

A PROSPECTIVE STUDY ON THE ASSESSMENT OF RISK FACTORS FOR TYPE 2 DIABETES MELLITUS IN OUTPATIENTS DEPARTMENT OF A SOUTH INDIAN TERTIARY CARE HOSPITAL: A CASE-CONTROL STUDY

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ABSTRACT

Objective: Type 2 diabetes mellitus (T2DM) is the most general type of diabetes. In India, the risk factors (modifiable and non-modifiable) for diabetes are seen more frequently, and there is a lack of perception about this problem. The objective of the study was to assess the incidence and risk factors for T2DM in a south Indian tertiary care hospital.

Methods: A prospective study was conducted on 1161 subjects (with or without T2DM) from November 2014 to April 2015 in General Medicine Department of Dr. Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation, Andhra Pradesh, South India. Chi-square test was used to evaluate the incidence of T2DM, and odds ratios were calculated in a univariate logistic regression analysis for risk factors.

Results: T2DM was significantly higher in the subjects of age above 41 years (86.3%, $p < 0.0001$), married (95.4%, $p = 0.002$), educators (degree and above, 13.2%, $p < 0.0001$), known family history (50.8%, $p < 0.0001$), body mass index (BMI) ($> 25 \text{ kg/m}^2$, 58.7%; $p < 0.0001$), Government job holders (5.5%, $p < 0.0001$), business people (12%, $p < 0.0001$), housewives (38.3%, $p < 0.0001$), high economic status (34.9%, $p < 0.0004$), preexisting hypertension (40.2%, $p < 0.0001$), urban residence (50.4%, $p < 0.0001$), physical inactivity (45.3%, $p < 0.001$), stress (61.0%, $p = 0.01$), consumption of tea and coffee (daily thrice or more, 6.3%, $p = 0.0003$), soft drinks (weekly thrice or more, 4%, $p = 0.0008$), and junk foods (weekly thrice or more 2.6%, $p = 0.025$) than non-diabetic subjects. The univariate logistic regression analysis showed that the age (above 41 years), marital status, education, family history, BMI ($> 25 \text{ kg/m}^2$), high economic status, co-morbidities (hypertension and thyroid disorders) urban residence, physical inactivity, stress, consumption of tea and coffee (daily thrice or more), soft drinks (weekly thrice or more), and junk foods are the significantly risk factors for T2DM.

Conclusion: This study results suggested that beware of hypertension, thyroids disorders, physical inactivity, stress, soft drinks and junk foods, which are major risk factors of T2DM.

Keywords: Type 2 diabetes mellitus, Glycated hemoglobin, Risk factors, Co-morbidities, Junk foods.

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INTRODUCTION

Diabetes mellitus (DM) is metabolic disorder that is characterized by chronic hyperglycemia and associated with microvascular and macrovascular complications with serious morbidity and mortality [1]. India, China, and the United States of America (USA) are the three countries with the largest numbers of people with diabetes. India had 33 million patients with diabetes in 2000, a figure that is projected to increase to 79.4 million by 2030 [2]. The number of people with diabetes in the worldwide was 171 million in 2000 and expected to increase to 366 million by 2030 [3,4]. Both genetic and environmental factors are strong risk factors for the development of Type 2 diabetes mellitus (T2DM) [5,6]. Known risk factors of T2DM are overweight ($> 25 \text{ kg/m}^2$), family history of diabetes, physical inactivity, ethnic predisposition, hypertension, dyslipidemia, cardiovascular disease, history of polycystic ovary syndrome, gestational DM, and macrosomia [7]. Young Indians are at increased 30-fold over 20 years for T2DM along with a concomitant increase in obesity [8]. The South Asian population presents with a number of diverse risk factors for T2DM due to a combination of several genetic and environmental factors [9]. Therefore, this study was planned to assess the risk factors for T2DM in a tertiary care south India hospital.

METHODS

The present prospective study was conducted at outpatients department of Dr. Pinnamaneni Siddhartha Institute of Medical

Sciences and Research Foundation, Vijayawada, Andhra Pradesh, South India. The study was initiated after approval by the Institutes Ethical Review Committee, KVSr Siddhartha College of Pharmaceutical Sciences (SCOPS), Vijayawada, India. KVSr SCOPS was recognized by All India Council of Technical Education and Pharmacy Council of India, New Delhi, Government of India. The protocol approval number was KVSrSCOPS/IEC/2015/004.

