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EXPLORING THE PREVALENCE AND RISK PROFILE OF CARDIOVASCULAR DISEASES AMONG PATIENTS WITH TYPE II DIABETES MELLITUS AT, KARACHI PAKISTAN

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Abstract

Background: *Cardiovascular disease (CVD) is a major cause of illness and death in diabetic mellitus patients. Type II diabetic mellitus is a chronic metabolic disorder that creates resistance in insulin secretion and its action. Early detection of CVD can help in evaluate the prevalence of CVD events in type II diabetic mellitus patients.*

Objective: *The study aimed is to assess the Prevalence and Risk Profile of Cardiovascular Diseases in Type II diabetic patients.*

Methods: *This cross-sectional research was carried out among 353 Type-II diabetic mellitus patients from February 2025 to May 2025 at tertiary care hospitals in Karachi. Data were collected using a self-structured questionnaire administered to the study participants after taken written informed consent. The data were analyzed by using SPSS version 26, and statistical tests, including ANOVA and Chi-square, were applied to assess the association between Type II diabetic mellitus and cardiovascular disease risk profile.*

Results: *The findings of this study discovered that the prevalence of cardiovascular disease events were considerable more significantly higher in Type II diabetic patients as compared to the general population. Among these patients, those with poor glycemic control, hypertension, and dyslipidemia demonstrated the highest rates of CVD events. The results further indicated that individuals with HbA1c levels ranging from 6.5% to 8.9% exhibited comparatively lower CVD risk, whereas patients with HbA1c levels above 9.0% had a significantly higher burden of CVD events with P value ($p < 0.001$).*

Conclusion: *This study highlights a markedly higher prevalence of CVD events among Type II diabetic patients. It emphasizes that key risk factors including poor glycemic control, hypertension, and dyslipidemia must be carefully monitored and effectively managed to reduce the burden of CVD in this population.*

INTRODUCTION

Cardiovascular diseases (CVD), such as atherosclerosis, heart attack, stroke, and hypertension produce a critical health risk for individuals living with diabetes. Diabetes mellitus speeds up the progression of atherosclerosis, which forms the structural foundation for coronary heart diseases [1]. In type II diabetes mellitus patients can lead to major heart diseases that's includes coronary artery disease, ischemic heart disease, heart failure, stroke, and peripheral artery disease these complications can be fatal 50% for type II diabetic patients [2]. Individuals with type II diabetes face 2 to 4 times higher risk of mortality and cardiovascular events as compared with non-diabetic patients. To understand the complex relationship between insulin resistance and atherogenic dyslipidemia is crucial for effectively managing CVD risk in diabetic patients [3]. Type II diabetes develop the metabolic syndrome and macro vascular complications like coronary artery diseases (CAD) and stroke, which are major contributing factors in illness and death in individuals with uncontrolled blood sugar levels [4]. Atherosclerosis influenced insulin resistance due to chronic increase of free fatty acid (FFA) in plasma. This process decreases glucose absorption in muscle leading to causes hyperinsulinemia. It promotes the growth of cardiac myocytes due to increase FFA levels which contributes the onset of myocardial contractile dysfunction [5]. Diabetes is well known risk factors for the narrowing or blocking heart vessels due to accelerating atherosclerotic progression, promoting plaque instability, and affecting endothelial function through mechanisms like inflammation, oxidative stress and dyslipidemia [6]. High blood pressure up to >140/100 increased cardiac diseases rate and clogged the arteries and triggered the inflammatory pathways [7] [8]. Lifestyle habits, including insufficient physical activity, psychological influences and consumption of smoking significantly increases the chance of developing cardiovascular diseases [9]. Obesity is linked to the buildup of adipose tissue, which can lead to adverse effects on mental and physical health. It is associated with many prolonged conditions such as hypertension, dyslipidemia, diabetes mellitus and cardiac diseases [10]. Dietary sodium intake is directly connected to elevate the blood pressure and it may activate certain metabolic and neuro hormonal pathway, such as angiotensin, aldosterone system, renin and sympathetic nervous system (SNS). These activations could lead to increased levels of total and LDL cholesterol and reduced insulin sensitivity in type II diabetes. In this way managing hypertension is crucial due to cardiovascular diseases [11].

