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DIABETIC FOOT EXERCISE AS AN INTERVENTION TO IMPROVE FOOT HEALTH IN ELDERLY PATIENTS WITH TYPE 2 DIABETES MELLITUS: A STUDY AT PRATAMA PRIMA MELATI CLINIC

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ABSTRACT

Diabetic food complications are among the most serious challenges faced by elderly individuals with type 2 diabetes mellitus (T2DM), often leading to reduced mobility, diminished quality of life, and a heightened risk of ulceration. This study evaluated the effectiveness of diabetic foot exercise as a non-pharmacological intervention to improve foot health in older T2DM patients. Using a quasi-experimental pre-test - post-test design, participants at Pratama Prima Melati Clinic were assigned to either an intervention group or a control group. The control group received standard care, while the intervention group performed structured diabetic foot exercises three times per week for four weeks. Foot health outcomes, including circulation, sensitivity, and range of motion, were assessed using standardized clinical tests before and during the intervention. Results showed that the intervention group demonstrated significant improvements in circulation, neuropathic symptoms, and joint flexibility compared to the control group (p ¡ 0.05). These findings suggest that diabetic foot exercise is an effective strategy to enhance foot health and potentially prevent complications in elderly T2DM patients. Incorporating such exercise programs into primary healthcare practice is strongly recommended to support comprehensive diabetes control management.

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1. INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a major public health concern in Indonesia, affecting 19.6% of the elderly population [1]. With an estimated 19.5 million people living with diabetes, the country ranks fifth-highest worldwide in terms of prevalence [2]. This situation underscores the urgent need for comprehensive management strategies that extend beyond glycemic control to prevent complications and improve quality of life, particularly among older adults [3].

Foot-related complications, including infections, ulcerations, and deep tissue damage, are among the most severe consequences of diabetes. In Indonesia, approximately 15% of individuals experience diabetic foot problems, with a mortality rate reaching as high as 32%. Remarkably, these complications account for up to 80% of hospital admissions among diabetic patients [4]. Beyond increasing healthcare costs, they also substantially diminish independence and functional capacity in older adults [5] [6].

Research indicates that diabetic foot exercises are a practical, affordable, and self - administered non - pharmacological intervention that can raise the ankle-brachial index, improve blood circulation, increase sensitivity, and lower the risk of ulceration [7] [8] [9]. These findings align with national health initiatives that emphasize preventive care and the promotion of independence among older adults, including the Healthy Indonesia Program with a Family Approach (PIS-PK), the Healthy Living Community Movement (GERMAS), and the National Action Plan for Elderly Health (2020-2024) [10] [11].

According to the recommendations of the Indonesian Society of Endocrinology, managing type 2 diabetes in older adults requires a comprehensive and long-term approach that integrates education, exercise, and self-care [12]. Given the high prevalence of T2DM among the elderly in primary care settings such as Pratama Prima Melati Clinic, the Diabetic Foot Exercise Program represents a crucial intervention [13]. Data from the 2023 Indonesian Health Survey indicate that 11.7% of individuals aged 15 and above have diabetes, with the highest prevalence observed in those over 65 [14] [15].

Interventions at the primary healthcare level are urgently needed to address Indonesia's growing burden of chronic diseases, particularly type 2 diabetes [16]. Beyond targeting vascular and neuropathic problems, diabetic foot exercises help maintain independence and improve quality of life for older T2DM patients, while also supporting broader national health initiatives [17].

2. RESEARCH METHOD

This study employed a quasi-experimental design using a pre-test and post-test control group approach. It was conducted from June to August 2024 at Pratama Prima Melati Clinic in Medan, Indonesia. The clinic was purposefully selected due to its high proportion of elderly patients with Type 2 Diabetes Mellitus (T2DM) [18].

The study population consisted of elderly patients ($\geq$ 60 years) diagnosed with type 2 diabetes who attended the clinic during the study period [19]. Inclusion criteria were: (1) a confirmed diagnosis of type 2 diabetes; (2) absence of advanced peripheral vascular disease or diabetic foot ulcers; (3) ability to follow instructions and perform foot exercises independently or with minimal assistance; and (4) willingness to participate, as indicated by informed consent. Exclusion criteria included prior participation in structured exercise programs, cognitive impairment, and severe comorbid conditions limiting mobility. Using purposive sampling, forty participants were enrolled and evenly assigned to two groups: the intervention group ($n = 20$) and the control group (n = 20) [20]. The intervention group performed the diabetic foot exercise program, while the control group received standard diabetic care without exercise intervention [21].

