

THE EFFECTIVENESS OF TERA EXERCISE ON BLOOD SUGAR LEVELS IN TYPE 2 DM SUFFERERS

Riska Rohmawati^{1*}, Imamatul Faizah¹, Ratna Yunita Sari¹

¹Universitas Nahdlatul Ulama Surabaya

Corresponding author: riskarohmawati@unusa.ac.id

ABSTRACT

Background: Blood sugar levels in type 2 DM sufferers tend to increase mildly but progressively because they are low self-care management in people with type 2 DM. One non-pharmacological therapy that can help blood sugar levels remain stable is tera exercise.

Purpose: This study aimed to analyze the effectiveness of tera exercise on blood sugar levels in type 2 DM sufferers at the Wonokromo Community Health Center.

Methods: The design of this study is RCT (Randomized Controlled Trial). The number of samples for each group was 24 in the control group and 24 in the intervention group. The study was conducted at the Wonokromo Community Health Center from July – 4 August times, every Tuesday and Friday for 2 weeks, with a duration of 45 minutes, using the technique of Simple Random Sampling. The independent variable in this study is physical exercise, and the dependent variable is blood sugar levels. The instrument in this study was the tera gymnastics SOP and blood sugar level observation sheet. The statistical test used is paired t-test and independent t-test with a significance level of $\alpha = 0.05$.

Results: The test result obtained a p-value of 0.000, which means that there is a significant difference in blood sugar levels before and after participating in tera exercise activities. Test results independent t-test A significant value was obtained of 0.034 ($p < 0.05$), which means tera exercise influences the blood sugar levels of type 2 DM patients at the Wonokromo Community Health Center

Conclusion: Tera exercise effectively reduces blood sugar levels in type 2 DM sufferers at the Wonokromo Community Health Center. The term exercise is hoped to be used as an independent intervention in the elderly posyandu program at the Wonokromo Community Health Center

Keywords: Blood sugar; Diabetes mellitus; Tera exercise.

Received November 25th, 2025; Revised July 1st, 2026; Accepted July 5th, 2026

DOI:<https://doi.org/10.36720/nhjk.v15i1.802>

This is an Open Access Article distributed under the terms of the Creative Commons Attribution – NonCommercial 4.0 (CC BY-NC) 4.0)

Copyright © 2025 Health Polytechnic of Kerta Cendekia. ISSN:(E)2623-2448;(P)2088-9909

BACKGROUND

Diabetes mellitus is one of the main health problems in society due to low levels of health self-care management of diabetes sufferers themselves. There are still many diabetes sufferers who pay little attention to their diet by consuming excessive sugar, rarely doing physical activity, rarely checking their blood sugar levels, not paying attention to caring for their feet, and not following doctor's recommendations for taking medication (Siwi Handayani et al., 2013).

Case diabetes mellitus in 2021, it is estimated that 1 in 10 or 537 million adults will experience diabetes mellitus. This number is projected to increase to 63 million in 2030 and 783 million in 2045 (Webber, 2021). According to (Indonesian Ministry of Health, 2019) there are 10.7 million cases of diabetes mellitus in Indonesia. Meanwhile, in the East Java region there were 875,745 diabetes mellitus sufferers in 2020 (East Java Provincial Health Service, 2020).

Regional Health Research Data (RISKESDAS) shows that the prevalence of diabetes sufferers in East Java province is in the top 10 in Indonesia with a prevalence of 6.8% (Riskesdas Jatim, 2018). Based on the results of initial data collection at the Wonokromo Community Health Center, there were 270 people suffering from diabetes mellitus from January – May 2023. The results of a preliminary study conducted at the Wonokromo Community Health Center through interviews with diabetes sufferers in May 2023 showed that 7 out of 15 diabetes sufferers had almost no do light exercise such as walking or gymnastics to control blood sugar levels and prevent complications of diabetes mellitus.

Complications due to high blood sugar levels in diabetes mellitus sufferers occur in the blood vessels in the body. If they cannot be controlled, they can cause complications in all organs of the body, namely microvascular complications, including those that can affect the nerves, kidney organs, and can cause kidney failure. Meanwhile, macrovascular complications can affect the blood vessels of the brain (stroke) which can also cause disability and even death (Lestari et al., 2021).

