Coronary heart disease in patients with type 2 diabetes mellitus (T2DM).

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Abstract

Background

Coronary heart disease (CHD) is the major cause of mortality and morbidity in patients with type 2 diabetes. But the utility of screening patients with type 2 diabetes for asymptomatic CAD is controversial.

Objective

To determine coronary heart disease in patients with type 2 diabetes mellitus.

Methods

A cross-sectional study was conducted at Saidu Group of Teaching Hospital, Swat, Pakistan, which was performed between October 2024 to September 2025, The total number of patients in our study were 100. The number of female patients in our study were 43 and males were 57. For all patients, we did diagnostic tests before for all patients who have coronary heart disease and type 2 diabetes mellitus. Our main focus was coronary heart disease in patients with type 2 diabetes mellitus. We took both patients who have coronary heart disease and those who have no coronary heart disease. We excluded pregnant women in our study. Data was tabulated and analyzed by SPSS version 27.

Result

In a current study total 100 patients were enrolled. The analysis of continuous variables indicates that the average age of participants is 68.5 years, with a notable range spanning from 47 to 81 years. The average BMI is 30 kg/m², reflecting a prevalence of obesity within the cohort. Fasting Plasma Glucose and HbA1c**:** Participants have an average fasting plasma glucose level of 149 mg/dl and an HbA1c of 8.0%, suggesting suboptimal glycemic control typical in individuals with type 2 diabetes mellitus. Categorical Variables**:** Among the categorical health indicators, coronary heart disease is present in 65% of participants, while complications such as heart failure and atherosclerosis also show significant prevalence (28% and 50%, respectively), highlighting the increased cardiovascular risk associated with type 2 diabetes.The grouped bar chart displays the mean values of BMI, Fasting Plasma Glucose, and HbA1c for patients with and without coronary heart disease, facilitating a visual comparison. CHD present mean ± SD of BMI were 31 (±2.5) and were not present in 28 (±2). P-value were 0.01. CHD were present mean ± SD of fasting plasma were 160 (±25) and were not present in 130 (±15). P-value were <0.01. In a current study, complications of Myocardial infarction, CHD were present in 26 patients and were absent in 4 patients. The p-value were 0.004. CHD present in Arrhythmias were 22 and were absent in 8 patients and its P-value were 0.05. The complication of stroke CHD were present in 10 patients and were absent in 0 patients and its P-value were 0.01. In our study P-Value were less than (< 0.05).

Conclusion

We concluded in our study that cardiovascular risk factors clustering with hyperinsulinemia increase the risk of coronary heart disease in patients with Type II diabetes. Complications of myocardial infarction are more found in patients who have coronary heart disease. Male patients were more in our study as compared to females.

Keywords: Coronary heart disease (CHD), Type 2 Diabetes Mellitus (T2DM), Coronary Artery disease (CAD).

Introduction

Type 2 diabetes affects over 200 million people globally [1]. The primary cause of death for those with type 2 diabetes is coronary heart disease (CHD), which is a serious health problem [2]. Until myocardial infarction or sudden cardiac death occurs, CAD is frequently asymptomatic in these patients [3]. Another well-established risk factor for CAD is type 2 diabetes [4]. Reducing cardiovascular risk factors is emphasised in the current standard of therapy for type 2 diabetes [5]. However, screening patients with type 2 diabetes has also generated a lot of interest in the early diagnosis of asymptomatic CAD [6]. According to recent research, a sizable portion of these people can have noninvasive CAD detection [7,9]. It has been demonstrated that coronary artery calcium and inducible ischaemia [10,11] are both linked to worse cardiac outcomes. It is mainly unknown, nevertheless, whether routine screening can avoid cardiac events and change treatment in those without clinically evident CAD [12,13]. Therefore, screening for patients with type 2 diabetes who do not exhibit symptoms of CAD is still very controversial given the absence of prospective outcome studies that demonstrate its usefulness [15,16], although being supported by several professional organisations [14]. Comprehensive cardiovascular risk reduction measures have been shown to offer significant advantages for T2DM patients. Even among patients with well-managed type 2 diabetes who are enrolled in modern outcomes trials, cardiovascular event rates are still high [17], which emphasises the need for more methods to further lower this risk. Thankfully, a number of these techniques have been developed recently, such as new lipid-modifying treatments, glucose-lowering medications with significant cardiovascular advantages, and advancements in anticoagulation and antiplatelet management [18,19]. Despite this strong evidence and the abundance of recently developed risk-reduction techniques, clinical practice has been hesitant to implement them, and significant gaps in care quality still exist [22]. For instance, a significant percentage of patients with CAD and type 2 diabetes, including those who have experienced an acute coronary syndrome, do not receive proven cardiovascularly beneficial therapies like dual antiplatelet therapy, high-intensity statins, angiotensin converting enzyme (ACE)
inhibitors/angiotensin II receptor blockers (ARBs), and glucose-lowering medications [23]. Failure to implement guidelines-based recommendations is still a significant contributing factor, even if patient adherence and pharmaceutical costs are significant factors that predispose to these gaps.
In order to reduce multifactorial risk, these gaps in care point to a crucial opportunity for cardiovascular experts to take on a more active role in the collaborative management of patients with T2DM and CAD [24]. There has never been a better moment to successfully apply this paradigm, given the abundance of useful technologies and the growing emphasis on population risk management and value-based care [25].

