



Physical Therapy Education and Prevention: Management of Type 2 Diabetes Complications in the Elderly at the Mitra Hati Senior Citizens' School, Department of Social Affairs and Family Planning (Dinsos P2kb), Pekalongan City

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ABSTRAK

Type 2 diabetes mellitus is a degenerative disease that is common among the elderly and has the potential to cause various complications, such as peripheral neuropathy, circulatory disorders, and diabetic foot ulcers, which can impair functional ability and quality of life. The elderly's lack of knowledge about preventing these complications, coupled with low levels of physical activity, are factors that exacerbate these conditions. This community service activity aims to improve older adults' knowledge and awareness regarding the prevention of Type 2 Diabetes Mellitus complications through health education and physical therapy exercises. The methods used included focus group discussions, health screenings, health education, and demonstrations of physical therapy exercises such as muscle-strengthening exercises using Therabands, light aerobic exercises, and balance exercises. The activity was conducted with older adults at the Pekalongan City Social Affairs and Family Planning Office's Senior Citizens' School, following a process that included a pre-test, presentation of educational materials, exercise demonstrations, and a post-test for evaluation. The results showed an increase in the older adults' understanding of diabetes, its risk factors, and the importance of physical activity in preventing complications. This educational and physical therapy program is expected to help older adults improve their functional abilities, maintain their health, and prevent further complications resulting from Type 2 Diabetes Mellitus

INTRODUCTION

Old age is a stage of life characterized by biological, psychological, and social changes that occur after a person reaches the age of 60 or older. Aging is a natural process involving a gradual decline in the physiological function of the body's organs—such as the musculoskeletal, cardiovascular, and cognitive systems—making older adults more vulnerable to health problems and chronic diseases. These changes reflect a decline in the body's capacity to maintain homeostasis, which is a common characteristic of the human aging process (Natashia et al., n.d.).

Demographically, Indonesia is experiencing an accelerated aging of its population. Data from the Central Statistics Agency show that the proportion of the elderly population has increased significantly; for example, the population aged 60 and older reached approximately 10.7% of Indonesia's total population in 2020 and is projected to continue rising, nearly doubling by 2045. This indicates a trend toward an increasingly aging population due to rising life expectancy and declining fertility rates (Indonesia, 2024). The prevalence of health conditions related to older adults also shows patterns that need attention. For example, a systematic study in Indonesia reported that around 26.8% of older adults experience frailty (functional weakness that increases the risk of falls, hospitalization, or death) and 55.5% are in a prefrailty state, indicating that many older adults are on the verge of health vulnerability (Pradana et al., 2023). In addition, older adults face various other health issues such as hypertension, diabetes mellitus, and cognitive decline (like dementia), and their prevalence tends to increase with age.

Type 2 diabetes mellitus is a noncommunicable disease whose prevalence continues to rise in Indonesia, particularly among the elderly. This disease is characterized by insulin resistance and impaired insulin secretion, which lead to elevated blood glucose levels (Indonesian Ministry of Health, 2020). The rise in diabetes mellitus is attributed to genetic factors, being overweight, sudden changes in lifestyle, an unhealthy diet, non-adherence to medication, lack of exercise, age, smoking, and stress. Stress is a factor that can affect blood sugar levels in people with type 2 diabetes; high stress levels and a lack of stress management can make it difficult for them to control their blood sugar levels. People with diabetes experience stress due to various physical changes and life challenges, such as physical changes that make it difficult for them to perform their usual activities, which ultimately affects their financial situation. Severe stress experienced by people with diabetes tends to result in frequent hunger, which increases their appetite, restlessness during sleep, and a tendency to speak less than usual. Another factor that can cause stress in people with diabetes is feeling lonely due to being far from their families or feeling alienated within their own families, which makes them

