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The Effect of Moringa Leaf Soup (Moringa oleifera) on Total Cholesterol Levels among Overweight Employees at Nusa Cendana University

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ABSTRACT
Background: Overweight and obesity remain major global health problems and are closely associated with metabolic disorders, including hypercholesterolemia. Elevated total cholesterol levels contribute significantly to the development of atherosclerosis and increase the risk of cardiovascular diseases. In Indonesia, particularly in East Nusa Tenggara, the prevalence of overweight and obesity is relatively high among employees. Moringa oleifera, a locally available plant widely consumed as food, contains dietary fiber and bioactive compounds with antioxidant properties that may influence lipid metabolism.
Objective: This study aimed to evaluate the effect of moringa leaf soup consumption on changes in total cholesterol levels among overweight employees at Nusa Cendana University.
Methods: A pre-experimental study with a one-group pre-test–post-test design was conducted among 27 employees selected using purposive sampling. Participants received moringa leaf soup as an intervention for seven consecutive days. Total cholesterol levels were measured before and after the intervention using capillary blood samples analyzed with a point-of-care testing device. Data were analyzed using a paired sample t-test.
Results: The mean total cholesterol level before the intervention was 190.18 mg/dL, which decreased to 179.22 mg/dL after the intervention. The mean reduction in total cholesterol level was 10.96 mg/dL. Statistical analysis demonstrated a significant decrease in total cholesterol levels following seven days of moringa leaf soup consumption ($p = 0.012$).
Conclusion: Consumption of moringa leaf soup was associated with a significant reduction in total cholesterol levels among overweight employees at Nusa Cendana University.

KEYWORDS: Total cholesterol, Moringa oleifera, overweight, employees, obesity

INTRODUCTION

Cholesterol is an essential lipid molecule involved in cellular membrane integrity, hormone synthesis, and bile acid production.[1] However, excessive cholesterol levels, particularly in the context of metabolic imbalance, contribute to the development of hypercholesterolemia and subsequent cardiovascular disease. Approximately 70% of circulating cholesterol is synthesized endogenously in the liver, while the remaining proportion is derived from dietary intake. When lipid homeostasis is disrupted, especially in individuals with excess body weight, cholesterol accumulation may accelerate atherogenic processes within the vascular wall.[1]

Overweight and obesity represent major global public health concerns with rapidly increasing prevalence.[2] Excess adiposity is strongly associated with metabolic disturbances, including dyslipidemia, insulin resistance, and chronic low-grade inflammation. These conditions promote elevated total cholesterol levels, increased low-density lipoprotein, and reduced high-density lipoprotein, thereby enhancing the risk of atherosclerosis and cardiovascular morbidity.[3]

In Indonesia, the burden of overweight and obesity continues to rise, particularly among the working-age population.[4] National health surveys have demonstrated a high prevalence of excessive body weight among adults, with employees representing one of the most affected occupational groups. Similar trends are observed in East Nusa Tenggara Province, where overweight and obesity remain prevalent among office workers.[4] This epidemiological pattern contributes to an increased incidence of hypercholesterolemia and cardiovascular disease, including coronary heart disease and stroke.[5]

Elevated total cholesterol plays a pivotal role in the initiation and progression of atherosclerosis. Endothelial injury facilitates low-density lipoprotein infiltration into the subendothelial space, followed by oxidative modification and macrophage uptake, resulting in foam cell formation and plaque development. Progressive lipid accumulation within arterial walls can impair blood flow to vital organs, ultimately leading to ischemic cardiovascular events.[6]

Dietary intervention constitutes a fundamental non-pharmacological approach for cholesterol management. Increasing attention has been directed toward the utilization of locally available functional foods with potential lipid-lowering properties. Moringa oleifera, commonly known as moringa, is widely distributed in tropical regions and has long been consumed as a traditional vegetable in East Nusa Tenggara. Its accessibility and cultural acceptability make moringa a potential dietary intervention for lipid control.[7]

