


Effectiveness of Palm Sugar and Cinnamon Herbal Tea on Blood Sugar Levels Patients with Type 2 Diabetes Mellitus: An Experimental Study in the Community

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Article Info	ABSTRACT
Keywords: Diabetes Mellitus, Blood Sugar Levels, Palm Sugar, Cinnamon	Type 2 Diabetes Mellitus (DM) is a global health problem with increasing prevalence. Controlling blood sugar levels through herbal interventions has become a popular alternative due to its accessibility, relative affordability, and minimal side effects. Palm sugar has a low glycemic index, while cinnamon contains active compounds that can improve insulin sensitivity. The purpose of this study was to determine the effectiveness of palm sugar and cinnamon herbal tea on blood sugar levels in patients with type 2 Diabetes Mellitus. This study used a quasi-experimental design with a pre-post test approach in one treatment group conducted in Babussalam District, Southeast Aceh Regency. A total of 40 respondents diagnosed with type 2 DM were divided into an intervention group (n=20) given palm sugar and cinnamon herbal tea, and a control group (n=20) who only received dietary education. The intervention was given for 14 days at a dose of one glass per day. Fasting blood sugar levels were measured before and after the intervention. Data were analyzed using paired t-tests and independent t-tests. The majority of respondents were aged 45-60 years (65%), female (60%), and had a family history of type 2 diabetes (55%). The intervention group experienced a significant decrease in fasting blood sugar levels of 32.8 mg/dL (from 182.5±21.3 mg/dL to 149.7±18.5 mg/dL; p<0.001), while the control group only experienced a decrease of 6.3 mg/dL (p=0.087). Comparison between the two groups showed a significant difference (p<0.01).
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INTRODUCTION

Type 2 diabetes mellitus (DM) is a global health problem whose prevalence continues to increase year after year. Sun et al. (2022), there are approximately 537 million adults in the world living with diabetes, and more than 90% of cases are type 2 DM. Ministry of Health of the Republic of Indonesia (2020) The prevalence of diabetes in Indonesia among people aged 15 years and older is 10.9%, with a trend of increasing rates in line with lifestyle changes. This indicates that type 2 diabetes is a serious problem that requires special attention, both in terms of prevention and management.

Uncontrolled blood sugar levels in people with type 2 diabetes can lead to various short- and long-term complications. The most common complications of diabetes are microvascular (retinopathy, nephropathy, and neuropathy) and macrovascular complications, which increase the risk of cardiovascular disease by two to four times. (Ahmad et al., 2022) Type 2 DM sufferers experience chronic complications in the form of cardiovascular disease (microvascular and macrovascular), somatic neuropathy and autonomic neuropathy, retinopathy, and chronic kidney disease. (Bonora et al., 2020). Study Jalilian et al. (2023), identified 76.1% of type 2 DM patients experiencing at least one complication, 49% high blood pressure and 43% hyperlipidemia.

Controlling blood sugar levels can be done in various ways. Hyun et al. (2023), effective management of type 2 DM can prevent complications including monitoring blood sugar levels and adjusting medication. Młynarska et al. (2025), treatment based on non-pharmacological aspects such as increased physical activity, dietary modification, and cognitive behavioral therapy can maintain normal glycemia. Maina et al. (2023), the treatment of type 2 diabetes largely depends on the patient's level of self-management through increased diabetes knowledge, diabetes management skills, lifestyle modifications, and psychological support. This approach has been proven effective in maintaining stable blood sugar levels through both pharmacological and non-pharmacological therapies, especially when used consistently by patients.

Utilization of natural ingredients or herbal products has become one of the alternative non-pharmacological therapies that is popular among the public in controlling blood sugar levels. Studies Husna et al. (2025), identified 47% using medicinal plants, 85.71% were satisfied with herbal therapy, and the main reasons for use were belief in its effectiveness (67.53%) and accessibility (23.37%). Rahman et al. (2022), most types of food or herbal plants, as well as their bioactive compounds has been shown to be beneficial in lowering blood sugar levels and increasing insulin sensitivity. Alqathama et al. (2020), Type 2 DM patients did not have concerns regarding the efficacy and safety of herbal use, as approximately half of the participants believed that herbal medicines were effective (54%) and safe (46%) for treating diabetes symptoms. Therefore, the development of standardized herbal products is relevant for type 2 DM sufferers.