Based on the Basic Health Research data, the prevalence of diabetes in Indonesia shows a significant increase with age and changes in people's lifestyles (Risksdas, 2018). Elderly people with Type 2 Diabetes Mellitus are at risk of various complications such as peripheral neuropathy, circulation problems, and diabetic foot ulcers, which can reduce functional ability and quality of life

(PERKENI, 2021). A lack of knowledge about preventing complications and low physical activity are factors that worsen this condition (Ministry of Health RI, 2020). Many elderly people do not yet understand the importance of controlling blood sugar levels, foot care, and regular physical activity as part of disease management. This leads to an increased risk of complications and affects their independence in performing daily activities. Therefore, the increasing prevalence of Type 2 Diabetes in the elderly is not just an individual health problem, but also a public health burden that requires special attention through ongoing promotive and preventive efforts

Globally, 1 in 5 elderly people suffer from diabetes mellitus. According to data from the International Diabetes Federation (IDF) in 2019, there were 136 million elderly people with diabetes (IDF, 2019). By 2021, the prevalence of diabetes among the elderly had increased to 200 million (47%), with nearly half of these cases in Asia, especially in India, China, Pakistan, and Indonesia (Safitri et al., 2023).

Poorly managed diabetes in Indonesia itself shows a very significant increase in cases. Based on the results of the Indonesian Health Survey (SKI) in 2023, the prevalence of diabetes continues to rise, with the highest incidence observed in the productive age group (18-59 years), where 52.1% of cases are type 2 diabetes, and in the elderly (60 years and above) 48.9% [3]. The prevalence of type II diabetes mellitus in Jambi Province in 2020 was 4.37%, ranking 10th among the most common diseases in Jambi Province. In 2021 it increased to the 7th rank at 5.48%, and in 2022 it went up further to rank 5 at 6.05%. There has been a significant year-to-year increase in type 2 diabetes cases, both in Jambi and nationally, mostly affecting the productive age group.

In the context of Diabetes Mellitus, this intervention focuses on preventing complications through health education and increased physical activity. Physical therapy helps improve muscle strength, balance, and blood circulation through structured exercises (Carolyn Kisner, Lynn Allen Colby, 2018). Proper education can also raise awareness among the elderly about adopting a healthy lifestyle and sticking to their therapy (PERKENI, 2021). Additionally, this intervention aims to boost insulin sensitivity, improve peripheral circulation, and prevent functional decline due to chronic complications. One common form of intervention is therapeutic exercise, which is a structured exercise program designed to enhance muscle strength, endurance, flexibility, and body balance (Kisner & Colby, 2012). This exercise has been proven to help control blood glucose levels and improve daily activity abilities in elderly people with diabetes. Besides that, aerobic exercise is also an important part of physiotherapy interventions, which is defined as physical activity that involves large muscle groups in a rhythmic and continuous way to boost cardiorespiratory capacity. Aerobic exercises like walking or light aerobics can help improve glucose metabolism and heart health.

Resistance exercise or training against weights using simple tools like a theraband is one form of physical activity that can stimulate blood flow, strengthen muscles, and help improve peripheral perfusion. This exercise is not only effective but also easy to do both at health facilities and at home (Wulandari

et al., 2025). Resistance exercise using a theraband is also called resistance strengthening exercise by shortening and lengthening muscles within a normal ROM using a theraband or colored elastic rubber that has high flexibility. Resistance band exercise can improve blood vascularization and physical strength in the elderly. In addition, resistance band exercise is believed to increase joint range of motion and body balance in older adults. Theraband is a tool made from elastic natural rubber latex (or non-latex) designed for strength training, rehabilitation, and physical therapy (Miranda et al., n.d.).

