

## EFFECT OF BASIL SEEDS (OCIMUM BASILICUM) ON THE GLYCEMIC INDEX AND GLYCEMIC LOAD OF ROOH AFZA: AN INTERVENTIONAL STUDY IN HEALTHY ADULTS

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DOI: <https://doi.org/10.5281/zenodo.17046008>

Received  
11 June 2025

Accepted  
21 August 2025

Published  
03 September 2025

### ABSTRACT

**Background and Objective:** Sugar-sweetened beverages (SSBs) are widely consumed and are associated with a higher risk of type 2 diabetes and cardiometabolic disorders. Rooh Afza, a popular beverage in Pakistan, has not been well studied for its glycemic impact. Basil seeds (*Ocimum basilicum*) are traditionally used for their medicinal properties and may reduce postprandial glycemic response. This study aimed to determine the glycemic index (GI) and glycemic load (GL) of Rooh Afza and to evaluate the effect of basil seeds on these parameters of Rooh Afza.

**Methods:** Fifteen healthy male participants (mean age  $22 \pm 0.83$  years) were recruited in a non-blind interventional repeated-measures study. On day one, participants consumed 25 g of glucose as a reference food. On day two, they consumed 33 ml of Rooh Afza containing 25 g glucose. On day three, participants were divided into three groups ( $n=5$  each) and consumed Rooh Afza with 1 g, 2.5 g, or 5 g of pre-soaked basil seeds. Capillary blood glucose was measured at 0, 15, 30, 60, 90, and 120 minutes post-consumption. Incremental area under the curve (iAUC) was calculated using the trapezoid method. GI and GL were determined, and statistical analysis was performed using paired t-tests.

**Results:** The GI and GL of Rooh Afza were 82.7 and 20.5, respectively, classifying it as a high GI/GL beverage. Addition of basil seeds significantly reduced both GI and GL. With 1 g basil seeds, GI and GL were  $72 \pm 16.9$  and  $20 \pm 4.2$  ( $p=0.513$ ). With 2.5 g, GI and GL were  $60 \pm 15.2$  and  $15 \pm 3.8$  ( $p=0.031$ ). With 5 g, GI and GL were  $46.4 \pm 12.4$  and  $11.6 \pm 3.1$  ( $p<0.001$ ). The greatest reduction was observed with 5 g of basil seeds.

**Conclusion:** Rooh Afza is a high GI/GL beverage and may contribute to increased risk of type 2 diabetes if consumed regularly. Basil seeds significantly reduce the glycemic response when consumed with Rooh Afza, with 5 g demonstrating the strongest effect. Incorporating basil seeds into high-GI beverages may provide a simple dietary strategy for reducing postprandial glycemia

**Keywords:** Glycemic index, Glycemic load, Basil seeds, Rooh Afza, Dietary fiber, Postprandial glucose

### INTRODUCTION

The escalating global prevalence of diabetes mellitus necessitates ongoing research into dietary interventions that can mitigate postprandial glucose excursions (Mpiana, 2013). Traditional

approaches often focus on carbohydrate restriction, yet the integration of functional ingredients and low-glycemic alternatives into common dietary staples presents a promising and

viable strategy for improved glycemic control and variability (Camps et al., 2021). Specifically, understanding the glycemic impact of popular beverages, such as Rooh Afza, when modified with functional food additives like basil seeds (*Ocimum basilicum*), is crucial for developing practical dietary recommendations for individuals managing their glycemic response (Ziaee et al., 2012). This study investigates the potential of basil seeds (*Ocimum basilicum*) to reduce the glycemic index and glycemic load of Rooh Afza, a widely consumed syrup. This investigation delves into the biochemical mechanisms by which the soluble fiber content of basil seeds might attenuate glucose absorption and consequently lower the glycemic burden of the beverage. This research aims to provide evidence-based insights into the formulation of healthier beverage options by exploring the interaction between a high-sugar matrix and a hydrogel-forming seed (Ali et al., 2011). The objective is to quantify the extent to which the mucilaginous fiber from basil seeds influences carbohydrate digestion and glucose kinetics in a complex sugary beverage. This understanding could pave the way for the development of novel dietary strategies aimed at mitigating hyperglycemia, thereby contributing to the broader effort to combat the global diabetes epidemic (Kabirat & Oluwaseun, 2020). The study will specifically assess the impact of basil seeds on alpha-glucosidase activity and glucose absorption in a controlled interventional setting (Ali et al., 2011). This investigation will explore the role of various phytochemicals present in basil seeds, such as flavonoids and phenolic compounds, in modulating glucose metabolism beyond their fiber content, potentially through the inhibition of key enzymes involved in carbohydrate digestion (Marmouzi et al., 2017).