Moringa leaves contain dietary fiber and various bioactive compounds, including flavonoids, alkaloids, β-carotene, and vitamin C, which exhibit antioxidant activity and may influence lipid metabolism. These compounds are believed to reduce oxidative stress and contribute to cholesterol regulation.[8] Experimental studies using animal models have demonstrated significant reductions in total cholesterol levels following moringa leaf extract administration.[9,10] However, evidence from human studies remains inconsistent, with some investigations reporting non-significant effects depending on preparation form and duration of administration.[11]

Given the persistent prevalence of overweight, the increasing burden of hypercholesterolemia, and inconsistent findings from previous studies, further investigation is warranted.[11] In addition, limited data are available regarding the effect of moringa leaf consumption in the form of soup, which represents the most commonly used preparation method in the local population.[7] Therefore, this study aimed to evaluate the effect of moringa leaf soup consumption on total cholesterol levels among overweight employees at Nusa Cendana University.

METHODS

This study employed a pre-experimental design using a one-group pre-test–post-test approach. The research was conducted at Universitas Nusa Cendana, Kupang, East Nusa Tenggara, in 2025. The study population consisted of university employees with excess nutritional status, including overweight and obesity, determined based on body mass index assessment.

Participants were selected using purposive sampling. A total of 27 employees who met the inclusion criteria were enrolled in the study and completed the intervention. The inclusion criteria comprised employees with excess nutritional status who were willing to participate in the study. Participants were excluded if they were unable to complete the intervention period or met the exclusion criteria stated in the research protocol.

Baseline data collection was performed prior to the intervention. Total cholesterol levels were measured using capillary blood samples obtained through finger-prick sampling. Cholesterol examination was conducted using a point-of-care testing device (Autocheck). Measurements were carried out before the intervention (pre-test) and repeated after completion of the intervention (post-test) using the same measurement method.

The intervention consisted of the administration of moringa leaf soup prepared from Moringa oleifera leaves. Participants consumed the moringa leaf soup once daily for seven consecutive days in accordance with the predetermined intervention schedule.

After completion of the intervention period, post-test measurements of total cholesterol levels were obtained using the same procedures as those used during baseline assessment. The primary outcome of this study was the difference in total cholesterol levels before and after the intervention.

Data were processed and analyzed using statistical methods. Normality testing was performed prior to hypothesis testing. Differences in total cholesterol levels before and after the intervention were analyzed using a paired sample t-test. Statistical significance was determined at a p-value of less than 0.05.

This study was reviewed and approved by the Health Research Ethics Committee of the Faculty of Medicine and Veterinary Medicine, Universitas Nusa Cendana. Ethical clearance was granted under approval number 59.1/UN15.21/KEPK-FKKH/2025, approved on 28 August 2025, with ethics registration number UN01250759. Written informed consent was obtained from all participants prior to study enrollment, and participant confidentiality was maintained throughout the research process.

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RESULTS

A total of 27 employees with excess nutritional status participated in this study. The distribution of respondent characteristics is presented in Table 1. Based on age classification, the majority of respondents were in the 36–45 years age group, comprising 12 participants (44.4%), followed by those aged 46–55 years with 10 participants (37.0%). Respondents aged 26–35 years accounted for 4 participants (14.8%), while only 1 participant (3.7%) was in the 18–25 years age group. Regarding sex distribution, male respondents predominated, with 15 participants (55.6%), whereas female respondents accounted for 12 participants (44.4%).

Based on body mass index classification, most respondents were categorized as obese, totaling 22 participants (81.5%), while 5 participants (18.5%) were classified as overweight. Assessment of waist circumference demonstrated that all respondents met the criteria for central obesity. Central obesity was observed in 15 male respondents (55.6%) and 12 female respondents (44.4%). Physical activity level was evaluated using the Baecke Physical Activity Index questionnaire. All respondents (100%) were classified as having light physical activity, and none were categorized as having moderate physical activity. Dietary assessment showed that the majority of respondents had inadequate caloric intake, with 25 participants (92.6%) consuming less than 80% of the recommended dietary allowance. Only 2 participants (7.4%) had adequate caloric intake. Similarly, fat intake assessment revealed that 23 respondents (85.2%) had insufficient fat intake, 1 respondent (3.7%) had adequate fat intake, and 3 respondents (11.1%) had excessive fat intake.