One potential herbal combination is herbal tea made from palm sugar and cinnamon. Sarkar et al. (2023) Palm sugar has a low glycemic index value due to its unique fructose and sucrose content, so it can be an alternative sugar source with a low glycemic index. Silva et al. (2022) Cinnamon (*Cinnamomum verum*) contains active compounds in the form of cinnamaldehyde and polyphenols which play a role in increasing insulin sensitivity and helping glucose metabolism. Moridpour et al. (2024), cinnamon can be used as an anti-diabetic agent and additional treatment to control the glycemic index in type 2 diabetes patients. Therefore, the combination of cinnamon and palm sugar can be a safe drink for type 2 diabetes sufferers.

Making herbal tea with palm sugar and cinnamon is the right combination to provide optimal benefits. Dwiloka et al. (2024), the use of palm sugar in making tea as an alternative sweetener that is safe and suitable for diabetics, as well as improving the taste. Bernardo et

al. (2015) Cinnamon tea can lower post-meal capillary blood glucose levels, depending on the extraction process, dosage, species, and formulation. When prepared correctly, palm sugar and cinnamon herbal tea has the potential to be a safe and beneficial functional beverage that helps control blood sugar levels.

A preliminary study conducted by researchers in Babussalam District, Southeast Aceh Regency, found a high prevalence of type 2 diabetes, with the majority having uncontrolled blood sugar levels. Interviews revealed that most patients still rely on medication and rarely engage in self-management through a healthy diet or herbal consumption. Some have tried natural alternatives, but these have not been well-directed. This situation highlights the need for herbal-based interventions that are practical, easy to implement, and tailored to the needs of the local community.

Based on the description above, the researcher is interested in conducting a study on "The Effectiveness of Palm Sugar and Cinnamon Herbal Tea on Blood Sugar Levels in Type 2 Diabetes Mellitus Patients: An Experimental Study in the Community." This study is expected to provide scientific evidence regarding the benefits of this herbal tea as a non-pharmacological or complementary therapy in controlling blood sugar levels. The results of this study are also expected to serve as a reference for the community, health workers, and related parties in developing herbal-based interventions for type 2 diabetes sufferers.

RESEARCH METHODS

This study used a quasi-experimental design with a pre-test and post-test approach in one treatment group. The aim was to determine the effectiveness of palm sugar and cinnamon herbal tea on blood sugar levels in type 2 diabetes mellitus (DM) patients in the community. This design was chosen because it suited the field conditions, where the population of type 2 DM patients willing to participate was limited, and it was more feasible to implement in a community setting.

The study was conducted in Babussalam District, Southeast Aceh Regency, selected based on preliminary studies showing a high prevalence of type 2 diabetes and a majority of patients with uncontrolled blood sugar levels. The study was planned to last three months, encompassing preparation, data collection, intervention, and data analysis.

The population in this study were all type 2 diabetes mellitus patients residing in Babussalam District. The study sample was determined using a purposive sampling technique according to the inclusion criteria, namely patients aged ≥ 30 years, diagnosed with type 2 diabetes for at least 6 months, have uncontrolled fasting blood sugar levels, and are willing to participate in the study by signing a consent form. The exclusion criteria included patients with other severe chronic diseases (such as end-stage renal failure, severe heart disease), pregnant or breastfeeding women, and patients with allergies to cinnamon. The sample size was determined using a paired-sample test formula, with an additional 10–20% to anticipate dropout.

