AMJ Australasian Medical Journal [AMJ 2023;16(12):938-952]

Prevalence of Comorbidities Associated With Type 2 Diabetes Mellitus In Ksa: A Cross-Sectional Study

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RESEARCH

Please cite this paper as: Barnawi SM, Abousada HJ, Alharbi RH, Adham SM, AlShehri NA, Alyami AA, Bawazir AA, Medher AM, Alharbi FM, Alnakhli AA, Alawami SY, Al rashed FA, Asiri FA, Alqarni AA, Shammakhi AH. Prevalence of Comorbidities Associated With Type 2 Diabetes Mellitus In Ksa: A Cross-Sectional Study. AMJ 2023;16(12):938-952.
https://doi.org/10.21767/AMJ.2023.3997

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ABSTRACT

Objective

To determine the prevalence of comorbidities associated with type 2 diabetes mellitus among the Saudi adult population

Methods

A cross-sectional study design will be employed to investigate the prevalence of comorbidities associated with Type 2 Diabetes Mellitus (T2DM) within the Kingdom of Saudi Arabia (KSA) population. This design allows for the collection of data at a single point in time, providing insights into the existing relationship between T2DM and comorbidities.

Results

The study included 601 participants. The most frequent body mass index BMI value among study participants was overweight 25-29.9 kg/m2 (n= 196, 33 Per Cent), followed by Normal 18.5-24.9 kg/m2 (n= 177, 29 Per Cent). The frequent gender among study participants was male years (n= 356, 59 Per Cent) and female (n= 245, 41 Per Cent). The most frequent age among study participants was 40-50 years (n= 145, 24 Per Cent), followed by 18-28 years (n= 140, 23 Per Cent). The most frequent marital status among study participants was married (n= 360, 60 Per Cent), followed by single (n= 160, 27 Per Cent). The perceived physical activity per week among study participants, most of whom did not do any activity (n=231,38 Per Cent) followed one-time activity (n=98,16 Per Cent).

Conclusion

The results showed that most of the study participants were overweight according to their BMI. The majority of patients had normal blood pressure. Most of the participants suffer from diabetes. In addition, most of the participants do not do any activity, and the majority of participants are non-smokers.

Key Words

Type 2 diabetes mellitus, Glycemic control, BMI

Introduction

The prevalence and long-term morbidity of diabetes mellitus (DM) are rapidly growing, making it a major public health concern[1]. Patients' quality of life can be greatly impacted by this debilitating and complex condition, which can develop as a result of a hereditary predisposition, and is exacerbated by environmental circumstances[2].

Prevalence estimates for DM range from 9.3 percent (463 million) in 2019 to 10.2 percent (578 million) in 2030 to 10.9 percent (700 million) in 2045[3]. The International Diabetes Federation (IDF) had predicted that 10.5 Per Cent (537 million) of individuals aged 20-79 worldwide would have diabetes in 2021; this number was revised upward to 643 million in 2030 and 783 million in 2045. As a result, while the world's population is forecast to grow by 20 Per Cent during this time, the prevalence of DM is projected to rise by 46 Per Cent [4]. The majority of the rise in cases will occur in low- and middle-income nations, further adding to the burden of the predicted cost for diabetes care between 2011 and 2030, which is projected to be around US$ 1.7 trillion.

One of the areas with the highest frequency of DM is the Arab Gulf Cooperation Council (GCC), which consists of Saudi Arabia, Kuwait, Bahrain, Oman, Qatar, and the United Arab Emirates[5]. Data from the International Diabetes Federation shows that between 8 and 22 percent of adults in Gulf countries (aged 20-79) have diabetes. Saudi Arabia had the largest number of deaths attributable to diabetes, whereas Kuwait had the highest prevalence in the GCC (22 Per Cent)[6]. Rapid epidemiological transformation, urbanization, bad diet, and decreased physical activity in recent decades are blamed for the alarming rise in the number of individuals with diabetes in Saudi Arabia [5]. The rising incidence of diabetes also places a heavy financial strain on society. It is estimated that public medical healthcare expenditures on those with diabetes are tenfold that of those without diabetes, and that total direct expenditures for diabetes treatment in Saudi Arabia in 2014 amounted to 17 billion Riyals[7-9].