Table 1. Characteristics of Respondents (n = 27)

Characteristic	n	Percentage (%)
Age (years)		
18–25	1	3.7
26–35	4	14.8
36–45	12	44.4
46–55	10	37.0
Sex		
Male	15	55.6
Female	12	44.4
Body Mass Index		
Overweight	5	18.5
Obese	22	81.5
Waist Circumference		
Central obesity (male)	15	55.6
Central obesity (female)	12	44.4
Physical Activity Level		
Light	27	100.0
Moderate	0	0
Caloric Intake*		
Inadequate (<80% RDA)	25	92.6
Adequate (80–100% RDA)	2	7.4
Fat Intake*		
Inadequate (<80% RDA)	23	85.2
Adequate (80–100% RDA)	1	3.7

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Characteristic	n	Percentage (%)
Excessive (>100% RDA)	3	11.1
Total	27	100

*RDA: Recommended Dietary Allowance (Indonesian RDA 2019)

Total cholesterol levels were measured before and after seven consecutive days of moringa leaf soup consumption. A decrease in mean total cholesterol level was observed following the intervention.

Table 2. Total Cholesterol Levels and Statistical Analysis Before and After Intervention (n = 27)

Variable	Pre-intervention Mean (mg/dL)	Post-intervention Mean (mg/dL)	Mean Difference (mg/dL)	Statistical Test	p-value
Total cholesterol	190.18	179.22	−10.96	Paired sample t-test	0.012

Table 2 presents the comparison of total cholesterol levels measured before and after seven days of moringa leaf soup consumption among 27 respondents. At baseline, the mean total cholesterol level was 190.18 mg/dL. Following completion of the intervention period, the mean total cholesterol level decreased to 179.22 mg/dL. This corresponded to a mean reduction of 10.96 mg/dL. Statistical analysis using a paired sample *t*-test demonstrated a significant difference between pre-intervention and post-intervention total cholesterol levels, with a p-value of 0.012. These findings indicate that measurable changes in total cholesterol levels occurred after the intervention period within the study population.

DISCUSSION

This study demonstrated a statistically significant reduction in mean total cholesterol levels following seven days of moringa leaf soup consumption among overweight and obese employees. Although the intervention duration was relatively short, the observed lipid response suggests that dietary modulation using plant-based foods may exert measurable metabolic effects even within a limited timeframe, particularly in populations with elevated baseline cardiometabolic risk.[12]

From a pathophysiological perspective, individuals with excess adiposity exhibit dysregulated lipid metabolism characterized by increased hepatic cholesterol synthesis, reduced LDL receptor activity, and enhanced oxidative stress. These alterations promote cholesterol accumulation and impair clearance from circulation. In such metabolic conditions, interventions targeting intestinal absorption and oxidative pathways may produce more rapid lipid changes compared with individuals with normal metabolic status.[13]

Moringa leaves contain substantial amounts of dietary fiber, polyphenols, flavonoids, and antioxidant vitamins, which may influence cholesterol homeostasis through multiple mechanisms. Soluble fiber components can bind bile acids in the intestinal lumen, increasing fecal excretion and stimulating hepatic conversion of cholesterol into bile acids. Concurrently, flavonoids and phenolic compounds have been shown to modulate key enzymes involved in lipid synthesis, including 3-hydroxy-3-methylglutaryl–coenzyme A reductase, thereby reducing endogenous cholesterol production.[14]

