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Short-Term Intake of Moringa oleifera Leaf Soup and Its Effect on Fasting Blood Glucose in Overweight Office Workers: A Preliminary Study

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ABSTRACT:
Background: The prevalence of diabetes mellitus and hyperglycemia continues to rise, particularly among workers with sedentary lifestyles and overweight conditions. Moringa *oleifera* leaves are known to contain antidiabetic bioactive compounds; however, studies regarding their effectiveness in the form of a cooked vegetable dish (soup) remain limited.
Objective: This study aims to determine the effect of *Moringa oleifera* leaf soup intake on changes in fasting blood glucose levels among overweight employees at the University of Nusa Cendana.
Methods: This study employed a pre-experimental one-group pre-test post-test design. Twenty-seven employees with a Body Mass Index (BMI) ≥ 25 were selected using a purposive sampling technique. The intervention consisted of administering Moringa leaf soup (100 grams of fresh leaves boiled at 80°C for 3 minutes), consumed daily for one week.
Results: Phytochemical analysis confirmed that the soup contained flavonoids, tannins, and vitamin C. Clinically, the intervention resulted in a decrease in mean fasting blood glucose from 121.37 mg/dL to 118.33 mg/dL, with 16 out of 27 respondents (59.3%) showing a reduction. However, statistical analysis using the Wilcoxon test indicated that this change was not statistically significant ($p = 0.361$).
Conclusion: Although the results were not statistically significant—likely due to the short duration of the intervention—a clinical downward trend was observed in the majority of respondents. This finding suggests the potential of Moringa leaf soup as a functional food to support glycemic control.

KEYWORDS: Employees, Flavonoids, Fasting Blood Glucose, *Moringa oleifera*, Obesity.

INTRODUCTION

Diabetes mellitus (DM) continues to be a major global health concern, and Indonesia currently ranks fifth in the world for the highest number of adult diabetes cases.[1] Its prevalence has also shown a steady increase, rising from 10.9% in 2018 to 11.7% in 2023.[2] In the province of East Nusa Tenggara (NTT), Kupang City reports the highest prevalence of diagnosed DM, indicating a notable regional health burden.[3] This growing trend is closely linked to modifiable risk factors, particularly overweight and obesity, which contribute to approximately 80% of Type 2 Diabetes Mellitus (T2DM) cases.[4] Office workers represent one of the groups most prone to metabolic problems due to prolonged sitting and unhealthy eating habits.[5] National data show that employees have the highest obesity rate (32%) compared to other occupational categories.[2] Low levels of physical activity combined with excess calorie intake can lead to the accumulation of free fatty acids and central obesity, both of which play a key role in the development of insulin resistance and hyperglycemia.[6] Given the long-term nature of these risks, practical and sustainable dietary approaches are needed to support prevention efforts.Moringa oleifera, commonly known as moringa or kelor, is a functional food abundant in tropical regions such as NTT. Its leaves are rich in bioactive compounds, including flavonoids (quercetin), tannins, saponins, and vitamin C, which have been associated with antihyperglycemic effects.[7] Quercetin, one of the major flavonoids in moringa, helps protect pancreatic β-cells from oxidative stress and inhibits α-glucosidase activity, thereby supporting glucose regulation.[8]
Although several studies have demonstrated the hypoglycemic effects of moringa leaf extracts or decoctions in individuals with diabetes,[9],[10] research evaluating the impact of moringa in commonly consumed culinary forms—such as vegetable soup—remains

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limited, especially among overweight or pre-diabetic populations. Most existing studies rely on extract-based interventions, which may not reflect typical dietary practices. Therefore, this preliminary study aims to examine the effect of short-term consumption of Moringa oleifera leaf soup on fasting blood glucose levels among overweight office employees in a university setting.

METHODS

I. MATERIALS AND METHODS

This study employed a quantitative pre-experimental research design utilizing a one-group pre-test post-test approach to evaluate the effect of Moringa oleifera leaf soup on blood glucose levels. The research was conducted at the University of Nusa Cendana, Kupang, East Nusa Tenggara, from June to July 2025. The study protocol received approval from the Health Research Ethics Commission of the Faculty of Medicine and Veterinary Medicine, University of Nusa Cendana (Ethical Clearance No: 21/UN15.21/KEPK-FKKH/2025).

