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Digital Based Education and Counseling on Self-Care Behaviors in Patients with Type 2 Diabetes Mellitus as a Prevention Strategy for Neuropathy Complications

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ABSTRACT

Background: Type 2 Diabetes Mellitus (T2DM) is the most common type of diabetes, accounting for approximately 90% of all diabetes cases. It is characterized by insulin resistance, where the body fails to adequately respond to insulin. Complications can include macrovascular and microvascular damage, as well as diabetic neuropathy, which can occur in both newly diagnosed and long-standing patients.

Purpose: This study aims to explain the influence of digital-based education and counseling on self-care behaviors in patients with T2DM as a prevention strategy for neuropathy complications.

Methods: This study used a quasi-experimental design with a two-group pretest posttest design, where the pretest was implemented before treatment digital education and counseling, the posttest was implemented after treatment digital education and counseling. the posttest was implemented after treatment digital education and counseling. This study was conducted with pretest observation before education on self-care for patients with T2DM was implemented.

Results: The study population consisted of 194 patients with T2DM in the Lawawoi Community Health Center area, from which 32 respondents were selected via purposive sampling. Data were collected through questionnaires The Summary of Diabetes Self Care Activities (SDSCA) Reliabilitas: Cronbach's alpha antara 0.62 – 0.91 Validated by experts with a score of CVI (Content Validity Index) > 0.80, Level of knowledge validated by experts, CVI > 0.80. Reliabilitas: Cronbach's alpha berkisar antara 0.70 – 0.85, shows good internal consistency, and analyzed using paired t-tests and independent samples t-tests.

Conclusion: The findings revealed that the digital education group's knowledge obtained a sig. (2 tailed) value on the pretest and posttest of 0.000 <0.05, the digital education group's skills obtained a sig. (2 tailed) value on the pretest and posttest of 0.000 <0.05, the counseling group's knowledge obtained a sig. (2 tailed) value on the pretest and posttest of 0.000 <0.05, while the counseling group's skills obtained a sig. (2 tailed) value on the pretest and posttest of 0.000 <0.05. There is a significant influence of digital-based education and counseling on the knowledge and skills of patients with T2DM.

Keywords: counseling, digital education, self-care behaviors, type 2 diabetes mellitus

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BACKGROUND

Diabetes mellitus (DM) is a chronic metabolic disease that occurs either when the pancreas fails to produce adequate insulin, or when the body cannot effectively utilize the insulin it produces (Ramadani et al., 2024). This condition causes hyperglycemia which can lead to acute metabolic complications such as diabetic ketoacidosis and nonketotic hyperosmolar hyperglycemic syndrome (Mistra, 2023). For some patients with Type 2 Diabetes Mellitus (T2DM), this condition can eventually exhaust pancreatic beta cells, causing the body to produce less insulin, leading to higher blood sugar levels (International Diabetes Federation, 2022). Data (International Diabetes Federation, 2022), in all countries, indicate that the incidence of T2DM is consistently higher than that of Type 1 Diabetes Mellitus (T1DM). T2DM is the most prevalent type of diabetes globally, accounting for approximately 90-95% of all diabetes cases (ADA, 2022).

In Indonesia, the prevalence of diabetes has significantly increased, with 1 in 25 Indonesians, or approximately 10% of the population, being affected by the disease. This represents a 6.2% rise from previous years (Ni Wayan Trisnadewi et al., 2022). In South Sulawesi, diabetes remains the second most prevalent non-communicable disease after cardiovascular disease (CVD), with a reported incidence of 15.79% in 2022. Diabetes is the leading cause of death in this region, accounting for 41.56% of deaths. South Sulawesi ranks third among Indonesian provinces with the highest prevalence of DM. The prevalence of DM in South Sulawesi for individuals over the age of 15 according to a doctor's diagnosis is 3.4%. In Sidenreng Rappang Regency, the prevalence of DM is 2.7%, ranking third in the province (South Sulawesi Health Profile, 2022). In South Sulawesi, the rise in Diabetes Mellitus (DM) cases is largely attributed to unhealthy lifestyle habits, leading to chronic hyperglycemia as blood sugar levels consistently exceed the normal threshold. In 2021, there were 41,497 recorded cases of DM in the region, and this number surged to 512,510 in 2022 (South Sulawesi Health Profile, 2022). Patients with insulin deficiency are unable to maintain normal fasting plasma glucose levels or postprandial glucose tolerance. When hyperglycemia becomes severe, exceeding the renal threshold (160-180 mg/dL), glycosuria occurs due to the inability of the renal tubules to reabsorb all the glucose (Dikri Muhammad, 2023). The excretion of glucose in the urine results in a negative protein balance, weight loss, and increased hunger, commonly referred to as polyphagia (Srikandi Waluyo, 2020).

