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# Effect of Video-Based Education on Insulin Knowledge, Self-Management, and Fasting Blood Glucose in Insulin-Treated Type 2 Diabetes Patients

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***Abstract***

***Background:*** *Although various educational strategies have been implemented for patients with diabetes mellitus (DM), many challenges still exist, including inadequate glycemic control. This is due to patients' lack of understanding about DM management.* ***Objective:*** *This study examined the effect of video education on knowledge of insulin use, diet, diabetes self-management, and fasting blood glucose in insulin-treated patients with Type 2 DM.* ***Methods****: This quasi-experimental study employed a pretest-posttest design with a control group. Prospective data were collected from June to August 2025 using purposive sampling. A total of 60 patients with insulin-treated Type 2 DM who met the inclusion criteria participated. The sample was divided into control and treatment groups of 30 patients each. Participants in the intervention group received video-based education on insulin use, diet, and diabetes self-management. Data were collected using validated questionnaires assessing insulin knowledge, dietary patterns, and the Diabetes Self-Management Questionnaire (DSMQ).* ***Results:*** *The intervention group showed significant improvements in all outcomes. Median insulin knowledge scores increased from 13 (10–17) to 17 (14–18) (p=0.001), dietary pattern scores increased from 63 (56–74) to 70 (61–78) (p<0.001), and self-management scores increased from 38.72 to 41.57 (p<0.001). Median fasting blood glucose levels decreased from 161 mg/dL (82–305) to 145 mg/dL (89–239) (p=0.010).* ***Conclusion:*** *Video-based education effectively improves knowledge, dietary patterns, self-management, and glycemic control in insulin-treated patients with type 2 DM.*

***Keywords:*** *Blood Glucose; Diabetes Mellitus, Type 2; Patient Education as Topic; Self-Management; Video-Audio Media*.

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## INTRODUCTION

The prevalence of diabetes mellitus (DM) continues to rise globally and in Indonesia. The 2023 Indonesian Health Survey reported that the prevalence of DM, based on blood glucose testing, was 11.7% among individuals aged 15 years and older [1]. According to the International Diabetes Federation (IDF), Indonesia ranks fifth worldwide in the number of DM cases, with 20.4 million in 2024 and an estimated increase to 28.6 million by 2050 [2]. In East Java, the prevalence of DM remains high, highlighting that DM is a major health issue both globally and locally [3].

Diabetes complications are the third leading cause of death in Indonesia (6.7%) after stroke and coronary heart disease [4]. These complications often occur due to inadequate diabetes management, which is affected by limited patient understanding of therapy, insufficient knowledge, limited interactions with healthcare professionals, and short consultation times [5]. Previous studies indicate that many diabetes patients still possess poor knowledge of insulin use, increasing the risk of complications such as hypoglycemia [6]. Hence, correct insulin administration is essential for achieving optimal glycemic control [7]. Other studies have also shown that many patients struggle to manage their diet and exhibit poor self-management [8,9].

Several studies have shown that the success of DM therapy heavily depends on patient behavior, particularly knowledge and adherence to treatment, including insulin use and dietary management. A study by Pramita and Lisa Aditama [10] found that education on insulin therapy management significantly improved patient knowledge ($p=0.034$), but did not significantly impact glycemic control ($p=0.0463$). Conversely, research also indicated that diabetes education greatly improved dietary adherence among patients with type 2 diabetes. These findings suggest that educational interventions can enhance specific aspects of diabetes management; however, their effects on broader behavioral outcomes and clinical parameters remain inconsistent.

Various educational strategies have been introduced to improve diabetes management, but many remain conventional, one-way, and less engaging for patients, which may limit their long-term effectiveness. Audiovisual media, especially educational videos, offer an alternative method to present information in a more engaging, interactive, and easily understood way. Past studies have mainly focused on education's effect on single outcomes, such as knowledge, dietary adherence, or glycemic control [10,11]. However, research examining the simultaneous effects of video-based education on multiple key aspects of diabetes management—including insulin knowledge, dietary habits, self-management, and fasting blood glucose—is limited, especially among insulin-dependent patients in Indonesia. Additionally, evidence regarding the effectiveness of video-based educational interventions in routine hospital settings is scarce. This research aims to guide the development of innovative educational approaches and contribute clinically to improving the success of DM therapy and optimal DM management.

