

**Association Between Food Frequency and Diabetes
Mellitus Among Men And Women Belonging To
Nellore District**

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Science degree in Clinical Nutrition and Dietetics

by
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DEPARTMENT OF CLINICAL NUTRITION AND DIETETICS
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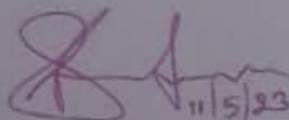
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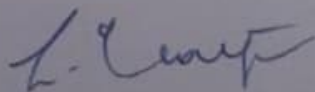
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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the Bonafide work of K. LAKSHMI YASASWINI (40736003) who had carried out The project "ASSOCIATION BETWEEN FOOD FREQUENCY AND DIABETES MELLITUS AMONG MEN AND WOMEN BELONGING TO NELLORE DISTRICT" under supervision of DR.S.PADMAPRIYA From June 2022 to May 2023



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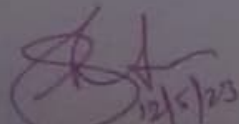
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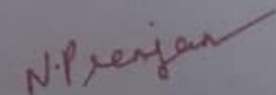
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DECLARATION

I K LAKSHMI YASASWINI (40736003) hereby declare that the Project Report entitled ASSOCIATION BETWEEN FOOD FREQUENCY AND DIABETES MELLITUS AMONG MEN AND WOMEN BELONGING TO NELLORE DISTRICT done by me under the guidance of DR. S.PADMAPRIYA is submitted in partial fulfillment of the requirements for the award of Bachelor of Science Degree in Clinical Nutrition and Dietetics

DATE: 11/5/23

PLACE: Chennai

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ABSTRACT

Diabetes mellitus among adult Indians is large and continuously increasing. Food frequency places a major role in controlling diabetic mellitus as the food consumed by the diabetic patients is directly associated with their blood sugar level. Recent studies have shown that the choice of foods and frequency of intake plays a role in diabetes prevention.

Objectives of the present study is to find the association between food frequency and diabetes mellitus, family history ,clinical parameters pre and post prandial test ,complications among the selected subjects and frequency of food consumption among type II diabetic mellitus patients belonging to Pogathota, Nellore District.

A cross sectional study was adopted. Around 80 patients belonging to 40 to 60 years with type 2 diabetic mellitus who were willing to participate in the survey were selected randomly from Modern Diabetic Center, Nellore District. The data were collected by a questionnaire which includes age, complications, gender, family history, pre and post prandial values, type of medication used and a food frequency questionnaire. The statistical analysis include the percentage distribution of various food groups under different frequencies and association between food frequency with pre and post prandial values using Chi square.

Results of the study revealed that majority 53.75 % of the selected patients belonged to 51 to 60 years and the remaining 46.25 % were from 40 to 50 years. Female diabetic patients were 51.25 % and nearly 53.75 % of the patients were having various complications, oral medication is taken by 80% of the subjects, majority of the subjects fall under 110 to 126 (38.75%) in pre-prandial test and majority of the subjects fall under more than 200mg/dl (79%) in post prandial test From the food consumption frequency among the selected diabetic patients it was found that cereal was consumed more than 3 times a day (96%) and 4% twice a day. Frequency of pulse consumption was high 93% in more than 3 times a day and 7% twice a day. Frequency of consumption of leafy vegetables was also found to be more frequent. Consumption of other vegetable were 4-6 times a day (35%) and nearly 34% of the people take once in a day. Majority of the patients consumed roots and tubers 1-3 times a week is (35%). 66 % of the patients consumed fruits once in

a day. Nuts and oil consumption was once in a day (61 %). Fish consumption among the selected patients were 37 % less than once in a week. Meat and poultry was found to be taken in once in a week and less than once a week. 70 % of the patients were taking milk and milk product once in a day. Fats and oil were taken twice a day by 50% of the study population.

Significant association was found between consumption of leafy vegetables, roots and tubers, fish and other food, fats and edible oils and sugars and the pre-prandial values .Significant association was found between consumption of leaf vegetables, roots and tubers other vegetables nuts and oilseeds, condiments and spices, fruits, fish and other foods, meat and poultry, fish and edible oil and sugar and the post prandial values.

Diet plays a very important role in the management of diabetic mellitus, proper attention and care must be given to the diabetic patients for the betterment of their life. This could be done with appropriate diet counselling and nutrition education.

Key words: Diabetic Mellitus, Food Frequency, Pre and Post prandial

LIST OF ABBREVIATIONS

ACRONYM	ABBREVIATION
NS	Non significant
*	significant

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Chapter –1

INTRODUCTION

1.1 Diabetes Mellitus

Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. Insulin is a hormone that regulates blood glucose. Hyperglycaemia, also called raised blood glucose or raised blood sugar, is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems, especially the nerves and blood vessels (WHO, 2022).

1.1.1 Type 1 Diabetes mellitus

Type 1 diabetes is a chronic autoimmune disease characterised by insulin deficiency and resultant hyperglycaemia it is also known as insulin-dependent, juvenile or childhood-onset is characterized by deficient insulin production and requires daily administration of insulin (Yue Y, 2018).

1.1.2 Type 2 Diabetes Mellitus

Type 2 diabetes (formerly called non-insulin-dependent, or adult-onset) results from the body's ineffective use of insulin. More than 95% of people with diabetes have type 2 diabetes. This type of diabetes is largely the result of excess body weight and physical inactivity. Until recently, this type of diabetes was seen only in adults but it is now also occurring increasingly frequently in children (Zimmet PZ, 2003).

1.1.3 Gestational diabetes

Gestational diabetes is hyperglycaemia with blood glucose values above normal but below those diagnostic of diabetes. Gestational diabetes occurs during pregnancy. Women with gestational diabetes are at an increased risk of complications during pregnancy and at delivery. These women and possibly their children are also at increased risk of type 2 diabetes in the future. Gestational diabetes is diagnosed through prenatal screening, rather than through reported symptoms (WHO, 2021).

1.2 Symptom of diabetic mellitus

1.2.1 Diabetes Mellitus type 1 symptoms

Symptoms include excessive excretion of urine (polyuria), thirst (polydipsia), constant hunger, weight loss, vision changes, and fatigue. These symptoms may occur suddenly.

1.2.2 Diabetes Mellitus type 2 symptoms

Symptoms may be similar to those of type 1 diabetes but are often less marked. As a result, the disease may be diagnosed several years after onset, after complications have already arisen.



