# Demographic parameters associated with Type 2 Diabetes Mellitus in North Kerala, India

**Balakrishnan Valliyot[1], Jayadevan Sreedharan[2], Sudha Balakrishnan Valliyot[3], Jayakumary Muttappallymyalil[4]**

[1]Professor, [3]Professor & HOD, Academy of Medical Sciences, Pariayaram, Kannur, Kerala, India, [2]Assistant Director & Professor, Statistical Support Facility,[4] Professor, Dept. of Community Medicine, Gulf Medical University, Ajman, United Arab Emirates
Address for **correspondence**: Prof. Jayakumary Muttappallymyalil
Dept. of Community Medicine, Gulf Medical University
Ajman, United Arab Emirates
Email: drjayakumary@gmail.com

**Abstract:**

**Objectives:** This study aims to assess the relationship between socio demographic characteristics and Diabetes Mellitus.

**Materials & Methods:** This cross sectional study was conducted among patients with Diabetes Mellitus reported to a rural tertiary care hospital in North Kerala, India. A pre-tested structured questionnaire included the socio demographic and life style characters like age, gender, type of work, religion and duration of onset of diabetes, family history of diabetes and the relationship.

**Results:** 1027 type 2 diabetes mellitus patients aged from 25 to 55 were selected for the study. The age of the patients ranged from 25 to 55 years. It has been observed that the disease is common among males than females. The mean duration of disease had been observed 21.8 months. No significant difference was observed with regard to different religion, 54% patients had a positive family history of diabetic mellitus. Most findings in the present study are in accordance with other reports from the other parts of the world.

**Conclusion:** The observations made in this study are of key importance to develop preventive strategy for the potential candidates who are in the verge of developing diabetes.

**Key-words**: Socio-demographic profile, Family history, Age at onset, Physical activity, Diabetes Mellitus, Kerala, India.

**Key Messages**: Demographic profile of the chronic diseases plays a major role in the application of prevention and control measures. Information regarding the demographic correlates of diabetes mellitus helps to develop the targeted intervention policies.

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## Introduction

Nearly 20.8 million Americans have diabetes and a million new diabetes cases are diagnosed yearly in US[1]. In 2005, the estimated prevalence of Diabetes mellitus (DM) in US by CDC is 13.3%, in African Americans, 9.5% in Latinos, and 15.1% in American Indians.[1] DM involves an enormous personal and socio- economic cost, and is now being recognized as a major health issue in most countries[2].
Large proportion of people living in urban areas of India has diabetes, but a few studies have been conducted in the rural areas of India to determine the magnitude of diabetes. A study conducted in rural India showed that the prevalence of diabetes was 13.2%, of which 6.4% were known and 6.8%were previously undiagnosed and 15.5% had impaired fasting glucose[3]. Recent studies reported that 10-16% of urban population and 5-8% of rural population in India suffer from diabetes mellitus[4,5].

Kowaikar from central India reported diabetes has been observed more among males due to sedentary habits, alcohol consumption and obese persons[6]. In Kerala also there has been a rapid increase in the number of type 2 diabetes mellitus patients in the last two decades. The Amritha Diabetes Endocrine Population Study (ADEPS) from Ernakulam district in Kerala revealed a 16.2% prevalence of type 2 diabetes and 20.8% of impaired glucose tolerance (IGT) among Keralites. Menon and Kumar studied the prevalence of type 2 diabetes from central Kerala and noticed an increasing prevalence[7]. Kutty et al. reported that there is a close association between diabetes and coronary artery disease in the Thiruvananthapuram city8. Poulose et al. studied the profile and association of type 2 diabetes patients in more than 8000 patients and noted that more than 50% had a family history of type 2 diabetes mellitus[9]. A number of socio-demographic factors such as age, gender, are associated with the occurrence of diabetes mellitus. Demographic correlates will help us to apply appropriate intervention either primordial, primary, or secondary prevention at an early age and also gender specific intervention can be applied.

This research report, based on different districts from Kerala, India and this study has been focused rural population from the northern part of state, where no such research has been taken before. Hence, the study was to assess the demographic correlates in Type 2 Diabetes Mellitus in Northern part of Kerala.

