



Application of Moringa Oleifera Lam Leaf Decoction as a Complementary Therapy for Reducing Blood Glucose Levels in Patients with Type 2 Diabetes Mellitus: A Case Study

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Received:
Revised:
Accepted:
Published:

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DOI:

<https://doi.org/10.63404/juka.v10i6.280>

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Abstract: Diabetes mellitus (DM) is a chronic metabolic disease characterized by hyperglycemia due to impaired insulin secretion or function. The increasing prevalence of DM encourages the use of herbal-based complementary therapies as an effort to control blood glucose levels. One plant that has the potential to be used is the Moringa oleifera lam. leaf, which contains flavonoids, alkaloids, saponins, and tannins known to play a role in increasing insulin sensitivity and inhibiting glucose absorption. This study aims to describe the application of Moringa leaf decoction in reducing blood glucose levels in type 2 DM patients in Lamie Village, Darul Makmur District, Nagan Raya Regency. The study used a descriptive method with a case study approach on two type 2 DM patients in November 2025. The intervention was given 200 ml of Moringa leaf decoction made from 300 g of fresh Moringa leaves boiled in 450 ml of water, given once daily before meals for four consecutive days. Blood glucose levels were measured daily using a glucometer. The results showed that Respondent 1's blood glucose levels decreased from 312 mg/dL to 238 mg/dL (23.7%), while Respondent 2's decreased from 298 mg/dL to 229 mg/dL (23.2%). Furthermore, both patients reported reduced symptoms of polyuria, polydipsia, and fatigue. Therefore, Moringa leaf decoction has the potential to help lower blood glucose levels in patients with type 2 diabetes and can be used as a safe, readily available, and affordable complementary therapy to support diabetes management.

Keywords: Diabetes Mellitus, Moringa Oleifera Lam, Blood Glucose, Complementary Therapy

Introduction

Diabetes Mellitus (DM) is a chronic health disorder characterized by elevated blood glucose levels (hyperglycemia) due to impaired insulin secretion, insulin action, or both (Ischak et al., 2024; Faswita, 2024). The prevalence of DM tends to increase with age, with the elderly being the most vulnerable due to their high

sensitivity to carbohydrate metabolism disorders (Putri, 2018). The main causes of DM include an unhealthy lifestyle, lack of physical activity, excessive consumption of sweet foods, and hereditary factors (Black & Hawks, 2019).

Globally, diabetes cases increased by 81.8% to 19.47 million sufferers according to WHO data in 2021,

How to Cite:

Rahmi, A., Adilla, V., Alfiandi, A., & Saputra, F. (2026). Application of Moringa Oleifera Lam Leaf Decoction as a Complementary Therapy for Reducing Blood Glucose Levels in Patients with Type 2 Diabetes Mellitus: A Case Study. *Akimba Nursing Journal*, 10(6), 90-97. <https://doi.org/10.63404/juka.v10i6.280>

with Indonesia ranking sixth in the world (Ministry of Health of the Republic of Indonesia, 2021). In Aceh Province, 2024 data shows an increasing trend in DM cases from 575 cases in 2023 to 701 cases in 2024, with the majority of sufferers being female (415 people) compared to male (286 people). Based on data obtained in Gampong Lamie, Darul Makmur District, Nagan Raya Regency, there were 150 residents diagnosed with DM in the last three months, consisting of 52 men and 98 women.

Uncontrolled diabetes can lead to acute complications such as hyperglycemia, hyperglycemia syndrome, and hypoglycemia, as well as chronic complications in the form of macrovascular complications (coronary heart disease, cerebrovascular disease, hypertension, peripheral vascular disease, and infection) and microvascular complications (retinopathy, nephropathy, foot ulcers, sensory neuropathy, and autonomic neuropathy) (Black & Hawks, 2019). These complications occur due to uncontrolled blood sugar levels over the long term.

DM management involves two approaches: pharmacological and non-pharmacological. Pharmacological therapy uses blood sugar-lowering medications such as sulfonylureas, metformin, thiazolidinediones, alpha-glucosidase inhibitors, DPP-4 inhibitors, SGLT-2 inhibitors, and insulin. Non-pharmacological therapy includes a healthy and balanced diet, maintaining an ideal body weight, regular exercise, and the use of herbal remedies such as boiled moringa leaves (Indra Sari, 2017; PERKENI, 2021).

