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Review Literature: Effectiveness of Moringa Leaf Tea in Reducing Blood Glucose and Cholesterol Levels in Obese Individuals

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Abstract

Background: Obesity is a major public health concern that is closely associated with metabolic disorders, including hyperglycemia and hypercholesterolemia. Natural plant-based therapies have increasingly attracted attention as alternative approaches for managing these conditions. *Moringa oleifera* leaves contain various bioactive compounds, such as flavonoids, polyphenols, and antioxidants, which are believed to have beneficial effects in reducing blood glucose and cholesterol levels. **Objective**: This study aimed to review the effectiveness of Moringa leaf tea in reducing blood glucose and cholesterol levels in obese individuals. **Method**: This research employed a literature review design by analyzing scientific articles obtained from several electronic databases, including PubMed, Google Scholar, Taylor & Francis, and ProQuest. The inclusion criteria were articles published between 2018 and 2023, full-text articles, and studies that examined the effects of Moringa leaves on blood glucose and cholesterol levels. A total of 178 articles were initially identified, and after the screening and eligibility process, seven relevant articles met the inclusion criteria and were included in the review. **Results**: The findings from the selected studies indicate that Moringa leaf consumption, including in the form of tea, powder, or extract, has the potential to reduce blood glucose and cholesterol levels due to its bioactive components that contribute to improved metabolic regulation. **Discussion**: These compounds may help enhance insulin sensitivity, reduce oxidative stress, and inhibit lipid accumulation. **Conclusion**: Moringa leaf tea shows promising potential as a natural therapeutic option for reducing blood glucose and cholesterol levels in obese individuals. However, further well-designed clinical studies are needed to strengthen the evidence regarding its effectiveness and safety.

Keywords: blood glucose, cholesterol, herbal therapy, *Moringa oleifera*, obesity

INTRODUCTION

Moringa oleifera, commonly known as the moringa plant, belongs to the Moringaceae family and is the most widely known and utilized species among the 13 species within the *Moringa* genus [1]. This plant is a fast-growing perennial tree that is widely cultivated in tropical and subtropical regions. Moringa leaves are widely consumed as a leafy vegetable because they contain high levels of nutrients, including protein, fiber, potassium, calcium, magnesium, β-carotene, and α-tocopherol [2]. In addition, moringa leaves are rich in polyphenolic compounds that contribute to their nutritional and medicinal value. Various parts of the plant, including the leaves, seeds, and pods, have been used as food sources and dietary supplements due to their potential therapeutic properties [3]. In particular, dried moringa leaves and their extracts have demonstrated various biological activities

both in vitro and in vivo, including hypoglycemic effects. The therapeutic potential of moringa as a cardioprotective, hepatoprotective, neuroprotective, antiasthma, antitumor, antimicrobial, hypolipidemic, and antidiabetic agent is largely attributed to its phytochemical constituents such as alkaloids, phenolics, flavonoids, and polyphenols [4].

Diabetes mellitus and hyperlipidemia are two major risk factors that contribute to the occurrence of cardiovascular diseases. The management of these conditions is therefore essential in preventing cardiovascular complications [5]. Pharmacological therapies have been widely implemented in clinical practice to control lipid and glucose levels. However, continuous research is still being conducted to identify more effective approaches to managing cholesterol levels, including strategies targeting the inhibition of Proprotein Convertase Subtilisin Kexin 9 (PCSK9) [6]. In addition to pharmacological treatment, the use of herbal plants has also been widely explored as an alternative or complementary therapy for improving lipid profiles. Several studies have reported the potential benefits of *Moringa oleifera* in reducing lipid levels. Experimental studies conducted on animals with hyperlipidemia induced by a high-fat diet have demonstrated significant improvements in lipid profiles. Furthermore, improvements in lipid profiles have also been observed in the early stages of diabetes mellitus [7]. The antioxidant compounds present in moringa leaves may contribute to lowering cholesterol levels by increasing the activation of the cholesterol 7α-hydroxylase enzyme (CYP7A1), inhibiting the production of 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA), and reducing the levels of reactive oxygen species (ROS) [8].

Antioxidant enzyme activity plays an important role in protecting body tissues from oxidative stress and is closely associated with the development of complications in diabetes mellitus. Moringa leaves contain several antioxidant compounds, including flavonoids, vitamin A, vitamin E, vitamin C, and selenium, which are known to contribute to the reduction of blood glucose levels. Flavonoid compounds, particularly those belonging to the terpenoid group found in moringa leaves, have been reported to be effective and relatively safe in lowering blood glucose levels. In addition, the antioxidant components in moringa leaves help protect the body from cellular damage caused by free radicals [9].