Fig 1.1 symptoms of diabetes

1.3 Causes of Diabetes Mellitus

Causes of Diabetes Mellitus Type 1 diabetes occurs when the immune system, of the body's system for fighting infection, attacks and destroys the insulin-producing beta cells of the pancreas. Scientists think type 1 diabetes is caused by genes and environmental factors, such as viruses, that might trigger the disease. Studies such as Trial Net [External link](#) are working to pinpoint causes of type 1 diabetes and possible ways to prevent or slow the disease.

Causes of type 2 diabetes mellitus the most common form of diabetes that is caused by several factors, including lifestyle factors and gene Overweight, obesity, and physical inactivity

People are more likely to develop type 2 diabetes if they are not physically active and are overweight or have obesity. Extra weight sometimes causes insulin resistance and is difference. Extra belly fat is linked to insulin resistance, type 2 diabetes, and heart and blood vessel disease. To see if your weight puts you at risk for type 2 diabetes, check out these Body Mass Index (BMI) charts (Lindström 2017) [Insulin resistance](#)

Type 2 diabetes usually begins with insulin resistance, a condition in which muscle, liver, and fat cells do not use insulin well. As a result, your body needs more insulin to help glucose enter cells. At first, the pancreas makes more insulin to keep up with the added demand. Over time, the pancreas can't make enough insulin, and blood glucose levels rise.

Genes and family history

As in type 1 diabetes, certain genes may make you more likely to develop type 2 diabetes. The disease tends to run in families and occurs more often in these racial/ethnic groups:

Causes gestational diabetes

Scientists believe gestational diabetes, a type of diabetes that develops during pregnancy, is caused by the hormonal changes of pregnancy along with genetic and lifestyle factors.

Insulin resistance hormones produced by the placenta NIH external link contribute to insulin resistance, which occurs in all women during late pregnancy. Most pregnant women can produce enough insulin to overcome insulin resistance, but some cannot. Gestational diabetes occurs when the pancreas can't make enough insulin.

As with type 2 diabetes, extra weight is linked to gestational diabetes. Women who are overweight or have obesity may already have insulin resistance when they become pregnant. Gaining too much weight during pregnancy may also be a factor

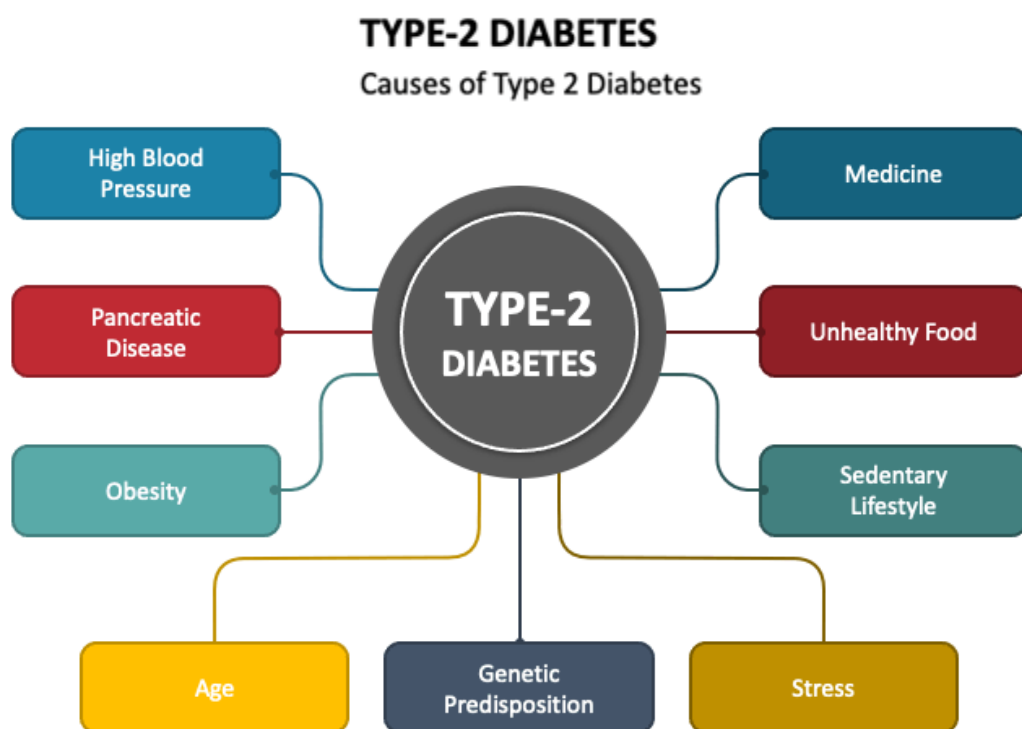


Fig 1.2 causes of diabetes

1.4 Complications

Long-term complications of diabetes develop gradually.

Possible complications include:

Heart and blood vessel (cardiovascular) disease. Diabetes majorly increases the risk of many heart problems. These can include coronary artery disease with chest pain (angina), heart attack, stroke and narrowing of arteries (atherosclerosis). If you have diabetes, you're more likely to have heart disease

or stroke. Nerve damage (neuropathy). Too much sugar can injure the walls of the tiny blood vessels (capillaries) that nourish the nerves, especially in the legs. This can cause tingling, numbness, burning or pain that usually begins at the tips of the toes or fingers and gradually spreads upward. Damage to the nerves related to digestion can cause problems with nausea, vomiting, diarrhoea or constipation. For men, it may lead to erectile dysfunction. Kidney damage (nephropathy). The kidneys hold millions of tiny blood vessel clusters (glomeruli) that filter waste from the blood. Diabetes can damage this delicate filtering system. Eye damage (retinopathy). Diabetes can damage the blood vessels of the eye (diabetic retinopathy). This could lead to blindness. Foot damage. Nerve damage in the feet or poor blood flow to the feet increases the risk of many foot complications. Skin and mouth conditions. Diabetes may leave you more prone to skin problems, including bacterial and fungal infections. Hearing impairment. Hearing problems are more common in people with diabetes. Alzheimer's disease. Type 2 diabetes may increase the risk of dementia, such as Alzheimer's disease. Depression. Depression symptoms are common in people with type 1 and type 2 diabetes (Hu FB. 2017) .

