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EFFECTIVENESS OF DIGITAL APPLICATION-BASED FOOT CARE EDUCATION AND TRAINING PROGRAM IN IMPROVING SELF-EFFICACY AND FOOT CARE BEHAVIOR IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

Feriadianto[1,4], *Dhea Natashia[1], Dewi Gayatri[2], Wati Jumaiyah[1], Winda Yuniarsih[3]
[1]Master of Nursing Program, Faculty of Nursing, Muhammadiyah University of Jakarta
[2]Faculty of Nursing, University of Indonesia
[3]Fatmawati Hospital of Jakarta
[4]Dr. Mohammad Hoesin Hospital of Palembang
natashia_dhea@umj.ac.id

Abstract

T2DM with low self-efficacy, it's can lead to reduced foot sensitivity and increase the risk of serious complications like ulcers and infections. This study aimed to evaluate the effectiveness of the Diabetic Educare digital application-based foot care education and exercise program on self-efficacy, foot care behavior, and foot sensitivity in patients with T2DM. Design was quasi-experimental conducted with two groups: intervention (n = 27), control (n = 27). Data were collected using DMSES, NAFF questionnaire and monofilament 10 gr test. Demographic data were analyzed using univariate analysis, while paired t-tests and independent t-tests were applied to examine within-group and between-group differences. The intervention group showed significant improvement in self-efficacy (p = 0.011, p < 0.05) and foot care behavior (p = 0.032, p < 0.05). However, no significant improvement was observed in foot sensitivity (p = 0.141, p > 0.05). The Diabetic Educare education and training program effectively enhanced self-efficacy and foot care behavior among T2DM patients, although it did not significantly improve foot sensitivity. It's may serve as a valuable modality in developing holistic non-pharmalogical interventions for foot care education and exercise in T2DM management.

Keywords: *Type 2 Diabetes Mellitus; self-efficacy; foot care behavior; foot sensitivity; digital application*

* Corresponding author :
Address : Cempaka Putih Tengah 1/1 Jakarta Pusat 1050
Email : natashia_dhea@umj.ac.id
Phone : 08111130689

INTRODUCTION

Diabetes mellitus is a long-term medical condition characterized by high blood glucose levels that over time damage blood vessels, kidneys, nerves, eyes, and heart (WHO, 2016). The prevalence of diabetes mellitus worldwide is very high and tends to increase every year (IDF, 2021) predicts that there will be 537 million adults aged 20 to 79 years with diabetes mellitus worldwide, an increase of 10.5% of the total adult population in the same age group in 2021. Estimates for 2030 indicate that there will be 643 million adults aged 20–79 living with diabetes, and by 2045, this number is projected to reach 783 million, representing a 46% increase in the number of diabetes mellitus patients. According to the Ministry of Health (2022), the estimated adult diabetes population aged 20–79 years is 19,465,100 people. The Central Statistics Agency (BPS) of South Sumatra Province reported that the number of people with diabetes in South Sumatra in 2020 was 172,044, in 2021 it was 279,345, and in 2022 it was 435,512 (BPS Sumsel, 2023).

Poor management of diabetes mellitus can lead to various serious chronic complications, one of which is diabetic foot ulcers (Mansoer et al., 2020). Ineffective management of this disease is often caused by low patient self-efficacy in carrying out self-care, including inadequate foot care behaviour. As a result, many patients experience reduced foot sensitivity due to peripheral neuropathy, increasing the risk of unnoticed wounds that can lead to infection or even amputation. Therefore, effective and sustainable intervention strategies are needed to enhance patients' knowledge and skills in performing care (Shaban et al., 2024)

Health Care have an important responsibility in improving the health status of diabetic patients, protecting them from foot complications, and teaching foot care skills to patients (Bahador et al., 2017). The use of appropriate media for education in diabetes management is needed, so that the information conveyed can be received optimally (Sabarudin et al., 2020). According to Mao et al (2020) in his study, the Diabetes Foot Care Application emphasizes the provision of information and self- education on innovative foot care, but is not yet equipped with many interactive features. Therefore, it is important to conduct further research on the development and evaluation of a more integrated and interactive, mobile application-based education program.

