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PREVALENCE OF TYPE 2 DIABETES MELLITUS AND ITS ASSOCIATION WITH SOCIOECONOMIC STATUS IN KANDAHAR CITY: A CROSS-SECTIONAL STUDY

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ABSTRACT

Diabetes mellitus is a chronic disease with a life long duration and generally of gradual progression. Beside the upward trend in the prevalence rate, diabetes and its complications also have a significant economic impact on countries and their health systems. This study was aimed to assess the prevalence of type 2 diabetes mellitus (T2DM) and its association with socioeconomic status (SES) in the urban population of Kandahar city. A population-based cross-sectional study was conducted from January 2019 to May 2019 in the urban area of Kandahar province. A total of 1308 subjects, 837 (64%) women and 471 (36%) men, were included in the study. Data on sociodemographic characteristics, medical history, dietary intake and physical activity were collected in a standardized questionnaire. Diagnosis of diabetes was established according to the WHO criteria. Mean age (SD) was significantly higher in men than in women (50.3 (14.4) vs. 44.9 (11.4) years). The difference in BMI was not significant between men and women (28.1 vs. 28.7 kg/m^2). Majority of the study population was aged 40-54 years (46.3%), married (86.7%), illiterate (87.4%), and obese (39%). 6.6% were tobacco smokers, higher in men (13.6%) than in women (2.6%). The prevalence of diabetes mellitus, hypertension, obesity and central obesity was 15.2%, 25.5%, 39%, and 67.1%, respectively. In this study population, it could be suggested that socioeconomic factors are associated with T2DM and socioeconomic status is worth further investigation nationwide to properly understand the role of SES.

Keywords: *Afghanistan, Kandahar, Prevalence, Socio-economic status, Type 2 diabetes mellitus*

INTRODUCTION

Diabetes mellitus (DM) is an established worldwide health emergency and around 463 million people are estimated to be affected globally with this major health problem [1]. Just like the other three non-communicable diseases NCDs (cardiovascular diseases, cancers, and chronic respiratory diseases), diabetes is of long duration and generally of gradual progression [2]. The rise in the number of diabetic cases has become a major public health concern worldwide. An estimated 80% of these cases are in low- and middle-income countries [3], and type 2 diabetes mellitus (T2DM) accounts for 85% to 95% of all cases [2]. In addition, developed countries also show an increasing prevalence of T2DM in urban areas as well as semi-urban and rural areas, inclusive of people belonging to middle and low socio-economic class [4-7].

Diabetes mellitus and its complications also have a significant economic impact on countries and their health systems, specifically when health care needs to be funded out of pocket for people with diabetes and their families [1]. T2DM is a lifelong health condition which can affect both individuals and their families and has an impact on economic and social development of a country. Low expenditure per capita in poor countries demonstrates that more resources are required to provide basic diabetes care. Because diabetes is now affecting many in the workforce, it has a major and deleterious impact on both individual and national productivity.

Insufficient data are available regarding the global economic burden of diabetes in low- and middle-income countries (LMIC), while large costs are associated with diabetes in high-income countries (HIC) [8]. In 2014, the overall health expenditure due to diabetes was estimated USD 612 billion, which is approximately 11% of the total spending on adults [2]. DM imposes an increasing economic burden on national health care systems worldwide [2]. International Diabetes Federation (IDF) estimates that in 2019, total healthcare costs related to diabetes will reach USD 760 billion. On the country level, diabetes-related healthcare costs per person with diabetes in 2019 have large differences between countries. The highest annual expenditures per person are Switzerland with USD 11916, followed by the United States of America and Norway with USD 9506 and 9061, respectively. The countries with the lowest annual expenditures per person are Bangladesh (USD 64), Central African Republic (72 USD) and Nepal (80 USD) [1].