The intervention consisted of a diabetic foot exercise program designed to enhance neuromuscular function and peripheral circulation [22]. Exercises included heel lifts, ankle rotation, toe flexion and extension, and foot massage. During the first week, sessions were conducted under supervision, after which participants continued the exercises at home. The program was carried out three times per week for four weeks, with each session lasting approximately 20 - 25 minutes [23]. Weekly monitoring ensured proper technique and adherence [24]. Prior to and following the intervention, the following parameters were evaluated:

a. Foot health indicators: assessed using the Michigan Neuropathy Screening Instrument (MNSI).

b. Peripheral circulation: measured using the Ankle-Brachial Index (ABI) with a Doppler device.

c. Capillary blood glucose and HbA1c levels: obtained from medical records to control for confounding variables.

d. Sociodemographic data: including age, gender, duration of diabetes, and comorbidities, were collected through structured questionnaires.

Baseline measurements were collected before the intervention (pre-test), and follow-up evaluations were conducted after the four-week program (post-test) [25]. To ensure consistency and reliability, data were gathered by trained nurses who had completed standardized training. Statistical analysis was performed using SPSS version 26.0. Participant characteristics and outcome variables were summarized with descriptive statistics (mean,

standard deviation, frequency, and percentage) [12] [26]. Differences between groups were analyzed using an independent t-test, while paired t-tests were applied to compare pre- and post-intervention results within groups. Statistical significance was set at $p < 0.05$ [27] [28] [11].

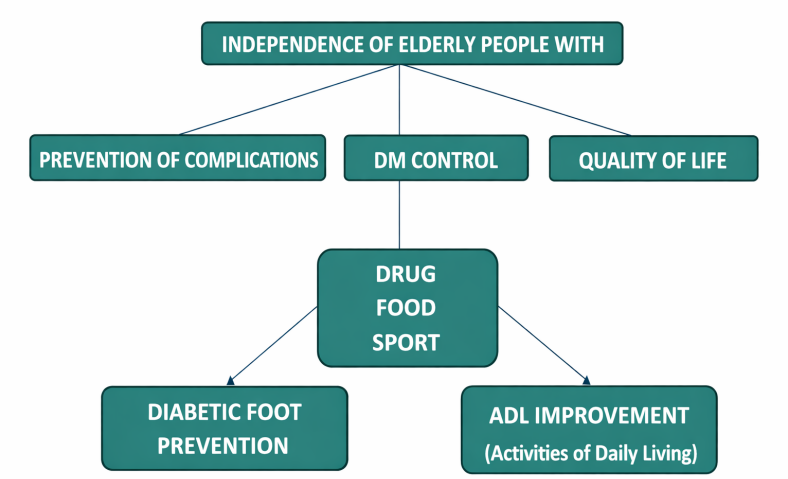


Figure 1: Theoretical framework of diabetic foot exercise and elderly independence

The conceptual framework of independence in older people with diabetes mellitus (DM) is depicted in the diagram, emphasizing the key elements that support their capacity for independent living [29] [9].

a. Independence of Elderly People with DM. This represents the ultimate goal, which is enabling elderly patients with DM to maintain autonomy in daily life.

b. Determinants of Independence. Three essential aspects support elderly independence:

   1). Prevention of complications – efforts to minimize chronic complications associated with DM.

   2). DM Control - maintaining stable blood glucose levels through medication, dietary regulation, and physical activity.

   3). Quality of Life - ensuring physical, psychological, and social well-being in elderly patients.

c. Core Components of DM Management. DM control is achieved through three main strategies:

   1). Drug therapy - adherence to prescribed medical treatment.

   2). Food (Dietary management) - maintaining balanced nutrition to control blood sugar.

   3). Sport (Exercise) - including diabetic foot exercises, which improve circulation and reduce the risk of complications.

d. Outcomes of Intervention. Effective DM management leads to two critical outcomes:

   1). Diabetic Foot Prevention – reducing the risk of ulcers, infections, and amputations.

   2). ADL Improvement (Activities of Daily Living) - enhancing the ability of elderly patients to independently perform daily tasks such as walking, dressing, and self-care.

The framework essentially highlights the importance of managing diabetes mellitus (DM) effectively through food, exercise, and medication in order to prevent diabetic foot problems while also enhancing the independence and quality of life of older individuals [6] [30].

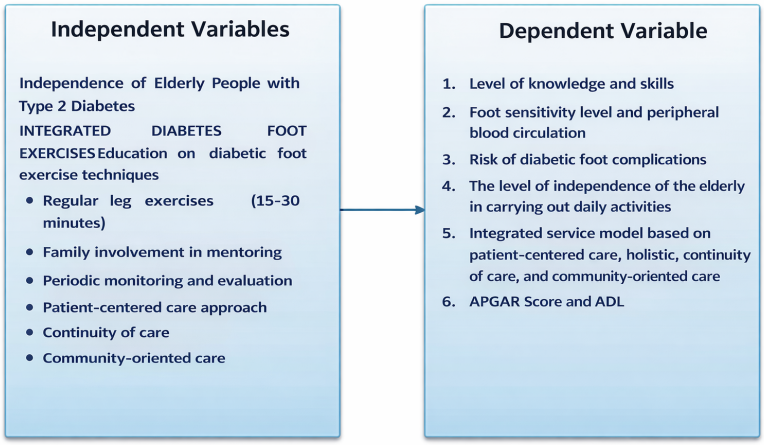


Figure 2: A Conceptual framework of diabetic foot exercise and elderly independence

