Prevalence and Risk Factors of Type 2 Diabetes Mellitus in the Rural Population of Mangalore, South India

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ABSTRACT

Introduction: Non communicable diseases are accountable for demise of 38 million people each year with diabetes accounting 1.5 million of global deaths. India is presently facing the epidemic of diabetes with around 31.7 million cases in 2000 and likely to cross 79.4 million by 2030. The current study was conducted to assess the prevalence and risk factors of type 2 DM among population aged 35 years and above in the rural population of Mangalore.

Methods: Present study was a cross sectional study conducted in the rural population among participants aged 35 years and above. Based on the prevalence rate of 16% by Rao et al the total sample was 226. Households were interviewed by using Systematic Random sampling with estimation of RBS using glucometer.

Results: Out of 226 subjects, 31.4% were male and 68.6% were female with mean age of 54 +11 yrs. The overall prevalence of diabetes and prediabetes was 28.3% and 11.5%. Hypertension, increased BMI, Waist Hip Ratio, age group of 46-55years and sedentary lifestyle showed a significant association with diabetes. In Multivariate analysis, being normotensive, negative genetic history and normal WHR in male was protective factors against diabetes.

Conclusion: The study showed an overall prevalence of Type 2 DM of 28.3%. Hence there is a need for effective primary preventive strategies to reduce the incidence.

Key Words: Prevalence, Risk factors, rural population, type 2 DM

INTRODUCTION

Non-communicable diseases have taken over the communicable diseases in both developed and developing nations and the individuals belonging to the age group in between " 35-65 years" have become more susceptible to NCDs. WHO Global status report finds that, non communicable diseases are responsible for the demise of approximately 38 million people each year, contributing to the majority of deaths in low and middle-income countries and yearly around 16 million of deaths occurs prematurely due to NCDs and among them diabetes contributes to 1.5 million of deaths.[1,2]

Diabetes is themed as an 'iceberg disease'. WHO has estimated the number of people living with diabetes in year 2000 being approximately around 171 million globally and this is likely to shoot up to 366 million by 2030. As per the Global reports, in the year 2010, diabetes accounted for 12% of the total health expenditure or around 376 billion dollars, which is expected to cross 490 billion dollars by 2030. The epidemic has reached its peak in parallel with rapid urbanization, nutrition transition,

sedentary lifestyles and physical inactivity along with the increase in prevalence of obesity[2,3].

India is now currently facing the epidemic of Diabetes Mellitus and was considered to be popularly termed as "Diabetic capital" of the world but now it is taken over by China. Increased ageing, urbanization and population growth estimates that India and China will remain as the two nations with the highest numbers of individuals being the victims of diabetes accounting to 79.4 million and 42.3 million cases by the year 2030 followed by other countries like Indonesia, Pakistan, Bangladesh and Philippines[4].

Urbanization in rural areas have led to more reliance on motorized transport leading to sedentary activity along with habits of consumption of unhealthy diets found to be rich in carbohydrates, fats, sugars and salts. These lifestyles have increased the risk of obesity and overweight in the population thereby increasing the risk for developing diabetes[5]. Henceforth, in view of this rapid epidemiological transition the present study was carried out in the rural population of Mangalore with an objective to assess the prevalence and risk factors for type 2 diabetes mellitus in this region so as to bring about necessary interventions in preventing the occurrence and long term complications of diabetes.

MATERIAL AND METHODS:

The present study was a community based cross sectional study conducted over a period of 18 months from October 2014 to April 2016 in Manjanady and Kuthar villages of Dakshina Kannada district which are the rural field practice areas of the department of Community Medicine, K.S.Hegde Medical Academy, Mangalore. The study population included the participants in the age group of 35 years and above who were permanent residents of the villages and subjects with Gestational diabetes , suffering from any psychiatric disorders and individuals with type I diabetes mellitus were excluded .Based on the prevalence rate of 16% from the study by Rao et al[6] and taking 10% for the non-respondents and relative precision of 5%, the minimum final desired sample came approximately to 226. Out of the total 3260 households , a minimum of 226 households were interviewed by using Systematic Random sampling method with an average sampling interval of 15 (K^{th}=15th) and from each household one individual in the age group of 35yrs and above were selected randomly. If the house was found to be locked during the interview or there was a non-respondents in the house the immediate next house was selected for the study. The list of

households, details of the streets and lane were obtained from Gram Panchayat with the help of our Medico social workers and Anganwadi workers. A pilot study was done initially to check for the feasibility of the study tool. Selected subjects were interviewed by administering a pretested questionnaire after obtaining a written informed consent.