Due to the world's highest rates of obesity and metabolic syndrome, the Middle East will likely have the highest rates of diabetes [10-12]. Type 2 diabetes affects 32.8 Per Cent of the population in Saudi Arabia. However, it is expected that the prevalence will increase to 35.37 percent in 2020, 40.37 percent in 2025, and 45.36 percent in 2030. The prevalence rate grew from 1982-2015, as shown by the coefficient on time factor [13].

Research Problem

This research problem delves into the prevalence, characteristics, and implications of comorbidities linked with Type 2 Diabetes Mellitus (T2DM) within the context of the Kingdom of Saudi Arabia (KSA). By conducting a cross-sectional study, this research aims to identify the various medical conditions that frequently coexist with T2DM in the KSA population, scrutinize the demographic and clinical attributes associated with these comorbidities, and assess their collective influence on the health outcomes, treatment strategies, and healthcare utilization of affected individuals. This study intends to quantify the prevalence rates of specific comorbidities that often accompany T2DM, such as hypertension, cardiovascular diseases, obesity, dyslipidemia, and renal disorders, among others. It seeks to establish a comprehensive understanding of how frequently these comorbid conditions coexist with T2DM in the KSA population. The research will investigate the demographic factors (age, gender, socioeconomic status) and clinical attributes (diabetes duration, glycemic control, BMI, etc.) that correlate with the presence of comorbidities among individuals with T2DM. This aims to reveal potential risk factors or vulnerability factors for specific comorbidities.

By analyzing health records and patient-reported data, the study will assess the impact of comorbidities on the overall health outcomes of individuals with T2DM. This includes evaluating the effects on glycemic control, quality of life, disease progression, and risk of complications. Understanding the prevalence of comorbidities in individuals with T2DM is crucial for designing effective treatment plans. The research will explore how the presence of comorbidities influences treatment complexity, medication regimens, and adherence to prescribed therapies.

The prevalence of overweight and obese people in Saudi Arabia is mostly attributable to the country's increasingly expansive food options, larger portion sizes, and less active lifestyle. In addition, the easy availability of fast food is contributing to the alarming rise in obesity rates among Saudis, which in turn increases the prevalence of diabetes [14].

Patients with diabetes often have comorbidities, or other chronic diseases, in addition to their "index disease"[15]. Diabetes patients with comorbidities have higher healthcare

consumption and expenditures[16]. Cardiovascular disease, retinopathy, nephropathy, and diabetic foot are just some of the complications that have been described[17]. Gaining insight into the future health care burdens of patients with DM requires a thorough understanding of the disease and its associated comorbidities. The purpose of this research was to evaluate comorbidities and complications of DM among Saudi Arabians.

Methods

Study design

A cross-sectional study design will be employed to investigate the prevalence of comorbidities associated with Type 2 Diabetes Mellitus (T2DM) within the Kingdom of Saudi Arabia (KSA) population. This design allows for the collection of data at a single point in time, providing insights into the existing relationship between T2DM and comorbidities.

Study approach

The study will be conducted in multiple healthcare facilities across diverse regions of the Kingdom of Saudi Arabia to ensure a representative sample. Both urban and rural settings will be included to capture variations in healthcare access and comorbidity prevalence.

Study population

The target population comprises individuals aged 18 and above who have been diagnosed with Type 2 Diabetes Mellitus in KSA. Both newly diagnosed and long-standing cases will be included to ensure a comprehensive representation of the population.

Study sample

A stratified random sampling technique will be employed. The strata will be based on geographical regions, ensuring proportional representation of urban and rural areas. From each stratum, healthcare facilities will be randomly selected, and eligible participants will be recruited from the selected facilities.

Study tool

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

Data collection

Data will be collected through face-to-face interviews and medical record reviews. Trained interviewers will administer structured questionnaires to participants, collecting information on demographics, diabetes history, clinical attributes, and comorbid conditions.

Data analysis

Descriptive statistics such as frequencies and percentages will be used to report the prevalence of comorbidities among individuals with T2DM. Chi-square tests and logistic regression analyses will be conducted to explore associations between demographic/clinical variables and the presence of comorbidities.

Ethical considerations

The study will adhere to ethical guidelines and regulations. Ethical approval will be obtained from the institutional review board. Informed consent will be obtained from all participants, ensuring their privacy, confidentiality, and the right to withdraw from the study at any time.