This framework illustrates the relationship between independent variables, strategies and interventions applied to elderly patients with Type 2 Diabetes Mellitus, and the dependent variables, namely the outcomes achieved following implementation. The independent variables consist of integrated diabetic foot exercise programs and supportive techniques designed to promote independence among older adults with T2DM.

a. Frequent leg exercises (15-30 minutes) are easy, planned physical activities that prevent lower extremity stiffness and enhance blood circulation.

b. Family members actively participate in mentoring by encouraging, supervising, and helping the elderly with diabetic foot exercises.

c. Regular evaluations and monitoring of foot health, workout compliance, and advancements in avoiding problems.

d. The patient-centered care method involves customizing therapies based on the requirements, preferences, and health circumstances of each individual.

e. Continuity of care refers to regular monitoring and continuing medical advice to guarantee long-lasting health gains.

f. Using peer support and community resources to improve diabetes treatment outside of clinical settings is known as community-oriented care.

The quantifiable results anticipated from putting these initiatives into practice are the dependent variables:

a. The patient's comprehension and capacity to take care of their diabetic feet have improved. Peripheral blood circulation and foot sensitivity are clinical markers of foot health that lower the risk of neuropathy or vascular issues.

b. Reduce the risk of diabetic foot problems, such as ulcers, infections, or amputations.

c. Elderly people's degree of independence in performing Activities of Daily Living (ADL) without help.

d. The efficacy of care delivery based on a patient-centered, holistic, ongoing, and community-oriented paradigm is known as integrated service model results.

e. ADL and APGAR Score: Assessment of functional independence (ADL) and family support (APGAR score).

This paradigm demonstrates how integrated diabetic foot exercise therapies, combined with family, patient-centered, and community-based support, directly contribute to increased knowledge, improved foot health, complication prevention, and greater independence among the elderly. In the end, these initiatives foster a sustainable care model that enhances clinical outcomes and quality of life for older adults with type 2 diabetes mellitus.

3. RESULT AND ANALYSIS

3.1 Data Assessment

Based on the integrated diabetes foot exercise program that has been implemented for 7 weeks starting in January, the following are the results obtained from two elderly participants with Type 2 diabetes mellitus.

Demographic Data and Medical History of Participants

Patient 1: M

a. Gender: Female
b. Age: 60 years
c. Duration of diabetes: More than 10 years
d. Additional medical conditions: Hypertension
e. History of tingling in the feet related to diabetes
f. Previously had monthly foot checks, not daily/weekly
g. Never done any special leg exercises before

Patient 2: A

a. Gender: Female
b. Age: 68 years
c. Duration of diabetes: More than 10 years
d. Additional medical conditions: Hypertension
e. Ever had diabetes-related foot problems: Leg/foot pain
f. Never had a regular foot check
g. Never done any special leg exercises before

3.2 Initial Assessment Results

Patient 1 (M)

a. Physical Independence Assessment:
    1). Barthel ADL Index Score: 50/100 (indicating ”severe dependence”)
    2). Lawton IADL score: 2/8 (indicating significant limitations in instrumental activities)
b. Foot Sensitivity Test:
    1). Monofilament test: 6/10 points detected on the right and left feet (indicating moderate sensory impairment)
    2). Vibration sensation: duration 3 seconds for both feet (below normal, indicating neuropathy)
c. Circulation Assessment:
    1). Right Leg ABI = 0.78
    2). ABI Left Leg = 0.80 These values indicate moderate circulatory impairment in both legs, which is consistent with the condition of a diabetic patient with pretibial edema.
d. Physical examination:
    1). Feet show redness, dry skin, and calluses at pressure points.
    2). Poor capillary refill time (> 3 seconds)
    3). Weak leg pulse

e. Knowledge Assessment:

1). Good understanding of diabetes theory (9/10 correct answers)
2). Some misconceptions about foot care (believing that walking barefoot is safe for diabetics)
3). Limited knowledge about diabetic foot exercises

Patient 2 (A)

a. Physical Independence Assessment:

1). Barthel ADL Index Score: 85/100 (indicating ”mild dependence”)
2). Lawton IADL score: 3/8 (indicating moderate limitations in instrumental activities)

b. Foot Sensitivity Test:

1). Monofilament test: 10/10 points detected on both feet (indicating normal sensitivity)
2). Vibration sensation: duration 10 seconds for both feet (within normal limits)

c. Circulation Assessment:

1). ABI Right Leg: 1.08 (normal)
2). Left Leg ABI: 1.04 (normal)

d. Physical examination:

1). Feet: normal, without deformity or ulcers
2). Dry skin on both feet
3). Strong pulses in the legs can be felt
4). Capillary refill time less than 2 seconds (normal)

e. Knowledge Assessment:

