Research Article

A cross-sectional study on risk factors for Type 2 diabetes mellitus in rural population of Davangere

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ABSTRACT

Background: Diabetes is a chronic metabolic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use insulin and it is characterized by a state of chronic hyperglycemia, resulting from various etiologies-environmental and genetic, acting jointly. To reduce the growing burden of diabetics, it is important not only to address the diseases but also their key underlying risk factors. **Objective:** To study the various risk factors and correlate them to Type 2 diabetes mellitus in a rural population of Davanagere. **Materials and Methods:** A hospital-based cross-sectional study was carried out in a rural area, Davanagere. A pre-designed pre-tested questionnaire was used to collect data. Data were entered into MS excel and analyzed using SPSS 16.0 software. Descriptive statistics was used to assess the frequency distribution. Chi-square test was used. **Results:** Of 315 study participants, 230 (73%) were male and 85 (27%) were female, 289 (74%) were literate, 52 (16.5%) were had positive family history of diabetes, and 81 (25.7%) had a habit of tobacco or alcohol or both. As per body mass index (BMI) for Asian population, in the present study, 30 (9.5%) were obese, according to waist circumference for the Indian population, 148 (47%) had abdominal obesity, 26 (8.3%) study participants had random blood sugar ≥200. **Conclusions:** Waist circumference measurement is a simple and effective indicator of abdominal obesity; it measures abdominal obesity in those individuals which are healthy according to BMI.

KEY WORDS: Type 2 Diabetes Mellitus; Random Blood Sugar; Body Mass Index; Rural Population

INTRODUCTION

Diabetes is a chronic metabolic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use insulin.[1] Characterized by a state of chronic hyperglycemia, resulting from various etiologies-environmental and genetic, acting jointly.[2]

A diabetes epidemic is underway. Approximately, 30 million people worldwide had diabetes in 1985. By 1995, this number had shot up to 135 million. The latest WHO estimate for the number of people with diabetics will increase to at least 300 million by 2025. The number of deaths attributed to diabetes is also increasing.[3] Type 2 diabetes comprises the majority of people with diabetes worldwide,[3] and is largely the result of excess body weight and physical inactivity.[1] India had 69.2 million people living with diabetes (8.7%) as per the 2015 data. Of these, it remained undiagnosed in more than 36 million people.[4] The most recent studies suggest prevalence rates 15-20% in Karnataka, a study reported the prevalence of Type 2 diabetes was 16%, in Karnataka.[5]

The WHO has defined a "risk factor" as any attribute, characteristic, or exposure of an individual that increases the likelihood of developing a disease or injury.[6] Preventable premature deaths from diabetes are due to exposure to risk factors of increased exposure to tobacco, unhealthy food habits, decrease physical activity, and the harmful use of

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alcohol. The study on these risk factors for diabetes provides opportunities in controlling the disease.

To reduce the growing burden of diabetics, it is important not only to address the disease but also their key underlying risk factors. Hence, the underlying study was conducted with an objective to study the various risk factors and correlates them to Type 2 diabetes mellitus in rural population of Davanagere.

MATERIALS AND METHODS

Hospital-based cross-sectional study was carried out in a rural health training center of J. J. M. Medical College, Davanagere, for 3 months from October to December 2016. Opportunistic screening for diabetes was done on all individual visited rural health training center during the study. Those individuals who were <18, not given consent and pregnant women were excluded from the study.

A pre-designed pre-tested questionnaire was used to collect data consisting of study variables such as age, gender, occupation, family history of diabetics, habit of tobacco smoking, and alcohol consumption, anthropometric measurements and blood glucose measurements.

Anthropometric measurements include height, weight, and waist circumference. Weight was recorded using a standard Bathroom weighing scale kept on a firm surface. Height was recorded using a measuring tape to the nearest 1 cm. Participants were requested to stand straight without shoes, heels together, and looking forward.[7]

Body mass index (BMI) was calculated by formula: Weight in kilogram divided by height in meter squared [weight (kg)/height (m^2)]. The study participants were considered to be overweight when BMI >23 kg/m^2 and obese if BMI >25 kg/m^2. Waist circumference was measured to the nearest 0.1 cm at the mid-point between the costal margin and iliac crest using a non-stretchable measuring tape at the end of normal expiration with the subject standing erect in relaxed position feet 25-30 cm apart. Central/abdominal obesity was considered to be present when waist circumference >90 cm in males and >80 cm in females.[8,9]

An individual who smokes or uses tobacco at the time of the study, either daily or occasionally and the individual who consumed one or more drinks of any alcohol in the past 12 months, from the time of the study were considered to have habits of smoking and alcohol consumption respectively in this study. Individuals with either a parent or sibling with diabetics were considered as positive family history.

