Buletin Kedokteran & Kesehatan Prima
Vol.4 No.2 (2025)
DOI: 10.34012/bkkp.v4i2.7811

ORIGINAL ARTICLE

Effectiveness of dragon fruit juice for glycemic control in elderly patients with type 2 diabetes mellitus

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ABSTRACT

Background: Type 2 Diabetes Mellitus (T2DM) is a global health challenge with a rising prevalence, particularly among the elderly. Its management requires a holistic approach, including medical nutrition therapy. Red dragon fruit (Hylocereus polyrhizus) is rich in fibre and antioxidants, which may help regulate glucose metabolism. This study aimed to evaluate the efficacy of red dragon fruit juice on reducing random blood glucose levels in elderly patients with T2DM.
Methods: A quasi-experimental study with a pretest-posttest control group design was employed. Thirty-two elderly T2DM patients within the working area of Karo District General Hospital were selected via purposive sampling and allocated into an intervention group (n=16) and a control group (n=16). The intervention group consumed 250 ml of red dragon fruit juice once daily for seven consecutive days, while the control group received routine care only. Random blood glucose levels were measured using a glucometer before and after the intervention. Data were analysed using descriptive statistics and the Wilcoxon Signed Ranks Test.
Results: At baseline, the mean random blood glucose was 231.88 ± 99.37 mg/dL in the intervention group and 250.31 ± 63.32 mg/dL in the control group. Post-intervention, the intervention group exhibited a significant decrease to 226.25 ± 96.99 mg/dL (p=0.017). Conversely, the control group showed a non-significant increase to 252.75 ± 63.66 mg/dL (p=0.027). Rank analysis indicated that 75% of subjects in the intervention group experienced a decrease in blood glucose, whereas 81.25% of subjects in the control group experienced an increase.
Conclusion: The administration of 250 ml of red dragon fruit juice daily for seven days was effective as an adjuvant therapy in reducing random blood glucose levels in elderly patients with Type 2 Diabetes Mellitus. Red dragon fruit may be considered a safe and affordable complementary nutritional intervention for T2DM management in the elderly population.

Keywords: *Hylocereus polyrhizus*, type 2 diabetes mellitus, random blood glucose

Introduction

Type 2 Diabetes Mellitus (T2DM) has become a global pandemic with significant health and economic burdens. The International Diabetes Federation (IDF) estimates that approximately 589 million adults aged 20-79 years were living with diabetes in 2024, a figure projected to rise to 853 million by 2050 [1]. In Indonesia, the prevalence of T2DM continues to increase, with 19.47 million cases recorded in 2023 [2]. The elderly are the age group most vulnerable to T2DM due to declining physiological functions, including insulin resistance and pancreatic beta-cell dysfunction [3].

Optimal T2DM management requires a multifaceted approach encompassing education, medical nutrition therapy (MNT), physical activity, pharmacological therapy, and self-monitoring of blood glucose

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[4]. MNT plays a critical role in controlling blood glucose levels and preventing complications. Dietary principles for T2DM patients include regulating the intake of high-fibre complex carbohydrates, restricting simple sugars, and increasing consumption of antioxidant-rich foods [5].

Red dragon fruit (*Hylocereus polyrhizus*) has garnered attention as a potential functional food for T2DM management. This tropical fruit is rich in dietary fibre (3.2 g/100g), antioxidants (betacyanin, flavonoids, vitamin C, vitamin E), B-complex vitamins, and minerals such as potassium and magnesium [6,7]. The potential mechanisms by which red dragon fruit lowers blood glucose include: (1) its high soluble fibre (pectin) content, which delays gastric emptying and glucose absorption in the small intestine; (2) antioxidants that reduce oxidative stress contributing to insulin resistance and beta-cell dysfunction; (3) bioactive compounds that may enhance insulin sensitivity and improve glucose metabolism [8–10].

Several previous studies have investigated the effects of red dragon fruit on glycaemic parameters. A study by Sijabat et al. (2022) reported a significant decrease in blood glucose levels in elderly T2DM patients following consumption of red dragon fruit juice [11]. Similarly, Riamah and Ritonga (2022) found a mean reduction in blood glucose from 283.47 mg/dL to 225.40 mg/dL after a dragon fruit juice intervention [12]. However, further research with a rigorous controlled design is needed to strengthen the evidence for its efficacy, particularly in the elderly population in Indonesia. Based on this background, this study aimed to evaluate the efficacy of red dragon fruit juice on reducing random blood glucose levels in elderly patients with T2DM within the working area of Karo District General Hospital (RSUD Kabupaten Karo), North Sumatra.