Moringa leaves (*Moringa oleifera* Lam.) are one of the plants that have been used by people in traditional medicine. The active compounds in moringa leaves include moringin alkaloids, saponins, polyphenols, flavonoids, tannins, and essential oils that play a role in lowering blood glucose levels by increasing insulin sensitivity and inhibiting glucose absorption (Dewiyati & Hidayat, 2015; Nugraha, 2013). Previous research by Syamra Indrawati and Warsyidah (2018) showed that giving 150 ml of boiled moringa leaves daily for 3-4 days effectively reduced blood glucose levels in people with diabetes. Similarly, research by Indra Sari (2017) proved that boiled moringa leaves can be used as a non-pharmacological support therapy in controlling blood sugar.

Despite growing scientific evidence on the antihyperglycemic effects of moringa leaves, research specifically conducted in the community of Gampong Lamie, Darul Makmur District, Nagan Raya Regency remains very limited. Interviews with three local residents revealed that many diabetes sufferers in the area have not yet optimally implemented non-pharmacological therapies. The majority of residents still rely on pharmacological medications without utilizing readily available and affordable herbal plants

such as moringa leaves. Furthermore, community knowledge regarding the processing and use of moringa leaves as a supportive therapy for diabetes remains inadequate. This gap in knowledge and practice, combined with the high prevalence of diabetes and limited access to health services in the area, necessitates further research into the effectiveness of moringa leaf decoction as an accessible, affordable, and culturally acceptable intervention for the local community.

Therefore, this study aims to describe the application of Moringa leaf decoction in reducing blood glucose levels in Diabetes Mellitus patients in Gampong Lamie, Darul Makmur District, Nagan Raya Regency through a case study approach, by assessing changes in blood glucose levels before and after the intervention of administering Moringa leaf decoction for 4 consecutive days.

Method

This research uses a descriptive method with a case study approach to illustrate the application of Moringa leaf decoction in lowering blood glucose levels in patients with diabetes mellitus. The case study design was chosen to provide an in-depth overview of the intervention's effects on individual subjects in a real-world community setting.

The subjects of the study were two Diabetes Mellitus patients in Gampong Lamie, Darul Makmur District, Nagan Raya Regency. Inclusion criteria included: patients with elevated blood glucose levels (>200 mg/dL), type II DM patients who were willing to be respondents and cooperative, patients with compos mentis awareness, patients aged 46-55 years, and not consuming drugs or other non-pharmacological therapies during the study period. Subject I was Mrs. S, a 52-year-old woman, with an initial blood glucose level of 312 mg/dL. Subject II was Mr. M, a 54-year-old man, with an initial blood glucose level of 298 mg/dL.

The focus of this case study is the application of Moringa leaf decoction in reducing blood glucose levels in Diabetes Mellitus patients in Gampong Lamie, Darul Makmur District, Nagan Raya Regency. The operational definition is set as follows: Moringa leaves are one of the traditional treatment methods to overcome diabetes mellitus because they contain alkaloids, saponins, and other chemical compounds that are proven to be able to reduce blood sugar levels; Blood sugar levels are the amount of glucose circulating in the blood which is influenced by various enzymes and hormones, especially the hormone insulin; Diabetes mellitus is a metabolic disorder characterized by increased blood sugar due to decreased insulin secretion by pancreatic beta cells or impaired insulin function (insulin resistance).

The instruments used include informed consent sheets, assessment sheets, standard operating

procedures for making Moringa leaf decoction, observation sheets, glucometers, glyco test strips, alcohol swabs, bent, tensiometers, and stethoscopes. Data were collected through interviews and observations for 4 consecutive days (November 1-5, 2025) with the following procedures: processing research permits from Akper Kesdam Iskandar Muda Banda Aceh and Gampong Lamie, identifying research subjects who meet the inclusion criteria, providing informed consent to the subjects, conducting initial assessments of the subjects, identifying problems and preparing plans, explaining the purpose of the action, measuring initial blood glucose levels using a glucometer, administering 1 glass (200 ml) of Moringa leaf decoction once a day before meals for 4 consecutive days, measuring final blood glucose levels after 4 days of application, and conducting data assessments.

The method of making Moringa leaf decoction is to prepare 300 mg of fresh Moringa leaves which are washed clean, then boiled in 450 ml of water (3 cups) for 15 minutes until the boiled water becomes 150-200 ml (1 cup), then filtered and waited a few minutes until warm before being given to the subject (Syamra Indrawati & Warsyidah, 2018). The data were analyzed descriptively and presented in narrative and tabular form to describe changes in blood glucose levels before and after administration of Moringa leaf decoction during the intervention period.

