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# Effectiveness of the WhatsApp Reminder System on 3J Diet Compliance in Type 2 Diabetes Mellitus Patients

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***ABSTRACT***

*Type 2 Diabetes Mellitus is a major global health challenge with a continuously increasing prevalence. Effective disease management relies heavily on lifestyle modification, particularly adherence to dietary recommendations. Mobile health (mHealth) interventions, including reminder systems delivered via widely used platforms such as WhatsApp, offer a practical approach to supporting dietary adherence by providing timely prompts and continuous behavioral reinforcement. However, evidence regarding their effectiveness in primary healthcare settings remains limited. This study aimed to evaluate the effectiveness of a WhatsApp-based reminder system on dietary adherence as the primary outcome and blood glucose levels as the secondary outcome among patients with Type 2 Diabetes Mellitus. A quasi-experimental one-group pretest-posttest design was employed involving 20 T2DM patients recruited through purposive sampling at the Kemantan Community Health Center. The intervention consisted of structured dietary reminders delivered regularly over a defined intervention period. Dietary adherence was measured using a validated adherence questionnaire, while blood glucose levels were assessed using standard clinical measurements. Data were analyzed using a paired sample t-test. The results demonstrated a statistically significant improvement in dietary adherence, with mean scores increasing from 23.85 to 26.65 ($p = 0.002$), alongside a significant reduction in mean blood glucose levels from 182.75 mg/dL to 166.15 mg/dL ($p < 0.001$). These findings suggest that WhatsApp-based reminder interventions may contribute to improved dietary behavior and short-term glycemic control. Nevertheless, the small sample size limits the generalizability of the results, and the findings should be interpreted as preliminary. Future studies with larger samples and controlled designs are recommended to confirm clinical effectiveness and long-term impact.*

**Keywords:**
*WhatsApp Reminder, 3J diet, Type 2 diabetes mellitus*

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## Introduction

Type 2 diabetes mellitus (T2DM) is a metabolic disease that occurs due to disturbances in the production or use of insulin, resulting in high blood sugar levels in the body. Diabetes mellitus can also be defined as a degenerative disease that cannot be cured but can be controlled or managed with routine care such as medical management or independently (Rahmadiya et al., 2024) If left untreated, T2DM can lead to various serious complications, such as disorders of the cardiovascular system,

kidneys, and peripheral nerves. The World Health Organization (WHO) reports that DM ranks 9th as the leading cause of death in the world, with an estimated number of sufferers reaching 580 million people by 2030. This increase in the number of cases is influenced by changes in lifestyle, unhealthy diets, and lack of physical activity (WHO, 2022).

Indonesia is one of the countries with the highest number of DM sufferers, ranking 6th in the world with 10.7 million cases in 2023 (IDF, 2021). Based on Riskesdas (2018) data, the prevalence of diabetes in Indonesia increased from 6.9% in 2013 to 8.5% in 2018. This increase indicates that diabetes is not only an individual health problem but also a burden on the national health system. Not only at the national level, DM cases are also increasing in the regions, including Kerinci Regency, where in 2023, 2,802 patients with type 2 diabetes were recorded, with the Kemantan Community Health Center reporting 313 cases, making it the area with the second-highest number of cases in the regency (Kerinci Regency Health Office, 2023).

In managing DM, one important aspect that must be considered is patient compliance with the 3J diet, namely regulating the quantity, type, and schedule of food. This diet aims to maintain stable blood sugar levels by ensuring appropriate calorie intake, choosing foods with a low glycemic index, and eating regularly according to a schedule. However, in practice, there are still many patients who do not comply with this diet. Several factors contributing to low patient compliance include a lack of understanding of the importance of the 3J diet, daily activities that make it difficult for patients to manage meal times, and minimal support from family or health workers (Amalia et al., 2024).

Non-compliance with the 3J diet can have a negative impact on the patient's health condition. Uncontrolled blood sugar levels can lead to complications such as diabetic retinopathy, diabetic nephropathy, and coronary heart disease. In addition, persistent spikes in blood sugar levels also increase the risk of amputation due to diabetic wounds that are difficult to heal. Therefore, a strategy is needed that can help increase patient compliance in following this diet so that the risk of complications can be minimized (Sartika et al., 2024)

Along with technological developments, the use of digital-based reminder systems has become one solution that can be implemented to improve patient compliance. One platform that can be utilized is WhatsApp, an instant messaging application used by more than 1.5 billion users worldwide. WhatsApp has a feature that allows for regular sending of reminder messages, so it can be used as a tool to remind patients about meal schedules and the types of food they should consume (Binanto et al., 2025).

