

Effectiveness of video-based home exercise program on physical activity and glycemic control in patients with type 2 diabetes mellitus

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ABSTRACT

Introduction: Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder characterized by persistent hyperglycemia and is frequently associated with low levels of physical activity. Limited access to structured exercise programs remains a major barrier to optimal diabetes management, particularly in primary healthcare settings. Video-based home exercise programs offer a practical and accessible approach to promoting physical activity and improving glycemic control. This study aimed to evaluate the effectiveness of a video-based home exercise program on physical activity levels and fasting blood glucose among patients with T2DM.

Research Methodology: A quantitative quasi-experimental study with a one-group pretest–posttest design was conducted among 30 patients with T2DM at a primary healthcare facility. Physical activity was assessed using the International Physical Activity Questionnaire (IPAQ), while fasting blood glucose levels were measured before and after the intervention. Data were analyzed using the Wilcoxon Signed Ranks Test and paired t-test, with statistical significance set at $p < 0.05$.

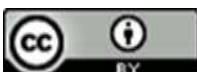
Results: The intervention resulted in a significant increase in physical activity levels ($Z = -4.704$; $p = 0.000$). In addition, mean fasting blood glucose levels decreased significantly from 172.60 ± 29.41 mg/dL to 151.87 ± 27.83 mg/dL ($t = 2.665$; $p = 0.012$).

Conclusion: The video-based home exercise program was effective in improving physical activity and glycemic control among patients with T2DM. This intervention is a feasible, low-cost strategy to support diabetes self-management in primary healthcare settings.

Keywords: exercise; glycemic control; home-based intervention; physical activity; type 2 diabetes mellitus.



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INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) represents one of the most pressing global public health challenges of the twenty-first century (Al Ozairi *et al.*, 2023). Characterized by chronic hyperglycemia resulting from insulin resistance and progressive pancreatic β -cell dysfunction, T2DM is associated with substantial morbidity, mortality, and healthcare costs (Anggraini, Oktora and Hasni, 2025). The global prevalence of diabetes continues to increase rapidly, particularly in low- and middle-income countries, where lifestyle transitions, population aging, and urbanization contribute to rising disease incidence (Balyan, Sri Andala and Yudi Akbar, 2023). In Indonesia, T2DM has emerged as a major non-communicable disease burden, with increasing case detection at primary healthcare facilities. This trend underscores the urgent need for effective, feasible, and scalable interventions that support glycemic control and long-term self-management among patients with T2DM (Bärg *et al.*, 2025).

Optimal glycemic control is essential to prevent or delay diabetes-related complications, including cardiovascular disease, nephropathy, neuropathy, and retinopathy. In addition to pharmacological therapy, lifestyle modification, particularly regular physical activity, plays a critical role in diabetes management (Cao *et al.*, 2024). Physical activity enhances insulin sensitivity, promotes glucose uptake by skeletal muscles, and improves overall metabolic regulation. Clinical guidelines consistently recommend structured and routine exercise as a core component of T2DM management. However, despite strong evidence and clear recommendations, physical inactivity remains highly prevalent among individuals with T2DM (Claggett *et al.*, 2024). Many patients experience difficulties in adhering to exercise prescriptions due to barriers such as limited access to exercise facilities, lack of professional supervision, time constraints, physical limitations, and low motivation. As a result, the gap between recommended physical activity levels and actual patient behavior remains substantial (Cui *et al.*, 2025).

Home-based exercise programs have been proposed as a practical alternative to conventional facility-based exercise interventions (Dewi Insani Muflihah and Alfiana Ainun Nisa, 2024). By allowing individuals to engage in physical activity within their own homes, such programs offer greater flexibility, reduce transportation and cost barriers, and may be more easily integrated into daily routines (Febriyana and Hisni, 2024). Recent advances in digital health technologies have further enhanced the potential of home-based interventions by enabling video-based educational and exercise media (Glavas *et al.*, 2024). Video-based programs can provide standardized exercise instructions, visual demonstrations of correct movement techniques, and motivational cues that support adherence and self-efficacy. For patients with chronic conditions such as T2DM, audiovisual interventions may facilitate better understanding of exercise procedures and encourage sustained behavioral change (Kim *et al.*, 2024).

Nevertheless, important research gaps remain in the existing literature. First, many studies examining the effects of physical activity on glycemic control rely on supervised, center-based exercise programs that are not always feasible in real-world primary healthcare settings, particularly in resource-limited or rural areas. Second, although digital and video-based interventions are increasingly utilized, evidence regarding their effectiveness as stand-alone home exercise programs for improving both physical activity levels and glycemic outcomes in patients with T2DM remains limited. Third, few studies have evaluated such interventions using pragmatic quasi-experimental designs that reflect routine clinical practice rather than highly controlled research environments. These limitations restrict the generalizability of existing

findings and highlight the need for context-specific evidence to inform diabetes management strategies at the primary care level.

