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Relationship between Stress Levels and Blood Sugar Levels in Diabetes Mellitus

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Abstract

Background: The relationship between stress and blood sugar levels in individuals with diabetes mellitus is complex and can be influenced by various factors. When a person experiences stress, whether physical or emotional, the body responds by releasing stress hormones, can contribute to insulin resistance, a condition where the body's cells become less responsive to the effects of insulin. Furthermore, stress may affect a person's ability to manage diabetes effectively. Chronic stress, if not managed, can have long-term effects on the body, potentially contributing to the development of complications associated with diabetes. It's important to recognize that the relationship between stress and blood sugar levels varies among individuals

Methods: We used descriptive analytic with cross sectional design. The population of this study were all patients with Diabetes Mellitus who were treated at the Internal Medicine Clcinic in Dr. Muhammad Zein general hospital Painan. The sample was taken as many as 79 respondents with accidental sampling technique. Data collection tool with documentation and questionnaire studies. Data analysis using chi square test.

Results: The result showed that more than half of 49 respondents (62.0%) have an abnormal blood sugar levels, more than half of 54 respondents (68.4%) with moderate stress levels and there is a relationship between moderate stress levels and blood sugar levels with a value of α 0.000 (p value <0.05).

Conclusion: The moderate stress levels are associated with increased blood sugar levels. The impacts of this study for nurses, that we must be able to review the psychosocial aspects of patients with diabetes mellitus and provide knowledge about diabetes mellitus either through direct counseling, dialogue, or through other information media such as posters, leafleats and social media.

Keywords: Stress level, Blood sugar level, Diabetes mellitus

Introduction

Diabetes Mellitus is a chronic metabolic disorder characterized by elevated blood glucose levels (hyperglycemia), resulting from an imbalance between the supply and the need to facilitate the entry of glucose into cells for metabolism and cell growth. The diminished or absence of insulin results in the retention of glucose in the blood, causing an increase in blood sugar, while cells experience a deficiency of glucose essential for their survival and function[1].

Diabetes Mellitus is divided into two types: Type I and Type II. Individuals with Type I diabetes require external insulin supply (exogenous insulin), such as injections, to sustain life. Without insulin, patients may experience diabetic ketoacidosis, a life-threatening condition resulting from metabolic acidosis. Individuals with Type II diabetes are resistant to insulin, a condition where the body or its tissues do not respond to the action of insulin. Consequently, these individuals must always manage their dietary patterns to prevent hypoglycemia or hyperglycemia, and this management continues throughout their lives[2].

The World Health Organization (WHO) predicts an increase in the number of individuals with diabetes, posing a global health threat. WHO anticipates a rise in the number of diabetes cases in Indonesia from 8.4 million in 2000 to approximately 21.3 million in 2030. This projection indicates a two to threefold increase in the number of diabetes cases by 2035. The International Diabetes Federation (IDF) also predicts an increase in diabetes cases in Indonesia from 9.1 million in 2014 to 14.1 million in 2035. The prevalence of diabetes is dominated by

undetected cases and those not taking medication, accounting for 73% of total diabetes cases in Indonesia. The remainder, detected cases, experience glucose disturbances at a rate of 10.2%[3].

The Pesisir Selatan District ranks 4th most (1.9%) prevalence of diabetes mellitus in West Sumatra. Dr. Muhammad Zein is the general hospital in the Pesisir Selatan district. Based on the medical record, the number of patients with diabetes mellitus who went to the Internal Medicine Polyclinic in 2016 was 330 people, in 2017 there were 372 people and in 2018 there were 293 peopleBased on the medical records of Dr. M Zein Painan Regional General Hospital, the number of diabetic patients seeking treatment at the Internal Medicine Clinic was 330 in 2016, 372 in 2017, and 293 in 2018[4]. The increasing number of diabetes patients may be attributed to various factors, including genetic/hereditary factors, obesity, lifestyle changes, improper dietary habits, medications affecting blood glucose levels, lack of physical activity, aging, pregnancy, smoking, and stress[5].

Previous study found that individuals with Type II diabetes experience stress symptoms resulting from the disease. As a chronic illness, diabetes often instills a sense of powerlessness in the affected individuals. Stressors due to chronic illness challenge the patient's ability to maintain emotional balance and self-satisfaction. Imbalances in this equilibrium lead to stress[6].

