

# EFFECT OF STRESS MANAGEMENT EXERCISE ON BLOOD GLUCOSE LEVEL IN PEOPLE WITH TYPE 2 DIABETES MELLITUS

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## Abstract

One of the major variables that can influence a person's elevated blood glucose levels in type 2 diabetes mellitus (T2DM) is stress. As a result, stress management requires work for those with T2DM. This study looked at how blood glucose control in patients with type 2 diabetes in the Pancur Batu Subdistrict was affected by stress management activities. The study used a pretest-posttest design for one group, making it quasi-experimental in character. The purposive sampling approach was utilized to acquire 30 samples from people with type 2 diabetes. The data were analyzed with a paired t-test. The findings revealed that there was a difference in the average blood glucose levels of patients with T2DM before and after stress management exercise ( $p = 0,001$ ). Finally, stress management has an impact on blood glucose control in persons with type 2 diabetes.

**Keywords:** T2DM; Stress Management; Blood Glucose Level.

## BACKGROUND

Diabetes mellitus is a complex metabolic disorder defined by chronic hyperglycemia caused by decreased insulin synthesis, diminished insulin activity, or both.(1).

It is anticipated that now, as many as 535.6 million (10.5%) individuals (20-79 years) have diabetes in the world; this figure will continue to rise to 642.7 million (11.3%) in 2030 and 783.2 million (12.2%) in 2045. (2)

Diabetes mellitus can induce a range of chronic effects, including retinopathy, neuropathy, nephropathy, coronary artery disease, cerebrovascular disease, diabetic cardiomyopathy, and diabetic foot ulcers. (3).

The number of diabetics in Indonesia is steadily increasing. In 2013, the prevalence of people with diabetes mellitus aged fifteen years and over based on a doctor's diagnosis was one point five percent, which increased to two percent by 2018. The Indonesian population aged 18 years and over diagnosed with diabetes mellitus in 2019 was 10.7 million people (6.2 percent) and there are about 73.7 cases of undiagnosed diabetes mellitus. This means that the actual prevalence of diabetes mellitus is much higher than reported.(4,5).

In North Sumatra Province, there was also an increase in DM from 1.8% in 2013 to 2% in 2018. Deli Serdang Regency is the second largest contributor to DM prevalence in North Sumatra (6). Pancur Batu is one of the sub-districts in Deli Serdang Regency. Diabetes mellitus is ranked fifth of the top ten diseases with the highest number of visits (1,485 cases) and is ranked 2nd out of the top five chronic diseases in the Pancur Batu's Health Community Center.

Stress is a natural response to situations that are considered dangerous (7) and should be considered as a trigger for diabetes (8). Stress elevates cortisol levels. Cortisol increases blood glucose levels via stimulating hepatic gluconeogenesis and

blocking insulin action. (9). Glucose mobilized from the liver is not used and remains in the bloodstream, causing an increase in blood sugar. On the other hand, the way individuals evaluate events can affect these reactions: An anxious person can anticipate difficulties and reinforce feelings of danger in dealing with everyday situations. This situation raises a constant alarm, which can lead to chronic hypercortisolism, possibly the development of metabolic syndrome and T2DM (10).

Diabetes mellitus is a chronic disease that requires diabetics to self-manage to carry out daily care such as following a diet and exercise plan, and preparing and remembering the schedule and dosage of taking medication, which can also be a source of stress for diabetics. (11,12)

Stress management interventions appear to reduce stress symptoms in T2DM, but effects on disease progression have not been established (13).

Many strategies can be used to manage stress such as yoga, deep breathing relaxation, progressive muscle relaxation (PMR), and 5-finger hypnosis, several stress management techniques that have been carried out such as yoga, deep breathing relaxation, and PMR have been shown to affect reducing blood sugar levels (14,15, 16). The word "yoga" comes from Sanskrit. This reminds us of the points raised by (17, 18) in using translation theory.

Interviews were conducted for people with diabetes mellitus in Pancur Batu, most of them felt stressed, anxious, and afraid of complications from the disease. The diabetics also did not know how to deal with the stress they experienced.

Based on this backdrop, it was necessary to research "The Effect of Stress Management Exercise on Blood Glucose Levels in People with Type 2 Diabetes Mellitus in Deli Serdang Regency".

