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Effect of stress on blood pressure in diabetic patients

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Abstract

Aims: The aim of present investigation was to study the effect of stress on blood pressure in diabetic patients.

Materials and Methods: This study included randomly selected diabetes patients and healthy controls, aged 40-50, who could read and write English. Participants completed a two-part questionnaire, including sociodemographic data and the 30-item Perceived Stress Scale. Blood pressure was measured, and descriptive statistics and ANOVA were used for analysis. SPSS version 21 was employed, with a significance level of 0.05. The results were presented accordingly.

Results: The study analyzed systolic and diastolic blood pressure among diabetic patients with varying levels of stress. Higher stress levels were associated with lower systolic blood pressure, while diastolic blood pressure increased with higher stress levels. The mean difference in stress levels between high and medium, high and low, and medium and low groups was significant.

Conclusions: Diabetes is a common disease in India, affecting individuals over 40 years old. Stress levels can impact blood pressure in diabetic patients. Early detection through simple tests and public awareness are crucial. Lifestyle modifications should be implemented to prevent diabetes progression. Managing stress is important for blood pressure control in diabetic patients. Healthcare professionals should address stress as a risk factor and develop interventions. Further research is needed to explore long-term effects of stress and efficacy of stress management interventions for blood pressure control in diabetes.

Keywords: Diabetes, perceived stress, blood pressure

Introduction

Diabetes is a major public health problem that is approaching epidemic proportions globally the prevalence of this chronic disease is increasing at an alarming rate. About 18 million people die every year from cardiovascular disease for which diabetes and hypertension are major predisposing factors the complication from diabetes are resulting in increasing disability, reduced life expectancy and enormous health cost for virtually every society. Diabetes is a chronic condition in which a person has high levels of glucose in their blood due to decreased levels or quality of the hormone insulin, resulting in reduced absorption of glucose into the body's tissues. Diabetes is a significant risk factor for cardiovascular diseases, including hypertension or high blood pressure. Hypertension in diabetic patients is a common problem, and it increases the risk of complications such as heart disease, stroke, and kidney damage. People with diabetes are particularly susceptible to the effects of stress on their health, including their blood pressure. Stress is a common experience that affects individuals in various ways, and it is known to have an impact on one's physical and emotional well-being. Stress triggers the release of hormones such as adrenaline and cortisol, which can cause the body's "fight or flight" response, leading to increased blood pressure levels. Stress can increase blood pressure in several ways. According to a study published in the Journal of Hypertension, stress can lead to an increase in blood pressure in individuals with diabetes, even in those who do not have hypertension (high blood pressure) at baseline (1). This is because stress activates the sympathetic nervous system, which in turn releases hormones like adrenaline and noradrenaline that cause blood vessels to constrict and the heart to beat faster. Over time, these physiological responses to stress can lead to chronic high blood pressure, which increases the risk of heart disease, stroke, and other complications in diabetic patients. Diabetic patients are particularly vulnerable to the effects of stress on their blood pressure due to the underlying condition.

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Diabetes damages the blood vessels, making them less flexible and more prone to narrowing, which can lead to hypertension. Additionally, high blood sugar levels can damage the kidneys, which can further contribute to hypertension. Stress can exacerbate these effects, leading to higher blood pressure levels in diabetic patients. The blunting of blood pressure dipping is not a benign phenomenon, as exemplified by its link with augmented left ventricular mass. Thus, blood pressure non-dipping may explain the increased incidence of left ventricular hypertrophy found in diabetic patients irrespective of office blood pressure. Sleep-associated blood pressure decline (dipping) is decreased in diabetic patients. The cause of this circadian abnormality is probably related to microvascular diabetic complications and the accompanying latent volume overload. High blood pressure is often related to unhealthy lifestyle habits, such as smoking, drinking too much alcohol, being overweight and not exercising enough. Left untreated, high blood pressure can increase your risk of developing a number of serious long-term health conditions, such as coronary heart disease and kidney disease. Low blood pressure is less common. Some medicines can cause low blood pressure as a side effect. It can also be caused by a number of underlying conditions, including heart failure and dehydration. Hence, this study is conducted to assess the relationship between perceived stress and blood pressure in diabetic patients."