Results

The study included 601 participants. The most frequent body mass index BMI value among study participants was overweight 25-29.9 kg/m2 (n= 196, 33 Per Cent), followed by Normal 18.5-24.9 kg/m2 (n= 177, 29 Per Cent). Figure 1 shows the distribution of BMI among study participants. The frequent gender among study participants was male years (n= 356, 59 Per Cent) and female (n= 245, 41 Per Cent). Figure 2 shows the gender distribution among study participants.

The most frequent age among study participants was 40-50 years (n= 145, 24 Per Cent), followed by 18-28 years (n= 140, 23 Per Cent). Figure 3 shows the age distribution among study participants.

The most frequent marital status among study participants was married (n= 360, 60 Per Cent), followed by single (n= 160, 27 Per Cent). Figure 4 shows the age distribution among study participants.

The perceived physical activity per week among study participants, most of whom did not do any activity (n=231,38 Per Cent), followed one-time activity (n=98,16 Per Cent). Perceived physical activity is presented in Figure 5.

A survey has been conducted on participants covering the medical diagnoses in Table1.

Discussion

The study of multimorbidity is now a focal point of international health initiatives[18]. Several previous studies have reported comorbidities in the T2D population; however, these investigations were either conducted in a different population (such as the US), did not focus on trends in CVD, or were conducted in the UK. Previous

research was conducted on either small cohorts [19-20] or a subset of individuals with T2D, such as those in a certain age range[21-22]. Most reports of the comorbidities examined either gave an aggregate number9 or focused solely on problems associated with diabetes[23]. It is believed that between 44 and 95 percent of persons with diabetes have other health problems. This includes certain groups of people with diabetes, such as veterans and the elderly [24-25]. Dutch study looked at the effect of comorbidities on patients with diabetes and found that the more comorbidities a person had, the more often they needed medical attention[26].

The profile of other prevalent physical and mental health illnesses in people with T2D is poorly understood, and no previous study has characterized and compared these trends in people with and without T2D, despite the importance of examining the multimorbidity burden in people with T2D. In addition, the 'single disease' model of care prevalent in current clinical recommendations and initiatives does not take multimorbidity into account.

Conclusion

The results showed that most of the study participants were overweight according to their BMI. The majority of patients had normal blood pressure. Most of the participants suffer from diabetes. In addition, most of the participants do not do any activity and majority of participants are non-smokers.

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Tables & Figures

Table 1: Medical diagnoses among study participants.

Survey item	Yes	No
Do you have a high blood pressure?	205 (34%)	396 (66%)
Do you suffer from high blood fat levels?	252 (42%)	349 (58%)
Do you suffer from high blood cholesterol?	265 (44%)	336 (56%)
Do you have obesity?	254 (42%)	347 (58%)
Do you suffer from retinal opacification?	153 (25%)	448 (75%)
Do you suffer from retinal damage?	105 (17%)	496 (83%)
Do you have diabetic feet?	128 (21%)	473 (79%)
Do you have nerve diseases?	186 (31%)	415 (69%)
Do you have kidney disease?	117 (19%)	484 (81%)
Do you have hardening of the arteries?	120 (20)%	481 (80%)
Do you have heart and blood vessel disease?	129 (21%)	472 (79%)
Do you have a stroke?	73 (12%)	528 (88%)
Do you have thyroid disease?	133 (22%)	468 (78%)
Do you have osteoporosis?	134 (22%)	467 (78%)
Do you have gout?	103 (17%)	498 (83%)
Do you have sleep disorders?	260 (43%)	341(57%)
Do you have gastroesophageal reflux disease?	202 (34%)	399 (66%)

