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Research Article

THE EFFECT OF MOBILE APPLICATION-BASED NUTRITION EDUCATION ON DIABETES KNOWLEDGE AND BLOOD GLUCOSE LEVELS IN PATIENTS WITH TYPE II DIABETES MELLITUS IN THE WORKING AREA OF BELIMBING PUBLIC HEALTH CENTER

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ABSTRACT

Background: Diabetes remains the most prevalent non-communicable disease (NCD) in Padang City, with the highest case burden reported at Belimbing Health Centre (74.3%, or 998 cases). This study aimed to evaluate the effect of mobile-based nutrition education on diabetes knowledge and blood glucose control among patients with type 2 diabetes mellitus.
Methods: A quasi-experimental design was employed involving 66 respondents, using a pre-test–post-test with control group design. Participants were selected through simple random sampling, and the intervention was conducted from December 2024 to July 2025. Data analysis was performed using univariate and bivariate methods.
Results: The intervention demonstrated statistically significant improvements in all outcome variables within the intervention group. The proportion of respondents with good diabetes knowledge increased from 0.0% to 90.9% ($p < 0.001$) and normal blood glucose levels rose from 27.3% to 81.8% ($p < 0.001$). In contrast, the control group showed no statistically significant changes across all variables ($p > 0.05$).
Conclusion: In conclusion, mobile-based nutrition education is effective in improving diabetes knowledge, promoting adherence to recommended dietary patterns, and achieving better glycemic control. This approach represents a practical and scalable educational intervention for supporting self-management of type 2 diabetes mellitus, particularly in primary care settings.

Keywords: Diabetes Mellitus, Education, Mobile, Application, Diet, Blood, Sugar

INTRODUCTION

Diabetes Mellitus (DM) is a metabolic disease that occurs when the pancreas is unable to produce sufficient insulin or when the body cannot effectively use the insulin it produces.1 In patients with type 2 diabetes, hyperglycemia is often the initial sign of the body's cells failing to fully respond to insulin, a condition known as insulin resistance.2 Elevated blood glucose levels or hyperglycemia can lead to various health problems or metabolic disorders, such as cardiovascular dysfunction, vision impairment, and kidney damage.3

Globally, diabetes is one of the four major non-communicable diseases (NCDs) that continue to increase significantly in prevalence.4 According to the International Diabetes Federation (IDF), approximately 536.6 million people were living with diabetes in 2021, and this number is projected to rise to 783.2 million by 2045.5 Indonesia ranks fifth among the top ten countries with the highest number of diabetes cases, reporting 19.5 million cases in 2021.5 Data from the Indonesian Basic Health Research (Riskesdas) indicate that the prevalence of DM increased from 1.5% in 2013 to 2.0% in 2018. West Sumatra is among the top 20 provinces with the highest diabetes prevalence, recorded at 1.6%.6 In Padang City, the prevalence of DM is higher than the provincial rate, reaching 2.47%, in contrast to Mentawai Islands District at only 0.44%.7 Belimbing Public Health Center reports the highest prevalence of DM in Padang, accounting for 74.3% or 998 known cases.8

The management of DM includes four key pillars: education, medical nutrition therapy, physical activity, and pharmacological therapy.9 Among these, education plays a foundational role in the treatment and prevention of diabetes. Lack of knowledge about DM is strongly associated with the early onset of complications, contributing to a greater burden on individuals, families, and society.10 A study by Putri et al. (2013) showed a significant relationship between educational interventions and average blood glucose levels.11

Advancements in mobile technology have encouraged innovations in various fields, including health and education, through the concept of mobile-based e-learning10. A study by Relawati et al. (2018) found that education delivered via an Android-based mobile application improved the knowledge of patients and their families about chronic kidney disease.12 Similarly, a study by Khairunnisa (2021) demonstrated that nutrition education delivered through lectures and online games significantly improved nutrition knowledge and healthier food choices among overweight adolescents.13

This study addresses this gap by developing and evaluating a mobile-based nutrition education intervention. By leveraging multimedia learning principles, the intervention aims to provide flexible, interactive, and accessible education to improve diabetes knowledge and blood glucose control.