## Subjects and Methods

This hospital based descriptive study has been conducted among patients with diabetes mellitus both outpatients and inpatients in medical wards of Academy of Medical Sciences, Pariyaram, Kannur, Kerala, India and those who satisfied the ADA diagnostic criteria of Diabetes mellitus[10].

The research was conducted over a period of two years and all cases of type 2 diabetes reported to the Department of Internal Medicine were recruited after obtaining consent. A total of 1027 patients with diabetes mellitus participated in this study.

All subjects were interviewed after obtaining consent from them. The study had approved by the Ethics Committee of Academy of Medical Sciences, Pariyaram, Kannur, Kerala, India. A pre-tested structured questionnaire have been used which includes the socio demographic, life style, family history of diabetes and the relationship with diabetic patients. Anthropometric measurements such as height, weight, and body mass index also been included, more over face to face interview have been conducted with selected patients to collect the relevant data. Anthropometric measurements like height

(in Cms) and weight (in Kgs.) were measured using a standardized instrument. Body mass index was calculated from this data.

The BMI was calculated based on the formula weight (kg) / [height (m)]$^2$. The standard categorization of BMI is done in the following table.

| BMI | Category |
|---|---|
| Less than 18.5 | Underweight |
| 18.5-24.9 | Normal |
| 25.0-29.9 | Overweight |
| 30.0 and above | Obese |

Patient's age has been mentioned in the completed years. Patients were classified according to the nature of works. The Physical Activity questionnaire for youth and middle aged used based on WHO criteria. It includes the questions based on different works, using foot back and forth, recreational activities, household work, gardening, farming and hours of work. The data have been collected and based on them; it has been divided into sedentary, moderate and heavy physical activity. A detailed family history which has closely related to patients also recorded. The data has been placed in Excel spread sheet and analyzed using PASW 18. Frequency, percentage, the mean and standard deviation were calculated.

## Results

Only permanent residents of Kannur, Kasargod, and Wyanad districts, which are the northern districts in Kerala, India, between the age groups 25 to 55 years and who gave consent for the study were interviewed. A total of 1027 patients with diabetes mellitus participated in this study. Out of them 660 the majorities were males about 64% and females 36%, the female to male ratio were 100:179. The gender distribution is illustrated in figure 1.

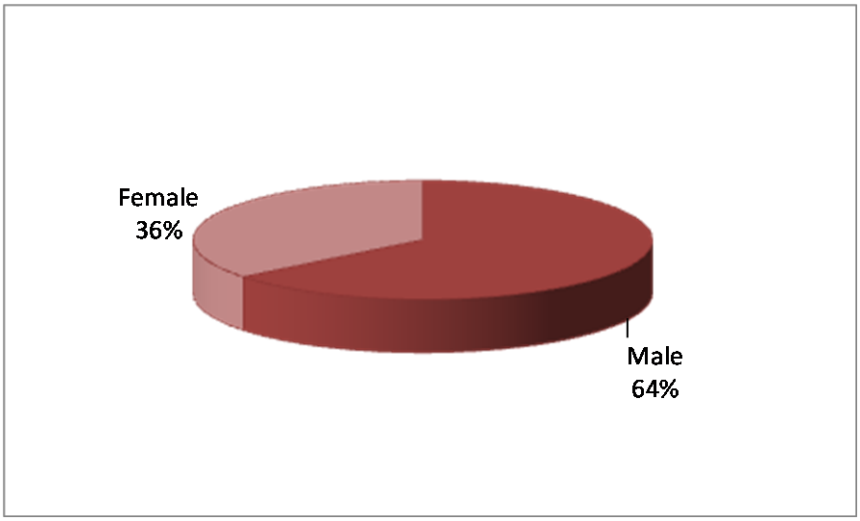


**Fig-1: Distribution of study subjects according to Gender.**

**Table 1. Distribution of subjects according to Age and Gender**

| Age | Gender | | | | | |
|---|---|---|---|---|---|---|
| | Male | | Female | | Total | |
| | No | % | No | % | No | % |
| 25-29 | 18 | 2.7 | 17 | 4.6 | 35 | 3.4 |
| 30-34 | 34 | 5.2 | 19 | 5.2 | 53 | 5.2 |
| 35-39 | 55 | 8.3 | 46 | 12.5 | 101 | 9.8 |
| 40-44 | 132 | 20.0 | 70 | 19.1 | 202 | 19.7 |
| 45-49 | 153 | 23.2 | 78 | 21.3 | 231 | 22.5 |
| >=50 | 268 | 40.6 | 137 | 37.3 | 405 | 39.4 |
| **Total** | 660 | 100.0 | 367 | 100.0 | 1027 | 100.0 |

Table 1 shows the distribution participants according to age and gender. Age was categorised into 6 groups according to WHO age categorization.