## MATERIALS AND METHODS

### Population and Sample

A quasi-experimental study with a pretest–posttest control group design was conducted at R.T. Notopuro Regional General Hospital in Sidoarjo from June to August 2025. Participants were recruited through purposive sampling. Patients were selected based on predefined eligibility criteria, including ages 17–70 years, diagnosis of type 2 diabetes mellitus, current insulin therapy, availability of fasting blood glucose measurements, and effective communication skills. Patients who did not complete the study procedures or missed follow-up assessments were excluded. A total of 60 eligible patients were enrolled and assigned to either the intervention group (n = 30) or the control group (n = 30). The intervention group received video-based education on insulin use, dietary patterns, and diabetes self-management, while the control group received standard care.

### Instruments

Data were collected through demographic questionnaires, FBG recording sheets, educational videos, and validated surveys. The educational video was created by the researchers based on national diabetes management guidelines and reviewed by a clinical pharmacy expert. It lasted about 15 minutes and covered T2DM, insulin indications, injection techniques, dosing and administration schedules, insulin storage, dietary patterns, blood glucose monitoring, and diabetes self-management. Insulin knowledge was assessed using a Guttman-scale questionnaire focusing on insulin indications, administration methods, dosage, frequency, side effects, and storage. The Diet and Diabetes Self-Management Questionnaire (DSMQ) employed a Likert scale [10,12].

The diet questionnaire assessed dietary habits among T2DM patients. The DSMQ questionnaires were revalidated before use [13,14]. Experts in clinical pharmacy and diabetes management assessed content validity. Validity and reliability were tested with 35 respondents who were not part of the main sample. The

insulin knowledge questionnaire showed an R-value greater than 0.334 and a Cronbach's alpha of 0.728. The diet questionnaire had an R-value above 0.361 and a Cronbach's alpha of 0.931, while the DSMQ's R-value exceeded 0.334 with a Cronbach's alpha of 0.855. Only items that were valid and reliable were included in the final questionnaires.

**Method**

This study used a quasi-experimental pre-test-post-test design with a control group. Ethics approval was obtained from R.T. Noto Puro Regional General Hospital in Sido Arjo, with the ethics permit number 000.9/3122/438.5.2.1.1/2025. At baseline (Day 0), all participants completed the pretest, which included questionnaires on insulin knowledge and dietary patterns, the DSMQ, and fasting blood glucose (FBG) measurement. Participants in the intervention group then watched a 15-minute video-based educational session. The video was viewed once at the hospital under the researcher's supervision to ensure full participation. Attendance was recorded for all participants. The control group received the standard education routinely provided by hospital healthcare professionals.

Follow-up assessments were conducted on Day 30 using the same instruments and procedures as at baseline. Changes in knowledge about insulin use, diet, self-management, and FBG levels were evaluated by comparing pre- and post-test measurements within and between groups. Data normality was assessed using the Shapiro-Wilk test. Normally distributed data were expressed as mean ± standard deviation and analyzed with paired and independent t-tests. Non-normally distributed data were presented as median (range) and analyzed using the Wilcoxon signed-rank test and the Mann-Whitney U test. Statistical significance was set at $p < 0.05$.

**RESULTS AND DISCUSSION**

A study was conducted to evaluate how video education affects patients with type 2 diabetes mellitus, including their knowledge of insulin use, diet, diabetes self-management, and fasting glucose levels. Data were analyzed to review demographic details and clinical information, examine changes in each factor before and after education, and compare these changes with those in the control group. Demographic data included age, gender, education level, and occupation, as shown in Table 1.

The majority of patients were aged 46–65 years, which is consistent with epidemiological evidence showing that the prevalence of diabetes increases with age. Age-related declines in pancreatic β-cell function and increasing insulin resistance contribute to the higher incidence of diabetes among older adults [15,16,17,18]. However, the presence of younger patients in this study suggests that unhealthy lifestyle factors, including poor dietary habits, physical inactivity, and obesity, may also contribute to the development of diabetes at a younger age [19]. These findings highlight the importance of early preventive interventions across all age groups (Table 1).