According to Turnbull et al (2022), app-based educational interventions are highly effective in educating patients with diabetes mellitus because they are accessible, user-friendly, and capable of providing real time feedback. Digitalisation through mobile applications plays a key role in enabling patients to monitor health parameters such as blood glucose levels, dietary patterns and physical activity, and to receive education directly from mobile applications without time or location constraints(Lee at al., 2024). This study is expected to shed new light on the development of the Diabetic Educare mobile app intervention in terms of self-efficacy and foot care behaviour in patients with type 2 diabetes mellitus.

METHOD

Study Design

The study used a quasi-experimental method with a pre- and post-test design and a control group.

Sampling and Participants

The population in this study consisted of 216 patients with type 2 diabetes mellitus at the Outpatient Clinic of Mohamad Hasan Hospital in Palembang. Sample measurement was performed using G-Power analysis from a previous study (Shaban et al., 2024), with an effect size of 0.75, an alpha error probability of 0.05, and a power of 0.80. To avoid the risk of missing data, the sample size was increased by 20%, resulting in 54 respondents, divided into two groups: intervention n = 27 and control n = 27. The inclusion criteria for this study were: type 2 diabetes mellitus; patients who were willing to be respondents; had a mobile phone connected to the internet; and were able to operate it. Patients with type 2 diabetes mellitus who had cognitive impairment, neuropathy, diabetic ulcers, and stroke were excluded.

Measurement

This study used demographic data as its instruments, including name, age, gender, level of education, occupation, duration of type 2 diabetes mellitus and blood glucose levels. Self-efficacy was measured using the Diabetes Management Self-Efficacy Scale (DMSES) questionnaire, which was developed by Van der Bijl (1999), translated by Rondhianto (2012) and consists of 20 positive statements to which respondents responded using a 1–5 Likert scale. The minimum possible score for this questionnaire is 20. The reliability test resulted in a Cronbach's Alpha value of 0,954. Foot care behaviour was measured using the Nottingham Assessment of Functional Footcare (NAFF) questionnaire, which was developed by the University of Nottingham in 2007 and revised in 2015, and translated by Sari et al. in 2016. This instrument contains 27 items, scored from 0 to 3, with a total possible score of 0 to 81. The reliability test resulted in a Cronbach's Alpha value of 0,736. Foot sensitivity was measured using a 10 g monofilament device adapted to the standard operating procedure for foot sensation assessment as outlined by the British Columbia Provincial Nursing Skin and Wound Committee 2012 (Istiroha et al., 2017). Test points were the back of the foot and the tips of the first, third and fifth toes.

Intervention Description

The intervention used the Diabetic Educare

mobile app, which provided educational content on four main topics: monitoring patients with diabetes mellitus, diet, physical activity and foot care. The intervention lasted 30 days. Respondents were advised to access the app for 20–30 minutes each day and were given the opportunity to consult directly with researchers regarding the educational material provided. Evaluations were conducted before the study began and after the 30 day intervention period.

Data Collection

Permission was obtained from the Bhayangkara Mohamad Hasan Hospital in Palembang before the study began. The researchers explained the purpose, objectives and benefits of the study, as well as the rights that respondents would have during the research process. Respondents who agreed to participate then signed an informed consent form and completed the Demographic Questionnaire, the Diabetes Management Self-Efficacy Scale (DMSES) and the Nottingham Assessment of Functional Footcare (NAFF). Respondents were given 10–15 minutes to complete the questionnaires. Once all the answers had been completed, the researcher performed a foot sensitivity examination using a monofilament 10gr tool.

Data Analysis

Data were analyzed using IBM SPSS Statistics version 20 software. Descriptive statistics summarized frequency distributions and mean values. Normality was tested, and homogeneity was assessed using Levene's test for numerical variables and the Fisher's Exact test for categorical variables. Differences within groups were examined using paired t-tests, while independent t-tests compared the intervention and control groups.

Ethical Considerations

This study has passed an ethics review by the Ethics Committee of the Faculty of Nursing at the University Muhammadiyah of Jakarta, in order to protect the rights and welfare of the respondents. The review number is 1816/F.9-UMJ/XII/2024.

RESULT AND DISCUSSION

Demographic and Characteristics of Respondents

As shown in Table 1, the respondents were predominantly women, with 17 in the intervention group and 19 in the control group. Of the intervention group, 10 people (37%) were high school or college graduates, while 17 respondents (63%) were elementary or junior high school graduates. The majority of the control group had a high school or college education is 15 respondents (55.5%) were elementary or junior high school graduates, and 12 respondents (44.5%) were high school or college graduates. 14 people (51.9%) in the control group were unemployed, while 13 people (48.1%) were employed. Meanwhile, 10 people (37%) from the intervention group were employed, while 17 people (63%) were unemployed. The results of the homogeneity test using the Fisher's exact test on respondents' characteristics (gender, education, and occupation) showed homogeneous values ($p > 0.05$).

