Cardiovascular Risks In Type 2 DM Patients In KSA

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ABSTRACT

Objective: This research aims to systematically review the literature on cardiovascular risk factors and complications associated with individuals diagnosed with Type 2 Diabetes Mellitus (T2DM) in Saudi Arabia. Additionally, the researcher will aim to identify and describe the most prevalent cardiovascular conditions associated with T2DM, such as coronary artery disease, heart failure, and stroke within the Saudi population.

Methods: This study will apply a cross-sectional observational design to examine the prevalence and distribution of cardiovascular risk factors in a population of patients with Type 2 Diabetes Mellitus (T2DM) across several regions of the Kingdom of Saudi Arabia (KSA). A cross-sectional design presents the opportunity to assess variables at one time point, and thereby gives a "snapshot," of cardiovascular health status in the selected population.

Results: The study included 357 participants. The most frequent gender among them was male (n = 214, 59.9%) and female (n = 143, 40.0%). The most frequent age group among

study participants was 18-29 years (n = 143, 40.1%), followed by 30-39 years (n = 107, 29.9%), and then 40-49 years (n = 72, 20.1%). The most frequent nationality among study participants was Saudi (n = 306, 85.7%), and non-Saudi (n = 51, 14.2%). Participants were asked if they have diabetes. Most of them answered no (n = 309, 86.5%) and yes (n = 48, 13.4%). Diabetes treatment among study participants, with most taking oral medications (n = 26, 54.2%), followed by Insulin (n = 13, 27.1%), then lifestyle modification (n = 8, 16.7%). Participants were asked about the frequency of blood glucose monitoring; most of them Daily (n = 16, 33.3%), followed by monthly (n = 14, 29.2%), then Weekly (n =10, 20.8%). And Rarely (n = 6, 12.5%). Diabetes treatment among study participants, with most taking oral medications (n = 26, 54.2%), followed by Insulin (n = 13, 27.1%), then lifestyle modification (n = 8, 16.7%). Smoking among study participants, with most of them never smoked (n = 219, 61.3%), followed by current smokers (n = 98, 27.4%), then former smokers (n = 40, 11.2%). The most frequent BMI among study participants was normal weight (n = 129, 36.1%), followed by overweight (n = 127, 35.3%), then obesity class I (n = 57, 16%), and obesity class II (n = 18, 5%). Most of them no (n = 277, 77.5%), followed by yes (n = 80, 22.4%), then Weekly (n =10, 20.8%). And Rarely (n = 6, 12.5%).

Conclusion: The study shows significant relationships between Cardiovascular risks in Type 2 DM patients and behavioral factors, including age, gender, BMI, smoking, and experiencing psychological stress.

INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) has emerged as a public health crisis in the Kingdom of Saudi Arabia (KSA), which has one of the highest prevalence rates in the Middle East. Urbanization, inactivity, and the transition to high-calorie, processed foods, along with genetic susceptibility, has led to a dramatic increase in the number of people with T2DM in the Kingdom. National health survey data indicates the prevalence of diabetes in adults exceeds 25%, with the vast majority of diabetes diagnosed as T2DM. This epidemic has significant consequences for the Saudi healthcare system in terms of cardiovascular disease (CVD), which is the leading cause of mortality for people with diabetes. Risk factors for CVD in patients with T2DM are multifactorial and can be insidious.

Chronic high blood glucose levels are known to accelerate atherosclerosis, inflammation, alter endothelial function, and increase the risk of coronary artery disease, stroke, peripheral vascular disease and heart failure. In Saudi Arabia, the previously-mentioned risks are exacerbated by two important factors. A very high prevalence of obesity, hypertension, dyslipidemia, and smoking that are often neither diagnosed nor managed in patients. With cultural customs that contribute to obesity, low physical activity levels, and few preventive services, patients with diabetes have very high burden of cardiovascular disease, in addition to diabetes and its other complications. Diabetes and cardiovascular disease have received growing attention, however, there remains a lack of regional data to properly define the cardiovascular risk profile of patients with T2DM in KSA. Most studies or cohorts are hospital-based or small in scope, and do not evaluate national trends, urban vs. rural, or general sex differences.

While there are existing guidelines for managing cardiovascular risk around the world in diabetes, it is not clear if the guidelines are appropriate for the Saudi Arabian context given the healthcare system, the patients' behaviors and policies. Saudi Arabia will be one of the top

ten countries in the world for population prevalence of diabetes, and estimates from 2024 show that 23.1% of adults have diabetes.

The number of adults diagnosed with diabetes increased to over 5.3 million in 2024 from less than one million in the year 2000, with estimates projected to exceed 9.5 million by 2050, and nearly 44% of adults with diabetes have not been diagnosed, leading to long delays in risk identification and opportunitiy for primary prevention of complications. The prevalence of impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) is increasing, which are both pre-diabetic states before progression to T2DM and affecting millions more people. This epidemiology includes potential genetic predisposition; however, it has increased with growing rates of high caloric diets, little physical activity, rapidly growing rates of obesity, and mortality. Regional disparities in access and control over T2DM increases the burden of healthcare especially in Northern, Central, and Southern regions, where rates of uncontrolled diabetes have increased.