The present study addresses these gaps by evaluating the effectiveness of a video-based home exercise program on physical activity and glycemic control among patients with T2DM. The novelty of this research lies in its integration of structured exercise guidance delivered through video media as a self-directed intervention that can be implemented within a primary healthcare context. Unlike traditional exercise programs that require direct supervision or specialized facilities, the video-based approach enables patients to perform exercises independently at home while maintaining consistency and safety. Furthermore, this study simultaneously assesses behavioral (physical activity levels) and physiological (fasting blood glucose levels) outcomes, providing a comprehensive evaluation of the intervention's impact.

By employing a one-group pretest–posttest quasi-experimental design, this study generates practical evidence on the feasibility and effectiveness of video-assisted home-based exercise in real-world settings. The findings are expected to contribute to the growing body of literature on digital health interventions for diabetes management and to support the development of accessible, low-cost, and sustainable strategies to enhance self-management and glycemic control among individuals with Type 2 Diabetes Mellitus.

RESEARCH METHODOLOGY

Study Design

This study employed a quantitative research approach using a quasi-experimental design with a one-group pretest–posttest model. This design was selected to evaluate the effectiveness of a video-based home exercise program on physical activity levels and glycemic control among patients with Type 2 Diabetes Mellitus (T2DM). The quasi-experimental approach allows for the assessment of intervention effects in real-world clinical settings where randomization and control groups may not be feasible. By comparing outcomes before and after the intervention within the same group of participants, this design enables direct observation of changes attributable to the intervention.

Study Setting and Population

The study was conducted at a primary healthcare facility in Sidenreng Rappang Regency, South Sulawesi, Indonesia. The study population consisted of all registered patients diagnosed with Type 2 Diabetes Mellitus who were receiving routine care at the selected healthcare facility during the study period. This setting was chosen due to the increasing prevalence of T2DM in the region and the need for practical, community-based management strategies.

Sample and Sampling Technique

The study sample comprised patients with T2DM who met the inclusion and exclusion criteria. Inclusion criteria were: (1) diagnosed with Type 2 Diabetes Mellitus by a physician, (2) aged 36 years or older, (3) able to perform mild to moderate physical activity, (4) willing to participate and provide informed consent, and (5) able to follow video-based exercise instructions. Exclusion criteria included patients with severe complications, musculoskeletal disorders, cardiovascular instability, or other medical conditions that contraindicated physical exercise. A purposive sampling technique was used to select participants most relevant to the study objectives. A total of 30 respondents were included in the final analysis.

Intervention

The intervention consisted of a video-based home exercise program designed specifically for patients with Type 2 Diabetes Mellitus. The exercise video provided structured guidance on mild-to-moderate-intensity physical activity, including warm-up, core exercises, and cool-down. Participants were instructed to follow the exercise video regularly at home, according to the prescribed schedule, throughout the intervention period. The video format allowed participants to visually observe correct exercise techniques, pace, and posture, thereby reducing the risk of injury and enhancing adherence. Participants were encouraged to maintain their usual diet and medication regimen during the study period to minimize confounding effects.

Data Collection Instruments

Physical activity levels were assessed using the short version of the International Physical Activity Questionnaire (IPAQ), which measures the frequency, duration, and intensity of physical activity over the previous seven days. The IPAQ has been widely validated and is commonly used in studies involving adults with chronic diseases. Glycemic control was evaluated by measuring fasting blood glucose levels using standard clinical procedures. Measurements were taken before the intervention (pretest) and after the completion of the video-based home exercise program (posttest).

Data Collection Procedure

Baseline data were collected before the intervention, including sociodemographic characteristics, physical activity levels, and fasting blood glucose measurements. After baseline assessment, participants received instructions on how to use the exercise video and were monitored periodically to ensure compliance. Upon completion of the intervention period, posttest data were collected using the same instruments and procedures as at baseline to ensure consistency.

Data Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics were used to summarize respondent characteristics. The normality of the data distribution was assessed using the Shapiro–Wilk test. For non-normally distributed variables, the Wilcoxon Signed Ranks Test was used; normally distributed variables were analyzed using the paired t-test. Statistical significance was set at $p < 0.05$.

Ethical Considerations

This study was conducted in accordance with ethical principles for health research, including respect for autonomy, beneficence, non-maleficence, and confidentiality. Ethical approval was obtained from the Research Ethics Committee of ITKES Muhammadiyah Sidrap. Written informed consent was obtained from all participants before data collection, and participants were informed of their right to withdraw from the study at any time without penalty.