Some light physical exercises that DM sufferers can do include diabetes exercise, aerobic exercise, yoga and tera exercise. Tera gymnastics is a type of physical and mental exercise, which combines the movement of body parts with breathing techniques and rhythms through focused thinking which is carried out regularly, harmoniously, correctly and continuously. Tera exercise can directly cause an increase in glucose use by active muscles so that there are more insulin receptors which will have an effect on reducing blood glucose in diabetes sufferers (Umiyah, 2022).

Objective(s): This research aims to determine the effectiveness of tera exercise on blood sugar levels in type 2 DM sufferers at the Wonokromo Community Health Center.

METHODS

Study Design

The study used a quasi-experimental, with plans for pre-test and post-test with the control group. In this design, the treatment group did tera exercises, while the control group did not do tera exercises.

Setting

The sample in this study was type 2 DM sufferers at the Wonokromo Community Health Center..

Research Subject

The sample in this study was type 2 DM sufferers at the Wonokromo Community Health Center. The study criteria are type 2 DM sufferers who are willing to be respondents and do not have accompanying complications. Inclusion criteria in this study were type 2 DM patients willing to be respondents, DM patients aged 40 - 70 years, and patients who had suffered from DM for 2 - 5 years. The exclusion criteria include patients who have had hearing loss since birth, patients who have mental disorders, and DM patients with complications

Instruments

The independent variable in this study is physical exercise, while the dependent variable is blood sugar levels. The researchers collected data using tera exercise SOP and blood sugar level observation sheets. They used a glucometer with a strip test and a needle to measure blood sugar levels and tera exercise procedures to carry out an exercise.

Intervention (this heading is only for experimental studies)

The intervention in this study is tera exercise in the treatment group, which will be carried out for 1 week twice on Tuesdays and Fridays for 45 minutes over 2 weeks by a certified exercise instructor. Meanwhile, in the control group, DM exercises will be carried out with a frequency of 2x per week for 2 weeks on Wednesdays and Saturdays. After 2 weeks of intervention on type 2 DM sufferers, blood sugar levels were measured again in 2 groups, namely the treatment group, whose blood sugar levels were measured after doing tera exercises, while in the control group, blood sugar levels were measured after giving diabetes exercises. The results of measuring blood sugar levels are recorded on the observation sheet

Data Analysis

The data collected is corrected again through observation sheets, and then the effectiveness of tera exercise on blood sugar levels for respondents before (pre) and after (post) performing tera exercises is assessed using a statistically paired t-test and independent t-test with a significance level of $\alpha < 0.05$.

Ethical Consideration

This research has been declared ethically appropriate under No.095/010/VII/EC/KEP/LCBL/2025

RESULTS

The results of the research are explained in the information below:

Table 1. Frequency distribution of respondent characteristics based on gender

Category	Treatment Group		Control Group		P value
	f	(%)	f	(%)	
Gender					
Man	4	16.7	9	37.5	0.012
Woman	20	83.3	15	62.5	
Age					
Middle Age	13	54.2	14	58.3	0.027
Advanced Age	11	45.8	10	41.7	
Old Age	0	0	0	0	0.034
Education					

Elementary	8	33.3	8	33.3
Intermediate	7	29.2	3	12.5
High	9	37.5	13	54.2

Table 1 above shows that almost all of the genders in the treatment group (83.3%) were female with 20 respondents, and in the control group, the majority (62.5%) were female with 15 respondents. The age characteristics of the treatment group were mostly (54.2%) in the middle age category (45 - 59 years) with 13 respondents and in the control group the majority (58.3%) were in the middle age category (45 - 59 years old) as many as 14 respondents. It can be seen that the characteristics of respondents based on education level in the treatment group were almost half (37.5%) in the higher education category (D3/Bachelor's degree), with nine respondents. In the control group, the majority (54.2%) were in the education category. High as many as 13 respondents.

Table 2 Blood sugar levels before doing tera exercise in the treatment group and control group

	group			
Blood Sugar Levels	Mean	SD	Min-Mak	N
Pre-treatment group	258	28	190-426	24
Pre-control group	274.7	22.6	157-498	24

In table 2 it can be seen that the average blood sugar level in the treatment group was 258mg/dL with a minimum value of 190mg/dL and a maximum value of 426mg/dL. The control group had an average blood sugar level of 274.7 mg/dL with a minimum value of 157 mg/dL and a maximum value of 498 mg/dL.