Selection of participants

The patients of either sex diagnosed with or without T2DM of any duration and willing to participate were included in the study. A total of 1161 patients (415 patients with T2DM and 746 patients without T2DM) were enrolled in the study.

Data collection

Physicians were requested to report the clinical and biochemical data not exceeding 6 months before the observation. Biochemical parameters (fasting blood glucose, oral glucose tolerance test, and HbA1c values) were derived from the latest laboratory investigation reports documented in the clinical records. The information regarding sociodemographics (age, sex, marital status, education, family history of known hypertension, body mass index (BMI), monthly income, and co-morbid conditions) and lifestyle characteristics (residential area, alcohol consumption, smoking status, food habits, stress at workplace, and physical activity) were collected by interviewing the participant to identify the possible risk factor. All the relevant data were collected

in a predesigned paper case record form with prior consent of the participant.

Statistical analysis

Statistical analyses were performed using SPSS version 20 (SPSS Inc., Chicago, IL, USA) and Graph Pad Prism 5.0 software (San Diego, CA). Estimates were expressed as mean±standard deviation (SD). One-way analysis of variance or Student's t-test was used to compare groups for continuous variables, and χ^2 -test was used to compare proportions between the two groups. The univariate logistic regression analysis was used to examine the association between various exposures (age, gender, place of residence, generalized obesity, cigarette smoking, alcohol consumption, income status, and literacy level) and outcome (T2DM). $p < 0.05$ was considered significant.

RESULTS

A total of 1161 subjects (415 with T2DM and 746 without T2DM) were included in the study. The biochemical and clinical characteristics of T2DM were presented in Table 1. Tables 2 and 3 show the sociodemographic and lifestyle characteristics of subjects with and without T2DM, respectively. T2DM was higher in males (48.4%) when compared to females (45.7%) but statistically not significant ($p = 0.372$). The mean±SD age was 53.6±10.8 ($p < 0.0001$) years in patients with T2DM and 44.6±15.0 years in patients without T2DM. Age above 41 years was significantly associated with the T2DM ($p < 0.0001$) compared to age below 40 years. T2DM was significantly higher in married (95.4%, $p = 0.002$) and widowed (3.4%, $p = 0.017$) compared to unmarried (1.2%). Educators (up to 10th standard, 45.8%, $p < 0.0001$; above 10th standard, 21.2%, $p < 0.0001$) and family history of known

Table 1: Biochemical and clinical characteristics of patients with T2DM

Variable	Patients with T2DM (N=415)
Age (years)	
Mean±SD	53.6±10.8
0-20	3 (0.7)
21-40	132 (31.8)
41-60	243 (58.6)
Above 61	37 (8.9)
Body weight (kg)	
Mean±SD	72.573±13.224
HbA1c (%)	
Mean±SD	7.985±1.683
<7.5	179 (43.13)
7.5-9	140 (33.73)
>9	96 (23.13)
Fasting blood glucose (mg/dL)	
Mean±SD	146.348±63.146
<100	95 (22.89)
100-125	107 (25.78)
>125	213 (51.32)
Oral glucose tolerance test (mg/dL)	
Mean±SD	196.516±65.326
<140	84 (20.24)
140-200	161 (38.79)
>200	170 (40.96)
Duration of T2DM (years)	
<5	176 (42.40)
5-10	135 (32.53)
>10	104 (25.06)
Frequency of health check-ups	
Monthly once	132 (31.8)
1-3 months	266 (64.1)
4-6 months	9 (2.2)
>6 months	8 (1.9)
Following T2DM education	
Yes	348 (83.9)
No	67 (16.1)