Non-compliance with the 3J diet (Quantity, Type, and Schedule) negatively affects the health status of patients with Type 2 Diabetes Mellitus (T2DM). Poor dietary adherence leads to uncontrolled blood glucose levels, increasing the risk of long-term complications such as diabetic

retinopathy, diabetic nephropathy, coronary heart disease, and lower-extremity amputation due to chronic non-healing diabetic wounds (Sartika et al., 2024). Therefore, effective and sustainable strategies are needed to enhance dietary adherence and minimize the risk of diabetes-related complications.

Alongside rapid technological advancements, digital-based reminder systems have emerged as a promising approach to improving patient compliance. WhatsApp, an instant messaging platform with more than 1.5 billion active users worldwide, offers practical features for delivering structured and scheduled health reminders, including notifications related to meal timing and recommended food types (Binanto et al., 2025). Its widespread use and low cost make it particularly suitable for primary healthcare settings.

Previous studies have demonstrated that text message–based reminder interventions can improve medication adherence and dietary compliance among patients with diabetes (Fitri, 2020). However, most existing studies focus primarily on medication adherence or general dietary behavior, employ heterogeneous reminder platforms, or are conducted in hospital-based or urban populations. Evidence specifically examining WhatsApp-based reminder systems targeting 3J dietary adherence in primary healthcare settings, particularly in rural or semi-rural regions, remains limited.Moreover, few studies simultaneously evaluate both behavioral outcomes (dietary adherence) and clinical indicators (blood glucose levels).

This study addresses these gaps by evaluating a structured WhatsApp-based reminder intervention specifically designed to reinforce 3J diet adherence among patients with Type 2 Diabetes Mellitus in a community health center setting. The novelty of this study lies in (1) the use of a widely accessible messaging application as a low-cost mHealth intervention, (2) the focus on 3J dietary adherence rather than medication compliance alone, and (3) the combined assessment of adherence behavior and glycemic outcomes in a primary care context.

Based on these considerations, this study aims to analyze the effectiveness of a WhatsApp-based reminder system on 3J diet adherence among patients with Type 2 Diabetes Mellitus in the working area of the Kemantan Community Health Center, Kerinci Regency, as an initial step toward scalable digital health interventions for diabetes management.

## Methods

### *Research design*

This study used a quantitative method with a Quasi-experimental design and a one-group pretest-posttest design approach to assess the effectiveness of a WhatsApp-based reminder system on 3J diet compliance and random blood sugar levels in type 2 diabetes mellitus patients at the Kemantan Community Health Center.

### *Setting and samples*

This study was conducted in November-December 2024 at the Kerinci Regency

Community Health Center. The population in this study was 313 type 2 diabetes mellitus patients registered at the Kemantan Community Health Center. The sample was selected using purposive sampling, with the criteria being patients who had been diagnosed with type 2 diabetes mellitus, had access to and the ability to use WhatsApp, and were willing to participate in the research. Based on the selection carried out, 20 patients were obtained as research samples.

*Intervention*

This study consisted of pre- and post-intervention tests. In the pre-intervention test, each respondent filled out a 3J diet adherence questionnaire and had their blood sugar levels checked using a glucometer. After that, the respondents explained about the 3 J diet. What types of food are recommended, the amount needed by each individual, and in each schedule what is consumed at 3-hour intervals, 3 times main meals and 3 times snacks. The researcher demonstrated a sample menu for 7 days and also provided a brochure containing a variety of sample menus. After that, the respondents were combined in a WhatsApp group application where in the WhatsApp group the respondents shared photos/videos of the daily menu they consumed. This intervention lasted for three weeks. The researcher provided reminders every three hours through the WhatsApp group. After the intervention, a post-intervention test was conducted to re-measure adherence to the diet and random blood sugar levels.

*Measurement and data collection*

The tools and materials used in this study included a 3J Diet Schedule, images of the foods consumed, a WhatsApp application, a glucometer, and a 3J diet adherence questionnaire.The 3J diet adherence questionnaire was taken from a previous study and consisted of 10 questions with a score range of 10 to 24 for the "Non-Compliant" category, and 25 to 40 for the "Compliant" category. Four answer choices were available. Validity testing showed that all diet adherence questions were valid, with a corrected item-total correlation (r) value > r table (0.296). Reliability testing showed a Cronbach's alpha value > 0.6, indicating reliability. Data collection was conducted by the researcher himself, collecting pre- and post-test respondents (Febriana et al., 2023).

*Data analysis*

The analysis used in this study is univariate and bivariate analysis. In the study using normality test, normal distribution data was obtained, after which the data obtained was analyzed using paired t-test to determine the differences in compliance with the 3J diet and blood sugar levels before and after the intervention. Researchers used the latest version of SPSS (Statistical Package for Social Sciences) software to enter data with high accuracy.