Some of the complications of diabetes include: 1) An increased risk of heart disease and stroke. 2) Neuropathy (nerve damage), particularly in the lower extremities, can lead to foot ulcers, infections, and, in severe cases, amputation (Ice Maya Sari Sianipar, 2023). 3) Diabetic retinopathy, a leading cause of blindness, results from damage to the small blood vessels in the retina. 4) Diabetes is a major contributor to kidney failure. 5) The mortality rate for patients with diabetes is generally twice that of non-diabetic patients (Sari et al., 2022) Macrovascular complications primarily affect the brain, blood vessels, and heart, while microvascular complications target the eyes and kidneys. Neuropathy complaints are frequently seen in patients with Type 2 Diabetes Mellitus (T2DM) and can manifest as sensory, motor, or autonomic neuropathy (PERKENI, 2022). Diabetes mellitus is a degenerative disease that, if not properly treated (managed), can have a negative impact and cause severe complications affecting multiple organ systems (Syahid, 2021), Diabetic neuropathy is a group of nerve disorders and loss of sensory function that starts from the distal part of the lower extremities due to high blood glucose in patients with diabetes which, if left untreated, can lead to further complications, such as diabetic ulcers (Ayu et al.,2022) as well as autonomic cardiovascular neuropathy and diabetic neuropathy—which are

complications with the greatest incidence compared to other diabetes complications (Alpheus Dachi, 2023).

Patients with Diabetes Mellitus face several challenges in managing their condition, including difficulties with emotional regulation, self-confidence, dietary management, physical activity, blood sugar control, and adherence to treatment regimens (Nyi Endah Puspitasari Pitaloka; DG et al., 2021).

The importance of proper care for patients with Diabetes Mellitus in fulfilling daily needs emphasizes the role of the nursing profession in providing specialized nursing care (Adelian et al., 2022). Counseling interventions play a crucial role in preventing complications in patients with Diabetes Mellitus. Improving self-care can be done through education for patients with Diabetes Mellitus (Esau Katuuk et al., 2022). Counseling on self-care practices is necessary to support health and mitigate the risk of complications. The more information patients receive, the more empowered they are to prevent complications. It is hoped that with counseling, patients with Diabetes Mellitus can improve their standard of living (Putri Kurniawati, 2022) Proper management of diabetes is directly linked to a higher quality of life for patients (IDF, 2021). Nurses, as educators, have a significant responsibility to provide education not only to individuals but also to families and communities. As researchers, community nurses are instrumental in investigating, collecting, analyzing, and addressing health problems within the community, thereby improving nursing practices in community health (J Allender et al, 2019) The widespread use of smartphones presents an opportunity to utilize these devices as a medium for health education. Health education via smartphones can be done through online short message services using applications, one of which is WhatsApp. Type 2 Diabetes Mellitus is a chronic health condition that often leads to various complications, one of the most common and debilitating being diabetic neuropathy. The high incidence of this complication is frequently associated with inadequate self-care behaviors, including poor dietary management, lack of physical activity, irregular blood glucose monitoring, and non-adherence to medication. Conventional educational approaches are often less effective, particularly in reaching patients in remote areas due to limited time, resources, and accessibility. In this context, digital-based education and counseling emerge as innovative solutions that are more flexible, accessible, and capable of enhancing patient engagement in self-management. However, there is still a lack of research, particularly in Indonesia, that specifically examines the effectiveness of digital interventions in preventing neuropathic complications. Therefore, this study is essential to fill that research gap and support preventive and promotive strategies in the long-term management of type 2 diabetes.

