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EFFECTIVENESS OF TELE-COUNSELING IN ENHANCING SELF-CARE AND METABOLIC MARKERS IN TYPE 2 DIABETES PATIENTS AMONG THE COASTAL AREAS: A QUASI-EXPERIMENTAL STUDY

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ABSTRACT

Tele-counseling has gained prominence as an effective tool for managing chronic diseases, including type 2 diabetes, particularly in underserved regions. This study aimed to assess the effectiveness of tele-counseling in improving self-care behaviors and metabolic markers in type 2 diabetes patients residing in the coastal areas of Kendari City, Southeast Sulawesi, Indonesia. A quasi-experimental design was employed, involving 70 participants who were randomly assigned to two groups: an intervention group (n = 35), which received tele-counseling for six weeks, and a control group (n = 35), which continued standard care. The primary outcomes measured included self-care behavior, fasting blood glucose (FBG), low-density lipoprotein (LDL) cholesterol, body weight, and blood pressure, all assessed at baseline and again six weeks after the intervention. Statistical analyses, including paired t-tests, Wilcoxon tests for non-normally distributed data, and independent t-tests for between-group comparisons, were conducted. Results indicated that the intervention group experienced significant improvements in self-care behavior ($p < 0.001$), along with reductions in FBG ($p < 0.001$), LDL cholesterol ($p < 0.001$), systolic blood pressure ($p = 0.001$), diastolic blood pressure ($p = 0.003$), and body weight ($p < 0.001$). In contrast, the control group showed minimal changes. These findings suggest that tele-counseling is an effective intervention for enhancing self-care behaviors and improving key metabolic markers in type 2 diabetes patients, particularly in coastal areas with limited access to healthcare services. This study provides valuable insights into the application of telemedicine for chronic disease management in underserved regions. Further research is recommended to examine the long-term effects of tele-counseling on diabetes management and to explore its scalability in other remote and rural areas.

Kata Kunci:

Tele-Konseling;
Diabetes Melitus Tipe 2;
Perilaku perawatan diri

ABSTRAK

Tele-konseling merupakan pendekatan yang semakin populer dalam pengelolaan penyakit kronis seperti diabetes tipe 2, khususnya di wilayah dengan keterbatasan aksesibilitas dan ketersediaan sumber daya layanan kesehatan. Penelitian ini bertujuan untuk menilai efektivitas tele-konseling dalam meningkatkan perilaku perawatan diri dan penanda metabolik pada pasien diabetes tipe 2 yang tinggal di daerah pesisir Kota Kendari, Sulawesi Tenggara, Indonesia. Desain penelitian kuasi-eksperimental digunakan dengan melibatkan 70 peserta yang dibagi secara acak menjadi dua kelompok: kelompok intervensi (n = 35) yang menerima tele-konseling selama enam minggu, dan kelompok kontrol (n = 35) yang melanjutkan perawatan standar. Hasil utama yang diukur meliputi perilaku perawatan diri, glukosa darah puasa (GDP), kolesterol lipoprotein densitas rendah (LDL), berat badan, dan tekanan darah, yang semuanya diukur pada saat baseline dan kembali diukur setelah enam minggu intervensi. Analisis statistik yang digunakan mencakup uji t berpasangan, uji Wilcoxon untuk data yang tidak terdistribusi normal, dan uji t tidak berpasangan untuk perbandingan antar kelompok. Hasil penelitian menunjukkan bahwa kelompok intervensi mengalami peningkatan signifikan dalam perilaku perawatan diri ($p < 0,001$), serta penurunan kadar GDP ($p < 0,001$), kolesterol LDL ($p < 0,001$), tekanan darah sistolik ($p = 0,001$), tekanan darah diastolik ($p = 0,003$), dan berat badan ($p < 0,001$). Sebaliknya, kelompok kontrol menunjukkan perubahan yang minimal. Temuan ini menunjukkan bahwa tele-konseling merupakan intervensi yang efektif untuk meningkatkan perilaku perawatan diri dan memperbaiki penanda metabolik pada pasien diabetes tipe 2, terutama di daerah pesisir dengan akses

layanan kesehatan terbatas. Penelitian ini memberikan wawasan yang berharga mengenai penerapan telemedicine dalam pengelolaan penyakit kronis di wilayah yang kurang terlayani. Penelitian lebih lanjut disarankan untuk menilai dampak jangka panjang dari tele-konseling dalam pengelolaan diabetes serta untuk mengeksplorasi potensi skalabilitasnya di daerah terpencil dan pedesaan lainnya.