Recent studies show that approximately 77% adults with T2DM in Saudi Arabia have poorly controlled blood glucose, with a high percentage of adults with uncontrolled hypertension, dyslipidemia, and other comorbidities. Treatment for this condition as a chronic disease is amenable to medication, including metformin, DPP-4 inhibitors, GLP-1 agonists and SGLT-2 inhibitors, which have increased considerably in the past 10 years. However, outcomes overall continue to be poor across the socioecological continuum of care in clinical practice. Urban care systems typically provide more thorough diabetes care - for example, providing statins and providing vitamins, compared to rural health systems, as evidenced by lower rates of routine care for diagnosis and management.

This suggests an opportunity for more coordinated, national efforts for prostate screening and education and to promote healthy lifestyle changes among populations at risk. Saudi Arabia's effort to achieve Vision 2030 face unique challenges as a result of the T2DM epidemic and and its consequences on cardiovascular health. In context with the vision 2030 objectives in Saudi Arabia for healthcare coordination and chronic disease prevention, this review of cardiovascular risk in patients with T2DM is timely and qualifies need.

The current review will summarize the available literature and associated gaps in knowledge, while also recommending culturally relevant approaches to intervention. Collectively, the review will offer opportunities for clinicians, researchers, and policy makers to develop actionable strategies to mitigate cardiovascular morbidity and mortality of patients with diabetes in Saudi Arabia.

METHODS

Research Question

As per the details mentioned in the above matter, some important research questions appear, which are stated below:

1. Which risk factors and complications involving cardiovascular events are most prevalent in the cohort of patients diagnosed with Type 2 Diabetes Mellitus within Saudi Arabia?
2. What are the contributions of demographic factors (e.g., gender), lifestyle factors (e.g., smoking or physical activity), and regional health system factors (treatment locations) to cardiovascular outcomes for patients with T2DM in Saudi Arabia?
3. What are the gaps in existing literature or practice with regard to cardiovascular risk assessment and outcomes in T2DM patients with the Saudi healthcare system?

Study design

This study will apply a cross-sectional observational design to examine the prevalence and distribution of cardiovascular risk factors in a population of patients with Type 2 Diabetes Mellitus (T2DM) across several regions of the Kingdom of Saudi Arabia (KSA). A cross-sectional design presents the opportunity to assess variables at one time point, and thereby gives a "snapshot," of cardiovascular health status in the selected population.

Study approach

Data will be collected via direct patient interviews and electronic medical records.

Study population

The focus of this present study will be on the selected respondents or the patients who have attained the minimum age of 18 years or above and were diagnosed with T2DM. The researcher will mainly focus on the government and private hospitals in urban and semi-rural areas of Riyadh. For the sake of meeting the variation in spatial and temporal aspects, some of the PHCs, specific diabetes clinics, and some tertiary hospitals will also be touched.

Study sample

The study will use a stratified random sampling method to ensure representation from three regions (Central, East, and West) of Riyadh and the sample size will be based on formulas for standard prevalence with a confidence level of 95% and regard for prevalence rates in the regions of interest. Approximately sample size is anticipated around 300-500 participants, and some additional participants may be added in case of potential non-response and refusal.

Formula for sample determination

$$n = N\frac{\left[\frac{Z^2 \times p \times (1-p)}{e^2}\right]}{\left[N - 1 + \frac{Z^2 \times p \times (1-p)}{e^2}\right]}$$

Were,

n= Sample Size

N= Population

Z= Level of confidence (95%)

e= Margin of error

p= Estimated Proportion (at least 50%)

Criteria of Inclusion and Exclusion

Component	Inclusion	Exclusion
Respondent	Confirmed diagnosis of T2DM, on the basis of criteria given by WHO	Patients diagnosed with type 1 diabetes or gestational diabetes.
Location	Only Saudi citizens will be included	Non-Saudi citizens will be excluded
Consent	The patient who have given prior consent to participate in the study	Not given a verbal or written consent to participate.
Medical Records	Patient with complete records will be included	Patients will missing records or diagnosis reports will be excluded.

Study tool

For the current study, the questionnaire was adopted for data collection, which was also categorized as a study tool.

Data collection

Structured Questionnaire

Designed to gather information about demographics, as well as lifestyle variables related to diet, exercise, smoking and self-reported cardiovascular symptoms. The respective questionnaire will include the questions based on Likert scale, multiple choices and some direct or open ended questions.

Medical Record Review

This will involve obtaining clinical data such as HbA1c, lipid profile, blood pressure, Body Mass Index (BMI), cardiovascular history (e.g., myocardial infarction, stroke), and medications.

Physical Examination

If feasible, basic anthropometric measurements and blood pressure readings will be obtained during clinic visits.

Variables of Study

Independent Variables

- Age of the respondent
- Gender of the respondent
- Duration of diagnosed with diabetes
- Physical activity(if applicable) and,
- Medication

Dependent Variables

- Presence of cardiovascular risk factors (hypertension, dyslipidemia, obesity)
- Diagnosed cardiovascular conditions (CAD, stroke, heart failure).

Data analysis

SPSS Ver. 27.0 will be used for the purpose of data analysis. Basic tools of descriptive statistics, like mean, standard deviation, frequency, percentage will be applied to present the data in a summary form and also to identify the basic characteristics of selected respondents. Then Chi square test will be applied to find the level of variation amond the responses given by the sample units. Finally logistic regression will be applied to find the relationship or association between cardiovascular risks and independent variables.

