Prevalence of Type 2 Diabetes Mellitus and Adherence to Anti Diabetic Treatment in an Urban Population

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ABSTRACT

Context: Diabetes is the largest health emergency of the 21st century. Among the diagnosed patients, a large number do not adhere to treatment. Non-adherence leads to increase of morbidity and mortality due to a compromise in the safety and effectiveness of the treatment. This study aimed to determine the prevalence of Type 2 Diabetes Mellitus (t2DM) among adults ≥ 30 years old in an urban community in Imphal West and to assess the adherence to anti diabetic treatment.

Methodology: This study was conducted in an urban area in Imphal between 2016 –2018 among adults ≥ 30 years. Data was collected using an interview schedule and analysed using IBM SPSS for Windows, Version 21.0.

Results: The prevalence of t2DM among the participants was 14.4% while pre-diabetes was 30.8%. Diabetes was associated with males, increase in age, smoking, tobacco use, alcohol use and family history of diabetes. Adherence to exercise (0%), diet (11.1%), foot-care (0%), RBS monitoring (3.7%), medication (85.2%), no smoking (100%).

Conclusions: The prevalence of t2DM in Imphal is 1.6 times more than the national average while the prevalence of pre-diabetes was even higher. All of the previously diagnosed diabetic patients had little or no adherence to lifestyle modifications.

Key-words: Diabetes, Prevalence, Adherence.

INTRODUCTION

Diabetes is the largest health emergency of the 21st century. In addition to the 415 million adults who are estimated to currently have diabetes, there are 318 million adults with impaired glucose tolerance, which puts them at high risk of developing the disease in the future.[1] Anticipating an epidemic like increase in the number of diabetic patients, India has been christened as the 'diabetic capital of the world' which leads the world with over 32 million diabetic patients and this number is projected to increase to 79.4 million by the year 2030.[2] Moreover, it is reported that 1 out of 4 individuals will be an Indian diabetic in the world. [3]

Type 2 is the most common type of diabetes which occurs due to insulin resistance even though the body is producing enough insulin. In spite of the increasing number of diabetics, a large proportion of the population remained undiagnosed because the symptoms of Type 2 diabetes are less marked as compared to Type 1. When the disease is detected, it is usually already associated with complications.

Pre-diabetes is an indicator of future diabetes. Impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) are collectively called as pre-diabetic states. They have a high risk of conversion to diabetes.[4] Global estimates of the burden of IFG and IGT are not available, but number of people with IGT is likely to be even greater than the number with diabetes.[5]

Among the diagnosed patients, a large number do not adhere to treatment. According to the World Health

Organization (WHO), adherence is the extent to which a person's behaviour- taking medication, following a diet, and/or executing lifestyle changes-corresponds with agreed recommendations from the health care provider.[6] Non-adherence leads to increase of morbidity and mortality due to a compromise in the safety and effectiveness of the treatment which ultimately translates into significant direct and indirect costs to the healthcare system.[6] More health benefits will be derived if adherence to existing treatments is improved rather than by developing new medical treatments.

A few studies have been conducted in Manipur with regards to diabetes mellitus however, repeated epidemiology studies need to be carried out to enable us to analyse the trend in diabetes prevalence, focus on whether our interventions are working and detect the large pool of undiagnosed diabetics who would otherwise be left untreated. The present study was conducted not only to meet these demands but also to guide interventions for improving drug adherence and optimal glycaemic control among patients with diabetes. To determine the prevalence of Type 2 Diabetes Mellitus among adults ≥ 30 years old and its associated risk factors in an urban community in Imphal West and to assess the adherence to anti diabetic treatment and its associated factors were the objectives of our study.

SUBJECTS AND METHODS

This cross-sectional study was conducted at the urban field practice area of Community Medicine Department, Regional Institute of Medical Sciences, Imphal between July 2016–October 2018 among adult's ≥30 years of age. The area is situated about three kms from the Institute. The study covered three Leikais namely Tarung, Neikanlong and Sinam Leikai with a population of 1535, 458 and 1191 respectively. The population consists of mainly of Hindus and Christians. Those who refused to take part in the study, could not be contacted even after 2 visits, were very ill, pregnant or lactating women up to 12 weeks postpartum, with thyroid disorder, with Polycystic Ovarian Syndrome (PCOS) were excluded from the study.