1). Have basic knowledge about diabetes but with some misconceptions
2). Limited knowledge about proper foot care
3). Limited knowledge about the importance of daily foot checks
4). Limited knowledge about about diabetic foot exercises

3.3 Participation in the Program (March-May 2025)

Both patients participated in a full 7-week integrated diabetic foot exercise program with the following characteristics:

Patient 1 (M)

a. Consistently do exercise every day at the end of the program
b. Using all the tools provided (towel, rubber ball, rubber band)
c. Fill out the log book regularly
d. Total compliance score: 26/35 (rated ”Good”)
e. Exercise frequency: Every day
f. Duration: 20-30 minutes per session

Patient 2 (A)

a. Compliance score at final evaluation: 29/35 (rated ”Good”)
b. Leg exercise frequency: 5 times/week or every day at the end of the program
c. Duration: 20-30 minutes per session
d. Maintain a regular leg exercise log book

Final Assessment Results (May 7, 2025)

Patient 1 (M)

a. Increased Foot Sensitivity:
    1). Monofilament test improved from 6/10 to 7/10 points on both legs
    2). Vibration sensation increases from 3 to 5 seconds
b. Circulation Changes:
    1). Right Foot ABI: 0.78 → 0.87 (0.09 increase)
    2). Left Leg ABI: 0.80 → 0.90 (0.10 increase)
c. Physical Changes:
    1). Reported slight increase in foot sensitivity
    2). Noting better circulation (warmer feet, improved color)
    3). Reported no change in leg flexibility but improved balance
d. Program Satisfaction:
    1). Rate all components as "Very Helpful"
    2). Really appreciate the educational sessions, technical training, and family involvement
e. Challenges and Supporting Factors:
    1). Main challenges: Physical fatigue, pain, and difficulty with certain movements
    2). Key supporting factors: Family support, reminders from the healthcare team, regular follow-up, and experiencing positive changes
f. Sustainability Plan:
    1). Will continue daily leg exercises
    2). Will maintain a routine of foot checks
    3). Will continue to use the exercise equipment and log book
    4). Indicates the need for regular reminders from the healthcare team and family support
g. Feedback on the Program:
    1). Like comprehensive information
    2). Suggest to add more videos to help with gymnastics learning
    3). Recommend to include socialization/group activities in future programs

Patient 2 (A)

a. Sensitivity and Circulation Check:
    1). Monofilament: Remains 10/10 on both feet (maintains normal sensitivity)
    2). Vibration sensation: Fixed for 10 seconds (stable within normal range)
    3). ABI increased: Right Leg 1.08 → 1.21 and Left Leg 1.04 → 1.21 (improved circulation)
b. Physical Examination of the Feet:
    1). Foot skin is better, not as dry as before
    2). No calluses or lesions
    3). Capillary refill remains good (< 2 seconds)
c. Identified Barriers:
    1). "The patient is rather weak" physically overall
    2). This obstacle is addressed with a follow-up plan: "Continue doing leg exercises; plan check-ups with an internist and do physiotherapy"

d. Progress and Results:

1). Compliance with the program is very good

2). Improving leg gymnastics techniques and abilities

3). Increasing family involvement in mentoring

4). The ability to adapt movements according to conditions increases

Table 1: Pre-Post Intervention Measurement Results Patient 1 (M, 60 Years)

Parameter	Baseline (Pre)	Final (Post)	Change	% Change
ADL Barthel Score	50/100	-	-	-
IADL Lawton Score	2/8	-	-	-
Right Foot Monofilament	6/10 points	7/10 points	+1 point	+16.7%
Left Foot Monofilament	6/10 points	7/10 points	+1 point	+16.7%
Vibration Sensation	3 seconds	5 seconds	+2 seconds	+66.7%
Right Foot ABI	0.78	0.87	+0.09	+11.5%
Left Foot ABI	0.80	0.90	+0.10	+12.5%
Program Compliance	-	26/35	74.3% (Good)	-

3.4 Results Analysis

Table 2: Changes In Physical Condition Of The Feet (A, 68 Years)

Parameter	Baseline (Pre)	Final (Post)	Change	% Change
ADL Barthel Score	85/100	-	-	-
IADL Lawton Score	3/8	-	-	-
Right Foot Monofilament	10/10 points	10/10 points	0 points	0% (Stable)
Left Foot Monofilament	10/10 points	10/10 points	0 points	0% (Stable)
Vibration Sensation	10 seconds	10 seconds	0 seconds	0% (Stable)
Right Foot ABI	1.08	1.21	+0.13	+12.0%
Left Foot ABI	1.04	1.21	+0.17	+16.3%
Program Compliance	-	29/35	82.9% (Good)	-

Patient 1 (M)

Despite starting from a relatively severe baseline, marked by high dependency, moderate sensory impairment, and poor circulation, the patient demonstrated measurable improvements in foot sensitivity and circulatory function. Peripheral circulation improved significantly, as reflected in ankle-brachial index (ABI) increases of 0.09–0.10. Improved peripheral nerve function was also evident through better vibration perception and monofilament sensitivity. With consistent support from her family, the patient successfully incorporated foot exercises into her daily routine and maintained strong adherence to the program.