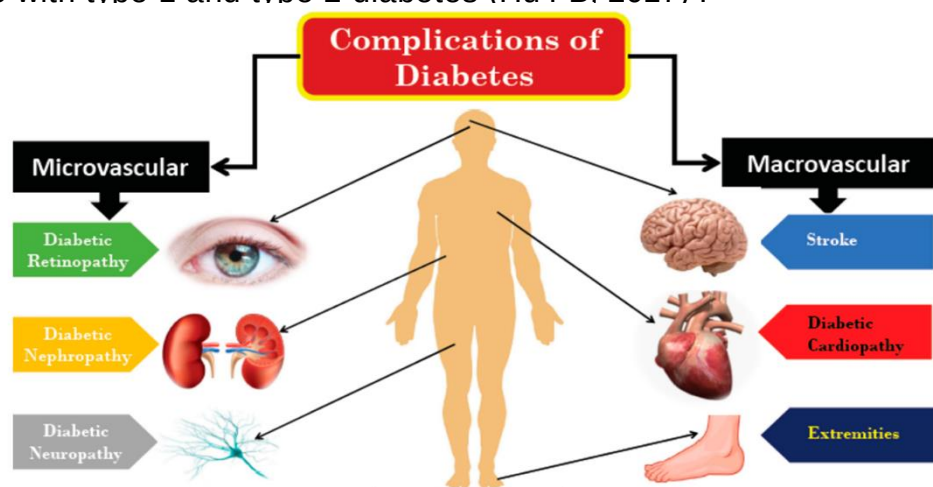


Fig 1.3 complications of diabetes

1.5 Dignosis

Doctor can diagnose diabetes, prediabetes, and gestational diabetes using blood tests. The blood tests show if your blood glucose level, also called blood sugar, Blood tests can also help identify the type of diabetes you have.

Testing must be done for the people who have symptoms of diabetes . Some people will not have any symptoms but may have risk factors for type 2 diabetes and need to be tested. Most pregnant women should also be tested for gestational diabetes. Testing helps doctors find diabetes sooner, so they can work with their patients to manage the disease and prevent health problems.

1.5.1 Type 2 diabetes

Experts recommend routine testing for type 2 diabetes if they have certain risk factors. People may have a higher risk of developing type 2 diabetes if they are age 35 or older

If the blood glucose levels are higher than the target range, but not high enough to be diagnosed with diabetes, doctors will be diagnose with prediabetes. Having prediabetes is serious because it raises the chance of developing type 2 diabetes. But developing type 2 diabetes can be prevented. Adults and children diagnosed with prediabetes should be tested for type 2 diabetes every year.

Testing for type 2 diabetes before and during pregnancy all women who are planning to get pregnant should be tested for type 2 diabetes, especially if they have risk factors.

If they are already pregnant, should be tested for type 2 diabetes at the first prenatal appointment, or in the first 15 weeks of pregnancy. If they have diabetes, they should receive special care during your pregnancy to avoid problems for you and the baby.

1.5.2 Gestational diabetes

All pregnant women who do not have a previous diagnosis of diabetes should be tested for gestational diabetes between 24 and 28 weeks of pregnancy.

If they have gestational diabetes, they should get tested after your baby is born to see if they have type 2 diabetes, usually within 12 weeks after delivery.

1.5.3 Fasting plasma glucose test

The fasting plasma glucose (FPG) test measures the blood glucose level at a single point in time. For the most reliable results, doctor will give the test in the

morning after you have fasted for at least 8 hours. Fasting means having nothing to eat or drink except sips of water.

1.5.3.1 Hba1c Test

The A1C test is a blood test that provides information about your average levels of blood glucose, also called blood sugar. The A1C test can be used to diagnose type 2 diabetes and prediabetes. This test is also the primary test used for diabetes Reference range

Health care professionals use the A1C test alone or in combination with other diabetes tests to diagnose type 2 diabetes and prediabetes. Don't have to fast before this test blood can be drawn for an A1C test, which means that blood can be drawn for the test at any time of the day.

If there are no symptoms but the A1C test shows diabetes or prediabetes, health care team will repeat test on a different times of the day using the A1C test or one of the other diabetes tests to confirm the diagnosis.

During the A1C test, a member of your health care team takes a blood sample by inserting a needle into a vein in your arm or pricking your finger tip with a small, pointed lancet. If the blood is taken from a vein, the blood sample is sent to a lab for analysis.

- Normal: A1C below 5.7%
- Prediabetes: A1C between 5.7% and 6.4%
- Diabetes: A1C of 6.5% or higher

1.5.3.2 Random plasma glucose test

Random plasma glucose test is used to diagnose diabetes when you have symptoms of diabetes and they do not want to wait until you have fasted for 8 hours. Blood test can be done at any time

Normal: 125 mg/dl

Diabetes: 200 mg/dL or above

1.5.3.3 Glucose challenge test

If they are pregnant, doctor will test for gestational diabetes with the glucose challenge test. Another name for this test is the glucose screening test. In this test, a health care professional will take a sample of your blood 1 hour after you drink a sweet liquid containing glucose. Fasting is not required for this test. If the blood glucose level is too high—135 mg/dL to 140 mg/dL or higher—they may need to return for an oral glucose tolerance test while fasting.

1.5.3.4 Oral glucose tolerance test

The oral glucose tolerance test (OGTT) helps doctors detect type 2 diabetes, prediabetes, and gestational diabetes. However, the OGTT is a more expensive test than the FPG test and the glucose challenge test, and it is not as easy to give.

Before the test, they will need to fast for at least 8 hours. A health care professional will take a blood sample to measure the glucose level after fasting. Next, they will drink a liquid that is high in sugar. Another blood sample is taken 2 hours later to check the blood glucose level. If the blood glucose level is high, they may have diabetes.

If they are pregnant, blood will be drawn every hour for 2 to 3 hours. If the blood glucose levels are high two or more times during the OGTT, they may have gestational diabetes.

- Normal: 139 mg/dl or below
- Prediabetes: 140 to 199 mg/dl
- Diabetes: 200 mg/dL or above

Source: (American Diabetes Association 2022).

1.6 Middle age group

Middle age is the period of age beyond young adulthood but before the onset of old age the exact range is disputed, but the general consensus has placed middle age as the ages of 40 to 60. This phase of life is marked by gradual physical, cognitive, and social changes in individuals as they age (WHO ,2020).