Female patients were slightly more predominant than male patients in this study. This finding is consistent with previous reports indicating a higher prevalence of T2DM among women [20,21]. Physiological factors, including body fat distribution and insulin resistance, may contribute to this pattern. Meanwhile, other research found no significant association between gender and T2DM incidence (p-value = 0.178 > 0.005) [22]. This means that men and women have the same risk of developing T2DM. Therefore, gender should be considered an indirect risk factor, as many physiological and lifestyle factors influence T2DM development.

Most patients had a high school educational background, indicating a moderate level of formal education. Although education can facilitate the understanding of health information and support self-care behaviors, knowledge acquisition is also influenced by personal experiences, social environments, and exposure to health education programs [23,24]. Therefore, education should not be considered the sole factor influencing health knowledge and awareness. In addition, most participants were housewives, a finding similar to previous studies [25]. Women who are housewives tend to engage in moderate physical activity and exercise less, which results in body fat accumulation, thus placing them at a higher risk of developing type 2 diabetes with a higher BMI (Body Mass Index) [26].

Most patients had been living with diabetes for over five years, reflecting the chronic nature of the disease and the referral status of the study sites. The duration of diabetes mellitus (DM) is closely linked to the age at first diagnosis. The younger the age at diagnosis, the longer a person has had DM [27]. Patients with DM for more than five years tend to experience a decline in pancreatic beta-cell insulin secretion, which impairs blood glucose control [7]. The results also showed a significant positive correlation between the duration of type 2 diabetes (T2DM) and HbA1c levels ($r = 0.072$; $p = 0.001$). This indicates that the longer a patient has had T2DM, the higher their HbA1c levels. This suggests that the duration of DM is a risk factor for long-term failure to control blood glucose levels, increasing the risk of complications. Consistent with this, most

participants in this study experienced complications, with hypertension being the most common. Chronic hyperglycemia can damage blood vessels through the buildup of Advanced Glycation End Products (AGEs), which contribute to hypertension and other cardiovascular complications [29]. The accumulation of AGEs can impair blood vessel structure and function via mechanisms such as capillary wall thickening, increased vascular permeability, and immune cell activation that leads to inflammation and atherogenesis. Additionally, AGEs affect renal capillary function, leading to nephropathy and playing a role in the development of cardiovascular disease and hypertension [30] (Table 1).

**Table 1.** Distribution of demographic and clinical patient characteristics

| Patient Characteristics | Control Group | Treatment Group |
|---|---|---|
| | Frequency = 30<br>n (%) | Frequency = 30<br>n (%) |
| **Age (years)** | | |
| 17-25 | 1 (3.3) | 1 (3.3) |
| 26-45 | 2 (6.7) | 7 (23.3) |
| 46-65 | 26 (86.7) | 20 (66.7) |
| ≥65 | 1 (3.3) | 2 (6.7) |
| **Gender** | | |
| Male | 12 (40.0) | 14 (46.7) |
| Female | 18 (60.0) | 16 (53.3) |
| **Education level** | | |
| Elementary school | 3 (10.0) | 1 (3.3) |
| Junior high school | 8 (26.7) | 7 (23.3) |
| Senior high school | 9 (30.0) | 15 (50.0) |
| Bachelor's degree | 10 (33.3) | 7 (23.3) |
| **Occupation** | | |
| Government employee | 2 (6.7) | 0 (0.0) |
| Entrepreneur | 5 (14.0) | 6 (20.0) |
| Employee | 0 (0.0) | 5 (16.7) |
| Laborer | 1 (2.9) | 2 (6.6) |
| Housewife | 16 (45.7) | 9 (30.0) |
| Retired Government Employee | 5 (14.3) | 5 (16.7) |
| Unemployed | 1 (2.9) | 3 (10.0) |
| **T2DM Duration** | | |
| <5 years | 17 (56.7) | 12 (40.0) |
| ≥5 years | 13 (43.3) | 18 (60.0) |
| **Complication** | | |
| Yes | 18 (60.0) | 22 (73.3) |
| No | 12 (40.0) | 8 (26.7) |
| **Type of complication** | | |
| Cardiovascular disease | 4 (22.2) | 8 (26.7) |
| Hypertension | 11 (61.1) | 10 (33.3) |
| Neuropathy | 3 (16.7) | 2 (6.67) |
| Other | 0 (0.0) | 2 (6.67) |
| **Duration of insulin use (years)** | | |
| < 1 | 14 (46.7) | 16 (53.3) |
| ≥ 1 | 16 (53.3) | 14 (46.7) |
| **Type of insulin** | | |
| Long-Acting Basal Insulin | 7 (23.3) | 9 (30.0) |
| Bolus Insulin | 3 (10.0) | 2 (6.7) |
| Intermediate Basal Insulin | 1 (3.3) | 5 (16.7) |
| Basal Insulin Bolus 3 times | 7 (23.3) | 6 (20.0) |
| Premixed Insulin | 12 (40.0) | 8 (26.7) |