### **Materials and Methods**

#### *Study Design and Participants*

A non-blind interventional study with repeated measures was conducted at the Institute of Paramedical Sciences, Khyber Medical University, Peshawar. Fifteen healthy male participants (mean age  $22 \pm 0.83$  years, BMI  $18.5$ – $24.5$  kg/m<sup>2</sup>) were recruited. Exclusion criteria included smoking, obesity, family history of diabetes, and use of medications affecting glucose metabolism. Ethical approval was obtained, and informed consent was secured.

#### *Test Foods*

**Reference food:** 25 g glucose dissolved in 300 ml water. **Test food:** 33 ml Rooh Afza containing 25 g glucose in 300 ml water. **Intervention food:** Rooh Afza with 1 g, 2.5 g, or 5 g of pre-soaked basil seeds.

#### *Procedure:*

*Day 1:* Participants consumed the reference glucose solution after overnight fasting. Blood glucose was measured at baseline (0 min) and 15, 30, 60, 90, and 120 minutes. *Day 2:* Participants consumed the Rooh Afza solution, and blood glucose was measured at the same time intervals. *Day 3:* Participants were divided into three groups ( $n=5$  each) and consumed Rooh Afza with 1 g, 2.5 g, or 5 g of basil seeds. Blood glucose was measured as above.

#### **Blood Glucose Measurement**

Glucometer [Accu-check Performa test (Roche Diagnostic GmbH, Mannheim), Germany]. Standard aseptic techniques were followed.

#### **Data Analysis**

The incremental area under the curve (iAUC) for glucose responses was calculated using the trapezoid method. GI was calculated by expressing the iAUC of the test food as a percentage of the reference glucose. GL was calculated using the formula:

Statistical analysis was performed using SPSS v25. Paired t-tests were applied to compare differences, with significance set at  $p < 0.05$ .

#### **Results**

##### *Reference Glucose*

The mean iAUC for glucose was 2251 mg/dl\*min, corresponding to GI = 100 and GL = 25.

##### *Rooh Afza (without basil seeds)*

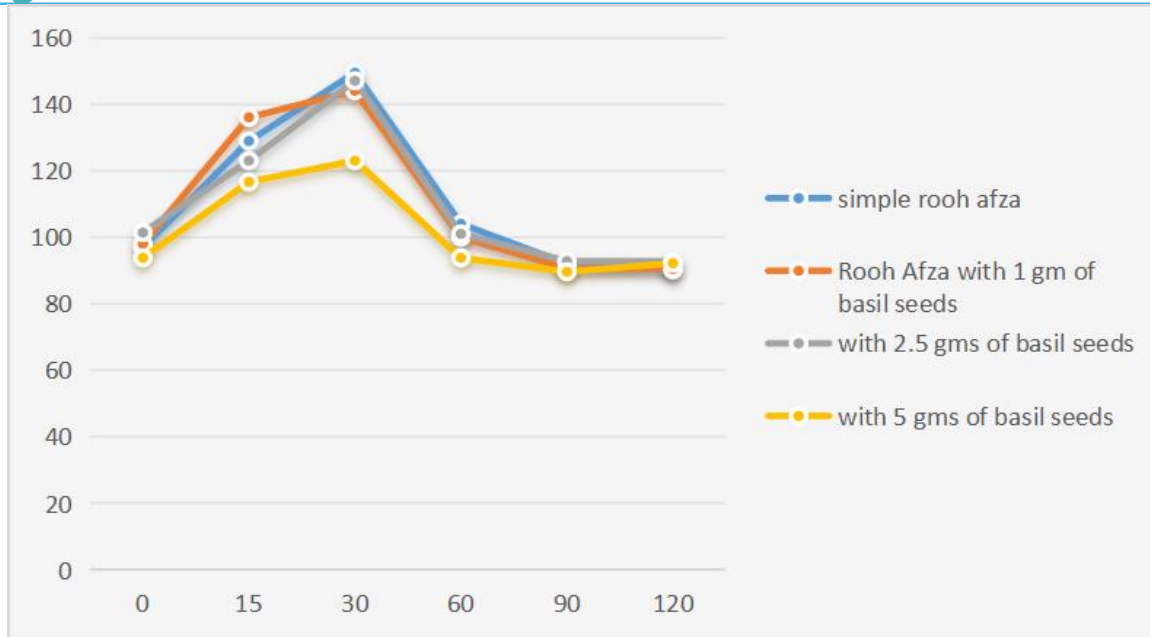
The iAUC for Rooh Afza was 1849.5 mg/dl\*min, giving GI = 82.7 and GL = 20.5, both classified as high.