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INTRODUCTION

Type 2 Diabetes (T2D) has become a major public health concern and a leading cause of mortality from non-communicable diseases, with a rising prevalence globally. In Indonesia, T2D ranked as the third leading cause of death in 2019, with 5,742 deaths per 100,000 population, according to the Institute for Health Metrics and Evaluation (IHME) (International Diabetes Federation, 2021, Christina Maar Andersen, et.al, 2023). The high mortality rate was primarily attributed to poor glycemic control, which can result in severe complications, including cardiovascular disease, stroke, and kidney failure (Hayashino et al., 2018, Curtis et al., 2024).

A key factor contributing to inadequate glycemic control in T2D patients is poor self-care behavior (American Diabetes Association, 2020; Saltar et al., 2023). Self-care behaviors encompass actions such as dietary management, physical activity, blood sugar monitoring, and medication adherence, all of which are essential for independent disease management (Ahmad & Joshi, 2023). Research has demonstrated that insufficient self-care behavior is closely associated with an elevated risk of T2D-related complications (Saad et al., 2018). Inadequate self-care also correlates with poor metabolic outcomes, such as elevated fasting blood glucose, uncontrolled HbA1c levels, and increased LDL cholesterol and triglycerides, all of which contribute to suboptimal glycemic control (Powers et al., 2015).

In managing T2D, healthcare providers, particularly nurses, play a vital role in supporting and improving patients' self-care behavior. Structured interventions by healthcare professionals can help patients better understand disease management, cope with stress, and monitor symptoms of complications more effectively. These interventions not only provide emotional support but also empower patients to take greater responsibility for their health, resulting in improved quality of life and a reduced risk of long-term complications (Eva et al., 2018).

However, challenges such as limited time and personnel often hinder the consistent provision of support to T2D patients. As a result, interventions such as home visits—which have proven effective in enhancing disease management—are not always feasible (Powers et al., 2015). One solution to overcome these limitations is tele-counseling, a remote healthcare service that uses telecommunications technology to deliver counseling and educational support without requiring face-to-face interaction (Lee & Park, 2021).

ele-counseling offers a practical and efficient means of providing remote support to T2D patients, allowing healthcare providers to regularly monitor patients' conditions, deliver educational guidance, and motivate them to adopt better self-care practices (Souza-junior et al., 2016). Studies have shown that tele-counseling improves patients' knowledge and adherence to diabetes care (Alkawaldeh et al., 2020), with other research indicating significant improvements in glycemic control among patients receiving remote counseling (Boels et al., 2018).

Kendari, the capital of Southeast Sulawesi, has a large coastal population with unique dietary and lifestyle characteristics that may influence the prevalence and management of T2D (Cahyo Wulandari, 2023). As a chronic metabolic disorder, T2D poses a significant public health challenge due to its progressive course, numerous associated complications, and the considerable burden it places on healthcare systems—especially in areas with limited infrastructure. Previous studies have demonstrated that T2D patients living in coastal areas often exhibit poor glycemic control, as evidenced by elevated fasting blood glucose, cholesterol, and blood pressure levels, which increase the risk of cardiovascular and other diabetes-related complications (Cahyo Wulandari, 2023). Specifically, a study conducted in the coastal region of Kendari City reported that 41.5% of T2D patients had random blood glucose levels

exceeding 300 mg/dL (Saltar et al., 2024). This challenge is further compounded by limited access to health services, a shortage of healthcare workers, and low awareness of the importance of self-care behaviors. Therefore, tele-counseling emerges as a promising intervention, offering remote, cost-effective, and easily accessible support for diabetes self-management—particularly in geographically underserved areas such as Kendari. However, empirical evidence on the effectiveness and applicability of tele-counseling for patients with type 2 diabetes in specific socio-cultural and geographical contexts remains limited, necessitating further research to inform tailored interventions and policy decisions.

In response, tele-counseling interventions have the potential to significantly improve T2D management in coastal regions by providing consistent and structured support that transcends geographic barriers. Additionally, tele-counseling enables healthcare providers to closely monitor patients' conditions and offer timely feedback to optimize diabetes management.

This study is the first to examine the effectiveness of tele-counseling in improving self-care behavior and metabolic markers in T2D patients in the coastal areas of Kendari. It aimed to provide valuable insights into the application of telemedicine in this unique geographical setting, focusing on the effectiveness of tele-counseling in enhancing self-care behavior and improving metabolic outcomes in T2D patients.

METHOD

Type of Research

This study employed a quasi-experimental design involving two groups: an intervention group that received tele-counseling and a control group that received standard care. Pre- and post-intervention measurements were taken over six weeks to assess changes in self-care behavior and metabolic markers, including fasting blood glucose (FBG), low-density lipoprotein (LDL) cholesterol, body weight (BW), and blood pressure. The six-week duration was selected based on prior studies demonstrating that short-term interventions of 4 to 8 weeks are sufficient to initiate measurable changes in self-care behaviors and produce early improvements in metabolic outcomes among patients with T2D (Powers et al., 2015; Haas et al., 2015). Additionally, a six-week period allows for adequate patient engagement while minimizing the risk of participant attrition, which is common in longer intervention studies.