The objective of this study is to analyze the effect of mobile-based nutrition education on diabetes knowledge and blood glucose levels among T2DM patients in the working area of Belimbing Public Health Center, Padang, Indonesia.

MATERIAL AND METHODS

This study employed a quantitative approach with a quasi-experimental design, specifically a pre-test and post-test design with a control group. Data on diabetes

knowledge and blood glucose levels were collected both before the nutrition education (pre-test) and after the intervention (post-test). This allowed the researchers to observe changes in diabetes knowledge and blood glucose levels among patients with type 2 diabetes mellitus before and after receiving mobile application-based nutrition education. The sample size was calculated using the paired two-sample mean difference hypothesis test formula as follows.14

Each group consisted of 30 participants. To anticipate potential dropout, additional participants were recruited to ensure sufficient sample size. With an estimated dropout rate of 10%, the total sample size was 66 participants, equally divided between the intervention and control groups. Research Procedure.

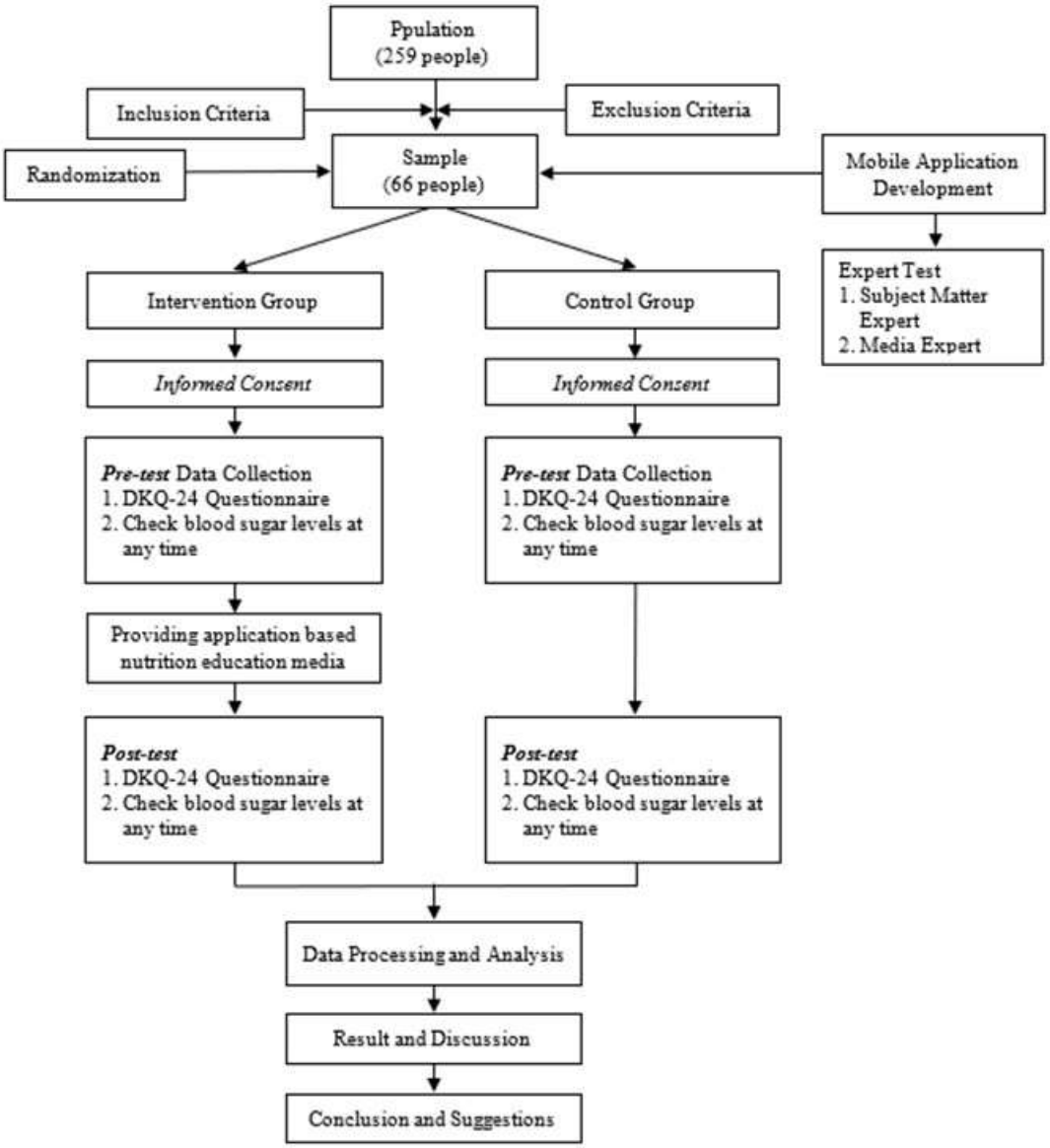

Figure 1. Research Procedure

RESULTS

Univariate Analysis

Table 1. Overview of Respondent Characteristics Based on Age and Gender

Respondent Characteristics	Group			
	Intervention		Control	
Age (years)				
Mean ± SD	55 ± 4,159		53 ± 5,973	
Range (*Min – Max*)	43 - 59		36 - 59	
	n	**%**	**n**	**%**
Gender				
Laki-laki	10	30,3	13	39,4
Perempuan	23	69,7	20	60,6
Total	**33**	**100**	**33**	**100**

Table 2. Respondent Description Based on Diabetes Knowledge Score

Variabel	Group			
	Intervention		Control	
	n	**%**	**n**	**%**
Diabetes Knowledge				
Pre-test				
Not enough	33	100	31	93,9