SD: Standard deviation, T2DM: Type 2 diabetes mellitus

history ($p < 0.0001$) are significantly associated with T2DM. T2DM subjects had a greater BMI ($>25 \text{ kg/m}^2$, $P < 0.0001$). High socioeconomic status (34.9%, $p < 0.0001$) was significantly associated with T2DM compared to low economic status. T2DM was significantly higher in the subjects of preexisting co-morbidities (hypertension, $p < 0.0001$; history of cardiovascular diseases, $p < 0.0001$; thyroid disorders, $p < 0.0001$), urban residence (50.4%, $p < 0.0001$), physical inactivity (45.3%, $p < 0.0001$), stress (61.0%, $p = 0.0108$), consumption of tea and coffee (daily twice, 5.8%, $p = 0.0008$; thrice or more, $p = 0.0003$), soft drinks (weekly twice, 5.5%, $p = 0.005$; weekly thrice or more, 4.0%, $p = 0.0008$), and junk foods (thrice or more in a week, $p = 0.025$) than non-diabetic subjects. Private job holders (4.8%, $p = 0.539$), history of cardiovascular diseases alone (2.7%, $p = 0.104$), thyroids disorders alone (2.8%, $p = 0.115$), past alcoholic (2.1%, $p = 0.401$), past smokers (3.6%, $p = 0.609$), consumption of tea (once daily, 12.3%, $p = 0.967$; daily twice, 28.5%, $p = 0.341$), coffee (once daily, 4.8%, $p = 0.127$), fruits

Table 2: Sociodemographic characteristics of patients with and without T2DM (N=1161)

Variable	Without DM (N=746) (%)	With DM (N=415) (%)	p value ^a
Gender			
Female	405 (54.3)	214 (51.6)	Ref
Male	341 (45.7)	201 (48.4)	0.372
Age			
Mean±SD	44.6±15.0	53.6±10.8	<0.0001
Below 40 years	329 (44.1)	57 (13.7)	Ref
41-60 years	305 (40.9)	255 (61.5)	<0.0001
Above 60 years	112 (15.0)	103 (24.8)	<0.0001
Marital Status			
Unmarried	34 (4.6)	05 (1.2)	Ref
Married	687 (92.0)	396 (95.4)	0.002
Widowed	25 (3.4)	14 (3.4)	0.017
Education			
Uneducated	394 (52.9)	137 (33.0)	Ref
Up to 10 th standard	251 (33.6)	190 (45.8)	<0.0001
Above 10 th standard	47 (6.3)	33 (8.0)	0.004
Degree	54 (7.2)	55 (13.2)	<0.0001
Family history of T2DM			
No family history	567 (76.0)	204 (49.2)	Ref
Father	62 (8.3)	72 (17.3)	<0.0001
Mother	67 (9.0)	61 (14.7)	<0.0001
Brother and sister	34 (4.5)	46 (11.1)	<0.0001
Father and mother	16 (2.2)	32 (7.7)	<0.0001
BMI			
<25 kg/m ²	538 (72.1)	171 (41.3)	Ref
>25 kg/m ²	208 (27.9)	244 (58.7)	<0.0001
Nature of work			
Daily labor	292 (39.2)	79 (19)	Ref
Private job	62 (8.3)	20 (4.8)	0.539
Government job	8 (1.0)	23 (5.5)	<0.0001
Retired	1 (0.1)	3 (0.7)	0.009
Business	21 (2.9)	50 (12)	<0.0001
House wife	239 (32.0)	159 (38.3)	<0.0001
Not working any where	62 (8.3)	51 (12.3)	<0.0001
Farmer	61 (8.2)	30 (7.2)	0.018
Socioeconomic status			
Low	617 (82.7)	270 (65.1)	Ref
High	129 (17.3)	145 (34.9)	<0.0001
Co-morbidities			
No	576 (77.2)	171 (41.2)	Ref
HTN	99 (13.3)	167 (40.2)	<0.0001
History of CVDs	20 (2.7)	11 (2.7)	0.104
Thyroid disorders	18 (2.4)	12 (2.8)	0.115
HTN and CVDs	29 (3.9)	37 (8.9)	<0.0001
HTN and thyroid	4 (0.5)	17 (4.1)	<0.0001

^aChi-square test. T2DM: Type 2 diabetes mellitus, DM: Diabetes mellitus, SD: Standard deviation, BMI: Body mass index, HTN: Hypertension, CVD: Cardiovascular disease

(22.2%, p=0.506), and junk foods (weekly once, 6.5%, p=0.093; weekly twice, 2.9%, p=0.444) are not significantly associated with the T2DM.