The mean age of the study population were 45.8±7.4 years. The mean age of males were 44.3±6.9 years, and that of females were 43±7.6 years. In the age group below 40 years, 107 were males (16.2%), and 82 were (22.3%) females. In the age group 40 to 55 years, there were 838 patients, and this constitute the largest group of patients with diabetes. There were 553 males (83.8%) and 285 females (77.7%) in this age groups and there were an increasing trend over the years observed.

The age at onset of 1013 patients' with diabetes mellitus were available. There were only 15 patients in the 20-25 years age group, but it increased to 289 patients when it reached to 45-50 years. This study observed a positive trend with regard to age of onset. The mean age at onset of diabetes among the males were 44.3±6.9 years and among the females were 43.6±7.5 years. No statistically significant difference were observed age of onset of diabetes between male and female subjects**.**

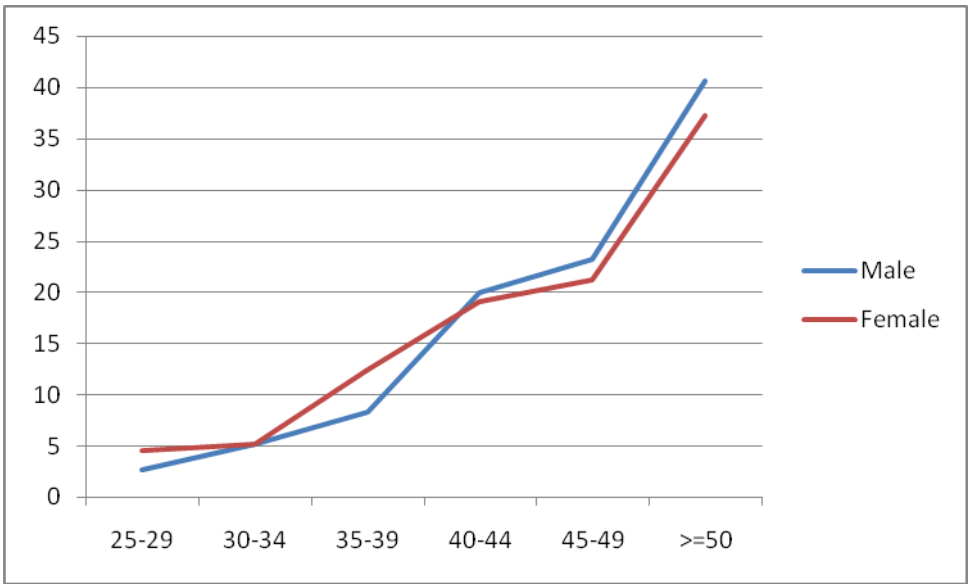


**Figure-2: Gender distribution of subjects according to age at onset.**

Figure-2 illustrates the age wise distribution of diabetes among male and female patients. Among the participants, 28.3% of males and 31.6% of females were in the age group of 35-44 years. This is the peak period to develop symptoms and lead to diabetes. A higher number of females were affected than males in this age group. Maximum number of patients were noticed in the 45-50 year age group. The age at onset were more or less similar in both gender. The onset of DM was less than 6 years among all the study participants. 360 male and 211 female patients were diagnosed with DM for less than one year period, and this category comprised 55.6% of all the patients studied. Those with duration more than one year but less than five years were 409 subjects (39.8%). The mean duration of DM was 20.7±21.8 months.