Good	0	0,0	2	6,1
Total	**33**	**100**	**33**	**100**
Post-test				
Not enough	3	9,1	31	93,9
Good	30	90,9	2	6,1
Total	**33**	**100**	**33**	**100**

Table 3. Description of Respondent Based on Blood Sugar Levels

Variabel	Group			
	Intervention		Control	
	n	**%**	**n**	**%**
Blood Sugar Levels				
Pre-test				
Normal	9	27,3	5	15,2
High	24	72,7	28	84,8
Total	**33**	**100**	**33**	**100**
Post-test				
Normal	27	81,8	8	24,2
High	6	18,2	25	75,8
Total	**33**	**100**	**33**	**100**

Bivariate Analysis

Table 4. Differences in Diabetes Knowledge Scores Before Intervention

Group	*Pre-Test*		Total	*Chi-Square*	*p-value*
	Not enough	Good			
Intervention	33	0	33	2,063	0,151
Control	31	2	33		

Table 5. Differences in Diabetes Knowledge Scores After Intervention

Kelompok	*Post-Test*		Total	*Chi-Square*	*p-value*
	Not enough	Good			
Intervention	3	30	33	47,559	**<0,001**
Control	31	2	33		

Table 6. Effect of Mobile Application-Based Nutrition Education on Diabetes Knowledge Scores

Group			*Post-test*		Total	*p-value*
			Not enough	Good		
Intervention	*Pre-test*	Not enough	3	30	33	**<0,001**
		Good	0	0	0	
		Total	3	30	33	
Control		Not enough	31	0	31	1,000
		Good	0	2	2	
		Total	31	2	33	

Table 7. Differences in Blood Sugar Levels Before Intervention

Group	*Pre-Test*		Total	*Chi-Square*	*p-value*
	Normal	High			
Intervention	9	24	33	1,451	0,228
Control	5	28	33		

Table 8. Differences in Blood Sugar Levels Before Intervention

Group	*Post-Test*		Total	*Chi-Square*	*p-value*
	Normal	High			
Intervention	27	6	33	21,959	**<0,001**
Control	8	25	33		

Table 9. Effect of Mobile Application-Based Nutrition Education on Blood Sugar Levels

Group			*Post-test*		Total	*p-value*
			Normal	High		
Intervention	*Pre-test*	Normal	9	0	9	**<0,001**
		High	18	6	24	
		Total	27	6	33	
Control		Normal	2	3	5	0,508
		High	6	22	28	
		Total	8	25	33	