Materials and Methods

The study involved randomly selected diabetes patients and apparently healthy normal controls, both males and females aged between 40 to 50 years who were able to read and write English. Diabetic patients who had a history of treatment with either oral hypoglycemic or insulin for more than 1 year were included in the study. The participants were selected from the wards and medicine outpatient departments of Arunachala Diabetic Canter, Cowley Brown Road, R.S. Puram, Coimbatore, Tamil Nadu. All participants received an information sheet explaining the study, and after obtaining voluntary consent, they were given a two-part questionnaire to complete. The first part included sociodemographic data such as name, age, sex, address, and duration of diabetes mellitus. The second part included the Perceived Stress Scale questionnaire, which has 30 questions asking the participants about their feelings and thoughts during the last month. The participants had to indicate how often they felt that way in a 4-point Levenstein response format. Four of the items were

reverse-scored. The total score was calculated by summing the responses, and then the scores were categorized into low, medium, and high-level groups. Blood pressure was determined using systolic Blood Pressure and Diastolic Blood Pressure as measured in mmHg. Descriptive statistics such as mean and standard deviation were calculated, and one-way analysis of variance (ANOVA) was used to find significant differences between two variables. The post-scheffe's post hoc test was used to compare the variables between the groups. The results were analyzed using SPSS version 21, and the level of significance was set at 0.05. The findings were presented appropriately.

Statistical technique

The purpose of the present study was to find out the effect of stress on blood pressure in diabetic patients. The collected data were analyzed using suitable statistical techniques. Descriptive statistics such as mean and standard deviation were calculated. One-way analysis of variance (ANOVA) was used to determine the significant difference between the two variables, and post hoc Scheffe's test was used to compare the variables between the groups. The statistical analyses were interpreted, and the results and findings were presented properly. A significance level of 0.05 was chosen to test the obtained results on variables, which was considered sufficient for the present study.

Table 1: Descriptive statistics on Systolic Blood Pressure among varied level of stress

Variable	Category	Mean	Standard deviation
Systolic blood pressure (SBP)	High level	106.37	13.46
	Medium level	107.82	14.31
	Low level	112.57	11.46

Table 4.2 shows the results of descriptive analysis on systolic blood pressure (SBP) among diabetic patients with varying levels of stress. The mean and standard deviation of SBP in the high stress group were 106.37 and 13.46, respectively. The mean and standard deviation of SBP in the medium stress group were 107.82 and 14.31, respectively. Finally, the mean and standard deviation of SBP in the low stress group were 112.57 and 11.46, respectively.