1.6.1 Physical characteristics

Middle-aged adults may begin to show visible signs of aging. This process can be more rapid in women who have osteoporosis. Changes might occur in the nervous system. The ability to perform complex tasks remains intact. During the years surrounding the age of 51, women experience menopause, which ends natural fertility. Menopause can have many side effects. Changes can occur to skin, and other changes may include a decline in physical fitness, including a reduction in aerobic performance, a decrease in maximal heart rate, and greying and loss of hair. Sensory sensitivity in middle-aged adults has been shown to be one of the lowest. These measurements are generalities, and people may exhibit changes at different rates and times.

Mortality rates can begin to increase from 50 onward, due mainly to health issues like heart problems, cancer, hypertension, and diabetes. Still, the majority of middle-aged people in industrialized nations can expect to live into old age. The Physical activity prevents the development of many chronic diseases, including metabolic syndrome, type 2 diabetes, coronary artery disease, hypertension, stroke, dyslipidaemia, cognitive impairment, depression, osteoarthritis, osteoporosis, colon cancer, breast cancer, non-alcoholic fatty liver disease and sarcopenia (Booth, 2012).

1.7 Food frequency

Food Frequency Questionnaires are dietary assessment tools widely used in epidemiological studies investigating the relationship between dietary intake and disease or risk factors since the early '90s. The three main components of these questionnaires are the list of foods, frequency of consumption and the portion size a specified period of time, typically the past month or year. FFQs may need to be developed and validated specifically for each region in order to be culturally sensitive and to correspond to the prevailing food culture. If the form of the questionnaire is not reasonably appropriate for the cultural background of the study population, developing a new questionnaire is the best approach

1.7.1 Preparation of food frequency questioner

To make food frequency we followed five steps to develop the FFQ: choosing appropriate foods, prioritisation and categorisation of food items, assembling a list of selected foods, frequency and portion size, and expert review and pre-testing (Thompson,2011).

A food frequency questionnaire (FFQ) consists of a finite list of foods and beverages with response categories to indicate usual frequency of consumption over the time period queried. To assess the total diet, the number of foods and beverages queried typically ranges from 80 to 120.

Usual portion size can be asked separately for each food and beverage. Alternatively, portion size can be combined with frequency information by asking respondents to translate usual consumption amount to number of specified until Some questionnaires include portion size images in an attempt to enhance reporting In addition to foods and beverages, FFQs often ask about the frequency of intake and dosages of commonly consumed .An FFQ is sometimes loosely referred to as a diet history. However, the term diet history can refer generally to any instrument that asks about diet in the past (Nil, 2015).

1.8 Prevalence of diabetics in India

The burden of diabetes is high and increasing globally, and in developing economies country like India, mainly by the increasing prevalence in 2019 showed that 77 million individuals had diabetes in India Approximately 57% of these individuals remain undiagnosed. Type 2 diabetes, which accounts for majority of the cases, can lead to multiorgan complications like cardiovascular disease (CVD), respiratory disease, and cancer.

International Diabetes Federation 2018 refers DM according to the World Health Organization non-communicable diseases (NCDs) accounted for 74% of deaths globally in 2019, of which, diabetes resulted in 1.6 million deaths, thus becoming the ninth leading cause of death globally. Type 2 diabetes, which constitutes 90% of all cases of diabetes, earlier considered to be a disease of the affluent “Western” countries, has now spread globally, and has become a major cause of disability and death affecting even younger age group. Diabetes has reached epidemic

proportions in many developing economies (Tao Z, 2016). Such as China and India. According to WHO, the prevalence of diabetes is growing most rapidly in low- and middle-income countries. The rapid socioeconomic change in conjunction with urbanization and industrialization are the major factors for the global increase in the diabetes epidemic, with other associated risk factors such as population growth, unhealthy eating habits, and a sedentary lifestyle also playing an important role (Pradeep R, 2016).

1.8.1 Prevalence rate in Andhra Pradesh

Diabetes is increasing at alarming rate among Indians especially South Indians with prevalence of diabetes mellitus (PODM) varying in populations of different regions. Study conducted by Nirmala, 2016 in northern coastal districts of Andhra Pradesh indicates that 35.5% individuals were identified to be diabetic, especially 7.8% from Tribal area, 12.5% from semi-urban and 15.1% from urban area.

Thus, the present study is intend to focus on the adult Diabetics mellitus patients belonging to Nellore District of Andhra Pradesh in association with their food frequency.

CHAPTER 2

REVIEW OF LITERATURE

Studies shows that Diabetes is a complex disease that involves a wide range of genetic and environmental factors. Genes that played a role in the molecular mechanism of diabetes development, despite the vast flow of genetic information including the identification of many gene mutations and a large array of single nucleotide polymorphisms (SNPs) in many genes involved in the metabolic pathways that affect blood glucose levels, the exact genetic mechanism of diabetes remains elusive. Evidently, a major complication is the fact that a single gene mutation or polymorphism will not impose the same effect among different individuals within a population or different populations (Frayling TM,2007).

Research shows that DM is the fourth among the leading causes of global deaths due to complications. Annually, more than three million people die because of diabetes or its complications. Worldwide, this disease weighs down on health systems and also on patients and their families who have to face too much financial, social and emotional strains. Diabetic patients have an increased risk of developing complications such as stroke, myocardial infarction, and coronary artery disease. However, complications such as retinopathy, nephropathy, and neuropathy can have a distressing impact on patient's quality of life and a significant increase in financial burden. The prevalence reported from studies conducted worldwide on the complications of T2DM showed varying rates. The prevalence of cataracts was 26-62%, retinopathy 17-50%, blindness 3%, nephropathy 17-28%, cardiovascular complications 10-22.5%, stroke 6-12%, neuropathy 19-42%, and foot problems 5-23%. Mortality from all causes was reported between 14% and 40%(Farrah M ,2017).

Study done by Alder in the year 2012 concluded that fish consumption affected pre-prandial level both men and women., the consumption of fish and related nutrients (especially long-chain omega-3 fatty acids) seems to have various metabolic effects on patients with diabetes.

Kodama in year 2012 did a study on association between food frequency and diabetes reported that Staple carbohydrates had negative effects on HbA1c in

women. As India the main dishes include carbohydrate foods such as rice, brown rice, and barley. The result of this study demonstrated this fact, however, the effect of carbohydrate composition on glycaemic control is increased (Kodama, 2012).

Jinkies (2012), reported legumes had a positive effect on HbA1c in women. Legumes are composed of various nutrients, including complex carbohydrates, vegetable protein, dietary fibre, oligosaccharides, and minerals. Legumes consisting of complex carbohydrates and dietary fibre are considered foods with low glycaemic index, which are thought to be beneficial to patients with diabetes (Jinkies, 2012).