Stress is a nonspecific body response to any disrupted bodily need, a universal phenomenon occurring in daily life that cannot be avoided; everyone experiences it. Stress can have a total impact on an individual, affecting physical, psychological, intellectual, social, and spiritual aspects. Stress can threaten physiological balance[7].

Stress can accelerate the onset of diabetes mellitus. Type II diabetes can manifest after a person experiences illness or a stress-filled event[8]. An acceptable hypothesis regarding this relationship is the physiological response to stress, which can affect the hypothalamus-pituitary axis, influencing endocrine functions such as an increase in cortisol levels, which, in turn, exerts antagonistic effects on insulin function. This can adversely affect blood glucose control in individuals with diabetes mellitus, ultimately influencing the lifestyle of a diabetic patient.

Methods

The research used a descriptive-analytic design with a cross-sectional approach. A cross-sectional design is an analytical research design aimed at determining the relationship between variables, where the dependent variable in this study is the stress level, and the independent variable is the blood sugar level identified at a single point in time[9]. This research was conducted at the Internal Medicine Clinic of Dr. Muhammad Zein Painan Regional General Hospital. The study took place from March 11 to March 15, 2023.

The population in this study consists of all patients with Diabetes Mellitus receiving treatment at the Internal Medicine Outpatient Clinic of Dr. Muhammad Zein Painan Regional General Hospital. The total population that visited in the last three months from August to October 2022 was 879, with an average of 293 individuals per month.

The research sample was selected using accidental sampling, where individuals encountered by the researcher by chance were used as the sample. The analysis techniques employed include univariate and bivariate analyses using the Chi-square statistical test with a confidence level of 95% or a significance level of $p \leq 0.05$. If the p-value is ≤ 0.05, it indicates a significant relationship between the independent and dependent variables.

Results

Our study conducted in Dr. Muhammad Zein General Hospital Painan and have 79 samples. Table 1 showed the frequency distribution of blood sugar levels in patients with diabetes mellitus. Table 2 showed the frequency distribution of stress level in patient diabetes mellitus.

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Tabel 1. The frequency distribution of blood sugar levels in patients with diabetes mellitus.

Category	f	%
Normal	30	38.0
Increase	49	62.0
Total	79	100

Tabel 2. The frequency distribution of stress levels in patients with diabetes mellitus.

Category	f	%
Mild	25	31.6
Moderate	54	68.4
Total	79	100

Table 3. The statistical analysis of the relationship between stress level with blood sugar level in patient with diabetes mellitus using chi square test.

		Blood sugar level				Total	%	p-value
		Normal	%	Increase	%			
Stress level	Mild stress level	23	29.11	2	2.53	25	31.64	0.000
	Moderate stress level	7	8.86	47	59.5	54	68.36	
Total		**30**	**37.97**	**49**	**62.03**	**79**	**100**	

The table above shows that out of 25 respondents with mild stress, 23 respondents (29.11%) had normal blood sugar levels, and 2 respondents (2.53%) had abnormal blood sugar levels. From 54 respondents with moderate stress, 7 respondents (8.86%) had normal blood sugar levels, while 47 respondents (59.5%) had abnormal blood sugar levels.

The statistical test resulted in a p-value of 0.000. Since the p-value of 0.000 is less than 0.05, it can be concluded that the alternative hypothesis (Ha) is accepted, meaning "there is a relationship between moderate stress levels and abnormal blood sugar levels in patients with diabetes mellitus at the Internal Medicine Clinic of Dr. Muhammad Zein Painan General Hospital.

Discussions

The results of this study revealed that more than half of the 49 respondents (62.0%) had abnormal blood sugar levels. These findings align with a previous study, the majority of blood sugar levels were poor, with 34 respondents (71%) having poor levels, 12 respondents (25%) having moderate levels, and 2 respondents (4%) having good levels [10].