## **METHOD**

### **Study design.**

This quasi-experimental study employed a one-group pretest-posttest design to investigate the effect of stress management exercise on blood glucose level regulation in persons with type 2 diabetes.

### **Sample.**

The sample for this study consisted of 30 adults with T2DM who worked at Pancur Batu Public Health Community Center. Inclusion criteria included having T2DM for more than a year, no problems, and blood sugar levels greater than 200 mg/dL.

### **Intervention**

Provide stress management education with deep breaths and progressive muscle relaxation techniques.

### **Data Collection**

First, the researchers collaborated with officers from the Community Health Center to identify persons who had been diagnosed with type 2 diabetes mellitus in the Sub District of Pancur Batu. The researcher discussed the study activities that will be carried out and inquired about their willingness to be respondents. The researchers next measured the responders' blood glucose levels. Researchers trained

respondents in deep breaths and progressive muscle relaxation techniques to deal with stress and provided leaflets to respondents. All respondents were asked to do stress management exercises (deep breath and progressive muscle relaxation) at least 3 times a day and at any time if they felt stressed. Blood glucose level was measured again after 7 days.

### Data Analysis

Data were analyzed by computerization, using the SPSS program. Univariate analysis to describe the characteristics of respondents such as gender, age, and blood glucose level of respondents. Bivariate analysis was utilized to determine the effect of stress management exercise on blood glucose level control in patients with type 2 diabetes mellitus.. Paired t-test was used in this study to see differences in the mean blood glucose level of respondents before and after receiving stress management exercise.

### Ethical Consideration

This research was approved by the Ethics Committee of the Poltekkes Kemenkes Medan with the ethical number: 052/KEPK/POLTEKKES KEMENKES MEDAN/2017.

## RESULT

### Characteristics of Respondents

Table 1 provides a description of the respondents' characteristics.

**Table 1: Characteristics of Respondents**

Characteristics	N	%
Gender		
Male	8	26,67
Female	22	73,33
Age (year)		
50-54	8	26,67
55-59	10	33,33
60-64	9	30,00
65-69	2	6,67
70-74	1	3,33
Total	30	100

Table 1. shows that the majority of respondents in this study were female as much as 73,33%, in terms of age, all respondents were above 50 years old, and the majority of them were 55-59 years old as much as 33,33 %.

### The blood glucose level of respondents

Table 2 shows the average responders' blood glucose levels before and after the intervention.

**Table 2: The average blood glucose level of respondents**

Blood Glucose Level	Minimum	Maximum	Mean	SD
Before SME	201	590	383,10	118,48
After SME	83	558	277,80	134,60

Table 2 reveals that all responders had blood glucose levels greater than 200 mg/dl prior to the stress management exercise. The average blood glucose level across respondents was 383.10 ± 118.48 mg/dL. After the stress management exercise, the average respondent's blood glucose level was 277, 80 ±134, 60.

## The difference in blood glucose levels of respondents before and after SME

To see the difference in blood glucose levels of respondents used pair t-test statistics and bootstrap techniques were used. The mean difference can be seen in Table 3.

**Table 3: The mean difference in respondents' blood glucose level**

Variable	Mean difference	SD	p-value
Blood glucose level before SME			
Blood glucose level after SME	105,30	99,91	0,01

Table 3 demonstrates a significant difference in the mean blood glucose levels of respondents before and after stress management exercise of up to 105.30 mg/dl (p-value = 0.01).

## DISCUSSION

The majority of respondents (73.33%) were female, which was consistent with data from basic health study conducted by the Indonesian Ministry of Health in 2018, which showed that the number of women suffering from diabetes is higher than that of men (women = 1.8%, men = 1.2%). This might be related to the stress experienced by women. Women were more easily stressed. Some studies said that women tend to have higher stress than men because they think about problems excessively.

All respondents were over fifty years old and the majority were 55-59 years old. Diabetes mellitus tends to occur in the elderly. It was by the WHO reported that diabetes mellitus increases at the age above 40 years due to reduced body tissue sensitivity to insulin. (19).

