m	14.30	0.86	4.00	0	peripheral numbness	32	n	0.00	s	y	10	15.00	y	32	15.00	2	6
55	dm		f	23.00	1.24	27.00	8	ihd	52	n	0.00	s	n	0	0.00	n	52	0.00	5	4
48	dm		m	17.03	0.80	10.00	2		0	y	20.20	s	n	0	0.00	y	0	0.00	3	5
55	dm		f	31.30	0.94	19.00	12	n	0	n	0.00	s	n	0	0.00	n	0	0.00	2	7
60	dm		m	22.41	1.07	14.00	3	dermatopathy-poor wound healing	59	y	45.00	s	n	0	0.00	y	59	0.00	3	5
63	dm		m	24.90	1.03	24.00	0		0	y	60.05	s	n	0	0.00	n	0	0.00	2	8
60	dm		m	23.77	1.04	9.00	6	decreases vision	60	n	0.00	s	n	0	0.00	y	60	0.00	1	0
68	dm		m	22.89	0.99	20.00	20	gangrene	67	y	45.00	s	n	0	0.00	n	67	0.00	4	4
53	dm		m	24.05	1.10	13.00	0		0	n	0.00	s	n	0	0.00	n	0	0.00	31	4
54	dm		m	22.71	1.03	10.00	0		0	n	0.00	s	n	0	0.00	n	0	0.00	2	4
58	dm		m	20.50	0.98	9.00	20		0	y	20.02	s	y	20	25.01	n	0	25.01	4	3
60	dm		f	19.51	0.87	19.00	0		0	n	0.00	s		0	0.00		0	0.00	2	5
51	dm		f	24.60	0.88	22.00	6	gallbladder stones removal	50	n	0.00	s		0	0.00		50	0.00	2	8
22	dm		m	23.98	0.97	18.00	0		0	n	0.00	s	n	0	0.00	n	0	0.00	31	5
43	cvd	r	m	25.00	0.86	11.20	0		0	n	0.00	s	y	10	20.00	n	0	20.00	3	2
48	cvd	r	m	24.09	1.08	6.80	2	ihd	49	n	0.00	s	n	0	0.00	n	49	0.00	21	4
52	cvd	h	f	29.50	0.92	29.00	1	dm	51	n	0.00	s		0	0.00	n	51	0.00	3	3
84	cvd	a	m	34.75	0.99	20.00	6		0	n	0.00	s	n	0	0.00	n	0	0.00	6	2
50	cvd	h	m	24.70	0.93	12.00	7	dm	43	n	0.00	s	n	0	0.00	n	43	0.00	5	3
53	cvd	a	m	26.42	1.00	13.00	2	dm	52	n	0.00	s	n	0	0.00	n	52	0.00	3	5
65	cvd	b	m	29.90	1.02	9.00	5		0	n	0.00	s	y	20	20.10	n	0	20.10	3	5
59	cvd	b	m	26.42	0.89	9.00	5		0	n	0.00	s	n	0	0.00	y	0	0.00	4	5
42	cvd	a	m	23.50	0.80	13.00	0		0	n	0.00	s	y	15	20.10	y	0	20.10	5	3
45	cvd	h	m	24.22	0.90	10.20	1	n	0	n	0.00	s	n	0	0.00	y	0	0.00	4	5
32	cvd	a	m	21.30	0.85	6.80	2	n	0	y	20.00	s	n	0	0.00	n	0	0.00	3	4
70	cvd	r	m	32.12	0.94	13.50	5	n	0	n	0.00	s	y	21	40.11	n	0	40.11	5	3
45	cvd	r	f	27.50	0.93	25.40	12	dm	3	n	0.00	s	n	0	0.00	n	3	0.00	4	3
75	cvd	h	f	33.80	0.93	28.00	8	dm crf	72	n	0.00	s	y	8	40.03	n	72	40.03	2	6
32	cvd	h	f	24.30	0.75	12.00	5		0	n	0.00	s	n	0	0.00	n	0	0.00	3	3
55	cvd	a	m	25.00	0.80	11.00	6		0	n	0.00	s	n	0	0.00	y	0	0.00	3	4
62	cvd	a	m	20.75	0.98	15.00	10	dm	55	y	25.00	s	n	0	0.00	n	55	0.00	4	4
55	cvd	b	f	28.70	0.71	8.00	2		0	n	0.00	s	n	0	0.00	n	0	0.00	3	5
68	cvd	r	f	33.16	0.86	32.00	5	dm	66	n	0.00	s	y	6	20.13	n	66	20.13	4	5
48	cvd	h	f	27.50	0.93	28.00	3		0	n	0.00	s	n	0	0.00	n	0	0.00	2	6
54	cvd	a	m	27.56	0.92	17.00	5	dm	50	n	0.00	s	y	12	20.01	y	50	20.01	3	3
83	cvd	h	m	15.60	0.76	7.00	1	n	0	n	0.00	s	y	8	40.10	n	0	40.10	4	3
55	cvd	b	f	28.70	0.86	18.80	2		0	n	0.00	s	n	0	0.00	n	0	0.00	3	5
63	cvd	h	m	27.20	1.20	18.00	10	dm	59	y	30.00	s	n	0	0.00	y	59	0.00	3	5
74	cvd	r	f	19.17	0.96	14.00	0		0	n	0.00	s	n	0	0.00	n	0	0.00	3	4
39	dm		m	24.80	1.05	19.00	0		0	y	30.03	s	n	0	0.00	n	0	0.00	3	3
74	cvd	b	m	28.90	0.93	15.00	40	dm	40	n	0.00	s	n	0	0.00	n	40	0.00	4	2
71	cvd	r	m	24.70	1.00	10.00	6	dm	65	n	0.00	s	n	0	0.00	n	65	0.00	3	6
40	cvd	h	m	23.70	0.89	12.00	3		0	n	0.00	s	n	0	0.00	n	0	0.00	2	6
58	cvd	p	m	28.90	1.14	18.00	2	dm	56	n	0.00	s	y	20	15.10	n	56	15.10	5	2
42	cvd	a	m	23.70	0.95	11.00	2	mi	40	n	0.00	s	y	15	15.10	n	40	15.10	4	2
57	cvd	r	m	29.40	1.18	13.00	20		0	n	0.00	s	y	10	20.10	n	0	20.10	2	6