Table 3 Blood sugar levels after doing tera exercise in the treatment group and control group

Blood Sugar Levels	Mean	SD	Min-Mak	N
Post treatment group	122.2	28.6	100 - 152	24
Post control group	139.2	22.5	92 - 200	24

In table 3 it can be seen that the average blood sugar level after tera exercise in the treatment group was 122.2 mg/dL with a minimum value of 100 mg/dL and a maximum value of 152 mg/dL. The control group had an average blood sugar level of 139.2 mg/dL with a minimum value of 92 mg/dL and a maximum value of 200 mg/dL.

Table 4 Test Results Paired t test effectiveness of tera exercise on blood sugar levels in type 2 DM sufferers

Variable	Group	Mean	Mean difference	P value
Pre test	Treatment group	258	16.7	0.000

	Control group	274.7		
Post test	Treatment group	122.2	17.0	0.000
	Control group	139.2		

Bivariate analysis results with test t-paired obtained p-value 0.000, this means that there is a difference in blood sugar levels between before and after participating in tera exercise activities. Likewise, in the control group the results of the paired t-test showed p-value 0.000, this means that there is a significant difference in blood sugar levels between before and after participating in diabetes exercise activities.

Table 5 Differences in blood sugar levels between the treatment group and the control group

	Df	t	Mean delta	Sig. (2 tailed)
Post test treatment	48	3.281	122.2	.034
Post Test Control			139.2	

Based on table 7 test results independent t- test obtained a significance value of 0.034 ($p < 0.05$) where the p value < 0.05 then H_0 is rejected and H_1 accepted, which means that there is an effect of tera exercise on the blood sugar levels of type 2 DM patients at the Wonokromo Community Health Center.

DISCUSSION

The results of the study showed that the average blood sugar level of the treatment group after doing tera exercise 4 times, which was done 2 times a week for 2 weeks, was 122.2 mg/dL with the lowest value being 100 mg/dL and the highest value being 152 mg/dL. The control group had an average value of 139.2 mg/dL, the lowest blood sugar level was 92 mg/dL and the highest blood sugar level was 200 mg/dL. From these results it can be concluded 48 that there was a significant decrease, shown by a decrease of 135.8 mg/dL in the treatment group and 135.5 mg/dL in the control group. From these results it can be seen that there is no significant difference between the treatment group and the control group in terms of the ability to reduce blood sugar levels.

The benefits of exercise for diabetes mellitus sufferers include reducing blood glucose levels, preventing obesity by burning the body's calories so that blood glucose can be used for energy, thereby lowering blood sugar levels. The results of research that support this theory are that diabetes exercise can cause a decrease in blood glucose levels, this is because when doing physical exercise there is an increase in glucose use by the muscles, many capillary beds are open, so that in turn there is an increase in blood flow and more insulin receptors are available and more active in lowering glucose (Lindawati & Wasludin, 2019).

Tera exercise is an aerobic exercise (with oxygen) because this exercise has an element of breathing (Novitasari et al., 2013). Tera exercise is carried out routinely 3x a week with a duration of 60 minutes so that it has an effect on reducing blood glucose levels (Ata et al., 2017). This is not in line with this research because the researchers only did tera exercises 2x a week with a duration of 45 minutes. Even though this exercise is only done 4 times over 2 weeks with a duration of 30 – 45 minutes, this exercise still has an effect on reducing blood glucose levels at any time. An increase in blood sugar levels can occur due to influencing risk factors, such as the respondent's failure to perform exercise movements (Pratiwi et al., 2020)

This research is in line with research conducted by (Pratiwi & Muf seenin, 2021) regarding the effect of tera exercise on blood pressure and sugar levels in elderly people with diabetes mellitus at PSTW Nirwana Puri Samarinda. Where after the tera exercise intervention was carried out routinely twice a week with a duration of 45 minutes for the posttest value, the average sugar level value was 118.38 with the lowest blood sugar level being 79 mmHg and the highest being 394 mmHg.