DISCUSSION

In this study, it was found that the average age of respondents in the intervention group was 55 years, while in the control group it was 53 years. Age affects the risk of developing diabetes mellitus due to physiological changes in the body and an increased incidence of glucose intolerance. A study by Tan et al. (2023) stated that the age

range of 55–65 years is associated with a higher risk of developing diabetes mellitus due to decreased cellular sensitivity and the loss of beta-cell function in the pancreas to produce insulin, resulting in less effective blood glucose regulation.15 Imelda (2019) explained that respondents over the age of 45 are classified as early elderly and begin to experience decreased organ function, including that of the pancreas.16

The majority of respondents in both the intervention group (69.7%) and the control group (60.6%) were female. Women tend to have a greater increase in body mass compared to men. A study by Saldeva et al. (2022) showed that out of 101 respondents with diabetes mellitus, 54 people (53.5%) were women.17 This indicates that fat accumulation in women is caused by postmenopausal conditions and menstrual syndromes. These factors contribute to impaired glucose transport into cells. Nadrati et al. (2019) clarified that women have the hormone estrogen, which plays a role in increasing High-Density Lipoprotein (HDL) levels.18 With age, estrogen production decreases, which can trigger the onset of diabetes mellitus in women.

In the intervention group, all respondents (100%) had low diabetes knowledge scores during the pre-test, and the majority (90.9%) experienced an increase to good knowledge scores in the post-test. In contrast, the control group showed that most respondents (93.9%) had low diabetes knowledge scores during both pre-test and post-test. Knowledge about diabetes plays an important role in diabetes mellitus management. Anggraeni et al. (2023) explained that in diabetes management, low levels of knowledge affect lifestyle changes and the overall health status of respondents.19

Kaluku (2021) stated that knowledge or cognition is a very important domain in forming individual actions, as behavior based on knowledge is more meaningful.20 Diabetes knowledge for people with diabetes mellitus serves as a tool for diabetes management; poor eating patterns trigger obesity, which in turn affects blood glucose levels.

The results of this study regarding the effect of mobile application-based nutrition education on respondents' diabetes knowledge showed that there was no significant difference in diabetes knowledge scores between the intervention and control groups before the intervention (p-value = 0.151). This indicates that both groups had relatively equal initial knowledge levels, allowing for an objective evaluation of the intervention without baseline bias. After receiving the mobile application-based nutrition education intervention, a significant difference was found between the intervention and control groups (p-value < 0.001). In the intervention group, there was an increase in the number of respondents with good diabetes knowledge scores after the intervention, while the control group showed no significant change.

The McNemar test in the intervention group supports these findings, showing a significant change in diabetes knowledge scores before and after the intervention (p-value < 0.001). This indicates that mobile application-based nutrition education can significantly improve respondents' understanding of type II diabetes mellitus. Meanwhile, in the control group, no significant changes were observed (p-value = 1.000), confirming that without intervention, respondents' understanding did not improve.

This study aligns with Astiza et al. (2023), which showed that education can improve knowledge in diabetes mellitus

management, with a 95.41% increase in respondents' knowledge.21 Similarly, Fitriyani et al. (2022) found that web-based education significantly influenced knowledge before and after the intervention ($p < 0.001$).22

The significant increase in diabetes knowledge in the intervention group was due to the installation of the diabetes mobile application, which made it easier for respondents to access and review the materials. Education is one of the key pillars in diabetes mellitus management to optimize treatment. When conducted effectively, education can enhance patients' knowledge and management of their condition. A study by Denecke et al. (2019) stated that educational programs can improve a person's cognition, emotion, and motivation, thereby contributing more positively to implementing a diabetes diet.23 Knowledge about diabetes mellitus is a tool that helps individuals manage their disease more effectively throughout their lives, enabling them to understand the disease and how to act in its management.

Overall, these findings suggest that the intervention in the form of mobile application-based nutrition education was effective in improving diabetes knowledge among type II diabetes mellitus patients in the working area of the Belimbing Health Center. According to the researcher's analysis, diabetes knowledge is one of the key risk factors that can enhance the management of type II diabetes mellitus. The respondents' knowledge of diabetes significantly influences their attitudes, health behaviors, beliefs, and trust, which can be seen in their health-seeking behavior at health facilities. Thus, better knowledge of diabetes mellitus can help respondents manage the disease throughout their lives and understand the necessity of behavior change and what actions are needed.