The univariate logistic regression analysis was performed to determine the odds ratios (OR) for the modifiable and non-modifiable risk factors for T2DM; the results were presented in Table 4. The analysis showed that age (between 41 and 60) years (OR: 4.826, 95% confidence interval [CI]: 3.481-6.691, p<0.0001), age above 61 years (OR: 5.309, 95% CI: 3.600-7.826, p<0.0001), married (OR: 3.920, 95% CI: 1.520-10.11, p=0.0091), widowed (OR: 3.808, 95% CI: 1.212-11.96, p=0.033), education (up to 10th standard, OR: 2.177, 95% CI: 1.660-2.854, p<0.0001; above 10th standard, OR: 2.019, 95% CI: 1.242-3.282, p=0.007), family history (father, OR: 3.228, 95% CI: 2.217-4.699, p<0.0001; mother, OR: 2.531, 95% CI: 1.727-3.708, p<0.0001; both

Table 3: Food and life style factors of patients with or without T2DM (N=1161)

Variable	Without DM (N=746) (%)	With DM (N=415) (%)	p value ^a
Locality			
Rural	473 (63.4)	206 (49.6)	Ref
Urban	273 (36.6)	209 (50.4)	<0.0001
Physical activity			
Yes	534 (71.6)	227 (54.7)	Ref
No	212 (28.4)	188 (45.3)	<0.0001
Food habits			
Vegetarian	59 (7.9)	104 (25)	Ref
Non-vegetarian	687 (92.1)	311 (75)	<0.0001
Alcohol			
No	616 (82.6)	370 (89.2)	Ref
Yes	109 (16.6)	36 (8.7)	0.002
Past alcoholic (stopped>6 months)	21 (2.8)	9 (2.1)	0.401
Smoking			
No	611 (81.9)	366 (88.2)	Ref
0-14 cigarettes/day	98 (13.1)	28 (6.8)	0.0008
>14 cigarettes/day	16 (2.1)	6 (1.4)	0.328
Past smoker	21 (2.9)	15 (3.6)	0.609
Stress			
No	349 (46.8)	162 (39.0)	Ref
Yes	397 (53.2)	253 (61.0)	0.0108
Tea and coffee			
No	110 (14.8)	59 (14.2)	Ref
Daily once tea	96 (12.9)	51 (12.3)	0.967
Daily twice tea	265 (35.6)	118 (28.5)	0.341
Daily thrice and even more tea	193 (25.9)	57 (13.7)	0.006
Daily once coffee	22 (3.0)	20 (4.8)	0.127
Daily twice coffee	17 (2.3)	20 (4.8)	0.030
Daily thrice coffee	4 (0.5)	10 (2.4)	0.006
Tea and coffee daily once	12 (1.6)	30 (7.2)	<0.0001
Tea and coffee daily twice	13 (1.7)	24 (5.8)	0.0008
Tea and coffee daily thrice and even more	13 (1.7)	26 (6.3)	0.0003
Fruits			
Yes	593 (79.5)	323 (77.8)	Ref
No	153 (20.5)	92 (22.2)	0.506
Soft drinks			
No	524 (70.3)	246 (59.3)	Ref
Weekly once	31 (4.1)	27 (6.5)	0.022
Weekly twice	21 (2.7)	23 (5.5)	0.005
Weekly thrice or more	10 (1.4)	17 (4.0)	0.0008
Occasionally	160 (21.4)	102 (24.7)	0.038
Junk foods			
No	575 (77.1)	287 (69.2)	Ref
Weekly once	30 (4.0)	24 (5.8)	0.093
Weekly twice	18 (2.4)	12 (2.9)	0.444
Weekly thrice or more	8 (1.0)	11 (2.6)	0.025
Occasionally	115 (15.5)	81 (19.5)	0.033

^aChi-square test. T2DM: Type 2 diabetes mellitus, DM: Diabetes mellitus

Table 4: Univariate logistic regression analysis for risk factors of T2DM (N=1161)