In Afghanistan, the prevalence of diabetes among Afghan population according to the International Diabetes Federation Atlas was estimated to be 8.6% in 2019 and is expected to reach to 9.9% in 2030 [9]. As per the report of World Health Organization (WHO), the total number of diabetes in 2016 was around 1 million [10], and it's estimated that an additional 1-2 million undiagnosed of diabetes very likely exist in Afghanistan [11]. Meanwhile, deaths due to diabetes in Afghanistan has reached 3,608 or 1.6% of total death and it is one of the 4 main case of premature mortality due to NCDs between ages 30 and 70 years [1]. Although more than 20% of the total health expenditure is spent on NCDs [12], like other many LMIC, information on the availability, cost, and quality of medical care for diabetes is mostly not available. Hence, it is important to determine economy-related determinants of diabetes, such as socioeconomic status (SES), which can contribute to the development of T2DM through different pathways [13]. To our knowledge, the association between socioeconomic status and health in terms of diabetes has never been tested in Kandahar city. Therefore, the current study aims to estimate the prevalence of type 2 diabetes mellitus in Kandahar city and to assess its association with socioeconomic status in the Afghan population.

METHODS

Study population

A population-based cross-sectional study was conducted in the urban area of Kandahar province. Kandahar city has an urban population of around 500,000 and is divided into 15 districts [14]. The study was conducted from January, 2019 to May, 2019. The sample size was calculated in Epi Info 7 by considering 17% prevalence of diabetes, 2% margin of error and confidence interval of 95%. Hence, the sample size was estimated to be 1352 men and women.

Participants were selected using a systematic random sampling method. In each household, an eligible male and female participants were selected on first contact with the interviewer. In case of refusal (3.3%), a neighbouring house was selected. In case of multiple families living in one house or when eligible men were not available, more than two persons were selected, hence, the total number of participants reached 1308.

The eligibility criteria were: 1) male or female residents of Kandahar province, 2) aged 25 years and above, 3) able to sign informed consent or welling to participate in the study. Pregnant women, people with severe health diseases and visitors from other provinces were excluded from the study. A total of 1308 participants were recruited from the population residing in the city and after excluding five participants with type 1 diabetes mellitus, 1303 were included in the study for statistical analyses.

Data collection

A standardized questionnaire was developed from other studies conducted in Kandahar city and included information on socio-demographic and housing characteristics, income, occupation, ethnicity, personal and family medical history of diabetes and blood pressure, women's reproductive health, anthropometry, and physical activity. Socio-economic and demographic indicators include age, gender, marital status, education level, occupation, ethnicity, address, type of housing, ownership of house and other house items. Personal and medical history include smoking status, previous diseases, present chronic diseases, family history of hypertension, diabetes and cancer, and for women, parity, age at first and last pregnancy, duration of breastfeeding, menstruation and use of oral contraceptive.

For data collection, three teams of health workers, which consisted of a male and female member, were trained at medical research unit. Anthropometric measurements including weight, height and waist circumference were measured for all the participants. Body weight was measured in all participants dressed in thin clothes with a digital electronic scale to the nearest 0.1kg. Height was measured without shoes with a stadiometer to the nearest millimetre. Body mass index (BMI) was calculated as weight (kilograms) divided by standing height (meters) squared. BMI was categorized according to WHO's classification: normal weight (BMI of 18.5-24.9), overweight (BMI of 25.0-29.9) and obese (BMI of ≥ 30). Waist circumference was measured midway between the lowest rib and superior border of the iliac crest at the end of normal expiration using a non-elastic tape to the nearest millimetre. For abdominal obesity, a cut-off point of 80cm and 94cm were considered for women and men, respectively [15].

Blood pressure was measured by a mercury sphygmomanometer at the right hand after resting for 5 minutes and recorded to the nearest 2 mmHg. Hypertension was defined as systolic blood pressure values of ≥ 140 mmHg and/or diastolic blood pressure values of ≥ 90 mmHg [16] or based on use of antihypertensive medicine. We used the short version of International Physical Activity Questionnaire (IPAQ) to measure participant's physical activity of previous week. The questionnaire included information about the duration of the physical activity in minutes and type of intensity as vigorous, moderate and light physical activity. This data was later converted into total MET (metabolic equivalent) minutes per week [17]. Capillary blood was obtained to measure random blood glucose levels during the survey using ACCU-CHEK glucometers and their test strips (Roche Diagnostics, Sydney, Australia). Participants who received antidiabetic medicine or

those with a cut-off point of 200 mg/dL or more during their blood glucose examination were considered diabetics [18].

