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ORIGINAL ARTICLE

Effect of Ergonomic Exercise on Blood Glucose Levels and Anxiety in Type 2 Diabetes Mellitus Patients.

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ABSTRACT

Introduction: *The majority of DM patients have less knowledge about DM disease, including how to control blood sugar levels and lack of awareness of healthy living behavior, which is one of the causes of complications of DM disease, namely how to control blood glucose levels to avoid complications and this makes The patient becomes anxious about these complications.* ***Objectives:*** *To determine the effect of ergonomic exercise on blood glucose levels and anxiety of clients with type 2 diabetes mellitus at the Jatibanteng Health Center Situbondo.* ***Methods:*** *This research method uses a quasi-experimental design. The population in this study were 150 diabetes mellitus patients at the Jatibanteng Situbondo Health Center. Samples were taken using purposive sampling technique as many as 109 respondents. Data were collected with the HARS scale questionnaire instrument for anxiety and GDA examination for the patient's blood sugar levels and tested by paired t test.* ***Results:*** *The results showed that there was a decrease in the average score in the experimental group by 19,783 greater than the control group = 6,633 so this indicated that ergonomic strings were more effective in reducing anxiety in people with diabetes mellitus. Based on the results of the Kolmogorov Smirnov normality test, it showed a value of $\rho > \alpha = 0.05$ so that the data was normally distributed and the test used was the paired t test as a parametric test. The results of the paired t test showed a significant value for both groups $\rho = 0.000 < \alpha = 0.05$ so that H0 was rejected and H1 was accepted, meaning that there is an effect of ergonomic gymnastics on the anxiety of diabetes mellitus patients at the Jatibanteng Health Center Situbondo.* ***Conclusions:*** *Ergonomic gymnastics can be used as an alternative to providing physical exercise for people with diabetes mellitus.*

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A. Introduction

Diabetes Mellitus is a progressive chronic disease characterized by the body's inability to metabolize carbohydrates, fats, and proteins, leading to hyperglycemia (high blood glucose levels). Diabetes Mellitus is known as a "silent killer" because it can affect all body organs and cause a variety of symptoms (Elsi Jerau & Arif, 2017). If not properly managed, the disease can lead to serious complications and death. Physical exercise is a lifelong necessity for diabetes mellitus patients. This condition often results in anxiety among individuals with diabetes mellitus (Anggraini & Intan, 2022).

Diabetes Mellitus (DM) has a high prevalence. According to the International Diabetes Federation (IDF) Atlas 2021, the IDF reported that 537 million adults (aged 20 - 79 years) or 1 in 10 people live with diabetes worldwide. Diabetes also causes 6.7 million deaths, or one death every 5 seconds. China has the highest number of diabetes patients globally, with 140.87 million people in 2021. Indonesia ranks fifth with 19.47 million diabetes patients. With a population of 179.72 million, the prevalence of diabetes in Indonesia is 10.6%. According to the Basic Health Research (Riskesdas) data, there are 10 million diabetes patients and 17.9 million people at risk of developing the disease. East Java Province is among the top 10 regions in Indonesia for diabetes prevalence, ranking ninth with a prevalence rate of 6.8% (Ministry of Health, 2022). The estimated number of Diabetes Mellitus cases in Situbondo Regency in 2021 was 17,386 individuals (3.1% of those aged ≥15 years), placing the regency at the 18th position. Health service data for Diabetes Mellitus patients in Situbondo Regency in 2021 reached 16,619 individuals (Situbondo Health Office, 2021). Preliminary studies conducted by the researcher indicated that the majority of DM patients at Puskesmas Jatibanteng Situbondo are farmers with limited knowledge about DM, including how to control blood glucose levels and awareness of healthy lifestyle behaviors. This contributes to DM complications. The aim of this study is to reduce DM complications through non-pharmacological treatment using ergonomic exercises.

Anxiety in type 2 DM patients is a complex issue influenced by various life factors. This anxiety can affect glucose control efforts and can lead to frustration, anger, overwhelm, and despair. If not properly addressed, this anxiety can exacerbate the management of type 2 DM and impose long-term psychological burdens on patients and their families, including high costs that may complicate type 2 DM management (Puspitaningsih, 2017). Research by Hayati indicates a relationship between the duration of type 2 DM and anxiety levels. The anxiety experienced by type 2 DM patients is due to fear of potential complications, limited information about type 2 DM, and feelings of uncertainty, despair, stress, and nervousness after diagnosis (Fathoni et al., 2019).