Using the prevalence of diabetes as 10% from a study conducted by Anjala et al[7], absolute allowable error as 10%, assuming a design effect of 1.5 and a non-response rate of 10%, sample size was calculated to be around 250. Stratified Random Sampling was done from the three Leikais proportional to their population sizes.

Operational definitions:

American Diabetes Association (ADA) guidelines was followed for the diagnosis of diabetes as follows:

Normal: A person was considered to have normal blood sugar if his/her Random Blood Sugar (RBS) is between 79-140 mg/dl.[8]

Pre-diabetes: A person was considered to be pre-diabetic if his/her RBS is 140-199 mg/dl.[8]

Diabetic: A person was considered to be diabetic if he/she is diagnosed by a physician and on anti-diabetic medication (self-reported) **or** his/her RBS is ≥200mg/dl.[8]

The diagnosis of hypertension, generalized obesity and abdominal obesity was made using WHO guidelines [9,10] as under:

Hypertension: A reading of ≥140 mm Hg for systolic blood pressure (SBP) and ≥ 90 mm Hg for diastolic blood pressure (DBP) was categorized as Hypertension.

Obesity: Generalized obesity (BMI ≥25 kg/m^2) and abdominal obesity (WC≥90cm in males and ≥80 cm in females; WHR> 0.9 in males and >0.85 in females).

Good Adherence: If a patient's calculated adherence was more than 80% of the expected number of days, it was categorized as good adherence.

Survey Instruments: Semi-structured Interview schedule was used to collect information about the socio-demographic characteristics, personal history, dietary history and family history.

A validated questionnaire on the Summary of Diabetes Self-Care Activities (SDSCA)[11] was also used. Only those respondents who have already been diagnosed with Type 2 Diabetes Mellitus was assessed by this questionnaire. It is a brief self-report questionnaire of diabetes self-management that includes items assessing the following aspects of the diabetes regimen: diet, exercise, blood-glucose testing, foot care, medication and smoking. The number of days used to assess each item was 7 days.

Scoring scales:

Diet: The mean number of days was taken for the first three items but for the last item, mean number of days after reversing the scale (0=7, 1=6, 2=5, 3=4, 4=3, 5=2, 6=1, 7=0).

Exercise: The mean number of days for both items.

Blood-Glucose Testing: Mean number of days for both items.

Foot-Care: Mean number of days for both items.

Medication: Mean number of days for all three items.

Smoking Status: for item one (0=non-smoker, 1=smoker) and number of cigarettes smoked per day.

A glucometer (One Touch, Johnson & Johnson, USA), a mercury sphygmomanometer (Model: Diamond deluxe BP apparatus, Pune, India) and a weighing scale (Model: Omron, Osaka, Japan) was used to measure the Random Blood Glucose (RBS), the blood pressure and the weight respectively. A non-stretchable measuring tape was used to measure the height, waist circumference and hip circumference.

Data Collection: A house to house survey was conducted identifying all adults ≥ 30 years of age residing in the 3 leikais under the urban field practice area of Community Medicine Department, Regional Institute of Medical Sciences, Imphal. Informed consent was taken from all the participants. Interview was conducted using interview guide following which anthropometric measurements and Random Blood Glucose level was assessed. Patients already diagnosed with Type 2 Diabetes Mellitus were subjected to further questioning using SDSCA.[11]

Data Handling and Analysis: Data collected was checked for completeness and consistency. Data was entered in IBM SPSS Statistics 21 for Windows (IBM Corp. 1995, 2012). Chi square test was used for comparing two proportions. A p-value of <0.05 was considered as significant.

Ethical approval: Ethical approval was obtained from the Research Ethics Board in RIMS. Informed written consent was obtained from the respondents.

