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Risk factors for type 2 diabetes mellitus: An urban perspective

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ABSTRACT

Background: Diabetes mellitus is rising to an alarming epidemic level; hence, strategies formulated based on the risk factors can be helpful to curb the rising trend of the same.

Objective: The objective of the study was to assess the prevalence of diagnosed cases of diabetes mellitus and correlate it with various risk factors and sociodemographic variables.

Methods: A cross-sectional study was carried out in randomly selected wards under the field practice area of Urban Health Training Center of Private Medical College, Pune, Maharashtra. A total of 425 subjects aged 20 years and above residing in the study area were screened for diabetes mellitus. Risk factors such as age, waist circumference, waist-to-hip ratio (WHR), family history of diabetes, and physical activities were recorded. The statistical analysis of the data was performed using Chi-square test.

Results: The prevalence of diagnosed cases of diabetes mellitus found in this study was 9.88%. There was a significant increase in the prevalence of diabetes as age increases (age 20–34 years: 1.66%, 35–49 years: 7.53%, ≥50 years: 15.66%, and $P < 0.05$). Furthermore, male gender, obesity, waist circumference, WHR, and diabetes mellitus were found to be statistically significant.

Conclusions: Risk factors such as rising age, family history of diabetes mellitus, lack of physical activity, and central obesity were the most common factors found in diagnosed cases of diabetes mellitus. Therefore, lifestyle changes and awareness regarding risk factors is needed to make control over the diabetes.

Keywords: Diabetes mellitus, Prevalence, Urban

INTRODUCTION

In 2008, an estimated 347 million people in the world had diabetes and the prevalence is growing, particularly, in low- and middle-income countries. Diabetes is fast gaining the status of a potential epidemic in India, with 69.2 million people living with diabetes (8.7%). Of these, more than 36 million people remained undiagnosed.[1] According to Wild *et al.*, the prevalence of diabetes is predicted to double globally from 171 million in 2000 to 366 million in 2030. It is predicted that by 2030 diabetes mellitus may afflict up to 79.4 million individuals in India.[2,3] The current scenario of diabetes in India is likely to worsen in the coming decade. The greatest numbers of people with diabetes are between 40 and 59 years of age.[4]

Indians characteristically have increased insulin resistance, greater abdominal adiposity (higher waist circumference despite lower body mass index), higher prevalence of impaired glucose

tolerance, contributing to a greater risk of developing disease at a relatively younger age. The epidemiological transition, economic boom, physical inactivity, trendy dietary patterns, and environmental factors also add to this risk.[5] By adopting urbanized lifestyle like changing food habits, sedentary working pattern and stress, urban poor the known vulnerable group are at higher risk for diabetes mellitus.[6]

As literature review does not reveal major studies from Pune area, to address this demand, the present study was undertaken with the objective of determining prevalence of diabetes mellitus and its association with various risk factors.

Objectives

The objectives of the study were as follows:

1. To estimate the prevalence of diagnosed cases of diabetes mellitus
2. To correlate diagnosed cases of type 2 diabetes mellitus with various risk factors and sociodemographic variables.

METHODOLOGY OF STUDY

A community-based cross-sectional study was conducted for a period of 1 year (2013–2014) in three randomly selected municipal wards of Pune city to which the field practice area of Urban Health Training Center of private Medical College, Pune, provides services. From each of these three wards, three areas namely Joshiwada (349), Ganjwewada (177), and Mangwada (243) with total population of 769 were randomly selected. Using prevalence of type 2 diabetes mellitus 18.6%[7] and considering allowable error of 20% by applying formula 4 pq/L^2, estimated sample size was 438. From each area, the study subjects selected were 199,100 and 139 from Joshiwada, Ganjwewada, and Mangwada, respectively. A total of 13 study subjects were nonrespondents, therefore, sample collected was 425.

Selection of study subjects

Inclusion criteria

All adult males and females 20 years and above residing in the study area were included in the study.

Exclusion criteria

Pregnant and lactating women up to 12 weeks' postpartum were excluded due to possible impaired glucose tolerance status in this group.[7]

Data collection

The study was conducted by carrying out house to house visits by covering the houses one after the other lane wise. The subjects were fully informed regarding the purpose of the study. The patient information sheet was explained to each subject and written consent was obtained. The interview was started with general discussion to build a rapport with the subjects and to gain confidence. The subjects who could not be contacted in first visit were contacted subsequently during weekends as per their convenience.

Institutional Ethical Committee Clearance was obtained before initiation of the study.

