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The Effect of Carrot Juice Consumption on Blood Glucose Levels Among Individuals with Diabetes Mellitus in the Piyeung Health Center Area, Montasik Subdistrict, Aceh Besar Regency

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Abstract

Diabetes mellitus is a chronic metabolic disorder characterized by elevated blood glucose levels resulting from impaired insulin production or utilization. In addition to pharmacological therapy, blood glucose control can be supported through the use of herbal interventions such as carrot juice. Carrots (Daucus carota L.) are low calorie, high fiber vegetables rich in antioxidants, including vitamin C, β-carotene, lycopene, and flavonoids which may protect pancreatic β-cells and help reduce blood glucose levels. This study aimed to examine the effect of carrot juice consumption on blood glucose levels among individuals with diabetes mellitus. A quasi-experimental design with a pre-test–post-test control group was employed at the Piyeung Health Center, Montasik Subdistrict, Aceh Besar Regency. A total of 32 participants were selected using purposive sampling and divided into two groups: the treatment group, which received carrot juice daily for seven days, and the control group, which received mineral water for the same duration. Blood glucose levels were measured using an Easy Touch device. Data were analyzed using paired and independent t-tests in SPSS, and the results were presented in tabular and textual form. The mean blood glucose level before carrot juice administration was 221.88 mg/dL, which decreased to 199.88 mg/dL after the intervention, indicating a reduction of 22.0 mg/dL. The findings demonstrate that carrot juice consumption significantly reduces blood glucose levels among individuals with diabetes mellitus in the Piyeung Health Center area ($p < 0.05$).

Keywords: Carrot juice, blood glucose, diabetes mellitus, Daucus carota L., glycemic control

Introduction

Degenerative diseases are chronic conditions that can significantly affect an individual's quality of life. The prevalence of these diseases continues to rise due to changes in physical activity, lifestyle, and dietary patterns. Degenerative diseases contribute to high morbidity and mortality rates, thereby decreasing individual productivity. One of the most prevalent degenerative diseases is diabetes mellitus (Wardani & Umayya, 2023). Diabetes mellitus is a chronic metabolic disorder caused by the pancreas' inability to produce sufficient insulin or the body's inability to effectively utilize the insulin produced, resulting in increased blood glucose levels (hyperglycemia) (Nissa & Fitriani, 2018).

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According to the World Health Organization (WHO), the global prevalence of diabetes is 8.5%, with an estimated 422 million people affected worldwide. In Indonesia, the Basic Health Research (Riskesdas, 2018) reported a diabetes prevalence of 8.5%, an increase from 1.5% in 2013. However, only 25% of individuals with diabetes in Indonesia are aware of their condition (Sagita et al., 2020). Data from the Aceh Provincial Health Office (2023) indicate that the number of diabetes mellitus cases reached 154,889, with the highest prevalence found in South Aceh (21,514 cases), followed by Aceh Besar (17,277 cases) and Aceh Tamiang (16,781 cases). At the Piyeung Community Health Center, Montasik Subdistrict, Aceh Besar Regency, the number of diabetes cases recorded in 2023 was 102. The increasing prevalence of diabetes requires immediate intervention through appropriate treatment and management.

Diabetes management generally involves four key components: education, nutritional therapy, physical activity, and pharmacological therapy. Among these, nutritional therapy (non-pharmacological) is widely utilized due to its relatively lower side effects compared to pharmacological treatment (Setiawan, 2019). This study focuses on non-pharmacological management through the application of healthy and nutritionally balanced dietary patterns, specifically the consumption of carrot juice (Milviniva, 2023).

Carrots are among the most widely consumed vegetables due to their palatability and easy availability. *Daucus carota* L. (carrot) is a low-calorie, high-fiber vegetable that is particularly beneficial for individuals with diabetes mellitus. The high fiber content of carrots helps slow glucose absorption in the small intestine and enhances satiety, thereby reducing the risk of hyperglycemia (Bayhakki & Khairunnisa, 2017). Carrots are also known for their strong antioxidant activity. Antioxidants are compounds that inhibit reactive oxygen species (ROS) and free radicals, thereby preventing oxidative stress–related diseases such as cancer, atherosclerosis, and diabetes mellitus. Carrots contain nutritional antioxidants such as vitamins C and E (Hartati et al., 2023).

Vitamin C enhances insulin sensitivity and helps maintain β-cell mass, thereby supporting insulin production. Meanwhile, vitamin E reduces oxidative stress, preventing increases in blood glucose levels (Purwaningtyastuti et al., 2016). Carrots are also rich in carotenoids, including lycopene (a non provitamin A compound) and β-carotene (a provitamin A compound), both of which have antidiabetic properties (Rahayuningsih, 2016). Lycopene protects pancreatic function by reducing oxidative stress and preventing β-cell damage, thereby improving insulin secretion and glucose tolerance (Yusharman, 2008; Dwi, 2020). β-carotene, as a precursor of vitamin A, acts as a hypoglycemic agent through free radical inhibition and suppression of lipid peroxidation, thus minimizing diabetes complications (Soviana et al., 2014). Additionally, carrots contain flavonoids, potent antioxidants that protect β-pancreatic cells, enhance insulin sensitivity, and reduce ROS by donating hydrogen atoms to stabilize free radicals (Dwi, 2020).