(Ni Luh Putu Anik Cahyani et al., 2021) Video-based media has also been proven effective in improving respondents' knowledge after being given education using picture stories and videos according to Yusral's study. This study is in line with a study that has been conducted by (Anisa Nurjannah et al., 2022). The purpose of this study was to identify the effect of digital-based education and counselling on the knowledge and skills of self-care among people with type II diabetes mellitus as an effort to prevent neuropathy complications.

METHODS

This study employed a quasi-experimental design with a two-group pretest-posttest approach. The independent variable was a digital-based education intervention delivered via WhatsApp video, combined with face-to-face counseling and supplemented with booklets and leaflets. The dependent variables measured were the knowledge and self-care skills of patients with type 2 diabetes. Knowledge was assessed using a diabetes knowledge questionnaire that had been validated (CVI > 0.80) and demonstrated good reliability (Cronbach’s alpha = 0.78). Self-care skills were measured using the Indonesian version of the

Summary of Diabetes Self-Care Activities (SDSCA) questionnaire, which showed domain reliability ranging from 0.70 to 0.89. Measurements were taken before and after the intervention to evaluate changes in participants' knowledge and self-care practices. A total of 32 respondents were selected through purposive sampling from 194 registered type 2 diabetes patients at Lawawoi Community Health Center in Sidrap Regency. The inclusion criteria for this study were type 2 diabetes mellitus (T2DM) patients residing in the working area of Lawawoi Community Health Center who were receiving outpatient care. Participants were required to have an Android smartphone and actively use WhatsApp (for those in the digital intervention group), have no advanced complications, and be free from cognitive impairments. They also had to be able to read, write, communicate clearly, and have adequate hearing and vision. Only patients who were conscious, cooperative, had a history of receiving diabetes treatment (oral medication or insulin), and were willing to participate by signing informed consent and committing to all sessions were included in the study. The exclusion criteria included patients with type 2 diabetes mellitus (T2DM) who had moved outside the working area of the Lawawoi Community Health Center, those with foot gangrene, or those with hearing impairments. Patients with severe complications such as heart disease or kidney failure, as well as those experiencing sudden health deterioration during the study period, were also excluded. the results of the Kolmogorov-Smirnov normality test for the digital education group show that the p-values for pretest knowledge (0.200), posttest knowledge (0.200), pretest skills (0.200), and posttest skills (0.200) all indicate that the data is normally distributed (p-value > 0.05). Since the normality test shows a normal distribution, the test used is the Paired T test. This research obtained ethical approval with No.001435/EC/KEPK/I/07/2024.

RESULTS

The univariate analysis presents the frequency distribution of categorical variables, including age, gender, education level, and occupation of the participants. The detailed distribution for each variable is shown in the following table :

Table 1. Respondent Characteristics Based on Intervention (Treatment) of Patients with T2DM in the Lawawoi Community Health Center Area, Sidenreng Rappang Regency (July 6 – August 6, 2024)(n=32)

Intervention/treatment	Amount	Percentage
Digital-Based Education	16	50.0
Counseling	16	50.0
Total	32	100.0

Source: Primary Data 2024

Based on Table 1, the intervention distribution for patients with T2DM was evenly split: 16 participants (50%) received digital-based education through WhatsApp, while the other 16 participants (50%) received counseling via booklets and leaflets.

Table 1. Respondent Characteristics Based on Age, Gender, Education Level, and Occupation of Patients with T2DM in the Lawawoi Community Health Center Area, Sidenreng Rappang Regency (July 6 – August 6, 2024)(n=32)

Respondent characteristics	Digital education		Counseling Group	
	n	Percentage (%)	n	Percentage(%)
Age				
>45 years	10	62.5	12	75.0

<45 years	6	37.5	4	25.0
Total	16	100.0	16	100.0
Gender				
Male	5	31.3	7	43.8
Female	11	68.8	9	56.3
Total	16	100.0	16	100.0
Education Level				
Elementary School	4	25.0	3	18.8
Junior High School	6	37.5	5	31.3
Senior High School	5	31.3	6	37.5
University/College	1	6.3	2	12.5
Total	16	100.0	16	100.0
Occupation				
Retired	1	6.3	3	18.8
Farmer	5	31.3	4	25.0
Self-employed	3	18.8	1	6.3
Housewife	7	43.8	8	50.0
Total	16	100.0	16	100.0

