Clinical Journal of Diabetes Care and Control
ISSN: 2642-0872

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Case Report *Volume 7 Issue 1*

Reversing the Blood Sugar Level by Using Millet Based Food Product

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Received Date: February 17, 2025; **Published Date:** April 07, 2025

Abstract

Diabetes can be managed effectively by providing holistic approach which integrates diet, exercise, and medication. In dietary interventions, the goal is to stabilize blood sugar levels by providing low-glycemic foods. Millets are known to provide energy as they are rich in complex carbohydrates and also improve satiety and insulin sensitivity. They are also rich in magnesium content and exhibit antioxidant properties. Incorporating millet-based products, such as porridge, dosa, or bread, into a diabetic diet can replace higher-glycemic alternatives, leading to lowering in blood sugar control. Studies conducted on millets have shown to lower HbA1c levels and improve fasting blood sugar levels. A combination of sprouted ragi, oats, wheat, groundnut, cumin seeds, pumpkin, flax seeds, foxtail millet, almonds, and chia seeds was prepared and administered as porridge daily for 60 days to 20 subjects. Fasting blood sugar (FBS) and post-prandial blood sugar (PPBS) levels were measured prior to the intervention, after 30 days, and after 60 days. Results showed a significant decrease in both FBS and PPBS levels in experimental subjects compared to those observed in subjects undergoing conventional medication. This study suggested that incorporating millet-based combination may serve as a complementary food for managing blood sugar levels in type 2 diabetes subjects. The study also highlighted the benefits of millets, known for their low glycemic index and rich nutritional profile, as part of a holistic approach to diabetes management. Further research is recommended to examine the long-term effects and underlying mechanisms of this dietary intervention.

Keywords: Diabetes; Fasting Blood Sugar; Millets; Intervention

Abbreviations

FBS: Fasting Blood Sugar; PPBS: Post-Prandial Blood Sugar; ALA: Alpha-Linolenic Acid.

Introduction

Diabetes management involves a complete methodology including diet, exercise, and medication. In dietary interventions, low-glycemic foods are the main requirement in preventing rapid spikes in blood sugar levels [1]. Millets such as foxtail, finger millet, and pearl millet have gained importance as beneficial for diabetes management due to their complex carbohydrates, high fiber content and rich nutritional profile [2].

Incorporating millet-based foods in different combinations into a diabetic diet can be transformative. Millets are rich in

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magnesium which is known to improve insulin sensitivity and antioxidants that combat inflammation which are commonly seen in diabetes [3]. Millets are also gluten-free providing vitamins B and E, iron, and calcium associating both overall health and diabetic needs [4]. Millet-based foods like porridge, dosa, or bread can be substituted for higher-glycemic alternatives like rice or wheat in order to decrease blood sugar control [5].

Research indicates that millet consumption improves HbA1c levels which is a marker of long-term blood glucose control and also reduces fasting blood sugar levels [6]. Thus, millet-based diets are recommended not only for diabetic individuals but also as preventive diets for those at risk [7]. Millet based products are distinguished as functional foods and have promising avenue for effective and natural diabetes management towards more sustainable and health-conscious eating habits.

Effect of Ragi, Oats, Wheat and Foxtail Millets on Diabetes

Ragi (Finger millet), is known to be beneficial for managing diabetes due to its low glycemic index and high fiber content, which prevent fast blood sugar points by helping a low release of glucose [8]. It is rich in complex carbohydrates, essential minerals and polyphenols, which help in increasing insulin sensitivity and decreasing oxidative stress which are common in diabetes. Ragi consists of essential amino acid tryptophan which helps in decreasing appetite accordingly supporting weight management [9]. Studies also show that regular consumption of Ragi can improve HbA1c levels accordingly stabilizing blood sugar levels [10].

Oats are also helpful in managing diabetes as they contain high soluble fiber in the form of beta-glucan, which is known to slow digestion and also helps in regulating blood sugar. The release of glucose is slow when oats get digested does decreasing the blood sugar levels; hence, oats is good diet form diabetic individuals. Furthermore, oats have shown to improve insulin sensitivity and cholesterol management [11]. Regular consumption of oats in the form of porridge or an ingredient in various meals helps in maintain blood glucose levels and help in contributing HbA1c levels does improving diabetes management.

Whole wheat is diabetes-friendly diet due to its moderate glycemic index and high fiber contents [12]. Whole wheat contains bran and germ, providing a slow-release of glucose which helps in controlling post prandial blood sugar levels. Whole wheat is also rich in minerals such as magnesium and zinc, which are related in improving insulin function and glycemic control. Incorporating whole wheat in food products such as whole grain bread, chapati, can support blood sugar management when eaten as part of a balanced fiber-rich diet [13].

