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RESEARCH ARTICLE

EFFECT OF CONSUMPTION OF MILLET DIET ON DIABETES MELLITUS, TREATED AND UNTREATED PATIENTS COLLECTED FROM CHEYYAR TALUK, THIRUVANNAMALAI DISTRICT

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ABSTRACT

Patients suffering from diabetes mellitus at different age group of both sexes were taken up for the present study. A total of 100 diabetes mellitus of the both sex (male 56, and female 44) have been taken for the present study.The age group of male patients ranged between 30 – 80 years. Out of 56 male patients the incidence of diabetes mellitus is high 39% (22 patients), in the age group between 50 – 60 years. The lowest incidence of diabetes mellitus that is 4 cases (7.14%) in the age group between 30 – 40 years. The age group of female patients ranged between 30 – 80 years, out of 44 female patients the incidence is high 40.9% (18 patients) in the age group between 50 – 60 years. The lowest incidence of diabetes mellitus that is 5 patients (11.3%) in the age group between 30 – 40 years. Majority of the patients are employers living in Cheyyar Taluk, Thiruvannamalai district. They belong to urban areas. Another important study in the present investigation is food habit of diabetes mellitus patients. Out of 100 patients selected 56 were males and 44 were females. Among 56 males 28 were taken medicine for diabetes and 28 were not taken any medicine for diabetes. Out of 28 patients treated with anti - diabetic drug 16 having the food habit of millet diet and 12 were having the habit of Rice diet. The diabetic patients with anti – diabetic treatment having the habit of millet diet, showed normal blood sugar level. But the diabetic patients with anti diabetic treatment having the habit of Rice diet showed moderate level of blood sugar both FBS (Fasting Blood Sugar) and PP (Post Prandial blood sugar). In comparison to rice and millets diet the millet diet with low carbohydrate content, low digestibility and water soluble gum content (β – glucan) have been attributed to improve glucose metabolism. These grains release sugar slowly in the blood and also diminish the glucose absorption. Out of 28 patients with diabetic untreated (without any anti diabetic drugs) 18 patients were having the habit of millet diet and 10 of them were having the habit of Rice diet. The untreated patients with millet diet showed normal level of blood sugar both FBS and PP, whereas the untreated patients without millet diet that is with rice diet showed High level of blood sugar level both FBS and PP respectively. On the other hand out of 44 female patients suffering with millet diet showed normal level of blood sugar in both FBS and PP. The patients having the habit of Rice diet showed high level of blood sugar both FBS and PP. But in untreated Female patients 15 patients showed having the habit of Millet diet and 5 patients showed having the habit of Rice diet. The untreated patients with Millet diet showed normal level of blood sugar. But the untreated female patients 5 having the habit of Rice diet showed high level of blood sugar in both FBS and PP. Insufficient physical activity is one of the major causes of diabetes mellitus among the people of Cheyyar Taluk, Thiruvannamalai District, Tamil Nadu. Unhealthy diet and obesity are also important factor for diabetes mellitus among people of Cheyyar Taluk, Thiruvannamalai District.

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INTRODUCTION

Diabetes Mellitus is a major and growing health problem in most countries and an important cause of prolonged ill health and early death (WHO, 2000). It was the sixteenth leading cause of global mortality in 1990, accounting for 571,000 deaths (Murray *et al.,* 1997). Diabetes is predicted to continue to grow world-wide at epidemic proportions in the first quarter of the 21st century. The growth will be particularly strong in India and China (King *et al.,* 1998; Roglic and King, 2000), which lead the world in the prevalence of diabetes, with 14.3% and 11.8% of prevalence, respectively in 1995. In USA, which ranks third after India and China in the prevalence of diabetes, the growth rate is expected to be much smaller: from 13.9 million in 1995 to 21.9 in 2025 (King *et al.,* 1998). The growth in number of people with diabetes is expected to be fast in Pakistan, Indonesia, Egypt and Mexico, and somewhat slow in Japan (King *et al.,* 1998). Recent studies of geographical and ethnical influences have shown that people of Indian origin are highly prone to diabetes (Shaw *et al.,* 1999). The number of adults suffering from diabetes in India is expected to increase three-fold, from 19.4 million in 1995 to 57.2 million in 2025. During the same period, China's diabetic adult population is

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slated to grow from 16 million to 37.6 million (King, *et al*., 1998). These figures are based on estimated population growth, population ageing, and urbanisation, but they do not take into account changes in other diabetes-related risk factors. For this reason Roglic and King (2000) believed that the figures are likely to be conservative estimates. And yet, the contribution of both India and China to the research literature of diabetes, based on papers indexed in *Pub Med,* is rather meagre – 1.11% by India and 0.63% by China. (How-ever, one must note that scientific articles in developing countries are under-represented in international databases and in general papers published by developing countries are not indexed comprehensively (Gibbs and Wayt, 1995 and Zielinski, 1995). Diabetes is devastating disease that is characterized by high glucose level in the blood and has been recorded in the medical literature since as early as 1500 BC (Brar, 2007). The causes were not well understood until the 19th century when Paul Langerhans, a German medical student discovered what have become known as the islets of Langerhans which produce insulin. Insulin is a protein hormone that promotes the uptake of glucose by the body's cells (Dictionary of biology 2005). Diabetics either do not produce enough insulin to process their intake of glucose or the body does not use the insulin efficiently enough to control glucose levels. Treating diabetes has always been difficult and prior to the 1920's, the primary treatment plan was controlling diet. In 1921, Dr. Frederick Banting discovered how to extract insulin from cattle that could be used as an injectable form for human diabetics which revolutionized the treatment of the disease and made it more manageable.