Source: Primary Data 2024

Based on Table 2, the results of the study conducted on 16 respondents in the digital education group and 16 respondents in the counseling group reveal that in the digital education group, 10 respondents (62.5%) were aged over 45 years, and 6 respondents (37.5%) were under 45 years. In the counseling group, 12 respondents (75.0%) were over 45 years, while 4 respondents (25.0%) were under 45 years. Regarding gender, the digital education group consisted of 5 males (31.3%) and 11 females (68.8%), while the counseling group consisted of 7 males (43.8%) and 9 females (56.3%). Regarding education level, the digital education group consisted of 4 respondents (25.0%) with elementary education, 6 respondents (37.5%) with junior high school education, 5 respondents (31.3%) with senior high school education, and 1 respondent (6.3%) with university/college education. Meanwhile, the counseling group consisted of 3 respondents (18.8%) with elementary education, 5 respondents (31.3%) with junior high education, 6 respondents (37.5%) with senior high school education, and 2 respondents (12.5%) with university/college education. Regarding occupation, the digital education group consisted of 1 retired individual (6.3%), 5 farmers (31.3%), 3 self-employed individuals (18.8%), and 7 housewives (43.8%). Meanwhile, the counseling group consisted of 3 retired individuals (18.8%), 4 farmers (25.0%), 1 self-employed individual (6.3%), and 8 housewives (50.0%).

Special Data

Digital Education Group

Table 2. Normality Test of the Digital Education Group in the Lawawoi Community Health Center Area, Sidenreng Rappang Regency (July 6 – August 6, 2024)(n=32)

Variable	Distribution	Kolmogorov-Smirnov	Statistics Options
Digital Education	**Statistics**	**Sig.**	**test**
Pretest Knowledge	0.133	0.200	Paired t-test
Posttest Knowledge	0.158	0.200	
Pretest Skills	0.172	0.200	Paired t-test
Posttest Skills	0.149	0.200	

Source: Primary Data 2024

ISSN: 2614-3488 (print); 2614-3496 (online) Vol.8 No.4. July 2025. Page.965-977

Based on Table 3, the results of the Kolmogorov-Smirnov normality test for the digital education group show that the p-values for pretest knowledge (0.200), posttest knowledge (0.200), pretest skills (0.200), and posttest skills (0.200) all indicate that the data is normally distributed (p-value > 0.05).

Counseling Group

Table 3. Normality Test of the the Counseling Group in the Lawawoi Community Health Center Area, Sidenreng Rappang Regency (July 6 – August 6, 2024)(n=32)

Variable	Distribution	Kolmogorov-Smirnov	Statistics Options
Counseling	**Statistics**	**Sig.**	**test**
Pretest Knowledge	0.101	0.200	Paired t-test
Posttest Knowledge	0.107	0.200	
Pretest Skills	0.111	0.200	Paired t-test
Posttest Skills	0.163	0.200	

Source: Primary Data 2024

Based on Table 4, the results of the Kolmogorov-Smirnov normality test for the counseling group show that the p-values for pretest knowledge (0.200), posttest knowledge (0.200), pretest skills (0.200), and posttest skills (0.200), all indicate that the data is normally distributed (p-value > 0.05).

Digital Education and Counseling Groups

Table 4. Pretest Posttest Normality Test between the Digital Education and Counseling Groups in the Lawawoi Community Health Center Area, Sidenreng Rappang Regency (July 6 – August 6, 2024)(n=32)

Variables	P Value	Data Distribution	Statistics Options
(Pretest) Digital Education Group	0.951	Normal	Independent Sample Test
(Pretest) Counseling Group	0.705	Normal	
(Posttest) Digital Education Group	0.397	Normal	
(Posttest) Counseling Group	0.971	Normal	
(Pretest) Digital Education Group	0.160	Normal	
(Pretest) Counseling Group	0.367	Normal	
(Posttest) Digital Education Group	0.275	Normal	