Ethical considerations

The Institutional Review Board (IRB) will provide ethical approval for studies that will take place, all participants will complete an informed consent process, and all participant data will be treated as confidential, and participant data will be fully anonymized.

Pilot Study

As a first step before launching large-scale data collection, a pilot study will be conducted to evaluate the feasibility, clarity, and consistency of the research tools and protocols. The pilot study will involve 30–50 patients diagnosed with T2DM in a health care facility in Saudi Arabia, with representation from both urban and rural locations. The pilot study will address whether the structured questionnaire achieves a data quality perspective, whether the medical record extraction protocols are working as designed, and any logistics related to collecting physical measures.

RESULTS

The study included 357 participants. The most frequent gender among them was male (n = 214, 59.9%) and female (n = 143, 40.0%). Figure 1 shows the gender distribution among study participants. The most frequent age group among study participants was 18-29 years (n = 143, 40.1%), followed by 30-39 years (n = 107, 29.9%), and then 40-49 years (n = 72, 20.1%). Figure 2 shows the age distribution among study participants. The most frequent nationality among study participants was Saudi (n = 306, 85.7%), and non-Saudi (n = 51, 14.2%). Figure 3 shows the distribution of nationality among study participants.

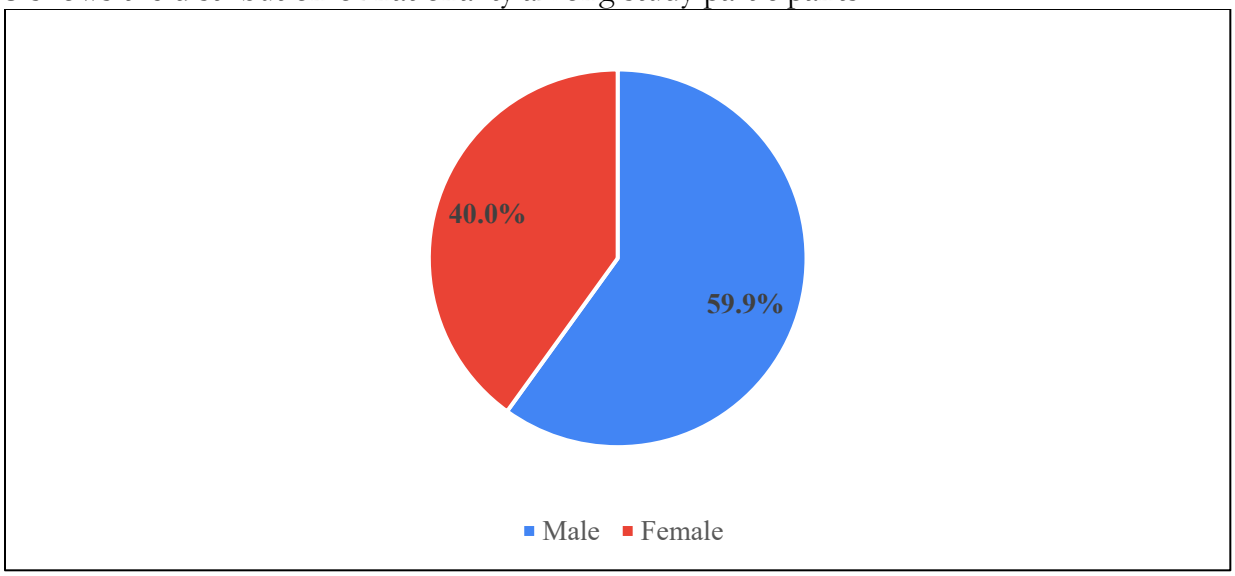

Figure 1: Gender distribution among study participants

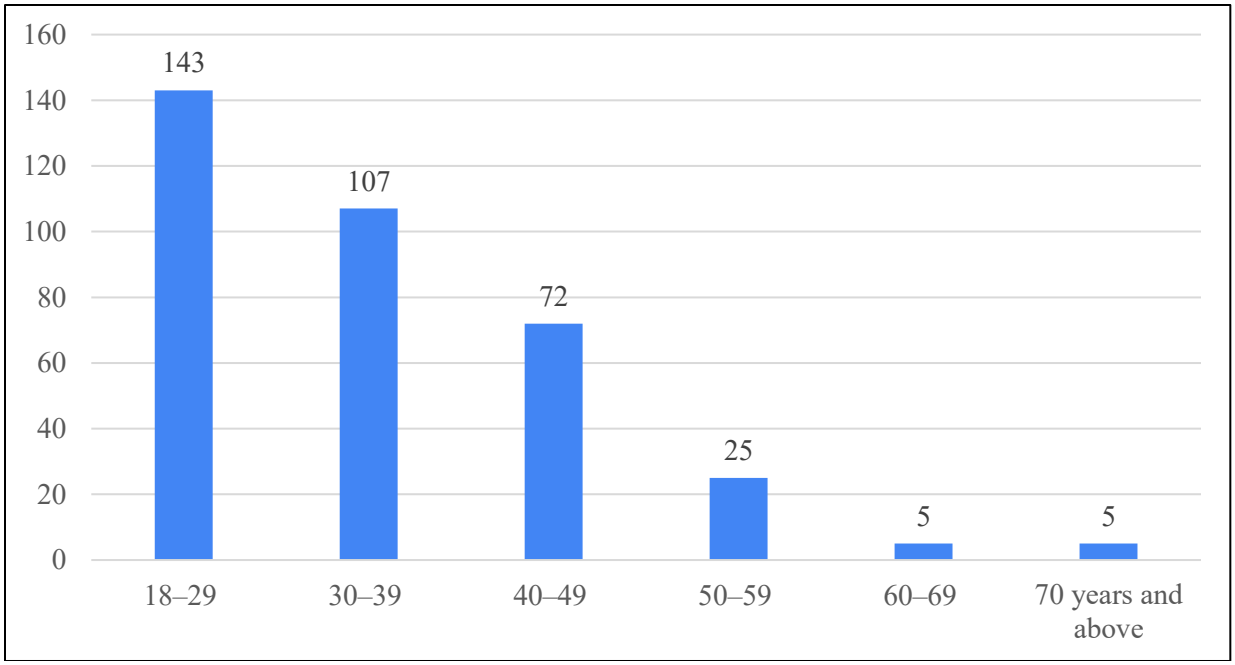

Figure 2: Age distribution among study participants

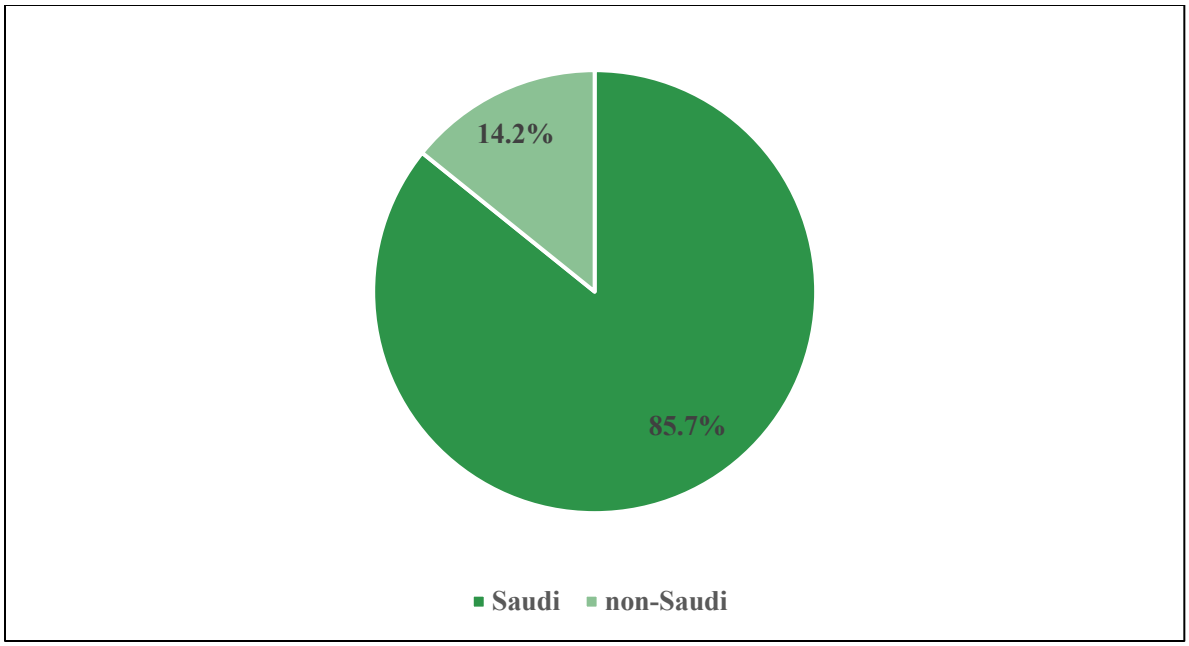

Figure 3: Nationality distribution among study participants

Participants were asked if they have diabetes. Most of them answered no (n = 309, 86.5%), and yes (n=48, 13.4%). Figure 4 shows the Diabetes distribution among study participants.