Variable	OR (95% CI)	p value
Gender		
Male	1.116 (0.877-1.419)	0.390
Age		
Below 40 years	Ref	
41-60 years	4.826 (3.481-6.691)	<0.0001
Above 61 years	5.309 (3.600-7.826)	<0.0001
Marital status		
Unmarried	Ref	
Married	3.920 (1.520-10.11)	0.0019
Widowed	3.808 (1.212-11.96)	0.0332
Education		
Uneducated	Ref	
Up to 10 th standard	2.177 (1.660-2.854)	<0.0001
Above 10 th standard	2.019 (1.242-3.282)	0.0070
Degree	2.929 (0.919-4.471)	<0.0001
Family history of T2DM		
No family history	Ref	
Father	3.228 (2.217-4.699)	<0.0001
Mother	2.531 (1.727-3.708)	<0.0001
Brother and sister	3.760 (2.347-6.025)	<0.0001
Father and mother	5.559 (2.987-10.35)	<0.0001
BMI		
<25 kg/m ²	Ref	
>25 kg/m ²	3.691 (2.867-4.752)	<0.0001
Nature of work/profession		
Daily labor	Ref	
Private job	1.192 (0.679-2.092)	0.559
Government job	10.63 (4.577-24.67)	<0.0001
Retired	11.09 (1.137-108.1)	0.0342
Business	8.800 (4.991-15.52)	<0.0001
House wife	2.459 (1.787-3.385)	<0.0001
Not working anywhere (sedentary)	3.040 (1.946-4.751)	<0.0001
Farmer	1.818 (1.099-3.006)	0.0268
Socioeconomic status		
Low	Ref	
High	2.569 (1.947-3.389)	<0.0001
Co-morbidities		
No	Ref	
HTN	5.682 (4.203-7.683)	<0.0001
History of CVDs	1.853 (0.870-3.943)	0.127
Thyroid disorders	2.246 (1.060-4.755)	0.045
HTN and CVDs	4.298 (2.567-7.195)	<0.0001
HTN and thyroid	14.32 (4.752-43.13)	<0.0001
Locality		
Rural	Ref	
Urban	1.758 (1.378-2.242)	<0.0001
Physical activity		
Yes	Ref	
No	2.086 (1.624-2.680)	<0.0001
Food habits		
Vegetarian	Ref	
Non-vegetarian	0.256 (0.181-0.363)	<0.0001
Alcohol		
No	Ref	
Yes	0.549 (0.369-0.818)	0.002
Past alcoholic	0.713 (0.323-1.575)	0.449
Smoking		
No	Ref	
0-14 cigarettes/day	0.477 (0.307-0.740)	0.0007
>14 ciggrates/day	0.626 (0.242-1.675)	0.379
Past smoker	1.192 (0.606-2.343)	0.603
Stress		
No	Ref	
Yes	1.373 (1.075-1.753)	0.011
Tea and coffee		
No	Ref	
Daily once tea	0.990 (0.622-1.576)	1.000
Daily twice tea	0.830 (0.565-1.218)	0.373
Daily thrice and even more tea	0.550 (0.357-0.848)	0.007

(Contd...)

Table 4: (Continued)

Variable	OR (95% CI)	p value
Daily once coffee	1.695 (0.855-3.357)	0.154
Daily twice coffee	2.663 (1.403-5.058)	0.003
Daily thrice coffee	4.661 (1.401-15.51)	0.009
Tea and coffee daily once	4.661 (2.223-9.775)	<0.0001
Tea and coffee daily twice	3.442 (1.633-7.254)	0.001
Tea and coffee daily thrice and even more	3.729 (1.784-7.794)	0.0005
Fruits		
Yes	Ref	
No	1.104 (0.824-1.478)	0.548
Soft drinks		
No	Ref	
Weekly once	1.855 (1.083-3.177)	0.029
Weekly twice	2.33 (1.267-4.297)	0.007
Weekly thrice or more	3.621 (1.634-8.026)	0.001
Occasionally	1.358 (1.015-1.817)	0.041
Junk foods		
No	Ref	
Weekly once	1.603 (0.919-2.793)	0.103
Weekly twice	1.336 (0.634-2.811)	0.437
Weekly thrice and more	2.755 (1.096-6.926)	0.046
Occasionally	1.411 (1.027-1.939)	0.037