Results and Discussion

This research was conducted in Lamie Village, Darul Makmur District, Nagan Raya Regency for 4 days from November 1 to 5, 2025. Based on data obtained from village officials and local health workers, there were approximately 150 diabetes mellitus sufferers recorded in the last three months, consisting of 52 men and 98 women. The people of Lamie Village generally have a habit of consuming foods and drinks high in sugar and lack of regular physical activity, which contributes to the high prevalence of DM in this area. In addition to lifestyle factors, hereditary factors also play an important role in increasing the number of diabetes mellitus sufferers in Lamie Village. The geographical condition of Lamie Village is quite strategic and easily accessible to health workers allows access to health services, but public awareness to utilize health facilities preventively is still relatively low. This is evident from the fact that many people still only come for treatment when they already experience severe complaints or complications.

Two subjects were selected based on the predetermined inclusion criteria for this case study. Subject I was Mrs. S, a 52-year-old woman with a history of diabetes mellitus for approximately 5 years. Her initial blood glucose level at the time of assessment was 312 mg/dL. Subject I reported frequent thirst, fatigue,

frequent urination, especially at night, and occasional tingling in both feet. Subject I still did not limit the consumption of sweet foods and drinks and did not engage in regular physical activity. Subject I also admitted to having a family history of diabetes mellitus, namely her mother who also suffered from the same disease. During her DM, Subject I only relied on medicines from the community health center without adequate dietary management and without utilizing herbal plants as supportive therapy.

Subject II is Mrs. A, a 54-year-old woman with a history of diabetes mellitus for approximately 4 years. Her initial blood glucose level was 298 mg/dL. Subject II reported frequently feeling tired quickly at work, frequent hunger, frequent urination, and occasional blurred vision. Subject II had not fully implemented the recommended diet for diabetes mellitus sufferers and still frequently consumed sweet foods and carbonated drinks. Subject II also had a family history of diabetes mellitus from her father's side. Subject II stated that she only checked her blood sugar levels when she felt complaints that interfered with her daily activities, and that she had never tried traditional medicine to help control her blood sugar levels.

Table 1. Subject Characteristics

Characteristics	Subject I	Subject II
Age (years)	52	54
Gender	Woman	Woman
Initial Blood Glucose Level (mg/dL)	312	298
DM duration (years)	5	4
Last education	Junior High School	Elementary School
Work	Housewife	Farmer
Main Complaint	Polydipsia, polyuria, fatigue, tingling	Polyphagia, fatigue, polyuria, blurred vision
Family History of DM	Yes (Mom)	Yes (Father)

Both subjects had one thing in common: they both suffered from diabetes mellitus with above-normal blood glucose levels and exhibited classic symptoms of diabetes mellitus, including polyuria, polydipsia, polyphagia, and fatigue. Both subjects also had a family history of diabetes mellitus and unhealthy eating habits. Therefore, both subjects met the criteria for intervention in the form of boiled moringa leaves as a non-pharmacological therapy to help lower blood glucose levels.

The intervention was conducted for 4 consecutive days (November 1-5, 2025). Moringa leaf decoction was made from 300 mg of fresh, washed Moringa leaves, then boiled in 450 ml of water (3 cups) for 15 minutes until the decoction becomes 150-200 ml (1 cup), then filtered and waited for a few minutes until warm before being given to the subjects (Syamra Indrawati & Warsyidah, 2018). The Moringa leaf decoction was given once a day before breakfast. Blood glucose levels were measured daily before administering the Moringa leaf decoction using a calibrated glucometer. The results showed a progressive and consistent decrease in blood glucose levels in both subjects during the intervention period.

Subject I showed a gradual decrease in blood glucose levels from 312 mg/dL on the first day to 238 mg/dL on the fourth day, representing a total decrease of 74 mg/dL. The decrease occurred progressively, with the most significant decrease occurring between the third and fourth days. Subject I also reported improvements in physical condition, including reduced thirst, decreased urination frequency, and a feeling of greater refreshment compared to before. Subject I also stated that he began to feel more energetic for daily activities and did not tire as easily as before.