Random blood glucose level was recorded at the time of interview using a standardized digital glucometer, using capillary finger prick method. The WHO recommendations for the diagnostic criteria for diabetics and intermediate hyperglycemia[10] used to classify the random blood sugar (RBS) values.

Data were entered into MS Excel and analyzed using SPSS 16.0 software. Descriptive statistics was used to assess the frequency distribution; Chi-square test was used as required, if 20% or more number of cells have expected count <5 then Fisher's exact test was applied, $P > 0.05$ was considered statistically significant.

The study was initiated after approval from the Institutional Ethics Committee. Written informed consent was obtained from the respondents after explaining the nature and objectives of the study in the local language.

RESULTS

A total of 315 participants were assessed in this study regarding the presence of risk factors for diabetes. Individuals more than 18-year-old were included in the study where 260 (82.5%) were >30 years among them 78 (25%) were in the age group of 41-50 years. Out of 315 study participants, 230 (73%) were males and 85 (27%) were females, 289 (74%) were literate, 52 (16.5%) had positive family history of diabetes, and 81 (25.7%) had habit of tobacco or alcohol or both. The general participant information is depicted in Table 1.

As per BMI for Asian population, in the present study, 30 (9.5%) were obese in which 18 (7.8%) were male and 12 (14%) were female, and 133 (42.2%) were overweight in which 95 (41.3%) were male and 38 (44.7%) were female, no statistically significant difference between male and female (Table 2). Totally, 19 (63.3%) obese participants were in the age group of 51-70 years, statistically significant association noted between age groups and BMI (Table 3).

According to waist circumference for Indian population, 148 (47%) had abdominal obesity, 100 (68.1%) were in the age group of 41-70 years, and 84 (75%) were females and 64 (36.5%) were men, which is statistically significant between gender (Table 2), and it also statistically significant when compared across age groups as age advances risk of abdominal obesity also increases (Table 3).

Totally, 26 (8.3%) study participants had RBS ≥200 mg/dl among whom 13 (15%) were female and 13(6%) male (Table 2), 9 (34.6%) belonged to the age group of 41-50 years 7 (26.9%) were in 61-70 years (Table 3). In total, 36 (11.4%) of them had RBS 140 - <200 mg/dl, 26 (12%) were female and 10 (11%) were male (Table 2), 21 (58.3%) belonged to the age group of 51-70 years (Table 3). The statistically significant difference was noted between gender and age groups.

Table 1: General information of the study participants (*n*=315)

Variables	*n* (%)
Age	
<30	55 (17.5)
31-40	56 (17.8)
41-50	78 (24.8)
51-60	49 (15.6)
61-70	57 (18.1)
>70	20 (6.3)
Gender	
Male	230 (73)
Female	85 (27)
Education	
Illiterate	82 (26)
Primary schooling	14 (4.4)
Middle schooling	28 (8.9)
Secondary schooling	87 (27.6)
PUC	62 (19.7)
Degree	39 (12.4)
Post-graduation	3 (1)
Family history of diabetes	
Present	52 (16.5)
Absent	263 (83.5)
Habits	
Present	81 (25.7)
Absent	234 (74.3)

Table 2: Distribution of variables according to gender

Variables	Gender *n* (%)		*P* value
	Male	Female	
BMI			
Under weight	23 (10)	7 (8)	0.266
Normal	94 (41)	28 (33)	
Over weight	95 (41)	38 (45)	
Obese	18 (8)	12 (14)	
Waist circumference			
Normal	21 (63.5)	146 (25)	0.0001
Obese	64 (36.5)	84 (75)	
RBS			
<140	62 (83)	191 (73)	0.020
140 - <200	10 (11)	26 (12)	
≥200	13 (6)	13 (15)	

BMI: Body mass index, RBS: Random blood sugar

In total, 19 (12.8%) of abdominal obesity participants had RBS level between 140 and <200 mg/dl and 20 (13.5%) of them were had RBS ≥200 mg/dl, statistically significant association was found between waist circumference and RBS level (Table 4). No statistically significant association was found between RBS level and BMI, family history of diabetes and habits (Table 4).

DISCUSSION

In the present study, age, gender, obesity, family history, and habit of tobacco and alcohol were investigated in relation RBS level. Out of 315 study participants, 73% were males and 27% were females, 25.7% had habit of tobacco or alcohol or both, 16.5% had positive family history of diabetes, 9.5% were obese, 42.2% were overweight, 47% had abdominal obesity, 8.3% had type 2 diabetes mellitus, and 11.4% had impaired blood sugar.