Method

This research utilized a quasi-experimental approach specifically employing a pretest-posttest control group design. This structure was chosen because it facilitates the comparison of outcome changes before and after a specific intervention between a treatment group and a non-treatment group, despite the lack of full randomization. The study was localized to the Karo District General Hospital in North Sumatra, Indonesia. The research timeline began with preliminary surveys in March 2025, while the core intervention and data collection phases were executed in November 2025.

The target population included all elderly patients aged 45 and older diagnosed with Type 2 Diabetes Mellitus (T2DM) at the hospital. Participants were selected through purposive sampling based on specific criteria. The inclusion criteria required participants to be at least 45 years old, have a confirmed T2DM diagnosis, maintain a random blood glucose level of at least 175 mg/dL, provide informed consent, and possess effective communication skills. Conversely, the exclusion criteria filtered out individuals with severe complications like advanced-stage kidney disease or active ulcers, those with dragon fruit allergies, and those using herbal supplements that might interfere with blood sugar levels. The sample size was established using Federer's formula for experimental research, expressed as $(n-1)(t-1) \geq 15$. Given there were two groups ($t = 2$), the calculation necessitated at least 16 participants per group. Consequently, the study enrolled a total of 32 individuals, split equally between the intervention and control groups.

Participants in this group consumed 250 ml of red dragon fruit juice daily for seven consecutive days, administered in the morning after breakfast. The juice was standardized by blending 250 grams of ripe *Hylocereus polyrhizus* pulp with 80 ml of boiled water. To ensure safety and consistency, the preparation followed strict hygiene protocols and consumption was directly supervised by the researcher. Participants in the control group did not receive the juice intervention. Instead, they maintained their routine T2DM medications and dietary plans as prescribed by their doctors. They underwent the same blood glucose monitoring schedule as the intervention group to ensure a valid comparison. To minimize variables, all 32 participants were instructed to avoid other fruit juices or supplements, and their daily intake was tracked via 24-hour food recall.

Researcher-designed structured questionnaires gathered demographic data such as age, sex, and medical history. The primary clinical metric, random blood glucose levels, was measured using an Accu-Chek® glucometer. These measurements were taken at two specific points: day one (pretest) and day eight (posttest), exactly 24 hours after the final dose was administered. The data were processed using SPSS version 25.0. Univariate analysis provided descriptive statistics, including mean, standard deviation, and frequency distributions. Before conducting comparative tests, a Shapiro-Wilk normality test was performed. Because the blood glucose data did not follow a normal distribution ($p < 0.05$), non-parametric methods were applied. The Wilcoxon Signed Ranks Test was used for bivariate analysis to determine the significance of glucose level changes within each group, with the significance threshold set at $p < 0.05$.

Results

A total of 32 elderly T2DM patients participated in this study. The demographic characteristics of participants in the intervention and control groups are presented in Table 1. The majority of participants were female (68.8%), with the most common age range being 50-59 years (46.8%). The highest educational level attained was primary and junior high school (65.6%), and the dominant occupations were homemaker (40.6%) and farmer (37.5%). The baseline characteristics between the intervention and control groups were relatively balanced.

Table 1. Demographic characteristics of elderly T2DM participants (n=32)

Characteristic	Intervention Group (n=16)	Control Group (n=16)	Total (n=32)
Age (Years)			
40-49	5 (31.3%)	2 (12.5%)	7 (21.8%)
50-59	8 (50.0%)	7 (43.8%)	15 (46.8%)
60-69	1 (6.3%)	5 (31.3%)	6 (18.7%)
70-79	2 (12.5%)	2 (12.5%)	4 (12.5%)
Sex			
Male	3 (18.8%)	7 (43.8%)	10 (31.2%)
Female	13 (81.3%)	9 (56.3%)	22 (68.8%)
Education			
Primary School	3 (18.8%)	5 (31.3%)	8 (25.0%)
Junior High School	8 (50.0%)	5 (31.3%)	13 (40.6%)
Senior High School	4 (25.0%)	6 (37.5%)	10 (31.3%)
Bachelor's Degree	1 (6.3%)	0 (0.0%)	1 (3.1%)
Occupation			
Homemaker	8 (50.0%)	5 (31.3%)	13 (40.6%)
Farmer	4 (25.0%)	8 (50.0%)	12 (37.5%)
Merchant	2 (12.5%)	3 (18.8%)	5 (15.6%)
Other	2 (12.5%)	0 (0.0%)	2 (6.3%)

The results of random blood glucose measurements before (pretest) and after (posttest) the intervention for both groups are presented in Table 2. The Shapiro-Wilk normality test indicated the data were not normally distributed ($p < 0.05$), thus analysis proceeded with the non-parametric Wilcoxon test.