Based on the background described above, moringa leaves—particularly when processed into dried leaves and prepared as herbal tea—have the potential to reduce cholesterol and blood glucose levels in individuals with diabetes mellitus, especially those who are obese. Obesity is considered an important risk factor that contributes to the development of diabetes mellitus. Therefore, this literature review aims to determine the effectiveness of Moringa leaf tea in reducing blood glucose levels and cholesterol levels in obese individuals.

METHOD

The research design used was a literature review. A systematic study to find journal articles adapted to the purpose of compiling this literature review. The literature search uses years limited to 2018-2023. This journal article collection uses electronic search databases

namely Pubmed, Taylor & Francis, Proquest and Google Scholar. The keywords used were Obese, Moringa leaves extract, Blood glucose level, Cholesterol level. The results of a literature search selection are illustrated in Figure 1.

The inclusion criteria for this study were: the article had a year of publication 2018 - 2023, the intervention was the administration of moringa leaf tea and there was an effect of giving moringa leaf tea on reducing blood glucose levels and cholesterol levels, and the type of article used was a randomized control trial. The exclusion criteria for this study were: there were no articles published in 2018 - 2023, the intervention was not given Moringa leaf tea and there was no effect of giving Moringa leaf tea on reducing blood glucose levels and cholesterol levels, and the type of article used was other than randomized control. trials.

Data analysis, the first thing to do is to select journal articles based on the title then proceed with the selection by looking at the abstracts of the journal articles that are in accordance with the discussion in the literature review. After selecting the title along with the abstract, then the selection of research journals is carried out to see whether or not there is duplication in the search for journal articles. After that, journal articles are selected full text journal articles with titles and abstracts according to the criteria of the journal to be reviewed. Selection was also carried out using the appropriateness of the inclusion and exclusion criteria.

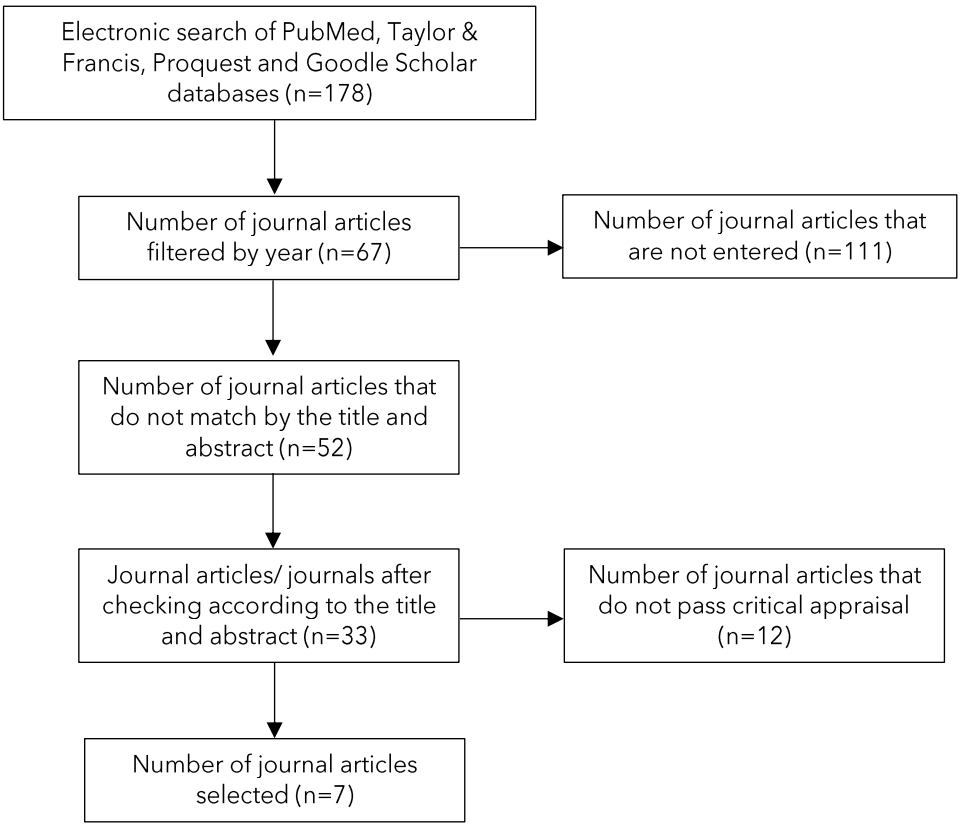

Figure 1. Prisma flow of articles selection

RESULTS AND DISCUSSION

The literature search found 178 articles but only 7 journal articles that met the search inclusion criteria and were included in the data analysis in the literature review study. This is described in the following tables.