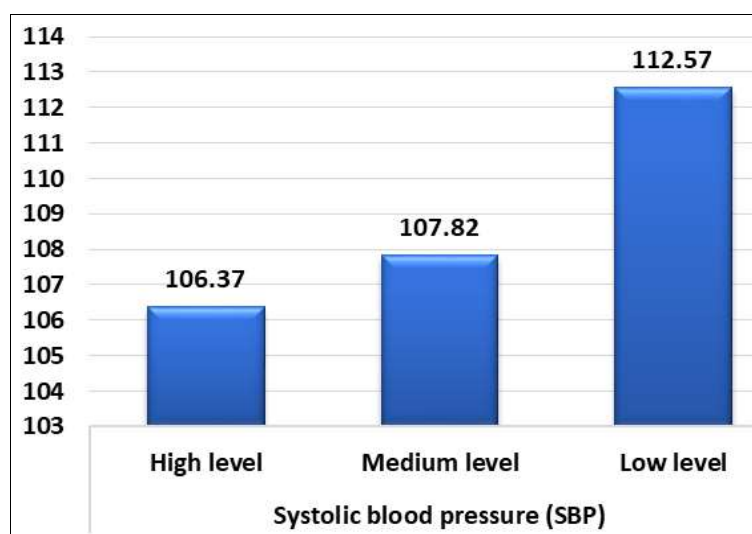
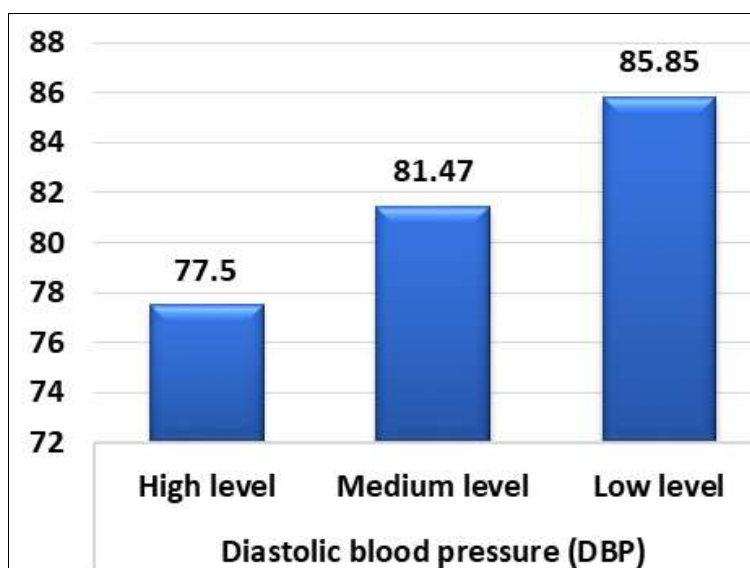


Fig 1: Bar diagram showing the mean difference diabetic patient on Systolic Blood Pressure

Table 2: Descriptive statistics Diastolic Blood Pressure among varied level of stress

Variable	Category	Mean	Standard deviation
Diastolic blood pressure (DBP)	High level	77.50	7.15
	Medium level	81.47	6.72
	Low level	85.85	6.91

Table 4.2 shows the descriptive statistics on Diastolic blood pressure of the Diabetic patients. The mean and standard deviation of Diastolic blood pressure in the high level of stress group are (77.50, 7.15), in the medium level of stress group are (81.47, 6.72), and in the low level of stress group are (85.85, 6.91), respectively.

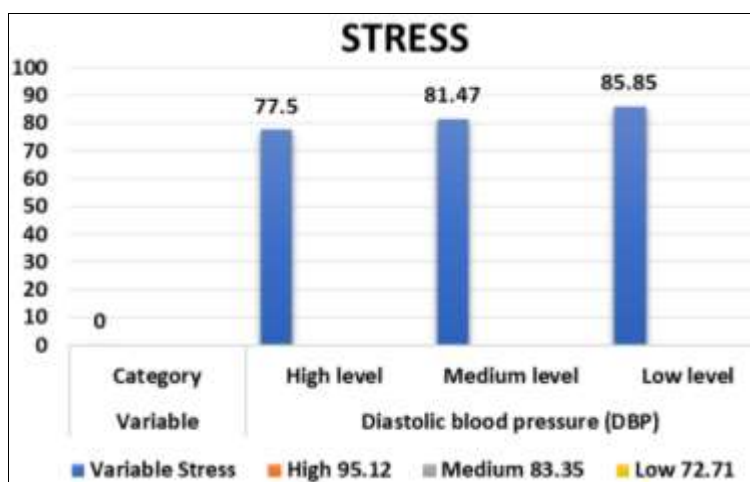
**Fig 2:** Bar diagram showing the mean difference between diabetic patient on Diastolic Blood Pressure**Table-3:** Analysis of post hoc result over the multiple comparisons on stress among the Diabetic Patient

Variable	High	Medium	Low	Mean Deference	Sig
Stress	95.12	83.35		11.77*	0.00
	95.12		72.71	22.41*	0.00
		83.35	72.71	10.63*	0.00

*Significant at 0.05 Level

Table 4.6 presents the post hoc results of multiple comparisons on stress among diabetic patients. The table

shows the mean differences and significance values for stress levels among patients with high, medium, and low stress. The asterisk (*) indicates significance at the 0.05 level. From the results, it was observed that there were significant mean differences in stress levels between the high and medium samples (11.77), high and low samples (22.41), and medium and low samples (10.63). The mean difference in stress between high and medium, and high and low were found to be significant.