Efforts to address anxiety and lower blood glucose levels in diabetes mellitus patients can be achieved through both pharmacological and non-pharmacological therapies. Pharmacological therapy includes the administration of oral hypoglycemic agents such as Glibenclamide, Glimepiride, Gluquidon, Gliclazide, Glipizide, as well as antidepressants like Imipramine and Doxepin. Non-pharmacological therapy includes dietary management (carbohydrates, proteins, fats) and physical exercise. Ergonomic exercise is a type of physical activity that can be performed daily or at least 2-3 times a week. Through ergonomic exercise, diabetes mellitus patients can alleviate anxiety, improve blood circulation, stimulate hormone release (endorphins, endogenous opioids), and lower blood glucose levels. The benefits of ergonomic exercise include reducing distress and lowering blood glucose levels in diabetes mellitus patients (Hasina et al., 2023).

B. Methods

This study employs a quasi-experimental research design with a pretest and posttest control group approach. The population for this research consists of 150 diabetes mellitus patients at Puskesmas Jatibanteng Situbondo, with a sample size of 109 respondents. The study has two variables: the independent variable is ergonomic exercise therapy, while the dependent variables are reduction in anxiety and blood glucose levels. Data collection involved gathering all prospective respondents at one time. Initial data were obtained through intervention and observation using a questionnaire with the HRS-A scale. The questionnaire consists of a closed-ended survey with 14 questions developed by Nixson, using the HRS-A scale. The ergonomic exercise therapy was implemented according to the ergonomic exercise guidelines. The research was conducted at Puskesmas Jatibanteng Situbondo and took place in July 2023. After data collection, data analysis was performed using a paired t-test.

C. Results and Discussion

1. The effect of ergonomic exercise on blood sugar levels in patients at the Jatibanteng Situbondo Community Health Center.

Based on Table 1, there is a decrease in the average blood glucose levels in the experimental group of 55.580, which is greater than the decrease in the control group of 18.383. This indicates that ergonomic exercises are more effective in reducing blood glucose levels in patients with diabetes mellitus. The results of the Kolmogorov-Smirnov normality test show that the p-value > α = 0.05, indicating that the data is normally distributed and the paired t-test, a parametric test, was used. The paired t-test results show a significance value for both groups of ρ = 0.000 < α = 0.05, leading to the rejection of H0 and acceptance of H1. This means that ergonomic exercises have a significant effect on the blood glucose levels of diabetes mellitus patients at Puskesmas Jatibanteng Situbondo.

Table 1.
Results of the paired t test The effect of ergonomic exercise on blood sugar levels in patients at the Jatibanteng Situbondo Community Health Center in August 2023

Group	Mean Pretest	Mean Postest	Mean Difference	Std Deviasi	Signifikansi
Eksperimen	204.40	148.55	55.850	12.153	0.000
Kontrol	204.40	185.87	18.383	18.692	0.000

Source: Processed Primary Data, 2023

Based on Table 1, there is a decrease in the average blood glucose level in the experimental group of 55.580, which is greater than the decrease in the control group of 18.383. This suggests that ergonomic exercises are more effective in reducing blood glucose levels in patients with diabetes mellitus. The results of the Kolmogorov-Smirnov normality test show that the p-value > α = 0.05, indicating that the data is normally distributed, and thus, the paired t-test, a parametric test, was used. The paired t-test results show a significance value for both groups of ρ = 0.000 < α = 0.05, leading to the rejection of H0 and the acceptance of H1. This indicates that ergonomic exercises have a significant effect on the blood glucose levels of diabetes mellitus patients at Puskesmas Jatibanteng Situbondo.

The Wilcoxon test results indicate that in the experimental group that was given ergonomic exercises, the mean rank of blood glucose levels in the pre-test and post-test was 30.5, with all respondents experiencing a decrease in blood glucose levels. In the control group, the mean rank of blood glucose levels in the pre-test and post-test was 20.5, and 20 respondents showed no change in blood glucose levels. The Wilcoxon test results

suggest that ergonomic exercises are more effective for patients with diabetes mellitus in reducing blood glucose levels.