The results in table 2 indicated that there was no difference between the intervention group and the control group, with the youngest respondent being 35 years old and the oldest respondent being 73 years old. The average respondent had suffered from type 2 diabetes mellitus for 8 years, with the shortest duration of type 2 diabetes mellitus being 1 year and the longest being 21 years. The average Blood Glucose Score value was 182.44 (mg/dL) in the intervention group and 167.04 (mg/dL) in the control group. The average self-efficacy value in the intervention group was 44.25, and in the control group was 47.77. The average foot care behavior score obtained in the intervention group was (40.70), and in the control group was (39.12). The average foot sensitivity score in the intervention group was (66.29), and the control group score was (68.81). Homogeneity testing using Levene's test for respondents' characteristics (age, duration of type 2 diabetes mellitus, and Blood Glucose Score), self-efficacy, foot care behavior, and foot sensitivity indicated homogeneity across groups ($p > 0.05$).

Effectiveness of a Foot Care Education and Training Program Based on the Diabetic Educare Digital Application on Self-Efficacy, Foot Care Behavior, and Foot Sensitivity

Table 3 shows that after receiving training and educational program based on the Diabetic Educare digital application, there was an increase in average self-efficacy of 7.92. There was also an increase in the average foot care behavior score of 10.63 and an increase in the average foot sensitivity score of 4.48.

Table 4 shows that after being given a digital application-based diabetic foot care education and training program, it was found that there was a significant difference in the mean values of self-efficacy between the intervention group (58.29 ± 12.57) and the control group (49.59 ± 11.61). Where the average score of the intervention group was 8.70 higher than that of the control group, with a p-value of 0.011 (p-value < 0.05) and an effect size of self-efficacy of 0.76 (moderate effect). In the foot care behavior variable, there was a significant difference between the mean values of the intervention group (53.81 ± 12.45) and the control group (47.27 ± 9.04), where the mean value of the intervention group was 6.54 higher, with a p- value of 0.032 (p-value < 0.005), and the effect size for foot care behavior was 0.62 (moderate effect). In the foot sensitivity variable, there was no significant difference in the mean values between the intervention group (74.25 ± 11.74) and the control group (69.81 ± 10.04), where the mean value of the intervention group was

4.44 higher, with a p-value of 0.141 (p-value < 0.005).

Table 1. Respondent demographics based on gender, education, and occupation

Characteristics	Group			
	Intervention *n* (%)	Control *n* (%)	Total *n* (%)	*p-value*
Gender				
Male	10 (37%)	8 (29,6%)	18 (33,3%)	0,773
Female	17 (63%)	19 (70,4%)	36 (66,7%)	
Education				
Senior High School and College	10 (37%)	15 (55,5%)	25 (46,3%)	
Elementary and Junior High School	17 (63%)	12 (44,5%)	29 (46,3%)	0,275
Work Status				
Work	10 (37%)	13 (48,1%)	31 (57,4%)	0,583
Don't Work	17 (63%)	14 (51,9%)	23 (42,6%)	

Table 2. Respondent characteristics based on age, long-suffering T2DM, glucose score, self-efficacy, foot care behaviour, and foot sensitivity by group.(Intervention *n* = 27 and Control *n* = 27)

Treatment group characteristics		*n*	*mean*	*min-max*	*SD*	*t*	*p-value*
Age	Intervention	27	53,63	35-71	10,0	0,845	0,362
	Control	27	56,30	41-73	8,76		
Long suffering T2DM	Intervention	27	8,03	1-18	4,48	0,669	0,417
	Control	27	7,81	1-21	5,54		
Glucose score	Intervention	27	182,44	61-341	68,19	0,081	0,777
	Control	27	167,04	78-317	64,13		
Self-eficacy	Intervention	27	44,25	31-64	10,10	4,544	0,316
	Control	27	47,77	23-76	14,95		
Foot care behaviour	Intervention	27	40,70	27,62-57,51	8,06	0,260	0,473
	Control	27	39,12	27,51-60,20	7,97		
Foot sensitivity	Intervention	27	66,29	50-85	10,24	0,083	0,400
	Control	27	68,81	45-85	10,59		