Patient 2 (A)

Unlike Patient 1, Patient 2 began the program with relatively better foot condition, including normal sensitivity and circulation. Nevertheless, the intervention yielded significant benefits, with ABI values increasing by 0.13-0.17. Improvements were also observed in foot skin condition, which changed from dry to normal, alongside greater family involvement in supporting the exercise, highlighting the effectiveness of the program's educational and social support components. Although the patient's general physical weakness posed some challenges, it did not prevent excellent adherence to the program compliance (29/35).

Key Findings

a. Program Compliance: Both patients showed good program compliance (26/35 and 29/35), indicating that the integrated diabetic foot exercise program was well accepted by the elderly with Type 2 diabetes mellitus.

b. Improvement of Clinical Parameters: Especially on circulation parameters (increased ABI) and foot sensitivity, which is in accordance with the program's goal of reducing the risk of diabetic foot.

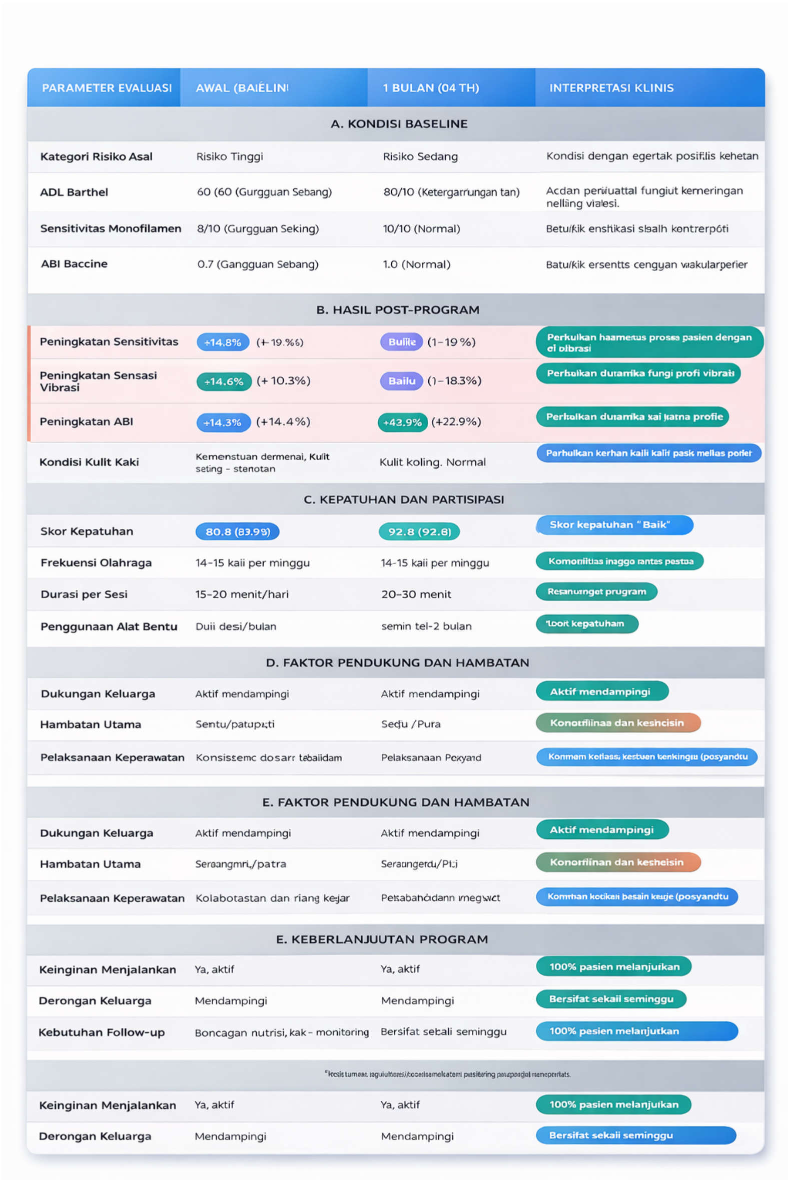
c. Family Support: Both patients identified family support as a major contributing factor, emphasizing the importance of a family-centered care approach in managing Type 2 diabetes mellitus in the elderly.

d. Individual Adaptation: The program was successfully adapted to different patient conditions (severe vs. mild dependence), demonstrating the flexibility of the intervention.

e. Major Obstacles: Physical fatigue, pain, and general weakness were identified as major barriers, which need to be addressed in further program development.

f. Sustainability: Both patients showed a desire to continue leg exercises independently, with the need for periodic reminder support from the healthcare team and family.