The results show that there is a change in blood glucose levels after doing exercise, this is due to the use of energy burned by cells that use blood glucose using insulin. A person who does sports activities will have a catalytic effect on insulin so that blood glucose in the body is easily burned by cells. In contrast to the situation of people who experience high insulin resistance, glucose in the body will be stored in the form of fat and will be excreted in the form of urine from the body.

Analysis of the Effectiveness of Tera Exercise on Blood Sugar Levels in DM Sufferers Type 2

The results of the study showed that both the treatment group and the control group experienced a significant reduction in blood sugar levels. This is proven by the results of the paired t-test in the treatment group and the control group, which obtained a p-value of 0.000, this means that there is a significant difference in blood sugar levels between before and after participating in tera exercise activities.

Physical exercise such as tera gymnastics that is done regularly can reduce blood sugar levels, after exercise glucose increases by at least 40%. During tera exercise the need for energy is much greater than during resting conditions so that the use of glucose in the blood also increases. In other words, because glucose in the muscles is burned by physical activity to produce energy, ultimately the glucose 52 in the blood decreases (Novitasari et al., 2013). Apart from that, tera exercise can also control blood pressure, this is because there are breathing movements that make the body more relaxed and dilate the capillaries so that it can increase blood circulation.

This research is in line with research conducted by (Pratiwi & Muf seenin, 2021). Where the results of the Wilcoxon test obtained significance (p) value = 0.000 or ≤ 0.05 . The hypothesis decision taken is that H_a is accepted, which means there is a significant influence on blood glucose levels before and after doing tera exercise.

In this research test results independent t – test obtained a significant value of 0.034 ($p < 0.05$) based on these results because the p-value < 0.05 then H_0 rejected and H_1 accepted, which means that there is effectiveness of Tera exercise on the blood sugar levels of type 2 DM patients at the Wonokromo Community Health Center.

In this study, it was found that several respondents experienced a less significant decrease in blood sugar levels. According to researchers, this is because apart from doing physical exercise, patients with DM are also required to maintain their diet. Tera exercise can be used as a non-pharmacological therapy to reduce and control blood glucose levels. Controlling blood glucose levels is important to avoid disease complications. Researchers strongly support that respondents can always control their blood glucose levels by exercising diligently, maintaining their diet and getting enough rest.

The results of research on the application of the 4 pillars of diabetes mellitus control with average blood sugar levels show that education, eating management, exercise and medication compliance have an impact on stabilizing blood glucose and improving quality of life. Exercise or physical exercise is one way for diabetes mellitus sufferers to control blood sugar levels within normal limits, because by exercising, it can increase the use of glucose by muscles, which can directly cause a decrease in blood sugar. The type of exercise

recommended for diabetes mellitus sufferers is aerobic exercise which can improve the function and efficiency of the body's metabolism. Aerobic sports such as jogging, swimming, group exercise and cycling are appropriate for diabetes mellitus sufferers because they use the large muscles in the body and improve the work of the cardiovascular system.

CONCLUSION

Respondents in the treatment group before doing tera exercise had blood sugar levels in the poor category with a mean of 258 mg/dL and after doing tera exercise had blood sugar levels in the good category with a mean of 122.2 mg/dL. Respondents in the control group before doing diabetes exercise had blood sugar levels in the poor category with a mean of 274.7 mg/dL and after doing diabetes exercise had blood sugar levels in the good category with a mean of 139.2 mg/dL. There is effectiveness of tera exercise on the blood sugar levels of type 2 DM patients at the Wonokromo Community Health Center.

To improve the quality of Puskesmas services, especially for DM patients, it is hoped that tera exercise can be used as one of the superior services and become an SOP in the diabetes management program. Future researchers should be able to carry out further research on other factors such as (history of DM, obesity, long suffering from DM and high blood pressure) which are associated with the incidence of type 2 DM.

SUGGESTIONS

The greater a person's beliefs mixed with the relaxation response, the stronger the relaxation effect obtained. Nurses can implement this intervention in meeting psychological needs.

ACKNOWLEDGMENT

We would like to thank all DM patients at the Wonokromo Community Health Center who are willing to be research respondents and medical personnel of the Wonokromo Community Health Center who have collaborated with researchers during data collection and the research process.

DECLARATION OF CONFLICTING INTEREST

There is no conflict of interest in this article.

