

Original Research Article Outline:**ASSESSMENT OF THE EFFECTS OF PROGRESSIVE MUSCLE RELAXATION AND LEMON AROMATHERAPY ON BLOOD SUGAR LEVELS IN PATIENTS WITH TYPE 2 DIABETES MELLITUS**

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ABSTRACT

Introduction: Individuals with diabetes mellitus must adhere to a series of examinations, which includes blood sugar monitoring. The effects of progressive muscle relaxation and lemon aromatherapy on blood sugar levels in individuals with type 2 diabetes are compared in this study as non-pharmacological interventions for controlling or lowering blood sugar increase that persons with diabetes mellitus can conduct on their own at home.

Method: The methodology of pre-experimental research is used. The study population consists of 36 volunteer diabetes patients who are divided into two groups using simple random sampling. The dependent variable is the blood sugar levels of patients with type 2 diabetes. The independent variables in this study are progressive muscle relaxation and lemon aromatherapy. The Wilcoxon signed-rank test & Mann-Whitney test is used to examine the data in order to determine the significance of the comparison between two sets of correlated data using ratio-shaped data. **Results & Analysis:** With a p-value of 0.016, progressive muscle relaxation is helpful in reducing blood sugar levels. Likewise, using lemons in aromatherapy decreases blood sugar levels (p-value = 0.028). However, the comparison results show that, with a p-value of 0.012, progressive muscular relaxation works better than lemon aromatherapy. **Discussion:** Both interventions involve relaxation techniques that block stress input and promote physiological calm in order to slow down heartbeats and boost the release of insulin hormones into the bloodstream, which is required for managing blood sugar. It is suggested that future research combine the two medicines to obtain more comprehensive findings.

Keywords: Blood Sugar Levels, Diabetes Mellitus, Lemon Aromatherapy, Progressive Muscle Relaxation.

INTRODUCTION

Most type 2 diabetes occurrences in Indonesia are brought on by poor lifestyles and inactivity, which interfere with the body's ability to metabolize glucose and use it as fuel (Veridiana and Nurjana, 2019). This is because insulin resistance or insufficient insulin prevent glucose from entering cells in the blood, which leads to persistently high blood glucose levels (Imelda, 2019). Diabetes

has emerged as the most deadly comorbidity during the pandemic due to its increased risk of serious consequences from a Corona virus infection. Many people are compelled to complete all tasks indoors due to the pandemic's restrictions on outdoor activities, which results in a sedentary lifestyle and disregard of lifestyle management-including physical activity, which is essential for balancing blood sugar levels and a sedentary lifestyle (Bistara, DN.,

Susanti S., Wardani, EM., Krisnawati, DI., Satiti, 2022). Furthermore, a lot of people with diabetes do not know that non-pharmacological methods, such as aromatherapy and relaxation techniques, can be used to reduce blood sugar (Bistara, D.N. and Susanti, 2022). Aromatherapy is beneficial because it stimulates the senses with pleasant, fresh scents that have a powerful emotional impact and influence other organs (Harismayanti, Retni and Diliham, 2023). However, because they believe it to be ineffective, the majority of diabetic patients do not use this management (Bistara *et al.*, 2022).

In Indonesia, the percentage of people with diabetes has climbed to 6.2% during the pandemic; by 2020, there will be over 10.8 million diabetics in the country. At 10.7 million, Indonesia is rated 7th out of 10 countries with the greatest number of sufferers. With an 11.3% diabetes prevalence, Indonesia is included in Southeast Asia, which comes in third place. The findings of a study carried out in the Surabaya region in 2021 revealed that 12 of the respondents the researcher spoke with that they had never engaged in any kind of physical exercise, including progressive muscle relaxation or using lemon aromatherapy.

Insulin resistance is the main cause of diabetes mellitus. A condition known as insulin resistance denotes the body's inability to react to insulin as it should (Nolan and Prentki, 2019). Obese or overweight people typically experience this. To enable glucose to enter the body's cells and be converted into energy, the hormone insulin is required. When the body loses its ability to respond to insulin, glucose eventually accumulates in the bloodstream and raises blood sugar levels because it is unable to enter the cells of the body and be converted into energy (Mukhtar, Y., Galalain, A. and Yunusa, 2020). PERKENI (2011) states that the five pillars of diabetes mellitus disease management are nutritional

control, physical activity, medication, glucose monitoring, and education. The basic approach to managing diabetes mellitus involves changing one's lifestyle for the better, such as attempting to reach a healthy body weight or adhering to a special diabetes diet. Food is the primary factor linked to elevated blood glucose levels in diabetic patients, particularly after eating, which can aid in the body's breakdown of carbs or increase energy use (Susanti & Bistara, 2020).

