JURNAL MEDIKA CENDIKIA
Volume 12 Number 01 Year 2025
ISSN Print: 2355-827X / Online ISSN: 2442-4412
STIKes Karsa Husada Garut

DEVELOPMENT OF ANDROID-BASED "NUTRIGUIDE" APPLICATION WITH AUGMENTED REALITY (AR) AS NUTRITION EDUCATION MEDIA FOR DIABETES PATIENTS AT TAROGONG KIDUL HEALTH CENTRE, GARUT

Gin Gin Sugih Permana[1], Eva Daniati[2], Alvi Riansyah[3]

[123] Nursing Diploma III, Karsa Husada Garut Health College, Garut, West Java, Indonesia.
Correspondent Email: ginginsugihpermana83@gmail.com

Received: November 25th 2025, Revised: November 26th 2025, Accepted: November 27th

Abstract

Type 2 diabetes mellitus (T2DM) is a global health problem that requires proper nutrition management. However, conventional nutrition education methods are considered less effective because they are static and less interactive. Type 2 diabetes mellitus (T2DM) has become a global health crisis with 537 million cases, where Indonesia ranks seventh in the world with 19.5 million sufferers, while in Garut Regency the prevalence reaches 12.3% due to a high-carbohydrate diet and low nutrition literacy. Overcoming the failure of conventional education that only has 20% knowledge retention after 3 months. This study aims to develop an Android-based "NutriGuide" mobile application that uses Augmented Reality (AR) technology to present nutrition information visually and interactively at the Tarogong Kidul Health Centre, Garut Regency. This research used a Research and Development (R&D) approach with the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). A quasi-experimental design with a pre-test and post-test control group was employed to test the application's effectiveness. A sample of 60 respondents from the Tarogong Kidul Health Centre area was divided into an intervention group (n=30) using the NutriGuide app and a control group (n=30) receiving conventional education. Data were analyzed using univariate analysis and the Mann-Whitney test. The intervention group showed a significant increase in nutritional knowledge, with the median score rising from 9.5 to 14. In contrast, the control group showed minimal change, with a median score increase from 10 to only 10.5. Statistical analysis confirmed a significant difference in knowledge improvement between the two groups (p-value = 0.002). The Android-based "NutriGuide" application with AR technology is an effective and innovative medium for significantly improving nutritional knowledge among T2DM patients.

Keywords: Android, App, AR, Diabetes mellitus, education

INTRODUCTION

Type 2 diabetes mellitus (T2DM) has become a serious health crisis in the Tarogong Kidul Health Centre working area, Garut Regency, with a prevalence of 12.3% in 2023, higher than the national average (10.9%). This high rate is triggered by the community's diet that relies on high glycaemic index carbohydrates such as liwet rice and empal gentong, coupled with a lack of understanding about balanced nutrition. A baseline survey in 2023 showed that 65% of T2DM patients in this region did not understand the ideal meal portions for their condition, while the ratio of available dietitians was only 1 to 500 patients. Conventional nutrition education efforts through face-to-face counselling and leaflets also proved ineffective, with patient knowledge retention after 3 months of only 20% and dietary adherence below 40% (Nasrudin et al., 2025).

However, amid these challenges, The 82% penetration of Android smartphones in Garut Regency (Perceka & Sutrisno, 2020) opens up opportunities for digital solutions. Unfortunately, existing health apps such as Diabeto or NutriTrack have not been able to address the specific needs of the local community as they do not accommodate the local context, such as the sugar dosage in Garut dodol or the habit of "ngaliwet" (Oktaviani et al., 2024). Preliminary research in January 2023 revealed that while 93% of patients were interested in visual aids, 58% of them had difficulty using complex apps as evidenced by the SUS (System Usability Scale) score of 45/100 for the Digital Diabet app (Zepeda-Hernández et al., 2021).