REFERENCES

- Achmad, S. (2017). The Effect of Tera Exercise on Reducing Blood Glucose Levels in Patients with Prolanis Participants at Upt Puskesmas Cangkreng Purworejo. Publication manuscript.
- Aini, N., & Aridiana, L. M. (2016). Endocrine System Nursing Care with the Nanda NIC NOC Approach. Salemba Medika.
- Antunes, L. A. (2013). The Relationship Of Self-Efficacy With Compliance With Self-Care Management In Diabetes Mellitus Patients. Literature Review, 6(November), 33–37.
- Arikunto, S. (2010). Research Procedures A Practical Approach. Rineka Cipta.
- Ata, A., Universitas, D., Ata, A., Universitas, D., & Ata, A. (2017). The Effect of Tera Exercise on Reducing Blood Glucose Levels in DM Patients Prolanis Participants at Upt Puskesmas Cangkreng Purworejo. 1, 1–12.
- Bhatt, H., Saklani, S., & Upadhyay, K. (2016). Diabetes Melitus Type 2. Indonesian Journal of Pharmacy, 27(2), 74–79.
<https://doi.org/10.14499/indonesianjpharm27iss2pp74>

- Bulu, A., Wahyuni, T. D., & Sutriningsih, A. (2019). The Relationship Between the Level of Adherence to Taking Medication and Blood Sugar Levels in Type II Diabetes Mellitus Patients. *Nursing Science*, 4(1), 181–189.
- Dafriani, P., & Dewi, R. I. S. (2019). Level of Knowledge in Type 2 Diabetes Mellitus (DM) Patients. *Abdimas Science Journal*, 1(1), 45–50.
<http://dx.doi.org/10.30633/jas.v1i1.467>
- Dzikri, A. A. (2016). STRESS LEVEL IN THE ELDERLY (Study at Sawunggaling Lidah Wetan Elderly Posyandu, Lakarsantri, Surabaya). 06(2), 1–7.
- Hatmanti, N. M., & Lindawati, N. (2017). Changes in Blood Sugar Levels Due to Intensity of Diabetes Exercise at the Menanggal Elderly Posyandu, Surabaya. *Proceedings of the 2017 National Nursing Seminar Theme Community Health Care Management as a Strategy for Achieving Healthy Family Indicators in Indonesia*, November, 28–30.
- Hotma, R. (2014). Prevent Diabetes Mellitus with Lifestyle Changes. IN MEDIA.
- J.M, B., & J.H, H. (2014). Medical Surgical Nursing: Clinical Management for Expected Outcomes. Salemba Medika.
- Jiahao, L., Jiajin, L., & Yifan, L. (2021). Effects of resistance training on insulin sensitivity in the elderly: A meta-analysis of randomized controlled trials. *Journal of Exercise Science and Fitness*, 19 (4), 241–251. <https://doi.org/10.1016/j.jesf.2021.08.002>
- Karuranga, Joao da Rocha Fernandes, Y. H. (2017). IDF DIABETES ATLAS. InIDF Diabetes Atlas, 8th edition. <https://www.idf.org/aboutdiabetes/type-2-diabetes.html>
- Indonesian Ministry of Health. (2019). Infodatin Data and Information Center Ministry of Health of the Republic of Indonesia World Diabetes Day 2018. Indonesian Ministry of Health Data and Information Center, 1–8.
- Lestari, Zulkarnain, & Sijid, S. A. (2021). Diabetes Mellitus: Review of Etiology, Pathophysiology, Symptoms, Causes, Examination Methods, Treatment Methods and Prevention Methods. UIN Alauddin Makassar, November, 237–241. <http://journal.uin-alauddin.ac.id/index.php/psb>
- Lindawati, & Wasludin. (2019). The Effect of Diabetic Gymnastics on Blood Sugar Levels in Type 2 Diabetes Mellitus Patients in the Periuk Jaya Community Health Center Area, Tangerang City. *Effect of Diabetic Gymnastics on Blood Sugar Levels in Patients With Type 2 Diabetes Mellitus in the Area of. Medikes (Health Information Media)*, 6 (November), 247–254.
- Mirza, M. (2020). Getting to Know Diabetes Mellitus. DONE.
- Montung, L. J. A., Paruntu, M. E., & Tiho, M. (2015). Comparison of Glucose Levels Before and After Heavy Intensity Physical Activity. *E-Biomedic Journal*, 3(3), 1–5.
<https://doi.org/10.35790/ebm.3.3.2015.9417>
- Mustikawati, D., Erawati, E., & Supriyatno, H. (2019). The Effect of Diabetes Exercise on Blood Sugar Levels of Diabetes Mellitus Clients in the Mertoyudan II Community Health Center Working Area. *Journal of Chemical Information and Modeling*, 15(2), 9–25.
- Notoatmojo, S. (2012). *Health Research Methodology*. Rineka Cipta.
- Novitasari, F., Setioputro, B., & Roymond. (2013). The Effect of Tera Exercise on Blood Sugar Levels in Elderly People with Diabetes Mellitus. 41–49.
- Nursalam. (2020). *Nursing Science Research Methodology* (P. P. Lestari (ed.); 5th ed.). Salemba Medika.
- Parwati, N. M., Karmaya, I. N. M., & Sutjana, D. P. (2013). Tera Indonesia Gymnastics improves the cardiorespiratory fitness of elderly people at the Wana Seraya Nursing Home in Denpasar. *Public Health and Preventive Medicine Archive*, 1(1), 30–35.
- Perkeni. (2018). Diagnostic Criteria for Diabetes Mellitus According to Perkeni. Dm, 2–3.