Data analyses

All the questionnaires were double-checked by the researchers after entering the data to Epi Info 7. A numerical identifier was assigned to each study participant and personal data such as names and contact numbers were removed from the database. Data variables were properly cleaned and coded and labelled for statistical analyses.

Direct healthcare costs of participants with diabetes were calculated from the questionnaire, which comprises medical care expenditures such as physician services, laboratory tests and medications. To calculate socioeconomic status (SES), we used a reliable and valid method used for developing countries, which is described elsewhere [19]. In this method, a score was obtained from calculating variables such as age, education, occupation, residence and vehicle ownership. The score was then converted into tertiles for the analyses.

Statistical analyses were performed using Stata 14.1 (StataCorp LP, College Station, TX, USA). One-way analysis of variance was performed to compare continuous variables and the x^2 test was used for the comparison of categorical variables. Data were expressed as mean ± standard deviation or number (percent). The association between diabetes and its risk factors were assessed. All potential confounders available were adjusted for in each analysis. Logistic regression was used to study the association between the exposures of interest and the risk of diabetes.

The study was approved by Kandahar University's institutional review board (IRB). Prior to data collection, patients who agreed to participate were informed about the objectives of the study and were assured of the confidentiality of the information. Written informed consent was taken from all participants prior to data collection.

RESULTS

This was a population-based cross-sectional study conducted in Kandahar. Data were collected from 15 districts of Kandahar City with an urban population of around 500,000. A total of 1308 subjects, 837 (64%) women and 471 (36%) men, were included in the analyses. Mean age (SD) at recruitment was significantly higher in men than in women (50.3 (14.4) vs 44.9 (11.4) years). Majority of the study population was aged 40-54 years (46.3%), married (86.7%), illiterate (87.4%), and obese (39%). 6.6% of the participants were tobacco smokers, higher in men (13.6%) than in women (2.6%), while tobacco snuff users were 23.6%, also higher in men (54.4%) than in women (6.3%). Men were more active than women with a total MET-minutes/week of 2300 in men vs 1164 in women. The difference in BMI was not significant between men and women (28.1 vs 28.7 kg/m^2). Major descriptive characteristics of the study population are presented in (Table 1, Table 2).

Table 1: Baseline characteristics of the study population according to gender

Variables[1]	GENDER		Total (n=1308)	P value[2]
	MALE	FEMALE		
	471 (36%)	837 (64%)		
Mean (STD)				
Age (years) (missing=7)	50.3 (14.4)	44.9 (11.4)	46.9 (12.9)	<0.001
Weight (kg) (missing=11)	74.5 (13.2)	69.5 (13.3)	71.3 (13.5)	<0.001
Height (cm) (missing=8)	163.7 (11.0)	155.9 (6.7)	158.7 (9.3)	<0.001
Waist circumference (cm) (missing=218)	96.4 (12.1)	91.6 (13.6)	93.1 (13.4)	<0.001
Body Mass Index (kg/m^2) (missing=14)	28.1 (5.9)	28.7 (5.8)	28.5 (5.8)	0.088
Weekly Physical Activity				
Vigorous Activity (METs)	961 (2034)	297 (754)	536 (1398)	<0.001
Moderate Activity (METs)	493 (1007)	267 (578)	348 (768)	<0.001
Light Activity (METs)	846 (1064)	599 (962)	688 (1007)	<0.001
Total Activity (METs)	2300 (3338)	1164 (1351)	1573 (2340)	<0.001