Table 3. Differences in self-efficacy, foot care behavior, and foot sensitivity before and after receiving digital application-based education: diabetic educare

Group	Intervention	*N*	*Mean*	95% CI (lower;upper)	±*SD*	*df*	*t*	*p-value*
Self-eficacy	T0	54	46,01 (±12,765)	-10,93;-4,91	11,01	53	-5,286	0,000
	T1	54	53,93 (±12,768)					
Foot care behaviour	T0	54	39,91 (±7,98)	-12,63;-8,61	7,35	53	-10,615	0,000
	T1	54	50,54 (±11,27)					
Foot sensitivity	T0	54	67,55 (±10,39)	-6,48;-2,47	7,34	53	-4,483	0,000
	T1	54	72,03 (±11,05)					

Table 4. Effectiveness of the diabetic education application on improving self-efficacy, foot care behavior, and foot sensitivity by group (intervention *n* = 27 and control *n* = 27).

Group	Treatment group	*n*	*Mean*	±*SD*	*df*	*t*	95% CI *(lower;upper)*	*p-value*
Self-eficacy	Intervention	27	58,29 (±12,57)	8,70	51,67	2,64	2,09;15,31	0,011
	Control	27	49,59 (±11,61)					
Foot care behaviour	Intervention	27	53,81 (±12,45)	6,53	47,46	2,20	0,59;12,48	0,032
	Control	27	47,27 (±9,04)					
Foot sensitivity	Intervention	27	74,25 (±11,74)	4,44	50,78	1,49	-1,52;10,41	0,141
	Control	27	69,81 (±10,04)					

Discussion

Responden Characteristics

The majority of respondents were over 50 years old, indicating that the average respondent was of pre-elderly age. The results of this study align with previous studies stating that most patients with type 2 diabetes mellitus are in the 51-60 age range. As age increases, so do blood glucose levels, and with

them, the prevalence of diabetes mellitus (DM) and impaired glucose tolerance (Zhao Y. et al., 2020). According to Susanti et al. (2020), bodily functions and abilities decline with age. Older adults have low self-confidence due to obstacles such as blurred vision and other complications that can limit their ability to properly care for their feet (Bullen et al., 2019). In general, women dominated the respondent pool, numbering 36 (67%). According to Salam et al. (2019), men are more likely than women to perform proper foot care. Women generally spend more time on household chores, which can affect their foot care behavior (Usta et al., 2019)

The majority of respondents in this study had a low level of education. Several factors can contribute to low educational attainment, including age, economic status, and place of residence. Educational attainment is an indicator of population quality. According to Sa'adah (2016), education is a factor that can influence foot care behavior in people with diabetes mellitus. A highly educated individual has a greater mindset and self-efficacy for achieving recovery (Zheng et al., 2019).

Most of the respondents were unemployed women. Housewives tend to have lighter physical activity when it comes to work related to physical activity. A lack of physical activity can cause insulin resistance, meaning the body cannot convert glucose into energy. This condition causes blood glucose levels to increase (Yari et al., 2023)In this study, patients with type 2 diabetes mellitus, low self-efficacy, and poor foot care behavior were predominantly unemployed. This finding is supported by research conducted by (Shaban et al (2024). Most respondents had hyperglycemia when their blood sugar levels were measured and had suffered from type 2 diabetes mellitus for an average of eight years. These results align with those of (Retnoningrum et al., (2023) study, which was dominated by respondents who had suffered from DM for over five years. According to Sharoni et al (2017)the longer a person has diabetes mellitus (DM), the higher the risk of complications due to an unhealthy lifestyle caused by low self-efficacy in managing DM and poor care behavior, which accelerates complications such as impaired sensitivity in the feet.

Effectiveness of a Foot Care Education and Training Program on Self-Efficacy

On average, self-efficacy scores increased in the intervention group after they received foot care education and training through the Diabetic Educare application. This suggests that respondents with high self-efficacy expected to improve their health. Using appropriate educational media and content can help patients with diabetes mellitus improve their self-efficacy. These results align with Shrivastava et al (2023) research, which revealed that mobile health applications effectively improve compliance with diabetes care management. They also align with the findings of Wang et al (2017) who found that mobile application interventions can significantly increase diabetic patients' awareness, thereby reducing complications. They are also consistent with the findings of Zhang et al. (2022), who found that mobile health educational media improves self-efficacy and health behavior. Mao et al (2020) found that mobile application based educational media effectively improves self- efficacy in patients with low incomes and limited access to health facilities. Mobile application based health intervention management has been proven to improve patient compliance and blood sugar control and reduce the incidence of complications (Zhang et al., 2022).