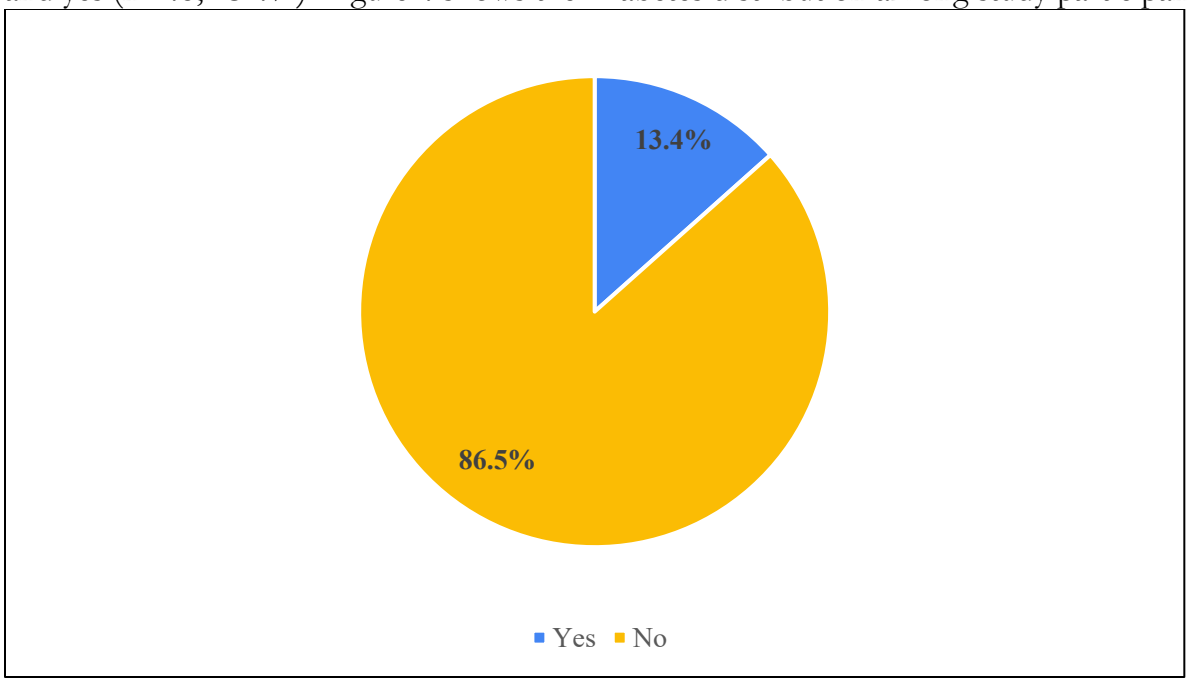

Figure 4: Diabetes distribution among study participants

Diabetes treatment among study participants, with most taking oral medications (n = 26, 54.2%), followed by Insulin (n = 13, 27.1%), then lifestyle modification (n = 8, 16.7%). Participants were asked about the frequency of blood glucose monitoring; most of them were Daily (n = 16, 33.3%), followed by monthly (n = 14, 29.2%), then Weekly (n =10, 20.8%). And Rarely (n = 6, 12.5%). Figure 5 shows the frequency of blood glucose monitoring distribution among study participants.

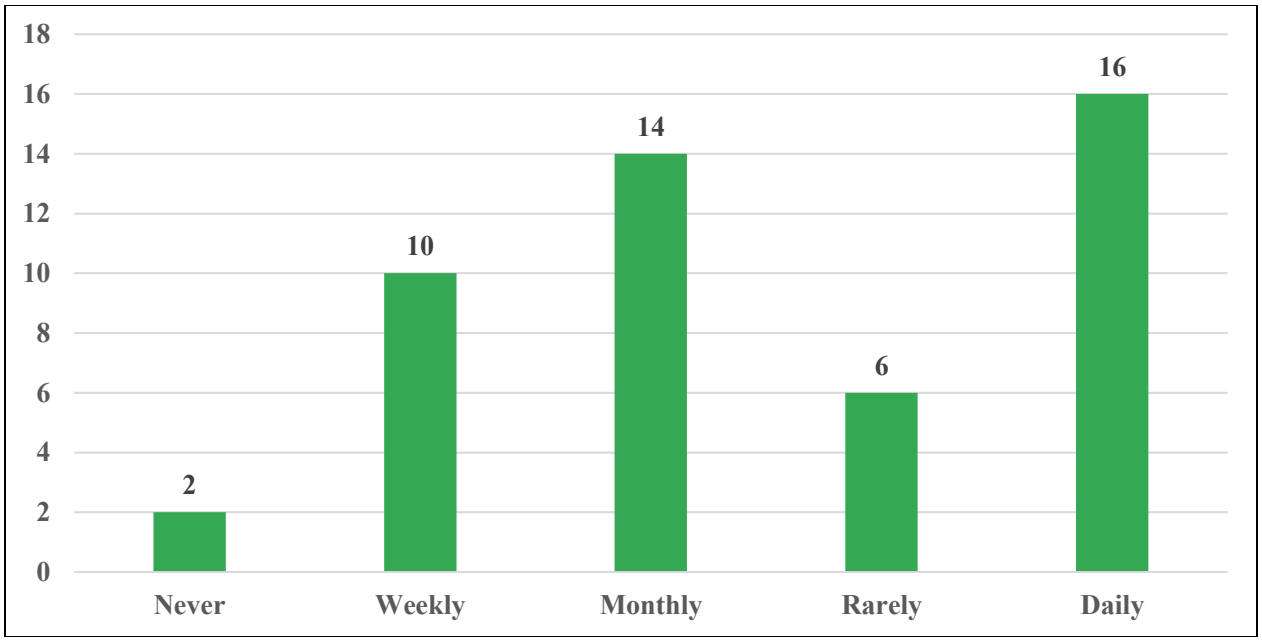

Figure 5: Frequency of blood glucose monitoring distribution among study participants.

Participants were asked about their blood pressure and lipid profile status. The responses and results are presented in Table 1.

Table 1: Blood Pressure and Lipid Profile Status among Participants

Scale item	Normal	Abnormal	I don't know
Blood pressure	224 (62.7%)	27 (7.6%)	106 (29.7%)
Lipid profile	146 (40.9%)	61 (17.1%)	150 (42.0%)
Total cholesterol	156 (43.7%)	49 (13.7%)	152 (42.6%)
LDL cholesterol	145 (40.6%)	48 (13.4%)	164 (45.9%)
HDL cholesterol	167 (46.7%)	19 (5.3%)	171 (47.9%)
Triglycerides	142 (39.8%)	41 (11.5%)	174 (48.7%)

Diabetes treatment among study participants, with most taking oral medications (n = 26, 54.2%), followed by Insulin (n = 13, 27.1%), then lifestyle modification (n = 8, 16.7%).
Smoking among study participants, with most of them never smoked (n = 219, 61.3%), followed by current smokers (n = 98, 27.4%), then former smokers (n = 40, 11.2%). Figure 6 shows the smoking distribution among study participants.