In Pakistan, there are several existing problems in the basic healthcare system related to cardiovascular disease and diabetes. One major issue is the lack of awareness and education about these conditions. Many people are not familiar with the risk factors, symptoms, and preventive measures associated with cardiovascular disease and diabetes. This lack of knowledge can lead to delayed diagnosis and treatment, resulting in poor health outcomes. Additionally, there is a need for improved access to specialized healthcare services for the controlling of cardiac and diabetes. An individual with type II diabetes and type I diabetes, cardiovascular diseases take the top spot as the most common cause of both mortality and morbidity. In Pakistan, few studies have been looked into the long-term complications of diabetes, including CVD. The WHO estimated that worldwide over 422 million people are affected by diabetes, in 2015, Pakistan was estimated to have 69,188 diabetes with 8.5% prevalence rate [12]. [13].

The objective of this research is to investigate the prevalence of cardiovascular diseases among diabetic patients. By conducting this study, we can contribute new knowledge to the existing scientific literature by providing an in depth understanding of the relationship between cardiovascular and diabetic mellitus. Cardiovascular diseases are primary cause of reduced life expectancy in Type-II diabetes mellitus patients which ratio remains higher as compared to those without diabetes. Important factors in preventing both primary and secondary CVD in diabetes include smoking cessation, weight management, lowering blood pressure, reducing blood sugar levels and achieving good glycemic control, metformin has shown vascular benefits in relation to myocardial infarction.

Methodology

The cross-sectional research was conducted in tertiary care hospitals over a period of four months. In this study 353 participants were enrolled through random sampling technique employed to select Type-II diabetic patients those were visit at outpatient departments for follow-up consultation. Both male and female patients were included, ensuring equal gender representation. The inclusion criteria comprised diabetic patients with cardiovascular disease, while cancer patients, hepatitis patients, and non-diabetic individuals were excluded in this study.

The study assessed variables such as age, weight, gender, smoking practices, blood pressure, body mass index, low-density lipoprotein cholesterol, and HbA1c levels. Data were collected through a structured questionnaire administered to the study participants at tertiary care hospitals and written informed consent was taken from all study participants. Statistical analysis was performed by using ANOVA and chi-square tests in SPSS version 26.

Result

The sociodemographic details and health status of 353 participants has showed. Individuals lied in 30 to 50 age group were 147(41.60%). On the other hand, 206(58.40%) participants were in >50 years' age group. Age distribution data is illustrated in Table 1. In this study it has found that 205 (58.1%) males indicating a higher prevalence of CVD. Whereas, 148(42.60%) female participants were involved in cardiovascular diseases which illustrated in Table 1. The research data showed that 120 (34%) participants was in normal weight category and its BMI range were 18.5- 24.9kg/m2, while 233 (66%) participants were in obsess category which BMI range were 25-39.0 kg/m2.The HbA1c level of 168 (47.6%) participants were between 6.5-8.9% and 52.40% were greater than 9.0% HbA1c.

The LDL cholesterol of 142 (40.4%) individuals were below 100 mg/dl, while 211(59.8%) individuals were LDL level greater than 100 mg/dl. The number of individuals lied in moderate hypertension category were 202 (57.02%), while 151 (42.08%) participants were in severe hypertension category. In smoker's category 190 (53.5%) participants and 163 (45.09%) were in the category of non-smokers which is illustrated in table 1.

TABLE: 1

SOCIODEMOGRAPHIC AND HEALTH DETAIL OF THE PARTICIPANTS:			
EXPLANATORY VARIABLE		**FREQUANCY**	**PERCENTAGE%**
Age of Participant	30-50	147	41.60%
	more than 50	206	58.40%
Gender	Male	205	58.10%
	Female	148	42.60%
BMI	18.5-24.9(normal)	120	34.00%
	25-39.0kg/m2(obese)	233	66.00%
HbA1c	6.5-8.9%	168	47.60%
	more than 9.0%	185	52.40%
LDL-Cholesterol mg/dl	less than 100(normal)	142	40.20%
	more than 100(dyslipidemia)	211	59.80%
Hypertension	moderate HTN	202	57.20%
	severe HTN	151	42.80%
Smoking History	Smoker	190	53.50%

	non-smoker	163	45.90%

ASSOCIATION OF DIABETES WITH CVD RISK FACTORS:

The Link between HbA1C with Age:

It has proved that among 78 participants in the age group of 30yrs to 50yrs have an HbA1c range of 6.5-8.9%, while 69 participants have an HbA1c level greater than 9.0%. In the age group > 50yrs, 90 participants have an HbA1c range of 6.5-8.9%, while 116 participants fall into >9.0% HbA1c category.