T2DM: Type 2 diabetes mellitus, HTN: Hypertension, CVD: Cardiovascular disease, BMI: Body mass index, OR: Odds ratio, CI: Confidence interval

mother and father, OR: 5.556, 95% CI: 2.987-10.35, $p < 0.0001$; both brother and sister, OR: 3.760, 95% CI: 2.347-6.025, $p < 0.0001$, BMI (OR: 3.691, 95% CI: 2.867-4.752, $p < 0.0001$), Government job (OR: 10.63, 95% CI: 4.577-24.67, $p < 0.0001$), high socioeconomic status (OR: 2.569, 95% CI: 1.947-3.389, $p < 0.0001$), hypertension (OR: 5.682, 95% CI: 4.203-7.683, $p < 0.0001$), thyroid disorders (OR: 2.246, 95% CI: 1.060-4.755, $p = 0.045$), co-existence of hypertension and thyroid (OR: 14.32, 95% CI: 4.752-43.13, $p < 0.0001$), urban residence (OR: 1.758, 95% CI: 1.378-2.248, $p < 0.0001$), physical inactivity (OR: 2.086, 95% CI: 1.624-2.680, $p < 0.0001$), stress (OR: 1.373, 95% CI: 1.075-1.753, $p = 0.011$), consumption of coffee (daily twice, OR: 2.663, 95% CI: 1.403-5.053, $p = 0.003$; daily thrice, OR: 4.661, 95% CI: 1.401-15.51, $p = 0.009$), tea and coffee (daily thrice or more, OR: 3.729, 95% CI: 1.784-7.794, $p = 0.0005$), soft drinks (weekly once, OR: 1.855, 95% CI: 1.083-3.177, $p = 0.029$; weekly twice, OR: 2.33, 95% CI: 1.267-4.279, $p = 0.007$; weekly thrice or more, OR: 3.621, 95% CI: 1.634-8.026, $p = 0.001$), and junk food (weekly thrice or more, OR: 2.755, 95% CI: 1.096-6.926, $p = 0.046$) were the significant risk factors for T2DM.

DISCUSSION

India is largely a rural nation and the recent available reports indicate rising prevalence of the disease in the rural areas also [10,11]. In another 20 years, nearly one-fifth of the world's diabetic population will be in India. India faces several major challenges in the management and the prevention of T2DM due to rising prevalence in urban and rural areas, genetic, environmental risk factors, and suboptimal diabetes control. In this study, univariate logistic regression analysis showed that the age (above 41 years), marital status, education, family history, BMI ($> 25 \text{ kg/m}^2$), high economic status, co-morbidities (hypertension and thyroid disorders) urban residence, physical inactivity, stress, consumption of tea and coffee (daily thrice or more), soft drinks (weekly thrice or more), and junk foods are the significantly risk factors for T2DM.

Increasing age is significantly associated and the most significant risk factor for T2DM. Shivananda *et al.* (2014) conducted a study and reported that there was a significant association of age 40-60 years ($n = 147$, 24.2%) and above 60 years (25.6%) to T2DM [12]. In this study, subjects of age above 40 years are at more risk to T2DM. Another study also agreed that marital status ($n = 208$, 61.2%) was associated with T2DM [13]. A study conducted by Ravikumar *et al.* (2011) on prevalence