This study's findings are supported by research conducted by Nurmalika, which demonstrated that after performing ergonomic exercises, participants Ny. M and Ny. S were able to manage hyperglycemia in elderly patients with diabetes mellitus. For instance, Ny. M had a blood glucose level of 385 mg/dl before engaging in ergonomic exercises, which decreased to 364 mg/dl after the exercises. Similarly, Ny. S had a blood glucose level of 230 mg/dl before the exercises, which reduced to 203 mg/dl afterward (Nurmalika, 2019).

Ergonomic exercises are a combination of muscle movements and breathing techniques. These exercises can prevent and treat various diseases because they optimize muscle movement, allowing the muscles to absorb more blood glucose for energy production, thereby reducing blood glucose levels towards normal. Ergonomic exercises are recommended as a routine practice at least 2-3 times a week to provide physiological benefits, including improved physical fitness and reduced blood glucose levels.

The researchers propose that ergonomic exercises are an alternative method for managing and preventing complications associated with diabetes mellitus. By implementing ergonomic exercises, patients with diabetes mellitus can maintain stable blood glucose levels and prevent complications related to the disease. Ergonomic exercises involve several stages of movement, including warm-up, core, and relaxation phases. These stages help respondents by initially enhancing muscle contraction in the first and second phases and then allowing muscles to relax in the third phase after being used in activities. During muscle contraction, glucose metabolism occurs, and glucose is burned as muscle energy, transferring glucose from the blood to the muscles during and after exercise, thus lowering blood glucose levels. Furthermore, physical exercise stimulates insulin to work by opening the pathway for glucose to enter cells that require energy during physical activity

2. The influence of ergonomic exercise on patient anxiety at the Jatibanteng Situbondo Community Health Center.

Based on Table 2, there is a decrease in the average anxiety levels in the experimental group of 19.783, which is greater than the decrease in the control group of 6.633. This indicates that ergonomic exercises are more effective in reducing anxiety in patients with diabetes mellitus. The results of the Kolmogorov-Smirnov normality test show that the p-value > α = 0.05, indicating that the data is normally distributed. Consequently, the paired t-test, a parametric test, was used. The paired t-test results show a significance value for both groups of ρ = 0.000 < α = 0.05, leading to the rejection of H0 and acceptance of H1. This means that ergonomic exercises have a significant effect on the anxiety levels of diabetes mellitus patients at Puskesmas Jatibanteng Situbondo.

Table 2.
Results of the paired t test The effect of ergonomic exercise on patient anxiety at the Jatibanteng Situbondo Health Center in August 2023.

Group	Mean Pretest	Mean Postest	Mean Difference	Std Deviasi	Signifikansi
Eksperimen	36.93	17.15	19.783	8.847	0.000
Kontrol	36.80	30.17	6.633	7.638	0.000

Source: Processed Primary Data, 2023

Based on Table 2, the experimental group experienced a greater decrease in the average anxiety levels, with a reduction of 19.783 compared to the control group's reduction of 6.633. This indicates that ergonomic exercises are more effective in reducing anxiety in patients with diabetes mellitus. The Kolmogorov-Smirnov normality test results show that the p-value > α = 0.05, indicating that the data is normally distributed. Consequently, the paired t-test, a parametric test, was used. The paired t-test results indicate a significance value of ρ = 0.000 < α = 0.05 for both groups, leading to the rejection of H0 and the acceptance of H1. This suggests that ergonomic exercises have a significant effect on the anxiety levels of diabetes mellitus patients at Puskesmas Jatibanteng Situbondo.

The Wilcoxon test results revealed that in the experimental group that received ergonomic exercises, the mean rank of anxiety levels in the pre-test and post-test was 29.5, with only two respondents showing no change in anxiety levels. In contrast, the control group had a mean rank of 16.5, with 28 respondents showing no change in anxiety levels. These results suggest that ergonomic exercises are more effective in reducing anxiety in patients with diabetes mellitus (Cahyani, 2019).