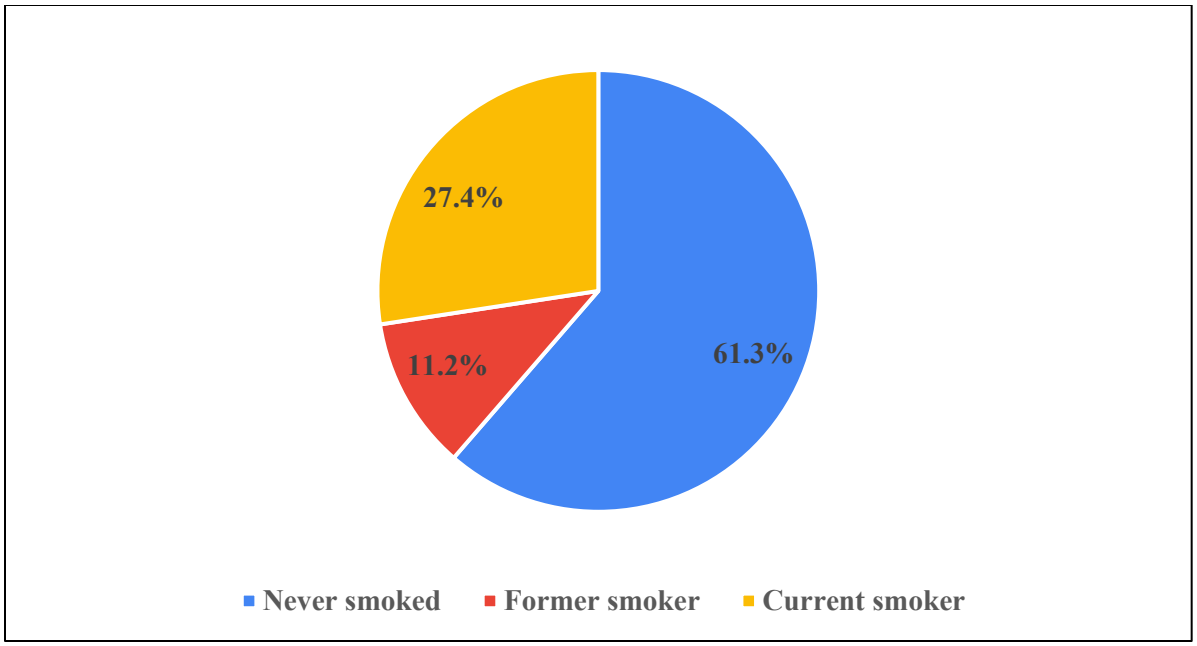

Figure 6: Family history distribution among study participants

The most frequent BMI among study participants was normal weight (n = 129, 36.1%), followed by overweight (n = 127, 35.3%), then obesity class I (n = 57, 16%), and obesity class II (n = 18, 5%). Figure 5 shows the BMI distribution among study participants. Figure 7 shows the BMI distribution among study participants.

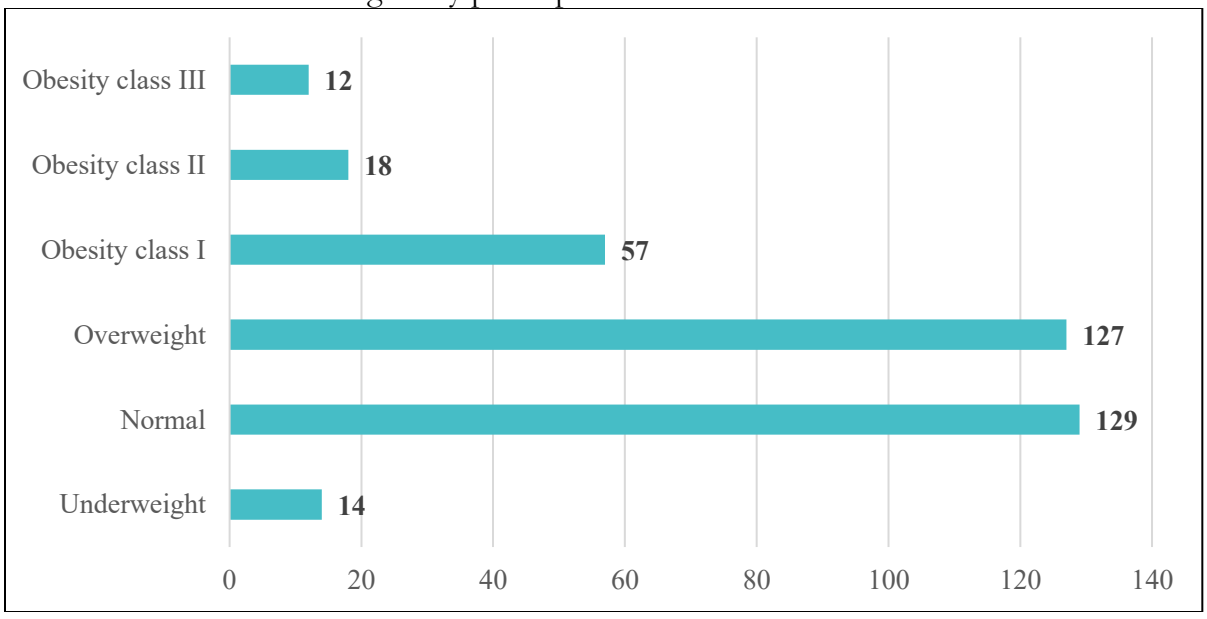

Figure 7: BMI distribution among study participants

Participants were asked about the experience of psychological stress related to their health condition**.** Most of them no (n = 277, 77.5%), followed by yes (n = 80, 22.4%), then Weekly (n =10, 20.8%). And Rarely (n = 6, 12.5%). Figure 8 shows the psychological stress distribution among study participants.