The study population consisted of active employees at the university, with a total of 27 participants selected using purposive sampling. Inclusion criteria included active employees with overnutrition status (Body Mass Index ≥ 25 kg/m²), willingness to fast for a minimum of 8 hours prior to blood sampling, and willingness to consume the intervention meal daily for seven days. Exclusion criteria included pregnancy, a history of diabetes mellitus under pharmacological treatment such as metformin, and known allergy to Moringa leaves. The intervention involved the preparation and administration of Moringa oleifera leaf soup.

Fresh Moringa leaves were harvested from a local plantation in Noelbaki, washed, separated from the stalks, and weighed to exactly 100 grams per serving. To preserve heat-sensitive bioactive compounds, the cooking process used a blanching technique in which the leaves were boiled in 300 ml of water at 80°C for 3 minutes. This temperature and duration were selected to minimize degradation of micronutrients such as Vitamin C and beta-carotene. The soup was administered once daily, one hour before lunch, for seven consecutive days. To validate the functional properties of the intervention, the soup underwent qualitative and quantitative phytochemical screening. Qualitative tests identified the presence of flavonoids using the Wilstater test, tannins using $FeCl_3$, and Vitamin C using iodine titration. Quantitative analysis of Total Flavonoid Content (TFC) was determined using UV-Vis spectrophotometry at a wavelength of 465 nm with quercetin as the standard.Data collection included anthropometric measurements and blood glucose monitoring. Height and weight were measured to asses nutritional status, and waist circumference was recorded to identify central obesity. Fasting Blood Glucose (FBG) levels were measured using capillary blood samples analyzed with a calibrated GCU meter device. Measurements were taken at two time points: baseline (pre-test) after an 8-hour fast, and on day 8 (post-test) after the 7-day intervention. Participant adherence was monitored through digital documentation submitted before and after consumption.

Data were analyzed using statistical software. The normality of the data was assessed using the Shapiro–Wilk test due to the small sample size. Since the data were not normally distributed ($p < 0.05$), the non-parametric Wilcoxon Signed Rank Test was used to analyze differences in fasting blood glucose levels before and after the intervention. A p-value of < 0.05 was considered statistically significant.

RESULTS

Phytochemical Analysis of the Intervention

The laboratory analysis of *Moringa oleifera* leaf soup prepared using the standardized blanching method (80°C for 3 minutes) confirmed the preservation of essential bioactive compounds. Qualitative screening showed strong positive results (+++) for flavonoids, tannins, and vitamin C. Quantitative analysis using UV-Vis spectrophotometry determined the Total Flavonoid Content (TFC) to be 0.002 mg QE/g. The results of the phytochemical examination are presented in Table 1.

Table 1. Phytochemical Screening of *Moringa oleifera* Leaf Soup

Phytochemical Constituent	Test Method	Result	Indicator
Qualitative Analysis			
Flavonoids	Wilstater (Mg + HCl)	Positive (+++)	Greenish-orange color change
Tannins	Ferric Chloride ($FeCl_3$)	Positive (+++)	Blackish-green color change

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Phytochemical Constituent	Test Method	Result	Indicator
Vitamin C	Iodine Titration	Positive (+++)	Clear solution after 50 drops
Quantitative Analysis			
Total Flavonoid Content (TFC)	UV-Vis Spectrophotometry	0.002 mg QE/g	Calculated using quercetin standard curve

II. Baseline Characteristics of Respondents

A total of 27 employees participated in the study. The demographic characteristics are presented in Table 2. Most respondents were male (55.6%) and aged 36–45 years (44.4%). Anthropometric assessments showed that 81.5% were classified as obese (BMI ≥ 27.0 kg/m²) and 100% had central obesity based on waist circumference criteria. Furthermore, all participants engaged in light-intensity physical activity and had daily carbohydrate intake below recommended levels.

Table 2. Distribution of Baseline Characteristics (N = 27)

Characteristic	Value
Age (years)	
Mean ± SD	**41.89 ± 7.86**
Gender, n (%)	
Male	**15 (55.6%)**
Female	**12 (44.4%)**
Nutritional Status (BMI), n (%)	
Overweight (25.0–<27.0 kg/m²)	**5 (18.5%)**
Obese (≥27.0 kg/m²)	**22 (81.5%)**
Waist Circumference, n (%)	
Central Obesity	**27 (100.0%)**
Physical Activity Level, n (%)	
Light	**27 (100.0%)**

The variation in Fasting Blood Glucose (FBG) levels after the 7-day intervention is summarized in Table 3. The mean FBG demonstrated a slight reduction, declining from 121.37 ± 38.94 mg/dL at baseline to 118.33 ± 30.65 mg/dL following the intervention. Descriptive findings indicated a favorable clinical tendency, with 16 participants (59.3%) exhibiting decreased glucose levels, while 11 participants (40.7%) showed an elevation. Despite this downward trend and the proportion of participants who experienced improvement, the Wilcoxon Signed Rank Test produced a p-value of 0.361, confirming that the change in FBG levels before and after the intervention was not statistically significant.