Given the relatively high prevalence of diabetes mellitus in the Piyeung Health Center area, Montasik Subdistrict, Aceh Besar Regency, and the potential antidiabetic benefits of carrot juice, this study aims to investigate the effect of carrot juice consumption on blood glucose levels among individuals with diabetes mellitus in this region.

Methods

This study employed a quantitative approach using a quasi-experimental design with a pre-test–post-test control group design to determine the effect of carrot juice consumption on blood

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glucose levels among patients with diabetes mellitus in the Piyeung Health Center area, Montasik Subdistrict, Aceh Besar Regency. Participants were divided into two groups: a treatment group and a control group. The treatment group received carrot juice, while the control group received only mineral water. The study was conducted in November 2024 at the Piyeung Health Center, Montasik Subdistrict, Aceh Besar Regency. A purposive sampling technique was used to select 32 individuals diagnosed with diabetes mellitus.

The research procedure began with baseline measurement of blood glucose levels prior to the intervention. Participants in the treatment group were then given 200 mL of carrot juice prepared from 400 g of fresh carrots, while participants in the control group were given 200 mL of mineral water. The intervention was administered daily at 10:00 a.m. for seven consecutive days. A five-minute observation period was conducted to ensure that participants consumed the provided beverage, both in the treatment and control groups. The post-test measurement of blood glucose levels was carried out on day eight by the health center team, assisted by the research team.Data were analyzed using paired t-tests to assess within-group differences and independent t-tests to compare between-group differences. The results were presented in both tabular and descriptive form.

Result

Mean values of blood glucose levels before and after in the treatment and control groups

Table 1. Mean values of blood glucose levels before and after in the treatment and control groups

Blood Glucose (mg/dL)	Groups							
	Intervention				Control			
	Min	Max	Mean	SD	Min	Max	Mean	SD
Before	154	290	221,88	41,993	151	294	216.81	50,004
After	143	283	199.88	38,283	151	304	227,94	48,950

Based on the table above, it can be seen that the average value of blood glucose levels in the treatment group before being given carrot juice was 221.88 mg/dl, and blood glucose levels after being given carrot juice in the treatment group amounted to 199.88 mg/dl. Meanwhile, the average value of blood glucose levels in the control group that was only given mineral water was 216.81 mg/dl before and after 227.94 mg/dl.

Effect of carrot juice administration on blood glucose levels in the treatment and control groups in people with Diabetes Mellitus

Table 2. Dependent T-Test Results

Variable	N	Mean	Mean Difference	t value	Asymp. Sig. (2-tailed)
Blood Glucose Pre intervention groups	16	221.88	- 22.000	5.083	0,0001
Blood Glucose Post intervention groups	16	199.88			
Blood Glucose Pre control groups	16	216.81	+ 11,13	1.201	0,248
Blood Glucose Post control groups	16	227.94			

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Based on the results presented in the table above, the paired-samples *t-test* conducted to examine the effect of carrot juice consumption among patients with diabetes mellitus in the Piyeung Health Center area, Montasik Subdistrict, Aceh Besar Regency, showed a significant value of 0.0001 ($p < 0.05$) in the treatment group. This finding indicates that carrot juice consumption had a statistically significant effect on reducing blood glucose levels among individuals with diabetes mellitus.

The mean blood glucose level before the intervention was higher than after the intervention, showing a reduction of 22.0 mg/dL. Therefore, the null hypothesis (H_0) was rejected, confirming the effectiveness of carrot juice in lowering blood glucose levels.

In contrast, the paired-samples *t*-test for the control group yielded a significance value of 0.248 ($p > 0.05$), indicating no significant difference in blood glucose levels before and after the study. This outcome is consistent with the fact that the control group did not receive carrot juice during the intervention period.

Differences in the Effect of Giving Carrot Juice on Blood Glucose Levels in People with Diabetes Mellitus in the Piyeung Health Center Working Area

Table 3. Independent T-Test Results

Variable	n	Mean	Mean Difference	t value	Asymp. Sig. (2tailed)
Blood Glucose Post intervention groups	16	199.88	-28.062	-1.806	0,081
Blood Glucose Post control groups	16	227.94			

Based on the table above, it shows that the significance value of the t-Independent samples Test to determine the difference in Blood Glucose between groups in patients with Diabetes Mellitus in the working area of the Piyeung Health Center, Montasik District, Aceh Besar Regency, obtained a significant value of 0.081 (P>0.05), this indicates that there is no difference in blood glucose levels in the two groups.