Effectiveness of a Foot Care Education and Training Program on Foot Care Behaviors

In general, the intervention group exhibited better foot care behavior than the control group. According to Tekir (2023), patients with diabetes mellitus require foot care to prevent complications. The intervention group demonstrated a notable increase in assessment frequency, self foot care adherence, and application usage combined with nursing consultations. Notably, this improvement was observed in patients with type 2 diabetes mellitus. These results align with Firdaus et al (2023) research, which states that health education applications that modify care behavior in diabetic patients yield significant results for foot care behavior. Patients with type 2 diabetes mellitus who have good knowledge and behavior can perform foot care independently and continuously, preventing complications. The researchers state that an increase in self-efficacy can influence the attitudes and behaviors of patients with diabetes mellitus in performing self care. This statement is supported by Shaban et al (2024) research, which found significant changes in foot care behavior after intervention.

Effectiveness of a Foot Care Education and Training Program on Foot Sensitivity

There was no significant increase in foot sensitivity in either the intervention or control groups. Increasing age affects blood circulation, and high blood sugar levels prevent an increase in foot sensitivity because they make blood flow to the lower extremities less efficient. This statement is supported by Stubbs Jr (2023) research in J. Holmes, which states that there were no significant changes in peripheral nerves following foot care, exercise interventions, and combined aerobic and isokinetic exercises. This statement is also supported by the results of Oh et al. (2022) research, which evaluated the clinical effects of using a mobile health education

application with self- monitoring for patients with type 2 diabetes mellitus aged 40 to 70 years. They found that there were no significant changes in body weight or blood glucose levels among patients who participated in the educational program through the application.

Effectiveness of a Foot Care Education and Training Program Based on the Diabetic Educare Digital Application on Self-Efficacy, Foot Care Behavior, and Foot Sensitivity

Although the majority of the control group did not experience an increase in self-efficacy, there was an increase in foot care behavior. This may be due to various factors, including education and employment levels. Five areas of foot care management for patients with type 2 diabetes mellitus were assessed: increased knowledge of foot care, increased foot care behavior, self- efficacy, and increased compliance with cost effective and effective self foot care (Killic et al., 2020). Mobile application–based interventions are commonly used for general diabetes management. However, patients with diabetic feet require continuous education to support foot care management (Zhang et al., 2022). Implementing diabetic foot care education and training programs can prevent existing problems and help maximize the limitations of space, time, and cost faced by patients with type 2 diabetes mellitus. Meanwhile, the intervention group demonstrated increased average self-efficacy and foot care behavior scores following the diabetes education program. These results align with Tekir et al., (2023) research, which found that education programs significantly increase self-efficacy and foot care behavior in people with diabetes. These results are also consistent with those of Shaban et al. (2024), who found that application-based education programs affect self-efficacy and foot care behavior. The results of the above study, supported by previous studies, show that self-efficacy is an important factor in shaping a persons mindset and behavior, which can lead to improvement. Diabetes mellitus patients with high self-efficacy are confident in their abilities and can support the treatment process to achieve better health. These results align with those reported by Zheng et al., (2017), who found that patients with diabetes and high self-efficacy exhibit positive behaviors in diabetes management, including foot care. These behaviors help prevent and delay complications.

CONCLUSION

Based on the study results, it can be concluded that the intervention group and the control group differ in terms of average self-efficacy and foot care behavior. The intervention group showed a more significant difference, on average, than the control group. The results indicate that the foot care education and training program through the Diabetic Educare mobile application significantly affected self-efficacy and foot care behavior. Using the Diabetic Educare Mobile Application as an educational medium could help prevent existing problems and maximize the limitations of space, time, and cost faced by patients with type 2 diabetes mellitus.

REFERENCE

Ahmad Sharoni, S. K., Mohd Razi, M. N., Abdul Rashid, N. F., & Mahmood, Y. E. (2017). Self-efficacy of foot care behaviour of elderly patients with diabetes. *Malaysian Family Physician*, *12*(2), 2–8.