Diabetes Mellitus (MD) is a clinical syndrome characterized by hyperglycemia, polyuria, polydypsia and weight loss (Aguocha *et al*., 2013). It is a condition in which glucose in the body is not properly utilized. It is either that the insulin is not adequately secreted by the pancreas or that the target cells do not respond to the available insulin in the body or both (Kelvin, *et al.,* 2007). Diabetes is as old as mankind. It is one of the non-communicable diseases that affect both the young and old (Smith *et al.,* 2009). Smith *et al*. (2009) in 1889 showed that depancreatized dogs developed diabetes. It was then logical to assume that diabetes was simply a hormone deficiency syndrome. This reasoning was strongly reinforced by Devaseran *et al.* (2004). When they observed that manifestations of diabetic hyperglycemia could be promptly resolved by the administration of insulin secreted by the islet cells of Langerhans. There are two main types of diabetes mellitus: Type I (Insulin dependent or Juvenile onset) and Type II (Non insulin dependent) (Devaseran *et al.,* 2004). It could also occur in pregnancy and this is referred to as Gestational diabetes mellitus. This can result in increase in both prenatal and maternal morbidity and mortality (Edwin and George, 2005). Some complications of diabetes mellitus include diabetic foot infections, retinopathy, nephropathy, gastroparesis, non alcoholic fatty liver disease, erectile dysfunction etc. and a general down run in health vitality and longevity (Mazen and Bader, 2008 and Obsi, 2005).

Millet actually targets diabetes and inflammation. Providing a good amount of magnesium, phosphorus, protein, fibre and anti-oxidants, this tasty cereal is certainly nutritious. The Hunzas, who are known for their excellent health and longevity, consume millet as a regular staple in their diet. Millet is also rich in a class of phytonutrients known as lignin. Bacteria in your intestine convert lignin into anti-cancer compounds. Millet, an important food crop in Asia and Africa has health benefits just recently investigated. (Alberta Cook, ASN). For one thing, the magnesium in the millet improves the ability of the cells to respond to insulin. Insulin helps to control the blood glucose levels. Secondly, millets have a relatively low glycemic index and have been shown to produce lower blood glucose level than either wheat or rice. However, there is more. To take this study, for example. To find out if millet could effectively help people with Type II diabetes, researchers fed diabetic mice a high –fat diet which also contained Japanese millet protein concentrate for three weeks. When the three weeks concluded, they found their HDL (good) cholesterol level was increased. Even more importantly, their adiponectin, a beneficial hormone that helps energy metabolism, was also increased (Nishizawa, 2009). A similar study using Korean proso millet showed basically the same results as did for the Japanese millet (Park, 2008). Proso millet is usually sold in the United States. The proportions for cooking whole grain millet are as follows: add one cup of millet to three or four cups of water with 1/8 to 1/4 teaspoon of salt. Bring to a boil, cover, and simmer for 45 minutes to an hour, or until the water is all absorbed. Do not stir while cooking. Thickened blueberries are dried fruits or can be added during the last ten minutes of cooking. Just place them on top of the cooking millet and they will soften, don't stir them in or, it can be served as part of a main meal as rice would be used, in casseroles and other dishes. Try it and gain the benefits of this very nutritious golden grain. Although there is an increase in the prevalence of Type I diabetes also, the major driver of the epidemic is the more common form of diabetes, namely Type II diabetes, which accounts for more than 90 percent of all diabetes cases.

It is also important to take into consideration that some of the phytochemicals present in sorghum and millets are not necessarily health-promoting. Some varieties of sorghum and finger millet contain substantial levels of condensed tannins (proanthocyanidins and procyanidins). The condensed tannins in sorghum are generally considered as antinutrients as they have been associated with adverse effects on dietary protein digestibility (Butler *et al*., 1984 and Mitaru *et al*., 1984), digestive enzyme activity (Al-Mamery *et al*., 2001) and mineral bioavailability (Al-Mamery, *et al*., 2001 and Towo *et al*., 2006). Their inhibitory effects on starch digestion have, however, been suggested as being potentially beneficial in the prevention of Type II diabetes and metabolic syndrome (Lemlioglu *et al*., 2012). Also pearl millet seems to uniquely contain flavonoids C-glycosyl flavones, especially vitexin (Reichert, 1979), which are goitrogenes (Birzerr, *et al*., 1987 and Gaitan *et al*., 1995). These glycosyl flavones have been implicated as a cause of the high incidence of goitre in certain communities in Sudan (Osman, *et al*., 1983) and India (Brahmbhatt *et al*., 2001) where pearl millet is a staple. Tannins are present in sorghums with a pigmented test (classified as type II and III sorghums). These sorghums have dominant B_1 _ B_2 _ genes. The B_1 and B_2 genes control the presence or absence of the pigmented test layer (Hahn and Rooney, 1986). Both genes must be dominant for a pigmented test to develop. When the S gene (spreader gene) is dominant concurrently with the dominant B_1 and B_2 genes, pericarp colour become phenotypically brown (Earp *et al.,* 1983). The sorghums with the dominant S – gene generally contain tannins that are more easily extractable than the ones with the recessive gene (Hahn and Rooney, 1986). Such sorghums (with dominant S – gene) also produce greater anti –

nutritional effects in animals (Cousins *et al.,* 1981). Since the pericarp colour and secondary plant colour of sorghum is genetically controlled, it is possible to develop different combinations of pericarp and plant colour with and without the pigmented test and spreader genes, which opens the possibility of significantly different levels and combinations of phenolic compounds. In addition, it can effectively control hyperglycemia and abnormal protein metabolism (Mani, *et al*., 1985, 1986, 1987).