Discussion

Based on the results obtained in the working area of the Piyeung Health Center, the majority of respondents in this study were female, comprising 25 participants (78%), while 7 participants (21%) were male. According to Irawan (2010), women are more susceptible to diabetes mellitus because they have a higher likelihood of increased body mass index due to physiological and hormonal factors. The majority of respondents had an elementary school education, accounting for 62.4% in the treatment group and 50.0% in the control group. A low level of education often results in limited knowledge regarding diabetes mellitus (DM), leading to poor awareness of proper diabetes management and the importance of controlling blood glucose levels. Consequently, individuals with lower education levels may pay less attention to lifestyle behaviors that help maintain glycemic stability and prevent DM-related complications.

Education is a key determinant of health behavior. A higher educational background contributes to more mature decision-making, better comprehension of health information, and a greater likelihood of adopting preventive measures. Individuals with higher education tend to have a lower risk of diabetes due to their enhanced understanding of risk factors and their ability to manage them effectively (Ramadhani & Khotami, 2023).

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In terms of occupation, most respondents were housewives. Employment type can influence health risk through several mechanisms: (1) occupational exposure to harmful substances; (2) psychological stress that triggers metabolic disorders; and (3) insufficient physical activity leading to obesity. Lack of physical activity is a significant contributor to insulin resistance, one of the main causes of diabetes mellitus (Tarigan, 2022).

Age was another important factor observed in this study, with the majority of respondents being over 46 years old. Aging is associated with physiological changes and declining organ function, which can impair glucose metabolism and insulin regulation. Individuals aged 45 years and above are at a higher risk of developing diabetes mellitus compared to younger individuals (Ekasari & Dhanny, 2022).

Body mass index (BMI) also plays a crucial role. In this study, 43% of respondents in the treatment group and 50% in the control group were classified as obese (BMI ≥ 25). According to Almatsier (2009), obesity occurs when caloric intake exceeds energy expenditure, resulting in excess fat accumulation. Obesity increases free fatty acid levels, which can inhibit glucose utilization in muscles and induce insulin resistance (McRight, 2008).

The study found that the mean blood glucose level in the treatment group before the intervention was 221.88 mg/dL, and after consuming carrot juice for seven consecutive days, the mean value decreased to 199.88 mg/dL—a reduction of 22.0 mg/dL. Statistical analysis using the paired-samples t-test showed a significant value of 0.0001 ($p < 0.05$) at a 95% confidence level, indicating a significant decrease in blood glucose levels after carrot juice consumption. Conversely, the control group showed no significant change, with a p-value of 0.248 ($p > 0.05$). These findings confirm that carrot juice effectively reduces blood glucose levels among individuals with diabetes mellitus.

The observed hypoglycemic effect is attributed to the bioactive compounds in carrots, including β-carotene, lycopene, flavonoids, and vitamins C and E, which act as potent antioxidants. These compounds protect pancreatic β-cells from oxidative stress, enhance insulin secretion, and improve insulin sensitivity. Additionally, the high fiber content in carrots slows glucose absorption in the small intestine, thereby helping to control postprandial blood glucose levels (Bayhakki & Khairunnisa, 2017).

The results of this study are consistent with previous research by Suharti et al. (2011), who found that carrot extract significantly reduced blood glucose levels in female white mice at a dose of 0.52 g/20 g body weight, achieving a 35.79% reduction. Similarly, Yohanes Nugroho (2020) reported that administration of carrot extract at a dose of 8.92 g/kg body weight for 14 days reduced blood glucose levels in male mice to 128.6 mg/dL.

Carrots (Daucus carota L.) are rich in carotenoids such as β-carotene and lycopene, both of which exhibit strong antioxidant properties. Lycopene, in particular, has an antioxidant capacity twice that of β-carotene and ten times that of α-carotene, and it is estimated to be 100 times more effective in neutralizing free radicals than vitamin E or 12,500 times more effective than glutathione. These antioxidant effects help prevent cellular damage, improve pancreatic function, and support glycemic control. Furthermore, the use of carrot juice as a complementary herbal therapy offers advantages over pharmacological interventions, which often cause side effects such as hypoglycemia, weight gain, hepatotoxicity, or lactic acidosis (Chaidir et al., 2017).

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As an easily available and cost-effective natural resource, carrot juice represents a promising dietary approach for managing blood glucose levels in individuals with diabetes mellitus. However, this study has several limitations, including its short intervention duration and relatively small sample size, which may limit the generalizability of the findings. Future research should involve larger populations, longer intervention periods, and biochemical measurements of oxidative stress markers to better understand the mechanisms and long-term benefits of carrot juice in glycemic control.

Conclusion

This study found that although there was a 22.0 mg/dL reduction in mean blood glucose levels in patients with diabetes mellitus who consumed carrot juice after seven days, the difference between the treatment and control groups was not statistically significant ($p > 0.05$). This suggests that carrot juice exhibits a potential trend in lowering blood glucose levels, but the effect was not strong enough to be statistically confirmed given the short intervention period and limited sample size. The observed reduction may be due to the presence of antioxidants, β-carotene, flavonoids, and vitamins C and E in carrots, which are known to help protect pancreatic β-cells and improve glucose metabolism. However, further research is needed to validate these findings.

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