Table 2. Changes in Blood Glucose Levels of Subject I (Mrs. S) During 4 Days of Moringa Leaf Decoction Intervention

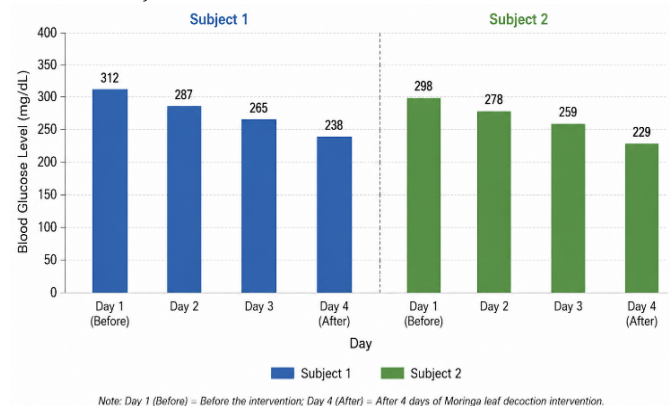
Day	Blood Glucose Level (mg/dL)	Decrease from Day One (mg/dL)
Day 1 (Beginning)	312	-
Day 2	287	25
Day 3	265	47
Day 4	238	74

Subject II showed a decrease in blood glucose levels from 298 mg/dL to 229 mg/dL on the fourth day, representing a total decrease of 69 mg/dL. Similar to Subject I, the decrease occurred progressively from the first to the fourth day. Subject II also reported improvements in physical condition, including reduced fatigue, decreased urination frequency, and greater comfort in performing daily activities. Subject II also stated that the blurred vision he had previously experienced had decreased and he felt more energetic in carrying out daily activities.

Table 3. Changes in Blood Glucose Levels of Subject II (Mrs. A) During 4 Days of Moringa Leaf Decoction Intervention

Day	Blood Glucose Level (mg/dL)	Decrease from Day One (mg/dL)
Day 1 (Beginning)	298	-
Day 2	278	20
Day 3	259	39
Day 4	229	69

Figure 1. Comparison of Blood Glucose Levels of Two Subjects Before and After Intervention



Based on Figure 1, it can be seen that both subjects experienced a decrease in blood glucose levels after being given boiled moringa leaves for 4 days. In Subject I, there was a decrease in blood glucose levels from 312 mg/dL to 238 mg/dL, a decrease of 74 mg/dL. Meanwhile, in Subject II, there was a decrease in blood glucose levels from 298 mg/dL to 229 mg/dL, a decrease of 69 mg/dL. These results indicate that administering boiled moringa leaves can help lower blood glucose levels in both study subjects.

The results of the study showed that giving Moringa leaf decoction once a day for 4 consecutive days effectively reduced blood glucose levels in patients with type 2 diabetes mellitus. The reductions that occurred in both subjects showed clinically significant results, with an average reduction of 71.5 mg/dL. In addition to the reduction in blood glucose levels, both subjects also reported improvements in physical condition in the form of reduced complaints of polyuria, polydipsia, and fatigue, which indicates that the intervention provided not only affected the results of blood glucose level tests, but also the general health condition of the subjects.

Based on the results of the assessment conducted on both subjects, it was found that both subjects experienced increased blood glucose levels as indicated by random blood glucose test results above normal values. In subject I, the random blood glucose level was 312 mg/dL, while in subject II it was 298 mg/dL. In addition, both subjects also experienced symptoms commonly found in diabetes mellitus

sufferers, namely frequent thirst (polydipsia), frequent urination (polyuria), fatigue, and increased hunger (polyphagia). The results of this assessment are in accordance with the theory that states that diabetes mellitus is a metabolic disorder characterized by hyperglycemia due to impaired insulin secretion, insulin action, or both. Prolonged hyperglycemia can cause various clinical manifestations such as polyuria, polydipsia, polyphagia, fatigue, and disorders of carbohydrate, fat, and protein metabolism (Bilous & Donnelly, 2015; Faswita, 2024). In subject I, the dominant complaints were frequent thirst, fatigue, and frequent urination, especially at night. Meanwhile, in Subject II, the dominant complaints were fatigue, frequent hunger, and occasional blurred vision. The differences in the complaints experienced by the two subjects may be influenced by their physical condition, duration of diabetes mellitus, lifestyle, and their respective bodies' ability to respond to increased blood glucose levels.