During house visit, data were collected using predesigned and pretested pro forma. It consists of information on sociodemographic characteristics, family history of diabetes, and physical activity. Anthropometric measurements were carried out for all study subjects. Measurements included height, weight, waist circumference, and hip circumference. The socioeconomic status was assessed according to modified BG Prasad's classification.[8]

Operational definitions used

1. Diagnosed cases of type 2 diabetes mellitus – person who gives a history of diabetes or who is on drug treatment for diabetes
2. Family history of diabetes – subjects with either or both parents having diabetes were considered to have positive family history
3. Physical activity – levels were graded based on a physical activity questionnaire, which included job-related and specific questions on exercise
    a. Vigorous – vigorous exercise or activity that made the person feel breathless and have palpitation, e.g. manual laborers and service forces
    b. Moderate – moderate exercise or not much breathless, e.g., household workers, teachers, professionals, and skilled workers
    c. Mild – mild exercise or no breathless, e.g., homemakers
    d. Sedentary – no exercise or felt no variation in heart rate and respiratory rate, e.g., elderly, retired executives, and businessmen.[9]
4. Weight – body weight was measured (to the nearest 0.01 kg) with the subject standing still on the electronic weighing scale, feet about 15 cm apart, and weight equally distributed on each leg. Subjects were instructed to wear minimum outerwear (as culturally appropriate) and no footwear while their weight was being measured.[10]
5. Height – height was measured using a nonstretchable tape (to the nearest 0.1 cm) with the subject in an erect position against a vertical surface and the head positioned so that the top of the external auditory meatus was in level with the inferior margin of the bony orbit.[10]

6. Body mass index (BMI) – BMI was calculated using formula – weight (kg)/height (m^2).[10] A person was considered to be overweight if BMI >25 kg/m^2 and obese when BMI >30 kg/m^2
7. Waist circumference – waist circumference (to the nearest 0.1 cm) was measured using a tailor's tape at a point mid-way between tip of iliac crest and last costal margin in the back and at umbilicus in the front. International diabetes federation (IDF) standard cutoffs of ≥88 cm and ≥90 cm were used for women and men, respectively.[10]
8. Hip circumference – measured at the widest portion of the hip (at the level of the greater trochanters) to the nearest 0.1 cm with a measuring tape, while the subject was standing with the arms by the side and feet together. Waist-to-hip ratio (WHR) of >1 for males and >8 for females was defined as truncal obesity.[6]
9. WHR was calculated as the ratio of waist circumference over the hip circumference.[6]

Table 1: Age and sex-wise prevalence of diagnosed cases of diabetes mellitus.

Age (years)*	Sex**		Total (%)
	Male (%)	Female (%)	
20–34	0/17 (0)	1/43 (2.32)	1/60 (1.66)
35–49	6/75 (8.00)	9/124 (7.25)	15/199 (7.53)
≥50	16/68 (23.52)	10/98 (10.20)	26/166 (15.66)
Total	22/160 (13.75)	20/265 (7.5)	42/425 (9.88)

Two age groups i.e., 20–34 years and 35–49 years were pooled for statistical analysis. *χ^2 cal=10.21, df=1, P<0.05, S **χ^2cal=4.31, df=1, P<0.05, S

Statistical methods

The prevalence of diabetes mellitus and risk factors was presented as percentages. A comparison of diagnosed cases with various risk factors was done using Chi-square test. $P < 0.05$ was considered as statistically significant.

RESULTS

Sociodemographic characteristics

Of total sample (425), 160 (37.64%) were male and 265 (62.35%) were female, and their ratio was 0:6. Forty-two (9.88%) subjects were the diagnosed cases of type 2 diabetes mellitus and of these cases, 22 (13.75%) were male and 20 (7.5%) were female with ratio 1:1.

The majority of diagnosed cases of type 2 diabetes mellitus had primary education, i.e., 12 (28.57%) followed by secondary education 11 (26.19%) and illiterate 11 (26.19%) while the percentage of type 2 diabetes mellitus was less in the subjects who were educated above higher secondary.

In the current study maximum, i.e.,17 (40.48%) cases of type 2 diabetes mellitus were from class I and II, i.e., from upper class and 13 (31%) diabetics were homemakers followed by 10 (24%) retired persons and others.

Risk factors

More than half, i.e. 26 (61.90%) diagnosed cases of type 2 diabetes mellitus had history of either or both parents suffering from diabetes and 16 (38.10%) had no history

Table 2: Effect of education, socioeconomic class, and occupation on DM.