The "epidemiological transition," which includes improved nutrition, better hygiene, control of many communicable diseases and improved access to quality healthcare have resulted in increased longevity; it has also led to the rapid rise of the new age diseases such as obesity, diabetes and heart disease. The intrusion of western culture into the lives of traditional indigenous communities has also had devastating results in terms of the rise in diabetes and related metabolic disorders. Higher fat diets and decreased physical activity and sedentary occupational habits have accompanied the process of modernization which has resulted in the doubling of the prevalence of obesity and Type 2 diabetes.[11] Type 2 diabetes mellitus is one of the most important public health problems in the developed and developing countries. Some studies reported that BMI as an independent risk factor for development of diabetes[12-14] but in the present study, there was no significant association between BMI and RBS, as majority of the participants in this study are <50-year-old, and are involved in moderate to heavy work; hence, lower values of BMI were recorded among them. The present study showed a significant association between waist circumference with age, sex, and RBS. As the age increases abdominal obesity also increased, female participants had higher abdominal obesity compare to males; we also observed that majority of them, i.e., 76.9% who had abdominal obesity also were found to have RBS ≥200 mg/dl. Several studies reported abdominal obesity can be a risk factor for diabetes.[13,15-17] In the present study, it was observed that the increasing in age was significantly associated with higher risk of impaired blood sugar and Type 2 diabetes[14,18,19] had reported the same results. This may be due to prolonged exposure to stress, obesity, genetic factor, and environmental risk factors with the advancement of age. In this study, more females have Type 2 diabetes compared to male which was found to be statistically significant, whereas, in the WHO report in southeast Asia, more male diabetics have been observed.[2] Several studies showed increased risk of diabetes with positive family history of diabetes,[14,20,21] but in the present study, there was no significant association between family history of diabetes and RBS level this may be due

Table 3: Distribution of variables according to age groups

Variables	Age groups *n* (%)						
	<30	31-40	41-50	51-60	61-70	>70	*P* value
BMI							
Underweight	11 (36.7)	6 (20.0)	4 (13.3)	3 (10.0)	5 (16.7)	1 (3.3)	0.002
Normal	30 (24.6)	24 (19.7)	29 (23.8)	16 (13.1)	17 (13.9)	6 (4.9)	
Overweight	12 (9.0)	23 (17.3)	41 (30.8)	21 (15.8)	25 (18.8)	11 (8.3)	
Obese	2 (6.7)	3 (10.0)	4 (13.3)	9 (30.0)	10 (33.3)	2 (6.7)	
Waist circumference							
Normal	44 (26.3)	32 (19.2)	40 (24.0)	19 (11.4)	25 (15.0)	7 (4.2)	0.0001
Obese	11 (7.4)	24 (16.2)	38 (25.7)	30 (20.3)	32 (21.6)	13 (8.8)	
RBS							
<140	55 (21.7)	47 (18.6)	63 (24.9)	38 (15.0)	37 (14.6)	13 (5.1)	0.001
140 - <200	0 (0.0)	5 (13.9)	6 (16.7)	8 (22.2)	13 (36.1)	4 (11.1)	
≥200	0 (0.0)	4 (15.4)	9 (34.6)	3 (11.5)	7 (26.9)	3 (11.5)	

BMI: Body mass index, RBS: Random blood sugar

Table 4: Distribution of risk factors and RBS level

Risk factors	RBS *n* (%)			
	<140	140 - <200	≥200	*P* value
BMI				
Underweight	27 (90)	3 (10)	0 (0)	0.417
Normal	102 (83.6)	11 (9)	9 (7.4)	
Overweight	102 (76.7)	17 (12.8)	14 (10.5)	
Obese	22 (73.3)	5 (16.7)	3 (10)	
Waist circumference				
Normal	144 (86.2)	17 (10.2)	6 (3.6)	0.003
Obese	109 (73.6)	19 (12.8)	20 (13.5)	
Family history				
Absent	216 (82.1)	27 (10.3)	20 (7.6)	0.187
Present	37 (71.2)	9 (17.3)	6 (11.5)	
Habits				
Absent	187 (79.9)	26 (11.1)	21 (9)	0.715
Present	66 (80.3)	10 (11.4)	5 (8.3)	

BMI: Body mass index, RBS: Random blood sugar

to majority of study participants parents or siblings were not screened for diabetes and awareness about screening for diabetics was found to be poor.

The present study generated awareness about Type 2 diabetes mellitus in rural population of this study area. The baseline data of the present study could be useful for future research. The limitation is the fasting blood sugar is the ideal for a measure of blood sugar level. However, we cannot ensure 100% fasting, hence, RBS was used as an indicator of the blood sugar level.

CONCLUSION

Screening for Type 2 diabetes mellitus by RBS is a simple and convenient method to study the various associated risk factors. In the present study, abdominal obesity was found to be a highly associated risk factor. Waist circumference measurement is a simple and effective indicator of abdominal obesity.

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