In addition, physical exercise is one of the first efforts undertaken for the prevention, control, and management of diabetes. According to Chaveau and Kaufman in Afridon (2018), physical exercise can have a direct effect on lowering blood sugar levels. This is because during physical exercise, muscles actively use glucose. There is also increased blood flow, allowing more capillary networks to open. This results in more insulin receptors being available and more active, leading to a reduction in blood glucose levels in diabetes patients (Oktavianisya & Aliftitah, 2022). In current education and prevention programs, a combination of sit-to-stand exercises with dumbbells is used. Sit-to-stand with dumbbells is a modified form of the standard functional test, adding weight (such as dumbbells), to more intensively measure improvements in muscle strength, lower limb endurance, and balance.

The next step in preventing type 2 diabetes mellitus can be done with light aerobic exercise in the form of anti-diabetes workouts. Aerobic exercise is a series of movements designed using musical choices/rhythms and performed intentionally, so it involves rhythm, continuity, and timing. The movements in aerobic exercise are adjusted to the music that will accompany each stage of the movements. According to its purpose, aerobic exercise training. This type of exercise has the same function, which is to improve physical fitness and make the body more prepared to participate in sports training. It uses more varied movements with different intensities. High-intensity movements naturally tend to be faster and more dynamic, while moderate-intensity movements are more evenly paced, and low-intensity movements are mostly slower or gentle. The hope is that by doing movements in aerobic exercise, you can maintain body stability and appearance (Supriatna & Gandasari, 2023). Aerobic exercise and activity are one way to manage the prevention and treatment of diabetes. With glycemic control, aerobic exercise has benefits in reducing insulin resistance, increasing aerobic capacity, body strength, and endothelial function (Suputra, 2024).

Based on this, there is a need for community service activities focused on education and physiotherapy exercises as an effort to prevent complications of Type 2 Diabetes in elderly people. This activity is expected to increase the knowledge, awareness, and skills of the elderly in managing their health independently through adopting an active and healthy lifestyle. In addition, the intervention provided also aims to improve functional abilities, maintain physical fitness, and reduce the risk of further complications. Thus, this program not only plays a preventive role but also promotes improving the quality of life for the elderly. Therefore, carrying out this community service activity is

important as a tangible contribution to improving public health, especially for elderly groups with Type 2 Diabetes.

IMPLEMENTATION AND METHOD

This community service activity started with a preparation stage that included observation and coordination with the Elderly School partner, Mitra Hati Dinsos P2KB in Pekalongan City. Next, problems were identified through group discussions to understand the elderly's level of knowledge about Type 2 Diabetes Mellitus and the prevention of its complications. The implementation stage began with health screening activities for the elderly, which included simple checks like blood pressure and random blood sugar levels. In addition, functional ability and balance measurements were carried out to determine the initial condition of the participants.

After the screening, a health education activity was carried out about Type 2 Diabetes Mellitus, including its definition, risk factors, complications, and the importance of prevention through a healthy lifestyle and physical activity. The education was given using an interactive lecture method and supporting media such as leaflets or posters to make it easy for the elderly to understand. The interventions provided included health education and physiotherapy exercises. The education was delivered through an interactive lecture covering the definition, risk factors, complications, and prevention of Type 2 Diabetes Mellitus. In addition, demonstrations and practice of physiotherapy exercises were given, which included muscle strengthening exercises using a theraband, light aerobic exercises, and balance exercises.

This activity is carried out in stages: a pre-test before education to understand the participants' initial knowledge, followed by the delivery of materials and exercises, and ending with a post-test to evaluate the improvement in the elderly participants' understanding. The evaluation stage is done by comparing the pre-test and post-test results and directly observing the participants' abilities during the exercises. The evaluation results are used to assess the effectiveness of the education program and physiotherapy exercises in increasing the elderly's knowledge and functional abilities to prevent Type 2 Diabetes complications.