It is also stressed that more than the quantity of carbohydrates (60-65 % of calories of a diabetic diet should be carbohydrate), it is the type of carbohydrate that is eaten, which has a direct bearing on the blood sugar level. Nutritional potential of millets in terms of protein, carbohydrate and energy values are comparable to the popular cereals like rice, wheat, barley or bajra. Finger millet contains about 5-8% protein, 1-2% ether extractives, 65-75% carbohydrates, 15-20% dietary fibre and 2.5-3.5% minerals (Chethan and Malleshi 2007). It has the highest calcium content among all cereals (344 mg/100g). However, the millet also contains phytates (0.48%), polyphenols, tannins (0.61%), trypsin inhibitory factors, and dietary fibre, which were once considered as "anti nutrients" due to their metal chelating and enzyme inhibition activities (Thompson 1993) but nowadays they are termed as neutraceuticals. Over the past 30 yrs, the status diabetes has changed from being considered as a mild disorder of the elderly to one of the major causes of morbidity and mortality affecting the youth and middle aged people. It is important to note that the rise in prevalence is seen in all six inhabitated continents of the globe (Wild and Roglic *et al.,* 2004). Nowhere is the diabetes epidemic more pronounced than in India has the World Health Organization (WHO) reports show that 32 million people had diabetes in the year 2000 (Wild and Roglic *et al*., 2004). Banyard millet (*Echinochloa frumentacaea*) is one of the hardest millets, which is called by several names viz., Japanese banyard millet, Ooda, Oadalu, Sawan, Sanwa, and Sanwank. Nutritionally, Banyard millet is an important crop. It is fair source of protein, which is highly digestible and is an excellent source of dietary fibre with good amounts of soluble and insoluble fraction (Hadimani and Malleshi 1993; Veena *et al*., 2005). For example, pearl millet was found significantly rich in resistant starch, soluble and insoluble dietary fibres, minerals, and antioxidants (Raagee and others 2006). It contains about 92.5% dry matter, 2.1% ash, 2.8% crude fibre, 7.8% crude fat, 13.6% crude protein, and 63.2% starch (Ali and others 2003). Also, foxtail millet protein characterization showed that its protein concentrate is a potential functional food ingredient and the essential amino acid pattern suggests possible use as a supplementary protein source to most cereals because it is rich in lysine (Mohamed and Others 2009). Utilization of Wholegrain cereals in food formulations is increasing worldwide, since they are rich sources of phytochemicals and dietary fibre which offer several health benefits (Jones and Engleson 2010).

Millet and some other coarse grains are usually dehulled and subjected to different treatments before consumption to improve their sensory and edible quality (Liu and others 2012). It has been reported that the food uses of finger millet are confined to flour-based products because it has not been possible to decorticate millet similar to other cereals. This is mainly due to millet grains that are small compared to other cereals. But it was observed that the hydrothermal treatment of millet hardened the endosperm texture and enabled its decortication. The decorticated millet could be cooked as discrete grains similar to rice to obtain soft edible texture within 5 min, which was not possible before. The pasting and the dough properties and also some of the functional characteristics of the product indicated its versatility for diversified for food uses (Shobnam and Malleshi, 2007). However, decortication of hydrothermally processed finger millet caused significant changes in the nutrient content (Dharmaraj and Malleshi, 2011). Finger millet also is known to have several potential health benefits and some of the health benefits are attributed to its polyphenols contents (Chethan and Malleshi, 2007). It has a carbohydrate content of 81.5%, protein 9.8%, crude fibre 4.3%, and mineral 2.7% that is comparable to other cereals and millets. Its crude fibre and mineral contents are markedly higher than those of wheat (1.2% fibre, 1.5% minerals) and rice (0.2% fibre, 0.6% minerals); its protein is relatively better balanced it contains more lysine, threonine, and valine than other millets (Sripriya and Others, 1997). In addition, black finger millet contains 8.71 mg/g dry weight fatty acid and 8.47 g/g dry weight protein (Glew and others 2008). Kodo millet and little millet were also reported to have 37% to 38% of dietary fibre, which is the highest among the cereals; and the fat has higher polyunsaturated fatty acids (Malleshi and Hadimani 1993; Hedge and Chandra, 2005). The protein content of proso millet (11.6% of dry matter) was found to be comparable with that of wheat and the grain of proso millet was significantly richer in essential amino acids (leucine, isoleusine, and methionine) than wheat protein (Kalinova and Moudry 2006). Thus, the presence of all the required nutrients in millets makes them suitable for large – scale utilization in the manufacture of food products such as baby foods, snack foods, and dietary food and, increasingly, more millet products have entered into the daily lives of people, including millet porridge, millet wine, and millet nutrition powder from both grain and flour form (Subramanian and Viswanathan, 2007; Liu and others, 2012).

MATERIALS AND METHODS

The present investigation about the incidence of diabetes mellitus among the people of Cheyyar Taluk, Thiruvannamalai district was taken up for the present study. They were personally interviewed using the following Questionnaire which included Gender, Age group, Blood group, Type of diabetes, with or without treatment and food habit (Millet diet or Rice diet).

Approval

The approval from the selected diabetes clinic in Cheyyar Taluk, Thiruvannamalai District, and informed written consent was obtained from the subjects enrolled for the present study.

Sampling and Study area

The subjects from Cheyyar Taluk, Thiruvannamalai District of Tamil Nadu were selected. 100 clinically confirmed diabetes mellitus patients were taken up.

- Only patients who are confirmed as type 2 diabetes or hyperlididemics (TC>200 mg, TG<150 mg/dl) by the physician were enrolled.
- Willing to be part of the study.

Background information

The information regarding gender, age, blood group, disease profile, food habit activity patterns were collected from diabetes patients using Questionnaire with informed conset.

Dietary pattern

Dietary pattern of the patients before and after the onset of disease was assessed using a food frequency Questionnaire. (FFQ).

Biochemical Parameters

Secondary data on parameters such as Fasting Blood Sugar level (FBS), Post Prandial Blood Sugar level (PPBS).

Gender study

The Gender study was identified by the external appearance of the diabetic mellitus patients.

Age group study

The age group study was made by asking their age using questionnaire.

Types of Diabetes were made by the doctor's report and case history

ABO blood group study

ABO Blood group was studied by the method of karl Landsteiner (1900).

Blood Sugar Estimation

The blood sugar Estimation was carried out by the method described by Trinder (1969).

RESULTS

Table 1 showing the incidence of Diabetes mellitus found in male and female during the period from January 2016 to June 2016. 100 people suffering from Diabetes mellitus of both the sexes were taken up for the present study (Table 1).

Gender study

Out of 100 patients suffering from Diabetes mellitus 56 were males and 44 were females. The results are given in Table 2 and Bar diagram 1. Males are more likely to be affected by diabetes mellitus than females. The results are in agreement with those of Sarah Wild, *et al.,* 2004. They found out the prevalence of diabetes is higher in men than women.