##### **Rooh Afza with Basil Seeds**

**1 g basil seeds:** iAUC = 1625; GI =  $72 \pm 16.9$ ; GL =  $20 \pm 4.2$  ( $p=0.513$ ; not significant).

**2.5 g basil seeds:** iAUC = 1358; GI =  $60 \pm 15.2$ ; GL =  $15 \pm 3.8$  ( $p=0.031$ ; significant).

**5 g basil seeds:** iAUC = 999; GI =  $46.4 \pm 12.4$ ; GL =  $11.6 \pm 3.1$  ( $p < 0.001$ ; highly significant).



The addition of basil seeds showed a dose-dependent reduction in GI and GL, with 5 g producing the strongest effect.

#### **Discussion:**

The present study demonstrates that Rooh Afza, a popular beverage in Pakistan, has a high glycemic index and load, making it potentially harmful for individuals at risk of type 2 diabetes or metabolic disorders. However, supplementation with basil seeds significantly attenuated the glycemic response in a dose-dependent manner.

Our findings are consistent with previous research highlighting the role of dietary fiber in lowering postprandial glycemia. Basil seeds contain mucilage, primarily glucomannan and xylan, which swell in water to form a gel that slows gastric emptying and carbohydrate absorption. Studies have shown similar effects of basil seeds in reducing glycemic response of staple foods such as rice cakes.

The significant reduction in GI and GL with 2.5 g and 5 g basil seeds suggests practical dietary applications. Consuming Rooh Afza with basil seeds may provide a simple, low-cost intervention to lower the glycemic impact of this commonly consumed beverage. However, the effect of 1 g basil seeds was not significant, indicating that a threshold amount is necessary.

Limitations of this study include the small sample size (n=15), restriction to young healthy males, and use of glucometer-based measurements instead of spectrophotometric methods. Future research should include larger, more diverse populations and employ more precise laboratory methods. Additionally, investigating the long-term effects of

basil seed consumption on glycemic control and other metabolic parameters in a free-living setting would provide valuable insights into its therapeutic potential. Further investigations could also delineate the precise molecular mechanisms underpinning the fiber-mediated modulation of glucose absorption, potentially through in vitro digestion models or gut microbiome analyses (Canfora et al., 2021). This comprehensive understanding could pave the way for developing novel functional foods and dietary recommendations to manage postprandial glucose excursions effectively (Tekin- Cakmak et al., 2023). Beyond glycemic control, the multifaceted impact of basil seeds on broader metabolic health, including lipid profiles and insulin sensitivity, warrants further exploration. Moreover, examining the influence of different processing methods on the bioactivity of basil seed mucilage could optimize its incorporation into various food matrices. Furthermore, exploring the optimal timing and frequency of basil seed consumption in relation to meals could refine dietary recommendations for maximal glycemic benefits.

#### **Conclusion**

Rooh Afza is a high glycemic beverage and should be consumed cautiously, especially by individuals with or at risk of diabetes. Incorporating 2.5 g to 5 g of basil seeds significantly reduces the glycemic

index and glycemic load of Rooh Afza. Basil seeds may serve as an accessible dietary strategy to lower postprandial glycemia in populations with high consumption of sugar-sweetened beverages. This simple intervention offers a promising approach for mitigating the adverse metabolic effects associated with such beverages (Singh et al., 2011). Further research is warranted to validate these findings in larger, diverse cohorts and to explore the long-term metabolic benefits of habitual basil seed consumption (Kabirat & Oluwaseun, 2020). Additionally, further studies could investigate the potential anti-diabetic properties of basil seeds beyond their fiber content, considering the presence of other bioactive compounds that might modulate glucose metabolism

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