The blood glucose-lowering effect of Moringa leaf decoction can be attributed to the bioactive compounds found in Moringa leaves. Moringa leaves contain various secondary metabolites such as flavonoids, alkaloids (especially moringin), saponins, tannins, and polyphenols (Nugraha, 2013; Simbolan et al., 2007). Flavonoids act as natural antioxidants and have been shown to increase insulin sensitivity, enhance glucose absorption by peripheral tissues, and inhibit glucose absorption in the intestine. Alkaloids, especially moringin, have antihyperglycemic effects by stimulating insulin secretion and improving glucose metabolism. Saponins and tannins also contribute to the glucose-lowering effect through various mechanisms, including inhibition of the alpha-glucosidase enzyme, which slows carbohydrate absorption (Dewiyati & Hidayat, 2015; Krisnadi, 2014). The results of phytochemical studies of Moringa leaves indicate that the content of these secondary metabolites can have a positive effect on glucose metabolism in the body. This content makes Moringa leaves one of the herbal plants that are often used in traditional medicine for diabetes mellitus sufferers (Nugraha, 2013).

The findings of this study are highly consistent with previous research. Syamra Indrawati and Warsyidah (2018) reported that administering 150 ml of boiled moringa leaves daily for 3-4 days to patients with diabetes mellitus showed a significant decrease in blood glucose levels. Similarly, research by Indra Sari (2017) demonstrated that boiled moringa leaves are effective in lowering blood sugar levels in patients with diabetes mellitus and can function as a non-pharmacological antihyperglycemic therapy. Research by Dewiyati and Hidayat (2015) also demonstrated that moringa leaves have a significant hypoglycemic effect in experimental animals, further strengthening the scientific evidence regarding the benefits of moringa leaves in the

management of diabetes mellitus. These studies collectively provide strong evidence supporting the efficacy of moringa leaves in controlling blood glucose levels, thus the use of moringa leaves as a supportive therapy for diabetes can be recommended as a safe and affordable alternative traditional treatment.

In addition to the pharmacological effects of the bioactive compounds, several behavioral factors contributed to the success of the intervention in this study. Both subjects demonstrated good adherence to the treatment protocol, consistently consuming Moringa leaf decoction once daily for four consecutive days. Both subjects also received health education regarding dietary modification and physical activity. Subject I was educated to reduce sugar and sweet food consumption, while Subject II was counseled on the importance of dietary management and physical activity.

Subject I began reducing consumption of sugary foods and drinks and tried taking regular morning walks, while Subject II began paying attention to their diet and reducing their consumption of carbonated drinks. These behavioral changes, combined with the Moringa leaf decoction intervention, likely produced a synergistic effect that increased overall blood glucose reduction. The results of this study also indicate that the success of therapy is determined not only by the intervention provided, but also by the subjects' willingness to make healthier lifestyle changes, which is a key factor in long-term diabetes mellitus management.

Several risk factors identified in both subjects are consistent with established epidemiological evidence. High blood glucose levels in both subjects were influenced by a combination of factors, including prolonged diabetes mellitus, poorly controlled diet, irregular physical activity, and poor adherence to a healthy lifestyle. Both subjects had had diabetes for 4-5 years and had not fully adopted the recommended dietary patterns.

Lifestyle factors, including dietary habits and physical inactivity, are significant modifiable risk factors for hyperglycemia (Febrinasari et al., 2020). Furthermore, based on interviews, both subjects had a family history of diabetes mellitus, a non-modifiable risk factor. Both subjects also had relatively low levels of education (junior high school and elementary school), which may impact their understanding of the disease and its management. The combination of non-modifiable risk factors (genetics, age, gender) with modifiable risk factors (dietary habits, sugar consumption, physical inactivity) created a high-risk profile for both subjects, underscoring the importance of comprehensive interventions addressing both pharmacological and behavioral aspects of DM management.

The gradual decrease in blood glucose levels observed over a 4-day period suggests that the

antihyperglycemic effect of Moringa leaf decoction is cumulative rather than immediate. This pattern is consistent with the mechanism of action of its bioactive compounds, which require continuous intake to effectively increase insulin sensitivity, improve glucose metabolism, and achieve optimal glycemic control (Krisnadi, 2015; Nugraha, 2013). The more pronounced decrease observed on the third and fourth days may reflect the cumulative effect of daily intake, where the active compounds begin to work optimally after repeated exposure. This suggests that consuming Moringa leaf decoction needs to be done regularly and continuously to achieve maximum results, rather than simply as a temporary treatment.

The success of this non-pharmacological intervention has significant implications for diabetes management in community settings. Moringa leaves are readily available, affordable, and culturally acceptable. Moringa plants thrive in various regions in Indonesia and are easy to cultivate, so availability is not a barrier. This can serve as a complementary therapy for diabetes patients who cannot tolerate or comply with pharmacological treatment or as an additional measure to improve glycemic control. The absence of side effects during the intervention further supports the safety of moringa leaf decoction for diabetes patients, allowing for long-term use without concern for adverse toxic effects.