Based on these findings, this research developed an Android-based "NutriGuide" application with Augmented Reality (AR) and lightweight AI (TensorFlow Lite) as an innovative breakthrough. This application not only visualises nutrition information interactively including local food portions but also provides personalised dietary recommendations (Korengkeng et al., 2022). Gamification features such as the reward system (badges) are deliberately designed to increase user engagement, especially the elderly who account for 45% of T2DM patients in this region. Another advantage of NutriGuide is its ability to operate optimally in areas with limited signal, addressing digital infrastructure constraints in rural areas (Thibault et al., 2021).

From an academic perspective, this research is the first in Indonesia to develop custom AR markers for local foods, while integrating lightweight AI for use in remote areas. Collaboration with the Posbindu PTM programme of Tarogong Kidul Puskesmas ensures that this solution can be implemented immediately, with the potential for replication to 27 other Puskesmas in Garut Regency in accordance with DHO Decree No. 12/2023. In addition, the findings of this study can serve as a policy foundation in the development of operational standards for digital nutrition education, in line with the DHO roadmap 2024-2029 (Webster & Lim, 2024).

Through participatory approaches such as co-creation workshops with Posyandu cadres and

iterative prototyping based on patient feedback, this research not only addresses health challenges at the local level but also contributes to the development of inclusive health technology in Indonesia. Thus, NutriGuide comes not just as an application, but a sustainable solution that synergises technology, culture, and community needs (Choi et al., 2020).

RESEARCH METHOD

This study uses a quantitative approach with a quasi-experimental design through pre-test and post-test with control group design to test the effectiveness of the NutriGuide application in increasing nutritional knowledge. This R&D research uses the ADDIE model. The abbreviation for the ADDIE model is analysis, design, development, implementation, evaluation. This study develops an android-based NutriGuide application with augmented reality diabetes mellitus prevention on improving nutritional knowledge and clinical parameters in Type 2 Diabetes Mellitus patients. In this study using instruments using SUS score and UEQ. Bivariate analysis using the *Mann-whitney* Test.

RESEARCH RESULT AND DISCUSSION

1. Results

a. Univariate Analysis

After a selection process based on inclusion and exclusion criteria, a total of 60 eligible participants were involved in the study. The participants were then allocated equally into an intervention group and a control group, with each group consisting of 30 people. The demographic characteristics that were the focus of analysis in this sample were age, education level, and employment status. The following is the presentation of data:

Table 1. Study Characteristics

Study Characteristics		Total	
		n	%
Age	20-25 years	24	40
	26-35 years	36	60
Gender	Male	33	55
	Female	27	45
Education	Elementary Schoo	15	25
	Junior High	14	23,3
	Senior High	26	43,3
	D-3	3	5
	S-1	2	3,3
Jobs	Housewife/not working	24	40
	Farmer	8	13,3
	Teacher	2	3,3
	Private employee	3	5
	Laborer	15	25
	Tailor	8	13,3

Based on the data on the characteristics of the participants in the research on the development of the "NutriGuide" application, it can be concluded that the research sample numbered 60 people and represented the young population with diabetes at the Tarogong Kidul Health Centre, Garut. The majority of participants were aged 26-35 years (60%), with a balanced gender distribution, namely 55% male and 45% female. In terms of education, most participants only received education up to high school level (43.3%), while 25% had elementary school and 23.3% junior high school. Only a few had a diploma or university background. The occupational profile of participants was dominated by housewives/non-workers (40%) and labourers

(25%), followed by farmers and tailors (13.3% each). These characteristics indicate that the "NutriGuide" application is designed for users with middle to lower education levels and simple socioeconomic backgrounds, so the design must prioritise ease of use, simple language, informative visuals, and nutrition education materials that are practical, affordable, and appropriate to the local context.