It's crucial that patients with diabetes mellitus adhere to a number of tests, including blood sugar control. Low blood sugar control compliance can lead to uncontrolled blood sugar levels in diabetics, which can lead to consequences (Susanti and Bistara, 2018). Maintaining blood sugar control poses a significant challenge in order to prevent subjective symptoms that could result in problems. If diabetes mellitus is not managed well, it can cause a number of problems. Diabetes mellitus has two types of complications: acute complications and chronic problems. Microvascular and macrovascular problems are the two types of chronic complications. Microvascular problems include retinopathy, nephropathy, and neuropathy; macrovascular complications include coronary heart disease, cerebral vascular disease, and peripheral vascular disease. Retinopathy is the term for damage to the retina that can cause either temporary or permanent blindness. Patients with diabetic nephropathy face the ultimate danger of kidney failure as a result of this complication (Bernando, A., Siregar, J. and Syafril, 2023).

The planning and management of diabetes mellitus involves two main approaches to treatment: pharmacology and nonpharmacology therapy. Meal planning and exercise are examples of nonpharmacological management, which is the initial stage in managing diabetes mellitus. The use of medications or pharmacology is the next step if the

stated diabetes control goals are not met after these stages (Nurhafiza, C.S. and Saputra, 2023). One supplementary alternative therapy that helps sick individuals recover is nonpharmacological therapy. It works by making patients feel better physically and mentally while also promoting recovery. Aerobic exercise, gradual relaxation, deep breathing techniques, hypnosis, musical relaxation, and aromatherapy are a few nonpharmacological approaches. One kind of stress management exercises for patients is progressive muscle relaxation, which helps them unwind, become more at ease, and less stressed, angry, or anxious. This progressive relaxation technique uses a gradual, ongoing practice approach (Putriani, 2018).

Aromatherapy is a type of complementary therapy that uses volatile plant liquid components, often known as essential and aromatic oils, to treat mental and physical health issues without the use of pharmaceuticals. Another application for aromatherapy is as a tool for relaxation. The fast-paced, time-constrained lifestyle of today makes downtime extremely rare. Refreshing aromatherapy is a useful tool for mental clarity, comfort, stress relief, and relaxation. Aromatherapy is classified as complementary therapy in the medical industry, which is therapy that is utilized in addition to traditional therapy. Some examples of aromatherapy include the use of avocado as a skin filter, lavender for pain relief, peppermint for nausea relief, and lemon for its flavonoids, which are thought to lower blood sugar levels (Putriani, 2018).

Lemon aromatherapy also helps with colds (fever), sore throats, and heat reduction. Lemon is frequently used in steam aromatherapy or as a massage oil. Lemon can be used as a massage oil to relieve infected lymph node congestion. Research indicates that vaporizing lemons in a room improves memory and

increases job concentration by calming the muscles. According to research by Penelitan Harismayanti et al., 2023, aromatherapy has a good impact since it stimulates sensory receptors and influences other organs, resulting in a powerful emotional impact.

As a result, scientists are interested in carrying out a study titled "Comparison of the Effectiveness of Progressive Muscle Relaxation and Lemon Aromatherapy on Blood Sugar Levels of Patients with Type 2 Diabetes" as a non-pharmacological method that individuals with type 2 diabetes mellitus can independently perform at home to control or lower blood sugar rises.

METHOD AND ANALYSIS

The study design compares the effects of progressive muscle relaxation and lemon aromatherapy on reducing blood sugar levels using a pre-experimental, two-group pre-post design technique. The study's population consisted of 36 diabetics who agreed to participate as respondents, and they were split into two groups using a straightforward random sample procedure. The blood sugar level of type 2 DM patients is the dependent variable. In this study, Progressive Muscle Relaxation and Lemon Aromatherapy serve as independent factors.

The researcher's data collection sheet served as the dependent variable instrument for data collection. Blood glucose levels, gender, and age characteristics were all listed on this data collection sheet. The device that measures blood glucose at random using bio-physiological measurements made with a glucometer. To ascertain whether there were any variations in blood sugar levels before and after (pre-test and post-test) receiving progressive muscle relaxation and receiving lemon aromatherapy, data were analyzed using the Wilcoxon signed rank test. The

significance of comparing two groups of correlated data with ratio-shaped observational data (pre- and post-test) is assessed using the Mann-Whitney test, which is also used to examine variations in the effects of progressive muscle relaxation and lemon aromatherapy on the stability of blood sugar levels in diabetes mellitus patients.

Research ethics is a process that entails social, legal, and professional obligations for research participants. Before conducting this study, researchers informed respondents in addition to following ethical guidelines. Respondents were contacted by researchers to explain the findings. Included in the explanation were the following: protecting the privacy of data, compensating for unexpected events, rewards and hazards associated with the research, processes followed, and the researcher's responsibilities. Once again, the researcher inquired if anyone would be interested to take part in the study. Informed consent was requested from respondents as primary data was gathered. Following confirmation that all the data is complete, it will be processed and evaluated in accordance with the goals of the study.