Age group study

Age group study in Males

According to age group study of males, out of 100 patients studied 56 wee males. Out of 56 male patients higher occurrence of 22 (39.2%) diabetic mellitus patients belongs to the age group between 50 – 60 years. Next to this 14(25%) patients were observed in the age group between 60 – 70 years. The occurrence of diabetes mellitus in the age group between 70 - 80 years was 6(10.7%). In the age group between 40 – 50 years was 10 (17.85%). Four patients (7.143%) were seen in the age group between 30 – 40 years. No occurrence of diabetes mellitus is seen in the age group between 0 – 10, 10 – 20 and 20 – 30 years (Table 3 and Bar diagram 2).

Age group study in females

Out of 100 patients studied, 44 patients were females. Table 3 and Bar diagram 2 clearly showed that the age group of female diabetic mellitus patients. The highest occurrence of 18(40.9%) diabetes mellitus are seen in females in the age group between 50-60 year. Next to this 8 (18.1%) patients were noticed in the age group between 40 – 50 years. The occurrence of Type II diabetes mellitus in the age group between 30 – 40 years was 5(11.36%) were found. In the age group between 60 – 70 years was 7(15.9%). In the age group between 30 – 40 years 5(11.36%) were seen. Six patients (13.6%) were seen in the age group between 70 – 80 years. No occurrence of this disease in the age group between 0 – 10, 10 – 20 and 20 – 30 years. The prevalence of diabetes mellitus is higher 40 (both male 22 and female 18) in the age group between 50 – 60 years. The results are in agreement with those of Shaw *et al*., (1999). They estimated the world prevalence of diabetes among adults (20 – 70 years) would be 6.4% affecting 285 million adults in 2010 and will increase to 7.7% and 439 million adults by 2030. The work of Sarah Wild, (2004) also show important they found for age group study in diabetes mellitus patients. The found out the most important demographic change to diabetic prevalence across the world appears to be increases in the proportion of peoples > 65 years age.

Blood group study

An other important parameter in diabetes mellitus study is blood group. A total of 100 patients suffering from diabetes mellitus were randomly taken up during the study period. Out of 100 patients 56 patients were male diabetic and 44 were female diabetic patients. Their blood group have been taken up for the present study and correlate with Diabetes mellitus. (Table 4 and Bar diagram 3).

Blood group study in Males

Among 56 male patients 32(57.1%) belongs to B^{+ve} Blood group, more than half of the male showed B^{+ve} blood group. More than half of the male patients showed B^{+ve} Blood group. Next to this 8(14.2%) patients showed A^{+ve} blood group, 4 patients (7.1%) belongs to B^{-ve} blood group, 3 patients (5.3%) showed AB^{+ve} and O^{+ve} blood group each, respectively. And 2 patients each (3.5%) showed A^{-ve}, AB^{-ve} and O^{-ve} blood groups respectively. The results were given in Table 4 and Br diagram 3

Blood group study in females

On the other hand out of 44 female patients affected by diabetes mellitus, 19 patients (43.1%) belong to B^{+ve} blood group. Nearly 50 percentages of female patients belongs to B^{+ve} blood group. Next to this 7 patients (15.9%) showed A^{+ve} blood group, 5 patients (11.3%) showed AB^{+ve} blood group, 4 patients each (9.091%) belongs to B^{-ve} and O^{+ve} blood groups. 3 Patients (6.8%) showed O^{-ve} blood group. And one patient each (2.2%) belongs to A^{-ve} and AB^{-ve} blood groups respectively. Results are given in Table 3 and bar diagram 3.

Table 1. Survey of diabetes mellitus patients in cheyyar taluk thiruvannamalai district with or without millet diet