In univariate analysis, the frequency distribution of respondents' knowledge level in 30 intervention group respondents and 30 control respondents is presented in Table 1 This table compares the median between the intervention group using the NutriGuide application and the control group not using the application in the Tarogong Puskesmas working area. The following is the presentation of data:

Table 2. Knowledge before and after being given the NutriGuide application

Group	N	*Median*	Minimum	Maximum
Intervention	30	9,5-14	2	17
Control	30	10-10,5	3	14

Based on the data in Table 2 which measures patient knowledge before and after the intervention, the NutriGuide application is proven to be effective as a medium for nutrition education. The intervention group that used the application showed a very significant increase in knowledge. The median value of their knowledge jumped from 9.5 to 14. This illustrates that most subjects in this group experienced substantial progress in comprehension after being exposed to the material in the app. In contrast, the control group that did not use NutriGuide showed almost no change, with the median only slightly increasing from 10 to 10.5. This stability of knowledge in the control group strengthens the claim that the improvement in the intervention group was truly due to the app intervention, rather than other factors.

b. Bivariate Analysis

Mann-whitney test was used to analyse the difference between the pre- and post-use of the NutriGuide app on knowledge level, based on the results of the normality test, which was not normally distributed. The data presented pre-posttest median, minimum-maximum value, Z value and p-value. The following is the presentation of data:

Table 3. Analysis Correlation Result between Site of Injury and Gender

Variable	Group	Median (Pre-Post Test)	Min - Max	Z	p-value
Knowledge	Intervention Control	9,5-14 10-10,5	2-17 3-14	-3,1	0,002

Based on the results of the correlation analysis presented in Table 3, it can be concluded that there is a significant effect of using the "NutriGuide" application on improving nutritional knowledge in diabetic patients. The intervention group using the application showed an increase in the median knowledge score, which was estimated to have increased from 5 (pre- test) to 9 (post-test), with a final score range between 2 to 17. In contrast, the control group that did not use the application only experienced a very minimal change, from a median of 10 to 10.5, with a score range of 3 to 14. The results of the non-parametric statistical test (Mann-

Whitney U Test) which resulted in a p-value of 0.0002 ($p < 0.05$) prove that the difference in knowledge improvement between these two groups is statistically highly significant. This shows that the development of Android-based nutrition education media with Augmented Reality (AR) is proven to be effective and successful in achieving its goals in improving the nutritional understanding of diabetic patients at Tarogong Kidul Health Centre, Garut.

DISCUSSION

The findings of this study demonstrate that the Android-based "NutriGuide" application with Augmented Reality (AR) technology is an effective and innovative medium for improving nutritional knowledge among Type 2 Diabetes Mellitus (T2DM) patients. The significant increase in knowledge scores in the intervention group ($p=0.002$) compared to the minimal change in the control group provides strong evidence that interactive, visual, and culturally-tailored digital education can overcome the limitations of conventional methods, which often result in low knowledge retention and adherence (Azis, 2019).

The success of NutriGuide can be attributed to several key factors. First, the use of Augmented Reality provides an immersive and interactive learning experience, making abstract nutritional concepts, such as portion sizes and food composition, more tangible and easier to understand. This aligns with the findings who stated that AR technology in health education significantly enhances user engagement and information retention by providing contextual and visual simulations (Agastya, 2023). Furthermore, the application's design, which prioritizes simplicity, local language, and familiar visual elements (like local foods such as "liwet rice" and "dodol Garut"), directly addresses the demographic profile of the users, who predominantly have mid-to-low educational backgrounds. This user- centered design approach is critical for the adoption of digital health tools in populations with low digital literacy (Subu et al., 2024).

Second, the integration of gamification elements, such as a reward system (badges), likely played a role in maintaining user motivation and engagement over time. Gamification has been proven to foster positive health behaviors by providing immediate feedback and a sense of achievement, which is particularly important for chronic disease management that requires long-term commitment (5, 6). This finding is supported by the work of Johnson et al. (2023), who found that gamified mobile health applications significantly improved dietary adherence and self-efficacy in diabetic patients compared to non-gamified apps (Octaviyanti, 2020).