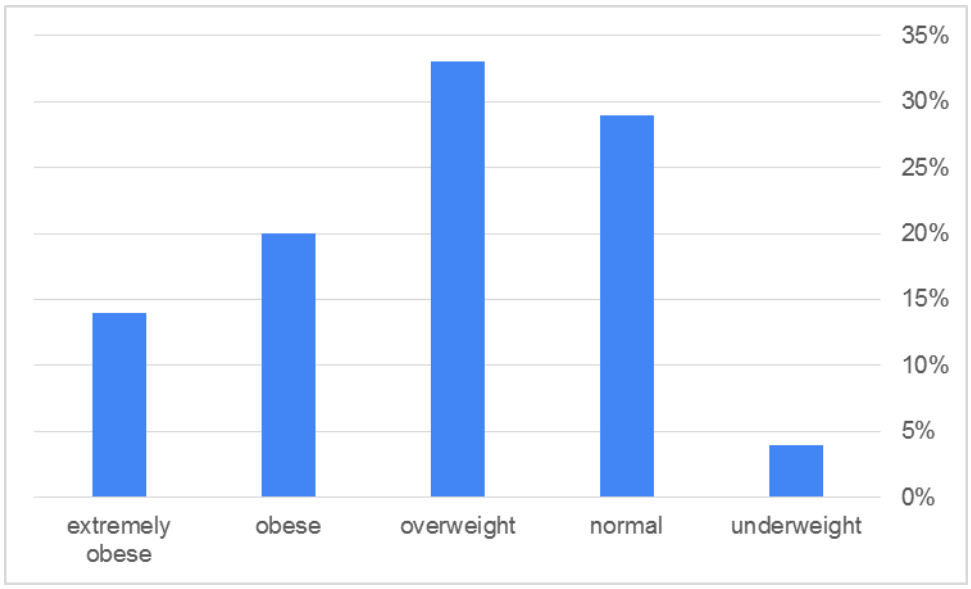

Figure 1: BMI distribution among study participants

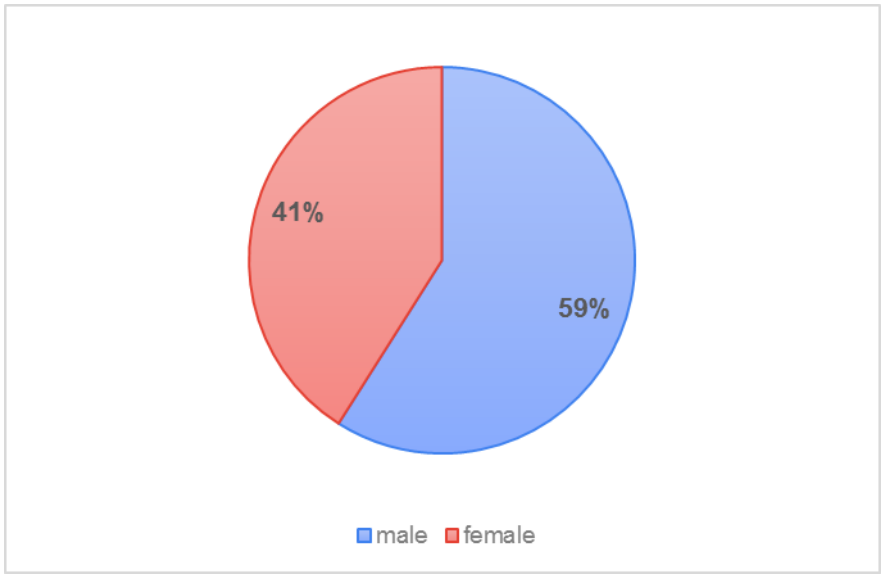

Figure 2: Gender distribution among study participants

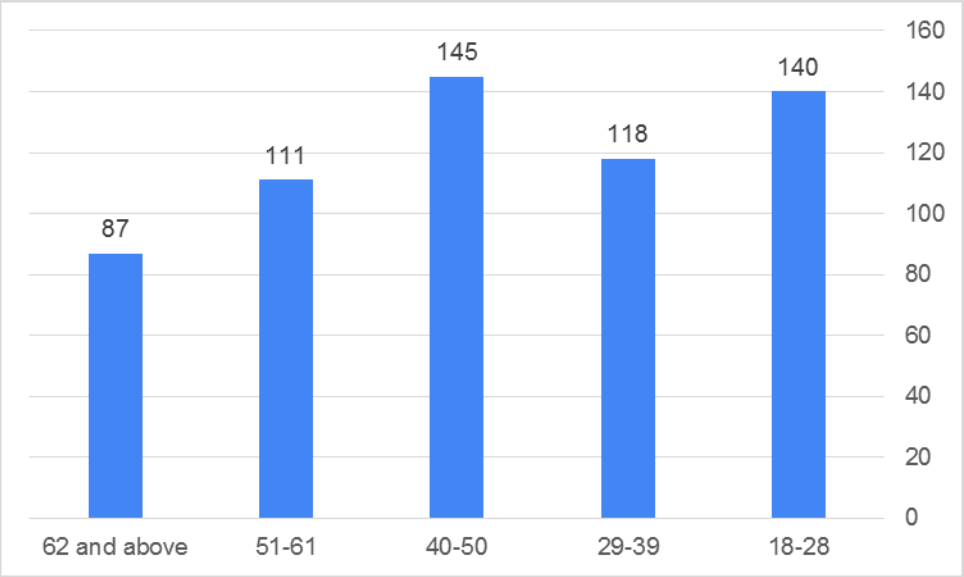

Figure 3: age distribution among study participants.