Blood sugar level is the amount or concentration of glucose present in the blood[2]. Several factors can influence the blood sugar levels of diabetes mellitus patients, such as diet, physical activity, diabetes medication usage,

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and stress. Insufficient physical activity can also lead to an increase in blood glucose levels. During physical activities, there is an increased utilization of glucose and muscle glycogen, resulting in a reduction in blood sugar levels as glucose is burned for energy during activity. Additionally, the frequency of the relationship between age and blood sugar levels is that as age increases, the likelihood of someone developing diabetes becomes greater. When over 50 years old, the likelihood of developing diabetes reaches 20-25%[3].

The researcher's analysis indicates that the high blood sugar levels in respondents are related to their educational background. Among the 79 respondents, less than half (45.6%) had basic education, with 36 respondents facing limitations in accessing more information about diabetes mellitus and diabetic diets due to their educational background. Lack of information becomes a cause of ignorance about diabetic diets. This is supported by questionnaire results showing that out of 79 respondents, 49 respondents (62%) had abnormal blood sugar levels.

Stress is a stimulus or situation that causes distress and creates psychological and physical demands on an individual. Stress requires coping and adaptation[4]. Factors influencing stress include genetics, life experiences, sleep, diet, body posture, illnesses, perceptions, emotions, psychological situations, physical environment, biotic, and social factors[3]. Stress occurring in diabetes mellitus patients can increase blood sugar levels through increased sympathetic stimuli. Stress can also increase appetite, making patients very hungry, especially for carbohydrate and fat-rich foods, making stress the most dangerous enemy for diabetes mellitus patients, as it can lead to uncontrolled blood sugar levels[5].

The researcher's analysis suggests that stress can trigger an increase in blood sugar levels in the body. The higher the stress caused by problems such as economic issues and dependence on others, the more likely it is for blood sugar levels to rise. This is evidenced by the fact that out of 79 respondents, less than half (39.2%) were unemployed, with 31 respondents facing economic challenges. This situation exacerbates the existing health conditions. Patient readiness psychologically and family support play a crucial role in preventing more severe stress. The questionnaire results showed that 67.9% of respondents often became angry over trivial matters, 64.56% had difficulty relaxing and unwinding, and 59.49% often became easily angered, while 59.49% had difficulty calming down after something disturbing.

The chi-square statistical test yielded a p-value of 0.000. Since the p-value of 0.000 is less than 0.05, it can be concluded that the alternative hypothesis (Ha) is accepted, meaning "there is a relationship between stress levels and blood sugar levels in patients with diabetes mellitus at the Internal Medicine Outpatient Clinic of Dr. Muhammad Zein Painan Regional General Hospital. Stress causes excessive production of cortisol, a hormone that counteracts the effects of insulin and leads to high blood sugar levels. During intense stress, the body produces more cortisol, reducing the body's sensitivity to insulin. Cortisol is an antagonist to insulin, making it more difficult for glucose to enter cells and increasing blood sugar levels[9].

The researcher's analysis suggests that the stress levels experienced by respondents result from changes, both physical and psychological, within themselves. Stress accompanied by other emotional attitudes affects the compliance or non-compliance of diabetes management by diabetes patients. The higher the stress, the more emotional problems diabetes mellitus patients experience. This condition is related to the weakening of the adherence of diabetes mellitus patients to treatment management, resulting in an increase in blood sugar levels. However, some respondents experiencing moderate stress had normal blood sugar levels. This occurred because they adhered to diabetes therapy, followed a diabetic diet even when stressed. Meanwhile, respondents with mild stress and an increase in blood sugar levels did not make an effort to control blood sugar levels, rarely engaged in physical activity, did not take medication regularly, and did not adhere to a diabetic diet.

Conclusions

This study showed that the moderate stress levels are associated with increased blood sugar levels. The hope is that this research can be used as a reference in studies on the relationship between stress and blood sugar levels in patients with diabetes mellitus. For nurses, it is essential to assess the psychosocial aspects of patients with diabetes mellitus and provide knowledge about diabetes mellitus through direct counseling, dialogue, or

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other informational media such as posters, leaflets, and so on. In this study, only a questionnaire was used for primary data collection without accompanying observations. Therefore, it is recommended for future researchers to enhance the study with a more comprehensive method, including data collection not only through questionnaires but also through observations of behavior and in-depth interviews to obtain better results.

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Declarations of competing interest

No potential competing interest was reported by the authors.

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