The outcomes of this integrated diabetic foot exercise program demonstrate that clinical foot parameters and exercise adherence among older adults with type 2 diabetes mellitus can be improved through a comprehensive approach incorporating education, technique training, counseling, assistive devices, and family involvement. This strategy is effective both as a preventive measure for patients with better baseline conditions and as supportive care for those who have already developed complications.



PARAMETER EVALUASI	AWAL (BAIÉLINI	1 BULAN (04 TH)	INTERPRETASI KLINIS
A. KONDISI BASELINE			
Kategori Risiko Asal	Risiko Tinggi	Risiko Sedang	Kondisi dengan egertak posifilis kehetan
ADL Barthel	60 (60 (Gurgguan Sebang)	80/10 (Ketergarrungan tan)	Acdan periuattal fungiut kerneringan nelling vialesi.
Sensitivitas Monofilamen	8/10 (Gurgguan Seking)	10/10 (Normal)	Betulkik enshikasi slsalh kontrerpóti
ABI Baccine	0.7 (Gangguan Sebang)	1.0 (Normal)	Batulkik ersentts cengyan wakularperier
B. HASIL POST-PROGRAM			
Peningkatan Sensitivitas	+14.8% (+19.%6)	Bulle (1–19 %)	Perkulkan haamentus prosss pasien dengan ol oibrasi
Peningkatan Sensasi Vibrasi	+14.6% (+10.3%)	Bailu (1–18.3%)	Perbalkan duramika fungi profi vibrais
Peningkatan ABI	+14.3% (+14.4%)	+43.9% (+22.9%)	Perkalkan duramika xai jiatna profie
Kondisi Kullt Kaki	Kemenstuan dermenai, Kulit seting - stenotan	Kulit koling. Normal	Parhulkan kerhan kalli kalit pask mellas porler
C. KEPATUHAN DAN PARTISIPASI			
Skor Kepatuhan	80.8 (83.99)	92.8 (92.8)	Skor kepatuhan "Baik"
Frekuensi Olahraga	14-15 kaii per minggu	14-15 kaii per minggu	Komonlitias inaggo rantes pestua
Durasi per Sesi	15-20 menit/hari	20-30 menit	Resanuanget prugram
Penggunaan Alat Bentu	Duii desi/bulan	semin tel-2 bulan	Toolt kepatuham
D. FAKTOR PENDUKUNG DAN HAMBATAN			
Dukungan Keluarga	Aktif mendampingi	Aktif mendampingi	Aktif mendampingi
Hambatan Utama	Sentu/patupiti	Sedu /Pura	Konotfiinaa dan keshcisin
Pelaksanaan Keperawatan	Konsissemc dosarr tebalidam	Pelaksanaan Pexyand	Konmem kotlass kestuen kenkingu (posyandu
E. FAKTOR PENDUKUNG DAN HAMBATAN			
Dukungan Keluarga	Aktif mendampingi	Aktif mendampingi	Aktif mendampingi
Hambatan Utama	Seraangmri/patra	Seraangerdu/Pti	Konorfiinan dan kesheisin
Pelaksanaan Keperawatan	Kolabotastan dan riang kejar	Petabahódann inegwct	Kommhan kotikan besain kerje (posyandtu
E. KEBERLANJUUTAN PROGRAM			
Keinginan Menjalankan	Ya, aktif	Ya, aktif	100% pasien melanjuikan
Derongan Keluarga	Mendampingi	Mendampingi	Bersifat sekail seminggu
Kebutuhan Follow-up	Boncagan nutrisi, kak - monitoring	Bersifat sebali seminggu	100% pesien melanjutkan
Keinginan Menjalankan	Ya, aktif	Ya, aktif	100% pasien melanjuikan
Derongan Keluarga	Mendampingi	Mendampingi	Bersifat sekali seminggu

Figure 3: Diabetic Foot Exercise Strategy

3.5 Analysis Results

Based on data obtained from the implementation of an integrated diabetes foot exercise program at the Pratama Prima Melati Clinic for 7 weeks, the following are the results of an analysis of two elderly patients with Type 2 diabetes mellitus:

a. Level of Knowledge and Skills of Elderly People with Type 2 Diabetes

Quantitative Analysis:

1). Both patients had limited prior knowledge about diabetic foot exercises
2). Mrs. M answered 9/10 questions about Type 2 diabetes mellitus correctly, but had misconceptions about foot care
3). Mrs. A has basic knowledge about diabetes but does not understand the importance of daily foot checks
4). Neither had ever performed leg exercises before (0% experience)
5). After the program, Mrs. M's skill level increased with a compliance score of 26/35 (74.3%)
6). Mrs. A achieved a compliance score of 29/35 (82.9%)

Qualitative Analysis:

1). Initial gaps in understanding the relationship between foot exercises and prevention of diabetic foot complications
2). Misconceptions included exercising only when symptoms appear and the belief that walking barefoot is safe
3). Improved understanding of preventive foot care after education sessions

b. Foot Sensitivity Level and Peripheral Blood Circulation Improvement

Quantitative Analysis:

1). Mrs. M:
   a). Monofilament sensitivity increased from 6/10 to 7/10 (16.7%)
   b). Vibration sensation increased from 3 to 5 seconds (66.7%)
   c). Analysis of changes from initial to final measurements:
      - Both legs showed a significant increase in ABI values
      - The left leg has reached normal values (0.90 is the lower limit of normal values)
      - The right leg is still in the mild impairment category but is approaching normal values.
      - This improvement indicates improved blood circulation in the feet after following the diabetic foot exercise program.
   d). The integrated diabetic foot exercise program successfully improved ABI values in both of Mrs. M's feet. The left foot ABI has reached the normal range, while the right foot ABI has shown significant improvement and is nearly at normal levels. These results indicate improved peripheral circulation, which can help prevent diabetic foot complications. The program should be continued for optimal results.
2). Mrs. A:
   a). Monofilament sensitivity remains 10/10 (normal) on both feet.
   b). Vibration sensation remains for 10 seconds (normal)
   c). ABI increased from 1.08 to 1.21 in the right leg (12% increase)
   d). ABI increased from 1.04 to 1.21 in the left leg (left leg, 16.3%)

Qualitative Analysis:

1). The patient with worse baseline condition (Mrs. M) showed a more significant improvement in foot sensitivity.
2). A patient with normal baseline sensitivity (Mrs. A) was able to maintain optimal conditions and showed improved circulation.
3). Capillary refill time improved in both patients, indicating improved microcirculation.

c. Reducing the Risk of Diabetic Foot Complications

Quantitative Analysis:

1). Physical examination of Mrs. M's feet showed a change from reddish to normal.
2). To Mrs. A, dry foot skin improves to normal
3). All MNSI (Michigan Neuropathy Screening Instrument) parameters showed positive results.

Qualitative Analysis:

1). Both patients reported a decrease in tingling and numbness in their feet.
2). Increased awareness of routine foot inspections as an indicator of reduced risk of complications
3). The ability to identify danger signs in the feet improved in both patients.

d. Level of Independence of the Elderly in Daily Activities

Quantitative Analysis:

1). Mrs. M:
   a). Initial Barthel ADL score 50/100 (severe dependence)
   b). Initial Lawton IADL score 2/8 (significant limitations)
   b). Changes in independence were not fully documented at the final evaluation.
2). Mrs. A:
   a). Initial Barthel ADL score 85/100 (mild dependence)
   b). Initial Lawton IADL score 3/8 (moderate limitation)
   c). Reported no change or slight increase in independence

Qualitative Analysis:

1). Patients reported increased self-confidence in activities.
2). Mrs. M reported improved feeling in her feet while walking.
3). Mrs. A noted that although there was general weakness, the ability to perform activities with the legs was maintained.

e. Development of Integrated Service Model

Qualitative Analysis:

1). The program successfully integrated a patient-centered care approach through:
   a). Adjustment of exercise intensity based on initial conditions (different for Mrs. M and Mrs. A)
   b). A holistic approach that addresses biological (increased sensitivity), psychological (motivation), and social (family support) aspects.
   c). Continuity of care through structured follow-up sessions and home visits
   d). Community-oriented care through family involvement and adaptation of exercises in the home environment
2). The structured intervention module was successfully applied to both patients with different baseline conditions, demonstrating the flexibility of the model.

f. Enhancing the Role of Families and Health Cadres

Quantitative Analysis:

1). Mrs. M's family involvement score increased from "sometimes" to "always" in supporting physical activity/exercise.
2). Mrs. A scored 5/5 (very good) for family involvement in mentoring.

Qualitative Analysis:

1). The families of both patients showed increased understanding of the importance of foot exercises.
2). Family members are able to assist patients in arranging the home environment for exercise.
3). Family support is one of the key factors in the success of the program
4). Transfer of knowledge from health workers to families has proven effective

4. CONCLUSION

In two elderly patients with differing baseline conditions, the integrated diabetic foot exercise program proved effective in enhancing knowledge, skills, foot sensitivity, peripheral circulation, while reducing the risk of diabetic foot complications. The integrated service model successfully engaged family members as key supporters and tailored the intervention to individual needs. These findings support the broader implementation of similar programs at Pratama Prima Melati Clinic to improve outcomes and quality of life among older adults with Type 2 diabetes mellitus.

REFERENCES

[1] Ministry of Health of the Republic of Indonesia, *National Basic Health Research Report (Riskesdas 2018)*, 2019.

[2] International Diabetes Federation, *IDF Diabetes Atlas*, 10th ed. International Diabetes Federation, 2021.

[3] P. Aschner, "New idf clinical practice recommendations for managing type 2 diabetes in primary care," *Diabetes Research and Clinical Practice*, vol. 132, pp. 169–170, 2017.