Furthermore, the educational component of the intervention increased both subjects' awareness of the benefits of moringa leaves as a potential therapy for diabetes, which may promote continued use beyond the study period. This is important because successful diabetes management depends heavily on patients' independence in managing their disease on a daily basis.

These findings also highlight the importance of integrated nursing care for DM patients. Effective management requires not only pharmacological and non-pharmacological interventions but also comprehensive health education that addresses modifiable risk factors. The role of nurses in assessing individual risk factors, providing education on dietary modifications, promoting physical activity, and supporting adherence to treatment protocols is crucial for achieving optimal outcomes.

This case study demonstrates how a simple and accessible intervention like Moringa leaf decoction, combined with lifestyle counseling, can significantly impact blood glucose control in community-based diabetes patients. Nurses have a strategic role in educating the community about the safe and effective use of herbal plants as part of self-care for diabetes patients, thereby improving their quality of life and reducing the risk of complications.

During the study, in addition to reducing blood glucose levels, both subjects also showed improvements

in their physical condition. Complaints of frequent thirst, fatigue, and frequent urination, experienced at the beginning of the study, began to decrease after receiving the Moringa leaf decoction. These changes indicate that the intervention not only affected blood glucose levels but also the subjects' overall health, ultimately improving their quality of life.

The decrease in blood glucose levels in both subjects also aligns with Indra Sari's (2017) opinion, which states that one non-pharmacological effort to control diabetes mellitus is to utilize herbal plants, one of which is boiled moringa leaves. Regular use of boiled moringa leaves can help control blood glucose levels as part of diabetes mellitus management, in addition to diet and physical activity.

This study has several limitations that should be acknowledged. The small sample size of two subjects limits the generalizability of the findings to a broader population. The short, 4-day intervention period did not assess the long-term sustainability of the achieved blood glucose reductions. The study did not control for other variables such as total dietary intake, physical activity levels, stress, or sleep quality, which may have influenced the blood glucose results. Furthermore, the lack of a control group means that the observed reductions in blood glucose levels cannot be definitively attributed solely to the moringa leaf decoction intervention, as other factors or the natural course of the disease may have contributed.

Future research should include larger sample sizes, longer intervention periods, and randomized controlled study designs to strengthen the evidence base for moringa leaf decoction as an antihyperglycemic therapy. Furthermore, further research is needed to explore the optimal dosage, the most effective treatment duration, and the molecular mechanisms underlying the antihyperglycemic effects of moringa leaves.

Despite these limitations, this study provides valuable preliminary evidence and practical insights for integrating Moringa leaf decoction into community-based diabetes management programs, particularly in areas with limited access to healthcare and medication. Therefore, the results of this case study indicate that administering Moringa leaf decoction for 4 days can help lower blood glucose levels in patients with diabetes mellitus. Although the reduction in blood glucose levels in both subjects did not reach the normal range, the results indicate positive changes, suggesting that Moringa leaf decoction can be used as a non-pharmacological complementary therapy to help control blood glucose levels in patients with diabetes mellitus, while still following the recommendations of healthcare professionals and consistently maintaining a healthy lifestyle.

Conclusion

The administration of *Moringa oleifera* leaf decoction once daily for four consecutive days was associated with a reduction in blood glucose levels in both subjects with type 2 diabetes mellitus. Blood glucose levels decreased from 312 mg/dL to 238 mg/dL in Subject 1 and from 298 mg/dL to 229 mg/dL in Subject 2. These findings suggest that *Moringa oleifera* leaf decoction may serve as a beneficial complementary non-pharmacological therapy for blood glucose control. The intervention was well tolerated, with no reported adverse effects, and its effectiveness was supported by adherence to healthy lifestyle modifications. Further studies with larger sample sizes and controlled designs are recommended to confirm its efficacy and establish standardized treatment protocols.

Acknowledgments

The authors would like to express their deepest gratitude to the health workers at the Darul Makmur Community Health Center, the Head of Lamie Village, and the health cadres in Darul Makmur District, Nagan Raya Regency, for their support, cooperation, and assistance in facilitating the research process. The authors are especially grateful to the two study subjects for their willingness to participate, their cooperation throughout the study period, and their commitment to following the intervention protocol.

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