Foxtail millet is advantageous in diabetes management due to its low glycemic index and high fiber content [2]. It is also rich in minerals like magnesium, which improves insulin sensitivity, and antioxidants that decrease oxidative stress which are common in diabetic individuals. Additionally, foxtail millet provides a good source of complex carbohydrates and protein which helps in prolonged energy while controlling appetite does helping in weight management. Studies suggest that regular consumption of foxtail millet can stabilize blood sugar in the form of balanced diet [14].

Effect of Peanut and Almonds on Diabetes

Peanuts are helpful for diabetes management as they have low glycemic index and higher content of good fats, dietary fiber and also protein, which are beneficial for wellbeing [15]. Peanuts are rich in magnesium supporting insulin sensitivity and improve overall metabolic health. Peanuts help increase satiety, which helps in weight management. Studies show that incorporating peanuts in diet can reduce post-meal blood sugar levels and improve long-term glucose control.

Almonds are good for diabetes management as they are low in carbohydrate content which contributes to slow digestion and a stable release of glucose [16]. Almonds are also rich in magnesium, does helping in improve insulin sensitivity. They also contain antioxidants like vitamin E, which help reduce oxidative stress, indirectly associated with diabetes. Studies indicate that consuming almonds before or with a meal can lower blood sugar level and improve HbA1c levels.

Effect of Chia Seeds, Pumpkin Seeds, Flax Seeds and Cumin on Diabetes

Chia seeds are helpful for diabetes management as they are rich in fiber, particularly soluble fiber, which slows glucose absorption and promotes stable blood sugar levels. It is also rich in omega-3 fatty acids, antioxidants and minerals which improve insulin sensitivity and reduce inflammation. The ability of chia seeds to absorb water and form a gel-like consistency in the stomach contributes to delayed satiety does maintaining weight. Studies suggest that incorporating chia seeds into meals can help lower blood sugar level and improve HbA1c levels helping to manage diabetes.

Pumpkin seeds are helpful for diabetes management as they have low glycemic index and high fiber content. The fiber in pumpkin seeds helps slow down the digestion and absorption of carbohydrates, managing stable blood sugar levels. The magnesium content supports insulin function and

helps improve glycemic control [17]. Pumpkin seeds are also rich in antioxidants which combat inflammation.

Flax seeds are highly beneficial for diabetes management due to their high fiber content, omega-3 fatty acids, and lignans, which help regulate blood sugar levels [18]. The soluble fiber in flax seeds slows digestion, promoting a gradual release of glucose. Flax seeds are rich in magnesium, which supports insulin function, and alpha-linolenic acid (ALA), an anti-inflammatory omega-3 fatty acid that benefits cardiovascular health.

Cumin is beneficial for diabetes management due to its potential to improve insulin sensitivity and regulate blood sugar levels. Research has shown that cumin possesses antioxidant properties, which help reduce oxidative stress and inflammation [19]. Cumin seeds may enhance the body's ability to utilize glucose effectively, leading to improved glycemic control. Additionally, incorporating cumin into meals can promote better digestion and support weight management. Regular consumption of cumin as a spice or in supplement form has been linked to lower fasting blood sugar levels.

Case Study

A dietary intervention of millet-based combination was done to check the influence of blood sugar levels in type 2 diabetes subjects. The combinations of millets were prepared as shown in Table 1. Ragi seeds were sprouted and dried. Oats, wheat, groundnut, cumin seeds, pumpkin, flax seeds foxtail millets, almonds, chia seeds are powdered and mixed in the quantities as shown in Table 1. Mixed powder is made to porridge by adding 50 gms to 200 ml water. It is allowed to gelatinize for proper cooking. This is provided to subjects with type 2 diabetes everyday continuously for 60 days to 20 subjects. The subjects were tested for Fasting Blood Sugar Level and Post Prandial Blood Sugar Level prior to intervention, after 30 days of intervention and 60 days of intervention. The data is represented in Figure 1.

Sl. No.	Ingredients	Quantity
1	Ragi	3 Kgs
2	Oats	1 Kg
3	Wheat	250 gms
4	Peanut	500 gms
5	Cumin	300 gms
6	Pumpkin seeds	250 gms
7	Chia seeds	250 gms
8	Flax seeds	250 gms
9	Almonds	500 gms
10	Foxtail millets	500 gms

Table 1: Incorporation of ingredients for intervention.

The laboratory investigation showed that there was slight decrease in fasting blood sugar and post - prandial sugar levels after intervention of millet combination for 30 days and 60 days. This was comparable to subjects with medication.