A small portion (27.3%) of respondents in the intervention group had normal (controlled) random blood glucose levels at pre-test, and this increased to 81.8% at post-test. Meanwhile, in the control group, only a small portion had normal blood glucose levels at both pre-test (15.2%) and post-test (24.2%). Padliah et al. (2019) explained that uncontrolled blood glucose levels are caused by improper dietary patterns due to a lack of knowledge and understanding of proper nutrition.24 Juhartini (2018) found that respondents who frequently received nutrition counseling experienced changes in attitudes and behaviors toward dietary management, which affected blood glucose levels.25

The results regarding the effect of mobile application-based nutrition education on respondents' random blood glucose levels showed that there was no significant difference between the intervention and control groups before the intervention (p-value = 1.451). This indicates that the initial conditions of both groups had relatively similar blood glucose levels, allowing for an objective evaluation of the intervention without initial bias. After the intervention, a significant difference was found between the intervention and control groups (p-value < 0.001). In the intervention group, there was an increase in the number of respondents with normal random blood glucose levels, while the control group showed no significant change.

The McNemar test in the intervention group further supports this finding, showing a significant change in random blood glucose levels before and after the intervention (p-value < 0.001). This indicates that mobile application-based nutrition education effectively helps control random blood

glucose levels in individuals with type II diabetes mellitus. In contrast, the control group showed no significant change (p-value = 0.508). This finding aligns with Jati et al. (2024), who reported significant differences in blood glucose levels before and after educational interventions in type II diabetes mellitus patients (p-value = 0.001; $p < 0.05$).26 Rahayu et al. (2018) also found that an Android-based reminder application significantly influenced changes in blood glucose levels.27

Health education can improve individual behavior, such as regularly checking blood glucose levels and motivating individuals to engage in self-care to control their blood sugar. A study conducted in South Korea stated that health education through continuous glucose monitoring systems affects blood glucose monitoring among diabetic patients, especially the elderly, thereby motivating them to improve their quality of life through consistent glucose monitoring.

Blood glucose control is a critical factor and has been proven to reduce blood glucose levels in both type 1 and type 2 diabetes patients. Uncontrolled blood glucose levels in diabetes mellitus patients can lead to various acute and chronic complications. Controlled blood glucose in diabetes mellitus patients is achieved through adherence and discipline in following dietary, physical activity, and treatment regimens. This adherence and discipline can be achieved through knowledge and motivation gained from education.

According to the researcher's analysis, the intervention in the form of mobile application-based nutrition education was effective in controlling blood glucose levels among type II diabetes mellitus patients in the working area of the Belimbing Health Center. Nutrition education is a standard part of diabetes care that provides motivation and aims to improve respondents' ability to control blood glucose levels and prevent complications.

CONCLUSION

The mobile application-based nutrition education was successfully developed and proven effective as an intervention medium for individuals with type II diabetes mellitus in the working area of the Belimbing Public Health Center. This intervention significantly improved diabetes knowledge, dietary adherence (including portion size, food types, and meal schedule), and blood glucose control compared to the control group. The majority of respondents were, on average, 55 years old and predominantly female. These findings indicate that digital education through mobile applications has the potential to serve as an innovative alternative in supporting independent and sustainable self-management for individuals with type II diabetes.

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REFERENCES

1. Viandarisa N, Priyono D. Penggunaan Mobile Health Berbasis Smartphone untuk Meningkatkan Self Management

pada Pasien Diabetes Melitus Tipe 2: Literature Review . ProNers. 2022;7:1-18.