MATERIALS AND METHODS

A cross-sectional study was conducted at Saidu Group of Teaching Hospital, Swat, Pakistan, which was performed between October 2024 to September 2025, The total number of patients in our study were 100. The number of female patients in our study were 43 and males were 57. For all patients, we did diagnostic tests before for all patients who have coronary heart disease and type 2 diabetes mellitus. Our main focus was coronary heart disease in patients with type 2 diabetes mellitus. We took both patients who have coronary heart disease and those who have no coronary heart disease. We excluded pregnant women in our study. Data was tabulated and analyzed by SPSS version 27.

Inclusion Criteria: All patients who have coronary heart disease with type 2 diabetes mellitus (T2DM).

Exclusion Criteria: Pregnant women.

Results

Table 1: Descriptive Statistics of Study Participants (*n=100*)

Variables	Mean (± SD)	Median	Range
Age (years)	68.5 (±14.2)	73	47-81
BMI (Kg/m²)	30 (±2.5)	29.5	23-33
Fasting Plasma Glucose (mg/dl)	149 (±20)	151	139-172
HbA1c (%)	8.0 (±1.5)	8.0	7.0-9.0
Coronary Heart Disease (Yes/No)	65/35		
Heart Failure (Yes/No)	28/72		

Atherosclerosis (Yes/No)	50/50		
Obesity (Yes/No)	40/60		