56	cvd	b	m	28.90	1.08	10.20	2		0	n	0.00	s	y	10	20.11	n	0	20.11	3	4
72	cvd	r	f	25.30	1.00	12.00	2		0	n	0.00	2	n	0	0.00	n	0	0.00	2	3
40	cvd	m	f	20.30	0.78	13.00	4		0	n	0.00	s	y	3	10.03	n	0	10.03	3	5
40	dm		m	20.00	0.95	6.00	6	n	0	n	0.00	s	y	2	12.00	n	0	12.00	2	6
50	dm		m	21.14	0.88	9.00	20	n	0	n	0.00	s	y	3	20.10	y	0	20.10	2	6
40	dm		m	24.00	1.05	12.00	5	n	0	n	0.00	s	n	0	0.00	n	0	0.00	2	3
48	dm		m	27.30	1.03	12.00	6	sexual inadequacy	45	y	30.00	s	n	0	0.00	y	45	0.00	2	4
38	dm		f	25.50	1.00	23.00	5	n	0	n	0.00	s	n	0	0.00	n	0	0.00	2	5
37	dm		m	25.00	1.04	12.00	0		0	n	0.00	s	n	0	0.00	n	0	0.00	0	0
55	dm		m	23.20	0.96	10.00	4		0	y	20.00	s	n	0	0.00	n	0	0.00	2	4
29	dm		f	23.80	0.91	19.00	0		0	n	0.00	s	n	0	0.00	n	0	0.00	1	0
55	dm		m	24.50	0.99	12.20	6		0	n	0.00	s	y	40	12.10	y	0	12.10	4	3
36	dm		m	25.90	0.89	23.00	0		0	n	0.00	s	n	0	0.00	y	0	0.00	2	4
53	cvd	a	f	28.60	0.78	27.00	1	dm	53	n	0.00	s	n	0	0.00	n	53	0.00	3	6
23	cvd	a	m	23.40	0.89	12.00	3	n	0	n	0.00	s	n	0	0.00	n	0	0.00	5	3
60	cvd	m	m	24.60	1.00	16.00	10	n	0	n	0.00	s	y	20	30.10	n	0	30.10	4	2
36	cvd	b	m	25.95	0.89	12.00	4	dbtic ketoacidosis	35	n	0.00	s	y	2	8.00	n	35	8.00	4	5
39	cvd	a	m	32.52	0.89	27.00	5	n	0	y	30.00	s	y	39	20.10	y	0	20.10	5	3
31	cvd	a	m	24.39	0.97	24.00	1	n	0	n	0.00	s	y	4	10.00	n	0	10.00	3	2
45	cvd	b	m	30.00	0.88	14.00	3	n	0	n	0.00	s	n	0	0.00	y	0	0.00	3	5
45	cvd	b	m	23.07	1.00	15.00	0		0	n	0.00	s	n	0	0.00	n	0	0.00	3	5
40	cvd	a	f	24.90	1.09	27.00	1	n	0	n	0.00	s	n	0	0.00	n	0	0.00	2	4
55	cvd	r	m	39.00	0.95	20.00	10	dm	50	n	0.00	s	y	15	18.10	n	50	18.10	4	2
55	cvd	a	m	23.04	0.89	11.00	7		0	n	0.00	s	y	20	25.11	n	0	25.11	2	4