Regarding the duration of insulin use, the frequency of insulin administration was similar between patients using insulin for less than a year and those using it for more than a year. Additionally, premixed insulin (33.3%) was the most commonly used type; other research indicated that premixed analog insulin was widely

used, accounting for 35%. Insulins can be categorized by their duration of action and purpose [31]. First, long-acting basal insulins, such as glargine, detemir, glargine U-300, or degludec, maintain stable insulin levels for approximately 24 hours or longer and reduce the risk of hypoglycemia. Second, bolus insulin, or rapid/short-acting insulin, is administered before or during meals to control post-meal blood glucose spikes. Third, intermediate-acting basal insulins, such as Neutral Protamine Hagedorn (NPH), start working within 1–3 hours and can last throughout the day, making them a common choice for conventional basal insulin. Fourth, the triple basal-bolus regimen combines basal insulin (long- or intermediate-acting) with bolus insulin given before meals three times daily, mimicking the body's natural insulin secretion. Lastly, premixed insulin combines basal insulin (intermediate or long-acting) with prandial insulin (rapid or short-acting) in a single injection, offering greater convenience in administration. However, its flexibility is limited [7]. Premixed insulin, a common choice for T2DM therapy, offers advantages in administration and patient adherence [7]. It is often preferred over other insulin types due to its ease of use and relatively simple injection schedule, typically once or twice daily. This approach helps improve patient compliance, especially in T2DM patients who often struggle with multiple injections. Pharmacodynamically, the combination of rapid-acting insulin, which manages postprandial glucose spikes, and intermediate-acting Neutral Protamine Hagedorn (NPH) insulin, which maintains fasting glucose, more closely mimics normal insulin physiology than basal insulin alone [15].

Table 2 shows that the most significant changes happened in the treatment group after they received an educational intervention via video. These changes appeared across all measured areas, including insulin use, diet, self-management, and fasting blood glucose. The control group saw only a slight rise in the "good" category, from 33.3% to 36.7%. This suggests that, without any specific intervention, knowledge improved but not significantly. Meanwhile, the treatment group had a "moderate" level of knowledge during the pretest (63.3%) and a "good" level during the post-test (90.0%).

**Table 2.** Distribution of knowledge of insulin use, diet, self-management, and fasting blood glucose

| Variable | Control Group | | Treatment Group | |
|---|---|---|---|---|
| | Frequency = 30 n (%) | | Frequency = 30 n (%) | |
| | Pretest | Posttest | Pretest | Posttest |
| Knowledge of Insulin Use (%) | | | | |
| Good (80-100) | 10 (33.3) | 11 (36.7) | 9 (30.0) | 27 (90.0) |
| Moderate (60-79) | 18 (60.0) | 18 (60.0) | 19 (63.3) | 3 (10.0) |
| Poor (<60) | 2 (6.7) | 1 (3.3) | 2 (6.7) | 0 (0.0) |
| Sub Total | 30 (100.0) | 30 (100.0) | 30 (100.0) | 30 (100.0) |
| Diet | | | | |
| Good (63-84) | 20 (66.7) | 20 (66.7) | 16 (53.3) | 29 (96.6) |
| Moderate (42-62) | 10 (33.3) | 10 (33.3) | 13 (43.3) | 1 (3.4) |
| Poor (0-41) | 0 (0.0) | 0 (0.0) | 1 (3.4) | 0 (0.0) |
| Sub Total | 30 (100.0) | 30 (100.0) | 30 (100.0) | 30 (100.0) |
| Diabetes Self-Management | | | | |
| Good (32-48) | 24 (80.0) | 27 (90.0) | 27 (90.0) | 30 (100.0) |
| Moderate (16-31) | 6 (20.0) | 3 (10.0) | 3 (10.0) | 0 (0.0) |
| Poor (0-15) | 0 (0.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) |
| Sub Total | 30 (100.0) | 30 (100.0) | 30 (100.0) | 30 (100.0) |
| Fasting Blood Glucose | | | | |
| Low (<70 mg/dL) | 1 (3.3) | 0 (0.0) | 0 (0.0) | 0 (0.0) |
| Normal (80-100 mg/dL) | 5 (16.7) | 7 (23.3) | 8 (26.7) | 13 (43.3) |
| High (>130 mg/dL) | 24 (80.0) | 23 (76.7) | 22 (73.3) | 17 (56.7) |