The study tool contained details about socio demographic characteristics and risk factors assessment which included dietary pattern, habits of alcohol or tobacco use, status of physical activity, family history of diabetes, history of hypertension and anthropometric measurements. Prevalence of diabetes was assessed by checking Random blood sugars (RBS) by capillary finger prick method using an automated glucometer under aseptic precautions. If one Random blood sugars was found to be more than or equal to 200mg/dl, then the test was repeated on the same subject in the next visit. The average of two RBS measuring >200mg/dl was taken as diabetic and blood glucose values in the range of >140 - <200mg/dl was taken as prediabetic (WHO diagnostic criteria)[7].

Study Variables: Socio economic status was assessed by using the Modified B.G Prasad classification scale (2014).[8] Current smokers were defined as subjects who were an ever smokers for the past 6 months at the time of the survey and tobacco chewing was defined as the one who consumed tobacco in the form of Gutka, Khaini or in the form of tooth powder or paste and snuffs. Current alcohol user was defined as subjects who had consumed alcohol at least once in past one year.[9] Physical activity was classified into sedentary, moderate and heavy based on both occupation and non occupation related activities including activity during leisure time. Blood pressure was measured using standardized Mercury Sphygmomanometer in a sitting position and according to JNC 7 guidelines, the average of two blood pressure recorded 15 minutes apart of >140/90 mmHg was taken as hypertensive.[10] Height was measured with the help of a measuring tape to the nearest cms. The subjects were advised to stand straight without shoes with their back against the wall and eyes looking forward.[11] Weight was recording using a bathroom scale kept on a flat surface, subjects were advised to wear light clothes and it was recorded to the nearest 0.5 kg.[11]Waist circumference was measured by using non stretchable measuring tape midway between lower border of the ribs and iliac crest. Waist Circumference (WC) > 102cm in male and > 88 in female is an indicator of intra-abdominal fat accumulation. Hip circumference was measured at the level of the greater trochanter of both the lower limbs to the nearest cms. Waist Hip Ratio(WHR) of > 0.90

in men and > 0.85 in women was taken as Central obesity.[11,12] BMI or Quetelet's index was calculated by using the formula(Weight in kilograms/height² in meters) and the subjects were classified as underweight(BMI <18.5 kg/mt²) ,normal(18.5-22.9 kg/mt²),overweight (BMI >23kg/mt²), Preobese (25-29.9kg/mt²) and Obese if (BMI >30kg/mt²).[13]

The content validation of the study tool was done by 3 external experts. The reliability of the tool was checked and the Cronbach alpha value was found to be 0.871.

Statistical Analysis: The collected information was summarized by using the descriptive statistics such as frequency, percentage of qualitative data. The inferential statistics used was chi -square test and Fischer exact. Multivariate analysis for independent risk factors was done using Logistic regression model. The "p" value of <0.05 was considered as significant. The data management and analysis were performed by using Microsoft excel and SPSS version 16 (SPSS Inc., Chicago, IL, USA).The study was approved by Institutional Ethics commitee, Nitte University.

RESULTS

Among the 226 participants,71(31.4%) were male and 155(68.6%) were female and the mean age of the subjects was 54 +11 yrs. Majority of them were in the age group of 46 to 55 years (31.4%) and most of them belonged to Muslim religion(62.8%), 36.3% were illiterate,51% of female were homemakers and 36.6% of male were unemployed and 31.4% of subjects belonged to Class IV Socio economic status.Table.1 describes the socio demographic features according to gender.

The overall prevalence of type 2 diabetes mellitus in the present study was found to be 64 (28.3%), and among them 18(25.4%) were male and 46(29.7%) were females, 6 (2.7%) were found to be newly detected at the time of the study and 26(11.5%) were found to be prediabetic. Almost all of our subjects (99.6%) had mixed dietary practices. Overall, 20.8% of the subjects were tobacco users, 47.9% males consumed cigarettes or beedi's and 8.4% females were tobacco chewers and 21.2% of males had history of alcohol use. Nearly 70% of our study subjects had sedentary lifestyles, 21.2% had positive family history of diabetes, 31.4% of the participants were obese (BMI>25kg/mt²). Majority of our subjects had central obesity and among them 95.5% were found to be female, 72.2% were male and the prevalence of hypertension among the study subjects was found to be 41.2%. In univariate analysis subjects in the age group of 46 -55years, sedentary lifestyles, hypertension, increased BMI and Waist hip ratio showed a significant association with diabetes (p<0.05),however dietary pattern, occupation, socio economic status and substance use did not show any association with diabetes.Table.2 describes the association of risk factors and diabetes.

The risk factors which were found to be significant in the univariate analysis by Chi square test were adjusted for other variables using multiple logistic regression model (Table.3), here physical inactivity showed 6 times increase in the risk of developing diabetes and subjects being normotensive (Odds of 0.32), negative genetic history of diabetes (OR=0.268) and normal waist hip ratio in males (OR=0.418) was found to be a protective factor against diabetes (p<0.05).

