ORIGINAL ARTICLE

The Silent Killer: Investigating the Influence of Stress on Cardiovascular Health of Diabetic Patients

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ABSTRACT
Aim: This study investigates impact of stress on cardiovascular health of diabetic patients.
Methodology: In this cross sectional survey, 450 participants were recruited using non probability consecutive sampling. Data was collected using structured questionnaire from diabetic patients visiting different hospitals and clinics in the city for checkup.
Results: Among the 450 diabetic patients, 110(24.4%) have Low perceived stress level, 200(44.4 %) have Mild, 100(22.2 %) have Moderate and 40(8.9 %) had High perceived stress level. With the increase in Stress level the level of LDL Cholesterol, HDL Cholesterol and Triglycerides were also increasing significantly. Significant association was also observed between healthy diet adherence and stress level among diabetic patients.
Conclusion; According to the study, stress management plays a significant role in diabetes treatment and management. By prioritizing stress management for diabetic patients, healthcare providers can promote better health outcomes and reduce cardiovascular disease risk.
Keywords: Psychological Stress, Cardiovascular, Diabetic Patients

INTRODUCTION
Diabetes increases the risk of complications like cardiovascular disease, which is one of the leading causes of death globally.[1, 2] A local study reveals that among diabetic patients frequency of generalized anxiety disorder was 14.4% and cardiovascular disease was 12.6%[3]. Different studies showed that the stress ranges from 25.5% to 37.4% among diabetic patients the prevalence of anxiety and depression was higher than stress level.[4, 5]

Psychological distress is common among diabetic patients. There could be many associated risk factors, like higher dietary acid load and patients using less plant based diet have poor sleep quality which leads to compromised mental health.[6] The medication used for diabetes & stress may effect cardiovascular anomalies.[7] A study reveals that type 2 diabetes patients with depression have higher cardiovascular mortality as compared to without depression.[8] Another study showed that the stress may be due to compromised daily activity in patients.[9]

Relation of stress with metabolic disorders like diabetes, obesity and cardiovascular disease is complex[10-12]. Recent literature has added that Hair cortisol ,secreted over several weeks, can be considered as cardio-metabolic risk factors for Cardio-Vascular Disease including high blood pressure, diabetes, and adiposity.[13] On the other hand, cortisol level increases among patients with gestational diabetic and raised level were observed among female with family history as compared to others[14]

This study investigates impact of stress on cardiovascular health among diabetic patients. Understanding the relationship between stress and cardiovascular health can improve diabetes management and reduce cardiovascular disease risk in this population. Furthermore, identifying modifiable risk factors such as physical activity and diet adherence in patients with high levels of perceived stress can inform interventions that target these factors to reduce cardiovascular disease risk.

METHODOLOGY
This Cross sectional survey was conducted on 450 diabetic patients in Lahore, Pakistan. The study data were collected from September, 2021 till January, 2022. The study population was recruited from various hospitals in the city using non probability, consecutive sampling. All participants aged 18 years or older, diagnosed with Type 2 diabetes were included in the study after their consent.

Data collection was conducted using a structured questionnaire that included questions about demographics, lifestyle factors, medical history, and perceived stress levels. The questionnaire was designed to collect accurate and reliable data to analyze factors related to stress and cardiovascular health in diabetic patients. The questionnaire was initially developed in English and translated into Urdu, the main language spoken in Pakistan. This was to ensure participants understood the questions. The questionnaire was administered to participants by trained data collectors who ensured participants understood the questions and provided assistance where required. Participants were given adequate time to fill in the questionnaire, and confidentiality and anonymity were ensured throughout the study.

Data analysis was performed using SPSS version 21. The relationship between stress and cardiovascular health was analyzed using chi square test taking p-value of 0.05 or less as significant. This was done to identify potential risk factors for cardiovascular disease in diabetic patients.

RESULTS
Majority of the participants, 160 out of 450, were aged 31-45 years, and were male 240 (53.3%). Regarding education, over 77.8% of the participants had at least a secondary education. (**Table 1**)

Table 1: Demographic Characteristics of the Study Population

Demographic variables	Frequency (%)
Age (Years):	
18-30	80(17.8 %)
31-45	160(35.6 %)
46-60	140(31.1 %)
More than 61	70(15.5 %)
Gender:	
Male	240(53.3 %)
Female	210(46.7 %)
Education:	
Primary	100(22.2 %)
Secondary	190(42.2 %)
Tertiary	160(35.6 %)

Among the 450 diabetic patients, 110(24.4%) have Low perceived stress level, 200(44.4 %) have Mild, 100(22.2 %) have Moderate and 40(8.9 %) had High perceived stress level. (**Figure 1**)
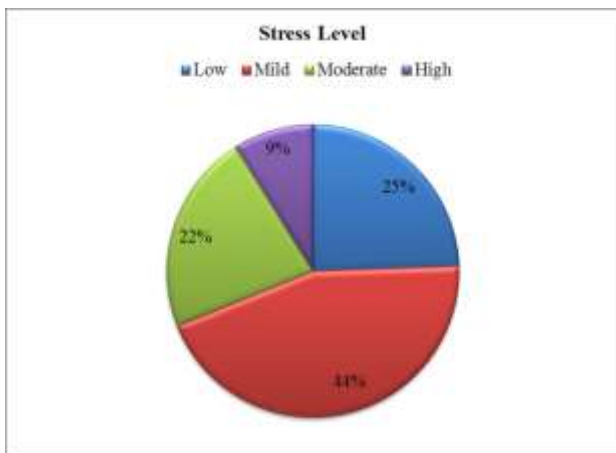
Figure 1: Perceived stress levels among diabetic patients