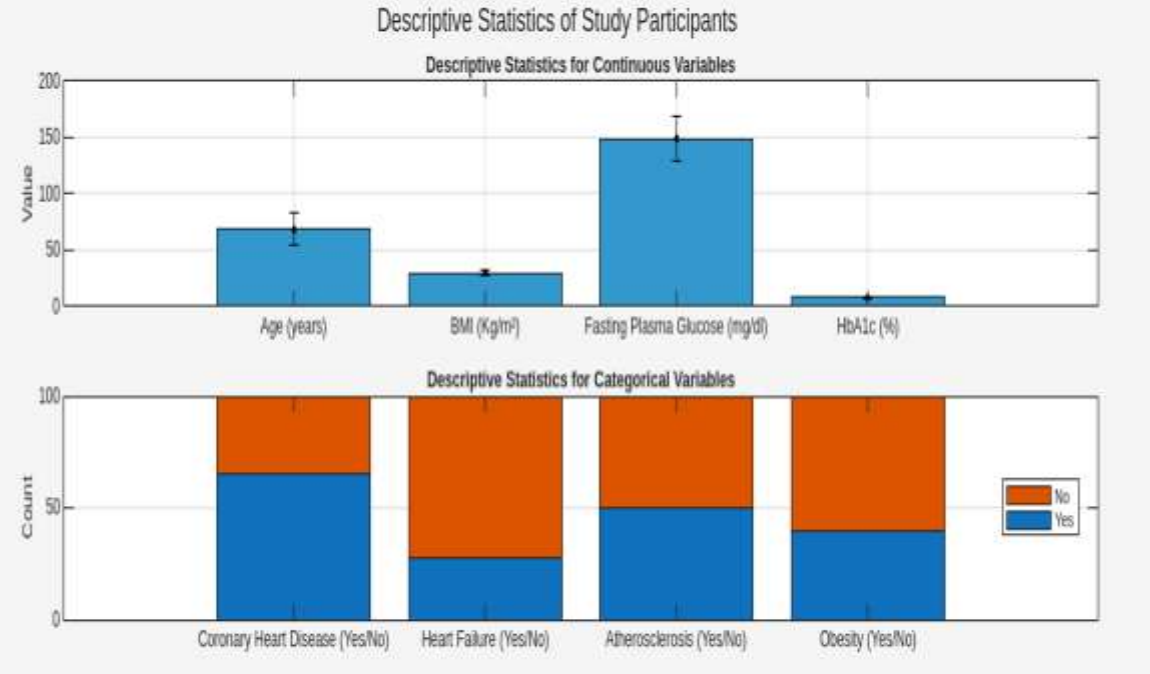

Figure 1: Descriptive statistics of study participants.

Continuous Variables: The analysis of continuous variables indicates that the average age of participants is 68.5 years, with a notable range spanning from 47 to 81 years. The average BMI is 30 kg/m², reflecting a prevalence of obesity within the cohort. **Fasting Plasma Glucose and HbA1c**: Participants have an average fasting plasma glucose level of 149 mg/dl and an HbA1c of 8.0%, suggesting suboptimal glycemic control typical in individuals with type 2 diabetes mellitus. **Categorical Variables**: Among the categorical health indicators, coronary heart disease is present in 65% of participants, while complications such as heart failure and atherosclerosis also show significant prevalence (28% and 50%, respectively), highlighting the increased cardiovascular risk associated with type 2 diabetes.

Table 2: Gender Distribution by Coronary Heart Disease (*n=100*)

Gender	CHD Present	CHD Absent	Total		Correlation Coefficient	p-value
Male	42	15	57		-	0.03
Female	23	20	43		-	
Total	65	35	100		-	
Age vs. CHD	-	-	-		0.34	<0.01

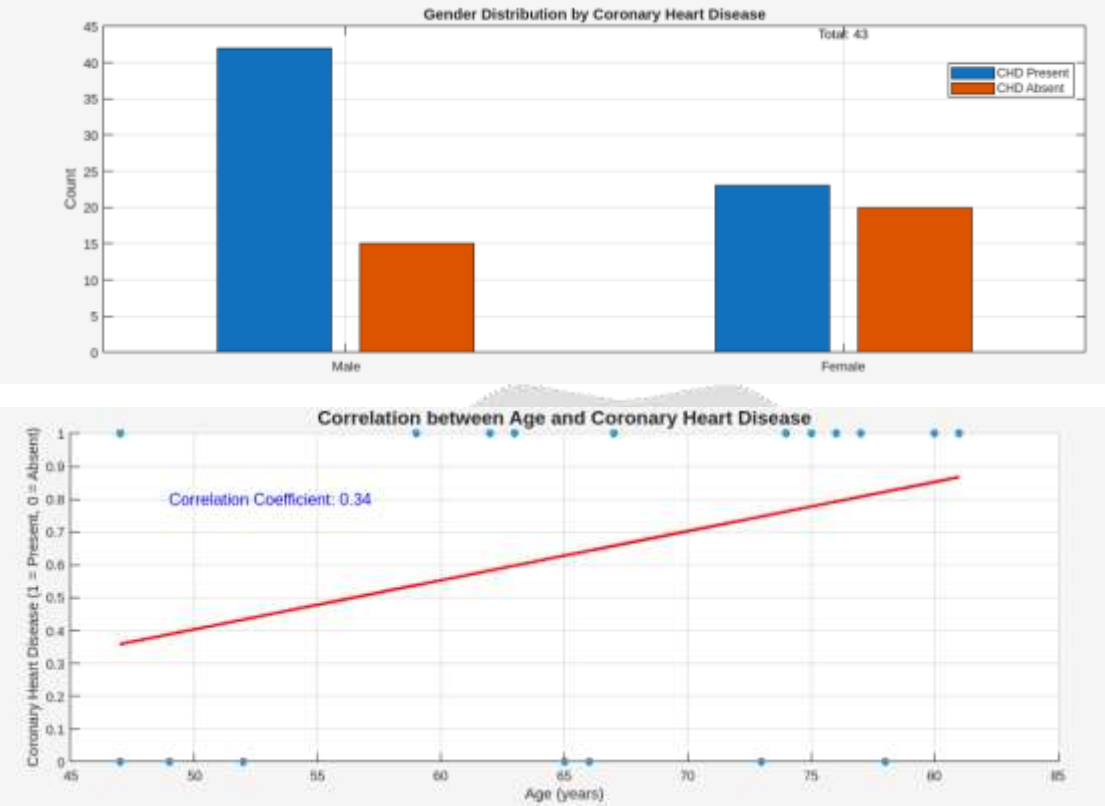

Figure 2: Gender distribution and correlation between age and coronary heart disease.