The Link between HbA1C with Gender:

The data has indicated that 78 male participants have an HbA1c range of 6.5-8.9%, while 90 male participants fall in HbA1c range of above 9.0%, demonstrating significant ratio. In females, 127 participants fall in 6.5-8.9% HbA1c range while 58 participants have an HbA1c range fall in more than 9.0% category.

The Link between HbA1C with BMI:

The given data demonstrated that 83 participants have HbA1c levels ranging from 6.5% to 8.9%, and their BMI is between 18.5-24.9 kg/m^2, while 37 of the study participants with BMI 18.5-24.9 kg/m^2 have HbA1c levels above 9.0%. On the other hand, 85 participants with BMI 25-39.0kg/m^2 have HbA1c levels ranging from 6.5 to 8.9%. While 148 participants with BMI 25-39.0kg/m^2 have an HbA1c range more than 9.0%.

The Link between HbA1C with Smoking:

It has found that 51 smokers have HbA1c levels ranging from 6.5-8.9% while 53 having HbA1c greater than 9.0%.

The Link between HbA1C with LDL cholesterol level:

It has proved that the 69 participants with LDL cholesterol level greater than 100 mg/dl have HbA1c levels ranging from 6.5-8.9%. On the other hand, 142 participants with LDL cholesterol level greater than 100mg/dl have HbA1c levels ranging more than 9.0%.

The Link between HbA1C with Hypertension:

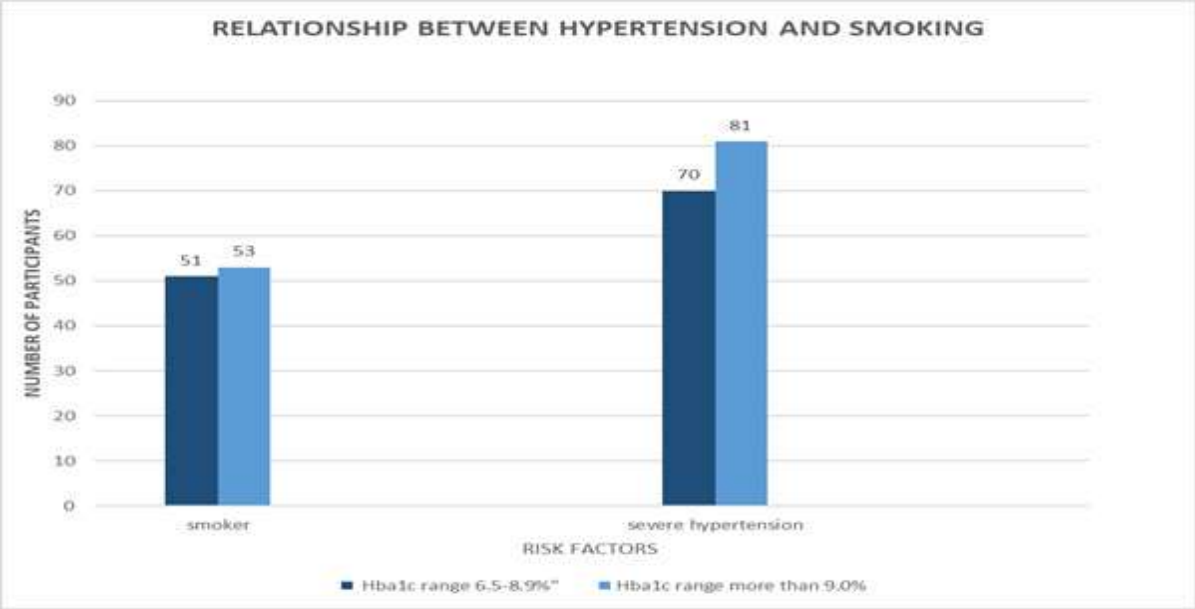
It has estimated that in severe hypertension category 81 participants have HbA1c greater than 9.0% and 70 participants have HbA1c ranging from 6.5-8.9%.