[1] Number of missing values is 0 unless otherwise specified; [2] ANOVA test

Table 2A: Baseline characteristics of the study population according to gender

Variables[1]	GENDER		Total (n=1308)	P value[2]
	MALE 471 (36%)	FEMALE 837 (64%)		
N (%)				
BMI Classes (missing=14)				0.185
Under Weight	13 (2.8)	24 (2.9)	37 (2.9)	
Normal Weight	156 (33.6)	232 (28.0)	388 (30.0)	
Overweight	127 (27.4)	237 (28.5)	364 (28.1)	
Obese	168 (36.2)	337 (40.6)	505 (39.0)	
Age in Categories				<0.001
25-39	111 (23.6)	278 (33.2)	389 (29.7)	
40-54	185 (39.3)	420 (50.2)	605 (46.3)	
55-69	114 (24.2)	86 (10.3)	200 (15.3)	
70+	61 (12.9)	53 (6.3)	114 (8.7)	
Marital Status				<0.001
Married	441 (93.6)	693 (82.8)	1134 (86.7)	
Single	11 (2.4)	14 (1.7)	25 (1.9)	
Widow	19 (4.0)	130 (15.5)	149 (11.4)	
Educational Status:				<0.001
None	336 (71.3)	808 (96.5)	1144 (87.4)	
Elementary	45 (9.5)	16 (1.9)	61 (4.7)	
High School/Vocational	77 (16.4)	10 (1.2)	87 (6.7)	
Higher Education	13 (2.8)	3 (0.4)	16 (1.2)	
Occupational Categories:				<0.001
Housewives	0 (0)	826 (98.7)	826 (63.2)	
Jobless	222 (47.1)	0 (0)	222 (17.0)	
Non-Manual Workers	152 (32.3)	7 (0.8)	159 (12.2)	
Farm Workers	45 (9.6)	0 (0)	45 (3.4)	
Manual Workers	52 (11.0)	4 (0.5)	56 (4.3)	
Monthly Income in Afghanis (AFN)				<0.001
Below 10000 AFN	62 (13.2)	288 (34.4)	350 (26.8)	
10000 to 20000 AFN	261 (55.4)	336 (40.1)	597 (45.6)	
More than 20000 AFN	148 (31.4)	213 (25.5)	361 (27.6)	

[1] Number of missing values is 0 unless otherwise specified; [2] Chi-square test

In this population, the prevalence of diabetes mellitus, hypertension, obesity and central obesity was 15.2%, 25.5%, 39%, and 67.1%, respectively. The association between T2DM and its other risk factors are summarized in (Table 3). In our study, the prevalence of diabetes was higher in women (51.5%, p <0.001), participants older than 45 years (79.4%, p <0.001), participants with obesity (39.5%, p <0.401), housewives (50.0%, p <0.001), and illiterate individuals (86.6%, p <0.001).

The association of T2DM and its risk factors is summarized in Table 4, using logistic regression in crude and adjusted models. In crude analysis, the risk of T2DM was significantly increased by age older than 45 years (OR 4.04, p<0.001), waist circumference of more than 80cm for women and 94cm for men (OR 1.04, p<0.001), family history of diabetes (14.06, p<0.001), hypertension (OR 3.18, p<0.001), smoking (OR 1.47, p=0.002), and tobacco snuffing (OR 1.85, p<0.001), while physical activity decreased the risk (OR 0.71, p=0.029). However, in the adjusted model (adjusted for age and sex) age older than 45 years, BMI, waist circumference, family history of diabetes, hypertension and smoking significantly increased the risk of T2DM

Table 2B: Baseline characteristics of the study population according to gender

Variables[1]	GENDER		Total (n=1308)	P value[2]
	MALE	FEMALE		
	471 (36%)	837 (64%)		
N (%)				
Smoking status:				<0.001
Never Smoker	368 (78.1)	794 (94.9)	1162 (88.8)	
Former Smoker	39 (8.3)	21 (2.5)	60 (4.6)	
Current Smoker	64 (13.6)	22 (2.6)	86 (6.6)	
Snuffing status:				<0.001
No	215 (45.6)	784 (93.7)	999 (76.4)	
Yes	256 (54.4)	53 (6.3)	309 (23.6)	
Physical Activity Level				<0.001
High	114 (24.2)	96 (11.5)	210 (16.0)	
Moderate	179 (38.0)	379 (45.3)	558 (42.7)	
Low	178 (37.8)	362 (43.2)	540 (41.3)	
Central Obesity (missing=218)				<0.001
No	190 (56.7)	169 (22.4)	359 (32.9)	
Yes	145 (43.3)	586 (77.6)	731 (67.1)	
Hypertension				0.07
No	337 (71.6)	637 (76.1)	974 (74.5)	
Yes	134 (28.4)	200 (23.9)	334 (25.5)	
Diabetes Mellitus				<0.001
No	374 (79.4)	735 (87.8)	1109 (84.8)	
Yes	97 (20.6)	102 (12.2)	199 (15.2)	
Socioeconomic Status (SES)				<0.001
Low SES	0 (0)	439 (52.9)	439 (33.9)	
Medium SES	62 (13.4)	365 (44.0)	427 (33.0)	
High SES	402 (86.6)	26 (3.1)	428 (33.1)	