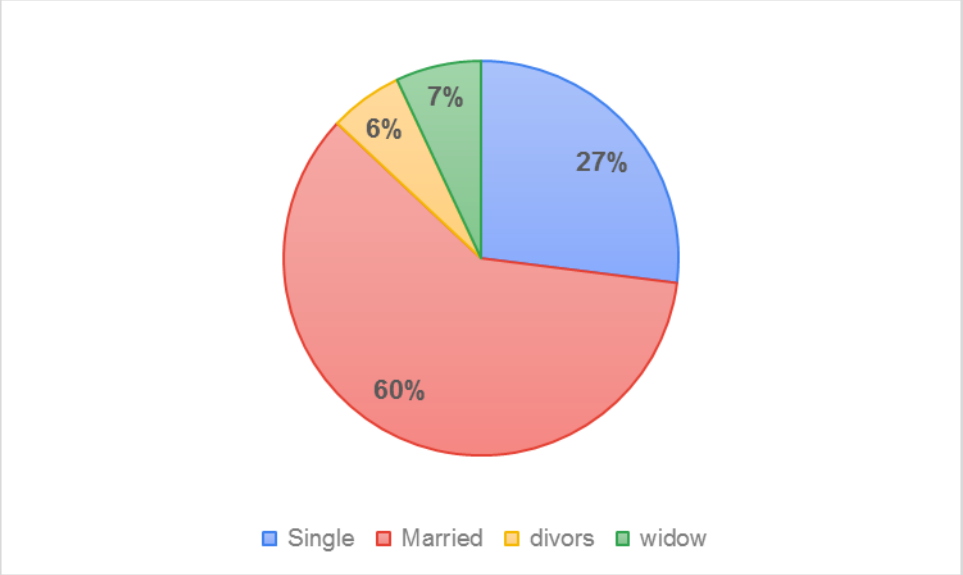

Figure 4: Nationality distribution among study participants.

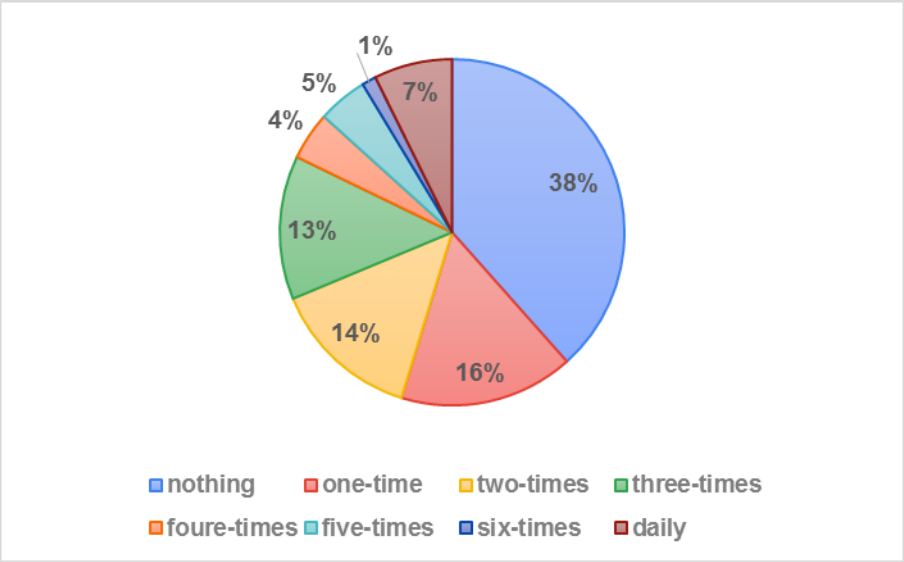

Figure 5: Educational level distribution among study participants.

ANNEX 1: DATA COLLECTION TOOL

1. 1. How old are you?
. 18-28
. 29-39
.40-50
.51-61
62 and above.