43	cvd	b	m	24.50	0.98	17.00	3	dm	41	n	0.00	s	y	15	20.10	y	41	20.10	3	4
58	dm		f	32.30	0.92	32.00	5	vaginal infection	58	n	0.00	s	n	0	0.00	n	58	0.00	2	4
59	cvd	h	f	23.90	0.98	27.00	18	dm	56	n	0.00	s	n	0	0.00	n	56	0.00	3	4
66	cvd	b	f	25.00	0.79	12.00	15		0	n	0.00	s	n	0	0.00	n	0	0.00	4	2
65	cvd	p	m	28.90	1.08	12.00	10		0	n	0.00	s	y	20	10.10	n	0	10.10	4	2
35	cvd	r	m	29.33	1.15	22.00	0		0	n	0.00	s	y	10	15.00	n	0	15.00	2	4
65	cvd	r	m	19.10	0.96	7.00	3	mi	63	n	0.00	s	y	30	29.11	n	63	29.11	4	3
75	dm		m	23.28	1.15	20.00	5	mi and ihd and gangrene of foot	73	n	0.00	s	y	40	40.10	n	73	40.10	5	2
51	dm		m	22.05	0.95	8.20	6	miand ihd and r toe amputation	49	n	0.00	s	y	30	25.10	n	49	25.10	7	2
61	cvd	b	m	28.00	0.97	10.00	5		0	n	0.00	s	y	30	15.10	y	0	15.10	5	3
68	cvd	p	m	26.00	1.15	25.00	5	dm	63	n	0.00	s	y	45	30.10	n	63	30.10	5	3
46	cvd	b	m	23.43	1.02	20.00	2	pericarditis	38	n	0.00	s	n	0	0.00	y	38	0.00	3	2
32	cvd	a	f	20.30	0.89	20.00	0		0	n	0.00	s	n	0	0.00	n	0	0.00	4	2
23	cvd	m	f	20.00	0.75	15.00	5		0	n	0.00	s	n	0	0.00	n	0	0.00	5	3
54	cvd	b	m	25.39	0.98	12.00	0	cad	54	n	0.00	s	y	10	30.00	y	54	30.00	3	6
60	cvd	a	f	27.50	0.91	21.00	6	dm	55	n	0.00	s	n	0	0.00	n	55	0.00	4	2
36	cvd	b	m	24.20	0.95	25.00	0		0	n	0.00	s	n	0	0.00	y	0	0.00	6	4
50	cvd	r	f	37.00	0.94	28.00	2	n	0	n	0.00	s	n	0	0.00	n	0	0.00	2	5
73	cvd	b	m	24.40	0.86	9.00	4		0	n	0.00	s	y	15	40.11	y	0	40.11	31	5
50	dm		f	27.45	0.97	19.80	0		0	n	0.00	s	n	0	0.00	n	0	0.00	31	4
35	dm		m	28.30	0.95	13.20	0	mi	35	n	0.00	s	n	0	0.00	n	35	0.00	4	3
68	cvd	r	m	22.48	0.95	8.00	1	mi and ihd	67	n	0.00	s	n	0	0.00	y	67	0.00	51	4
36	cvd	r	m	32.50	0.96	20.00	0		0	n	0.00	s	y	3	15.00	n	0	15.00	3	5