[1] Number of missing values is 0 unless otherwise specified; [2] Chi-square test

Table 3A: Characteristics of the study population according to type 2 diabetes status

Variables[1]	Overall	Type 2 Diabetes Mellitus		P value[2]
		No	Yes	
	1303 (100%)	1109 (85.1%)	194 (14.9%)	
N (%)				
Gender				<0.001
Male	468 (35.9)	374 (33.7)	94 (48.5)	
Female	835 (64.1)	735 (66.3)	100 (51.5)	
Age				<0.001
Less or equal to 45	608 (46.7)	568 (51.2)	40 (20.6)	
More than 45	695 (53.3)	541 (48.8)	154 (79.4)	
Age in Categories				<0.001
25-39 Years	388 (29.8)	370 (33.4)	18 (9.3)	
40-54 Years	604 (46.4)	515 (46.4)	89 (45.9)	
55-69 Years	197 (15.1)	142 (12.8)	55 (28.3)	
70+	114 (8.7)	82 (7.4)	32 (16.5)	

[1] Number of missing values is 0 unless otherwise specified; [2] Chi-square test

Table 3B: Characteristics of the study population according to type 2 diabetes status

Variables[1]	Overall	Type 2 Diabetes Mellitus		P value[2]
		No	Yes	
	1303 (100%)	1109 (85.1%)	194 (14.9%)	
BMI (missing=13)				0.401
Under Weight	37 (2.8)	35 (3.2)	2 (1.0)	
Normal Weight	387 (30.0)	326 (29.6)	61 (32.1)	
Overweight	362 (28.1)	310 (28.2)	52 (27.4)	
Obese	504 (39.1)	429 (39.0)	75 (39.5)	
Marital Status				0.298
Married	1131 (86.8)	966 (87.1)	165 (85.1)	
Single	25 (1.9)	23 (2.1)	2 (1.0)	
Widow	147 (11.3)	120 (10.8)	27 (13.9)	
Educational Status				0.71
Illiterate	1139 (87.4)	971 (87.6)	168 (86.6)	
Literate	164 (12.6)	138 (12.4)	26 (13.4)	
Occupation				<0.001
Housewives	824 (63.2)	727 (65.6)	97 (50.0)	
Jobless	221 (17.0)	167 (15.1)	54 (27.8)	
Non-Manual Workers	159 (12.2)	130 (11.7)	29 (15.0)	
Farm Workers	45 (3.5)	38 (3.4)	7 (3.6)	
Manual Workers	54 (4.1)	47 (4.2)	7 (3.6)	
N (%)				
Monthly Income in Afghanis (AFN)				0.005
Below 10000 AFN	349 (26.8)	312 (28.1)	37 (19.1)	
10000 to 20000 AFN	593 (45.5)	485 (43.7)	108 (55.7)	
More than 20000 AFN	361 (27.7)	312 (28.1)	49 (25.2)	
Socioeconomic status				<0.001
Low	439 (33.9)	393 (35.7)	46 (23.8)	
Medium	427 (33.0)	368 (33.4)	59 (30.6)	
High	428 (33.1)	340 (30.9)	88 (45.6)	
Smoking status				0.005
Never	1157 (88.8)	998 (90.0)	159 (82.0)	
Former	60 (4.6)	46 (4.2)	14 (7.2)	
Current	86 (6.6)	65 (5.8)	21 (10.8)	
Snuffing				<0.001
No	995 (76.4)	867 (78.2)	128 (66.0)	
Yes	308 (23.6)	242 (21.8)	66 (34.0)	
Physical Activity				0.028
No	538 (41.3)	444 (40.0)	94 (48.5)	
Yes	765 (58.7)	665 (60.0)	100 (51.5)	
Central Obesity (missing=217)				0.866
No	358 (33.0)	304 (32.9)	54 (33.5)	
Yes	728 (67.0)	621 (67.1)	107 (66.5)	
Hypertension				<0.001
No	971 (74.5)	868 (78.3)	103 (53.1)	
Yes	332 (25.5)	241 (21.7)	91 (46.9)	