The blood glucose level of respondents before stress management exercise was very uncontrolled. The average blood glucose level was 383.10 mg/dl, with a range between 201 and 590 mg/dl. This condition might be caused by respondents who did not apply diabetes management properly, such as pharmacological therapy, nutritional therapy, physical exercise, and education. Most respondents consume traditional medicines that have not been clinically tested for their benefits and dosage. Respondents also rarely checked their blood glucose levels regularly, they usually go to community health centers to get medical services if they feel sick.

In this study, respondents were trained to manage stress and were asked to apply it to everyday life. Observations on stress management actions carried out by respondents were carried out for 7 days. The blood glucose levels of respondents were checked again after 7 days.

A paired t-test revealed significant variations in respondents' average blood glucose levels before and after stress management exercises utilizing progressive muscle and deep breathing relaxation techniques. The blood glucose level decreased by 105.3 mg/dl (p-value = 0.01). The data showed that stress management exercises have a positive influence on controlling blood glucose levels.

According to the concept of the relationship between stress and T2DM, the psychological reaction to the stressor of defeatism or helplessness activates the hypothalamic-pituitary-adrenal (HPA) axis, resulting in various endocrine abnormalities, such as high cortisol, which inhibits insulin action. (8). People with DM should have the ability to manage stress so that uncontrolled increases in blood glucose levels can be prevented.

This result is in line with the study conducted by Astuti in Surabaya. The study found that Progressive Muscle Relaxation (PMR) helped lower blood glucose levels. The study found that before undergoing progressive muscle relaxation, the average blood glucose level was 238,40 mg/dl, and after, it was 125,68 mg/dl. (14).

Another study conducted in Purwokerto using deep breathing relaxation techniques for stress management did not have a significant effect on reducing blood sugar levels. (15).

Stress management training was associated with a decrease in HbA1c., A stress management program in a "real-world" situation can produce clinically substantial advantages for people with type 2 diabetes. (20).

Stress management exercise is very useful for managing the stress that experienced by people with type 2 diabetes, They feel more relaxed and free from pressure. In a relaxed state, insulin could more effectively regulate blood glucose levels.

### Research Limitations

The study's drawback was the lack of a control group. In a quasi-experimental study, it is advantageous to use a control group to compare treatment differences. In the absence of a control group in this study, researchers were unable to control other factors that might influence decreasing respondents' blood glucose levels, such as diet, physical activity, and drugs consumed by respondents.

### CONCLUSION AND RECOMMENDATION

According to a study of 30 adults with type 2 diabetes mellitus in Sub District Pancur Batu Deli Serdang Regency, there were significant differences in average blood glucose levels before and after stress management exercise. The study also found that stress management exercise improved blood glucose levels in persons with type 2 diabetes..

### References

- 1) Petersmann, A., Müller-Wieland, D., Müller, U. A., Landgraf, R., Nauck, M., Freckmann, G., Heinemann, L., & Schleicher, E. (2019). Definition, Classification, and Diagnosis of Diabetes Mellitus. *Experimental and Clinical Endocrinology and Diabetes*, 127(Suppl 1), S1–S7. <https://doi.org/10.1055/a-1018-9078>
- 2) International Diabetes Federation. (2021). IDF Diabetes Atlas. In *Diabetes Research and Clinical Practice* (10th ed, Vol. 102, Issue 2). <https://doi.org/10.1016/j.diabres.2013.10.013>
- 3) Mezil, S. A., & Abed, B. A. (2021). Complications of diabetes mellitus. *Annals of The Romanian Society for Cell Biology*, 25(3), 1546–1556. <https://www.annalsofrscb.ro/index.php/index>
- 4) IDF. (2019). IDF Diabetes Atlas. In *The Lancet* (ninth). [https://doi.org/10.1016/S0140-6736\(55\)92135-8](https://doi.org/10.1016/S0140-6736(55)92135-8)
- 5) Ministry of Health of the Republic of Indonesia. (2019). *National report on basic health research 2018*. Health research and development agency. [http://labdata.litbang.kemkes.go.id/images/download/laporan/RKD/2018/Laporan\\_Nasional\\_RKD\\_2018\\_FINAL.pdf](http://labdata.litbang.kemkes.go.id/images/download/laporan/RKD/2018/Laporan_Nasional_RKD_2018_FINAL.pdf)
- 6) Ministry of Health of the Republic of Indonesia. (2018). North Sumatra Province Basic Health Research Report. In *Badan Penelitian dan Pengembangan Kesehatan*. Health research and development agency.
- 7) Nash, J. (2014). Stress and diabetes: The use of “worry time” as a way of managing stress. *Journal of Diabetes Nursing*, 18(8), 329–332.