TABLE: 2

ASSOCIATION DIABETES WITH CVD RISK FACTORS				
CVD RISK FACTORS		**HbA1c**		**P value**
	6.5-8.9		more than 9.0	0.00
Age of Participant	30-50	78	69	
	more than 50	90	116	
Gender	Male	78	90	0.00
	Female	127	58	
BMI Kg/m2	18.5-24.9	83	37	0.00
	25-39.0	85	148	
Smoking	Smoker	51	53	0.00
LDL Cholesterol mg/dl	>100 dyslipidemia	69	142	0.00

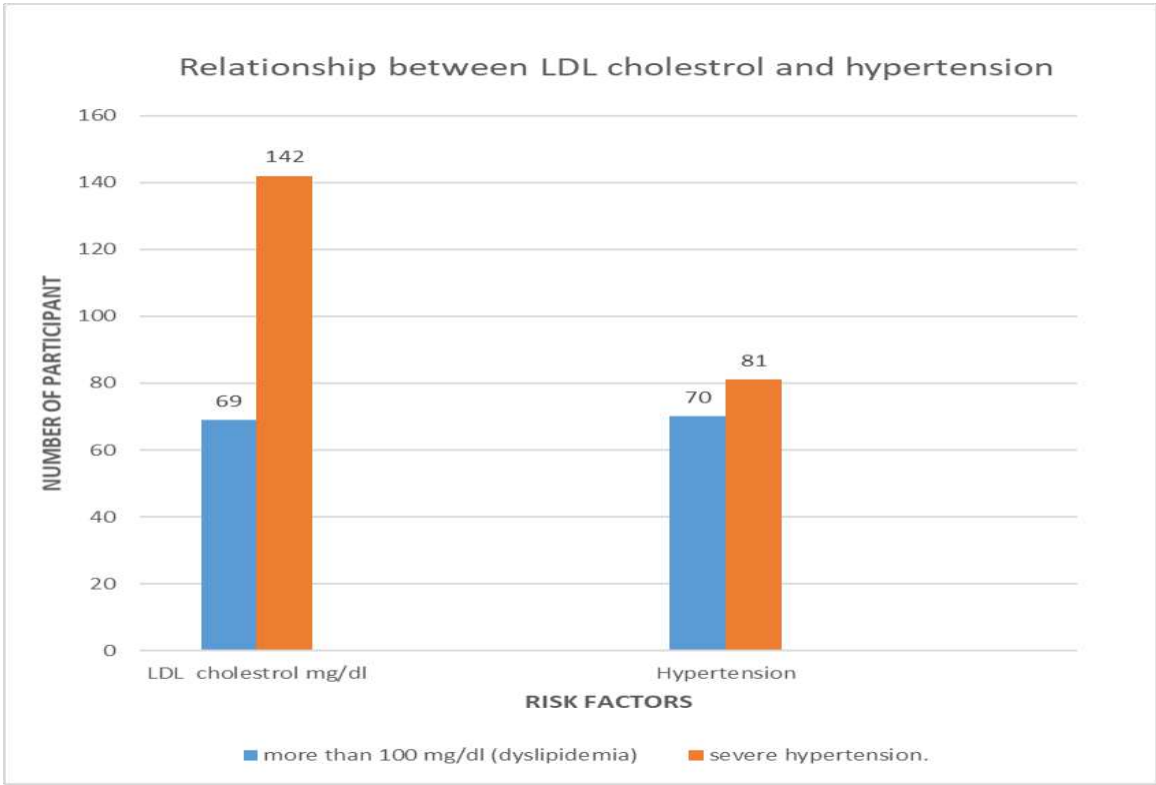
Hypertension	severe hypertension	70	81	0.74