Place and Time of Research

This study was conducted in the coastal areas of Kendari City, with the research taking place from August to September 2024. Ethical approval was obtained from the Health Research Ethics Committee of Universitas Mandala Waluya, under approval number No. 16/KEP/UMW/VII/2024.

Population and Sample

Participants were selected using consecutive sampling from four coastal villages in Kendari City. Recruitment was facilitated through home visits based on data from the cadres of the Integrated Development Post for Non-Communicable Diseases (IDP-NCD). Inclusion criteria included individuals diagnosed with T2D, aged ≥18 years, with access to telecommunication devices suitable for tele-counseling, and willing to participate throughout the intervention period. Exclusion criteria included T2D patients without access to Android mobile phones and those with limited literacy, defined as the inability to read adequately. The sample size was calculated using a formula for unpaired categorical–numerical analysis, incorporating Zα (1.96), Zβ (1.28), and the minimum mean difference between groups based on a previous study (Sayin Kasar et al., 2022). An additional 10% was added to account for potential dropouts, resulting in a sample size of 35 participants per group. The intervention group (n = 35) received tele-counseling for six weeks, while the control group (n = 35) continued with standard care without tele-counseling. Both groups were comparable in demographic characteristics such as age, gender, and duration of diabetes.

Data Collection

Data collection was conducted by five public health center nurses, who also served as study facilitators through home visits or sessions at health centers. Measurements included self-care behavior, FBG, LDL cholesterol, body weight, and blood pressure, assessed at baseline and again six weeks after

the intervention. Self-care behavior was measured using the Summary of Diabetes Self-Care Activities (SDSCA) questionnaire developed by Toobert et al., (2000), which was modified into 16 items for this study. Validity and reliability testing confirmed its adequacy, with a Cronbach's alpha of 0.7 (Saltar et al., 2023). The intervention group received six weekly tele-counseling sessions via phone or video call, focusing on T2D management aspects such as diet, physical activity, medication adherence, blood glucose monitoring, and problem-solving.

The sessions were as follows: Session 1: Diet Behavior Counseling: Participants received guidance on healthy carbohydrate sources, fat and protein intake management, and portion control to maintain stable blood glucose levels. Session 2: Physical Activity Counseling: Education on the importance of physical activity in diabetes management. Session 3: Medication Counseling: Focused on improving adherence to prescribed medications, including correct timing, the importance of not discontinuing treatment without consultation, and managing side effects. Session 4: Self-Blood Glucose Monitoring Counseling: Training on how to use a blood glucose meter, when to test, and how to interpret results for dietary or medication decisions. Session 5: Stress Management Counseling: Provided relaxation techniques such as meditation and breathing exercises to manage emotions and prevent stress-induced blood glucose spikes. Session 6: Complication Prevention and Management Counseling: Education on the long-term complications of diabetes, including neuropathy, retinopathy, and heart disease.

Data Analysis and Processing

Self-care behavior data, fasting blood glucose (FBG), low-density lipoprotein (LDL) cholesterol, body weight, and blood pressure were measured at baseline and again at six weeks following the intervention. Data collection was conducted by five public health center nurses, who also served as study facilitators, either through home visits or during health center visits.

All data were analyzed using SPSS software (Version XX, IBM Corp.). To determine the appropriate statistical tests, data normality was first assessed using the Shapiro–Wilk test for each variable. For data that were normally distributed, dependent t-tests were employed to compare within-group differences (pre- and post-intervention). For data that were not normally distributed, the Wilcoxon signed-rank test was applied. Comparisons between the intervention and control groups were conducted using independent t-tests for continuous variables and Chi-square tests for categorical variables. A significance level of $p < 0.05$ was used, with a 95% confidence interval.

To ensure baseline homogeneity between the intervention and control groups, demographic variables such as age, gender, education level, employment status, marital status, and diabetes duration were compared. Specifically, age and diabetes duration were treated as continuous variables and analyzed using independent t-tests, while gender, education level, employment status, and marital status were categorical variables analyzed using Chi-square tests.

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RESULT

The results of this study are presented below, highlighting the demographic characteristics of the participants and the changes observed in both the intervention and control groups over the study period. Table 1 shows that most respondents in both the intervention and control groups were female, with no significant difference between the groups (p = 0.383). Educational levels were similar, with the majority being high school graduates. Employment and marital status were evenly distributed, indicating demographic homogeneity between the two groups.

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Table 1: Distribution of Respondents by Characteristics in the Intervention and Control Groups (August 2024 - September 2024).