ISSN: 2614-3488 (print); 2614-3496 (online) Vol.8 No.4. July 2025. Page.965-977

(Posttest) Counseling Group	0.078	Normal

Source: Primary Data 2024

Based on Table 5, the results of the Kolmogorov-Smirnov normality test indicate that the pretest for the digital education group's knowledge had a p-value of 0.951 (normal distribution), while the pretest for the counseling group's knowledge had a p-value of 0.705 (normal distribution). The posttest for the digital education group's knowledge had a p-value of 0.397 (normal distribution), while the post-test for the counseling group's knowledge had a p-value of 0.971 (normal distribution). Additionally, the pretest for the digital education group's skills had a p-value of 0.160 (normal distribution), while the pretest for the counseling group's skills had a p-value of 0.367 (normal distribution). The posttest for the digital education group's skills had a p-value of 0.275 (normal distribution), while the post-test for the counseling group's skills had a p-value of 0.078 (normal distribution).

Data analysis

Digital Based Education Group on knowledge and skills

Table 5. T-Test of the Digital Education Group in the Lawawoi Community Health Center Area, Sidenreng Rappang Regency (July 6 – August 6, 2024)(n=32)

				95% confidence interval of the difference		T	df	Sig.(2-tailed)
	Mean	**Std.Deviation**	**Std. Error Mean**	**lower**	**Upper**			
Pretest (knowledge)-posttest (knowledge) digital education	-34.250	10.175	2.544	-39.672	-28.828	-13.464	15	.000
Pretest (skills)-posttest (skills) digital education	-30.750	7.629	1.907	-34.815	-26.685	-16.123	15	.000

Source: Primary Data 2024

Based on Table 6, the results of the paired t-test for the digital education group's knowledge had a significant (2-tailed) value of 0.000 ($p < 0.05$) in both the pretest and posttest, indicating a significant influence of digital-based education on knowledge related to self-care in patients with T2DM. Similarly, for the digital education group's skills, the paired t-test had a significant (2-tailed) value of 0.000 ($p < 0.05$) in both the pretest and posttest, indicating a significant influence of digital-based education on skills related to self-care in patients with T2DM.

ISSN: 2614-3488 (print); 2614-3496 (online) Vol.8 No.4. July 2025. Page.965-977

Counseling Group on knowledge and skills

Table 6. T-Test of the Counseling Group in the Lawawoi Community Health Center Area, Sidenreng Rappang Regency (July 6 – August 6, 2024)(n=32)

				95% confidence interval of the difference		T	Sig.(2-tailed)
	Mean	Std.Deviation	Std. Error Mean	lower	Upper		
Pretest (knowledge)-posttest (knowledge) counseling	-29.312	7.786	1.947	-33.462	-25.163	-15.058	.000
Pretest (skills)-posttest (skills) counseling	-31.687	10.713	2.678	-37.396	-25.979	-11.832	.000

Source: Primary Data 2024

Based on Table 7, the results of the paired t-test for the counseling group's knowledge had a significant (2-tailed) value of 0.000 ($p < 0.05$) in both the pretest and post-test, indicating a significant influence of counseling on knowledge related to self-care in patients with T2DM. Similarly, for the counseling group's skills, the paired t-test had a significant (2-tailed) value of 0.000 ($p < 0.05$) in both the pretest and posttest, indicating a significant influence of counseling on skills related to self-care in patients with T2DM.

Digital-Based Education Group Analysis of Knowledge and Skills

Table 7. Results of the Independent Samples Test for Pretest and Posttest between the Digital Education and Counseling Groups in the Lawawoi Community Health Center Area, Sidenreng Rappang Regency (July 6 – August 6, 2024)(n=32)

							95% confidence interval of the difference	
	f	Sig.	T	Sig. (2-tailed)	Mean difference	Std. error difference	lower	Upper
Pretest Knowledge	0.000	0.994	-0.924	0.363	-3.375	3.651	-10.832	4.082
			-0.924	0.363	-3.375	3.651	-10.833	4.083
Posttest knowledge	0.036	0.851	0.571	0.573	1.563	2.739	-4.031	7.156
			0.571	0.573	1.563	2.739	-4.031	7.156
Pretest Skills	0.392	0.536	0.005	0.323	2.625	2.613	-2.711	7.961
			1,005	0.323	2.625	2.613	-2.716	7.966
Posttest skills	1.358	0.253	0.535	0.597	1.688	3.154	-4.754	8.129
			0.535	0.597	1.688	3.154	-4.788	8.163