Table 3. Analysis of Fasting Blood Glucose (FBG) Before and After Intervention

Variable	Mean (mg/dL)	SD	Min–Max	Trend (n, %)	p-value*
Pre-test FBG	121.37	38.94	93–269	—	—
Post-test FBG	118.33	30.65	91–205	Decreased: 16 (59.3%) Increased: 11 (40.7%)	0.361

DISCUSSION

The slight improvement observed in this study may be attributed to the bioactive compounds retained in the soup. Phytochemical analysis confirmed the presence of flavonoids, tannins, and vitamin C, all of which are known to contribute to

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glycemic regulation. Flavonoids—particularly quercetin—play a role in protecting pancreatic β-cells from oxidative stress while promoting insulin secretion.[8]. They also enhance insulin sensitivity and inhibit α-glucosidase activity, slowing carbohydrate digestion.[12]. Meanwhile, tannins and alkaloids may help reduce glucose absorption in the intestine.[7]. The presence of these compounds supports the biological plausibility of the observed FBG reduction, even if the effect did not reach statistical significance.

The effectiveness of these bioactive compounds is closely related to the food processing technique used. The blanching method applied in this study (80°C for 3 minutes) successfully preserved key heat-sensitive nutrients, as indicated by the strong phytochemical results. Prior research has shown that this specific temperature–time combination prevents excessive degradation of vitamin C and beta-carotene compared with prolonged boiling.[13],[14]. This suggests that the Moringa soup used in the intervention maintained its functional properties and could serve as a viable dietary source of beneficial plant compounds when prepared appropriately.

Participant characteristics may also help explain the modest magnitude of glycemic improvement. All respondents had central obesity and reported light physical activity, both of which are well-established contributors to insulin resistance. Central obesity increases circulating free fatty acids and inflammatory cytokines that impair insulin signaling.[6]. Additionally, sedentary behavior associated with office work, as described by Rosa et al., reduces muscle glucose uptake and further exacerbates insulin resistance.[15]. Considering these persistent metabolic and lifestyle risk factors, the downward glucose trend observed—even without statistical significance—indicates that Moringa soup may offer supportive benefits, particularly if paired with lifestyle modifications such as increased physical activity.

This study has several limitations that should be acknowledged. The relatively small sample size (N = 27) limits statistical power, and the absence of a control group reduces the ability to attribute changes solely to the intervention. The 7-day intervention period may have been too short to produce meaningful physiological changes, especially in non-diabetic populations. Furthermore, although dietary intake was assessed through recall, strict control over total caloric or carbohydrate intake was not feasible. Future research should consider randomized controlled designs with larger sample sizes and longer intervention durations to more comprehensively evaluate the long-term glycemic benefits of Moringa leaf soup.

CONCLUSION

The administration of Moringa oleifera leaf soup (100 g/day for 7 days) among overweight office workers resulted in a modest clinical improvement, with 59.3% of participants exhibiting reductions in fasting blood glucose (FBG). However, the overall change was not statistically significant ($p > 0.05$). This outcome is likely influenced by the short duration of the intervention and the absence of controlled lifestyle factors in a free-living setting, which may have limited the detectability of physiological changes. Phytochemical evaluation showed that the blanching method used in this study (80°C for 3 minutes) effectively preserved key antidiabetic constituents, particularly flavonoids and vitamin C, supporting the validity of this preparation as a functional food. The retention of these bioactive compounds reinforces the biological plausibility of the downward glycemic trend observed despite the non-significant statistical result. Overall, these findings suggest that Moringa oleifera leaf soup may serve as a safe adjunctive dietary measure for glycemic management. Its effectiveness, however, is likely to be greater when combined with broader lifestyle modifications, including increased physical activity and structured dietary control. Future research should employ randomized controlled trials with larger sample sizes and longer intervention periods (minimum ≥ 4 weeks) to more conclusively determine its therapeutic potential.

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