RESULTS AND DISCUSSION

This community service activity was carried out at the Mitra Hati Senior School under Dinsos P2KB in Pekalongan City, targeting elderly participants in the training program. Based on the initial screening results, most participants showed limited knowledge about Type 2 Diabetes Mellitus, especially regarding risk factors, complications, and the importance of physical activity in preventing complications. The pre-test results showed that the elderly's level of knowledge was still quite low. This was evident from the many participants who did not yet understand the link between uncontrolled blood sugar levels and the risk of complications such as peripheral neuropathy, circulation problems, and diabetic foot ulcers. Also, most elderly participants did not know what types of physical exercises were safe and suitable for their condition.



Figure 1 Diabetes Mellitus Exercise



Figure 2 General Check

After the intervention, which included health education and enforced physiotherapy exercises, there was an improvement in participants' understanding, as shown by the post-test results. Participants began to understand the importance of managing Type 2 Diabetes on their own, including maintaining a proper diet, regularly engaging in physical activity, and having routine health check-ups. During the practice sessions, most participants were able to follow the exercises provided, such as muscle strengthening with therabands, light aerobic exercises, and balance exercises. However, some participants still needed guidance in maintaining coordination and balance while performing the movements, especially during balance exercises.

The increase in participants' knowledge and abilities shows that combining health education with physiotherapy exercises has a positive impact on older adults' understanding and skills in preventing Type 2 Diabetes complications. The exercises help improve muscle strength, balance, and blood circulation, which can support maintaining seniors' functional abilities. These results align with previous studies stating that health education can boost awareness and healthy habits in people with diabetes, and regular physical exercise can help control blood sugar levels and prevent further complications. Additionally, balance exercises also help reduce the risk of falls in older adults, which often happen due to a decline in sensorimotor function.

Thus, the combination of education and physiotherapy exercises is an effective approach for promoting health and preventing problems in elderly people with Type 2 Diabetes. This program not only increases knowledge but also encourages behavior changes toward a healthier lifestyle. After conducting this physiotherapy screening and education activity, the participants' knowledge and understanding regarding the physiotherapy prevention of type 2 Diabetes Mellitus complications at the Mitra Hati Elderly School in Pekalongan City were measured by giving a pre-test before the counseling and training, and a post-test after the physiotherapy counseling and training. The pre-test and post-test were conducted by giving participants a sheet containing 5 statements, and then the participants chose whether the statements were "True" or "False." The results obtained were as follows:

Table 1 Pre Test Results

question	Pre Test	
	Number of participants who answered 'Yes'	Number of participants who answered 'No'
1	19	14
2	11	22
3	3	30
4	0	33
5	3	30

Out of 33 participants, all 33 completed the pre-test. Based on the table above, the pre-test results given to the 33 people before the physiotherapy education session were as follows: For statement 1, 19 people answered 'Yes' and 14 answered 'No'; for statement 2, 11 answered 'Yes' and 22 answered 'No'; for statement 3, 3 answered 'Yes' and 30 answered 'No'; for statement 4, 0 answered 'Yes' and 33 answered 'No'; and for statement 5, 3 answered 'Yes' and 30 answered 'No'