S.No.	Code no.	Sex	Age	Weight	Previous history	Blood sugar								Blood group	Treatment	Exercise	Diet r/m
						1st week		2nd week		3rd week		4th week					
						FBS	PP	FBS	PP	FBS	PP	FBS	PP				
1	DM01	F	40	64	N	150	237	90	150	120	236	95	145	AB+VE	N	Y	M
2	DM02	M	45	65	Y	300	380	289	377	302	370	297	366	B+VE	Y	Y	R
3	DM03	F	75	67	Y	146	196	145	189	132	196	150	160	A+VE	Y	N	R
4	DM04	F	48	61	Y	145	246	110	200	120	236	99	130	B+VE	N	N	M
5	DM05	F	60	56	Y	280	340	267	339	287	352	270	341	O+VE	Y	N	R
6	DM06	M	65	73	Y	146	230	95	145	123	234	98	145	B+VE	Y	Y	M
7	DM07	F	60	58	N	130	160	98	155	125	170	87	150	B-VE	Y	N	M
8	DM08	M	52	80	Y	120	176	115	134	110	140	100	132	B+VE	N	N	M
9	DM09	M	43	89	Y	300	380	281	329	195	230	115	193	A+VE	Y	N	R
10	DM10	F	51	62	Y	118	260	87	143	132	174	91	100	A+VE	Y	N	M
11	DM11	M	68	76	Y	268	320	257	318	260	325	265	322	B+VE	N	Y	R
12	DM12	F	37	72	Y	155	235	99	156	125	220	100	150	B+VE	Y	Y	M
13	DM13	F	60	64	Y	300	380	281	329	195	230	282	310	B+VE	N	N	R
14	DM14	M	65	73	N	240	326	235	330	245	340	239	330	B+VE	Y	N	R
15	DM15	F	41	56	N	220	310	223	315	231	320	240	334	B+VE	Y	Y	R
16	DM16	F	66	67	Y	150	238	95	200	120	236	95	140	O+VE	Y	Y	M
17	DM17	F	57	63	Y	120	265	89	145	130	176	92	110	O-VE	N	Y	M
18	DM18	M	59	55	N	147	218	149	224	158	230	165	241	B+VE	Y	Y	R
19	DM19	F	64	65	Y	160	270	129	235	149	214	92	147	AB+VE	Y	Y	M
20	DM20	M	61	70	Y	258	310	264	321	270	328	276	330	B+VE	Y	Y	R
21	DM21	M	45	80	Y	274	320	285	328	291	340	295	353	B+VE	N	Y	R
22	DM22	F	67	57	N	158	186	139	155	152	164	105	120	B+VE	N	Y	R
23	DM23	M	70	81	N	162	190	145	160	156	170	97	130	B+VE	N	N	M
24	DM24	F	38	61	Y	132	164	102	154	128	176	99	145	O+VE	N	Y	M
25	DM25	M	46	58	Y	146	196	104	176	132	196	94	158	B-VE	Y	N	M
26	DM26	M	40	60	Y	162	189	145	162	152	164	95	110	B +VE	N	Y	R
27	DM27	M	70	55	N	167	198	128	165	118	140	100	130	AB-VE	N	N	R
28	DM28	F	65	50	N	153	184	110	170	135	178	95	158	O-VE	Y	N	R
29	DM29	F	40	45	Y	200	380	159	290	165	310	100	170	O+VE	N	Y	R
30	DM30	M	48	72	Y	248	270	105	210	201	230	95	175	B+VE	Y	Y	R
31	DM31	M	70	65	N	199	376	150	181	152	301	98	143	B+VE	N	Y	M
32	DM32	F	42	56	Y	148	170	123	165	135	130	110	162	B+VE	Y	Y	R
33	DM33	F	72	75	Y	158	180	143	175	135	168	120	165	B+VE	Y	N	R
34	DM34	M	54	67	Y	153	289	112	131	128	210	96	140	AB+VE	N	N	M
35	DM35	M	60	69	N	221	308	189	276	104	166	99	158	A+VE	N	N	M
36	DM36	M	42	73	Y	118	194	91	186	109	165	89	132	A+VE	N	N	M
37	DM37	M	60	56	N	174	259	83	113	95	139	76	100	A+VE	N	N	M
38	DM38	M	46	65	Y	124	265	110	186	118	174	87	150	B+VE	Y	N	M
39	DM39	M	40	71	Y	82	126	79	127	81	129	75	110	B+VE	Y	Y	M
40	DM40	M	64	73	N	195	371	118	280	145	285	100	195	AB+VE	Y	N	M
41	DM41	M	49	75	Y	126	208	79	116	110	197	75	96	B+VE	N	Y	M
42	DM42	M	59	66	Y	129	169	116	148	125	156	99	130	A+VE	N	N	M
43	DM43	F	72	59	N	125	190	118	174	120	185	96	151	B-VE	N	N	M
44	DM44	M	60	61	Y	130	250	116	234	125	241	100	159	B+VE	N	Y	M
45	DM45	F	63	58	Y	79	120	72	110	75	115	70	99	AB+VE	N	Y	M
46	DM46	M	60	74	Y	110	180	105	165	110	172	90	156	A-VE	N	Y	M
47	DM47	F	57	56	Y	198	320	125	240	110	262	96	149	B-VE	Y	Y	M
48	DM48	F	49	58	Y	205	330	168	284	197	302	85	175	B+VE	Y	N	M
49	DM49	F	56	65	N	120	210	106	195	110	208	98	155	B+VE	N	N	M
50	DM50	F	57	78	N	135	204	111	189	125	195	85	160	B+VE	N	Y	M
51	DM51	F	43	62	Y	320	410	266	375	300	30	160	310	B+VE	Y	Y	M
52	DM52	F	45	67	Y	210	245	164	220	178	235	95	155	A+VE	N	Y	M
53	DM53	M	57	85	Y	255	302	164	266	198	276	2	160	AB+VE	Y	Y	R
54	DM54	M	60	75	Y	130	165	95	112	135	130	78	100	O+VE	N	Y	R
55	DM55	M	70	67	N	119	167	90	134	104	145	70	115	O+VE	Y	Y	M
56	DM56	M	54	76	N	207	359	168	307	175	318	115	265	O-VE	N	N	M
57	DM57	F	58	63	Y	118	169	95	146	110	158	86	122	B+VE	Y	Y	M
58	DM58	M	79	61	Y	172	217	154	193	162	204	97	143	B+VE	Y	N	R
59	DM59	F	75	60	Y	96	168	85	157	90	160	75	110	AB+VE	Y	Y	R
60	DM60	M	68	67	N	140	176	125	156	132	163	89	147	A-VE	Y	N	R
61	DM61	F	64	59	N	143	279	110	230	126	250	95	155	A+VE	Y	N	M
62	DM62	F	55	58	Y	112	131	93	162	115	176	78	114	A+VE	N	N	M
63	DM63	F	75	59	Y	221	308	180	263	204	288	110	192	B+VE	Y	Y	M
64	DM64	F	43	63	Y	189	266	142	210	165	224	104	164	B-VE	N	Y	M
65	DM65	M	56	67	Y	104	156	84	122	98	135	72	98	B+VE	Y	Y	M
66	DM66	F	56	60	Y	108	184	92	144	101	162	83	125	B+VE	Y	Y	M
67	DM67	M	70	72	N	164	249	124	225	142	233	98	158	B+VE	Y	Y	M
68	DM68	M	52	70	Y	114	255	95	175	106	204	79	153	B+VE	N	Y	M
69	DM69	F	38	60	Y	126	240	183	205	144	218	98	160	B+VE	N	N	M
70	DM70	M	75	67	N	117	211	100	188	108	209	85	154	B+VE	Y	Y	M