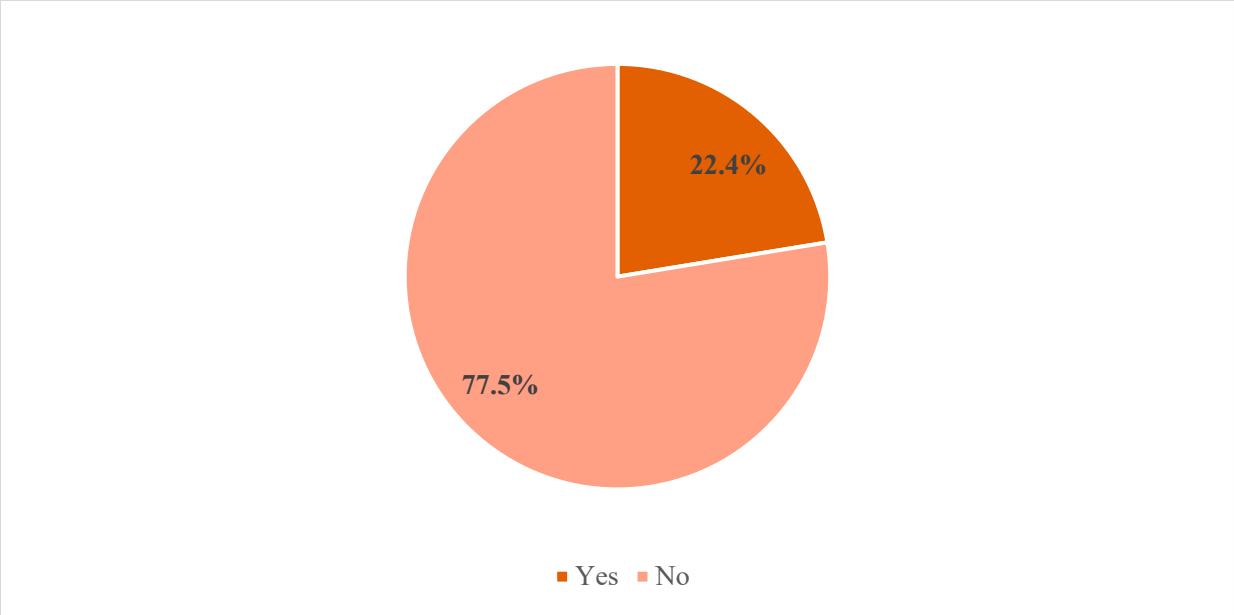

Figure 8: Psychological stress distribution among study participants

CONCLUSION

The study shows significant relationships between Cardiovascular risks in Type 2 DM patients and behavioral factors, including age, gender, BMI, smoking, and experiencing psychological stress.

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ANNEX 1: DATA COLLECTION TOOL

1. Age

☐ 18–29 years
☐ 30–39 years
☐ 40–49 years
☐ 50–59 years
☐ 60–69 years
☐ 70 years and more

2. Gender

☐ Male

☐ Female

3. Nationality

☐ Saudi

☐ Non-Saudi

4. Do you have diabetes?

☐ Yes

☐ No

5. Duration of type 2 diabetes (in years): _____

6. Current diabetes treatment

☐ Oral medications

☐ Insulin

☐ Lifestyle modification

☐ Combination therapy (medications and insulin)

7. Frequency of blood glucose monitoring

☐ Never

☐ Weekly

☐ Monthly

☐ Rarely

☐ Daily

8. Do you have a history of any of the following?

☐ Hypertension ☐ Dyslipidemia (high cholesterol or triglycerides)

☐ Obesity (excessive weight gain) ☐ Excessive caffeine consumption

☐ coronary artery disease ☐ Stroke or transient ischemic attack (TIA)

☐ Heart failure ☐ Psychological or mental disorders / chronic stress

☐ Cardiac arrhythmias

☐ None of the above

9. Are you currently taking any of the following medications?

☐ Lipid-lowering medications (statins)

☐ Antihypertensive medications

☐ Antiplatelet agents (e.g., aspirin)

☐ Beta-blockers

☐ ACE inhibitors (ACEIs) or angiotensin receptor blockers (ARBs)

☐ None

10. Blood pressure (most recent reading):

☐ Normal

☐ Abnormal

☐ I don't know

11. Lipid profile (most recent result):

☐ Normal

☐ Abnormal

☐ I don't know

12. Total cholesterol (most recent reading):

☐ Normal

☐ Abnormal

☐ I don't know

13. LDL cholesterol (most recent reading):

☐ Normal

☐ Abnormal

☐ I don't know

14. HDL cholesterol (most recent reading):

☐ Normal

☐ Abnormal

☐ I don't know

15. Triglycerides (most recent reading):

☐ Normal

☐ Abnormal

☐ I don't know

16. Smoking status:

☐ Never smoked

☐ Former smoker

☐ Current smoker

17. Physical activity level (according to WHO guidelines):

☐ Sedentary (no regular physical activity)