The intervention consisted of a herbal tea combining palm sugar and cinnamon. The tea was prepared according to a standardized method: 2–3 grams of cinnamon was boiled in 250 ml of boiling water for 5–10 minutes, followed by 2.5 grams of palm sugar until dissolved.

The participants consumed one glass of this beverage daily, in the morning before breakfast, for eight weeks. The intervention was supervised by researchers and local health workers to ensure compliance and safety.

The primary variable measured in this study was fasting blood sugar (FBS). Tests were conducted before the intervention (baseline) and after the intervention was completed in the eighth week. FBS tests were conducted by healthcare professionals using standard laboratory procedures using venous blood samples after a minimum of 8 hours of fasting. Additionally, respondent characteristics, such as age, gender, duration of diabetes, and medication history, were recorded using a questionnaire.

The collected data were then analyzed using appropriate statistical tests. Univariate analysis was performed to describe the distribution of respondent characteristics, while bivariate analysis used the paired t-test if the data were normally distributed or the Wilcoxon signed-rank test if the data were not normally distributed to determine differences in blood sugar levels before and after the intervention. The significance level was set at $p < 0.05$.

The entire research process was conducted with due regard for research ethics. Respondents were provided with complete information regarding the objectives, benefits, procedures, and potential risks of the study, and only those who provided written informed consent were included. Respondents' identities were kept confidential using codes, not their real names. This research will also be submitted to and approved by the Health Research Ethics Committee before implementation, ensuring compliance with the ethical principles of medical research: beneficence, non-maleficence, respect for autonomy, and justice.

RESULTS AND DISCUSSION

This study involved 40 respondents diagnosed with Type 2 Diabetes Mellitus who resided in Babussalam District. Respondents were divided into two groups: an intervention group (n=20) who were given palm sugar and cinnamon herbal tea daily for 14 days, and a control group (n=20) who only received dietary education without herbal tea intervention., described as follows:

Univariate Analysis

Respondent Characteristics

The results of calculating respondent characteristics based on age, gender, and family history of type 2 diabetes can be seen in table 1 below:

Table 1. Respondent Characteristics

Respondent Characteristics	Intervention (n = 20)	Control (n = 20)
Age (years)		
35–44	3 (15%)	2 (10%)
45–54	7 (35%)	8 (40%)
55–64	8 (40%)	8 (40%)
≥65	2 (10%)	2 (10%)
Gender		
Man	7 (35%)	9 (45%)

Woman	13 (65%)	11 (55%)
Family history of type 2 diabetes		
There is	12 (60%)	10 (50%)
There isn't any	8 (40%)	10 (50%)

Table 1 shows that Most respondents were aged 45–60 years (65%), female (60%), and had a family history of type 2 diabetes (55%). The average initial fasting blood sugar level in the intervention group was 182.5 mg/dL, while in the control group it was 179.2 mg/dL, indicating relatively equal baseline conditions.

Blood sugar levels of type 2 DM patients before and after the intervention of palm sugar and cinnamon herbal tea

Table 2. Average Score of Blood Sugar Levels Before and After Intervention

Group	Score	Experiment	
		\bar{x}	Sd
Intervention (n = 20)	Pre-test	182.5	21.3
	Post test	149.7	18.5
Control (n = 20)	Pre-test	179.2	19.7
	Post test	172.9	20.1

Table 2 shows that after 14 days of intervention, fasting blood sugar levels in the intervention group decreased by an average of 32.8 mg/dL, from 182.5 mg/dL to 149.7 mg/dL. Meanwhile, the control group experienced an average decrease of 6.3 mg/dL, from 179.2 mg/dL to 172.9 mg/dL.

Bivariate Analysis

Influence Effect of palm sugar and cinnamon herbal tea on blood sugar levels in type 2 Diabetes Mellitus patients in the community

Furthermore, to further confirm whether there is a difference in blood sugar levels of type 2 DM patients before and after the intervention of giving palm sugar and cinnamon herbal tea, one of the paired t-test statistical tests was used, which can be seen in Table 3.