2. International Diabetes Federation. IDF Diabetes Atlas Ninth Edition 2019. 9th Edn. International Diabetes Federation.; 2019. Accessed November 22, 2024. https://diabetesatlas.org/atlas/ninth-edition/
3. Ramadhani NF, Siregar KN, Adrian V, Sari IR, Hikmahrachim HG. Hubungan Aktivitas Fisik dengan Diabetes Melitus pada Wanita Usia 20-25 di DKI Jakarta (Analisis Data Posbindu PTM 2019). Jurnal Biostatistik, Kependudukan, dan Informatika Kesehatan. 2022;2(2). doi:10.51181/bikfokes.v2i2.5820
4. Wardoyo NB, Kusumo MP. Education Needs Analysis Through Smart-Phone Applications in Changing Knowledge, Attitude, and Behavior among Patients with Diabetes Mellitus. Jurnal Aisyah : Jurnal Ilmu Kesehatan. 2023;8(1). doi:10.30604/jika.v8i1.1512
5. Sun H, Saeedi P, Karuranga S, et al. IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. Diabetes Res Clin Pract. 2022;183:109119. doi:10.1016/j.diabres.2021.109119
6. Badan Penelitian dan Pengembangan Kesehatan Kementrian Kesehatan Republik Indonesia. Laporan Riskesdas 2018 Nasional. Published online 2018. Accessed November 22, 2024. https://repository.badankebijakan.kemkes.go.id/id/eprint/3514/
7. Badan Penelitian dan Pengembangan Kesehatan Kementrian Kesehatan Republik Indonesia. Laporan Riskesdas Sumatera Barat 2018. Published online 2018. Accessed November 22, 2024. https://repository.badankebijakan.kemkes.go.id/id/eprint/3906/1/LAPORAN%20RISKESDAS%20SUMATRA%20BARAT%202018.pdf
8. Dinas Kesehatan. Profil Kesehatan Tahun 2023 (Edisi 2024).; 2024. Accessed November 1, 2024. https://dinkes.padang.go.id/uploads/audios/dinkes_66ceae73612a7.pdf
9. Perkumpulan Endokrinologi Indonesia (PERKENI). Pedoman Pengelolaan Dan Pencegahan Diabetes Melitus Tipe 2 Dewasa Di Indonesia.; 2019. Accessed October 25, 2023. https://pbperkeni.or.id/wp-content/uploads/2021/06/Pedoman-Pengelolaan-DM-Tipe-2-Dewasa-di-Indonesia-eBook-PDF.pdf
10. Laila MN, Yuniarti Y, Noviardhi A, Prasetya Muninggar DL, Jaelani M. Edukasi Gizi Berbasis Aplikasi Android Meningkatkan Pengetahuan Empat Pilar Penatalaksanaa Diabetes Melitus pada Peserta Prolanis. Jurnal Riset Gizi. 2020;8(1):18-24. doi:10.31983/jrg.v8i1.5516
11. Haida N, Putri K, Isfandiari MA. Hubungan Empat Pilar Pengendalian DM Tipe 2 dengan Rerata Kadar Gula Darah. Published online 2013:1-10.
12. Relawati A, Syafriati A, Al Hasbi H, Fitria PN. Edukasi pasien chronic kidney disease berbasis aplikasi android : buku saku pasien. JHeS (Journal of Health Studies). 2018;2(2):1-7. doi:10.31101/jhes.408
13. Risti KN. Pengaruh Edukasi Gizi melalui Ceramah disertai Game Online terhadap Pengetahuan Gizi dan Pemilihan Makanan Sehat pada Remaja Overweight. Published online 2021:1-14. Accessed November 22, 2024. https://digilib.uns.ac.id/dokumen/detail/84369/Pengaruh-Edukasi-Gizi-Melalui-Ceramah-Disertai-Game-Online-