RESULT

Table 1 Respondent Characteristics

No.	Data Source	Characteristics of Respondents			
		Treatment Group 1		Treatment Group 2	
		N	%	N	%
1	Gender characteristics				
	Male	5	28	4	22
	Female	13	72	14	78
	Total	18	100	18	100
2	Age characteristics				
	age <40 years	1	6	4	22
	age 50-60	5	28	6	33
	age >60 years	12	67	8	44

	Total	18	100	18	100
3	Latest Education				
	Elementary School		0	1	6
	Junior High School	5	28	7	39
	Senior High School	8	44	10	56
	College	5	28	-	0
	Total	18	100	18	100
4	Characteristics of respondents based on medication routine				
	Routine	5	28	8	44
	Not Drinking	13	72	10	56
	Total	18	100	18	100
5	Characteristics of respondents based on length of illness				
	> 5 Years	13	72	4	22
	< 5 Years	5	28	14	78
	Total	18	100	18	100

According to Table 1's age-based characteristics, 12 respondents, or 67% of the sample, have diabetes mellitus and are older than 60. Gender-specific characteristics of the responses revealed that 13 persons, or 72% of the total, were female. Features of responders according to educational attainment: eight persons, or 44% of the total, have only completed high school. Features of respondents based on medication routines: 13 respondents (72%), or the majority, regularly take diabetes medication. Features of respondents based on how long they have had diabetes mellitus: 13 persons (72%), or the majority, have had the disease for more than five years.

Table 2 Characteristics of Respondents Before and After Intervention in Treatment Groups 1 and 2

No	Characteristics of Respondents Before and After the Intervention				
1	After being given progressive muscle relaxation	Blood sugar before intervention		Blood sugar after intervention	
		N	%	N	%

intervention					
Normal	4	22	13	72	
Hypoglycemia	-	0	-	0	
Hyperglycemia	14	78	5	28	
Total	18	100	18	100	
<i>Wilcoxon Signed Rank Test, p-value = 0.016</i>					
2	After the lemon aroma therapy intervention	Blood sugar before intervention		Blood sugar after intervention	
		n			
		N	%	N	%
	Normal	2	11	7	39
	Hypoglycemia	-	0	-	0
	Hyperglycemia	16	89	11	61
	Total	18	100	18	100
<i>Wilcoxon Signed Rank Test, p-value = 0.028</i>					

Table 3 Differences in Blood Sugar Levels of Treatment Group 1 and Treatment Group 2

Group	Mean
First treatment	257,4
Second treatment	218,7

Mann-Whitney U Test ; p = 0,012

The study findings indicate that following two weeks of Progressive Muscle Relaxation, once a day, the researchers measured the blood sugar levels of the participants. After the intervention, 4 people (22% of the total) fell into the normal category (blood sugar levels between 80 and 199 mg/dL); 13 people (72% of the total) received the intervention; no respondents fell into the hypoglycemia category (blood sugar levels between 80 and 199 mg/dL); and 5 people (28% of the total) fell into the hyperglycemia category (blood sugar levels exceeding 200 mg/dL).

DISCUSSION

According to Table 1's age-based characteristics, 12 respondents, or 67% of the sample, have diabetes mellitus and are older than 60. Gender-specific characteristics of the responses revealed that 13 persons, or 72% of the total, were female. Features of responders according to educational attainment: eight persons, or 44% of the total, have only completed

high school. features of respondents based on medication routines: 13 respondents (72%), or the majority, regularly take diabetes medication. features of respondents based on how long they have had diabetes mellitus: 13 persons (72%) are among the respondents who have had the disease for more than five years.

Age is a risk factor for diabetes mellitus and influences the condition itself. An increased age also increases the chance of having diabetes mellitus. Rochman asserts that the incidence of diabetes rises with age. You'll have poorer glucose tolerance as you age. elevated blood glucose levels in elderly adults with insulin resistance brought on by dietary modifications, altered body composition, decreased exercise, and impaired neurohormonal function (Istianah, I., Haerunnisa, H. and Hapipah, 2022). Gender is another risk factor that influences the development of diabetes mellitus; women are more likely than males to develop the disease. Taylor claims that this is brought on by a drop in estrogen hormone levels brought on by menopause. Progesterone helps to stabilize blood sugar levels and facilitates the use of fat as energy, while estrogen primarily serves to maintain blood sugar balance and promote fat storage. Insulin triggers an action in the estrogen hormone. Women are more likely than men to develop diabetes mellitus (DM) because blood glucose fluctuations are brought on by changes in estrogen hormone levels after menopause (Widari, 2022).