Variable	Intervention Group (n=35)	Control Group (n=35)	P-Value*
Gender			
Male	13 (37.1%)	7 (20%)	0.383
Female	22 (62.9%)	28 (80%)	
Education Level			
College	6 (17.1%)	8 (22.9%)	0.636
High School	17 (48.6%)	16 (45.7%)	
Junior High School	9 (25.7%)	7 (20%)	
Primary School	3 (8.6%)	4 (11.4%)	
Employment			
Employed	20 (57.1%)	17 (48.6%)	0.309
Unemployed	15 (42.9%)	18 (51.4%)	
Marital Status			
Married	31 (88.6%)	30 (85.7%)	0.945
Single	1 (2.9%)	1 (2.9%)	
Widowed	3 (8.6%)	4 (11.4%)	

*Chi-square test

As shown in Table 2, there were no significant differences in age ($p = 0.588$) or duration of diabetes ($p = 0.872$) between the intervention and control groups. This confirms that the groups were comparable regarding these key variables.

Table 2: Age, Duration of Diabetes, Metabolic Markers, and Self-Care Behavior in Respondents (n=35)

Variable	Group	Mean	SD	P-Value*
Age (years)	Intervention	52.2	5.4	0.588*
	Control	52.3	6.7	
Duration of DM (years)	Intervention	5.1	2.3	0.872*
	Control	5.0	2.2	

*Independent t-test

Changes in Metabolic Markers Before and After Tele-Counseling Intervention

The changes in metabolic markers before and after the intervention are presented in Table 3.

Table 3 demonstrates significant improvements in several metabolic markers in the intervention group following the tele-counseling intervention. Specifically, the intervention group showed notable reductions in systolic blood pressure ($p = 0.001$), diastolic blood pressure ($p = 0.003$), LDL cholesterol ($p = 0.001$), and fasting blood glucose ($p < 0.00001$), as well as a slight but statistically significant reduction in body weight ($p < 0.00001$). These results suggest that tele-counseling had a positive effect on these important metabolic indicators in patients with T2D.

In contrast, the control group, which did not receive the intervention, showed no significant changes in systolic or diastolic blood pressure, LDL cholesterol, fasting blood glucose, or body weight. The lack of significant improvement in the control group further highlights the effectiveness of tele-counseling as a therapeutic intervention. This finding underscores the potential of tele-counseling to enhance metabolic control and weight management in T2D patients, particularly in regions with limited access to healthcare services.

Table 3: Mean Values of Metabolic Markers Before and After Intervention (August 2024 - September 2024)

Variable	Observation Time	Intervention Group	P-Value*	Control Group	P-Value*
Systolic Blood Pressure	Before	134 ± 13.22	0.001*	129.14 ± 16.11	0.317
	After	132 ± 12.72		129.57 ± 15.21	
Diastolic Blood Pressure	Before	84.06 ± 8.66	0.003*	81.57 ± 7.64	0.214
	After	82.91 ± 8.49		82.14 ± 6.78	
LDL Cholesterol (mg/dL)	Before	207.43 ± 16.39	0.001**	196.63 ± 13.22	0.003**
	After	200.77 ± 16.86		198.77 ± 14.06	
Fasting Blood Glucose	Before	150.14 ± 26.87	0.00001*	137.40 ± 20.18	0.00001*
	After	140.40 ± 24.48		139.74 ± 20.12	
Body Weight (kg)	Before	64.77 ± 7.78	0.00001*	61.09 ± 6.50	0.564
	After	64.23 ± 7.63		61.11 ± 6.46	

*Wilcoxon test
**Paired t-test

Changes in Self-Care Behavior Before and After Tele-Counseling Intervention

The changes in self-care behavior before and after the intervention are presented in Table 4.

Table 4: Self-Care Behavior Scores Before and After Intervention (August 2024 - September 2024)

Observation Time	Intervention Group	P-Value*	Control Group	P-Value*
Before	55.03 ± 21.23	0.00001*	48.37 ± 16.66	0.007*
After	75.34 ± 18.94		48.94 ± 16.35	

*Paired t-test

Table 4 shows a significant improvement in self-care behavior scores in the intervention group (p = 0.00001), while the control group exhibited minimal changes (p = 0.007). This indicates that tele-counseling was effective in enhancing self-care behavior among patients with type 2 diabetes.

Comparison of Metabolic Markers and Self-Care Behavior Between Groups

The comparison of changes in metabolic markers and self-care behavior between the intervention and control groups was analyzed using the Mann-Whitney test, as the data were not normally distributed.