**Fig 3:** Bar diagram showing the Analysis of post hoc result over the multiple comparisons on stress among the Diastolic Blood Pressure

Discussion

Diabetes is one of the causes of many deadly diseases. The number of diabetes cases is increasing day by day. It not only affects older people; in recent years, a large number of children and adolescents are prone to type-I diabetes, and it may increase in future years, as predicted by many researchers. India is also home to the second-largest number

of type-1 diabetes cases in the world. With the rising trajectory, more effective health policies have to be implemented to control the rapid growth of diabetes cases. Diabetes is multidimensional in its causes. It may be due to environmental, lifestyle, clinical, and genetic factors. Early detection is an important strategy to prevent and control diabetes. An epidemiological observational study with 39

participants revealed that individuals in the higher tertile of polyphenol consumption have lower systolic and diastolic blood pressure. It is widely recognized that people with diabetes who are regularly stressed are more likely to have poor blood glucose control. One of the reasons for this is that stress hormones such as cortisol increase the amount of sugar in our blood. High levels of cortisol can lead to conditions such as Cushing's syndrome, which is one of the lesser-known causes of diabetes: Stress can make it more difficult to control your diabetes, as it may throw off your daily routine and can result in wear and tear on your body. Hormones from stress increase your blood pressure, raise your heart rate, and can cause blood sugar to rise. High blood sugar can make you feel down or tired. The body produces a surge of hormones when in a stressful situation. These hormones temporarily increase blood pressure by causing the heart to beat faster and blood vessels to narrow. Stress can cause hypertension through repeated blood pressure elevations as well as by stimulation of the nervous system to produce large amounts of vasoconstriction hormones that increase blood pressure. If the blood pressure is taken while thinking about something that causes you to tense up or become stressed, the systolic and diastolic blood pressure could increase approximately 10 to 15 mm Hg and 4 to 8 mm Hg, respectively (Stephanic monk). Biomedical engineering BS, MS, identified ten factors that can temporarily elevate blood pressure readings. The rapid rise of the Indian middle class, coupled with sedentary lifestyle and a shift in dietary patterns, fuels the existing burden of this disease. Generally, it is accepted that stress itself is a potential cause of diabetes but when analyzing the varied levels of stress among diabetic patients, it has a relation to diastolic blood pressure. Because blood with high glucose levels travels through the body, it can cause widespread damage, including to the blood vessels and kidneys firstly, it causes the blood vessels to constrict, which increases resistance to blood flow and raises blood pressure. Secondly, it can increase heart rate, which also raises blood pressure. Finally, stress can stimulate the release of certain hormones, such as aldosterone and vasopressin, which can cause the kidneys to retain water and sodium, leading to an increase in blood volume and blood pressure these organs play a key role in maintaining healthy blood pressure. If they experience damage, blood pressure can rise, increasing the risk of further harm and complications. When finding the functional association of the stress level of diabetic patients with the Body Mass Index, Systolic Blood Pressure, and Diastolic Blood Pressure, only Diastolic Blood Pressure was loaded. This shows that there may be physiological changes in the body due to diabetes. Since the patients have chronic diseases, they are habituated to diabetes, and stress does not affect their physiological parameters much.

Conclusion

Diabetes is a prevalent non-communicable disease in India that typically affects people over the age of 40. A recent study found that individuals with diabetes who experience high, medium, or low levels of stress may experience a slight decline in their blood pressure. Therefore, it's crucial to detect these changes as early as possible through simple bedside tests and raise awareness among the public about these changes. Additionally, lifestyle modifications should be developed as interventions to prevent the progression of diabetes. This study highlights the importance of stress management in the management of blood pressure among diabetic patients. Healthcare professionals should consider

stress as a risk factor for blood pressure control and develop interventions to reduce stress in patients with diabetes. Further research is needed to investigate the long-term effects of stress on blood pressure and the efficacy of stress management interventions in improving blood pressure control among diabetic patients.

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