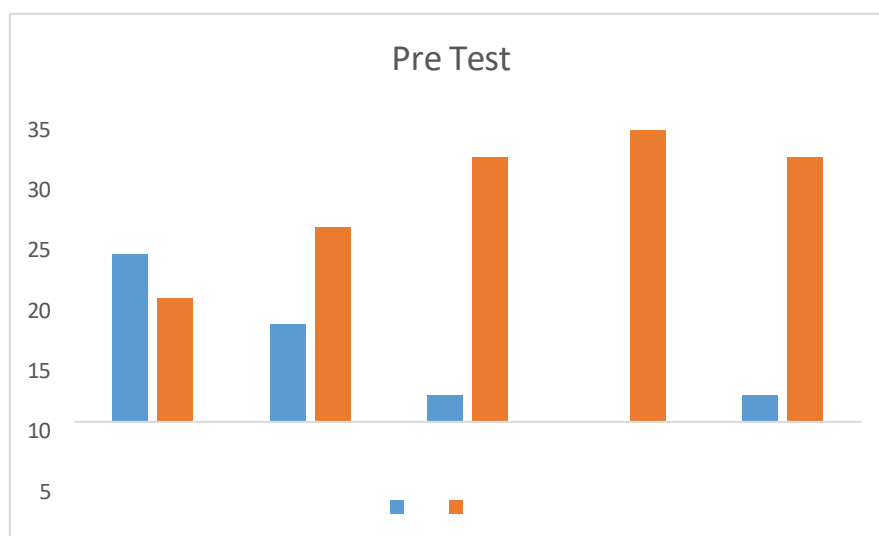


Figure 3. Grafik Total Pre Test

Based on the knowledge and understanding from the 5 pre-test questions, it was concluded that participants do not yet fully understand the prevention of type 2 diabetes

Table 2 Post Test Results

Question	Post Test	
	Number of participants who answered 'Yes'	Number of participants who answered 'No'
1	29	4
2	31	2
3	32	1
4	32	1
5	32	1

Out of 33 participants, all 33 completed the post-test. Based on the table above, we can see the post-test results for the 33 people before the physiotherapy education was conducted: for statement 1, 29 people answered 'Yes' and 4 answered 'No'; for statement 2, 31 answered 'Yes' and 2 'No'; for statement 3, 32 answered 'Yes' and 1 'No'; for statement 4, 32 answered 'Yes' and 1 'No'; and for statement 5, 32 answered 'Yes' and 1 'No'



Figure 4. Grafik Total Post Test

Based on the results of knowledge and understanding from 5 post-test questions, it is concluded that the participants have more knowledge and understanding about preventing type 2 diabetes.

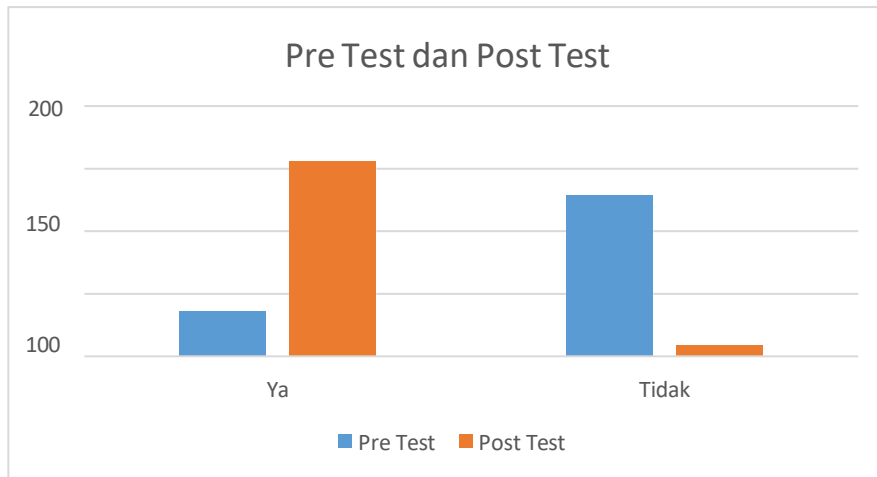


Figure 5. Grafik Total Pre Test and Post Test

Based on the graph above, it can be seen that the results of the pre-test and post-test on knowledge about preventing type 2 diabetes show that before the counseling was conducted, questions about preventing type 2 diabetes were first distributed. The pre-test results indicated that knowledge about preventing type 2 diabetes was mostly not good (lacking understanding of the material) at 78%, while good knowledge (understanding the material) was 22%. The post-test results showed that knowledge about preventing type 2 diabetes was mostly in the good category at 95%, with not good knowledge at 5% out of a total of 33 respondents.