Characteristics	Number of cases with DM (%)	Number of cases without DM (%)	Total (%)	*P*-value
Education				
Illiterate	11 (26.19)	85 (22.20)	96 (22.59)	9.352, df=3, P<0.05, S
Primary	12 (28.57)	54 (14.09)	66 (15.52)	
Secondary	11 (26.19)	182 (47.52)	193 (45.41)	
Higher secondary and above	8 (19.05)	62 (16.19)	70 (16.48)	
Socioeconomic class				
Class I and II	17 (40.48)	128 (33.43)	145 (34.12)	0.95, df=2, P>0.05, NS
Class III	14 (33.33)	152 (39.68)	166 (39.06)	
Class IV and V	11 (26.19)	103 (26.89)	114 (26.82)	
Occupation				
Business	1 (2.38)	38 (9.93)	39 (9.18)	-
Household worker	1 (2.38)	39 (10.18)	40 (9.43)	
House wife	13 (30.95)	156 (40.73)	169 (39.76)	
Laborer	4 (9.53)	34 (8.87)	38 (8.92)	
Service	3 (7.14)	41 (10.70)	44 (10.35)	
Retired	10 (23.81)	19 (4.96)	29 (6.84)	
Others	10 (23.81)	56 (14.63)	66 (15.52)	
Total	42 (9.88)	383 (90.12)	425 (100)	

DM: Diabetes mellitus

of diabetes in their family. The majority, i.e. 26 (61.91%) diagnosed cases of type 2 diabetes mellitus were involved in sedentary to mild physical activity. Of total diagnosed cases of type 2 diabetes mellitus, maximum, i.e., 22 (52.38%) belonged to preobese to obese group and 20 (47.62%) diabetics were underweight.

In the current study, 14 (63.64%) diabetic males and 14 (70%) diabetic females had high waist circumference. Of total 425 subjects, 66 (41.25%) males and 223 (84.16%) females had a higher WHR. Of 138 nondiabetic males, 60% had normal WHR (<1) while of 22 diabetic males, half of them had high WHR (>1) while 83.26% of nondiabetic females had high WHR (>0.8), and 19 (95%) diabetic females had high WHR (>0.8).

DISCUSSION

The total prevalence of diagnosed cases of type 2 diabetes mellitus found in this study was 9.88%. The prevalence below the age of 50 years was 9.19% and it was 15.66% in the age 50 years and above. Thus, the prevalence of diabetes mellitus increased with increase in age which was found to be statistically significant ($P < 0.05$) [Table 1]. Similar findings were noted by authors in India, as well as outside.[6,9-17] Almost three times increase in the prevalence of diabetes mellitus after the age of 60 years (40–60 years – 5.8% vs. above 60 years – 16.66%) were found by Ahmad *et al.*[18]

In the current study, the prevalence of diabetes mellitus is more in males (13.75%) compared to females (7.5%) which was found statistically significant ($P < 0.05$) [Table 1]. Gikas *et al.*[11] and Shrestha *et al.*[12] reported similar findings like the current study, while in the population-based studies were done by Rao *et al.*[6] and Arora *et al.*[17] have reported that the prevalence was higher in females.

The association between low educational status and diabetes mellitus was found to be statistically significant in the present study ($P < 0.05$) [Table 2]. Gikas *et al.*,[11] Arora *et al.*,[17] and Acemoglu *et al.*[19] also found highest prevalence in illiterates with decreasing trends in better-educated people like the

Table 3: Risk factors for type 2 diabetes mellitus.

Risk factors	Number of cases with DM (%)	Number of cases without DM (%)	Total (%)	*P*-value
F/H/O DM				
Either or both parents	26 (61.90)	42 (10.97)	68 (16)	χ^2cal=73.07, df=1, P<0.001, HS
No	16 (38.10)	341 (89.03)	357 (84)	
Physical activity				
Sedentary to mild	26 (61.91)	256 (66.85)	282 (66.36)	χ^2=0.413, df=1, P>0.05, NS
Moderate to vigorous	16 (38.09)	127 (33.15)	143 (33.64)	
Body mass index				
Underweight to normal	20 (47.62)	224 (58.50)	244 (57.41)	χ^2=7.54, df=2, P<0.05, S
Preobese	13 (30.95)	127 (33.15)	140 (32.95)	
Obese	9 (21.43)	32 (8.35)	41 (9.64)	
Waist circumference				
Male				
<90	8 (36.36)	85 (61.59)	93 (58.13)	χ^2=4.962, df=1, P<0.05, S
≥90	14 (63.64)	53 (38.41)	67 (41.87)	
-	22 (13.75)	138 (86.25)	160 (37.60)	
Female				
<80	6 (30)	101 (41.23)	107 (40.37)	χ^2=0.967, df=1, P>0.05, NS
≥80	14 (70)	144 (58.77)	158 (59.63)	
-	20 (7.54)	245 (92.46)	265 (62.40)	
Waist-to-hip ratio				
Male				
≤1	11 (50)	83 (60.15)	94 (58.75)	χ^2=12.02, df=1, P<0.001, HS
>1	11 (50)	55 (39.85)	66 (41.25)	
-	22 (13.75)	138 (86.25)	160 (37.60)	
Female				
≤0.8	1 (5)	41 (16.74)	42 (15.84)	χ^2=1.90, df=1, P>0.05, NS
>0.8	19 (95)	204 (83.26)	223 (84.16)	
-	20 (7.54)	245 (92.46)	265 (62.40)	
Total	42 (9.88)	383 (90.12)	425 (100)	