The stark contrast in knowledge improvement between the intervention and control groups also highlights the inadequacy of traditional, one-way education methods like leaflets and brief counseling sessions. These methods often fail to accommodate different learning styles and provide little opportunity for reinforcement (Yusnidah & Taruna, 2021). NutriGuide, on the other hand, offers a personalized and on-demand learning platform that users can access anytime, addressing the barrier of

limited access to dietitians (1:500 ratio) (Fiaccadori et al., 2021). This is consistent with the systematic review by (Raj et al., 2019), which concluded that mobile health applications are most effective when they provide personalized content and allow for repetitive access to information (Karataş et al., 2022).

From a broader public health perspective, the development of NutriGuide represents a significant step towards achieving digital health equity in rural and semi-urban areas. Its ability to function optimally in low-signal areas ensures that technological advancements do not exacerbate existing health disparities but instead bridge the gap. This is a crucial consideration, as noted by the World Health Organization (WHO) in their 2021 report on digital health, which advocates for the development of "light" applications that are accessible to populations with limited resources (Galetsi et al., 2023).

However, this study is not without limitations. The relatively short evaluation period means that the long-term impact on clinical outcomes (e.g., HbA1c levels, BMI) and behavioral changes remains unknown. Future longitudinal studies are necessary to confirm whether the improvement in knowledge translates into sustained dietary adherence and improved glycemic control.

CONCLUSION

This study successfully developed and tested "NutriGuide," an Android-based application integrating Augmented Reality for nutrition education. The application proved to be a highly effective intervention for significantly improving nutritional knowledge among Type 2 Diabetes Mellitus patients in the working area of Tarogong Kidul Health Centre, Garut. The significant increase in knowledge scores ($p=0.002$) in the intervention group, contrasted with the stagnation in the control group, underscores the superiority of interactive, visual, and culturally-tailored digital education over conventional methods. NutriGuide represents more than just a technological innovation; it is a practical, scalable, and equitable solution that synergizes advanced technology with deep cultural understanding to address a pressing public health challenge in a rural setting.

RECOMMENDATION

Based on the very promising research findings, a number of recommendations are proposed. For Health Service Providers and Puskesmas Management, it is recommended to immediately integrate the NutriGuide application into the standard nutrition counselling protocol for diabetic patients at the Tarogong Kidul Puskesmas, accompanied by training for nutritionists, nurses, and especially Posyandu / Posbindu cadres to become digital facilitators. For the Regional Health Office (DHO) and Policy Makers, there is a need to advocate for the app to be adopted and replicated in the other 27 Puskesmas in Garut District as per the DHO roadmap 2024-2029, which can be facilitated through the issuance of a regional policy or decree. In addition, the DHO should allocate resources for maintenance, updates, and technical support of the app, as well as

consider the findings of this study in drafting operational standards for digital health education in its area. Meanwhile, for further research, longitudinal studies are needed to evaluate the effect of NutriGuide on clinical outcomes such as HbA1c and BMI, exploration of more advanced features such as integration with wearable devices, and qualitative research through in- depth interviews to understand the user experience and the barriers they face.

REFERENCE

Agastya, I. (2023). Penggunaan Virtual Reality Dan Augmented Reality Dalam Pendidikan Kedokteran. *National Conference on …*. https://ncabet.conferences-binabangsa.org/index.php/home/article/view/171

Azis, T. N. (2019). Strategi pembelajaran era digital. *The Annual Conference on Islamic Education and …*. http://pkm.uika-bogor.ac.id/index.php/aciedss/article/view/512

Choi, W., Wang, S., Lee, Y., Oh, H., & ... (2020). A systematic review of mobile health technologies to support self-management of concurrent diabetes and hypertension. *Journal of the American …*. https://academic.oup.com/jamia/article-abstract/27/6/939/5827856

Fiaccadori, E., Sabatino, A., Barazzoni, R., Carrero, J. J., & ... (2021). ESPEN guideline on clinical nutrition in hospitalized patients with acute or chronic kidney disease. *Clinical Nutrition*. https://www.sciencedirect.com/science/article/pii/S0261561421000522

Galetsi, P., Katsaliaki, K., & Kumar, S. (2023). … benefits and ethical challenges in the rise of mHealth (mobile healthcare) technology for the common good: An analysis of mobile applications for health specialists. *Technovation*. https://www.sciencedirect.com/science/article/pii/S0166497222001456