☐ Moderate (150 minutes or more per week)

☐ Vigorous (75 minutes or more per week)

18. Dietary habits:

Frequency of fruit and vegetable consumption:

☐ Daily ☐ Weekly ☐ Rarely

19. Frequency of fast-food consumption:

☐ Daily ☐ Weekly ☐ Rarely

20. Height: ____ cm

21. Weight: ____ kg

22. Do you experience psychological stress related to your health condition?

☐ Yes

☐ No

APPENDIX 2: Participants' responses to scale items

Age	Frequency	Percent
18–29	143	40.1%
30–39	107	29.9%
40–49	72	20.1%
50–59	25	7.0%
60–69	5	1.4%
70 years and above	5	1.4%

Gender	Frequency	Percent
Male	214	59.9%
Female	143	40.0%

Nationally	Frequency	Percent
Saudi	306	85.7%
non-Saudi	51	14.2%

Diabetes	Frequency	Percent
Yes	48	13.4%
No	309	86.5%

Diabetes treatment	Frequency	Percent
Oral medications	26	54.2%
Insulin	13	27.1%
Lifestyle modification	8	16.7%
Combination therapy (medications and insulin)	1	2.1%

Blood glucose monitoring	Frequency	Percent
Never	2	4.2%
Weekly	10	20.8%
Monthly	14	29.2%
Rarely	6	12.5%
Daily	16	33.3%

Blood pressure	Frequency	Percent
Normal	224	62.7%
Abnormal	27	7.5%
I don't know	106	29.6%

Lipid profile	Frequency	Percent
Normal	146	40.8%
Abnormal	61	17.0%
I don't know	150	42.0%

Total cholesterol	Frequency	Percent
Normal	156	43.6%
Abnormal	49	13.7%
I don't know	152	42.5%

LDL cholesterol	Frequency	Percent
Normal	145	40.6%
Abnormal	48	13.4%
I don't know	164	45.9%

HDL cholesterol	Frequency	Percent
Normal	167	46.7%
Abnormal	19	5.3%
I don't know	171	47.8%

Triglycerides	Frequency	Percent
Normal	142	39.7%
Abnormal	41	11.4%
I don't know	174	48.7%

Smoking	Frequency	Percent
Never smoked	219	61.3%
Former smoker	40	11.2%
Current smoker	98	27.4%

Physical activity level	Frequency	Percent
Sedentary (no regular physical activity)	153	42.8%
Moderate (150 minutes or more per week)	171	47.8%
Vigorous (75 minutes or more per week)	33	9.2%

Frequency fruit and vegetable	Frequency	Percent
Daily	78	21.8
Weekly	160	44.8
Rarely	119	33.3

Fast food	Frequency	Percent
Daily	70	19.6
Weekly	163	45.7
Rarely	124	34.7

BMI level	Frequency	Percent
Underweight	14	3.9%
Normal	129	36.1%
Overweight	127	35.5%
Obesity class I	57	16.0%
Obesity class II	18	5.0%
Obesity class III	12	3.4%

Experience psychological stress	Frequency	Percent
Yes	80	22.4%
No	277	77.5%

Do you have a history of any of the following?	Frequency	Percent
Hypertension	45	11.8%

Dyslipidemia (high cholesterol or triglycerides)	32	8.4%
Obesity (excessive weight gain)	24	6.3%
Excessive caffeine consumption	33	8.7%
coronary artery disease	5	1.3%
Stroke or transient ischemic attack (TIA)	9	2.4%
Heart failure	1	0.3%
Psychological or mental disorders / chronic stress	14	3.7%
Cardiac arrhythmias	20	10.1%
None	198	52.0%

Are you currently taking any of the following medications?	Frequency	Percent
Lipid-lowering medications (statins)	31	11.0%
Antihypertensive medications	28	9.9%
Antiplatelet agents (e.g., aspirin)	17	6.0%
Beta-blockers	6	2.1%
ACE inhibitors (ACEIs) or angiotensin receptor blockers (ARBs)	2	0.7%
None	199	70.3%

Chi-Square Test:

Test Statistics							
	Age	Gender	Nationality	Diabetes	BMI level	Smoking	Experience psychological stress
Chi-Square	277.571[a]	14.120[b]	182.143[b]	190.815[b]	259.521[a]	140.185[c]	108.709[b]
df	5	1	1	1	5	2	1
Asymp. Sig.	.000	.000	.000	.000	.000	.000	.000
a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 59.5.							
b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 178.5.							
c. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 119.0.							

	Diabetes	Blood pressure	Lipid profile	Total cholesterol	LDL cholesterol	HDL cholesterol	Triglycerides
Chi-Square	190.815[a]	165.193[b]	42.471[b]	61.832[b]	65.059[b]	126.118[b]	80.992[b]
df	1	2	2	2	2	2	2
Asymp. Sig.	.000	.000	.000	.000	.000	.000	.000
a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 178.5.							

b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 119.0.

P-value > 0.05, there a significance relation