83	cvd	h	m	19.08	0.80	7.20	1	0	n	0.00	s	n	0	0.00	n	0	0.00	4	3
60	dm		m	28.62	0.95	17.00	5 usa	60	n	0.00	s	n	0	0.00	n	60	0.00	7	3
60	cvd	b	f	40.40	0.80	30.00	10	0	n	0.00	s	n	0	0.00	n	0	0.00	5	4
52	cvd	h	m	25.30	1.00	14.00	0	0	n	0.00	s	y	25	37.01	y	0	37.01	2	4
55	dm		m	18.80	0.86	4.00	15 usa and ht and pvd	50	n	0.00	s	n	0	0.00	y	50	0.00	3	4
50	cvd	a	f	30.59	0.87	19.00	12 dm and ht	42	n	0.00	s	n	0	0.00	n	42	0.00	5	4
55	cvd	a	f	22.90	0.85	20.00	12 dm	44	n	0.00	s	n	0	0.00	n	44	0.00	6	3
60	cvd	a	m	25.90	0.94	11.00	10 nephrotic syndrome	55	n	0.00	s	n	0	0.00	y	55	0.00	4	2
64	cvd	h	m	32.05	0.96	22.00	3	0	n	0.00	s	y	12	28.10	n	0	28.10	5	2
53	cvd	b	m	23.30	0.90	21.00	10	0	n	0.00	s	n	0	0.00	n	0	0.00	6	4
58	cvd	m	m	27.00	0.93	9.00	3	0	n	0.00	s	y	6	20.10	n	0	20.10	6	3
50	dm		f	37.00	0.78	29.00	4 glaucoma	49	n	0.00	s	n	0	0.00	n	49	0.00	5	3
60	cvd	h	m	21.40	0.89	12.00	5 crf	57	n	0.00	s	n	0	0.00	y	57	0.00	5	2
54	cvd	b	f	18.29	0.88	23.00	0	0	n	0.00	s	n	0	0.00	n	0	0.00	4	5
69	cvd	h	m	24.10	0.94	13.00	0	0	n	0.00	s	y	4	10.00	m	0	10.00	3	6
35	cvd	h	m	26.80	0.86	11.00	1	0	n	0.00	s	y	20	12.00	n	0	12.00	3	5
51	cvd	b	m	26.90	0.97	18.00	0	0	y	35.00	s	y	10	20.10	n	0	20.10	6	4
57	cvd	r	m	28.30	1.00	20.00	5 ihd	55	n	0.00	s	y	10	25.10	n	55	25.10	3	5
47	cvd	m	f	24.60	0.85	16.00	2 dilated cardiomyopathy	46	n	0.00	s	n	0	0.00	n	46	0.00	3	4
40	cvd	r	f	25.20	0.85	21.00	0	0	n	0.00	s	n	0	0.00	n	0	0.00	4	3
50	cvd	a	m	26.60	0.97	13.00	3 dilated c	48	n	0.00	s	y	9	20.10	n	48	20.10	5	3
63	cvd	m	f	23.00	0.84	9.00	15	0	n	0.00	s	n	0	0.00	n	0	0.00	5	3
32	cvd	m	f	24.00	0.77	14.00	4	0	n	0.00	s	n	0	0.00	m	0	0.00	4	3
36	cvd	b	f	27.00	0.96	23.00	4	0	n	0.00	s	y	4	10.02	n	0	10.02	5	3
53	dm		m	40.00	1.23	28.00	7	0	y	35.00	s	y	9	21.00	n	0	21.00	3	5
47	cvd	b	m	23.00	0.99	11.00	5 n	0	n	0.00	s	y	20	15.10	y	0	15.10	5	2
34	cvd	p	m	33.00	0.98	14.00	2 n	0	n	0.00	s	n	0	0.00	y	0	0.00	8	3
62	dm		f	27.00	0.87	23.00	4 ihd	60	n	0.00	s	n	0	0.00	n	60	0.00	7	4
65	dm		m	33.00	0.98	14.00	7	0	n	0.00	s	y	27	20.10	m	0	20.10	2	6