Consumption of milk and dairy products may have beneficial effects on body weight, insulin resistance and cardiovascular disease this and also helps in glucose control of diabetes. Study found that low-fat dairy products reduced the risk of diabetes this shows a (Boskic, 2012).

Study done by shine at the year 2018 concluded that the intake Fruit like berries and show cherries, plums, grapes have a positive effect on diabetic patients as they contain vitamins and antioxidence but some fruits contain high glycaemic index like banana mangoes spike up the insulin level and have an negative effect on diabetic patients(Shine,2018).

Consumption of protein for diabetic patient's helps to improve the blood sugar level and also helps in maintain the lean body mass (Jaceldo-Siegl, 2010).

Consumption of non-starchy vegetable such as broccoli spinners green beans do not spike up the insulin level and also helps in maintaining the blood sugar level for diabetic patients in long run (Ramachandran, 2018).

Research indicates that low carbohydrate eating plans may result in improved glycaemia and have the potential to reduce anti hyperglycaemic medications for individuals with type 2 diabetes". Further, low the carbohydrate diets are not recommended for pregnant and lactating women, those who have or are at risk for disordered eating, and those with renal disease (Fineman, 2015).

Research indicates that for individuals whose daily insulin dosing is fixed, a consistent pattern of carbohydrate intake with respect to time and amount may be

recommended to improve glycaemic control and reduce the risk of hypoglycaemia (Franz, 2014).

Evart (2014) did a study on management of diet on diabetes he noticed that People with diabetes should limit or avoid intake of sugar-sweetened beverages (SSBs) (from any caloric sweetener including high-fructose corn syrup and sucrose) to reduce risk for weight gain and worsening of cardio metabolic risk profile.

Conception of fibre rich meal is processed more slowly, which promotes satiety, may be less caloric, and lower in added sugars, which can help combat obesity and also may prevent risk of heart disease, type 2 diabetes, and colon cancer. It is advised consumption of 25 g dietary fiber helps in control of blood sugar level (sluik, 2013).Conception of fiber supplements like bulk laxatives are used frequently as additional dietary fiber sources, but since few fiber supplements have been studied for physiological effectiveness, the best advice is to consume foods that are high in fiber (Winky, 2015).

A study shows concluded that the consumption of whole grains was not associated with pre-prandial as grains contain fibre and do not affect the blood sugar level (Wheeler, 2012).

Conception of Resistant starches are starch enclosed within intact cell walls. These include some legumes, starch granules in raw potato, retrograde amylose from plants modified to increase amylose content, or high amylose containing foods, such as specially formulated corn starch, which are not digested and absorbed as glucose. Resistant starches are completely fermented in the colon. It has been proposed that resistant starches may affect postprandial glucose response (Evert A.B, 2018).Study conducted by Position of the Academy of Nutrition and Dietetics concluded that people with diabetes and those at risk are advised to avoid sugar-sweetened beverages (including fruit juices) in order to control glycaemia and weight and reduce their risk for cardiovascular disease and fatty liver and should minimize the consumption of foods with added sugar.<https://www.who.int/news-room/factsheets/detail/diabetes#:~:text=Diabetes%20is%20a%20chronic%20disease,hormone%20that%20regulates%20blood%20glucose>).

The shows that people were suffering with diabetic mellitus will also suffer with diseases like hypertension renal problem nerve damage when they do not control diabetic mellitus diet place and major role in controlling of diabetes (T. N. N. Aung, 2021) .

Research studies showed that high carbohydrate and high monounsaturated fat diets improve insulin sensitivity, whereas glucose disposal dietary measures comprise the first line intervention for control of dyslipidaemia in diabetic patients (Kiawah AM, 2018).

Metabolic control can be considered as the cornerstone in diabetes management and its complications. Acquiring HbA1c target minimizes the risk for developing microvascular complications and may also protect CVD, particularly in newly diagnosed patients. Carbohydrate intake has a direct effect on postprandial glucose levels in people with diabetes and diet plays an important role in glycogen management (Holman RR, 2019).

Studies shows that people who are suffering with diabetes have to follow a good nutrition as their energy balance have an effect on body weight, blood pressure, and lipid levels directly. Through the mutual efforts, health-care professionals can help their patients in achieving health goals by individualizing their nutrition interventions and continuing the support their nutrition requirements (Turnbull, 2016).

A study suggested that intake of virgin olive oil diet in the Mediterranean area has a beneficial effect on the reduction of progression of T2DM retinopathy (Al-Sinani, 2017).

Dietary habits are essential elements of individual cardiovascular and metabolic risk. Numerous health benefits have been observed to the Mediterranean diet over the last decades, which contains abundant intake of fruit and vegetables. The beneficial effects of using fish and olive oil have been reported to be associated with improved glucose metabolism and decreased risk of T2DM, obesity and CVD. (Buscemi S, 2016).

CHAPTER 3

METHODOLOGY

Research methodology is the specific procedures or techniques used to identify, select, process, and analyse information about a topic. In a research paper, the methodology section allows the reader to critically evaluate a study's overall validity and reliability.

3.1 Objective

- To measure the pre and post prandial values of the selected subjects
- To assess the conception of food frequency of the selected subjects
- To analyse the food frequency consumption and clinical parameters

3.2 Hypothesis

H1- There is no significant association between food frequency questionnaire and pre-prandial values among the selected men and women with diabetes mellitus

H2- There is no significant association between food frequency questionnaire and post prandial values among the selected men and women with diabetes mellitus

3.3 Study area

The study subjects were choose from Modern diabetic centre Nellore District.

3.4 Selection of subjects

The inclusion creature for the study are Subjects from modern diabetics centre are only both male and female belonging to Nellore district ,Subjects between 40-60 years are taken in the study and Subjects who are willing to participate in the study are only taken

The exclusion creatures for the study are subjects below the age 40 and above the age of 60 are not taken in the study, Pregnant, lactating women are not taken in this study

3.5 Tools used

3.5.1 Assessment of Dietary Intake

Assessment of Dietary Intakes Using FFQ Dietary intake was surveyed using a 15-questions with the help of food frequency questionnaire (FFQ) structured to. Subjects were asked how frequently they consumed the following food groups with seven frequency options like never ,less than once a week ,1-3 times a week,4-6 times a week once a day ,twice a day and more than 3 times a day and Consumption frequencies of certain food groups like Cereals and grain products, Pulses and legumes, Leafy vegetables ,Roots and tubers, Other vegetables, Nuts and oil seeds, Condiments and spices , Fruits ,Fish and Other food ,Meat and poultry, Milk and milk products, Fats and edible oil ,Sugars ,Beverages alcoholic and Non-alcoholic

3.5.2 Measurement of Clinical Parameters

Pre and post prandial blood sugars levels are taken for the study to know their blood glucose levels.