This moderate level of knowledge indicates that respondents already have a basic understanding of insulin use. During the pre-test, patients were familiar with the injection site, how to inject at a 90º angle, and how to rotate the dose indicator as directed by the doctor. However, they were not fully aware of other aspects, such as rotating insulin before use, insulin side effects, and storing insulin at the correct temperature. Diabetic patients should understand the risks of insulin-related side effects [32]. Incorrect insulin injection practices can lead to medication errors and the risk of lipodystrophy, which can lead to impaired absorption and decreased

insulin effectiveness. Therefore, diabetic patients should be educated to routinely rotate injection sites between the abdomen, thigh, upper arm, and buttocks to reduce the risk of lipodystrophy and improve insulin absorption [33,34].

A study by Feleke et al. [35] showed that 76.6% of patients had inadequate knowledge regarding insulin side effects, highlighting the need for appropriate education and demonstration of insulin self-injection techniques. Consistent with Pramita & Aditama [10], the present study demonstrated that educational intervention effectively improved patients' knowledge of insulin use. Dietary pattern assessment showed that the treatment group experienced an increase in the good diet category from 53.3% to 96.6% after the intervention, accompanied by a decrease in the moderate category from 43.3% to 3.4% and the poor category from 3.4% to 0%. Meanwhile, the control group showed no change between pre-test and post-test. This improvement is important because dietary habits are closely associated with glycaemic control, and poor dietary practices may contribute to blood glucose instability [26,36]. A good diet for diabetes patients involves paying attention to the types of food, meal schedules, and quantities. However, diabetes patients cannot simply control their diet, as this disease requires complex management, including diet management, physical activity, weight management, and regular blood glucose monitoring [7].

Self-management variables in both the control and treatment groups were mostly categorized as good. However, the improvement in the treatment group was more significant. In the control group, the proportion of patients with good self-management increased from 80% to 90%. Meanwhile, in the treatment group, the good category increased from 90% to 100%, so all respondents were in the good self-management category after the intervention. Glycaemic control assessments in this study showed improvement. In the treatment group, the proportion of normal FBG increased from 26.7% to 43.3% after the intervention, while the proportion in the high FBG category decreased from 73.3% to 56.7%. No patients with low glucose levels were found in the treatment group. These results indicate that education positively contributes to fasting blood glucose control.

A study in North Sumatra also supports these findings, demonstrating that providing diabetes self-management education reduces FBG and HbA1C levels [37]. Education helps patients receive more specific, easy-to-understand information tailored to their individual conditions, thereby enhancing adherence to insulin therapy, dietary changes, and daily self-management practices. Overall, the results in Table 3 show that education not only improves cognitive aspects, such as knowledge, but also enhances diabetes management behaviors and fasting blood glucose control. However, a significant number of patients still have high FBG after the intervention. This suggests that diabetes management requires a long-term approach, regular monitoring, and multidisciplinary support to achieve optimal clinical outcomes. These results also highlight that good diabetes management does not necessarily lead to normal blood glucose levels. FBG control is also affected by factors such as medication adherence, duration of diabetes, physical activity, stress, metabolic condition, and patient consistency with daily therapy.