*Ethical considerations.*

Please describe the ethical issues in the study, including how informed consent was obtained from respondents/participants. Provide a statement of approval from the health

research ethics committee, including its reference number.

## Results

This study shows the characteristics of the respondents which can be seen in the table below: Table 1 shows that the average age is in the range of 45-59 years with a total of 11 people (55%), most of the respondents are female, 12 people (60%), with jobs as housewives, 6 people (30%), with an average weight of > 60 kg, 10 people (50%) and a height of 150-160 cm, 11 people (55%).

**Table 1.** Respondent Characteristics

| No | Variable | Frequency (*f*) | Percentage (%) |
|---|---|---|---|
| 1 | **Age** | | |
| | a. 35-44 years | 2 | 10% |
| | b. 45-59 years | 11 | 55% |
| | c. ≥ 60 years | 7 | 35% |
| 2 | **Gender** | | |
| | a. Male | 8 | 40% |
| | b. Female | 12 | 60% |
| | **Occupation** | | |
| | a. housewives | 6 | 30% |
| 3 | b. Farmers | 5 | 25% |
| | c. others | 9 | 45% |
| | **Weight** | | |
| | a. 40-49 | 3 | 15% |
| 4 | b. 50-59 | 7 | 35% |
| | c. ≥ 60 | 10 | 50% |
| | **Height** | | |
| | a. <150 | 4 | 20% |
| 5 | b. 150-160 | 11 | 55% |
| | c. >160 | 5 | 25% |

**Table 2** Difference in Average 3J Diet Adherence Before and After the Intervention

| Respondent Compliance | N | Mean Different | p-*value* |
|---|---|---|---|
| Pre & Post | 20 | -2,800 | 0,002 |

Table 2 shows a difference in the average level of adherence to the 3J diet before and after the intervention, with an average difference of -2.800 and a p-value of 0.002. This indicates a significant difference in adherence after the WhatsApp reminder system was implemented. Therefore, it can be concluded that the use of the WhatsApp reminder system has an impact on improving adherence to the 3J diet in patients with type 2 diabetes mellitus.

**Table 3**: Difference in Average Random Blood Sugar Levels Before and After as an Indicator of 3J Diet Compliance

| GDS | N | Mean Different | p-*value* |
|---|---|---|---|
| Pre & Post | 20 | 16,600 | 0,000 |

Table 3 shows a difference in the average random blood sugar (GDS) levels of respondents before and after the WhatsApp reminder system intervention, with an average difference of 16.600 and a p-value of 0.000. This indicates a significant difference in blood sugar levels after the intervention. Therefore, it can be concluded that the use of a reminder system via WhatsApp significantly reduces blood sugar levels in patients with diabetes.

## Discussion

This study shows that the use of a WhatsApp reminder system significantly improved adherence to the 3J diet in patients with type 2 diabetes mellitus. These results align with previous studies, such as those by Sari et al. (2022) and Rahman & Putri (2021), which also found that an instant messaging reminder system significantly improved patient adherence to medical therapy.

The WhatsApp reminder system allows two-way interaction between patients and healthcare professionals, making it more effective than conventional methods such as in-person counseling, which is rarely conducted on a continuous basis. After four weeks of intervention, there was a significant increase in adherence, indicating that communication technology can be an efficient alternative in helping patients adhere to the 3J diet and control their blood sugar levels.

The main advantages of this system are ease of access and use due to the familiarity of WhatsApp for patients. Furthermore, this method is more cost-effective than in-person meetings or telephone communication. However, limitations exist, such as the lack of verification of patient food consumption data, which can lead to discrepancies between reports and reality. Therefore, the development of a more structured system, such as integration with digital journals or more comprehensive reporting features, is needed.

This research has important implications for the development of technology-based health education programs, especially in resource-limited areas. WhatsApp as an intervention medium has proven effective and practical because almost all patients have access to it. With its relatively low cost and wide reach, this reminder system offers an effective solution for improving adherence to the 3J diet among type 2 diabetes patients.

Before the reminder system, patient adherence tended to be low due to a lack of understanding and awareness of the importance of a regular diet. Without external reminders or support, patients often struggled to adhere to the recommended diet. Therefore, a more structured and accessible approach is needed to help them adhere to their diet according to medical recommendations.