Table 5: Differences in Metabolic Markers and Self-Care Behavior Between Groups (August 2024 - September 2024)

Variable	Difference Between Groups	P-Value*
Systolic Blood Pressure	-1.57 ± 2.10	0.00001
Diastolic Blood Pressure	-1.14 ± 1.88	0.0003
LDL Cholesterol	-6.66 ± 10.93	0.00001
Fasting Blood Glucose	-9.74 ± 11.99	0.00001
Body Weight	-0.55 ± 0.61	0.00001
Self-Care Behavior	20.31 ± 10.09	0.00001

*Mann-Whitney test

Table 5 reveals significant differences between the intervention and control groups across all measured variables following the tele-counseling intervention. The intervention group showed significant improvements in systolic blood pressure (–1.57 ± 2.10), diastolic blood pressure (–1.14 ± 1.88), LDL cholesterol (–6.66 ± 10.93), fasting blood glucose (–9.74 ± 11.99), and body weight (–0.55 ± 0.61), all with p-values well below the significance threshold ($p < 0.00001$). These results suggest that tele-counseling had a substantial positive impact on the metabolic control of T2D patients, improving critical health markers.

In addition to the metabolic markers, the intervention group showed a significant improvement in self-care behavior (20.31 ± 10.09, $p < 0.00001$), highlighting the positive influence of tele-counseling on patient engagement in managing their condition. In contrast, the control group showed no comparable improvements in these variables. The significant differences between the groups underline the effectiveness of tele-counseling as an intervention for both improving metabolic outcomes and promoting better self-care behaviors in T2D patients.

DISCUSSION

Characteristics of Type 2 DM Patients in the Intervention and Control Groups

Understanding the demographic and clinical characteristics of T2D patients is essential for interpreting the effectiveness of interventions, particularly in geographically unique areas such as coastal regions. In this study, the baseline characteristics of the intervention and control groups—such as age, gender, education level, and duration of diabetes—were statistically similar, ensuring an unbiased comparison of the outcomes.

Coastal areas, often characterized by limited access to healthcare, present unique challenges in managing chronic conditions like diabetes (Abdulrehman et al., 2016). This study highlights the significance of geography in healthcare access, reinforcing the need for tailored interventions that address the specific challenges coastal populations face. The homogeneity in the duration of diabetes between the groups further supports the validity of the comparison. As Soeatmadji et al. (2023) indicated, patients with longer disease duration tend to experience greater difficulty in maintaining glycemic control, thus requiring additional support through interventions like tele-counseling.

Educational level also plays a vital role in diabetes self-management. Although there were no statistically significant differences in education levels between the two groups, it is important to consider that coastal communities generally have lower educational attainment compared to urban populations. This disparity may impact patients' understanding and implementation of disease management strategies. The findings of this study suggest that simple and accessible educational tools—such as tele-counseling—can effectively bridge this gap and contribute to improved diabetes self-management in low-literacy populations.

Effectiveness of Tele-Counseling in Improving Metabolic Markers

The tele-counseling intervention significantly improved several metabolic markers in the intervention group, including reductions in systolic and diastolic blood pressure, LDL cholesterol, fasting blood glucose (FBG), and body weight. These physiological parameters are essential for the prevention of diabetes-related complications, including cardiovascular disease and kidney failure.

The intervention group exhibited a statistically significant reduction in systolic blood pressure from 134 mmHg to 132 mmHg. Although this decrease is statistically meaningful, its clinical significance may be limited, as reductions of ≥10 mmHg are generally more impactful in lowering cardiovascular risk (Arrieta et al., 2020). Nevertheless, this improvement demonstrates the value of tele-counseling in promoting awareness of blood pressure control through regular monitoring and targeted education.

Diastolic blood pressure decreased from 84.06 mmHg to 82.91 mmHg in the intervention group. While this reduction is statistically significant, its clinical relevance is modest. Reductions in diastolic blood pressure of less than 5 mmHg are generally considered minimal in clinical terms (Nikbina et al., 2020). Nevertheless, ongoing interventions could result in cumulative benefits over time.

The intervention group showed a significant reduction in LDL cholesterol levels, whereas the control group experienced an increase. Clinically, even a moderate decrease in LDL cholesterol can reduce cardiovascular risk in T2D patients (Khil et al., 2023). Although the observed reduction in this

study is below the ≥10 mg/dL threshold associated with marked cardiovascular benefits, it highlights the positive role of tele-counseling in enhancing patient awareness and adherence to cholesterol-lowering interventions.

The decrease in FBG in the intervention group, from 150.14 mg/dL to 140.40 mg/dL, is statistically and clinically significant. Lowering FBG is crucial in reducing the risk of diabetes-related complications, such as neuropathy and nephropathy (Merid et al., 2024). This result demonstrates the effectiveness of tele-counseling in encouraging patients to adhere to prescribed treatments and lifestyle modifications.