FIGURE: 1



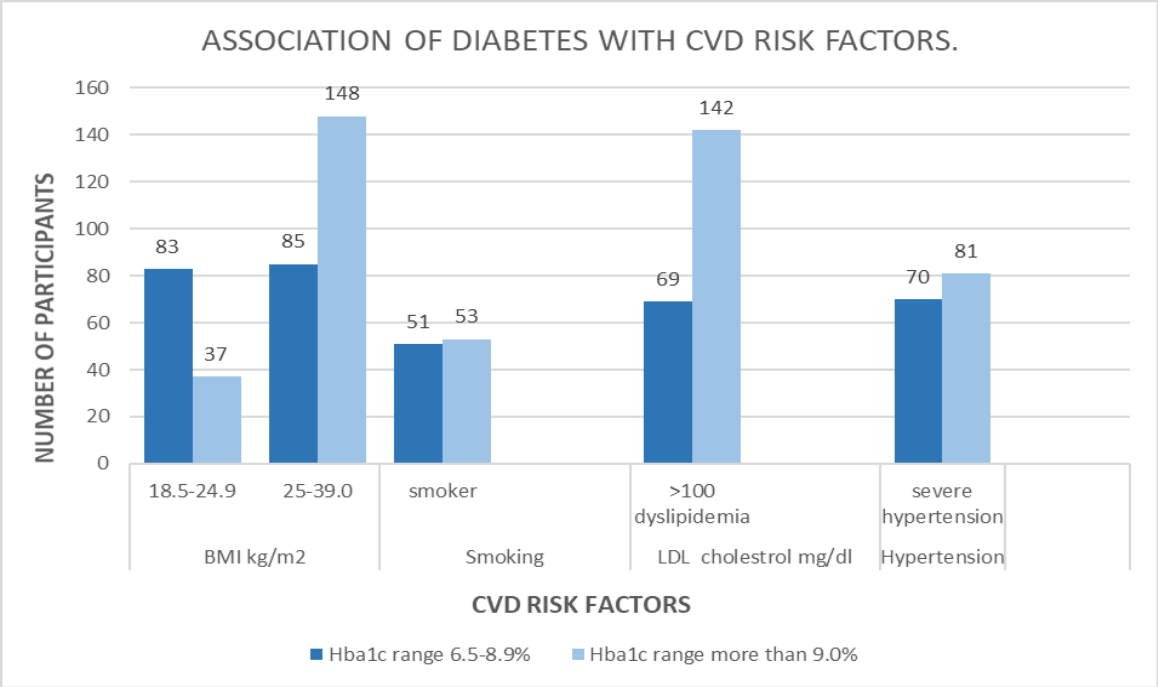
This bar graph illustrates the relationship between smoking and hypertension, corresponding with HbA1c categories. The horizontal axis representing the HbA1c categories and the vertical axis showing the relationship between the two factors. It reveals that individuals in the 6.5-8.9% HbA1c category who smoke have a lower smoking ratio, whereas those with an HbA1c greater than 9.0% have a higher smoking ratio. Additionally, hypertension appears to have a lower impact on health in the 6.5- 8.9% HbA1c category, while those with an HbA1c over 9.0% show a higher rate of hypertension and blood pressure issues.

FIGURE: 2



This bar graph illustrates the relationship between LDL cholesterol levels and hypertension with corresponding HbA1c categories. The horizontal axis representing the HbA1c categories and the vertical axis represent the corresponding values for both factors. The graph shows that individuals in the 6.5-8.9% HbA1c category tend to have lower LDL cholesterol levels, while those with an HbA1c greater than 9.0% exhibit higher cholesterol levels. Additionally, hypertension has a lesser impact on health in the 6.5-8.9% HbA1c category, whereas individuals with an HbA1c above 9.0% experience a higher prevalence of hypertension and elevated blood pressure.

FIGURE: 3



This bar graph illustrates the relationship between CVD risk factor with HbA1c. The horizontal axis representing the HbA1c categories and the vertical axis represent the corresponding values for both factors. The graph series shows that individuals in the 6.5- 8.9% HbA1c category tend to have lower CVD risk factor, while those with an HbA1c greater than 9.0% exhibit higher CVD problem.

Discussion

The current study found that patients with glycated hemoglobin levels above 9.0% were at a significantly higher risk for adverse health outcomes. Furthermore, the analysis identified several risk factors, like elevated body mass index, high blood pressure, male gender and advanced age. All of these factors contributed to an increased susceptibility to CVD in the population. The analysis of the data revealed that patients with diabetes mellitus having these risk factors faced a higher risk of myocardial infarction than the general population [33]. Diabetes can lead to myocardial infarction through several mechanisms that affect the heart and blood vessels such as atherosclerosis development, inflammation, insulin resistance, blood pressure, dyslipidemia [34]. Patients with high blood glucose level damage the endothelium that make it pathways for cholesterol and other substance to accumulate and form plaque.