Al-Khawaldeh, O. A., Al-Hassan, M. A., & Froelicher, E. S. (2012). Self-efficacy, self-management, and glycemic control in adults with type 2 diabetes mellitus. *Journal of Diabetes and Its Complications*, *26*(1), 10–16. https://doi.org/10.1016/j.jdiacomp.2011.11.0 02

Bahador, R. S., Afrazandeh, S. S., Ghanbarzehi, N., & Ebrahimi, M. (2017). The impact of three-month training programme on foot care and self-efficacy of patients with diabetic foot ulcers. *Journal of Clinical and Diagnostic Research*, *11*(7), IC01–IC04. https://doi.org/10.7860/JCDR/2017/29025.10 261

Darni, Z., & Agustin, S. A. (2023). The Implementation of Health Education about Diabetic Foot Care among Patiens with Diabetes Mellitus to Improve Patients Knowledge: A Literature Review. *JIKO (Jurnal Ilmiah Keperawatan Orthopedi)*, *7*(1), 12–21. https://doi.org/10.46749/jiko.v7i1.113 Drovandi, A., Seng, L., & Golledge, J. (2024). Effectiveness of educational interventions for diabetes-related foot disease: A systematic review and meta-analysis. *Diabetes/Metabolism Research and Reviews*, *40*(3). https://doi.org/10.1002/dmrr.3746 Firdaus, M. K. Z. H., Jittanoon, P., Boonyasopun, U., & Hasan, M. K. C. (2023). The effect of mHealth program on behavior modification and health outcomes among patients with diabetes: A randomized controlled trial study. *Belitung Nursing Journal*, *9*(5), 437–447. https://doi.org/10.33546/bnj.2664

Goodall, R. J., Ellauzi, J., Tan, M. K. H., Onida, S., Davies, A. H., & Shalhoub, J. (2020). A Systematic Review of the Impact of Foot Care Education on Self Efficacy and Self Care in Patients With Diabetes. *European Journal of Vascular and Endovascular Surgery*, *60*(2), 282–292. https://doi.org/10.1016/j.ejvs.2020.03.053 Hoe, C. Y. W., Ahmad, B., & Watterson, J. (2024). The use of videos for diabetes patient

education: A systematic review. *Diabetes/Metabolism Research and Reviews*, *40*(2). https://doi.org/10.1002/dmrr.3722

Kartika, A. W., Widyatuti, W., & Rekawati, E. (2023). DIMAS (Diabetes Management Support) Application: Mobile-Phone Based Intervention to Support Diabetes Self-Management Activities. *Malaysian Journal of Medicine and Health Sciences*, *19*(4), 186– 192. https://doi.org/10.47836/MJMHS.19.4.28

Keller-Senn, A., Probst, S., Imhof, R. M., & Imhof, L. (2015). Nurse-led education programme enhancing foot care self-efficacy in high-risk diabetes population: pilot randomised controlled study. *International Diabetes Nursing*, *12*(2), 74–78. https://doi.org/10.1179/2057331615z.0000000009

Lee, J. L., & Kim, Y. (2024). Evaluation of Mobile Applications for Patients with Diabetes Mellitus: A Scoping Review. *Healthcare (Switzerland)*, *12*(3), 1–11. https://doi.org/10.3390/healthcare12030368

Mahdalena, & Purwanti Ningsih, E. S. (2016). Effectivity of foot care education program in improving knowledge, self-efficacy and foot care behavior among diabetes mellitus patients in Banjarbaru, Indonesia. *Kesmas*, *11*(2), 56–60. https://doi.org/10.21109/kesmas.v11i2.583

Mao, Y., Lin, W., Wen, J., & Chen, G. (2020). Impact and efficacy of mobile health intervention in the management of diabetes and hypertension: A systematic review and meta-analysis. *BMJ Open Diabetes Research and Care*, *8*(1), 1–11. https://doi.org/10.1136/bmjdrc-2020-001225

Pereira, M. G., Pedras, S., & Ferreira, G. (2019). Self-reported adherence to foot care in type 2 diabetes patients: Do illness representations and distress matter? *Primary Health Care Research and Development*, *20*. https://doi.org/10.1017/S1463423618000531

Palembang, D. K. (2018). *Profil Kesehatan Kota Palembang*.