The scatter plot illustrates the correlation between age and the presence of coronary heart disease (CHD), showing a trend where older individuals tend to have a higher likelihood of CHD. The fitted regression line indicates a positive association, suggesting that as age increases, the probability of having CHD also increases. The correlation coefficient of 0.34 confirms a moderate positive relationship between these two variables.

Table 3: Comparison of BMI, FPG, and HbA1c between CHD Patients and Non-CHD Patients (*n=100*)

Variable	CHD Present (mean ± SD)	CHD Absent (mean ± SD)	p-value
BMI (Kg/m²)	31 (±2.5)	28 (±2)	0.01
Fasting Plasma Glucose	160 (±25)	130 (±15)	<0.01
HbA1c (%)	8.5 (±1.2)	7.2 (±0.8)	<0.01

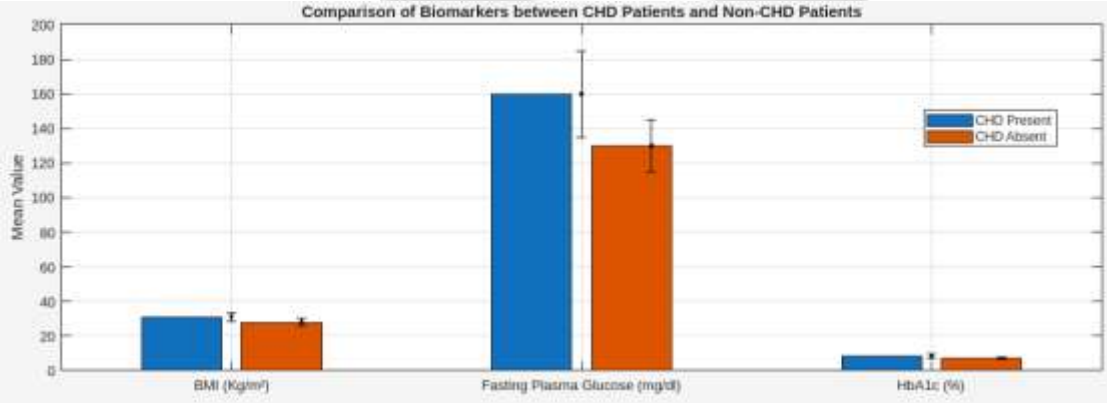

Figure 3: Comparison of CHD patients and non CHD patients

The grouped bar chart displays the mean values of BMI, Fasting Plasma Glucose, and HbA1c for patients with and without coronary heart disease, facilitating a visual comparison.

CHD present mean ± SD of BMI were 31 (±2.5) and were not present in 28 (±2). P-value were 0.01. CHD were present mean ± SD of fasting plasma were 160 (±25) and were not present in 130 (±15). P-value were <0.01.

Table 4: Complications Cross-Tabulation with Coronary Heart Disease (*n=100*)

Complication	CHD Present	CHD Absent	Total		p-value
Myocardial Infarction	26	4	30		0.004
Arrhythmias	22	8	30		0.05
Stroke	10	0	10		0.01