When inflammation occur in body, it can stabilize plaque and cause the blockage which can limit blood flow to the heart muscles and cause heart attack. CVD remains the main cause of death for people having diabetes. Those who have diabetes are two to four times more likely to develop CVD compared to those who do not have diabetes. These mechanisms that contribute the risk are complex, involving both metabolic and vascular abnormalities [35].

The present study revealed that age is widely significant risk factor for cardiovascular disease in type-II diabetic patients. Among the participants, 116 individuals were >50yrs category with HbA1c levels higher than 9.0% indicating a statistical significant. Thus, it is found a significant association between age and CVD.

Similarly, another investigation by Swedish National Diabetes Registry that diabetes played a significant role in increasing the risk of cardiovascular conditions. As people age over 50, their bodies may

become fewer sensitive to insulin which is leading to higher blood sugar levels. Insulin resistance and decreased beta cell function in the pancreas are common in older adults. Comorbidities like hypertension, obesity, and other chronic conditions also contribute to worsening blood sugar control. It found that people over 50yrs already have diabetes are about three times more likely to die, while this increased risk was not seen in those diagnosed with diabetes after age 75 [37].

The present investigation showed that 148 patients lied in overweight BMI category 25-39.kg/m², which was the highest proportion observed in the HbA1c category of more than 9.0%. This finding highlights a significant correlation between body weight and glycemic control. Specifically, as BMI increased, we noted a corresponding rise in HbA1c levels among the participants. It has been observed that individuals with higher body mass may be at a greater risk of poor glucose regulation and developed diabetes-related complications. Existing investigation has emphasized the monitoring of BMI and HbA1c levels in clinical settings to better manage and prevent diabetes and CVD risk in patients with higher body weight. Two studies examined the connection between rising BMI and the risk of CVD. The prevalence of coronary artery disease (CAD) increased in both males and females as BMI categories. There was a five-fold increase in CAD prevalence between the lowest and highest BMI categories: < 25 (normal weight), 25-30 kg/m² (overweight), 30-35 kg/m² (mild obesity), 35-40 kg/m² (moderate obesity), and > 40 kg/m² (severe obesity). Notably, the prevalence rates for males were approximately twice as high as those for females across all BMI categories [38]. Obesity is indeed a significant risk factor for cardiovascular diseases and is closely linked to conditions such as CAD, atherosclerosis, and increased cardiac mortality. The relationship between obesity and cardiovascular health is particularly concerning in patients with diabetes mellitus, where the prevalence of overweight and obesity is notably high, contributing to an elevated cardiovascular risk factor. It is strongly connected to various factors of metabolic syndrome, such as insulin resistance, high blood pressure, and dyslipidemia. These factors not only increase the likelihood of cardiovascular issues but also serve as key contributors to the development of type II diabetes [39].

The current study demonstrates a significant difference in smoking habits between type-II diabetic males and females, with a p-value of <0.00. The data reveals that type-II diabetic males tend to smoke more than females. Males show a positive percentage of 53.50%, and those with higher levels of glycated hemoglobin greater than 9.0% face a greater risk of heart disease compared to non-smokers with diabetes. Smoking can increase insulin resistance, making it harder for the body to use insulin effectively this can lead to high blood sugar level, and smoking can also cause chronic inflammation in the body, which can worsen diabetes complications. This inflammation can damage blood vessels and contributes to various cardiovascular problems. Smoking can further damage blood vessels that are already compromised by high blood sugar level, leading to more severe cardiovascular issues. Smoking and diabetes are thought to contribute to development of cardiac dysfunction by promoting oxidative stress, causing endothelial damage and leading to atheroma formation. Smoking is independently linked to severe cardiovascular health consequences in individual with diabetes [40]. Among individuals with diabetes, smoking stands out as a significant life style risk factor for CVD. We expanded on previous research by demonstrating that smoking and diabetes can mutually intensify each other's harmful effects on the risk of CVD. These findings emphasize the critical importance of avoiding or quitting smoking to effectively prevent CVD events, especially for those with diabetes.

In the present study it is observed a notable significant difference in the prevalence of cardiovascular disease between males and females. Males show a higher prevalence of CVD, with 206 male participants affected, compared to 148 females, who demonstrate a lower risk. This gender disparity is further reflected in HbA1c levels, with a higher proportion of males (90 out of 206) having levels above 9.0%, while 78 males fall within the 6.5-8.9% range. In contrast, more females (127 out of 148) have HbA1c levels between 6.5-8.9%, with fewer (58 females) surpassing the 9.0% threshold.