RESULTS

The mean age of the participants was 46.96±13.78 years. The maximum age was 85 years and the minimum age was 30 years. Table 1 shows that majority of the participants (61.6%) were female, were in the age group of 30-45 years (54.0%) and were housewife by occupation (40.4%). More than two-thirds of the participants were currently married (87.6%), have more than 4 family members (64.8%) while more than half (52.8%) have more than 2 children. More than half (58.4%) of the participants were from Christian faith. Nearly one-third (32.0%) of the participants were under matriculation. Almost all of the participants (98.8%) were non-vegetarians and income range was equally divided among all the participants. It was found that only 12.8% of the respondents are smokers, 39.2% use tobacco, 21.2% use alcohol, 16.4% had a family history of diabetes, 10% had a history of chronic diseases in their family. Chronic diseases included here were hypertension, kidney disease, cervical spondolysis, heart diseases, cirrhosis, stroke, etc. Table 2 shows the mean and standard deviation of the quantitative measurements.

Table 3 shows that the prevalence of Type 2 Diabetes Mellitus among the participants was 14.4% while that of pre-diabetes was 30.8%. The prevalence of previously diagnosed diabetic patients were more in females (51.9%) while males were more among newly diagnosed diabetic patients (66.7%). For pre-diabetics, males were also more in number (51.9%).

Among those with participants with generalised obesity, 56.3% were females. For abdominal obesity based on waist circumference and abdominal obesity based on waist hip ratio, majority of the participants were also female (72.2% and 65.0% respectively). It was the opposite for hypertension where 64.4% of the participants were male.

Table 1: Socio-demographic characteristics of the respondents (N=250)

Characteristics	Frequency (%)
Age (in years)	
30-45	135 (54)
46-60	70 (28)
≥61	45 (18)
Gender	
Female	154 (61.6)
Male	96 (38.4)
Religion	
Hindu	85 (34)
Christian	146 (58.4)
Meitei	15 (6)
Muslim	4 (1.6)
Education	
Illiterate	27 (10.8)
Under matriculation	80 (32)
Matric passed	46 (18.4)
Higher Secondary	41 (16.4)
Graduate and above	56 (22.4)
Marital status	
Single	8 (3.2)
Married	219 (87.6)
Widowed	21 (8.4)
Divorced	2 (0.8)
Occupation	
Government employed	50 (20)
Private employed	29 (11.6)
Self employed	57 (22.8)
Housewife	101 (40.4)
Unemployed	13 (5.2)
Family income (in Rs)	
≤12000	65 (26)
12001-21000	61 (24.4)
1001-40000	67 (26.8)
>40000	57 (22.8)
Number of family members	
≤4	88 (35.2)
>4	162 (64.8)
Number of children	
≤2	118 (47.2)
>2	132 (52.8)
Food preference	
Non-vegetarian	247 (98.8)
Vegetarian	3 (1.2)
Smoking status	
Smokers	32 (12.8)
Non-smokers	218 (87.2)
Tobacco use	
Yes	98 (39.2)
No	152 (60.8)
Alcohol use	
Yes	53 (21.2)
No	197 (78.8)
Family history of DM	
Yes	41 (16.4)
No	209 (83.6)
Family history of chronic illness	
Yes	25 (10)
No	225 (90)

Table 4 shows the adherence of the previously diagnosed diabetic patients to anti diabetic treatment. It can be seen that all the respondents (100%) had no adherence to either exercise or foot-care while all of them have adherence to no smoking.

Table 2: Mean and standard deviation of the measurements (N=250)

Measurements (units)	Mean ± SD
Weight (in kg)	60.63±8.8
Height (in m)	1.56±0.08
BMI (kg/m^2)	24.98±3.63
SBP (mm Hg)	125.25±16.94
DBP (mm Hg)	82.4±10.59
WC (cm)	89.87±8.96
HC (cm)	95.88±7.21
RBS (mg/dl)	152±66.80

Table 3: Prevalence of obesity, hypertension and diabetes (N=250)