PAGE - Patients Age
DIS - Disease
BMI - Body Mass Index
WHR - Waist Hip Ratio
TSF - Triceps Skin Fold
DIDU - Disease Duration
COMPLI - Complications
OAGE - On Set Age
EX - Exercise
EDUR - Exercise Duration
PACT - Patients' Activity
SM - Smoking
NCIG - Number of Cigarettes
DYR - Duration
ALC - Alcoholism
OAGE - On Set Age
DYR - Duration
NCFD - Number of Coffee/day
FRQ - Frequency

APPENDIX V

ASSOCIATION BETWEEN BODY MASS INDEX, WAIST HIP RATIO BLOOD SUGAR LEVELS, TOTAL ENERGY, CARBOHYDRATE AND FAT IN SELECTED DIABETIC PATIENTS

S.No	Age	Sex	BMI	WHR	FBS mg/dl	PP mg/dl	Total Energy	CHO	Fat
1	22	M	23.98	0.97	140	178	1570	187	50
2	29	F	21.80	0.78	138	176	1750	115	45
3	30	F	28.80	0.93	158	180	1800	112	40
4	30	M	23.89	0.96	155	179	1950	145	52
5	30	F	27.10	0.70	142	169	1995	175	59
6	30	F	28.80	0.93	158	180	2012	182	48
7	35	M	28.30	0.95	160	203	3200	425	47
8	36	F	25.10	0.90	158	189	4000	414	51
9	36	M	21.62	0.97	159	220	2027	198	57
10	36	F	21.70	0.90	157	200	2156	200	58
11	37	M	25.00	1.04	160	190	3000	250	59
12	38	M	24.90	1.02	149	205	2875	218	55
13	38	F	23.89	0.99	151	207	2500	219	58
14	38	F	24.00	0.90	160	199	2860	392	50
15	38	F	25.50	1.00	158	203	1848	148	49
16	39	M	32.52	0.89	153	197	2950	212	58
17	39	M	26.50	1.02	158	204	1987	258	55
18	39	M	24.00	1.01	152	205	1847	228	56
19	39	M	24.80	1.05	157	209	2812	248	52
20	39	F	23.90	0.90	149	217	2192	275	49
21	39	F	22.85	0.95	153	212	1999	212	45
22	40	F	28.80	0.90	159	230	1926	218	48
23	40	F	21.90	1.11	155	229	2960	280	70
24	40	M	24.00	1.05	159	220	1895	195	55
25	41	F	27.08	0.87	158	202	3020	350	52
26	42	M	24.40	1.05	156	198	2450	300	51
27	42	F	25.00	0.89	155	196	3420	387	56
28	43	M	27.09	1.06	160	220	3000	287	55
29	43	M	22.36	0.98	152	202	2560	292	54
30	44	M	26.42	1.13	159	199	1942	275	52
31	44	F	27.00	0.90	157	197	1998	320	60
32	45	M	25.54	1.01	152	225	2908	400	38
33	46	F	30.50	0.91	153	258	2928	447	39
34	47	M	25.80	1.08	152	262	2875	450	55
35	47	M	30.70	1.07	152	262	4050	428	48
36	48	M	29.00	1.02	154	211	2895	562	58
37	48	M	27.00	1.03	153	210	3680	578	59
38	49	F	28.20	1.03	156	223	4212	595	60
39	50	M	20.90	1.02	148	212	3612	520	60
40	50	F	25.20	0.87	152	214	2875	287	50