Table.1.Basic Socio demographic characteristics of the study subjects

Socio demographic variables	Gender (%)		Total (n=226) (%)
	Male (n=71)	Female (n=155)	
Age group(years)			
35-45	9(12.7)	53(34.2)	62(27.5)
46-55	24(33.8)	47(30.3)	**71(31.4)**
56-65	24(33.8)	35(22.6)	59(26.1)
>66	14(19.7)	20(12.9)	34(15)
Mean age+SD(yrs)	**56.9+10.6**	**52.6+11.2**	
Marital status			
Unmarried	2(2.8)	2(1.3)	4(1.8)
Married	69(97.2)	142(91.6)	**211(93.4)**
Widow/widower	-	11(7.1)	11(4.9)
Religion			
Hindu	18(25.3)	51(33)	69(30.5)
Muslims	49(69.0)	93(60)	**142(62.8)**
Christians	4(5.6)	11(7.0)	15(6.7)
Educational status			
Illiterate	14(9.7)	68(43.9)	82(36.3)
Primary school	48(67.6)	67(43.2)	**115(50.9)**
High school	6(8.5)	15(9.7)	21(9.3)
Higher secondary(PUC)	2(2.8)	3(1.9)	5(2.2)
Graduate	1(1.4)	2(1.3)	3(1.3)
Occupation			
Skilled	11(15.5)	-	11(4.9)
Semi skilled	15(21.1)	47(30.3)	62(27.4)
Laborer	19(26.8)	9(5.8)	28(12.4)
Homemaker	-	79(51)	79(35.0)
Unemployed	26(36.6)	20(12.9)	46(20.4)
Socio economic status*			
Class I	5(7)	9(5.8)	14(6.2)
Class II	12(16.9)	22(14.2)	34(15.1)
Class III	24(33.8)	42(27.1)	66(29.2)
Class IV	22(31)	49(31.6)	**71(31.4)**
Class V	8(11.3)	33(21.3)	41(18.1)

* As per total per capita income

Table.2.Association of various risk factors and Type 2 Diabetes Mellitus:

Risk factors	Disease status (%)		Total (n=226) (%)	p value
	Diabetic (n=64)	Non diabetic (n=162)		
Age group(years)				
35-45	9(14.1)	53(32.7)	62(27.4)	**0.035**
46-55	**22(34.4)**	49(30.2)	**71(31.4)**	
56-65	20(31.2)	39(24.1)	59(26.2)	
>66	13(20.3)	21(13.0)	34(15)	
BMI(kg/mt^2)				
Underweight	2(3.1)	22(13.6)	24(10.6)	**0.004**
Normal	20(31.2)	61(37.7)	81(35.8)	
Overweight	10(15.6)	34(21.0)	**44(19.5)**	
Preobese	27(42.2)	31(19.1)	**58(25.7)**	
obese	5(7.8)	14(8.6)	19(8.4)	
WHR-male				
central obesity	**13(72.2)**	13(24.5)	26(36.6)	**<0.001**
normal	5(27.8)	40(75.5)	45(63.4)	
WHR-female				
central obesity	45(97.8)	103(94.5)	148(95.5)	0.675
normal	1(2.2)	6(5.5)	7(4.5)	
Physical activity				
Sedentary	**57(89.1)**	101(62.3)	**158(69.9)**	**<0.001**
Moderate	6(9.4)	55(34.0)	61(27.0)	
Heavy	1(1.6)	6(3.7)	7(3.1)	
Family history#				
Present	**22(45.8)**	26(54.2)	48(100)	**0.002**
Absent	42(23.6)	136(76.4)	178(100)	
Hypertension				
Present	**41(64.1)**	52(32.1)	93(41.2)	**<0.001**
Absent	23(53.9)	110(67.9)	133(58.8)	
Socio economic status				
Class I	1(1.6)	13(8)	14(6.2)	0.215
Class II	8(12.5)	26(16)	34(15)	
Class III	19(29.7)	47(29)	66(29.2)	
Class IV	20(31.2)	51(31.5)	**71(31.4)**	
Class V	16(25.0)	25(15.4)	41(18.1)	

*p value calculated using Chi square test; #parenthesis indicates % of row total

Table.3.Multivariate analysis to see the association of Independent risk factors and Type 2 Diabetes mellitus