Testing blood glucose both before and after tells how that meal affects the blood glucose levels and helps you to understand which meals are best for the blood glucose control.

Components of pre and postprandial blood sugar test

This includes two tests that are:

- Fasting blood sugar test-it is preferably taken in early morning after 8-12 hours of overnight fasting.
- After meal blood sugar test-it is taken 2 hours after eating a meal. This is because within 2 hours of eating your blood glucose and insulin levels should return to normal range. If blood glucose is still high you may have diabetes.

3.5.3 Procedure and prerequisites

The sample for fasting sugar test and post meal sugar test is taken from blood by inserting a small needle into vein of your arm. A small amount of blood is then collected in test tube or vial. You may feel some pain due to needle prick.

For fasting blood sugar test you need to fast for at least 8 hrs before the test. Overnight fasting is preferred with glucose fasting sample taken early next morning before having any food. Water intake is allowed before the test.

Post meal blood sugar test is done exactly 2 hours after intake of moderate to heavy meals. The meal should have at least 75 grams of carbohydrates. After the meal don't eat anything before the test.

Hba1c Test

A haemoglobin A1C (HbA1C) test is a blood test that shows what average blood sugar (glucose) level was over the past two to three months.

Glucose is a type of sugar in the blood that comes from the foods we eat. Cells use glucose for energy. A hormone called insulin helps glucose get into the cells. If the patients have diabetes their body doesn't make enough insulin, or can't use it well. As a result, glucose can't get into the cells, so that blood sugar levels increases. An A1C test can show your average glucose level for the past three months because:

- Glucose sticks to haemoglobin for as long as the red blood cells are alive.
- Red blood cells live about three months.

High A1C levels are a sign of high blood glucose from diabetes. Diabetes can cause serious health problems, including heart disease, kidney disease, and nerve damage. But with treatment and lifestyle changes, we can control the blood glucose levels.

Other names: HbA1C, A1C, glycohemoglobin, glycated haemoglobin, glycosylated haemoglobin.

An A1C test may be used to screen or diagnose:

- Type 2 diabetes. With type 2 diabetes the blood glucose gets too high because your body doesn't make enough insulin to move blood sugar from the bloodstream into the cells, or because cells stop responding to insulin.

A health care professional will take a blood sample from a vein in the arm, using a small needle. After the needle is inserted, a small amount of blood will be collected into a test tube . This usually takes less than five minutes.

A1C results tell you what percentage of your hemoglobin is coated with glucose. The percent ranges are just a guide to what is normal. It depends on health, age, and other factors. To diagnose diabetes or prediabetes, the percentages commonly used are:

- Normal: A1C below 5.7%
- Prediabetes: A1C between 5.7% and 6.4%
- Diabetes: A1C of 6.5% or higher

3.6 Data collection

The gathered data is about age, gender, family history, complications, clinical parameters like pre and post prandial test, type of medication they use and food frequency questionnaire that includes all the 15 food groups of diabetic patients belonging to middle age group

3.7 Sample size

The sample size is calculated from Rao soft software with margin of error 5%, confidence level 95%, and population size 100, and response distribution 50% recommended sample size is 80 .

3.8 Sample method

Random sampling among men and women were done and collection of Demographic and clinical Data like Age, sex (M/F), history of diabetes (yes /no), place, complications, medications they use (oral /insulin) clinical parameters like pre and post prandial test were done .

3.9 Statistical analysis

The calculated of percentage is done for age ,gender, pre and postprandial test ,family history medications they take and food frequency table(Cereals and grain products, Pulses and legumes, Leafy vegetables ,Roots and tubers, Other vegetables, Nuts and oil seeds, Condiments and spices , Fruits ,Fish and Other food

,Meat and poultry, Milk and milk products, Fats and edible oil ,Sugars ,Beverages alcoholic and Non-alcoholic) And Association between foot frequency and pre and postprandial values is done by chi square test.

CHAPTER 4

RESULT

The results of the present study are discussed under this chapter.

Table 4.1 Percentage Distribution of Participants According to their Age

Age Group	Percentage
40-50	46.25%
51-60	53.75%

Table 4.1 represents the percentage distribution of participants according to their age, it was found that 46.25% of patients belonged to age group of 40-50 years and 53.75% belonged to 51 -60 years.

Table 4.2 Percentage Distribution of Participants According to their Gender

Female	Male
51.25%	48.75%

Table 4.2 shows Majority of patients were female (51.25%) and the remaining were males (48.75%) in the present study.

Table 4.3 Percentage Distribution of Participants According to their pre-prandial values

Prandial Values	Percentages
Below 110mg/dl	31.5%
110-126	38.755
127-156	15%
More than 156	18.75

Table 4.3 shows the values of pre-prandial test majority of the subjects fall under 110 to 126 mg/dl category (38.75%) and 31.5% fall under below 110 and 18.75 subjects have more than 156 dl/mg

Table 4.4 Percentage Distribution of Participants According to their post prandial

Post-Prandial Values	Percentages
Less than 160mg/dl	7%
160-180mg/dl	7%
180-200mg/dl	7%
More than200mg/dl	79%

Table 4.4 shows the values of post-prandial test majority of the subjects fall under more than 200mg/dl (79%) and 7%of the subjects fall under less than 16mg/dl,160-180mg/dl and 180-200mg/dl

Table 4.5 Percentage Distribution of Participants According to their Gender

Complications	Percentages
Retinopathy	29%
Hypertension	5%
Vision Impairment	3%
Hearing Impact	5%
Nephropathy	1%
CoronaryArtery Disease	2%
No Complications	48.25%

Table 4.5 demonstrates that No complication was reported by 48.25% of the selected participants, 29% reported with retinopathy and very minimal percentage of the participants reported with other complication such as hypertension, vision impairment, hearing impact, nephropathy, coronary artery diseases.

Table 4.6 Percentage Distribution of Participants According to their Medication

Medication	percentages
Insulin	20%
Oral tablets	80%

Table 4.6 shows most of the subjects consume oral tablets (80%) and only 20% take insulin.