2. What is your gender?
- **Male**
- **Female**

3. What is your educational level?
- **uneducated**
- **the school**
- **the university and more.**

4. What is your marital status?
- **Single**
- **Married**
- **Absolute/divorced**
- **Widower/widow**

5. Do you smoke?
- **Yes**
- **No**

6. What is your weight?
- **<50 Kg**
- **51-65 Kg**
- **66-75 Kg**
- **76-85 Kg**
- **86-95 Kg**
- **>96 Kg**

7. What is your height?
- **<150 cm**
- **151-160 cm**
- **161-170 cm**
- **171-180 cm**
- **>181 cm**

8. What is your BMI value?
- **<18.5**
- **18.5-24.9**
- **25-29.9**
- **30-34.9**
- **>35**

9. How many times a week do you exercise?
- **nothing**
- **one time a week**
- **two times a week**
- **three times a week**
- **four times a week**
- **five times a week**
- **six times a week**
- **daily**

10. Is there a family history of diabetes?
- Yes
- No

11. Do you eat fat?
- Yes
- No

12. Are you committed to taking the medication on time as prescribed by the doctor?
- Yes
- No

13. Are you committed to follow-up in primary care clinics?
- Yes
- No

14. Do you have a high blood pressure?
- Yes
- No

15. Do you suffer from high blood fat levels?
- Yes
- No

16. Do you suffer from high blood cholesterol?
- Yes
- No

17. Do you have obesity?
- Yes
- No

17. Do you suffer from retinal opacification?
- Yes
- No

18. Do you suffer from retinal damage?
- Yes
- No

19. Do you have diabetic feet?
- Yes
- No

20. Do you have nerve diseases?
- Yes
- No

21. Do you have kidney disease?
- Yes
- No

22. Do you have hardening of the arteries?
- Yes
- No

23. Do you have heart and blood vessel disease?
- Yes
- No

24. Do you have a stroke?
- Yes
- No

25. Do you have thyroid disease?
- Yes
- No

26. Do you have osteoporosis?
- Yes
- No

27. Do you have gout?
- Yes
- No

28. Do you have sleep disorders?
- Yes
- No

29. Do you have gastroesophageal reflux disease?
- Yes
- No

APPENDIX 2: Participants responses to scale items

No	Yes	scale item
364	237	Do you smoke?
61%	39%	
272	329	Do you eat fat?
45%	55%	
205	396	Is there a family history of diabetes?
34%	66%	
195	406	Are you committed to taking the medication on time as prescribed by the doctor?
32%	68%	
276	325	Are you

		committed to follow-up in primary care clinics?
46%	54%	
396	205	Do you have a high blood pressure?
66%	34%	
349	252	Do you suffer from high blood fat levels?
58%	42%	
336	265	Do you suffer from high blood cholesterol?
56%	44%	
347	254	Do you have obesity?
58%	42%	
448	153	Do you suffer from retinal opacification?
75%	25%	
496	105	Do you suffer from retinal damage?
83%	17%	
473	128	Do you have diabetic feet?
79%	21%	
415	186	Do you have nerve diseases?
69%	31%	
484	117	Do you have kidney disease?
81%	19%	
481	120	Do you have hardening of the arteries?
80%	20%	
472	129	Do you have heart and blood vessel disease?
79%	21%	
528	73	Do you have a stroke?
88%	12%	
468	133	Do you have thyroid disease?
78%	22%	
467	134	Do you have osteoporosis?
78%	22%	
498	103	Do you have gout?
83%	17%	
341	260	Do you have sleep disorders?
57%	43%	
399	202	Do you have gastroesophageal reflux disease?
66%	34%	
Gender	Frequency	Percent
Male	191	34.2 Per Cent
Female	367	65.8 Per Cent
Total	558	100 Per Cent

Age	Frequency	Percent
18-28	140	23%
29-39	118	20%
40-50	145	24%
51-61	111	18%
62 and above	87	14%
Address	Frequency	Percent
countryside	52	9.3 Per Cent
city	506	90.7 Per Cent
Total	558	100 Per Cent

BMI	Frequency	Percent
underweight	24	4%
normal	177	29%
overweight	196	33%
obese	119	20%
extremely obese	85	14%
Marital status	Frequency	Percent
single	273	48.9 Per Cent

married	258	46.2 Per Cent
divorced	7	1.3 Per Cent
widow	20	3.6 Per Cent
Total	558	100 Per Cent