Terhadap-Pengetahuan-Gizi-dan-Pemilihan-Makanan-Sehat-pada-Remaja-Overweight
14. Fauziyah RN. Sampling Dan Besar Sampel Bidang Kesehatan Masyarakat Dan Klinis. Cetakan pertama. (Mulyo GPE, ed.). Politeknik Kesehatan Kemenkes Bandung; 2019.
15. Rosilawati Tan, I Made Rantiasa, Sarwan Sarwan. Pengaruh Edukasi Media Booklet Terhadap Kepatuhan Diet Pada Penderita Diabetes Melitus Tipe 2 Di Wilayah Kerja Puskesmas Ranomuut. Vitamin : Jurnal ilmu Kesehatan Umum. 2024;1(4):55-64. doi:10.61132/vitamin.v1i4.102
16. Imelda S. Faktor-Faktor yang Mempengaruhi Terjadinya Diabetes Melitus di Puskesmas Harapan Raya Tahun 2018. Scientia Journal. 2019;8(1):28-39. doi:https://doi.org/10.5281/scj.v8i1.406
17. Saldeva ID, Rohmawati DL, Sa'adah HD. Hubungan Tingkat Pengetahuan dan Kepatuhan Pengobatan Terhadap Kejadian Peningkatan Kadar Gula Darah pada Pasien Diabetes Melitus di Wilayah Kecamatan Ngawi. e-Journal Cakra Medika. 2022;9(1):31. doi:10.55313/ojs.v9i1.88
18. Nadrati B, Hajri Z, Suharti S. Gambaran nilai Ankle Brachial Index (ABI) pada penyandang DM Tipe 2 di Puskesmas Gunungsari Lombok Barat . Holistik Jurnal Kesehatan. 2019;13(2):128-135. doi:10.33024/hjk.v13i2.1392
19. Anggraeni DE, Darmayanti R, Saputra A, Khasanah U, Hardiyanti A. Hubungan pengetahuan dengan kepatuhan diet pada pasien Diabetes Mellitus Tipe II di RSUD Kota Bandung . Jurnal Keperawatan BSI. 2023;11(2). https://ejurnal.ars.ac.id/index.php/keperawatan/index
20. Kaluku K. Pengaruh Edukasi Gizi Terhadap Pengetahuan dan Sikap Pasien Diabetes Mellitus Tipe II. Global Health Science (GHS). 2021;5(3):121. doi:10.33846/ghs5305
21. Devina Nur Astiza, Cahyono J, Wahyuningrum DR. The Effect of Nutrition Education Using Leaflet Media on Knowledge of Meal Planning in Type II Diabetes Mellitus Outpatients at the Pasundan Health Center in Samarinda. Formosa Journal of Science and Technology. 2023;2(7):1901-1912. doi:10.55927/fjst.v2i7.5262
22. Fitriyani W, Kurniasari R. Pengaruh Media Edukasi terhadap Peningkatan Pengetahuan Pencegahan Diabetes Mellitus pada Remaja. Jurnal Untuk Masyarakat Sehat (JUKMAS) e-ISSN. 2022;6(2):2715-8748. http://ejournal.urindo.ac.id/index.php/jukmas
23. Denecke K, Jolo P, Sevinc B, Nussli S. Creating Individualized Education Material for Diabetes Patients Using the eDiabetes Platform. Stud Health Technol Inform. 2019;(260):1-8. Accessed July 3, 2025. https://pubmed.ncbi.nlm.nih.gov/31118312/
24. Padliah R, S KE. Hubungan tingkat pengetahuan nutrisi dengan kadar gula darah nuchter post Prandial pada pasien Diabetes Mellitus tipe 2 di Poliklinik Rumah Sakit Islam Sukapura Jakarta Tahun 2019. Afiat : Kesehatan dan Anak. 2019;5(02):59-70. doi:10.34005/afiat.v5i02.2563
25. Juhartini J. Hubungan antara frekuensi pemberian konsultasi gizi dengan kepatuhan diet dan kadar gula darah pada Diabetes Tipe 2 di Unit Pelayanan

Terpadu Diabetes Melitus Center Kota Ternate. Jurnal Riset Kesehatan. 2018;6(2):35-40. doi:10.31983/jrk.v6i2.2907

26. Jati SAY, Setyaji DY, Purnawijayanti HA. The Effect of Family Support in Nutrition Education on Dietary Adherence and Blood Glucose Levels of Type 2 Diabetes Mellitus Inpatients at Panti Rapih Hospital Yogyakarta. Journal of Global Nutrition (JGN). 2024;4(2):358-365.
27. Rahayu KB, Dian Saraswati L, Setyawan H. Faktor-faktor yang berhubungan dengan kadar gula darah pada penderita Diabetes Melitus Tipe 2 (Studi di Wilayah Kerja Puskesmas Kedung Mundu Kota Semarang. 2018;6(2):2356-3346. doi:https://doi.org/10.14710/jkm.v6i2.20782