The intervention group experienced a slight but statistically significant reduction in body weight. Although the decrease is small and may not have immediate clinical implications, weight loss of ≥5% has significantly improved metabolic outcomes (Kang et al., 2018). The results suggest that tele-counseling could contribute to long-term weight management if sustained over a longer period.

Effectiveness of Tele-Counseling in Improving Diabetes Self-Care Behavior

Self-care behavior is a critical component of diabetes management, and this study found that tele-counseling significantly improved self-care behavior in the intervention group. The increase in self-care scores demonstrates the substantial impact of regular, structured counseling on patient engagement in managing their condition. Improved self-care behavior is directly linked to better glycemic control and a reduced risk of diabetes-related complications (Pokhrel et al., 2019; Sumikawa et al., 2018).

Tele-counseling provided continuous education and support, empowering patients to monitor their blood glucose, manage dietary intake, and engage in physical activity. The provision of remote, structured counseling is particularly beneficial for coastal populations, who often face logistical challenges in accessing healthcare services. The success of tele-counseling in these communities highlights its potential to expand healthcare access and enhance self-care behavior in underserved areas (Shaban et al., 2024).

The minimal improvement in self-care behavior observed in the control group suggests that, in the absence of structured interventions such as tele-counseling, significant advancements in diabetes management are unlikely. These findings reinforce the importance of sustained, remote support in promoting behavior change among diabetes patients. For coastal populations facing barriers such as travel difficulties and limited availability of in-person services, the flexibility of tele-counseling serves as a critical enabler of health equity. By reducing the need for frequent clinic visits, tele-counseling not only facilitates behavioral change but also eases logistical burdens on both patients and healthcare providers.

Limitations of the Study

This study has several limitations. First, the relatively short duration of six weeks may not fully reflect the long-term effects of tele-counseling on metabolic markers and self-care behavior. Extended intervention periods are recommended to assess whether the improvements observed can be maintained over time. Prior research suggests that the effectiveness of tele-counseling tends to increase with longer intervention durations.

Second, the study's relatively small sample size and its focus on a single coastal region (Kendari City) limit the generalizability of the findings. Future studies with larger sample sizes and broader geographic coverage, including various coastal communities, are needed to validate and expand upon these results. Finally, the reliance on telecommunication technology may exclude individuals without access to digital devices or stable internet connections—barriers that are particularly relevant in underdeveloped coastal areas. This technological gap poses a risk of widening health disparities unless inclusive strategies are implemented to ensure digital access for all patients.

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CONCLUSION AND SUGGESTION

This study demonstrates that tele-counseling is significantly effective in improving self-care behavior and several key metabolic markers in patients with type 2 diabetes (T2D) living in the coastal areas of Kendari City. The intervention group showed notable improvements in systolic and diastolic

blood pressure, LDL cholesterol, fasting blood glucose (FBG), and body weight, along with a significant increase in self-care behavior. These findings indicate that tele-counseling represents a practical and efficient strategy for diabetes management, particularly in regions with limited access to healthcare services.

While improvements in blood pressure and body weight were statistically significant, the clinical relevance of these changes warrants further investigation. Longer-term interventions may yield more pronounced clinical benefits and provide clearer insights into the sustainability of such outcomes.

This study highlights the potential of tele-counseling to address healthcare access challenges in coastal areas and to foster greater patient autonomy in the management of chronic diseases like diabetes. Future research should explore longer intervention periods, larger and more diverse sample populations, and the implementation of tele-counseling across various geographic settings. Such efforts will be instrumental in strengthening the evidence base and offering more comprehensive recommendations for integrating telemedicine into Indonesia's national healthcare policies.

The findings of this study suggest that tele-counseling can serve as a viable solution for managing T2D in underserved coastal communities. Integrating telemedicine into national healthcare systems may expand access to essential health services for populations that are currently marginalized. Furthermore, enhancing telecommunications infrastructure in remote areas is critical to broaden the reach and effectiveness of tele-counseling initiatives.

Healthcare providers must also be adequately trained to deliver high-quality tele-counseling, ensuring that remote consultations uphold the same standard of care as in-person interactions. Equipping providers with the necessary skills can increase patient engagement, support sustained behavior change, and ultimately lead to improved health outcomes—particularly among populations with limited access to traditional healthcare services.