Characteristic	Male (%)	Female (%)
Generalised obesity		
Present	40 (43.8)	82 (56.2)
Absent	56 (32.8)	72 (67.2)
Abdominal obesity (based on waist circumference)		
Present	52 (27.8)	135 (72.2)
Absent	44 (69.8)	19 (30.2)
Abdominal obesity (based on Waist Hip Ratio)		
Present	75 (35.0)	139 (65.0)
Absent	21 (58.3)	15 (41.7)
Hypertension		
Present	29 (64.4)	16 (35.6)
Absent	67 (32.7)	138 (67.3)
Diabetes status		
Normal	37 (27.0)	100 (73.0)
Pre-diabetic	40 (51.9)	37 (48.1)
Earlier diagnosed with diabetes	13 (48.1)	14 (51.9)
Newly diagnosed with diabetes	6 (66.7)	3 (33.3)

Table 4: Adherence to anti-diabetic treatment (N=27)

Items	Adherence	Non-Adherence
Diet	3 (11.1)	24 (88.9)
Exercise	0	27 (100)
Blood sugar testing	1 (3.7)	26 (96.3)
Foot-care	0	27 (100)
No smoking	27 (100)	0
Medication	23 (85.2)	4 (14.8)

Figures in parenthesis indicate Percentage from row total.

All but one (96.3%) had no adherence to RBS monitoring. Out of the 27 respondents, only 14.8% of them had no adherence to medication. For diet, more than one third (88.9%) had no adherence.

Table 5 shows that males are more likely to be pre-diabetic and diabetic than females, the chance of having pre-diabetes as well as diabetes increases as the age increases, smokers, tobacco users, those consuming alcohol, those who had history of diabetes in the family were more likely to be diabetic than others.

DISCUSSION

The prevalence of diabetes in this study was found to be 14.4 % with previously diagnosed and newly diagnosed diabetic patients to be 10.8% and 3.6% respectively. The International Diabetes Federation reported that the prevalence of diabetes in India as 8.8%. The Indian Council of Medical Research–India

Diabetes (ICMR–INDIAB) study which was a community-based survey conducted by Anjana et al[12] covering all 28 states, Delhi, and two of the union territories in the mainland of India recorded the prevalence in Manipur as 5.1%. As such, this study is recording a much higher prevalence than both the national and state figures. Self-reported and newly diagnosed diabetes was found to be 3.3% and 1.8% respectively in the ICMR study. Prevalence of pre-diabetic participants was also found to be on the higher side (30.8%) while the aforesaid study reported a prevalence of 10.0%. However, like this study, the prevalence of pre-diabetes was also found more than that of diabetes.

The prevalence for generalised obesity was found to be 48.8% which is comparatively lesser as compared to a study conducted by Tripathy at al[13] which was 74.69%. Abdominal obesity based on waist circumference and waist hip ratio was found to be 74.8% and 85.6% respectively. This is in contrast with the aforementioned study which recorded a prevalence of abdominal obesity based on waist circumference as 56.71%. Hypertension was seen in 18.0 % of the study participants. This was found to be lower as compared to 30.0% seen in Tripathy's study. Almost all of the participants were non-vegetarians. As meat consumption has been linked with obesity and hypertension, this could explain the finding.

The previously diagnosed diabetic participants were non-adherent to exercise and foot-care (100.0% for both items) and were adherent to no smoking (100%). This is in contrast to a study conducted by Inbaraj et al[14] where only 41.0% were non-adherent to exercise. Non-adherence to diet was found to be 88.9% which is also different from 49.0% reported by Inbaraj. This might be due to the difference in the scales used with our study. Adherence to medication was found to be 85.2% among the participants which is a positive finding compared with 59.7% and 21.0% reported by Aghoja et al[15] and Imran et al[16] respectively. However, both these studies did not use the Summary of Self-Care Diabetes Activities which could explain the big difference and limits the comparison. For blood sugar testing, only 3.7% of the diabetic participants were adherent.

In this study, men were more likely to be pre-diabetic and diabetic than women. This is a similar finding reported by Anjana et al[12] where the male gender was associated with development of diabetes. However, there was no association between gender and pre-diabetes in the same study. Another study conducted by Shah et al also reported that the prevalence of diabetes to be more in men. Both these two studies were also conducted in Manipur.