Source: Primary Data 2024

ISSN: 2614-3488 (print); 2614-3496 (online) Vol.8 No.4. July 2025. Page.965-977

Based on Table 1.8, the results of the independent samples test show the following: the pretest for the digital education group's knowledge had a sig. (2-tailed) value of 0.363, while the pretest for the counseling group's knowledge also had a sig. (2-tailed) value of 0.363. The posttest for the digital education group's knowledge had a sig. (2-tailed) value of 0.573, while the post-test for the counseling group's knowledge had the same sig. (2-tailed) value of 0.573. Regarding skills, the pretest for the digital education group's skills had a sig. (2-tailed) value of 0.323, while the pretest for the counseling group's skills also had a sig. (2-tailed) value of 0.323. The posttest for the digital education group's skills had a sig. (2-tailed) value of 0.597, while the post-test for the counseling group's skills had the same sig. (2-tailed) value of 0.597. It can be concluded that there is no significant difference between the digital education and counseling groups in terms of knowledge and skills, as all significant values are >0.05.

DISCUSSION

The Influence of Digital Education and Counseling on the Level of Knowledge related to Self-care in Patients with Type 2 Diabetes Mellitus (T2DM)

The findings of this study demonstrated a significant improvement in the level of knowledge among patients with type 2 diabetes mellitus (T2DM) after receiving digital-based education and counseling. This result is consistent with previous studies that have shown the positive impact of technology-assisted education on diabetes management. For instance, a study by Kebede et al. (2019) found that mobile health interventions significantly improved diabetes knowledge and self-care behaviors among T2DM patients in low-resource settings. Similarly, Alanzi et al. (2018) reported that WhatsApp-based diabetes education led to better knowledge and adherence to treatment recommendations.

Improved knowledge is closely linked to improved self-care behaviors, as patients who understand their condition are more likely to follow dietary guidelines, adhere to medication schedules, and engage in routine physical activity (Shrivastava et al., 2013). In this study, digital education provided through video messages and written materials, supported by face-to-face counseling, enabled participants to access information conveniently and repeatedly, which enhanced retention and understanding.

Furthermore, this approach supports a patient-centered model of care that utilizes digital platforms to overcome barriers such as limited access to health facilities and time constraints of healthcare providers. By combining technology with direct counseling, the intervention addressed both informational and motivational aspects of behavior change.

Therefore, the study concludes that digital education and counseling are effective strategies for enhancing patients' knowledge of diabetes self-care. This integrated approach empowers patients not only to better understand their illness but also to actively manage it in daily life. These findings contribute to the growing body of evidence supporting digital health interventions as a promising tool in chronic disease management, offering a more flexible and scalable alternative to traditional educational methods.

The Influence of Digital Education and Counseling on the Level of Skills related to Self-care in Patients with Type 2 Diabetes Mellitus (T2DM)

Previous studies have shown that digital education can significantly improve skills related to self-care in patients with Type 2 Diabetes Mellitus. A study by (Mahardika & Ni Made Ayu Sukma Widyandari, 2023) revealed that patients who used a mobile app to monitor blood glucose and manage their diet showed substantial improvements in their ability to manage their condition. The app provides easily accessible, interactive guidance, allowing patients to practice skills such as blood glucose monitoring, meal planning, and medication management independently. Other studies have also shown that digital education improves

the ability to identify and manage symptoms of hypoglycemia and other complications, which are crucial for long-term disease management.

Additionally, counseling has been shown to improve skills related to self-care acquired through digital education. A study by Jackson and Lee (2019) found that patients who received in-person counseling in addition to digital education demonstrated greater improvements in skills related to self-care compared to those who received digital education alone. Counseling provides an opportunity for patients to discuss challenges they may encounter in applying the skills they have learned with a healthcare professional. For example, counseling can assist patients in adjusting their insulin dosage based on blood sugar fluctuations or coping with psychological challenges when adhering to a diet or exercise routine.