Gender	Frequency	Percent
Male	356	59%
Female	245	41%

	Frequency	Percent
Single	160	27%
Married	360	60%
divorce	36	6%
widow	45	7%

Blood pressure	Frequency	Percent
Low	9	1%
Normal	560	93%
High	32	5%

Physical activity	Frequency	Percent
Nothing	231	38%
One-time	98	16%
Two-times	84	14%
Three-times	81	13%
Four-times	27	4%
Five-times	28	5%
Six-times	8	1%
Daily	44	7%

HbA1c	Frequency	Percent
Normal	177	29%
Prediabetes	60	10%
Diabetes	364	61%

Chi-square test

Test Statistics							
	gender	Marital status		Blood pressure	BMI levels	age	Family. history
Chi-Square	20.501[a]	454.048[b]	26.837[a]	969.907[c]	161.953[d]	465.626[a]	60.700[a]
df	1	3	1	2	4	1	1
Asymp. Sig.	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Test Statistics							
	Eat.fat	Physical.activity	Number.med	Commit.take.med.	Commit.followup.	obesity	High.blood.pressure
Chi-Square	5.406[a]	465.156[b]	846.338[c]	74.078[a]	3.995[a]	14.391[a]	60.700[a]
df	1	7	9	1	1	1	1
Asymp. Sig.	0.020	0.000	0.000	.000	.046	0.000	0.000

Test Statistics							
	High.cholestrol	Retinal.opacification	Retinal.damage	Diabetic.feet	Nerve.disease	Kidney	Hardening.arteries
Chi-Square	8.388[a]	144.800[a]	254.378[a]	198.045[a]	87.256[a]	224.108[a]	216.840[a]
df	1	1	1	1	1	1	1
Asymp. Sig.	0.004	0.000	0.000	.000	0.000	.000	0.000

Test Statistics							
	Heart.blood.disease	stroke	thyroid	osteoporosis	gout	Sleep.disorder	reflux
Chi-Square	195.755[a]	344.468[a]	186.730[a]	184.507[a]	259.609[a]	10.917[a]	64.574[a]
df	1	1	1	1	1	1	1
Asymp. Sig.	0.000	0.000	.000	0.000	0.000	0.001	0.000
All p-value < 0.05 there is no association between the categorical variables, they are independent.							

Regression

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19.513	15	1.301	1.643	.059[b]
	Residual	463.302	585	.792		
	Total	482.815	600			

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.796	0.260		10.746	0.000
	High.blood.pressure	-0.174-	0.092	-0.092-	-1.894-	0.059
	obesity	0.050	0.086	0.028	0.579	0.563
	Retinal.opacification	-0.002-	0.120	-0.001-	-0.020-	0.984
	Retinal.damage	0.252	0.143	0.107	1.762	0.079
	Diabetic.feet	0.063	0.131	0.029	0.481	0.631
	Nerve.disease	-0.152-	0.110	-0.078-	-1.388-	0.166
	Kidney	0.030	0.134	0.013	0.225	0.822
	Hardening.arteries	-0.232-	0.167	-.0104-	-1.393-	0.164
	Heart.blood.disease	-0.040-	0.159	-0.018-	-0.250-	0.803
	stroke	-0.008-	0.154	-0.003-	-0.053-	0.958
	thyroid	0.056	0.102	0.026	0.547	0.585
	osteoporosis	0.050	0.114	0.023	0.440	0.660
	gout	-0.014-	0.111	-0.006-	-0.124-	0.902

	Sleep.disorders	-0.111-	0.090	-0.061-	-1.237-	0.217
	reflux	-0.075-	0.094	-.0039-	-.0801-	0.423
p-value< 0.05 The extent to which comorbidities affect diabetes, we find that there is no relationship between them.						

Received: *27-Nov-2023, Manuscript No. AMJ-23-3997;* ***Editor assigned:*** *30-Nov-2023, PreQC No. AMJ-23-3997(PQ);* ***Reviewed:*** *14-Dec-2023, QC No. AMJ-23-3997;* ***Revised:*** *19-Dec-2023, Manuscript No. AMJ-23-3997(R);* ***Published:*** *26-Dec-2023*