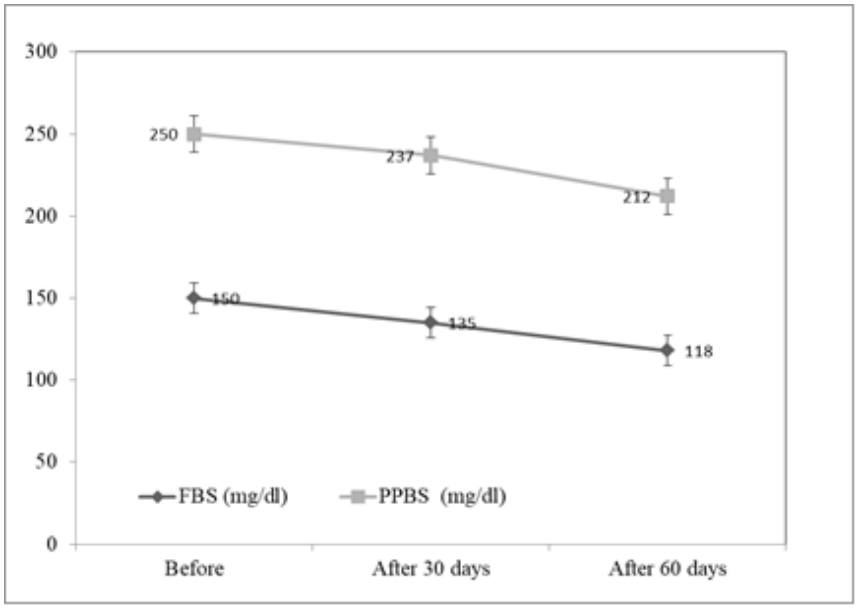

Figure 1: Fasting Blood Sugar level (FBS) and Post-prandial Blood Sugar level (PPBS) before and after Dietary intervention.
Note: FBS & PPBS data expressed in average of 20 subjects

Discussion

The present dietary intervention study aimed to evaluate the impact of a millet-based combination on blood sugar levels in individuals with type 2 diabetes over a 60-day period. The combination provided included a blend of Ragi, Oats, Wheat, Groundnut, Cumin, Pumpkin seeds, Chia seeds, Flax seeds, Almonds and Foxtail millets, as provided in Table 1. Millets like ragi and foxtail millets, are known for their low glycemic index and high dietary fiber content, which aid in the slow release of glucose into the bloodstream [4]. The inclusion of oats and wheat further contributed to the fiber content, helping in the regulation of postprandial blood glucose levels [20]. Additionally, flax seeds, chia seeds, and almonds provided essential fatty acids and antioxidants, which are beneficial in managing diabetes-related oxidative stress and inflammation [21]. The presence of cumin, a spice known for its potential hypoglycemic properties, has further enhanced the overall effectiveness of the intervention.

The fasting blood sugar levels and postprandial blood sugar levels of the participants were measured before the intervention, at 30 days, and at 60 days to assess the influence of the millet-based diet. The results, represented in Figure 1, suggest that there was a noticeable reduction in both fasting and postprandial glucose levels over time. This trend indicates that the incorporation of this millet-based porridge into the daily diet of type 2 diabetic individuals may have positively influenced their glycemic control [22-25].

The observed reduction in blood glucose levels can be attributed to the synergistic effect of the dietary fiber, complex carbohydrates, and bioactive components present in the formulation. The slow digestion and absorption of carbohydrates, coupled with the insulin-sensitizing effects of certain ingredients such as flax seeds and almonds, likely contributed to the improved glucose metabolism. Moreover, the prolonged intervention period of 60 days ensured sustained exposure to the beneficial effects of these ingredients, reinforcing the positive outcomes.

Despite the promising results, the study has certain limitations. The sample size was relatively small (20 subjects), which may limit the generalizability of the findings. Additionally, other lifestyle factors such as physical activity and medication adherence were not accounted for, which could have influenced the results. Future studies with a larger sample size and controlled variables are recommended to further validate the findings and explore the long-term benefits of such dietary interventions.

In conclusion, the millet-based dietary intervention demonstrated a potential positive impact on blood sugar levels in type 2 diabetes subjects. The combination of nutrient-dense ingredients contributed to better glycemic control, highlighting the role of dietary modifications in diabetes management. Further research is warranted to establish the efficacy of this intervention on a larger scale and to determine its long-term benefits.

Conclusion

The dietary intervention involving a millet-based combination demonstrated a positive effect on blood sugar levels in subjects with type 2 diabetes over a 60-day period. The study revealed a slight but significant decrease in both fasting blood sugar and post-prandial blood sugar levels after 30 and 60 days of daily consumption of the millet porridge. These findings suggest that incorporating this millet combination into the diet may serve as a beneficial complementary approach for managing blood sugar levels in individuals with type 2 diabetes, showing comparable results to those obtained through conventional medication. Further research is warranted to explore the long-term effects and potential mechanisms underlying these improvements.

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