and risk factors of T2DM concluded that educational qualification ($p < 0.001$) was significantly related to the presence of T2DM [2]. Obesity is one of the major risk factors for T2DM. Nandimath *et al.* (2015) conducted a study on T2DM incidence in contributions of overweight and obesity ($p < 0.001$) and indicate that T2DM is more attributable to overweight and obesity [14]. Fahad *et al.* (2015) conducted a study on uncontrolled T2DM prevalence and risk factors among people with T2DM and concluded that housewives and unemployed are at risk for T2DM [13]. Urban people are at more risk to T2DM. Ivan *et al.* (2016) conducted study on the prevalence of T2DM and concluded that urban population ($p < 0.001$) are more prone to T2DM than rural population [15]. High socioeconomic status (SES) is associated with T2DM. Lee *et al.* (2013) conducted study on sex differences in the association between socioeconomic status and T2DM and reported that high SES and T2DM are significantly associated to each other ($n = 132$, 28.4%; $p < 0.001$) [16]. Shivananda *et al.* (2014) conducted study on association of age to T2DM and reported that hypertension ($n = 147$, 28.4%) was a more significant risk factor for T2DM [12]. Lifestyle habits and diet plays a major role in T2DM. Tonstad *et al.* (2013) conducted study on vegetarian diets and incidence of T2DM and identified that vegetarian diets were associated with a substantial and independent reduction in T2DM incidence when compared with non-vegetarians ($n = 616$, 61.6%, $p < 0.0001$) [17].

Physical inactivity is one of the risk factors for the development of obesity which results in increased risk for T2DM. A study conducted by Sanz *et al.* (2010) on physical exercise for the prevention and treatment of T2DM and reported that physical exercise can delay progression to T2DM [18]. Alcohol is a risk factor for T2DM, but alcohol consumption ($n = 120$, 9.3%, $p = 0.14$) was not associated with increased incidence of T2DM [19]. The current study results also suggested that alcohol consumption was not a risk factor for T2DM (OR: 0.549, 95% CI: 0.369-0.818, $p = 0.002$). Therefore, further studies are needed to evaluate the exact impact of alcohol consumption on risk for T2DM. When compared to people who never smoked, people who are currently smoking are at no risk and people who are past smokers and not smoking in the present ($n = 91$, 7.5%, $p < 0.001$) are at risk for incidence of T2DM [19]. This study results also suggested that smoking (OR: 0.626, 95% CI: 0.242-1.675, $p = 0.379$) was not a risk factor for T2DM. There are some studies which showed the association between smoking and T2DM. Therefore, the impact of smoking on incidence of T2DM should be studied in future. A study conducted by Jacqueline *et al.* (2016) on dietary patterns and T2DM and reported that consumption of unhealthy marketed foods increase the risk of T2DM [20]. In this study, consumption of junk foods is associated with increased incidence of T2DM (weekly thrice or more, OR: 2.755, 95% CI: 1.096-6.926, $p = 0.046$). In this study, people taking tea, coffee, and soft drinks are associated with increased risk of acquiring T2DM when compared to people not taking them. In this study, it is also concluded that there is association between frequency of consuming soft drinks, tea, coffee and acquiring T2DM. Ehab *et al.* (2013) conducted study on soft drinks, fruit juice and vegetable juice intake and risk of DM and concluded that increased consumption of fruits and soft drinks around the world was associated with parallel increase in incidence of T2DM ($p < 0.001$) [21]. This study results suggested that when compared to persons with no stress, the persons with stress either may be from job/working stress or family stress (OR: 1.373, 95% CI: 1.075-1.753, $p = 0.011$) are at more risk for developing T2DM. A study published by Fahad *et al.* (2015) reported that patients with stress either from anxiety/depression are at increased risk for developing T2DM when compared to stable patients [13]. Consumption of coffee or both tea and coffee are associated with increased risk for acquiring T2DM. It has also shown that how frequency of consuming tea or coffee or both are contributing to the extent of risk for T2DM. The results from the current study showed that increasing the frequency of coffee intake or both coffee and tea increased the risk for T2DM. Furthermore, there is a most recent study that concluded that drinking tea or coffee cups had an increased risk of acquiring T2DM. Rob *et al.* (2002) conducted a study on coffee consumption, and risk of T2DM concluded that coffee

consumption of ≤ 2 cups/day is at more risk to T2DM ($n=125, 774, 95\%$, $p=0.0002$) [22]. Therefore, there is a need of further studies to identify and evaluate the exact impact of tea or coffee on the incidence of T2DM.

CONCLUSION

This study results indicated that increased age, BMI (>25 kg/m²), urban residence, daily labors, housewives, high economic status, hypertension, physical inactivity, stress, tea, coffee, junk foods, soft drinks, and known family history are the major risk factors for T2DM.

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