Continue……

71	DM71	F	57	51	Y	267	319	256	317	259	324	264	321	AB-VE	N	Y	M
72	DM72	M	40	38	Y	274	320	285	328	291	340	295	353	B+VE	Y	N	M
73	DM73	F	50	38	Y	154	234	98	154	124	219	99	149	B+VE	N	Y	M
74	DM74	M	72	59	Y	158	186	139	155	152	164	105	120	O+VE	Y	Y	R
75	DM75	F	55	40	Y	299	378	280	328	194	228	280	300	O-VE	N	Y	R
76	DM76	M	37	36	Y	162	190	145	160	156	170	97	130	B+VE	N	N	M
77	DM77	F	56	47	Y	240	326	235	330	245	340	239	330	B+VE	N	Y	M
78	DM78	F	54	41	Y	220	310	223	315	231	320	240	334	AB+VE	Y	Y	M
79	DM79	M	74	55	N	132	164	102	154	128	176	99	145	AB-VE	Y	Y	M
80	DM80	M	65	49	N	146	196	104	176	132	196	94	158	B+VE	N	Y	M
81	DM81	M	54	47	Y	162	189	145	162	152	164	95	110	A+VE	N	Y	M
82	DM82	F	55	43	Y	150	238	95	200	120	236	95	140	B+VE	N	N	M
83	DM83	F	71	50	Y	120	265	89	145	130	176	92	110	A+	Y	N	M
84	DM84	M	52	48	Y	167	198	128	165	118	140	100	130	B+VE	Y	N	M
85	DM85	F	48	41	Y	147	218	149	224	158	230	165	241	B+VE	Y	Y	M
86	DM86	M	45	37	Y	153	184	110	170	135	178	95	158	B-VE	Y	N	M
87	DM87	M	58	45	Y	200	380	159	290	165	310	100	170	B-VE	Y	N	M
88	DM88	M	56	42	Y	248	270	105	210	201	230	95	175	B-VE	N	Y	M
89	DM89	F	65	55	N	160	270	129	235	149	214	92	147	A+	N	Y	R
90	DM90	M	54	41	N	199	376	150	181	152	301	98	143	B+VE	N	Y	R
91	DM91	M	50	38	Y	148	170	123	165	135	130	110	162	B+VE	Y	N	R
92	DM92	M	68	45	Y	158	180	143	175	135	168	120	165	B+VE	N	Y	R
93	DM93	M	69	52	N	153	289	112	131	128	210	96	140	B+VE	N	Y	R
94	DM94	M	56	45	Y	221	308	189	276	104	166	99	158	A+VE	Y	Y	R
95	DM95	M	75	62	Y	118	194	91	186	109	165	89	132	B+VE	N	Y	R
96	DM96	M	57	40	Y	174	259	83	113	95	139	76	100	A+VE	Y	Y	R
97	DM97	M	58	42	N	124	265	110	186	118	174	87	150	B+VE	N	Y	R
98	DM98	M	80	55	Y	82	126	79	127	81	129	75	110	O-VE	Y	Y	R
99	DM99	M	56	48	Y	195	371	118	280	145	285	100	195	B+VE	N	Y	M
100	DM100	F	58	45	Y	258	310	264	321	270	328	276	330	A-VE	Y	Y	M

Abreviations

		Normal Range	
FBS	Fasting blood sugar	FBS	PP
PP	Post prandial blood sugar	70-100 g/cc	90-160 g/cc
M	Millets		
R	Rice		
Y	Yes		
N	No		

Table 2. The incidence of Diabetes Mellitus in Male and Female collected from Cheyyar Taluk

Male	Female	Total
56	44	100

Table 3. The Age group study of Diabetes Mellitus patients in Cheyyar Taluk

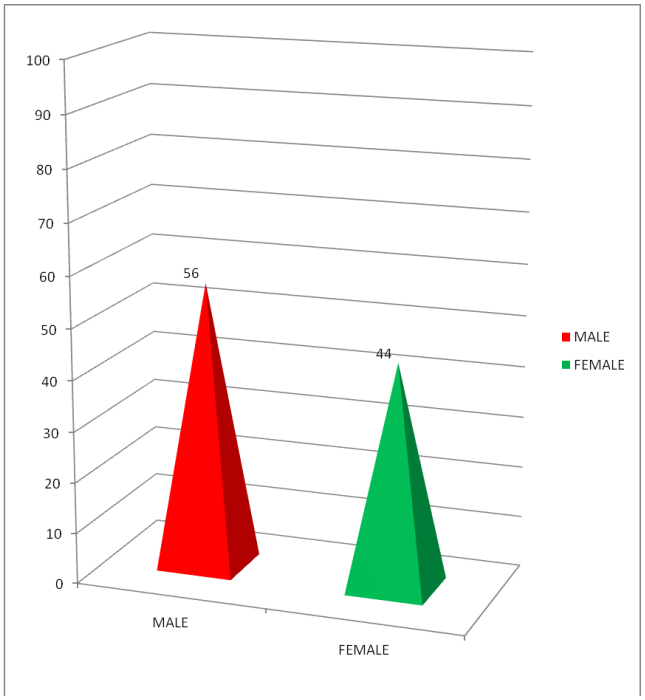
S. NO	AGE GROUP	MALE	FEMALE	TOTAL
1	0-10	0	0	0
2	10-20	0	0	0
3	20-30	0	0	0
4	30-40	4	5	9
5	40-50	10	8	18
6	50-60	22	18	40
7	60-70	14	7	21
8	70-80	6	6	12
	TOTAL	56	44	100

Table 4. The blood group study of Diabetes Mellitus patients collected from Cheyyar Taluk

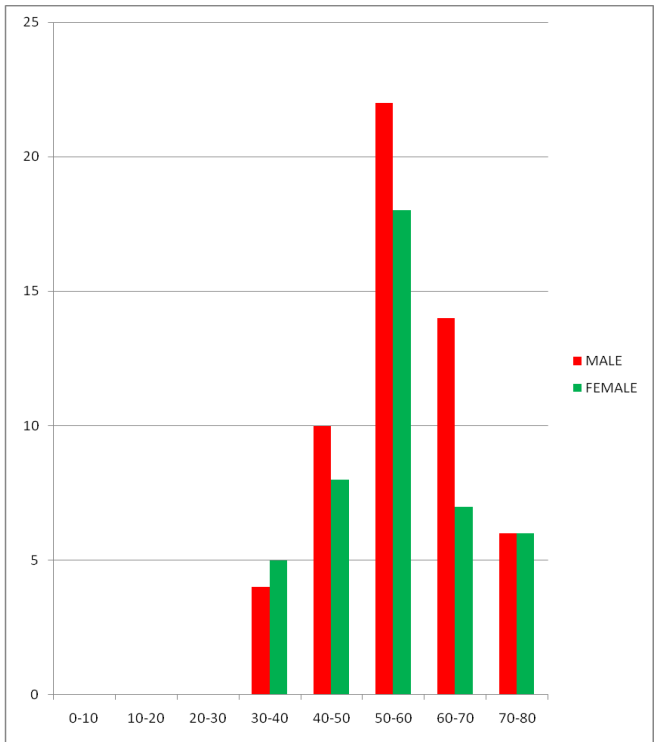
S.No.	Blood group	Male	Female	Total
1	A^{+ve}	8	7	14
2	A^{-ve}	2	1	3
3	B^{+ve}	32	19	51
4	B^{-ve}	4	4	7
5	AB^{+ve}	3	5	10
6	AB^{-ve}	2	1	2
7	O^{+ve}	3	4	9
8	O^{-ve}	2	3	4
	TOTAL	56	44	100