DM: Diabetes mellitus

current study. Ramachandran *et al.*[7] and Satman *et al.*[16] reported a positive association of education with diabetes mellitus similar to our study; however, Ravikumar *et al.*[15] found a negative association between education and diabetes mellitus.

There was no statistically significant association between diabetes mellitus and socioeconomic class ($P > 0.05$) was seen [Table 2]. A study done by Satman *et al.*[16] and Mohan *et al.*[20] found higher prevalence in higher socioeconomic class like the current study and Shah *et al.*[9] showed increasing socioeconomic strata was associated with diabetes mellitus, while Arora *et al.*[17] reported higher prevalence in lower and upper class compared to upper middle class.

In the current study, although total prevalence of diabetes was found maximum in males, occupation wise homemakers showed higher prevalence of diabetes mellitus than any other occupation. This could be due to homemakers tend to have less outdoor activities along with the traditional less active lifestyle which may be responsible for a higher prevalence of diabetes mellitus in them [Table 2]. The highest prevalence in homemakers (9.9%) followed by unemployed and retired personnel (9.6%) was also noted by Arora *et al.*[17] and Ahmad *et al.*[18] in their study.

The association of family history of diabetes mellitus and diagnosed cases of diabetes mellitus was proved highly significant ($P < 0.001$) [Table 3]. Many studies noted similar findings like our study.[6,7,11,14-18] Mohan *et al.*[20] showed higher prevalence of diabetes mellitus among subjects with both parents diabetic (55%) compared to those with one parent diabetic (22%).

Doing less physical activity is one of the risk factors for diabetes mellitus which was reported in the current study; however, the association of physical activity with diabetes was not significant ($P > 0.05$) [Table 3]. Tiwari *et al.*[10] reported similar findings, i.e., those involved in mild activity were having diabetes mellitus and the difference was not significant. Shah *et al.*,[9] Ahmad *et al.*,[18] and Mohan *et al.*[20] found less physical activity was significantly associated with diabetes mellitus and those subjects who performed moderate to light grade physical activity were having diabetes mellitus as compared to those who performed heavy physical activity.

The association between obesity and diabetes mellitus was found to be significant in the present study ($P < 0.05$) [Table 3]. This was supported by other studies done in India and other countries,[6,11,14-20] while Shah *et al.*[9] and Tiwari *et al.*[10] did not find any association between BMI and diabetes mellitus.

Abdominal obesity commonly found in Indian population was more prevalent in our diabetic subjects also. A significant association between waist circumference and diabetes mellitus ($P < 0.05$) was found only in males [Table 3]. Similar results were noted by few authors.[6,7,10,15,20] In addition to this a significant association between WHR and diabetes was found in males ($P > 0.05$) [Table 3]. Results were consistent with the study conducted by other authors.[16,18,20]

CONCLUSIONS

This study determines association of various risk factors among diagnosed cases of type 2 diabetes mellitus. The association between increasing age, male sex, low educational status, obesity, waist circumference in males, and diabetes mellitus was found to be significant. It was observed that the association between family history of diabetes and WHR in males and diabetes mellitus was highly significant while there was no significant association found between physical activity, socioeconomic class, waist circumference, and WHR in females and diabetes mellitus. Thus, it is to conclude that nonmodifiable risk factors such as rising age, family history of diabetes mellitus, and modifiable risk factors such as lack of physical activity and central obesity were the most common factors found in diagnosed cases of diabetes mellitus. Hence, there is an impending need to conduct regular screening programs for early identification of high-risk group for diabetes mellitus and intensive health education programs focusing on the risk factors need to be carried out in the general population.

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Conflicts of interest

There are no conflicts of interest.

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