Independent risk factors / Covariates	P value	aOR (95% CI)
Physical inactivity	**<0.001**	6.001 (2.239 to 16.082)
No Family h/o type 2 DM	**0.002**	0.268 (0.117 to 0.616)
Normotensive's	**0.002**	0.327 (0.159 to 0.670)
BMI(Asian)		
Underweight	0.497	0.497 (0.066 to 3.730)
Normal	0.608	1.446 (0.354 to 5.911)
Overweight	0.538	1.61 (0.354 to 7.312)
Pre obese	0.086	3.423 (0.839 to 13.966)
WHR(Male)-Normal	**0.022**	0.418 (0.198 to 0.884)
Age Category		
35 to 45 yrs	0.345	0.544 (0.154 to 1.921)
46 to 55 yrs	0.739	0.833 (0.285 to 2.435)
56 to 65 yrs	0.643	0.777 (0.267 to 2.260)

aOR=adjusted Odds ratio

DISCUSSION

Among the 226 study participants, 71(31.4%) were male and 155(68.6%) were found to be females. The proportion of female population was found to be comparatively more than the males which re-flected the findings by Gupta et al[14] which showed 39.7% of male and 60.3% of female respondents. Majority of the adult males in the current study worked overseas and were daily wage workers which could be the reason for disproportionate distribution of male respondents.

The overall prevalence of type 2 Diabetes mellitus in the present study was found to be 64(28.3%), 25.4% were male and 29.6% were found to be females and prediabetics was 11.5% and newly detected cases was 6(2.7%). Similarly F. Akthar et al[15] in their study conducted in the rural population of Karnataka reported an overall prevalence of diabetes being 19.8% and Impaired glucose tolerance of 12.04%, the proportion of female diabetics was comparatively higher around 22.04% than the male diabetics,16.6%. Rao et al[6] in the coastal Karnataka reported an overall prevalence of 16% and Dasappa et al[16] reported prevalence of 12.3% and Impaired glucose tolerance of 11.6% with female preponderance. Majority of our female subjects were homemakers with a sedentary lifestyles and this could be one of the reason for the increase in the prevalence among the females.

An increase in the prevalence of diabetes was seen in the age group of 46 to 55 years (34.4%) and the association was statistically significant, which reflected the findings of Hemavathi and Malini et al.[16,17] Sedentary lifestyles leading to obesity and changes in the traditional food habits could be the reason for the early onset of diabetes in these age group. Nearly 70% of our subjects had a sedentary lifestyles, among the diabetics it was found to be 89.1%.Javid et al[18] also reported 52.7% prevalence of physical inactivity and among the diabetic it was 63%, similarly Dasappa and Saurabh et al[16,19] also showed 1.4 and 5.3 times increase in the risk of developing diabetes with physical inactivity. Majority of our female subjects were homemakers and involved in light household activities and majority of the males were unemployed or retired.

In the current study 31.4% were found to be obese and prevalence of obesity among the diabetics was found to be 50% (p<0.001) which reflected the findings of Rao et al[6] where 28% subjects were obese with an increase in risk by 1.8 times. Vijayakumar and Ahmed et al[20,18] also found the similar findings where 38.6% and 52% were found to be obese with an increase in risk of diabetes.

Increased Waist Hip Ratio was seen in 77% of the participants and among them 90.6% were found to be diabetic which reflected the findings of Hemavathi et al[16] where 73% of the subjects were centrally obese with a significant association with diabetes. Physical inactivity was more prevalent in our study subjects and this could be one of the factor for the increase in obesity.

Among the study subjects, 21.2% of them had a genetic history of diabetes and among them 45.8% of them were diabetic(p<0.05) which reflected the findings of Bharathi et al[21] where 21.2% of them had positive history with an Odds of 2.5.The prevalence of hypertension in the study was 41.2% and among them majority,64.1% were diabetics(p<0.001),the study reflected the findings of Farah et al[16] where the prevalence was found to be 44.9%.Shrivastava and Valliyot et al[19,22] also reported 3.6 and 4.7 times increase in the risk of developing diabetes among the hypertensive subjects.

A sample size of 226 has limited the opportunity to study the association of alcohol and tobacco usage and socio economic status associated with diabetes. However as the study population in both the villages were homogenous in terms of literacy, dietary habits and socio economic status, the findings of the current study can be extrapolated to the rest of the population.

CONCLUSION

The present study conducted showed an overall prevalence of Type 2 Diabetes Mellitus and prediabetes of 28.3% and 11.5% respectively. Physical inactivity, Hypertension, Positive genetic history, Obesity and middle aged group (46-55yrs) was found to be the major risk factors associated with type 2 diabetes mellitus.

RECOMMENDATIONS

There is a need for an effective implementation of primary preventive strategies through health education of the community to reduce the incidence of type 2 DM and secondary preventive strategies through screening programme to reduce the prevalence of type 2 DM and its long term complications. High prevalence of diabetes in this rural population needs further evaluation.

ACKNOWLEDGEMENTS:

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