Ranjbar, F., Karimi, M., Zare, E., & Ghahremani, L. (2024). The effect of educational intervention based on the behavioral reasoning theory on self-management behaviors in type 2 diabetes patients: a randomized controlled trial. *BMC Public Health*, *24*(1), 1–12. https://doi.org/10.1186/s12889-024-19207-0

Retnoningrum, D., & Herawati, T. (2023). Efektivitas Mhealth dalam peningkatan manajemen kesehatan diri Pasien DM tipe 2: Literatur Review. *Prepotif: Jurnal Kesehatan Masyarakat*, *7*(1), 1069–1078. http://journal.universitaspahlawan.ac.id/index.php/prepotif/article/view/10592

Sabarudin, Mahmudah, R., Ruslin, Aba, L., Nggawu, L. O., Syahbudin, Nirmala, F., Saputri, A. I., & Hasyim, M. S. (2020). Efektivitas Pemberian Edukasi secara Online melalui Media Video dan Leaflet terhadap Tingkat Pengetahuan Pencegahan Covid-19 di Kota Baubau. *Jurnal Farmasi Galenika (Galenika Journal of Pharmacy) (e-Journal)*, *6*(2), 309–318. https://doi.org/10.22487/j24428744.2020.v6.i2.15253

Shaban, M. M., Sharaa, H. M., Amer, F. G. M., & Shaban, M. (2024). Effect of digital based nursing intervention on knowledge of self- care behaviors and self-efficacy of adult clients with diabetes. *BMC Nursing*, *23*(1), 1–12. https://doi.org/10.1186/s12912-024-01787-2

Shrivastava, T. P., Goswami, S., Gupta, R., & Goyal, R. K. (2023). Mobile App Interventions to Improve Medication Adherence Among Type 2 Diabetes Mellitus Patients: A Systematic Review of Clinical Trials. *Journal of Diabetes Science and Technology*, *17*(2), 458–466. https://doi.org/10.1177/19322968211060060

Silalahi, L. E., Irawati, D., Anggraeni, D., Jumaiyah, W., & Abriyanti, R. M. (2023). Penerapan Intervensi Edukasi terhadap Self- Management, Self Efficacy dan Nilai Gula Darah pada Pasien Diabetes Melitus. *Journal of Telenursing (JOTING)*, *5*(2), 3745–3753. https://doi.org/10.31539/joting.v5i2.7929

Turnbull, L. A., Littlehales, M. T., Wilson, M. N., Birch, M. T., Popescu, H., Jaouen, N., Verezhak, J. A. T., Balakrishnan, G., & Hatton, P. D. (2022). X-ray holographic imaging of magnetic surface spirals in FeGe lamellae. *Physical Review B*, *106*(6), 1–6. https://doi.org/10.1103/PhysRevB.106.06442 2

Usta, Y. Y., Dikmen, Y., Yorgun, S., & Berdo, I. (2019). Predictors of foot care behaviours in patients with diabetes in Turkey. *PeerJ*, *2019*(2), 1–12. https://doi.org/10.7717/peerj.6416

van Netten, J. J., Sacco, I. C. N., Lavery, L., Monteiro-Soares, M., Paton, J., Rasmussen, A., Raspovic, A., & Bus, S. A. (2024). Clinical and biomechanical effectiveness of foot-ankle exercise programs and weight- bearing activity in people with diabetes and neuropathy: A systematic review and meta- analysis. *Diabetes/Metabolism Research and Reviews*, *40*(3). https://doi.org/10.1002/dmrr.3649

Wang, Y., Xue, H., Huang, Y., Huang, L., & Zhang, D. (2017). A systematic review of application and effectiveness of mHealth interventions for obesity and diabetes treatment and self-management. *Advances in Nutrition*, *8*(3), 449–462. https://doi.org/10.3945/an.116.014100

World Health Organization. (2016). Global Report on

Diabetes. *Isbn*, *978*, 88. https://doi.org/ISBN 978 92 4 156525 7

Yari, A., Hassani, L., Ziapour, A., Toghroli, R., Mohammadkhah, F., & Yazdi, F. (2023). Prediction of self-care behaviors among diabetic patients based on social cognitive theory. *Journal of Public Health Research*, *12*(1). https://doi.org/10.1177/22799036221150330

Zheng, F., Liu, S., Liu, Y., & Deng, L. (2019). Effects of an outpatient diabetes self-management education on patients with type 2 diabetes in China: A randomized controlled trial. *Journal of Diabetes Research*, *2019*. https://doi.org/10.1155/2019/1073131