**Table-2. Distribution of participants according to Religion, Physical activity, and Family history of DM**

| Variable | Group | Gender | | | | | |
|---|---|---|---|---|---|---|---|
| | | Male | | Female | | Total | |
| | | No | % | No | % | No | |
| Religion | Hindu | 447 | 67.7 | 215 | 58.6 | 662 | 64.5 |
| | Muslim | 101 | 15.3 | 62 | 16.9 | 163 | 15.9 |
| | Christian | 112 | 17.0 | 90 | 24.5 | 202 | 19.7 |
| Physical activity | Hard work | 386 | 58.5 | 282 | 76.8 | 668 | 65.0 |
| | Moderate activity | 173 | 26.2 | 77 | 21.0 | 250 | 24.3 |
| | Minimal or Sedentary | 101 | 15.3 | 8 | 2.2 | 109 | 10.6 |
| Family history | Present | 357 | 54.1 | 200 | 54.5 | 557 | 54.2 |
| | Not present | 303 | 45.9 | 167 | 45.5 | 470 | 45.8 |
| **Total** | | 660 | 100.0 | 367 | 100.0 | 1027 | 100.0 |

In the present study, indicates among the groups based on religion. Hindus 662 (64.5%) 447 males and 215 females. Christians 202 (19.7%) 112 males and 90 females. Muslims 163 (15.9%) 101 males and 62 females. males, 25% farmers and 50% involved in other occupations. Out of 367 females included in this study, 314 (85.6%) were home makers. Patients were grouped into three, based on their physical activities, duration of daily activities and leisure time activities. The distribution based on physical activities shows 668 (65.0%) were involved more physically 250 (24.3%) in moderately involved 109 (10.6%) less involved group, also family history cases have been classified and about 557 (54.2%) in this, 357 (54.1%) males and 200 (54.5%) females had first degree of relatives with diabetes mellitus in their family. Mothers were diabetic in 299 cases (53.7%) and fathers in 139 cases (25%). In 13.1% cases siblings were affected. Brothers were diabetic in 52 cases (9.3%) and sisters in 21 (3.8%). More than 8% subjects were not sure of any family history of diabetes. In 45.9% males and 45.5% females there were no family history of diabetes mellitus. It can be observed that the distribution of family history is equal in both genders. Details are given in table 2.

**Discussion**

Type 2 diabetes mellitus (T2DM) is an important public health problem in both developed and developing countries. In several prospective and case control studies, ages were reported as an important factor in the development of type 2 diabetes mellitus. Sara Wild, Mokad et al, King and Aubert reported that in the developed countries, type 2 diabetes mellitus commonly occur in individuals aged more than 60 years[11-13]. According to the Diab care Asia India study, the mean age of onset of diabetes in India is 43.6 years[14]. The Diabetic Epidemiology Study groups (DESI), T2DM were more among patients in the age group of 40-59 years[15]. In the WHO-ICMR National NCD risk factor surveillance study and Indian Diabetic Risk Scoring System (IDRS), ages were considered as an important factor in predicting the risk for T2DM[16]. Earlier onset of T2DM among Indians was validated by Yajnik. Demographic and anthropometric profile of T2DM patients were compared and reported that Indians develop T2DM a decade early in life than their counterparts in UK[17]. The recent DECODA study by Iao Q et al. made a comparative analysis of age at onset of diabetes mellitus in different races and found that there is a marked difference among various ethnic groups[18]. In the National Urban Diabetic Survey reported an earlier onset of diabetes below 50 years age in 54.1% Indian diabetic patients[19]. He also reported marked difference between the diabetic patients in the urban and rural population, and noticed an earlier onset of diabetes among rural population. The Chennai Urban Population Study (CUPS) also reported that as age increases, prevalence of diabetes also increases[20]. In the CUPS, the average age of onset of diabetes is 50.7±10.3 years and 49.3±10.2 years among the subjects from the Panthuruthi area which is a peri urban area. Recently Panicker et al. reported that second generation develops diabetes earlier than first generation and the average age of onset of diabetes is 38.4 years[21]. In 1989 PV Rao reported a mean age of 52.3 years in the Avurvikakanam village of Kerala[22]. Poulose et al. reported that 57% of the diabetic patients were in the 41-50 years of age group, and only 29% of his patients were above 50 years. In his study only 5% of the subjects of South Kerala developed diabetes after 60 years[9]. The present study noticed that 60.6% of the patient had onset of diabetes below 50 year which is not in accordance with the study by Poulose et al. In the present study the mean age at onset was 44.3±6.9 years much less than reported by Ramachandran but in accordance with most of the other studies reported from South India[20-22].