RESULT

This section presents the study's findings following the implementation of a video-based home exercise program among patients with Type 2 Diabetes Mellitus. The results are organized to describe respondents' demographic characteristics, data distribution, and normality testing, and the effects of the intervention on physical activity levels and fasting blood glucose. Comparative analyses between pretest and posttest measurements were conducted to evaluate changes attributable to the intervention, using appropriate statistical tests based on data distribution.

Table 1. Distribution of Respondents by Sex and Age Group (n = 30)

Characteristic	Category	Frequency (n)	Percentage (%)
Sex	Male	2	6.7
	Female	28	93.3
Age (years)	36–45	3	10.0
	46–55	9	30.0
	56–65	14	46.7
	> 66	4	13.3
	Total	30	100.0

The majority of respondents were female (93.3%), indicating higher participation of women in primary healthcare services. Most participants were aged 56–65 years (46.7%), followed by those aged 46–55 years (30.0%). This distribution reflects the higher prevalence of Type 2 Diabetes Mellitus among middle-aged and older adults.

Table 2. Shapiro–Wilk Normality Test Results for Physical Activity and Blood Glucose Levels

Variable	Shapiro–Wilk Statistic	p-value	Data Distribution
Physical Activity (Pretest)	0.537	0.000	Not normal
Physical Activity (Posttest)	0.356	0.000	Not normal
Blood Glucose Level (Pretest)	0.961	0.326	Normal
Blood Glucose Level (Posttest)	0.968	0.479	Normal

The Shapiro–Wilk test indicated that physical activity data were not normally distributed ($p < 0.05$), whereas blood glucose data were normally distributed ($p > 0.05$). Therefore, the Wilcoxon Signed Ranks Test was applied for physical activity, and the paired t-test was used for blood glucose analysis.

Table 3. Effect of Video-Based Home Exercise on Physical Activity and Blood Glucose Levels

Outcome Variable	Pretest (Mean ± SD)	Posttest (Mean ± SD)	Statistical Test	Test Value	df	p-value
Physical Activity (IPAQ score)			Wilcoxon Signed Ranks Test	Z = 4.704		0.000
Fasting Blood Glucose (mg/dL)	172.60 ± 29.41	151.87 ± 27.83	Paired t-test	t = 2.665	29	0.012

Physical activity levels increased significantly following the video-based home exercise intervention ($p = 0.000$), as indicated by the Wilcoxon Signed Ranks Test. In addition, fasting blood glucose levels decreased significantly from a mean of 172.60 mg/dL before the intervention to 151.87 mg/dL after the intervention ($p = 0.012$). These findings confirm that the video-based home exercise program effectively improved both physical activity behavior and glycemic control among patients with Type 2 Diabetes Mellitus. The findings of this study demonstrate that the video-based home exercise program was effective in significantly increasing physical activity levels and reducing fasting blood glucose among patients with Type 2 Diabetes Mellitus. These results indicate that structured, video-assisted home-based exercise represents a practical and accessible intervention to support diabetes self-management and improve glycemic control, particularly in primary healthcare settings.

DISCUSSION

This study demonstrated that implementing a video-based home exercise program significantly improved physical activity levels and reduced fasting blood glucose among patients with Type 2 Diabetes Mellitus (T2DM). These findings indicate that structured, video-assisted home-based exercise is an effective behavioral and metabolic intervention for individuals with

T2DM, particularly within primary healthcare settings where access to supervised exercise programs may be limited.

The significant increase in physical activity observed after the intervention highlights the capacity of video-based exercise to overcome common barriers to exercise adherence among patients with T2DM (Lin *et al.*, 2022). Before the intervention, many patients exhibited low levels of physical activity, consistent with previous studies reporting high rates of sedentary behavior in individuals with diabetes (Młynarska *et al.*, 2025). The use of video media likely contributed to improved engagement by providing clear demonstrations of exercise movements, appropriate pacing, and structured routines that could be followed independently at home (Mustikaningtias *et al.*, 2025). From a behavioral perspective, audiovisual guidance can enhance self-efficacy by increasing patients' confidence in their ability to perform physical activity correctly and safely. This aligns with Social Cognitive Theory, which emphasizes observational learning and self-efficacy as key determinants of behavior change. By observing modeled exercise behaviors in the video, participants may have developed stronger beliefs in their capacity to engage in regular physical activity (Nurhayani, 2022).

The improvement in physical activity levels is also consistent with previous research indicating that home-based exercise programs can effectively increase exercise frequency and duration among individuals with chronic diseases (Parada Flores *et al.*, 2023). Unlike facility-based programs, home-based interventions reduce logistical barriers such as transportation, cost, and time constraints, which are commonly reported obstacles to regular exercise participation (Qiu *et al.*, 2025). In the present study, the flexibility of exercising at home likely facilitated greater adherence, particularly among older adults, who constituted the majority of participants (Sacks *et al.*, 2023). This finding supports the notion that home-based interventions are well-suited for aging populations with mobility limitations or comorbid conditions (Sinclair *et al.*, 2023).