REFERENCES

Abdulrehman, M. S., Woith, W., Jenkins, S., Kossman, S., & Hunter, G. L. (2016). Exploring Cultural Influences of Self-Management of Diabetes in Coastal Kenya: An Ethnography. *Global Qualitative Nursing Research*, *3*. https://doi.org/10.1177/2333393616641825

Ahmad, F., & Joshi, S. H. (2023). Self-Care Practices and Their Role in the Control of Diabetes: A Narrative Review. *Cureus*, *15*(7). https://doi.org/10.7759/cureus.41409

Alkawaldeh, M. Y., Choi, J., & Jacelon, C. S. (2020). A diabetes self-management tablet-based application for older adults with type 2 diabetes: The ASSISTwell pilot study. *Geriatric Nursing*, *41*, 839–845. https://doi.org/10.1016/j.gerinurse.2020.05.004

American Diabetes Association. (2020). Standards of Medical Care in Diabetes—2020 Abridged for Primary Care Providers. *Clinical Diabetes*, *38*(1), 10–38. https://doi.org/https://doi.org/10.2337/cd20-as01

Arrieta, A., Woods, J. R., Qiao, N., & Jay, S. J. (2020). Cost-benefit analysis of blood pressure reduction in patients with diabetes mellitus: From a US payer perspective. *Journal of Hypertension*, *38*(6), 1096–1103. https://doi.org/10.1097/HJH.0000000000002354

Boels, A. M., Rutten, G., Zuithoff, N., Wit, A. De, & Vos, R. (2018). *Effectiveness of diabetes self-management education via a smartphone application in insulin treated type 2 diabetes patients – design of a randomised controlled trial (' TRIGGER study ')*. 1–11. https://doi.org/10.1186/s12902-018-0304-9

Cahyo Wulandari. (2023). Hubungan Kebiasaan Masyarakat Pesisir dengan Penyakit Diabetes Melitus dan Asam Urat. *Jurnal Pengabdian, Riset, Kreativitas, Inovasi, Dan Teknologi Tepat Guna*, *1*(2), 172–180. https://doi.org/10.22146/parikesit.v1i2.9550

Christina Maar Andersen, Anne Sophie Mathiesen, François Pouwer, Julie Drotner Mouritsen, Kim Mathiasen, M. J. R. (2023). Can online and app-based interventions be used by people with diabetes to reduce diabetes distress? A protocol for a scoping review. *BMJ Open*, *13*(11).

https://doi.org/10.1136/bmjopen-2023-074015

Curtis, F., Burton, J. O., Butt, A., Dhaliwal, H. K., Graham-Brown, M. M. P., Lightfoot, C. J., Rawat, R., Smith, A. C., Wilkinson, T. J., & March, D. S. (2024). Lifestyle interventions delivered by eHealth in chronic kidney disease: A scoping review. *PLoS ONE*, *19*(1 January), 1–25. https://doi.org/10.1371/journal.pone.0297107

Eva, J. J., Kassab, Y. W., Neoh, C. F., & Ming, L. C. (2018). *Self-Care and Self-Management Among Adolescent T2DM Patients : A Review*. *9*(October), 1–7. https://doi.org/10.3389/fendo.2018.00489

Haas, L., Maryniuk, M., Beck, J., Carla, E., Duker, P., Edward, L., Fisher, E., Hnason, L., Kent, D., Kolb, L., Mclaughlin, S., Eric, O., Piette, J. D., Rhinehart, A. S., Rothman, R., Sklaroff, S., Tomky, D., & Youssef, G. (2015). National Standards for Diabetes Self-Management Education and Support. *The Diabetes Educator*, 619–630. https://doi.org/10.1177/0145721712455997

Hayashino, Y., Okamura, S., Tsujii, S., & Ishii, H. (2018). Association between diabetes distress and all-cause mortality in Japanese individuals with type 2 diabetes: a prospective cohort study (Diabetes Distress and Care Registry in Tenri [DDCRT 18]). *Diabetologia*, *61*(9), 1978–1984. https://doi.org/10.1007/s00125-018-4657-4

International Diabetes Federation. (2021). Kasus Kematian Akibat Diabetes di Indonesia Terbesar Keenam di Dunia. *Katadata Books*, 2021. https://databoks.katadata.co.id/datapublish/2021/11/26/kasus-kematian-akibat-diabetes-di-indonesia-terbesar-keenam-di-dunia

Kang, G. J. G., Ewing-Nelson, S., Mackey, L., JT.Schlitt, Marathe, Abbas, K., & Swarup, S. (2018). Weight Loss and Improvement in Comorbidity: Differences at 5%, 10%, 15%, and Over. *Physiology & Behavior*, *176*(1), 139–148. https://doi.org/10.1007/s13679-017-0262-y.Weight

Khil, J., Kim, S. M., Chang, J., Choi, S., Lee, G., Son, J. S., Park, S. M., & Keum, N. N. (2023). Changes in total cholesterol level and cardiovascular disease risk among type 2 diabetes patients. *Scientific Reports*, *13*(1), 1–11. https://doi.org/10.1038/s41598-023-33743-6