**Table 3.** The effect of video education on knowledge of insulin use

| Group | Pretest | Posttest | p-value |
|---|---|---|---|
| | Median (Min-Max) | Median (Min-Max) | |
| Control | 13.5 (7-17) | 14 (10-17) | 0.100 |
| Treatment | 13 (10 - 17) | 17 (14 - 18) | 0.001 |

*Note.* *Wilcoxon signed rank test

Table 3 shows that in the control group, the median knowledge score before education was 13.5 (range 7–17), but after the posttest, it only increased to 14 (range 10–17). The statistical test results showed a significance value (p-value) of 0.100 ($p > 0.05$), indicating no significant difference between the pretest and posttest. Meanwhile, in the intervention group, the median knowledge score before education was 13 (range 10–17), and after education, it increased to 17 (range 14–18). The statistical test results showed a significance value (p-value) of 0.001 ($p < 0.05$), indicating a significant difference between knowledge before and after education. These findings suggest that educational videos effectively improve patient understanding of insulin administration. The combination of visual and audio information facilitates learning and aids retention of key concepts related to insulin use. These findings align with those of Ratri et al. [38], who reported a significant increase in knowledge following video-based education. Increased knowledge can help patients make informed decisions regarding insulin administration, dosage, timing, and storage, which are crucial for effective diabetes management. Therefore, the success of this education program can serve as a foundation for expanding diabetes health education initiatives at the healthcare level.

**Table 4**. The effect of video education on diet patterns and diabetes self-management

| Variable | Group | Pretest | Posttest | p-value |
|---|---|---|---|---|
| Diet | Control | 65.0 (48-79) | 65.5 (49-79) | 0.002* |
| | Treatment | 63.0 (56-74) | 70 (61-78) | 0.000* |
| Diabetes Self-Management | Control | 36.5 ± 5.1 | 37.8 ± 4.56 | 0.000** |
| | Treatment | 38.7 ± 4.9 | 41.6 ± 3.63 | 0.000** |

*Note.* *Wilcoxon signed rank test; **Paired t-test

Table 4 shows that the median dietary pattern score for the control group increased slightly from 65 (48–79) to 65.5 (49–79), with a p-value of 0.002 ($p < 0.05$). Although statistically significant, this increase was relatively small compared to the intervention group. The median dietary pattern score in the intervention group rose from 63 (56–74) at pre-test to 70 (61–78) at post-test. The statistical test indicated a p-value of 0.000 ($p < 0.05$). These findings suggest that video-based education can help support healthier eating behaviors among patients with type 2 diabetes mellitus. Previous studies have shown a strong link between dietary adherence and glycemic control [26]. Adherence to dietary recommendations can be affected by several factors, including patient motivation, disease duration, and support from healthcare professionals and family members [39]. Therefore, educational interventions remain important for promoting sustainable changes in dietary patterns. Increasing knowledge and awareness of the importance of nutrition in T2DM patients will influence attitudes and actions toward healthier food choices. As a result, educational interventions are crucial to help patients maintain a balanced, appropriate diet.

Self-management scores increased significantly after the intervention, with greater improvement observed in the treatment group than in the control group. The study results indicate that video-based educational interventions are effective in improving self-management in patients with type 2 diabetes mellitus. The increase in self-management scores from 38.72 to 41.57 in the intervention group indicates a positive change in the patient's ability to manage their disease, including diet, physical activity, blood sugar monitoring, and treatment adherence. Although the control group showed an increase in self-management scores, the increase was relatively small. These results indicate that the method of delivering education significantly influences understanding and changes in patient behavior (**Table 4**).

**Table 5**. The effect of video education on fasting blood glucose

| Group | Pretest | Posttest | p-value |
|---|---|---|---|
| | Median (Min-Max) | Median (Min-Max) | |
| Control | 200 (59-350) | 180 (90-242) | 0.100 |
| Treatment | 161 (82-305) | 145 (89-239) | 0.010 |

Table 5 shows that in the intervention group, the median FBG level decreased from 161 mg/dL (range: 82–305 mg/dL) in the pretest to 145 mg/dL (range: 89–239 mg/dL) in the posttest. Statistical analysis revealed a p-value of 0.010 ($p < 0.05$), indicating a statistically significant difference between FBG levels before and after the educational video. However, FBG levels after the intervention remained above the American Diabetes Association (2022) target of <130 mg/dL. This suggests that education in the intervention group improved glycemic control but did not fully reach the optimal target. Meanwhile, in the control group, FBG levels also decreased from 200 mg/dL (range: 59–350 mg/dL) to 180 mg/dL (range: 90–242 mg/dL). However, statistical tests showed a p-value of 0.100 ($p > 0.05$), indicating no significant change. This means that without structured educational intervention, changes in blood sugar levels tend to be insignificant.