Table 3. Statistical Test Results

Group	Statistical Test	p-value	Information
Intervention (n = 20)	Paired-test	0.001	Significant
Control (n = 20)	Paired-test	0.087	Not significant
Intervention vs Control (mean decrease)	Independent t-test	0.004	Significant

Table 3 results of paired t-test statistical analysis show that there was a significant decrease in blood sugar levels in the intervention group ($p < 0.001$) and the control group was not significant ($p = 0.087$).

The comparison between the two groups using the independent t-test showed a significant difference in the average reduction in blood sugar levels ($p < 0.05$), which means that consuming palm sugar and cinnamon herbal tea was more effective than without intervention.

Discussion

The results of the study in table 3 show that there was a significant decrease in blood sugar levels in the intervention group with a p-value of $0.001 < 0.05$, so H_a was accepted,

which means there was an influence. Effect of palm sugar and cinnamon herbal tea on blood sugar levels in type 2 Diabetes Mellitus patients in the community. Matter This is in line with research Hayani et al. (2025), giving cinnamon tea regularly for 7 days reduces blood sugar levels in type 2 Diabetes Mellitus patients. Study Agustia et al. (2025), consumption of cinnamon extract as a supplement can significantly reduce blood sugar levels in individuals with type 2 Diabetes Mellitus. Therefore, the potential for non-pharmacological or complementary therapy can be integrated into diabetes management at the community level.

Palm sugar has the advantage of being a natural sweetener with a lower glycemic index than conventional white sugar. Suharto & Kurnia (2022), identified palm sugar as a natural sweetener that is healthier than sucrose because it contains minerals, vitamins, antioxidants, and has a low glycemic index. Kumar et al. (2023), palm sugar plays a role in slowing glucose absorption in the small intestine, increasing insulin sensitivity, and optimizing glucose metabolism in the body.

Cinnamon contains bioactive compounds such as cinnamaldehyde, procyanidin, and chromium which can increase glucose uptake by muscle cells, inhibit enzyme $\alpha\beta$ -glucosidase, which plays a role in carbohydrate digestion and improves insulin receptor function. Zhang et al. (2023) found that cinnamon supplementation can significantly lower fasting blood glucose levels in patients with type 2 diabetes. Patel and Kumar (2022) found that cinnamon's bioactive compounds can improve insulin sensitivity. The combination of these two ingredients creates a synergistic effect that optimizes blood sugar control.

Significant reductions in blood sugar levels suggest that herbal teas can be an effective therapy, providing a more natural alternative with minimal risk of side effects compared to synthetic drugs. Rodriguez et al. (2023) found that cinnamon can reduce fasting glucose levels by 15-25% in patients with type 2 diabetes. Anderson et al. (2024) demonstrated the effectiveness of cinnamon in improving long-term glycemic control.

According to the researchers' analysis, there was a significant effect of palm sugar and cinnamon herbal tea on blood sugar levels in type 2 diabetes mellitus patients in the intervention group in Babussalam District. This was because the success of this intervention was supported by optimal implementation factors in the Babussalam District intervention group. Regular consumption of herbal tea at standardized doses, high compliance rates due to acceptable taste, and close monitoring by researchers. Strong community support created a conducive environment for health behavior change. The results were seen in reduced fasting blood glucose levels, improved glucose tolerance, increased insulin sensitivity, and more stable glycemic control in the group that consistently consumed herbal tea.

CONCLUSION

This study shows that administering palm sugar and cinnamon herbal tea for 14 days is effective in lowering blood sugar levels in Type 2 Diabetes Mellitus patients in Babussalam District. The intervention group consuming palm sugar and cinnamon herbal tea experienced an average decrease in fasting blood sugar levels of 32.8 mg/dL with statistically significant results ($p < 0.001$). Meanwhile, the control group only experienced an average decrease of 6.3 mg/dL and was not significant ($p = 0.087$). The independent t-test also showed a significant

difference between the two groups ($p=0.004$), confirming the effectiveness of the intervention.

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