Lee, M. H., & Park, Y. H. (2021). The effectiveness of the information-motivation-behavioral skills model-based intervention on preventive behaviors against respiratory infection among community-dwelling older adults. *Patient Education and Counseling*, *104*(8), 2028–2036. https://doi.org/10.1016/j.pec.2021.01.016

Merid, F., Getahun, F., Esubalew, H., & Gezahegn, T. (2024). Incidence and Predictors of Diabetic Nephropathy among Type 2 Diabetes Mellitus Patients, Southern Ethiopia. *Journal of Nutrition and Metabolism*, *2024*. https://doi.org/10.1155/2024/6976870

Nikbina, M., Mameneh, M., Bakaeian, M., Dehcheshmeh, N. F., Moradi, A., Jalilian, H., & Jabbari, M. (2020). Effectiveness of nutrition education and counseling on metabolic control parameters of diabetes mellitus type 2 patients in primary health care centers. *Clinical Diabetology*, *9*(5), 293–299. https://doi.org/10.5603/DK.2020.0030

Pokhrel, S., Shrestha, S., Timilsina, A., Sapkota, M., Bhatt, M. P., & Pardhe, B. D. (2019). Self-care adherence and barriers to good glycaemic control in nepalese type 2 diabetes mellitus patients: A hospital-based cross-sectional study. *Journal of Multidisciplinary Healthcare*, *12*, 817–826. https://doi.org/10.2147/JMDH.S216842

Powers, M. A., Bardsley, J., Cypress, M., Duker, P., Funnell, M. M., Hess Fischl, A., Maryniuk, M. D., Siminerio, L., & Vivian, E. (2015). Diabetes Self-Management Education and Support in Type 2 Diabetes: A Joint Position Statement of the American Diabetes Association, the American Association of Diabetes Educators, and the Academy of Nutrition and Dietetics. *Journal of the Academy of Nutrition and Dietetics*, *115*(8), 1323–1334. https://doi.org/10.1016/j.jand.2015.05.012

Saad, A. M. J., Younes, Z. M. H., Ahmed, H., Brown, J. A., Al Owesie, R. M., & Hassoun, A. A. K. (2018). Self-efficacy, self-care and glycemic control in Saudi Arabian patients with type 2 diabetes

mellitus: A cross-sectional survey. *Diabetes Research and Clinical Practice*, *137*, 28–36. https://doi.org/10.1016/j.diabres.2017.12.014

Saltar, L., Masriwati, S., Mimiyati, Merry, Lisnawati, & Islamiyah. (2024). Quality of life of uncontrolled type 2 diabetes mellitus patients and related factors in the coastal area of Kendary City. *NurseLine Journal*, *9*(2). https://doi.org/http://doi.org/10.19184/nlj.v9i2.52553

Saltar, L., Sahar, J., & Rekawati, E. (2023). Self-Care Behavior , Self-Efficacy and Quality of Life of Patients with Type 2 Diabetes Mellitus with Symptoms of Peripheral Neuropathy. *Journal for Re Attach Therapy and Developmental Diversities*, *6*, 799–809. https://jrtdd.com/index.php/journal/article/view/1642

Sayin Kasar, K., Duru Asiret, G., Kutmec Yilmaz, C., & Canlar, Ş. (2022). The effect of model-based telephone counseling on HbA1c and self-management for individuals with type 2 diabetes: A randomized controlled trial. *Primary Care Diabetes*, *16*(1), 41–48. https://doi.org/10.1016/j.pcd.2021.09.005

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

Soeatmadji, D. W., Rosandi, R., Saraswati, M. R., Sibarani, R. P., & Tarigan, W. O. (2023). Clinicodemographic Profile and Outcomes of Type 2 Diabetes Mellitus in the Indonesian Cohort of DISCOVER: A 3-Year Prospective Cohort Study. *Journal of the ASEAN Federation of Endocrine Societies*, *38*(1), 68–74. https://doi.org/10.15605/jafes.038.01.10

Souza-junior, V. D., Amélia, I., Mendes, C., Mazzo, A., & Godoy, S. (2016). Application of telenursing in nursing practice : an integrative literature review. *Applied Nursing Research*, *29*, 254–260. https://doi.org/10.1016/j.apnr.2015.05.005

Sumikawa, M., Kuwamura, Y., Sumikawa, Y., Fujiwara, T., & Kamiya, C. (2018). Effect of Foot Self-Care Behavior According to Severity of Diabetic Neuropathy in Japanese Patients with Diabetes. *Health*, *10*(09), 1192–1199. https://doi.org/10.4236/health.2018.109091

Toobert, D. J., Hampson, S. E., & Glasgow, R. E. (2000). The Summary of Diabetes Self-Care. *Diabetes Care*, *23*(July), 943–950. https://doi.org/10.2337/diacare.23.7.943