S.No	Age	Sex	BMI	WHR	FBS mg/dl	PP mg/dl	Total Energy	CHO	Fat
41	50	F	31.27	0.82	158	204	3500	380	75
42	50	M	27.90	1.00	168	201	3800	450	62
43	52	M	40.00	1.23	158	212	3212	500	63
44	52	M	25.50	1.03	160	203	3180	550	71
45	53	F	24.78	1.04	160	202	2156	428	58
46	53	M	24.05	1.01	162	206	3280	520	61
47	55	F	31.30	0.94	152	199	2895	450	55
48	55	M	30.12	1.07	165	202	3280	508	52
49	55	M	27.00	1.00	155	207	2925	487	58
50	56	M	25.00	0.90	165	206	2156	500	60
51	56	M	25.96	1.04	158	211	2780	550	70
52	57	F	21.80	0.94	165	197	2198	520	68
53	58	M	35.78	1.19	158	254	1800	560	49
54	58	F	28.39	0.89	150	258	1795	525	58
55	58	F	32.30	0.92	143	278	1920	515	38
56	60	F	25.00	1.00	165	204	2862	520	39
57	60	M	28.62	0.95	169	217	1989	512	48
58	60	M	22.41	1.07	165	219	1942	515	49
59	60	M	23.77	1.04	163	224	2175	540	68.2
60	61	F	40.00	1.20	170	189	2280	534	48
61	62	F	27.00	0.87	158	199	2148	525	49
62	63	M	24.90	1.03	166.8	212	2258	495	52
63	65	M	33.00	0.98	164	210	2187	520	49
64	65	F	27.00	0.90	158	211	2250	512	49
65	68	M	22.89	0.99	152	207	2196	489	50
66	68	F	31.14	0.86	158	228	2985	289	55
67	70	M	27.80	1.05	162	215	3200	212	39
68	70	F	29.00	0.90	159	230	3800	218	35
69	71	M	29.00	0.97	165	270	3500	257	48
70	72	F	27.00	1.20	166	286	2870	512	55
71	72	M	28.00	1.50	168	225	2156	550	60
72	73	M	21.60	1.01	165	214	2170	575	70
73	74	M	32.44	1.15	159	205	1995	492	58
74	75	M	23.28	1.15	149	220	1948	450	52
75	78	M	27.20	1.09	148	215	2560	287	49

Correlation Values

	Energy	Carbohydrate	Fat
Waist Hip Ratio			
Females	0.025	0.027	0.085
Males	0.007	0.002	0.024

	Fasting Blood Sugar
Famales	0.000
Males	0.001

APPENDIX VI

ASSOCIATION BETWEEN BODY MASS INDEX, WAIST HIP RATIO, LIPID PROFILE, TOTAL ENERGY, CARBOHYDRATE AND FAT IN SELECTED CARDIAC PATIENTS

S.No	Age	Sex	BMI	WHR	HDL	Total Chol	LDL	Total Energy	CHO	Fat
1	23	F	27.00	0.89	55.00	210	87.00	1990	286	42
2	23	F	30.00	0.75	43.00	103	27.20	1852	256	55
3	24	F	26.78	1.05	53.00	135	46.40	1942	224	56
4	24	F	28.00	0.75	42.00	142	67.00	1580	287	57
5	30	F	27.54	0.92	50.00	170	82.00	1758	248	58
6	31	M	24.39	0.97	53.00	120	33.00	1995	276	59
7	34	M	33.00	0.98	58.00	193	107.00	1452	292	49
8	35	M	29.33	1.15	54.00	248	158.00	2170	280	52
9	36	M	24.20	0.95	44.00	167	86.80	2250	212	58
10	36	F	27.00	0.96	51.00	160	53.00	2842	287	55
11	37	M	30.90	1.02	53.00	203	117.20	2957	198	52
12	39	M	32.52	0.89	53.00	167	77.80	2412	146	55
13	40	M	27.70	1.04	52.00	167	87.00	3200	186	52
14	40	F	24.90	1.09	53.00	160	71.40	1978	195	52.5
15	45	M	23.07	1.00	42.00	215	138.40	2500	167	56.5
16	45	F	27.50	0.93	48.00	207	127.20	1650	380	42.5
17	45	M	28.00	1.00	52.00	198	116.80	1725	490	32
18	46	M	32.60	1.00	45.00	252	160.00	2178	448	37
19	47	M	23.00	0.99	32.70	152	95.44	2156	420	49
20	48	F	27.50	0.93	35.00	215	144.00	2250	490	35
21	48	M	29.04	1.03	52.30	164	94.16	2780	415	58
22	49	F	25.72	0.90	53.40	186	77.80	2112	285	52
23	50	M	24.70	0.99	42.80	152	107.00	1892	411	53
24	50	M	25.21	1.02	55.80	256	92.20	1992	187	58
25	50	M	27.55	1.04	47.90	220	127.00	2102	198	59
26	50	M	36.50	1.50	49.20	189	107.20	1823	218	56
27	50	M	25.20	1.02	47.50	212	120.20	1892	250	62
28	50	M	28.26	1.04	51.20	287	78.90	1955	411	48
29	51	F	33.33	1.00	50.80	198	112.70	2450	328	38
30	52	M	20.80	1.07	48.70	212	113.30	3200	420	42
31	52	F	37.30	1.00	52.80	198	102.80	4111	318	32
32	52	F	29.50	0.92	50.70	212	138.30	1928	328	42
33	53	M	25.80	1.23	49.80	224	107.20	1755	412	49
34	53	F	25.01	1.23	49.00	215	111.20	2112	398	55
35	54	M	28.56	0.92	48.00	220	117.50	2102	358	52
36	54	M	27.50	1.01	47.50	218	107.20	2420	402	67
37	55	M	39.00	0.95	50.80	257	112.50	2280	312	48
38	55	M	33.13	1.02	49.20	212	98.20	3800	550	49
39	55	F	30.80	0.83	50.20	218	99.70	4250	487	38
40	55	F	28.70	0.86	51.80	237	102.70	2156	448	39
41	56	M	30.34	1.00	50.20	242	98.70	3800	512	32
42	56	M	28.90	1.08	45.60	222	112.20	2875	515	36