- Pratiwi, & Muf seenin, S. K. (2021). The Effect of Tera Exercise on Temporary Blood Pressure in the Elderly at Pstw Nirwana Puri Samarinda. *Borneo Student Research Journal*, 3(1), 248–253.
- Pratiwi, P., Amatiria, G., & Yamin, M. (2020). The Effect of Stress on Blood Sugar Levels in Diabetes Mellitus Patients Undergoing Hemodialysis. *Health Journal*, in (1), 11–16.
- Putradana, A., Fhitriana, D., & Firdayanti, N. (2021). The Effect of Tera Exercise on Changes in Blood Sugar Levels in Elderly People Suffering from Type 2 Diabetes Mellitus in Bolo Village, Bima Regency. 7(2).
- Putri, N., & Isfandiari, M. (2013). Relationship between the Four Pillars of Type 2 DM Control and Average Blood Sugar Levels. *Periodical Journal of Epidemiology*, 234–243.
- Cow, N. H., Harmiardillah, S., & Puspita, T. (2022). LIMA PILAR DIABETES MELLITUS. Rizmedia.
- East Java Riskesdas. (2018). East Java Province Report RISKESDAS 2018. In Indonesian Ministry of Health.
- Siwi Handayani, D., Yudianto, K., & Kurniawan, T. (2013). Self-Management Behavior of Diabetes Mellitus (DM) Patients. *Padjadjaran Nursing Journal*, v1(n1), 30–38.
<https://doi.org/10.24198/jkp.v1n1.4>
- Sugiyono. (2017). *Quantitative-Qualitative and R&D Research Methods*. PT. Alfabeta, CV.
- Tayrol, C., & Lynn, P. (2012). *Fundamentals of Nursing, The Art of Science and Nursing care*. Philadelphia.
- Tera, K.S. (2009). Indonesian Tera Gymnastics: Getting to know Indonesian Tera Gymnastics. https://senamteraindonesiajakartabarat.blogspot.com/2009/05/mengenai-senam-tera-indonesia_25.html
- Tera, K.S. (2011). Indonesian Tera Gymnastics: The essence and benefits of Indonesian Tera Gymnastics (2).
<https://senamteraindonesiajakartabarat.blogspot.com/2011/04/hakekat-dan-manfaat-senam-tera.html>
- Umiyah, A. (2022). The Effect of Tera Exercise Frequency on the Risk Level of Non-Communicable Diseases (Diabetes Mellitus). *Obsign Scientific Journal*, 14(1), 1–5.
<https://stikes-nhm.e-journal.id/JOB/article/view/593>
- Webber, S. (2021). International Diabetes Federation. In *Diabetes Research and Clinical Practice* (Vol. 102, Issue 2). <https://doi.org/10.1016/j.diabres.2013.10.013>