The degree of education can influence a person's capacity, knowledge, and behavior in implementing healthy living behaviors, particularly in controlling blood sugar levels, making it another risk factor for diabetes mellitus (Arania et al., 2021). Regular medication use is another risk factor for diabetes mellitus. According to research findings, respondents who regularly take anti-

diabetes drugs have average blood sugar levels that are higher in both number and percentage than respondents who do not regularly take anti-diabetes drugs (OAD). This suggests that regular medication use may have an impact on lowering blood sugar levels. Furthermore, (Marlinda, S. and Zurriyani, 2021) study found that there are notable variations in blood glucose levels between patients with diabetes mellitus (DM) who take oral hypoglycemic drugs (OHO) and those who do not. Length of illness is another risk factor that contributes to diabetes mellitus; individuals with diabetes mellitus who have had the disease for a longer period of time have accumulated a great deal of experience and knowledge about blood sugar control that they can apply to their daily lives.

The study's findings demonstrated that following two weeks of daily, one-day Progressive Muscle Relaxation sessions, the researcher measured the blood sugar levels of participants. After the intervention, the results showed that 4 individuals (22% of the total) had normal blood sugar levels (80-199 mg/dL); 13 individuals (72% of the total) had normal blood sugar levels; no respondents were found in the hypoglycemia category; and 5 individuals (28% of the total) had hyperglycemia (>200 mg/dL), down from 14 (89%) at the beginning of the study.

Pharmacological therapy is the treatment that is frequently used or utilized to lower blood sugar levels. Blood sugar levels can be effectively lowered with pharmacological therapy. However, pharmacology and non-pharmacology must work together for patients to be able to independently control their blood sugar levels.

One kind of stress management exercises for patients is progressive muscle relaxation, which helps them unwind, become more at ease, and less stressed, angry, or anxious. The methodology used in this progressive

muscle relaxation therapy involves steady, incremental exercise.

Progressive muscle relaxation, according to (Sari, N.P. and Harmanto, 2020), is helpful for lowering peripheral resistance and raising vascular elasticity because it helps the patient focus on differentiating between the sensations felt when the muscle group is relaxed and when the muscles are calm.

Lowering blood sugar levels is the aim of the Progressive Muscle Relaxation exercise, which also relaxes the body. The hypothalamus will be stimulated by the parasympathetic nervous system to reduce the release of Corticotropin-Releasing Hormone (CRH).

Adreno Corticotropic Hormone (ACTH) secretion will be impacted by the reduction in CRH. The secretion of cortisol by the adrenal cortex may be inhibited by this circumstance. Inhibiting gluconeogenesis and increasing cell uptake of glucose will result from a drop in cortisol levels, bringing blood sugar levels back within normal ranges (Putriani, 2018).

The findings demonstrated that following a two-week Aroma Therapy Lemon Therapy session, blood sugar levels were measured by the researcher. Initially, 11 people (11% of the total) fell into the normal normal category (80-199 mg/dL); after the intervention, 7 people (39% of the total) fell into this category; no respondents fell into the hypoglycemia category (>200 mg/dL); and 11 people (61%) fell into the hyperglycemia category (>200 mg/dL), of which 16 people (89%) initially fell into this category after the intervention.

One application of volatile plant liquid components in alternative medicine is lemon aromatherapy. Because aromatherapy is one of the therapies linked with deep breath relaxation, which is also one of the pillars of physical activity management in diabetes mellitus planning, aromatherapy is also utilized as a relaxation aid.

The theoretical assertion from Smeltzer (2010), which claims that one of the nursing interventions that can lower anxiety and automatically lower blood sugar levels is supported by the study's findings. This is so because essential oils, which have anti-depressant, anti-inflammatory, analgesic, and antioxidant properties, are used in lemon aromatherapy. When someone inhales the scent of lemons while under stress, it will raise alpha waves in the brain, which will promote relaxation in the body. This has an impact on the physiological system of the body, suppressing hormones that raise blood sugar levels and causing them to fall. Research conducted in the Pacarkeling RW 07 Pacarkeling Village, Tambak Sari Surabaya Subdistrict, yielded results showing that progressive muscle relaxation is superior to lemon aromatherapy in terms of lowering and stabilizing blood sugar levels (p-value = 0.012).

CONCLUSION

It is found that progressive muscle relaxation therapy, as opposed to lemon aromatherapy, can lower blood sugar levels in diabetics more steadily. The goals of both interventions are to suppress stress feedback and promote physical relaxation through relaxation exercises. In a relaxed condition, the parasympathetic nervous system will take over, which can slow down the heart's rate of contraction and increase the body's production of the hormone insulin, which the body needs for blood glucose homeostasis.

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