This finding aligns with existing literature that suggests men are generally at a greater risk for

developing cardiovascular conditions due to a combination of biological, behavioral, and lifestyle factors. These factors may include higher levels of stress, dietary choices, and lower health-seeking behavior among men, which can contribute to the increased incidence of CVD. Additionally, the study highlights a concerning trend regarding diabetes prevalence, where males also exhibit a higher ratio of diabetes cases than females. The interplay between diabetes and CVD is critical, as individuals with diabetes are more likely to develop heart-related issues. The higher ratio of diabetes among males could be attributed to factors such as obesity, sedentary lifestyles, and genetic predispositions, which further exacerbate their risk for both diabetes and cardiovascular diseases. Generally, men tend to have higher insulin resistance, elevated fasting glucose levels, and greater visceral fat mass than women [41].

The current results indicate a notable increase in cardiovascular disease risk among individuals with diabetics' mellitus, largely due to improvements in patient care and management. However, in many developing countries, where the prevalence of diabetics' mellitus is increasing and lifestyle patterns are evolving, there is likely to be a rise in cardiovascular risk factors among people with type II diabetics' mellitus [42].Better adherence to a healthy lifestyle is strongly linked to a significantly lower risk of both cardiovascular disease incidence and mortality in adults with type II diabetics' mellitus. These findings highlight the immense advantages of maintaining a healthy lifestyle in minimizing the future burden of cardiovascular complications in diabetic patients. Our findings underscore a significant opportunity to enhance the monitoring of complications and emphasize the need for early and proactive risk factor management. This aligns with current clinical guidelines. For instance, the European Society of Cardiology guidelines for cardiovascular disease prevention categorize diabetic patients as being at very high cardiovascular risk, irrespective of other risk factors, and thus recommend statin therapy alongside intensive blood pressure control for all patients. Similarly, both the American Heart Association and the American Diabetes Association advocate for the rigorous management of cardiovascular risk factors in individuals with diabetes. Additionally, the joint position statement from the American Diabetes Association and the European Association for the Study of diabetes highlights the importance of selecting glucose-lowering medications that positively affect cardiovascular risk factors, particularly in patients with existing cardiovascular disease [43].

The goal is to reduce the risk of cardiovascular events, manage existing CVD, and improve overall outcomes in diabetic patients through a combination of pharmacologic treatments and lifestyle changes. In cases of advanced CVD, procedures such as angioplasty or coronary artery bypass grafting (CABG) may be necessary to restore blood flow and prevent heart attacks. Continuous monitoring of glucose levels, blood pressure, and lipid profile is important to adjust treatment plans as needed and prevent complications. Encouraging patients to adopt a healthy lifestyle, including a balanced diet, regular physical activity, smoking cessation, and weight management, is critical in managing both diabetes and CVD. Statins are commonly recommended to lower cholesterol levels and reduce cardiovascular risk. In some cases, additional lipid-lowering agents may be used. Control of blood glucose levels is essential to reduce the long-term risks of CVD. This can be achieved through lifestyle modifications (diet and exercise) and medications such as metformin, insulin. The high prevalence of CVD events among diabetic patient underscores the importance of public health initiatives aimed at diabetic management and cardiovascular health promotion.

Conclusion

It is concluded that evaluating the prevalence of cardiovascular disease events in type II diabetic mellitus patients reveals a significant association between diabetes and increased cardiovascular risk. The findings highlights that individuals with diabetes, particularly those with poorly controlled blood glucose, hypertension, and dyslipidemia, are at a markedly higher risk of experiencing CVD events. This emphasizes the need for proactive screening and early intervention to manage cardiovascular risk factors effectively. Additionally, the results underline the importance of personalized care, lifestyle modifications, and the use of appropriate pharmacologic therapies to reduce the burden of

CVD in this population. Addressing these risk factors through a comprehensive, multidisciplinary approach serve as a critical role in preventing cardiovascular complications and improving whole health outcomes for diabetic patients. Future efforts should emphasis on continuous observing, patient education, and the development of new therapeutic strategies to further mitigate the risk of CVD events in this high-risk population.

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