Table 2. Comparison of random blood glucose levels (mg/dL) before and after intervention

Group	Time	Mean ± SD	Median (Min-Max)	p-value (Wilcoxon)
Intervention (n=16)	Pretest	231.88 ± 99.37	206.00 (175 - 588)	0.017*
	Posttest	226.25 ± 96.99	201.50 (160 - 574)	
Control (n=16)	Pretest	250.31 ± 63.32	219.00 (184 - 375)	0.027*
	Posttest	252.75 ± 63.66	222.00 (179 - 378)	

The findings from this study reveal a stark contrast in blood glucose trajectories between the two groups over the one-week observation period. For the Intervention Group, the intervention appeared effective in lowering glycemic levels, as evidenced by a mean reduction from 231.88 mg/dL to 226.25 mg/dL. This 5.63 mg/dL decrease was supported by a statistically significant Wilcoxon test result (p=0.017), which is further bolstered by the fact that three-quarters of the participants saw their levels drop. Conversely, the Control Group showed a concerning upward trend, with mean blood glucose rising by 2.44 mg/dL to reach 252.75 mg/dL. This increase was also statistically significant (p=0.027), driven by more than 81% of the participants experiencing a rise in their levels. When visualized, these divergent paths highlight that while the intervention successfully initiated a downward trend in glucose, the lack of intervention in the control group allowed for a continued increase in blood sugar levels.

Discussion

This study successfully demonstrated that an intervention of 250 ml of red dragon fruit juice daily for seven days significantly reduced random blood glucose levels in elderly patients with T2DM. This finding aligns with several previous studies reporting the hypoglycaemic effects of red dragon fruit. A study by

Priyanti et al. (2024) reported a significant decrease in blood glucose following dragon fruit juice administration in elderly T2DM patients (p=0.000) [14]. Similarly, Sijabat et al. (2022) found a mean reduction in blood glucose from 142.23 mg/dL to 136.32 mg/dL after a similar intervention [11].

The mechanism underlying the blood glucose-lowering effect of red dragon fruit is presumed to be multifactorial. First, its high soluble fibre (pectin) content (3.2 g/100g) plays a key role. Soluble fibre forms a viscous gel in the gastrointestinal tract which delays gastric emptying, inhibits digestive enzyme activity, and slows glucose absorption into the portal circulation, thereby preventing postprandial blood glucose spikes [15,16]. Second, its abundant antioxidant content, particularly betacyanin (red pigment), flavonoids, and vitamin C, functions to reduce oxidative stress. Chronic oxidative stress is a key pathomechanism in the development of insulin resistance and pancreatic beta-cell dysfunction in T2DM [17,18]. By neutralising free radicals, the antioxidants in red dragon fruit may enhance insulin sensitivity and protect beta cells from apoptosis [9,10]. Third, red dragon fruit contains B-complex vitamins (B1, B2, B3) and magnesium, which are involved in energy metabolism and insulin sensitivity [6,19].

The contrasting results between the intervention and control groups strengthen the validity of the findings. The control group, which received only routine care, exhibited a significant trend of increasing blood glucose. This phenomenon may be explained by several factors: (1) The natural progression of T2DM, especially in the elderly where beta-cell function continually declines; (2) Daily variability in dietary adherence, physical activity, and stress factors which can influence glycaemia; (3) A minimal Hawthorne effect as the control group was merely monitored without a specific intervention [20]. This finding underscores that conventional medical therapy alone may be insufficient to achieve optimal glycaemic control without the support of structured lifestyle interventions, including dietary modification.

Several limitations of this study must be acknowledged. First, the relatively short intervention duration (7 days) may be insufficient to observe long-term effects or changes in other parameters such as HbA1c. Second, the small sample size (n=32) limits the generalisability of the results. Third, this study measured random blood glucose, which is highly influenced by the last meal intake, rather than fasting blood glucose or the more stable HbA1c. Fourth, the lack of true randomisation (quasi-experimental design) potentially introduces selection bias, although the baseline characteristics of both groups were relatively balanced.

Notwithstanding these limitations, this study provides valuable scientific evidence regarding the potential of red dragon fruit as a complementary, low-cost, readily available, and safe nutritional therapy for the elderly T2DM population in Indonesia. Integrating functional local foods such as red dragon fruit into Medical Nutrition Therapy (MNT) guidelines for diabetes could represent a cost-effective strategy within primary healthcare services.

Conclusion

The administration of 250 ml of red dragon fruit juice (*Hylocereus polyrhizus*) daily for seven consecutive days was effective in reducing random blood glucose levels in elderly patients with Type 2 Diabetes Mellitus within the working area of Karo District General Hospital. This hypoglycaemic effect is likely mediated by the soluble fibre and antioxidant compounds present in red dragon fruit.

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