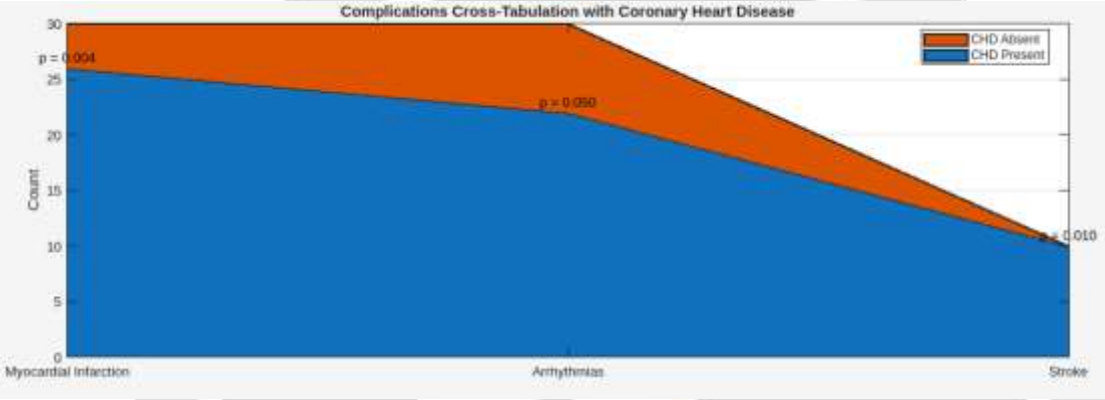

Figure 4: Complications cross-tabulation with coronary heart disease

In a current study, complications of Myocardial infarction, CHD were present in 26 patients and were absent in 4 patients. The p-value were 0.004. CHD present in Arrhythmias were 22 and were absent in 8 patients and its P-value were 0.05. The complication of stroke CHD were present in 10 patients and were absent in 0 patients and its P-value were 0.01.

Discussion

In patients with Type II diabetes, cardiovascular risk factors that cluster with hyperinsulinemia (insulin resistance) are linked to CHD death. Because the significant association between hyperinsulinemia and death from CHD was eliminated when the components of the insulin resistance syndrome (HDL cholesterol, triglycerides, and obesity) were taken into account, the predictive value of high fasting insulin with regard to death from CHD was independent of total cholesterol, smoking, and hypertension, but not of risk factors clustering with hyperinsulinemia. However, using factor analysis and principal component analysis, we were able to demonstrate that in patients with Type II diabetes, Ψhyperinsulinaemia clusterº was predictive of death from CHD (Table 4), and this association remained statistically significant even after controlling for a prior history of MI, which is a strong predictor of CHD mortality [26]. This is a new discovery that shows, for the first time, that people with Type II diabetes who have hyperinsulinemia and clustering cardiovascular risk factors are at an increased risk of dying from coronary heart disease. It was first proposed in the 1960s that high insulin levels could increase the risk of atherosclerosis. Following an oral glucose load, two investigations from Finland and England showed elevated insulin values in MI patients [27]. Since then, this theory has been supported by published data from epidemiological, clinical, and experimental research [28]. However, there is disagreement over whether hyperinsulinemia has a significant role in the risk of coronary heart disease (CHD) in the same manner as smoking, high blood pressure, high cholesterol, and other traditional risk factors [29].

There are currently no studies that have assessed insulin resistance and linked it to the likelihood of subsequent CHD occurrences. The link between hyperinsulinemia and CHD is the foundation of all epidemiological evidence from prospective population-based investigations. While insulin sensitivity as assessed by the euglycaemic clamp technique is rather highly correlated with fasting and insulin concentrations following a glucose load, this correlation ranges only between 0.60 and 0.70 [30]. As a result, it is unclear whether the results of the prospective studies based on insulin measurements may be used to support or refute the idea that insulin resistance contributes to coronary heart disease. Insulin concentrations in people with Type II diabetes are considerably more challenging to interpret than in subjects without the disease. Insulin concentrations and insulin resistance have a significantly lower association in type II diabetes than in normoglycemic participants because the condition is marked by both insulin resistance and insulin insufficiency [38]. Consequently, in patients with Type II diabetes, a positive correlation between high insulin levels and CHD understates rather than overestimates the actual relationship between these variables.