Overview of cardiovascular health among diabetic patients has been discussed in table 2 according to stress level. Results indicate that participants who reported higher stress levels had higher systolic blood pressure, LDL cholesterol, and triglyceride levels, as well as lower HDL cholesterol levels. Moreover, metabolic syndrome prevalence increased with stress levels.

Table 2: Cardiovascular Health Indicators among Study Participants, by Stress Level

Abnormal Cardiovascular Indicator	Stress Level				p-vlue
	Low	Mild	Moderate	High	
Blood Pressure (mmHg)					
Systolic	127±8.2	131±10.4	135±17.9	135±14.3	<0.001*
Diastolic	78±5.4	80±16.5	82±17.2	85±19.5	0.052
LDL Cholesterol (mg/dL)	100±12.5	105±14.1	115±27.8	125±28.2	<0.001*
HDL Cholesterol (mg/dL)	50±8.5	48±7.4	45±8.7	42±6.0	<0.001*
Triglycerides (mg/dL)	130±10.0	135±22.2	150±46.4	170±53.4	<0.001*

Independent sample t test, *p-value significant at 0.05

Lifestyle factors among study participants, by stress level. Results indicate that stress was in inverse relation with regular physical activity and healthy diet adherence, as participants with higher stress levels were less likely to engage in regular physical activity and consume a healthy diet. Smoking history also increased among participants with higher stress levels.

Table 3: Lifestyle Factors among Study Participants, by Stress Level

Lifestyle Factor	Stress Level				p-value
	Low	Mild	Moderate	High	
Metabolic Syndrome (%)	12(10.9%)	48(24%)	36(36%)	18(45%)	<0.001*
Regular Physical Activity (%)	72(65.5%)	100(50%)	40(40%)	10(25%)	<0.001*
Smoking History (%)	11(10%)	40(20%)	35(35%)	20(50%)	<0.001*
Healthy Diet Adherence (%)	94(85.5%)	150(75%)	60(60%)	18(45%)	<0.001*

Chi square test, *p-value significant at 0.05

DISCUSSION

The study found that stress significantly increases cardiovascular disease risk in diabetic patients. Patients who reported higher levels of perceived stress were more likely to have elevated blood pressure, elevated LDL cholesterol levels, and an increased prevalence of metabolic syndrome. Furthermore, patients who reported high levels of stress were less willing to engage in regular physical activity and more likely to have a smoking history. Our

results are comparable with the study in which contribution of oxidative stress was observed[15]

This study provides valuable insights into the relationship between stress and cardiovascular health in diabetic patients in Lahore, Pakistan. Overall, these results suggest that stress management is crucial in diabetes treatment and management in Lahore, Pakistan, and globally. Healthcare providers should incorporate stress management techniques, such as mindfulness and relaxation techniques, into diabetes management programs. Increased physical activity and adherence to a healthy diet should also be encouraged to improve cardiovascular health in these patients. By addressing stress levels and promoting healthy lifestyle habits, healthcare providers can improve diabetic patients' cardiovascular health and overall well-being. These findings call for future research into the effectiveness of stress management interventions designed specifically for diabetic patients.

There should be development of effective stress-reducing interventions specifically designed for diabetic patients. These interventions should focus on promoting healthy lifestyle habits, increasing awareness of stress management techniques, and providing patients with the tools and resources necessary to manage their stress effectively.[16]

The provision of support groups, group exercise classes, and mindfulness-based stress reduction therapies could benefit diabetic patients struggling with high stress levels. Routine patient follow-ups should also include addressing stress management and ensuring patients have access to the necessary support and resources. Over results were also supporting the healthy dietary adherence[6]

In conclusion, diabetes management requires a multifaceted approach that includes blood glucose control but also cardiovascular health and stress management. By prioritizing stress management, healthcare providers can promote better health outcomes for diabetic patients. This will enable them to achieve improved quality of life, and reduce cardiovascular disease risk.

CONCLUSION

In conclusion, it is found that here is significant impact of stress on cardiovascular health in diabetic patients. The findings suggest that stress is a significant risk factor for cardiovascular disease in this population. Patients reporting high levels of stress are more likely to have elevated blood pressure, higher LDL cholesterol levels, and a higher prevalence of metabolic syndrome.

Our study highlights the importance of stress management in diabetes management. Healthcare providers must prioritize screening for stress levels and promoting stress-reducing interventions in diabetic patients to reduce cardiovascular disease risk. It is essential to recognize the impact of stress on the body and how it can exacerbate existing health problems further.

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