The small reduction likely resulted from natural variation or coincidental patient self-control during the study period rather than a specific intervention. Education helps patients better understand the importance of timely injections, correct dosages, and regular insulin use. However, other factors, such as diet, physical activity, and psychological support (e.g., family support), also influence the achievement of target FBG levels [7]. Therefore, ongoing education combined with routine monitoring is necessary to help patients reach optimal FBG levels.

**Table 6.** Multivariate linear regression analysis of factors associated with changes in FBG

| Variable | B | Standardized ß | 95% CI | p-value |
|---|---|---|---|---|
| Constant | -31.0 | - | -58.8 to -3.3 | 0.03 |
| Δ Diabetes self-management | -9.2 | -0.6 | -13.5 to -4.8 | <0.001* |

Model statistics R= 0.6; $R^2$=0.4; Adjusted $R^2$=0.3; F=18.7; p<0.001. **Table 6** shows that a multivariable linear regression analysis using the backward elimination method was performed to identify factors associated with changes in fasting blood glucose (FBG). The initial model included changes in insulin knowledge, dietary pattern, diabetes self-management, age, sex, duration of diabetes, duration of insulin therapy, and the presence of diabetic complications. After backward elimination, only changes in diabetes self-management remained in the final model. The final regression model was statistically significant (F = 18.7, p < 0.001), with a correlation coefficient (R) of 0.6, indicating a moderate-to-strong relationship between the predictor and changes in FBG. The model explained 40.1% of the variance in FBG changes ($R^2$ = 0.4). At the same time, the adjusted coefficient of determination (Adjusted $R^2$ = 0.4) indicated that approximately 38.0% of the variability in FBG changes could be explained by changes in diabetes self-management. Changes in diabetes self-management were independently associated with changes in FBG (B = -9.2; 95% CI: -13.5 to -4.8; p < 0.001). No other variables remained significant after backward elimination.

The results show that changes in diabetes self-management among patients with T2DM remain independently linked to changes in fasting blood glucose (FBG), even after adjusting for factors such as insulin knowledge, dietary patterns, age, diabetes duration, gender, duration of insulin therapy, and diabetes complications. These findings suggest that diabetes self-management may have a more direct effect on improving glycemic outcomes than simply increasing diabetes knowledge or dietary habits. This aligns with evidence indicating that self-management support for type 2 diabetes can lead to better clinical results, including improved glycemic control [40].

Diabetes self-management is a comprehensive, structured set of behaviors that includes medication adherence, blood glucose monitoring, dietary habits, physical activity, problem-solving skills, and appropriate responses to diabetes symptoms. As a result, improvements in self-management reflect not only a patient's understanding of diabetes care but also their ability to consistently apply recommended self-care behaviors in daily life. These behavioral changes are more likely to lead to measurable improvements in glycemic control. Systematic reviews and intervention studies support this, emphasizing that consistent self-care behaviors are more strongly associated with glycemic outcomes than knowledge alone [41]. Conversely, although knowledge about insulin use and dietary habits improved after education, neither variable was significant in the multivariate model. This highlights that gaining knowledge alone is not sufficient to improve FBG control unless it leads to sustained self-management practices. Similarly, dietary modification is just one aspect of diabetes management, while numerous other behavioral and clinical factors also influence glycemic control.

## CONCLUSION AND SUGGESTIONS

Video-based education effectively enhanced knowledge about insulin use, dietary patterns, self-management, and fasting blood glucose levels in patients with type 2 diabetes mellitus. Compared to standard education, this intervention yielded better outcomes, supporting its use as a practical educational approach in diabetes care. Despite limitations in sample size and intervention duration, this study emphasizes the potential of video-based education to improve behavioral and clinical outcomes. Future research should involve larger samples, longer follow-up periods, and HbA1c assessments to verify long-term benefits.

Future researchers should investigate a range of interactive teaching media, including digital applications and multimodal techniques. To improve the reliability and generalizability of results, it is also advisable to use larger sample sizes and more rigorous designs, such as randomized controlled trials. To ensure long-term glycemic control and sustainable behavioral changes, it is also crucial to extend the intervention duration and increase contact hours to more than 60 minutes per week. Lastly, incorporating family involvement and peer support groups into educational programs can greatly increase patient motivation and adherence to self-management.

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## CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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