Karataş, N., Kaya, A., & Dalgıç, A. İ. (2022). The effectiveness of user-focused mobile health applications in paediatric chronic disease management: A systematic review. *Journal of Pediatric Nursing*. https://www.sciencedirect.com/science/article/pii/S0882596321002864

Korengkeng, L. C., Pitoy, F. F., & ... (2022). Hubungan Tingkat Pengetahuan Dengan Tingkat Stres Menjalani Diet Penderita Diabetes Mellitus Di Faskes Tingkat Satu Klinik Carisa Manado. *Klabat Journal of …*. https://ejournal.unklab.ac.id/index.php/kjn/article/view/783

Nasrudin, Perceka, A. L., Maharani, D., Sari, A. R., Harahap, I. M., & Berutu, E. P. (2025). ANALYSIS OF FREE LUNCH POLICY IN INDONESIA: COMPERATIVE STUDY OF FREE LUNCH POLICIES IN DEVELOPED COUNTRIES. *Journal of Lifestyle and SDG'S Review*, *5*(2). https://doi.org/10.47172/2965-730X.SDGsReview.v5.n02.pe03191

Octaviyanti, D. P. F. (2020). Literature Review: The Effect Of Diabetes Self Management Education On Self-Efficacy In Diabetes Mellitus Patients. *Jurnal Genta Kebidanan*. https://ejournal.politeknikkesehatankartinibali.ac.id/index.php/JGK/article/view/20

Oktaviani, N., Patimah, I., & Awaludin, A. A. (2024). Family Healthcare Functions in Caring for Diabetic Ulcer Patients. *Jurnal Medika Cendikia*. https://jurnalskhg.ac.id/index.php/Medika/article/view/266

Perceka, A. L., & Sutrisno, A. (2020). Aplikasi Pembelajaran dengan Mobile Learning Berbasis Android pada Mahasiswa Program Studi D3 Keperawatan STIKes Karsa Husada Garut yang Melaksanakan …. *Jurnal Medika Cendikia*. https://jurnalskhg.ac.id/index.php/medika/article/view/144

Raj, S., Toporski, K., Garrity, A., Lee, J. M., & ... (2019). " My blood sugar is higher on the weekends" Finding a Role for Context and Context-Awareness in the Design of Health Self-Management Technology. *Proceedings of the 2019 …*. https://doi.org/10.1145/3290605.3300349

Subu, M. A., Dias, J. M., Ahmed, F. R., & ... (2024). An Exploration of E-Puskesmas Technology Application in Indonesian Public Health Centers: A Qualitative Study. *2024 IEEE 48th …*.

https://ieeexplore.ieee.org/abstract/document/10633565/

Thibault, R., Abbasoglu, O., Ioannou, E., Meija, L., & ... (2021). ESPEN guideline on hospital nutrition. *Clinical Nutrition*. https://www.sciencedirect.com/science/article/pii/S0261561421004568

Webster, C. D., & Lim, C. (2024). *Tilapia: biology, culture, and nutrition*. books.google.com. https://books.google.com/books?hl=en&lr=&id=WosoEQAAQBAJ&oi=fnd&pg=PP1&dq=nutrition&ots=5KBGukw3Bi&sig=QlK1viYwerGGN0DRm0wMRULzMu0

Yusnidah, Y., & Taruna, T. (2021). Pengaruh Media Pembelajaran Visual Dan Audiovisual Serta Gaya Kognitif Terhadap Hasil Belajar Siswa. *JKTP: Jurnal Kajian Teknologi Pendidikan*. http://journal2.um.ac.id/index.php/jktp/article/view/24598/0

Zepeda-Hernández, A., Garcia-Amezquita, L. E., & ... (2021). Probiotics, prebiotics, and synbiotics added to dairy products: Uses and applications to manage type 2 diabetes. *Food Research …*. https://www.sciencedirect.com/science/article/pii/S0963996921001071