[1] Number of missing values is 0 unless otherwise specified; [2] Chi-square test

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Table 4. Logistic regression analysis of type 2 diabetes mellitus and its risk factors, crude and adjusted models

	Crude Analysis				Adjusted Analysis for Age and Sex			
Variables	Odds Ratio	(95% CI)		P value	Odds Ratio	(95% CI)		P value
Age 45 years	4.04	2.80	5.84	**<0.001**	2.5	1.52	4.11	**<0.001**
BMI	1.02	0.99	1.05	0.087	1.04	1.01	1.07	**<0.001**
Waist	1.04	1.02	1.05	**<0.001**	1.03	1.02	1.05	**<0.001**
Education	1.09	0.70	1.71	0.71	0.9	0.55	1.49	0.69
Marital Status	1.23	0.89	1.41	0.302	0.88	0.68	1.14	0.33
DM Family History	14.06	6.54	30.20	**<0.001**	17.85	7.87	40.47	**<0.001**
Hypertension	3.18	2.32	4.36	**<0.001**	2.56	1.84	3.55	**<0.001**
Physical Activity	0.71	0.52	0.96	**0.029**	0.99	0.71	1.38	0.947
Smoking	1.47	1.15	1.88	**0.002**	1.34	1.03	1.74	**0.029**
Snuffing	1.85	1.33	2.57	**<0.001**	1.01	0.67	1.53	0.964
Socioeconomic Status	1.50	1.24	1.82	**<0.001**	1.29	0.92	1.81	0.144

Socioeconomic status (SES) was significantly different between men and women. Most of the women participants (52.9%) were in low SES, while majority of the men (86.6%) were in high SES (Table 2). The association of socioeconomic status was significant in diabetic population. Participants in the lower tertiles of SES were negatively and those in the higher tertiles were positively associated with the prevalence of diabetes (Table 3).

DISCUSSION

This is the first community-based cross-sectional study which assessed the prevalence and socioeconomic status of T2DM among Kandahar citizen. A total of 1308 subjects, 837 (64%) women and 471 (36%) men, were included in the analyses. The prevalence of diabetes was 14.9% and was significantly higher in women. Risk factors for T2DM were age older than 45 years, higher BMI and waist circumference, hypertension, smoking and history of DM. Higher SES was associated with increased prevalence of T2DM.

This prevalence of T2DM seems to be higher than the estimated prevalence of diabetes in 2019 for Afghanistan, which was 9.2% in the whole country [1]. In previous published studies of different provinces of Afghanistan, the prevalence of diabetes in Kabul, Nangarhar, Balkh, and Herat provinces was 13.3%, 11.4%, 9.2% and 9.9%, respectively, while in Kandahar province, the prevalence was 22.4% [20-24]. These differences are probably related to the difference in age and region, as in the current study only participants from the urban area were included. The results of our study regarding the prevalence of diabetes are comparable to other studies conducted in neighboring and other countries. For example, a study conducted in 15 states of India, showed that the prevalence of T2DM ranged from 4% to 13.6%, and showed differences depending on the age, sex, obesity and family history [4]. A high incidence was reported in the Indian study ranged 12.1% to 14% for diabetes with a sample of 11216 subjects [5]. In a cross-sectional study of prevalence of diabetes mellitus in the urban population of Pakistan, among 1091 respondents who were selected for the study, 15.41% of the males and 12.31% of females were found to have diabetes with total prevalence of 13.14% [25]. Our study results are also comparable with the results of a recently published survey conducted in 2009 among the Chinese population of Shanghai, where the prevalence was 15.6% [26]. The overall prevalence of diabetes for Sri Lankans was 10.5% and the risk factors were almost the same as in our study [6].