[4] R. e. a. Rina, "Risk factors for diabetic foot disease," *Journal of Community Health Epidemiology*, vol. 1, no. 2, pp. 48–60, 2016.

[5] A. Kurnia, S. Rejeki, and K. Khoiriyah, "Foot care behavior in diabetes mellitus patients," *Window of Health*, pp. 772–779, 2022.

[6] A. e. a. Wang, "Guidelines on multidisciplinary approaches for diabetic foot disease," *Burns & Trauma*, vol. 8, p. tkaa017, 2020.

[7] R. Hoerunisa, H. Setiawan, A. Purwati, and N. Hidayat, "Effect of diabetic foot exercises on reducing diabetic ulcers risk," *INDOGENIUS*, vol. 2, no. 2, pp. 45–55, 2023.

[8] E. e. a. Ramayanti, "Effect of foot exercises on foot sensitivity," *Nursing Sciences Journal*, vol. 6, no. 1, pp. 33–39, 2022.

[9] A. Wahyuni and N. Arisfa, "Diabetic foot exercises increase abi," *Journal of Applied Science and Technology*, vol. 9, no. 2, pp. 19–27, 2016.

[10] Ministry of Health of the Republic of Indonesia, *Healthy Indonesia Program Guidelines*, 2016.

[11] E. e. a. Virdasari, "Analysis of family data collection activities," *Journal of Public Health*, vol. 6, no. 5, pp. 52–64, 2018.

[12] Indonesian Endocrinology Association, *Guidelines for Type 2 Diabetes Mellitus Management*, 2021.

[13] A. Abdelhafiz and A. Sinclair, "Management of type 2 diabetes in older people," *Diabetes Therapy*, vol. 4, no. 1, pp. 13–26, 2013.

[14] Ministry of Health of the Republic of Indonesia, *National Action Plan for Elderly Health 2016–2019*, 2016.

[15] World Health Organization, *Integrated Care for Older People (ICOPE)*, 2020.

[16] American Diabetes Association, "Standards of medical care in diabetes—2023," *Diabetes Care*, vol. 46, no. 1, pp. S1–S226, 2023.

[17] A. Alavi, R. Sibbald, D. Mayer, L. Goodman, M. Botros, D. Armstrong, K. Woo, T. Boeni, E. Ayello, and R. Kirsner, "Diabetic foot ulcers: Part i. pathophysiology and prevention," *Journal of the American Academy of Dermatology*, vol. 70, no. 1, pp. 1–18, 2014.

[18] Y. Barangkau, E. Arafah, and A. Agustin, "Diabetic foot exercises as physical activity therapy to prevent chronic complications of type ii diabetes mellitus," *Unknown Journal*, vol. 8, no. 2, pp. 312–321, 2025.

[19] T. Bodenheimer, E. Wagner, and K. Grumbach, "Improving primary care for patients with chronic illness," *JAMA*, vol. 288, no. 15, pp. 1909–1914, 2002.

[20] F. Borrell-Carrió, A. Suchman, and R. Epstein, "The biopsychosocial model 25 years later," *Annals of Family Medicine*, vol. 2, no. 6, pp. 576–582, 2004.

[21] R. Faizah, F. Efendi, and S. Suprajitno, "Foot exercises with group support to improve foot health," *Nursing Journal*, vol. 15, no. 1, pp. 129–134, 2020.

[22] V. Graciella and D. Prabawati, "Effectiveness of diabetic foot exercise to peripheral neuropathy symptoms," *Unknown Journal*, 2020.

[23] M. e. a. Kirkman, "Diabetes in older adults: a consensus report," *Journal of the American Geriatrics Society*, vol. 60, no. 12, pp. 2342–2356, 2012.

[24] F. Mullan and L. Epstein, "Community-oriented primary care," *American Journal of Public Health*, vol. 92, no. 11, pp. 1748–1755, 2002.

[25] N. Nadirawati and I. Pratama, "Elderly experiences in type 2 diabetes care," *Journal of Telenursing*, vol. 3, no. 1, pp. 20–36, 2021.

[26] S. Sukron, "Foot sensitivity of type ii diabetes mellitus patients," *Masker Medika*, vol. 8, no. 1, pp. 163–175, 2020.

[27] A. e. a. Tarigan, "Effect of foot exercises on foot sensitivity," *Indonesian Online Nursing Journal*, vol. 7, no. 2, pp. 88–94, 2024.

[28] J. e. a. van Netten, "Definitions and criteria for diabetic foot disease," *Diabetes/Metabolism Research and Reviews*, vol. 36, p. e3268, 2020.

[29] E. e. a. Wagner, "Improving chronic illness care," *Health Affairs*, vol. 20, no. 6, pp. 64–78, 2001.

[30] A. Widianti and A. Proverawati, *Health Gymnastics*. Nuha Medika, 2018.