Table 4.7 Frequency of consumption of cereals

Frequency	Percentages
Twice a day	4%
More than 3 times a day	96%
Total	100%

Table 4.7 frequent conception of cereals displays majority of the selected subjects (96 %) consumed cereals more than 3 times a day, whereas a very small percent of the subjects (4 %) consumed cereals twice a day.

Table 4.8 Frequency of intake of pulses

Frequency	Percentages
Twice a day	7%
More than 3 times a day	93%
Total	100%

Table 4.8 shows majority of the subjects consumed pulses and legumes (93%), whereas only (7%) of the subjects consumed twice a day

Table 4.9 Frequency of intake of leafy vegetables

Frequency	Percentages
Less than once a week	2%
1-3 times a week	25%
4-6 times a week	46%
Once a day	23%
Twice a day	7%
Total	100%

Table 4.9 represents majority of the subjects consumed green leafy vegetables 4-6 times a day (46%), 25% of the subjects consumed 1-3 times a week, 23 % of the subjects consumed once a day and only 7% of the subjects consumed twice a day.

Table 4.10 Frequency of intake of other vegetables

Frequency	Percentage
Less than once a week	2%
1-3 time week	25%
4-6 time week	35%
Once a day	34%
Twice a day	1%
More than 3 times a day	3%
Total	100%

Table 4.10 shows that conception of other vegetables were consumed 4-6 times a day by 35% of the selected participants, 34% of the subjects consumed once in a day, 25% 1-3 times a day, 3% more than 3 times a day, 2% less than once a week and 1% twice a day.

Table 4.11 Frequency of intake of Roots and Tubers

Frequency	Percentages
Never	4%
Less than once a week	21%
1-3 times a week	35%
4-6 times week	29%
Once a day	14%
Twice a day	1%
Total	100%

Table 4.11 represents Roots and tubers were consumed 1-3 times per week (35%), 29% of subjects consumed 4-6 times a week, 21% of the subjects consumed less than once a week, 14% of the subjects consumed once a day, 4% never consumed, 1% of the subjects consumed twice a day.

Table 4.12 Frequency of intake of nuts and oils

Frequency	Percentages
Never	4%
Less than once a week	2%
1-3 a week	15%
4-6 a week	17%
Once a day	51%
Twice a day	3%
More than 3 times a day	3%
Total	100%

Table 4.12 represents subject's intake of nuts and oils once a day (51%), 17 % of the subjects consumes 4-6 a week, 15% of the subjects consumes 1-3 times a week, and 3 percent of the subjects consumes twice a day and more than 3 time a day

Table 4.13 Frequency of intake of fruits

Frequency	percentage
Never	4%
Less than once a week	3%
1-3 times a week	12%
4-6 times a week	18%
Once a day	66%
Total	100%

Table 4.13 shows that most of the subjects consumes fruits once a day (66%), 18%of subjects consumes 4-6 times a week, 12%of the subjects consumes 1-3 times a week, 3% consumes less than once a week and 4% never consumes fruits

Table 4.14 Frequency of people intake of fish

Frequency	percentage
Never	9%
Less than once a week	37%
1-3 times a week	30%
4-6 times a week	20%
Once a day	4%
Total	100%

Table 4.14 represents that maximum number of the subjects consumes fish less than once a week (37%), 30% of the subjects consumes 1-3 times a week, 20% consumes 4-6 times a week, 4% consumes daily once, and 9% never consume fish at all

Table 4.15 Frequency of intake of meat and poultry

Frequency	percentage
Never	4%
Less than once a week	40%
1-3 times a week	40%
4-6 times a week	11%
Once a day	5%
Total	100%

Table 4.15 shows that majority of subjects consumes meat and poultry less than once a week and 1-3 times a week (40%), 11% of subject consume 4-6 times a week, 5% subject consume once a day and 4% of subject never consumes.

Table 4.16 Frequency of intake of milk and milk products

Frequency	percentage
Never	4%
Less than once a week	1%
1-3 times a week	6%
4-6 times a week	15%
Once a day	70%
Twice a day	8%
Total	100%

Table 4.16 demonstrates that of the subjects frequency of consume of milk and milk products are once a day 15% of the subjects consume 4-6 times a week, 6% of the subjects consume 1-3 times a week, 70% of subjects consume once a day, 8% of subjects consume twice a day, 4% of subjects will not consume.

Table 4.17 Frequency of intake of fats and edible oils

Frequency	percentage
Never	4%
Less than once a week	2%
1-3 times a week	4%
4-6 times a week	4%
Once a day	19%
Twice a day	55%
Total	100%

Table 4.17 shows that Majority of the subjects consumes fats and edible oils twice a day(55%) ,4% of subjects consumes 1-3 times a week,4% of subjects consumes 4-6 times a week, 19% of subjects consumes once a week,2% of subjects consumes less than once a week and 4% of subjects will not consume.

Table 4.18 Frequency of intake of condiments and spices

Frequency	percentage
Never	29%
Less than once a week	20%
1-3 times a week	27%
4-6 times a week	9%
Once a day	15%
Total	100%

Table 4.18 represents that Maximum number of subjects will not consume condiments and spices(29%),27% of subjects consume 1-3 times a week,9% of subjects consumes 4-6 times a week,15% of subjects consume once a day and 20% of subjects consume less than once a week.

Table 4.19 Frequent of intake of sugar

Frequency	percentage
Never	11%
Less than once a week	20%
1-3 times a week	5%
4-6 times a week	7%
Once a day	28%
twice a day	28%
Total	100%

Table 4.19 shows that Most of the subjects consumes sugar twice a day (29%),28 %of the subjects consumes once a day ,20%of the subjects consumed less than once a week ,11% done consumes at all ,7% of the subjects consumes 4-6 times a week and 5%1-3 time a week.