Ergonomic exercises are a technique aimed at restoring or correcting the position and flexibility of the nervous system and blood flow, maximizing blood supply to the brain, and enhancing various bodily systems, including intelligence, sweating, uric acid metabolism, cholesterol, blood sugar, lactic acid, oxalate crystal conversion, carbohydrate conversion, electrolyte or ozone production in the blood, physical fitness, and immune system defenses against negative energy or viruses. By activating these health systems, individuals can be protected from early-onset dementia, breast cancer, prostate cancer, migraines, stress, cholesterol, diabetes mellitus, and other conditions (Fitriani & Fadilla, 2020).

Another study by Angraini et al. showed that the average difference in anxiety levels between the pre-test and post-test in the ergonomic exercise intervention group was 5.61, with a pre-test standard deviation of 2.981 and a post-test standard deviation of 2.831. The paired sample t-test analysis resulted in a t-value of 6.674 and a significance p-value of 0.000, which is less than or equal to p ≤ 0.05 (Anggraini & Intan, 2022).

According to the researchers' assumptions, implementing physical or fitness training, such as ergonomic exercises, can serve as an alternative program for diabetes mellitus patients to maintain stable blood glucose levels, thereby preventing complications associated with their current condition. The movements in ergonomic exercises combine muscle movements with breathing techniques. The breathing technique, performed in conjunction with muscle movements using the diaphragm, allows for a gradual lifting of the abdomen and full chest expansion. This exercise benefits the heart by providing a gentle massage effect, clearing blockages, improving blood flow to the heart, and enhancing circulation throughout the body. Increased blood flow boosts the supply of oxygen and nutrients to body organs. Increased oxygen levels in the brain can stimulate serotonin production, promoting relaxation and better sleep quality. This, in turn, provides a sense of calm and comfort for diabetes mellitus patients, helping to alleviate their anxiety related to their condition.

D. Conclusion

The average blood glucose level of respondents at Puskesmas Jatibanteng Situbondo before undergoing ergonomic exercises was 204, with a standard deviation of 10.804, a minimum blood glucose level of 190, and a maximum of 230. After participating in ergonomic exercises,

the average blood glucose level dropped to 148.5, with a standard deviation of 8.510, a minimum of 130, and a maximum of 160. In the control group at Puskesmas Jatibanteng Situbondo, the average blood glucose level before the study was also 204, with a standard deviation of 10.707, a minimum blood glucose level of 190, and a maximum of 230. After the study, the control group's average blood glucose level was 185.87, with a standard deviation of 14.220, a minimum of 155, and a maximum of 205.

The average anxiety level of respondents in the experimental group at Puskesmas Jatibanteng Situbondo before ergonomic exercises was 36.93, with a standard deviation of 7.609, a minimum anxiety level of 26, and a maximum of 51. After the ergonomic exercises, the average anxiety level dropped to 17.15, with a standard deviation of 4.218, a minimum of 8, and a maximum of 28. In the control group, the average anxiety level before the study was 36.8, with a standard deviation of 7.281, a minimum anxiety level of 26, and a maximum of 51. After the study, the control group's average anxiety level was 30.17, with a standard deviation of 6.129, a minimum of 20, and a maximum of 47.

The paired t-test results for blood glucose levels showed a significance value of $\rho = 0.000 < \alpha = 0.05$ for both groups, leading to the rejection of H0 and the acceptance of H1. This indicates a significant effect of ergonomic exercises on the blood glucose levels of diabetes mellitus patients at Puskesmas Jatibanteng Situbondo. Similarly, the paired t-test results for anxiety levels also showed a significance value of $\rho = 0.000 < \alpha = 0.05$ for both groups, leading to the rejection of H0 and the acceptance of H1, indicating a significant effect of ergonomic exercises on the anxiety levels of diabetes mellitus patients at Puskesmas Jatibanteng Situbondo.

The findings of this study can be utilized by diabetes mellitus patients to lower their blood glucose levels through regular ergonomic exercises, which help stabilize blood sugar levels. For Puskesmas Jatibanteng Situbondo, it is recommended that ergonomic exercises be adopted as a program or activity to maintain the health of diabetes mellitus patients. Future researchers can replicate this study by adding different variables, increasing the frequency of sessions, and conducting daily observations to further confirm that physical exercise or ergonomic exercise therapy can lower blood glucose levels.

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