Sara wild and Richard Sicree earlier reported that the incidence of T2DM was found to be equal in both male and female[11]. Ahuja et al noticed an overall male preponderance in his study[23]. In this study a male predominance was noticed. There were only few studies on the age and gender wise distribution of diabetic patients from Kerala.Male predominance was also noticed in Poulose et al[9]. The gender wise analysis showed that more males were affected, similar to that of other studies from India. In the present study, 22.3% females and 16.2% males were below 40 years of age. According to females preponderance noticed in age group below 40 years of age. These aspects need more studies to know why there are marked differences in the prevalence of diabetes below 40 years among males and females.

The association of physical activity (PA), physical fitness, and life style in the development of type 2 diabetes mellitus were assessed in few studies from India[24-27] and Overseas.[28-30]. The traditional rural work patterns and physical activities are undergoing changes and certain rural areas of the country in an epidemiological transition similar to that noticed by Orman in western countries[31]. The occupation and physical activities are two closely related entities, which cannot be separated when the influence of PA studied. When physical activity is considered, the leisure time activities also become important, since this involve additional calorie expenditure. Sedentary life style, prolonged sitting for hours in offices, watching television for long hours and working on computers as the risk factors for type 2 diabetes were pointed out in many observational studies[24-30].

Heimrich et al found that protective effect of physical activity was more for obese diabetics[32]. The physician health study involving 21271 health professional from US, which have been followed up for

5 years[33] and the Finnish men study[34], Iowa women's health study,[35] also showed that physical activities are beneficial, and has a protective effect. The CUPS-14 also noticed higher prevalence of type 2 diabetes among those engaged in light work[20]. Physical activity which is beneficial is defined as light to moderate activity five times or more per week for 30 minutes each time or vigorous activity three or more time per week for 20 minutes or more each time. Present data showed that there were many diabetic patients involved physically more had the protective effect and less development of diabetes mellitus as observed by Nicola abate or in the physician health study or Nurse health study cannot be fully supported in this study, but type 2 diabetes has been noticed less, those who are physically involved.

Genetic factors and ethnic susceptibility are the two commonly discussed risk factors in the development of T2DM. Due to multi-factorial origin of type 2 diabetes mellitus, isolation of a single gene responsible for type 2 DM not yet successful[36,37]. Pincus et.al and Taylor et al showed a strong genetic association in the development of insulin resistance and type 2 DM[38,39]. Several studies noticed clustering of type 2 DM in families[20,40,41]. Familial clustering was also reported by Deo et al[42] and Mohan etal Chennai,[20] The prevalence of T2DM among family members varied in different studies from India and Overseas[43]. In the NUDS 19.6% incidence of family histories were noticed in India[44]. In the present study, 54.2% of the T2DM patients had family history of diabetes similar to Mohan etal Chennai,[18] and Ramachandran et al[45]. Poulose et al. from South Kerala reported that 58% of all diabetic patients had a family history and this is 4% higher than noticed in the present study[9].

The gender distribution of those with family history was also studied in detail. Of the 54.2% cases that had family histories of diabetes, 54.1% were males and 54.5% were females. Equal prevalence of family history in both males and females were also observed by another study. Sibling involvement was 22.8% according to the report, where as only 13.1% involvement in siblings were noticed in the present study. The Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR)[46] where family histories of 923 cases were studied reported a prevalence of 10.4% among siblings. In the present study prevalence among siblings are found to be 13.1%. In WESDR, 31% of index cases had parents with diabetes mellitus. The fact of irrespective of region or gender, 50% of the diabetic patients had family members with diabetes. In these instances from Kerala, it has been observed that the mothers were diabetic in 53.7% of cases and fathers in 25% cases. The finding in this study is very important in planning preventive strategy and will help in identifying potential candidate who have high chance to develop diabetes.

## Conclusion

This study concluded that males are more prone to develop diabetic mellitus compared to females. Regarding age at onset of the disease, the mean age at onset of diabetes among the males and females were around 44 years. The mean duration of disease observed was 20.±21.8 months. With regard to religion no significant difference observed. Those are involved physically more, less affected than lightly worked patients. With regard to family history of disease males and females about 54% positive family histories of diabetic mellitus. Maternal history was more compared to paternal history of DM.

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