Table 1. Theoretical Mapping

No	Author and Year	Title	Design and Sample	Results
1	(Aulia et al, 2023)	Effects of Ethanolic Extract of Moringa Leaves on HDL Levels, LDL Levels, and Aortic Thickness of Wistar Rats Model of Metabolic Syndrome	Design: laboratory experimental Sample: 30 rats with the inclusion criteria of male wistar rats	There was a significant difference between HDL and LDL levels before and after extract administration. There were significant differences in HDL and LDL levels between groups, while there was no significant difference in aortic thickness between groups. Ethanolic extract of Moringa leaves dose 150; 250; and 350 mg/kg/day increased HDL levels and decreased LDL levels, but had no effect on the aortic thickness of the male Wistar rat model of metabolic syndrome.
2	(Alfian et al, 2023)	Combination Effects of Noni and Moringa Powders on Fasting Blood Glucose of Dyslipidemia DMT2 Rats	Design: pre-posttest design with control group Sample: 30 tails, aged 2-3 months with body weight between 150 to 250 grams	GDP levels were examined using the GOD-PAP method, data analysis using the Wilcoxon test. After 14 days of intervention, the P2 group experienced a maximum decrease in GDP levels of 176.20 ± 20.25 mg/dL (p=0.043), while there was no significant difference in the control group (p=0.416). Provision of combination powder has an effect on reducing GDP levels. Combination powders can be considered for lowering glucose levels.
3	(Anggeria et al., 2022)	Moringa Leaf Powder Effectively Lowers Blood Glucose Levels and Cholesterol Levels in Obese Individuals	Design: quasi-experimental pre and post-test one group Sample: 40 people consisting of 20 people in the treatment group and 20 people in the control group. The treatment group was given 2 x 500 mg of Moringa leaf powder which was put in a	The results of the study showed that Moringa leaf powder had a significant effect on reducing blood glucose and cholesterol levels in obese individuals in Pakong District, Pamekasan Regency (P<0.05). Moringa leaf powder can be used as a natural food ingredient for the prevention of hyperglycemia and hypercholesterolemia

No	Author and Year	Title	Design and Sample	Results
			capsule and consumed after eating in the morning and evening. The control group was only given education on preventing hyperglycemia and hypercholesterolemia.	
4	(Pipiet et al, 2022)	Effective Dose of Moringa Leaf Extract (Moringa oleifera Lamk.) to Reduce Total Cholesterol Levels of Male Wistar Rats Induced by Streptozotocin	Design: true experimental design with pre and posttest only control group design Sample: 28 male wistar rats (Rattus norvergius) aged 2-3 months and weighing 200-350 grams	The results of the Pearson correlation test showed p <0.05 proving that administration of moringa leaf extract had a relationship with reduced cholesterol levels in male Wistar rats. The effective dose of Moringa leaf extract was calculated using a linear regression test. The equation obtained from the regression test is y = 0.0739x + 153.59 with a Y value of 114.4 mg/dl, so that the effective dose of Moringa leaf extract in reducing total cholesterol levels in male Wistar rats is 528.96 mg/kg BW.
5	(Sonia dkk, 2021)	Moringa oleifera Leaf Supplementation as a Glycemic Control Strategy in Subjects with Prediabetes	Design: double-blind, randomized, placebo-controlled, parallel group clinical trial Sample: Subjects aged 40 to 70 years. who meet the American Diabetic Association (ADA) criteria for the diagnosis of prediabetes (HbA1c: 5.7–6.4%, or fasting glucose: 100–125 mg/dL, or 2-hour glucose tolerance test: 140–199 mg/dL) and who has never used drugs for glycemic control.	ANCOVA with "treatment" fixed factor and basal value as covariate was used to compare score changes between groups. The results showed significant differences between groups in the rate of change of fasting blood glucose (FBG) and glycated hemoglobin (HbA1c), which showed opposite directions during the intervention, decreasing MO and increasing PLC. No distinct change scores were found between groups in the microbiota, markers of liver and kidney function or appetite control hormones measured. MO supplementation resulted in favorable changes in glycemic markers compared with placebo in the studied subjects with prediabetes, suggesting that MO may act as a natural ant hyperglycemic agent.
6	(Jenny, 2018)	The Effect of Giving Moringa Leaf	Design: pre-experiment with one	The average change in blood sugar levels after being given moringa

No	Author and Year	Title	Design and Sample	Results
		Decoction on Blood Sugar Levels in Patients with Type 2 DM in Bangkinang Village, City Health Center Working Area in 2017	group pretest-posttest design Sample: all Type II DM sufferers in the Bangkinang Subdistrict, Working Area of the Bangkinang City Health Center, totaling 58 people	leaf decoction was 71.41 with a standard deviation of 40.77. The results of the statistical test obtained a P-value of 0.000 (≤ 0.05), which means that there is a difference between blood sugar levels before and after being given moringa leaf decoction to type II DM sufferers in Bangkinang Village, City Work Area, Bangkinang City Health Center in 2017. There is an effect of giving leaf decoction moringa on decreasing blood sugar levels with a P-value of 0.000.
7	(Arieni et al., 2018)	Administration of Moringa Leaf Decoction to Decreased Blood Glucose Levels in Patients with Diabetes Mellitus (DM)	Design: laboratory observation Sample: patients with Diabetes Mellitus (DM) at Nusa Mappala Gowa Housing in September 2017	Giving boiled water from Moringa leaves can reduce blood glucose levels in patients with diabetes mellitus (DM). From the administration of boiled water for Moringa leaves for 4 days, a decrease in blood glucose levels was seen in the administration of boiled water for Moringa leaves on the 4th day of the study.