In addition to behavioral outcomes, this study found a significant reduction in fasting blood glucose levels following the video-based home exercise intervention. This result underscores the physiological benefits of regular physical activity in improving glycemic control among patients with T2DM (Sujarwati, 2023). Physical exercise enhances insulin sensitivity by increasing glucose uptake in skeletal muscles through insulin-dependent and insulin-independent pathways. Repeated muscle contractions during exercise stimulate translocation of glucose transporter type 4 (GLUT4) to the cell membrane, facilitating glucose entry into muscle cells and contributing to lower circulating glucose levels. Over time, these adaptations improve overall metabolic regulation and glycemic stability (Syaharuddin *et al.*, 2025).

The observed reduction in fasting blood glucose in this study is consistent with previous findings demonstrating the positive effects of home-based and moderate-intensity exercise on glycemic outcomes in patients with T2DM (Tegegne *et al.*, 2024). While the magnitude of glucose reduction may vary across studies depending on exercise intensity, duration, and participant characteristics, the significant decrease observed in this study suggests that even relatively simple and accessible exercise interventions can yield meaningful metabolic benefits (Ujiie *et al.*, 2026). Importantly, participants were encouraged to maintain their usual diet and medication regimens, suggesting that the observed changes in glycemic control were largely attributable to increased physical activity rather than confounding lifestyle modifications (Wulandari, Viviandhari and Febriani, 2021).

From a theoretical perspective, the findings of this study can be explained by integrating Dorothea Orem's Self-Care Theory with mechanisms of insulin sensitivity. Orem's theory

emphasizes individuals' ability to engage in self-care behaviors to maintain health and well-being (Xue *et al.*, 2025). The video-based home exercise program empowered participants to take an active role in managing their condition by incorporating regular physical activity into their daily routines. This sense of autonomy and responsibility may have contributed to sustained engagement and improved outcomes. Additionally, improved insulin sensitivity resulting from regular exercise provides a physiological explanation for the observed reduction in fasting blood glucose levels (Zulfiah, Kadang and Suprpto, 2025).

The findings of this study have important implications for clinical practice and public health. Video-based home exercise programs represent a low-cost, scalable, and easily disseminated intervention that can be integrated into routine diabetes education and management programs. Such interventions are particularly valuable in primary healthcare settings and resource-limited environments where access to exercise professionals and facilities is restricted. By leveraging digital media, healthcare providers can deliver standardized exercise guidance to a broad population while minimizing the need for intensive supervision.

Despite its strengths, this study has several limitations that should be acknowledged. The use of a one-group pretest–posttest design without a control group limits the ability to attribute observed changes exclusively to the intervention and precludes comparison with alternative interventions. The relatively small sample size and short intervention duration may also limit the generalizability of the findings. Additionally, physical activity was assessed using self-reported measures, which may be subject to recall bias. Future studies employing randomized controlled designs, larger and more diverse samples, and objective measures of physical activity are recommended to strengthen the evidence base.

In conclusion, this study's findings suggest that video-based home exercise is an effective strategy to enhance physical activity and improve glycemic control among patients with T2DM. By addressing both behavioral and physiological dimensions of diabetes management, this intervention offers a promising approach for supporting sustainable self-care practices and improving long-term health outcomes in individuals with Type 2 Diabetes Mellitus.

CONCLUSION

This study concludes that the video-based home exercise program was effective in increasing physical activity levels and significantly reducing fasting blood glucose among patients with Type 2 Diabetes Mellitus. The findings indicate that video-assisted home-based exercise is a practical, accessible, and effective intervention to support glycemic control and promote self-management, particularly in primary healthcare settings.

Healthcare providers are encouraged to integrate video-based home exercise programs into routine diabetes education and management services. Such interventions may enhance patient engagement, improve adherence to physical activity recommendations, and improve metabolic outcomes. Future research should involve larger sample sizes, controlled study designs, and longer follow-up periods to evaluate the long-term effectiveness and sustainability of video-based home exercise interventions in diverse populations.

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Conflict of Interest

There are no potential conflicts of interest relevant to this article.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to ethical and confidentiality considerations.

Authors' Contributions

Asnuddin conceptualized and designed the study, coordinated the research process, and drafted the manuscript. Adillah Nurfatiyah contributed to data collection, statistical analysis, and interpretation of the results. Sulaeman participated in the study design, data analysis, and critical revision of the manuscript. Meriem Meisyaroh Syamson assisted with data collection, literature review, and manuscript editing. All authors reviewed and approved the final manuscript and agreed to be accountable for all aspects of the work.

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