- 8) Falco, G., Pirro, P. S., Castellano, E., Anfossi, M., Borreata, G., & Gainotti, L. (2015). The Relationship between Stress and Diabetes Mellitus. *Journal of Neurology and Psychology*, 3(1), 1–7. <https://doi.org/10.13188/2332-3469.1000018>
- 9) Mommersteeg, P. M. C., Herr, R., Zijlstra, W. P., Schneider, S., & Pouwer, F. (2012). Higher levels of psychological distress are associated with a higher risk of incident diabetes during 18-year follow-up: Results from the British household panel survey. *BMC*.
- 10) Joseph, J. J., & Golden, S. H. (2017). Cortisol dysregulation: the bidirectional link between stress, depression, and type 2 diabetes mellitus. *Annals of the New York* 34. <https://doi.org/10.1111/nyas.13217>
- 11) Lloyd, C., Smith, J., & Weinger, K. (2005). Stress and diabetes: A review of the links. *Diabetes Spectrum*, 18(2), 121–127. <https://doi.org/10.2337/diaspect.18.2.121>
- 12) Marcovecchio, M. L., & Chiarelli, F. (2012). The Effects of Acute and Chronic Stress on Diabetes Control. *Science Signalling*, 5(247). <https://www.science.org/doi/abs/10.1126/scisignal.2003508>
- 13) Kelly, S. J., & Ismail, M. (2015). Stress and Type 2 Diabetes : A Review of How Stress Contributes to the Development of Type 2 Diabetes. *Annual Review of Public Health*, 36441–462. <https://doi.org/10.1146/annurev-publhealth-031914-122921>
- 14) Astuti, P. (2018). Teknik Progressive Muscle Relaxation Mempengaruhi Kadar Glukosa Darah Penderita Diabetes Mellitus Tipe 2. *Journal of Health Sciences*, 7(2), 114–121. <https://doi.org/10.33086/jhs.v7i2.499>
- 15) Ekowati, W., Iskandar, A., & Sumarwati, M. (2013). Pengaruh Terapi Relaksasi Terhadap Kontrol Glikemik Pada Pasien Diabetes Mellitus Di Purwokerto. *Kesmas Indonesia*, 6(01), 64–74. <http://jos.unsoed.ac.id/index.php/kesmasindo/article/view/52>
- 16) Suwarno, M. L., & Sianturi, S. R. (2017). Efektifitas Latihan Fisik Yoga terhadap Kadar Gula Darah Sewaktu pada Diabetes Mellitus Tipe 2 di Kramat Jakarta. *Jurnal Keperawatan Soedirman*, 12(2), 102. <https://doi.org/10.20884/1.jks.2017.12.2.712>
- 17) Sembiring, M., Girsang, M., & Siregar, R. (2022). Translating Nure-Nure Texts in Karonese Society into English: Applying Translation Techniques. *Theory and Practice in Language Studies*, 12(5), 904-912. <https://doi.org/10.17507/tpis.1205.10>
- 18) Sembiring, M., & Girsang, M. (2023). Translating Politeness of Persadaan Tendi Texts in Karonese Language Into English. *Theory and Practice in Language Studies*, 13(6), 1444–1451.
- 19) Roglic, G. (2016). WHO Global Report on Diabetes : A Summary. *Int J Non-Commun Dis*, 1, 3–8. <https://www.ijncd.org/text.asp?2016/1/1/3/184853>
- 20) Surwit, R. S., Van Tilburg, M. A. L., Zucker, N., McCaskill, C. C., Parekh, P., Feinglos, M. N., Edwards, C. L., Williams, P., & Lane, J. D. (2002). Stress management improves long-term glycemic control in type 2 diabetes. *Diabetes Care*, 25(1), 30–34. <https://doi.org/10.2337/diacare.25.1.30>