Table 2. Types of therapy and statistical test results

No	Author and Year	Types of Therapy	p-value	Result
1	(Aulia et al, 2023)	Moringa leaf ethanolic extract	p< 0,05	There is influence
2	(Alfian et al, 2023)	Giving a combination of moringa and noni powder	P< 0,05	There is a decline
3	(Anggeria et al., 2022)	Giving moringa leaf powder	P< 0,05	There is a decline
4	(Pipiet et al, 2022)	Moringa leaf extract	p< 0,05	There is influence
5	(Sonia dkk, 2021)	Provision of dry moringa leaf powder capsules	p= 0,001	There is a decline
6	(Jenny, 2018)	Giving a decoction of moringa leaves	p= 0,000	There is influence
7	(Arieni et al., 2018)	Giving a decoction of moringa leaves	p= 0.000	There is influence

Types of Therapy

It can be seen that the distribution of types of moringa leaf tea therapy or moringa leaf decoction is found in 2 studies, namely research [10]. Therapy by administering powder was found in 2 studies namely research [11] therapy by administering Moringa leaf extract was found in 2 studies namely research [12] and for therapy by administering Moringa leaf capsules and dried Moringa leaves are found in research by [13]. There is a role for flavonoids and alkaloids as hypoglycemic agents working through intra-pancreatic and extra-pancreatic mechanisms by repairing and playing a role in cell regeneration β

pancreas and stimulates the release of the hormone insulin [14]. Alkaloids provide stimulation to the sympathetic nerves resulting in increased insulin secretion. Giving moringa leaf decoction can reduce blood glucose levels in DM patients. Moringa leaf powder is proven to significantly reduce blood glucose levels in mice [15].

The process of making Moringa leaf powder includes washing the Moringa leaves and then draining them and letting them air for ± 24 hours [16]. The next stage is the separation of the moringa leaves from the stalks for the drying process, then the moringa leaves are dried using an oven at 35ºC, for 5 hours. Moringa leaf powder as much as 2 x 500 mg which is put in a capsule and consumed after eating in the morning and evening [17].

Make a decoction of 300 mg of Moringa leaves, which are washed clean, then boiled in 3 cups of water = 450 ml, for 15 minutes until the boiled water becomes 1 cup = 150 ml, then filtered and wait a few minutes until it is warm. Provision of moringa leaf decoction is given for 1x a day.

Duration of Implementation

The duration of administering tea/moringa leaf extract varied starting from 56 days in the study [18]. According to [19] 14 days can lower blood glucose levels and have a hypoglycemic effect. The doses of Moringa leaf extract were divided into 5 groups, namely 62.5 mg/kg, 125 mg/kg, 250 mg/kg, 500 mg/kg, and 1000 mg/kg, for 28 days by [20]. in 12 weeks, 58% of subjects had elevated HbA1c levels after 12 weeks. compared to baseline in the MO group and only 38% in the PLC group by [21]. According to [22] 4 days there was a difference between blood sugar levels before and after being given moringa leaf decoction to type II DM sufferers. Moringa leaf decoction was given every morning for 3-4 days, with a dose of 150 ml each. It can be concluded that the fastest time for administering moringa leaf tea is 4 days and the longest is 3 months.

CONCLUSION

Based on the findings of this literature review, *Moringa oleifera* leaves demonstrate potential effectiveness in reducing blood glucose and cholesterol levels in obese individuals. The bioactive compounds present in moringa leaves, including flavonoids, polyphenols, vitamins, and antioxidants, contribute to improved glucose metabolism, enhanced insulin sensitivity, and better lipid profile regulation. The reviewed studies indicate that the consumption of moringa leaves in various forms, particularly as herbal tea, powder, or extract, may provide beneficial effects in managing metabolic disorders associated with obesity. These findings suggest that moringa leaf tea could be considered a complementary natural therapy for controlling blood glucose and cholesterol levels. However, further well-designed clinical studies with larger sample sizes are required to strengthen the scientific evidence regarding the efficacy and safety of moringa consumption in the management of metabolic disorders among obese individuals.

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