Table 5. The diabetes Mellitus Patients treated by anti diabetic drugs with Millet diet and Rice diet and untreated patients with millet diet and rice diet

Patients	Treated		Untreated		Total
	Millet diet	Rice diet	Millet diet	Rice diet	
Male	16	12	18	10	56
Female	15	9	15	5	44
Total	31	21	33	15	100



Bar diagram 1. Bar Diagram shows the Incidence of Diabetes Mellitus in male and female collected from Cheyyar taluk



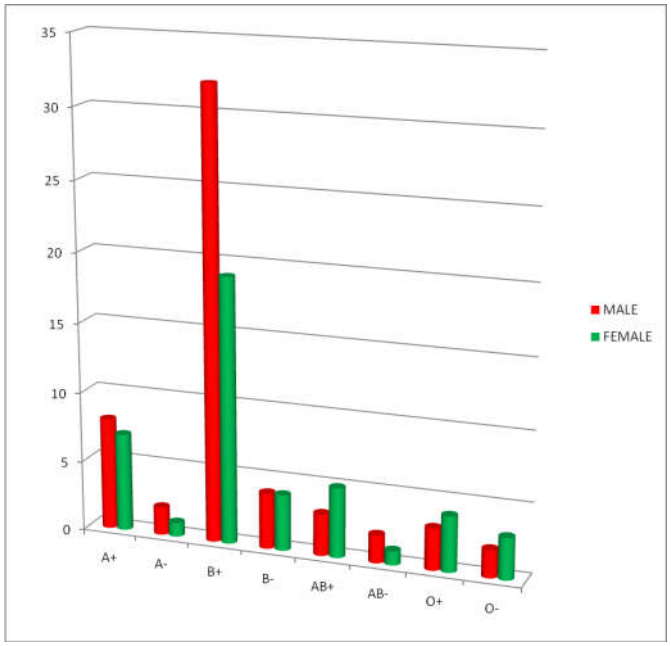
Bar Diagram 2. The Age group study of Diabetes Mellitus patients in Cheyyar Taluk

In both the sexes (male and female) with B^{+ve} blood group is more likely to be affected by Diabetes mellitus. That is out of 100 patients 51 patients (more than 51%) belong to B^{+ve} blood group.

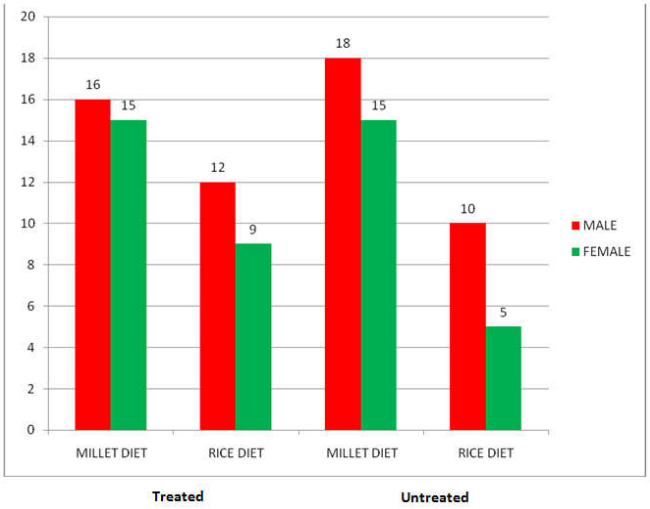
Food Habit Study

Food Habit Study in males

Out of 56 male patients, 28 were suffering from diabetes mellitus with treatment of anti diabetic drugs and 28 were having diabetes mellitus without treatment of any anti diabetic drugs. Out of 28 treated patients 16 having the habit of millet diet and 12 of them having the habit of rice diet. On the other hand the untreated 28 patients, 18 patients having the habit of millet diet and 10 were having the habit of Rice diet. The results are given in Table 5 and Bar diagram 4.



Bar Diagram 3. The Age group study of Diabetes Mellitus patients in Cheyyar Taluk



Bardiagram 4. The diabetes Mellitus Patients treated by anti - diabetic drugs with millet diet and rice diet and untreated patients with millet diet and rice diet

Food habit study in females

Out of 44 female patients, 24 were under anti diabetic treatment and 20 were not under anti diabetic treatment. Out of 24 treated patients 15 of them having the habit of taking millet diet and 9 of them having the habit of taking Rice diet. Out of 20 untreated patients, 15 of them having the habit of taking millet diet and 5 of them having the habit of taking rice diet. The results are given in Table 5 and Bar diagram 4. In both the sexes the treated patients are 52 (male 28 and female 24). Out of 52 patients both male and female, 31 were (16 male and 15 female) having the habit of taking millet diet. And 21 were (12

males and 9 females) having the habit of taking rice diet. Among 48 untreated patients of both male and female (male 28 and female 20), 33 were (male 18 and female 15) having the habit of taking millet diet in their food. And 15 were (male 10 and female 5) having the habit of taking rice diet. The results are given in Table 5 and bar diagram 4. Both treated and untreated diabetic patients having the habit of millet diet showed normal range of blood sugar level both FBS and PP. But patients with treated and untreated having the habit of rice diet showed increased level of blood sugar both FBS and PP. From the present study the millet diet can reduce the blood sugar level. But the rice diet can not reduce (can increase) the blood sugar level, Even though they are treated with anti diabetic drugs. The results are in agreement with those of Shobana *et al*. (2007). They found out Diabetic patients in India, it has been shown that wheat – based and millet based formulations diet yield lower glycemic indices than rice – based formulation diet. The results are also supported by the work of Chethan *et al*. (2008) and Mathanghi and Sudha (2012). Chettan *et al*. (2008) concluded that carbohydrates present in finger millet are slowly digested and assimilated than those present in other cereals. Regular consumption of finger millet is known to reduce the risk of diabetes mellitus and gastrointestinal tract disorders and these properties were attributed to its high polyphenols and dietary fibre contents. The work of Mathanghai and Sudha (2012) is of great interest. They found out finger millet diets lowered blood glucose and cholesterol level in diabetic rat models.