As the age increases the chance of having pre-diabetes and diabetes also increases and it was found to be more in those individuals who were above 60 years of age. In contrast, Anjana et al[12] reported the prevalence of diabetes to be more between the ages

of 35 and 65 years of age. Tripathy et al[13] also re-ported a higher prevalence in the 45 to 69 age group.

Table 5: Association between patient characteristics and diabetes status (N=250)

Variables	Diabetes status			p-value*
	No diabetes (%)	Pre-diabetes (%)	Diabetes (%)	
Gender				
Male	37(38.5)	40(41.7)	19(19.8)	0.000
Female	100(64.9)	37(24.0)	17(11.0)	
Age- group				
30-45	90(66.7)	38(28.1)	7(5.2)	0.000
46-60	33(97.1)	22(31.4)	15(21.4)	
≥60	14(31.1)	17(37.8)	14(31.1)	
Educational qualifications				
Illiterate	12(44.4)	9(33.3)	6(22.2)	0.493
Under matriculation	39(48.8)	30(37.5)	11(13.8)	
Matric passed	25(54.3)	14(30.4)	7(15.2)	
Higher Secondary	24(58.5)	10(24.4)	7(17.1)	
Graduate and above	37(66.1)	14(25.0)	5(8.9)	
Smoking status				
Smoker	10(31.3)	10(31.3)	12(37.5)	0.000
Non-smoker	127(58.3)	67(30.7)	24(11.0)	
Tobacco use				
Present	49(50.0)	28(28.6)	21(21.4)	0.039
Absent	88(57.9)	49(32.2)	15(9.9)	
Alcohol history				
Present	17(32.1)	23(43.4)	13(24.5)	0.001
Absent	120(60.9)	54(27.4)	23(11.7)	
Family history of diabetes				
Present	19(46.3)	10(24.4)	12(29.3)	0.012
Absent	118(56.5)	67(32.1)	24(11.5)	
Family history of chronic illness				
Present	12(48.0)	10(40.0)	3(12.0)	0.574
Absent	125(55.6)	67(29.8)	33(14.7)	
Generalised obesity				
Present	74(57.8)	39(30.5)	15(11.7)	0.416
Absent	63(51.6)	38(31.1)	21(17.2)	
Abdominal obesity				
Present	101(54.0)	56(29.9)	30(16.0)	0.438
Absent	36(57.1)	21(33.3)	6(9.5)	
Abdominal obesity based on waist hip ratio				
Present	114(53.3)	66(30.8)	34(15.9)	0.232
Absent	23(63.9)	11(30.6)	21(5.6)	
Hypertension				
Present	19(42.2)	17(37.8)	9(20.0)	0.161
Absent	118(57.6)	60(29.3)	27(13.2)	

Smoking, tobacco use and alcohol use were found to be risk factors in the development of diabetes. This finding is varied across the different studies. Anjana et al[13] and Tripathy et al[14] reported no such association. On the other hand, Liu et al[17] found that a higher prevalence of diabetes was seen among alcohol users. There was also a significant association between those individuals with family history of diabetes and diabetes status. This finding is consistent with other studies.

CONCLUSION

The prevalence of type 2 diabetes mellitus in Imphal is 1.6 times more than the national average at 14.4% while that of pre-diabetes was even higher at 30.8%. Diabetes was found to be associated with male gender, increase in age, smoking, tobacco use, alcohol use and family history of diabetes. The main limitation of this study is the fact that only Random Blood Sugar was used for identifying diabetics and these people were advised for Oral Glucose Tolerance Test for confirmation of diagnosis.

All of the previously diagnosed diabetic patients had no adherence to either exercise or foot-care while all of them have adherence to no smoking. All but one had no adherence to RBS monitoring. A little less than one-fifth of them had no adherence to medication while more than one third had no adherence to diet. Awareness programs should be initiated to emphasise the importance of lifestyle modifications as this is as important as the medications prescribed against diabetes.

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