Table 4.20 Frequency of intake of alcohol

Frequency	percentage
Never	76%
Less than once a week	2%
1-3 times a week	8%
4-6 times a week	11%
Once a day	3%
Total	100%

Table 4.20 represent about alcohol consumption over 76% never take alcohol ,11%concumes 4-6 times a week,8%consumes 1-3 times a week ,2%consumes less than once a week,3% consumes once a day

Table 4.21 Frequency of intake of non-alcoholic

Frequency	percentage
Never	59%
Less than once a week	34%
1-3 times a week	8%
4-6 times a week	1%
Total	100%

Table 21 represents majority of the subjects never consumes non -alcoholic beverages at all (59%),34% of subjects consumes less than once a week ,8% of the subjects consumes 1-3 times a week and 1% consumes 4-6 times a week

Table 4.22 Association between food frequency and pre-prandial values

s.no	Food groups	Cal x ²	d.f	Tab x ²
1	Cereals and grain products	1.35NS	2	5.99
2	Pulses and legumes	1.367NS	2	5.99
3	Leafy vegetables	25.853*	10	18.31
4	Roots and tubers	22.506*	10	18.31
5	Other vegetables	10.08*	12	21.03
6	Nuts and oil seeds	18.456NS	12	21.03
7	Condiments and spices	13.430*	8	15.51
8	Fruits	16.79NS	10	18.31
9	Fish and other food	22.596*	8	15.51
10	Meat and poultry	17.324NS	10	18.31
11	Milk and milk products	11.425*	8	15.51
12	Fats and edible oils	20.232*	105.	18.31
13	Sugars	21.063*	10	18.31
14	Alcoholic beverages	13.368NS	8	15.51
15	Non alcoholic	7.325NS	8	15.51

* Significant at 0.05 level

NS- Non Significant

The present study conducted in modern diabetics centre Nellore district among diabetic men and women on association with food frequency shows a significant

association between consumption of leafy vegetables, roots and tubers, fish and other food, fats and edible oils and sugars to pre-prandial values. The mentioned food group are significant at 0.05 level.

Whereas there is no significant association between Cereals and grain products, Pulses and legumes ,Other vegetables, Nuts and oil seeds , Condiments and spices, Fruits, Meat and poultry ,Milk and milk products, Alcoholic beverages and Non-alcoholic to pre-prandial values.

The results done in Modern diabetic centre Nellore district support the study of wheeler (2012)this study concluded that the consumption of whole grains was not associated with significant improvements in glycaemic control in individuals with type 2 diabetes in pre-prandial value.

Hence, the hypothesis H1 is partially rejected

Table 4.23 Association between food frequency and post-prandial values

s.no	Food groups	Cal x ²	d.f	Tab x ²
1	Cereals and grain products	1.35NS	2	5.99
2	Pulses and legumes	1.367NS	2	5.99
3	Leafy vegetables	25.853*	10	18.31
4	Roots and tubers	22.506*	10	18.31
5	Other vegetables	10.08*	12	21.03
6	Nuts and oil seeds	18.456NS	12	21.03
7	Condiments and spices	13.430*	8	15.51
8	Fruits	16.79NS	10	18.31
9	Fish and other food	22.596*	8	15.51
10	Meat and poultry	17.324NS	10	18.31
11	Milk and milk products	11.425*	8	15.51
12	Fats and edible oils	20.232*	105.	18.31
13	Sugars	21.063*	10	18.31
14	Alcoholic beverages	13.368NS	8	15.51
15	Non alcoholic	7.325NS	8	15.51

* Significant at 0.05 level

NS- Non Significant

The above table shows significant association between food frequency and post prandial values significant association between consumption of leaf vegetables, roots and tubers other vegetables nuts and oilseeds, condiments and spices, fruits, fish and other foods, meat and poultry, fish and edible oil and sugar to post prandial values The mentioned food group are significant at 0.05 level.

Where as they is no significant association between Cereals and grain products, Pulses and legumes, Milk and milk products, Alcoholic Beverages and Non-alcoholic to post prandial values.

The results done in Modern diabetic centre Nellore district support the study of Evert in 2014 concluded that are is a rapid increase in post prandial values when sugar is consumed this effects the patients insulin level

The results are supports the study conducted by Alder in 2012 concludes that fish consumption affected HbA1c inversely in both men and women. , the consumption of fish and related nutrients (especially long-chain omega-3 fatty acids) seems to have various metabolic effects on patients with diabetes and have a significant decrease in pre-prandial values.

Hence, the hypothesis H2 is partially rejected

CHAPTER 5

CONCLUSION

The present study was conducted in modern diabetic centre Nellore district, Andhra Pradesh, this study revealed that majority 53.75 % of the selected patients belonged to 51 to 60 years and the remaining 46.25 % were from 40 to 50 years. Female diabetic patients were 51.25 % and nearly 29% of the patients were having retinopathy. From the food consumption frequency among the selected diabetic patients it was found that cereal was consumed more than 3 times a day (96%) and 4% twice a day. Frequency of pulse consumption was high 93% in more than 3 times a day and 7% twice a day. Frequency of consumption of leafy vegetables was also found to be more frequent. Consumption of other vegetable were 4-6 times a day (35%) and nearly 34% of the people take once in a day. Majority of the patients consumed roots and tubers 1-3 times a week is (35%). 66 % of the patients consumed fruits once in a day. Nuts and oil consumption was once in a day (61 %). Fish consumption among the selected patients were 37 % less than once in a week. Meat and poultry was found to be taken in once in a week and less than once a week. 70 % of the patients were taking milk and milk product once in a day. Fats and oil were taken twice a day by 50% of the study population.

Significant association was found between food frequency and pre-prandial values of men and women with Diabetics mellitus .Food groups such as Roots and tubers(22.50), other vegetable(10.8), Condiments and spices(13.43), Fish and other food (22.59), Meat and poultry(17.32), Fats and edible oils(20.23)and Sugars(21.06) are Significant at 0.05 level. There is no significant association between Cereals and grain products, Pulses and legumes ,Other vegetables, Nuts and oil seeds , Condiments and spices, Fruits, Meat and poultry ,Milk and milk products, Alcoholic beverages and Non-alcoholic to pre-prandial values.

Significant association was found between food frequency and post -prandial values of men and women with Diabetics mellitus .Food groups such as Roots and tubers(39.38), other vegetable(30.41), Nuts and oil seeds(21.65), Condiments and spices(31.24), Fish and other food(22.70), Meat and poultry(27.44), Fats and edible oils(10.60) and Sugars(17.6) are Significant at 0.05 level . There is no significant association between Cereals and grain products, Pulses and legumes, Milk and milk products, Alcoholic Beverages and Non-alcoholic to post prandial values

SUGGESTIONS

Diet plays a very important role in the management of diabetic mellitus, proper attention and care must be given to the diabetic patients for the betterment of the life.

1. Diet counselling and nutrition education can be provided to the patients in order to manage their life style according to their disease condition.
2. The study can be included with specific food group's items such as cereals rice, wheat and oats.
3. Feather the same study can be done on diabetic's patients by following specific dietary guidelines.

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