DISCUSSION

The number of people with diabetes is increasing due to population growth, aging, urbanization and increasing prevalence of obesity and physical inactivity. Quantifying the prevalence of diabetes and the number of people affected by diabetes, now and in the future, is important to allow rational planning and allocation of resources. Surveys were generally performed on middle aged population, and data are more limited at younger and older ages. In the present study all the diabetic patients were collected in the urban areas of Cheyyar Taluk, the results are in agreement with those of Shah *et al*., (2004). They found out the prevalence of diabetes in rural areas was assumed to be one quarter than that of urban areas of Bangladesh, Brittan, India, the Maldives, Nepal and Srilanka. In developed countries the majority of the people with diabetes are aged over 60 years, whereas in developing countries most people with diabetes are of working age between 40 and 60 years. India is also a developing country. The present findings showed that diabetes mellitus was higher in males 56 (56%) than in females 44 (44%). The results are in agreement with those of Prospar Obunikem Uchechukwa Adogu *et al*., (2015). They found out a total of 18,912 patients attended the designated hospitals within the period under review, out of this patients 2028 were diabetic mellitus giving a prevalence of 107.2 per 1000 patients (10.7%). They further concluded that diabetes mellitus was higher in males 1056 (52.1%) than in female 972 (47.9%), Vanisha Nambiar and Tanvee patwardhan (2014) also found out, the male patients having onset of diabetes mellitus was higher than woman patients and their age group ranges between 30 -39 and 40 – 49 years.

The blood group study is an important factor for diabetes mellitus patients. In the present investigation out of 100 patients (male 56 and female 44), 51 subjects both male 32 (57.1%) and female 19 (43.1%) belongs to B^{+ve} blood group. next to this 14 patients both male 8 (14.2%) and female 7 (15.9%) belongs to A^{+ve} blood group. No study available on literature regarding the blood group and diabetes and no reports regarding the blood group responsible for diabetes mellitus. The blood group and diabetes are questionable. Diet plays a vital role in disease prevention and management, over and above literature has documented several health benefits of millets especially against non-communicable diseases. Therefore occurrence of diabetes and heperlipidaemia was assessed against millet consumption among the selected subjects. Alarmingly non communicable disease (NCD) related mortality is occurring at earlier ages in developing countries: 29 percent of NCD related deaths in developing countries occur before the age of 60 compared with 13 percent in developed countries (Engelgau *et al.,* 2011). NCDs' are now affecting more people who are in their prime economically productive years, and these deaths were frequently preceded by years of disability. NCD such as diabetes mellitus share four main behavioural risk features all of which likely escalate in developing countries, tobacco use, and harmful use of alcohol, insufficient physical activity and unhealthy diet/obesity. According to the World Bank more than half of the NCD burden could be avoided through health promotion and prevention initiatives (World Bank, 2011). Millets consumption has a long legacy and evidence of millets intake has been observed in Harappan archaeological sites and Kalidasa's legendary literatures. Millets are small grained, annual, warm weather cereals belonging to grass family. In Tamil Nadu, besides cholam and cumbu the little millets like finger millet, thinai, kudhiraivali, varagu and panivaragu and samai are cultivated which offer the much needed nutritional and livelihood security. It has been scientifically proved that millets are way ahead of rice and wheat in terms of nutritional content. For instance, millets contain 10.6 grams proteins per 100 grams, as against rice which contains only 6.8 grams. Similarly, millets are also richer in fibre (1.3 grams to 10.1 grams), minerals (1.9 grams to 4.4 grams) and calcium (31 mg to 344 mg) in comparison to rice. In comparison to rice, millets with their low carbohydrate content, low digestibility and water soluble gum content (β – glucans) have been attributed to improve glucose metabolism. These grains release sugar slowly in the blood and also diminish the glucose absorption. For all these superior properties of minor millets, they are designated as nutritious millets. A substantial number of Indian children and women are underweight, anaemic and suffer from micro nutrient deficiencies which are the indicators of malnutrition. Changes in lifestyle decrease in diversification of cereals in foods basket and increased share of junk foods during the recent period are the few major factors that binder's millets uptake. Research studies indicate that presence of insoluble fibre in millets not only increases intestinal transit times but also reduces the secretion of bile acids and thereby increases insulin sensibility and lowers the triglycerides. (Agricultural policy and planning Division State Planning Commission).

Pearl millet has a very high amylase activity, about 10 times that of wheat. Maltose and D-ribose are the predominant sugars in the flour, while fructose and glucose levels are low (Oshodi *et al.,* 1999). Most of the dietary fibre is insoluble interestingly; α amylase activity is 8 to 15 times greater in pearl millet than in wheat (Sheorian and Wagle, 1973). Foods with a low glycemic index are useful to manage maturity onset diabetes, by improving metabolic control of blood pressure and plasma low density lipoprotein cholesterol

levels due to less pronounced insulin response (Asp, 1996). Several pearl millet based novel food products can be developed and traditional recipes need to be promoted for the diabetic patients. Recent reports indicate that hyperglycemia could induce non – enzymatic glycosylation of various proteins, results in the development of chronic complications in diabetes. Therefore, control of postprandial blood glucose level is critical for treatment of diabetes and for reducing chronic vascular complications which can be controlled by intake of high complex carbohydrate and high fibre diet. Carbohydrate present in finger millet are slowly digested and assimilated than those present in other cereals. Regular consumption of finger millet is known to reduce the risk of diabetes mellitus and gastro vascular tract disorders and these properties were attributed to its high polyphenols and dietary fibre contents (Chethan *et al*., 2008). The beneficial effect of phenolics is due to partial inhibition of amylase and α – glycosidase during enzymatic hydrolysis of complex carbohydrates and delay the absorption of glucose, which ultimately controls the postprandial blood glucose levels (Shobana *et al.,* 2009).

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