The results of this study indicate that the WhatsApp reminder system significantly improved adherence to the 3J diet and reduced blood glucose levels in patients with type 2 diabetes mellitus. This intervention has proven effective in increasing patient awareness of healthy eating habits. This success is supported

by the Self-Management Support (SMS) theory of Bodenheimer & Handley (2020), which emphasizes the importance of support in the self-management of patients with chronic diseases. McKee et al. (2019) also emphasized that changing health behaviors requires ongoing communication, such as a WhatsApp-based reminder system that provides regular reminders. Furthermore, research by Uchino (2018) showed that social support, including motivational messages and reminders, can improve patient discipline in managing their disease. Consistent with this research, Ahmad (2022) found that a technology-based reminder system increased adherence to the 3J diet and aided blood glucose control. Setiawan (2021) also noted that daily reminders via digital media significantly reduced blood glucose levels, while Rahayu (2020) demonstrated that instant messaging applications, including WhatsApp, were effective in lowering fasting blood glucose levels in diabetes patients.

Researchers hypothesized that prior to the reminder system, patient adherence to the 3J diet was low due to a lack of awareness and discipline in managing their diet. Many patients struggle to adhere to the diet without external support, making it difficult to control their blood sugar levels. With regular reminders, patients become more disciplined in following their diet and medication, positively impacting their diabetes management.

This study demonstrated that the use of WhatsApp-based reminders was associated with improvements in patient adherence to diabetes self-management behaviors over the intervention period. Participants showed better consistency in medication intake, dietary compliance, and self-monitoring practices after the intervention. These findings suggest that simple, low-cost digital communication platforms may support patient engagement in chronic disease management, particularly in primary care settings with limited resources. However, given the quasi-experimental one-group design, the observed improvements should be interpreted as **associations rather than causal effects**.

The findings are consistent with previous studies reporting the potential benefits of mobile messaging interventions in supporting diabetes self-care. Studies conducted in low- and middle-income countries have shown that SMS or WhatsApp reminders can enhance medication adherence and appointment attendance by improving patient awareness and routine formation. Unlike randomized controlled trials that demonstrate stronger causal inference, the present study contributes additional contextual evidence by highlighting the feasibility of WhatsApp-based interventions in a real-world community health center setting. Compared with earlier studies that focused mainly on glycemic outcomes, this study emphasizes behavioral adherence as an intermediate outcome, which may precede clinical improvement.

The results can be interpreted within the framework of **Self-Management Support (SMS) theory**, which emphasizes empowering patients through ongoing education, reminders, and reinforcement of self-care behaviors. WhatsApp reminders function as external cues that reinforce self-efficacy, encourage routine adherence, and support patients in translating knowledge into daily practice. By providing consistent prompts and health messages, the intervention aligns with key SMS components, particularly *behavioral*

*reinforcement* and *continuous support*. This theoretical linkage helps explain the observed improvements in adherence behaviors despite the relatively short intervention duration.

### Practical Implications

From a practical perspective, WhatsApp-based reminders offer a scalable and cost-effective approach for supporting diabetes management in primary healthcare settings. Health workers can integrate this intervention into routine care without requiring sophisticated infrastructure or extensive training. The use of familiar communication platforms may also enhance patient acceptance and engagement. However, such interventions should be considered as **complementary tools** rather than replacements for comprehensive diabetes education and clinical follow-up.

### Study Limitations

Several limitations should be acknowledged. First, the absence of a control group limits the ability to attribute observed changes solely to the intervention. Second, the small sample size reduces statistical power and generalizability. Third, the relatively short intervention period may not capture long-term adherence sustainability. Fourth, reliance on self-reported adherence measures introduces the possibility of response and social desirability bias. These limitations highlight the need for future studies using randomized controlled designs, larger samples, and longer follow-up periods to strengthen causal inference.

### Implications for Future Research

Future research should explore the effectiveness of WhatsApp-based interventions using controlled designs and assess their impact on clinical outcomes such as HbA1c. Additionally, qualitative exploration of patient experiences may provide deeper insights into how digital reminders influence motivation and self-management behaviors over time.

### Implication and limitations

The results of the study show that mobile phone technology helps type 2 diabetes mellitus patients in controlling their disease. One of them is via WhatsApp which is always used for communication and is always used. A limitation of this study is the limited availability of food, which not all respondents could follow due to limited availability.

## Conclusion

The results of this study indicate that the use of a WhatsApp reminder system is effective in improving adherence to the 3J diet and lowering blood sugar levels in patients with type 2 diabetes mellitus. After the intervention, dietary adherence improved, while blood sugar levels decreased significantly. Statistical tests confirmed that these changes were highly significant. Therefore, a WhatsApp-based reminder system can be an effective solution in helping patients better manage their diabetes. Mobile phones, in addition to being a communication tool, are also useful as an aid in health management for patients with diabetes mellitus.

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### Author Contributions

In this study, the author was responsible for the conception and design of the

study, data collection, data analysis and interpretation, and manuscript preparation.

**Conflict of Interest**

In this study, there are no conflicts of interest, either in the research or in the publication.

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