Numerous prospective epidemiological investigations have demonstrated that hyperinsulinemia predicts the incidence of coronary heart disease in non-diabetic patients [31]. Hyperinsulinemia predicts death from CHD in multivariate analysis, according to our 3.5-year follow-up research of older non-diabetic participants [odds ratio 2.57 after adjustment of conventional cardiovascular risk variables]. We recently demonstrated that clustering of cardiovascular risk variables with hyperinsulinemia predicted CHD occurrences among men using factor analysis, based on a 7-year follow-up of the same study population [32]. In non-diabetic participants aged 45–76 years without CHD at baseline, it was effectively demonstrated [41] that high fasting specific insulin was a strong independent predictor of ischaemic heart disease. Furthermore, the most recent study, the Helsinki Policeman Study's 22-year follow-up, demonstrated that hyperinsulinemia was a significant independent risk factor for CHD and that its predictive ability was comparable to that of cholesterol, albeit diminishing with longer follow-up periods [33]. There is currently little and conflicting data regarding the relationship between hyperinsulinemia and the risk of coronary heart disease (CHD) and other types of atherosclerotic vascular disease in individuals with Type II diabetes.According to certain cross-sectional studies, people with Type II diabetes who also have atherosclerotic vascular disease have greater levels of postglucose plasma insulin or fasting plasma insulin or C-peptide than people without atherosclerotic vascular disease [18–21]. High fasting insulin was linked to the occurrence of new ischaemic ECG abnormalities in a 5-year follow-up study of patients with recently diagnosed Type II diabetes. High fasting plasma insulin predicted the risk of dying from coronary heart disease (CHD) in both Type II diabetes and non-diabetic patients over an 11-year follow-up, according to the Paris Prospective Study [34]. However, no adjustment was done for other risk factors. High fasting insulin was linked to the development of MI in individuals with Type II diabetes in a 6-year follow-up of the Diabetes Intervention Study, regardless of other risk factors. Fasting insulin measured by tertiles was positively associated with the incidence of MI in the UK Prospective Diabetes Study, but this association vanished when other risk variables were taken into account [35]. Contrary to these findings, a low 2-hour post-glucose plasma insulin was linked to a higher risk of CHD events in a 10-year follow-up of the Bedford Study's ¯borderlineº diabetic group [36]. It is generally acknowledged that insulin insufficiency and insulin resistance/hyperinsulinemia play a key role in the aetiology of Type II diabetes. Additionally, cross-sectional investigations have shown that elevated insulin concentrations in Type II diabetes patients cluster with abnormalities in lipids and lipoproteins in a manner similar to that of normoglycemic people. In patients with Type II diabetes, the correlation between hyperinsulinemia/insulin resistance and central obesity and arterial stiffness is well established; however, the relationship with hypertension is debatable. Prior research on individuals without diabetes has demonstrated that factor analysis can reveal a clustering of cardiovascular risk variables characteristic of insulin resistance syndrome. Three different factors were discovered in a different population research. We were also able to identify the clustering of illnesses that define the insulin resistance syndrome by using factor analysis. Because factor 2 had positive loadings for fasting plasma insulin, BMI, hypertension, total triglycerides, and a negative loading for HDL cholesterol, it might be referred to as a hyperinsulinemia factor. Death from CHD was significantly predicted by this cluster of hyperinsulinemia [37]. The ramifications of our findings are multifaceted. First, our research demonstrates that factor analysis can identify a factor with high loadings for insulin and other elements of the insulin resistance syndrome in both non-diabetic individuals and patients with Type II diabetes. Second, our research demonstrates that the importance of hyperinsulinemia in predicting CHD is understated by traditional statistical techniques that rely on the independence of many variables to predict an endpoint. Thirdly, our research supports the notion that individuals with Type II diabetes who have a cluster of hyperinsulinemia may be at increased risk for cardiovascular disease. Previously, this outcome has been suspected but not proven [38]. There are limitations to our investigation. Since the early 1980s, our insulin test has been used to quantify proinsulin and des 31.32 proinsulin in addition to specific insulin. In persons without diabetes, the latter make up around 10% of insulin-like molecules. Proinsulin levels rise disproportionately in patients with Type II diabetes. Therefore, the idea that elevated proinsulin levels may raise the risk of CHD in individuals with Type II diabetes cannot be totally ruled out.

However, since the relationship between specific and total immunoreactive insulin and other metabolic risk factors is similar in non-diabetic subjects [39] and in patients with Type II diabetes [59], it is unlikely that proinsulin or split products of insulin could have complicated the association between hyperinsulinemia and CHD. The diagnosis of CHD prior to the baseline testing may also have affected cardiovascular risk factor levels, especially in patients who passed away from CHD during the follow-up. Factor analysis on the relationship between smoking, age, and hypertension may be biassed since, for instance, smoking was somewhat less common among female diabetic patients who died of CHD than among those who did not (Table 3). Furthermore, it was challenging to draw firm conclusions from factor analysis regarding the relationship between age and smoking in this patient population because factor loadings for these variables varied throughout factors. However, the relationship between cardiovascular risk variables (such as hyperinsulinemia) and CHD mortality is expected to be weakened rather than strengthened by lifestyle changes [40].

CONCLUSION

We concluded in our study that cardiovascular risk factors clustering with hyperinsulinemia increase the risk of coronary heart disease in patients with Type II diabetes. Complications of myocardial infarction are more found in patients who have coronary heart disease. Male patients were more in our study as compared to females.

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