S.No	Age	Sex	BMI	WHR	HDL	Total Chol	LDL	Total Energy	CHO	Fat
43	56	F	26.94	0.94	47.80	219	107.80	3950	520	52
44	56	M	24.30	1.13	52.10	280	128.70	4750	411	56
45	57	M	29.40	1.18	47.90	254	142.80	3200	418	52
46	57	F	28.58	1.06	50.90	262	150.20	3850	212	59
47	58	M	26.42	0.90	49.20	202	115.70	3250	555	58
48	58	F	24.60	0.95	42.80	258	127.20	1875	158	42
49	58	M	28.90	1.14	41.20	276	112.80	2150	287	49
50	59	F	23.90	0.98	40.90	232	127.80	2285	212	48
51	59	M	26.42	1.12	48.20	268	112.80	4500	511	42
52	60	F	40.40	0.80	40.70	156	132.70	4200	428	58
53	60	F	27.50	0.91	51.20	198	149.80	2750	333	56
54	60	F	30.50	0.90	50.20	176	117.70	3100	512	49
55	60	M	28.00	1.99	47.80	158	128.70	2875	299	56
56	62	F	25.54	1.13	50.20	259	112.80	1992	192	58
57	62	M	20.75	0.99	49.90	212	122.70	1956	420	36
58	62	F	40.00	0.87	40.10	242	107.20	1972	312	32
59	63	M	27.20	1.20	50.00	238	117.50	2412	196	55
60	64	M	20.50	1.23	55.00	248	142.80	3216	212	58
61	65	M	16.40	1.90	59.00	286	137.20	3500	348	48
62	66	F	24.39	0.90	49.00	250	111.80	4100	415	47
63	66	F	29.56	0.87	45.00	240	107.20	3119	420	38
64	67	M	25.00	1.05	47.00	259	107.20	3212	420	36
65	67	M	26.80	1.02	50.00	262	112.80	2895	402	42
66	68	F	33.16	0.86	42.00	215	117.60	2500	396	58
67	68	M	26.00	1.15	48.00	275	112.80	1656	356	52
68	70	F	29.00	0.80	50.00	212	128.20	1785	312	39
69	70	M	22.68	1.07	49.00	217	122.20	1842	198	28
70	72	F	27.00	0.90	43.50	226.7	112.70	2111	199	29
71	72	M	28.00	1.50	57.20	212	107.90	1976	156	35
72	73	M	21.60	1.21	47.50	217	113.70	2102	198	30
73	74	M	32.44	1.15	50.20	289	116.80	2422	280	42
74	75	M	15.20	1.99	49.80	292	112.20	2625	272	52
75	78	M	27.20	1.09	47.50	290.7	89.80	2100	216	27

Correlation Values

	TC	HDL	LDL
Waist Hip Ratio			
Females	0.036	0.002	0.027
Males	0.032	0.002	0.024
Energy			
Famales	0.057	0.042	0.052
Males	0.027	0.052	0.040
Fat			
Famales	0.036	0.042	0.022
Males	0.042	0.036	0.052