Researchers hypothesize that combining digital education with counseling will lead to more significant improvements in skills related to self-care of patients with Type 2 Diabetes Mellitus. Patients who receive both interventions are expected to have a better understanding of their condition, along with stronger practical skills to manage the disease independently. They will be better equipped to control blood glucose levels, follow a healthy diet, and respond to symptoms of complications quickly and effectively. These improvements are anticipated to have a positive impact not only on glycemic control but also on overall quality of life, as patients will feel more independent and confident in managing their condition. (Kebede et al., 2019; Pal et al., 2013). The results of this study demonstrate that combining digital education with counseling significantly improves self-care skills in patients with type 2 diabetes mellitus. This can be explained by the comprehensive nature of the approach, which integrates accessible and repeatable information delivery through digital media with emotional and motivational support provided through face-to-face counseling. Digital education enhances patients' conceptual understanding of the disease and its management, while counseling reinforces practical skills and the application of knowledge in daily life. These findings are consistent with the study by Kebede et al. (2019), which showed that mHealth interventions significantly improved diabetes knowledge and self-care behaviors, although the study did not include direct counseling. Similarly, Alanzi et al. (2018) found that WhatsApp-based education improved patient understanding, but did not evaluate practical self-care skills comprehensively. In addition, Shrivastava et al. (2013) emphasized that behavior change in diabetes self-care requires more than education alone—it also needs emotional support and motivation, which are typically gained through personal interaction. Therefore, the combined approach used in this study is considered more effective, as it addresses the limitations of each method when used separately and produces a greater impact on glycemic control and patients' quality of life.

The Effectiveness of Digital-Based Educational Media and Counseling Interventions on Self-Care Behaviors in Patients with Type II Diabetes Mellitus as a Prevention Strategy for Neuropathy Complications

A comparison of the effectiveness of digital-based educational media and and Counseling Interventions on Self-Care Behaviors in Patients with Type II Diabetes Mellitus as a Prevention Strategy for Neuropathy Complications showed that there was no statistically significant difference between the digital education and counseling groups in terms of knowledge and skills, with a p-value >0.05. This is likely because both groups received interventions, resulting in no significant statistical difference between the two approaches. However, there was a significant improvement in knowledge and skills between the pretest and post-test in both intervention groups.

ISSN: 2614-3488 (print); 2614-3496 (online) Vol.8 No.4. July 2025. Page.965-977

The theoretical frameworks underlying this study, including Constructivist Learning Theory and Self-Efficacy Theory, provide valuable insights into how both digital education and counseling can play a role in improving skills related to self-care necessary to prevent complications such as neuropathy.

The conclusion drawn from these findings is that while both methods are equally effective, the choice of intervention should be tailored to the individual needs and characteristics of each patient. These findings support a more personalized approach to healthcare, where patients actively participate in selecting the type of intervention that best fits their lifestyle and preferences. In an era of rapid technological advancement, this study also underscores the importance of offering a variety of options accessible to all patients, including those with limited access to technology or a preference for face-to-face interactions.

CONCLUSION

Based on the preliminary study and the results of data analysis, this study concludes that both digital-based education and counseling interventions significantly influence patients' knowledge and self-care skills related to the management of Type 2 Diabetes Mellitus (T2DM). The findings demonstrate that digital-based education has a significant impact on improving patients' knowledge and practical skills before and after the intervention. Similarly, counseling interventions also show a significant effect in enhancing knowledge and self-care skills among T2DM patients.

This study further analyzes and confirms that patients who received digital-based education showed meaningful improvements in understanding their condition and demonstrated better self-care practices, such as blood glucose monitoring, dietary adjustments, and medication adherence. In parallel, those who received counseling sessions exhibited a comparable level of progress in both cognitive understanding and behavioral application of diabetes self-management.

Although the comparison between the two intervention groups—digital-based education and counseling did not reveal a statistically significant difference in outcomes, both groups showed substantial improvements from pretest to posttest in terms of knowledge and self-care skills. These findings suggest that either approach can be effective in supporting diabetes self-care when implemented properly. Thus, digital education and counseling can be considered as valuable, evidence-based strategies to help prevent neuropathy complications in T2DM patients by enhancing their ability to manage the disease effectively through increased awareness and improved self-care practices.

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CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest related to this study. There are no financial or personal relationships that could influence the results. The research was conducted with integrity and transparency. Should any potential conflicts of interest arise in the future, they will be disclosed in accordance with the applicable ethical guidelines**.**

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