Age is a non-modifiable risk factor and has an influence on the development of diabetes. Responsible mechanisms of age-related risk increase include decreased insulin sensitivity and decreased ß-cell function [27]. In current study, older age was a significant risk factor and was strongly associated with T2DM. Almost fourth fifth of the participants (79.4%) were found in the range of above 45 years. The risk increased from 9.3% in the 25-39 years age group to about 45.9% in age 40-54 years. Other similar studies in Afghanistan which were conducted for the prevalence of T2DM in Kabul, Jalalabad and Herat city, diabetes was found to be 13.2%, 11.8% and 9.9%, respectively among age group of ≥40 years old participants [20-22]. Other risk factors for diabetes include female sex, higher BMI, socioeconomic level, family history of diabetes, smoking and physical inactivity which have been claimed by various studies [5,7,28]. In our study one of the fixed risk factors for T2DM was family history in first degree relative which increased the risk of being diabetic. These results are same with the finding from studies in China and India regarding risk factors of positive family history of diabetes, older age and low socio-economic status [5,26]. Obesity, a modifiable risk factor of diabetes, was also associated with T2DM. Similar results of obesity were also reported in a previous study conducted in Jalalabad, Afghanistan [21]. Other studies conducted in India, Bangladesh and Middle East, also highlighted obesity and

overweight as a risk factor for T2DM [4,7,29]. The association of central obesity with diabetes was also significant in our study. This is in agreement with other studies conducted in Ethiopia, India and Indonesia [30-32]. In our study smoking was also a risk factor for T2DM. These results are in line with multiple studies which reported similar findings, such as the Health Professional's study, where fewer cases of T2DM were observed in non-smokers than in smokers [33] and a study in Pakistan smoking increased the risk of diabetes [34] as smoking leads to insulin resistant or inadequate compensatory insulin secretion [35] through various underlying effects, including oxidative stress, inflammation, and endothelial dysfunction [36].

Our findings of positive association of high SES with T2DM are consistent with the results of other LMICs. In a neighboring country India, a national survey of diabetes found that people at the highest group of SES appeared to be at risk for T2DM [37]. Although SES can be a determinant of T2DM, the exact causal pathway is not known. Factors related to SES which could play a role in the development of such chronic disease are lifestyle factors, the availability of economic and occupational opportunities, sedentary behavior, healthy diet and environment for exercise [38]. According to Afghanistan's Health Survey 2018, a large amount of out-of-pocket expenses for patient healthcare comprises costs for medicine and supplies, and expenses of travelling to health facilities [39]. T2DM is a large economic burden on LMICs and is directly affecting patients [40], including Afghanistan and it is important to collect further evidence for better understanding the role of SES on T2DM. This can also help the ministry of public health to invest timely on prevention and management programs related to NCDs.

Strength of the current study is its recent data on the prevalence of T2DM, as very few epidemiological studies have been conducted in Afghanistan on the prevalence of T2DM and for assessing the socioeconomic status of T2DM, especially in Kandahar. Limitations include the cross-sectional design of the study, which cannot assess cause and relation. During the survey, most of the time men were not available due to working hours, which caused oversampling of the women. Newly diagnosed diabetic cases were not confirmed with further analyses such as HbA1c. Considering security in mind, the study was designed for urban areas of Kandahar province and therefore, information regarding the rural inhabitants of the province could not be achieved.

CONCLUSION

T2DM is prevalent in Kandahar city and is associated with high socioeconomic status. Advanced age, family history in first degree relative, obesity, hypertension, and smoking were the fixed risk factors for T2DM in the study population. There is a strong need for well-designed research in Afghanistan to investigate the association of type 2 diabetes mellitus with SES and its economic impact on society.

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Competing interests

None declared.

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Author's contributions

All the authors participated in the research design and project implementation. MSS, AWW, NF and ANA supervised data collection and analysis. MSS, AWW and NF wrote the initial manuscript. ANA, MSH, MZA and NI revised the manuscript. All authors have read and approved the manuscript.

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