CONCLUSION AND RECOMMENDATIONS

Based on community service activities at the Mitra Hati Elderly School in Pekalongan City, it can be concluded that providing health education combined with physiotherapy exercises is proven to be very effective in improving the understanding and functional abilities of elderly individuals with Type 2 Diabetes Mellitus. Before the intervention, most elderly participants had low knowledge levels, with only about 22% having a good understanding of the material. However, after participating in the counseling and training program, there was a drastic increase, with 95% of participants gaining a good understanding of risk factors, prevention of complications such as neuropathy and foot ulcers, and the importance of physical activity. Specific physiotherapy interventions applied, such as strength training with therabands, light aerobic exercises, and balance exercises, play an important role in improving blood circulation, increasing muscle strength, and reducing the risk of falls in the elderly. This structured physical activity helps control blood glucose levels by boosting the muscles' active use of glucose. Overall, this program not only works as a preventive measure to avoid further decline in body function, but it also promotes independence and improves the quality of life for older adults through a healthier and more active lifestyle.

REFERENCES

- Carolyn Kisner, Lynn Allen Colby, J. B. (2018). *Therapeutic Exercise: Foundations and Techniques*.
- Indonesia, B. P. statistik. (2024). *Statistik Populasi Lansia 2024*. 21.
https://www.bps.go.id/en/publication/2024/12/31/a00d4477490caaf0716b711d/statistik-penduduk-lanjut-?utm_source=chatgpt.com
- Kementrian Kesehatan RI, K. K. R. (2020). *Profil Kesehatan Indonesia 2020*.
- Kisner, C., & Colby, L. A. (2012). *Therapeutic Exercise Foundations and Techniques*, Sixth Edition, F.A. Davis Company, America.
- Miranda, G., Utomo, B., & Ghufroni, A. (n.d.). Pengaruh Resistance Exercise Menggunakan Theraband Terhadap Peningkatan Keseimbangan Dinamis Lansia. 000, 338–348.
- Natashia, D., Rahma, P. A., & Fitria, D. (n.d.). Exploring The Relationships Between Psychological Changes, Sleep Quality, And Hypertension Among Community-Dwelling Elderly.
- Oktavianisya, N., & Aliftitah, S. (2022). Pengaruh Senam Diabetes Mellitus terhadap Penurunan Kadar Gula Darah pada Penderita Diabetes Mellitus Tipe 2 The Effect of Diabetes Mellitus Exercise on Reducing Blood Sugar Levels in Type 2 Diabetes Mellitus Patients. 16(2), 214–219.
- PERKENI. (2021). *Pedoman pengelolaan dan pencegahan diabetes melitus tipe 2 di indonesia*.
- Pradana, A. A., Chiu, H. L., Lin, C. J., & Lee, S. C. (2023). Prevalence of frailty in Indonesia : a systematic review and meta - analysis. *BMC Geriatrics*, 1–14. <https://doi.org/10.1186/s12877-023-04468-y>
- Riskesdas. (2018).
- Safitri, Lestari, indri puji, & Fitri, N. (2023). pengaruh pemberian rebusan daun kelor (*moringa oleifera*) terhadap penurunan kadar glukosa darah pada lansia DM tipe 2. 5, 657–666.
- Supriatna, E., & Gandasari, M. F. (2023). Latihan Senam Aerobic Intensitas Sedang (Low Impact) terhadap Penurunan Persen Lemak Tubuh dan Berat Badan. *Ilmu Olahraga*, 4(1), 78–86.
- Suputra, P. A. (2024). Latihan Aerobik Pada Diabetes Tipe 2. 4(2), 105–116.
- Uad, F. K. M. (2021). Faktor Penyebab Stres Pada Penderita Diabetes Melitus Tipe 2 Factors Causing Stress In Type 2 Diabetes Mellitus Patients. 3(2), 304–313.
- Wulandari, A., Damayantie, N., & Yan, L. S. (2025). Studi Kasus : Penerapan Resistance Exersice untuk Meningkatkan Sirkulasi Perifer pada Pasien Diabetes Mellitus Tipe II. 4(2), 193–198.