Oxidative stress plays a central role in the progression of dyslipidemia and atherosclerosis. Excess adipose tissue promotes chronic low-grade inflammation, increasing reactive oxygen species and accelerating lipid oxidation. Antioxidant compounds in moringa leaves may attenuate oxidative modification of lipoproteins, indirectly improving lipid handling and reducing circulating cholesterol concentrations. This antioxidant-mediated pathway provides biological plausibility for the cholesterol-lowering effect observed in the present study.[15]

Experimental animal studies have consistently demonstrated lipid-lowering effects of moringa leaf extracts, including reductions in total cholesterol and LDL cholesterol. These effects were associated with improved hepatic lipid metabolism and decreased lipid peroxidation. However, translation of these findings into human populations has yielded heterogeneous results, likely due to variability in preparation form, dosage, intervention duration, and baseline metabolic status of participants.[16]

In the present study, moringa was administered as soup, which differs substantially from capsules, extracts, or powdered formulations used in previous trials. This traditional preparation may preserve fiber content while providing lower concentrations of isolated phytochemicals. Nevertheless, its cultural acceptability and ease of consumption may enhance adherence, which is a critical determinant of effectiveness in real-world dietary interventions.[17]

Participant characteristics further contextualize the findings. Nearly all respondents were classified as obese, and all met criteria for central obesity, indicating significant visceral adiposity. Visceral fat is strongly associated with hepatic insulin resistance and increased very-low-density lipoprotein production. In such metabolic settings, even modest dietary interventions may yield detectable short-term lipid changes, particularly in total cholesterol, which reflects combined alterations in multiple lipoprotein fractions.[18]

Despite statistical significance, the magnitude of cholesterol reduction observed should be interpreted cautiously from a clinical standpoint. While a mean reduction of approximately 11 mg/dL may contribute to cardiovascular risk modification at the population level, it is unlikely to substitute pharmacological therapy in high-risk individuals. Therefore, moringa leaf soup should be considered as a complementary nutritional strategy rather than a stand-alone therapeutic intervention.[19]

Several methodological considerations warrant discussion. The absence of a control group limits causal inference, as spontaneous fluctuation in cholesterol levels, regression to the mean, or concurrent dietary changes may partially contribute to the observed effect. In addition, reliance on point-of-care testing, although practical for field research, may introduce measurement variability compared with standardized laboratory assays.[20]

The short duration of intervention also restricts interpretation regarding sustainability of effect. Cholesterol metabolism reflects both acute dietary intake and longer-term hepatic adaptation; thus, longer intervention periods are necessary to determine whether the observed reduction can be maintained or amplified over time. Furthermore, assessment was limited to total cholesterol without evaluation of LDL-C, HDL-C, or triglycerides, which limits comprehensive cardiovascular risk interpretation.[21]

Nevertheless, this study provides important preliminary evidence within a local Indonesian context. In regions such as East Nusa Tenggara, where access to long-term pharmacological management may be limited, utilization of locally available functional foods offers a pragmatic approach to population-level cardiovascular risk reduction. Integration of culturally familiar dietary interventions may enhance feasibility and sustainability of lifestyle-based prevention programs.[22]

Future research should prioritize randomized controlled designs with adequate sample sizes, standardized preparation protocols, longer follow-up durations, and comprehensive lipid profiling. Such studies are essential to clarify dose–response relationships, durability of lipid changes, and the role of moringa-based interventions as part of integrated cardiometabolic prevention strategies.[23]

CONCLUSION

This study demonstrated that daily consumption of moringa leaf soup for seven consecutive days was associated with a significant reduction in total cholesterol levels among overweight and obese employees at Universitas Nusa Cendana. The findings suggest that moringa leaf soup may serve as a feasible and culturally acceptable dietary approach to support cholesterol management in adults with excess nutritional status. Although the observed effect was modest and derived from a short-term intervention, the results highlight the potential role of locally available functional foods as complementary strategies in cardiometabolic risk reduction. Further studies with randomized controlled designs, longer intervention periods, and comprehensive lipid profiling are warranted to confirm the efficacy and sustainability of moringa-based dietary interventions.

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