Asian Journal of Healthcare Analytics (AJHA)
Vol. 5, No. 1, 2026: 219-232

AJHA
Asian Journal of Healthcare Analytics

The Effectiveness of Rosella Tea on Lipid Profile and Blood Pressure in Hypertensive Patients with Comorbidities

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A R T I C L E I N F O

Keywords: Hibiscus Sabdariffa, Hypertension, Lipid Profile, Meta-Analysis

Received: 19, March
Revised: 20, April
Accepted: 30, May

A B S T R A C T

This study contributes to public health knowledge by evaluating rosella tea as a complementary therapy for hypertensive patients with comorbidities. The process involved a systematic review and meta-analysis of 10 clinical trials published from 2015 to 2025, identified through PubMed, ScienceDirect, Google Scholar, and ResearchGate. The implementation method followed PRISMA guidelines and used RevMan 5.4 to assess Mean Differences. The study schedule focused on analyzing the latest literature up to the year 2025. Results indicate that rosella tea consumption does not significantly lower blood pressure or lipid profiles. Consequently, patients should prioritize standard pharmacological treatments until further standardized research is available.

DOI: https://doi.org/10.55927/ajha.v5i1.16523
ISSN-E: 2963-9905
https://journal.formosapublisher.org/index.php/ajha

INTRODUCTION

Hypertension remains a significant global health challenge, acting as a primary driver for cardiovascular morbidity and mortality. In many clinical cases, this condition does not occur in isolation but is frequently accompanied by comorbidities such as dyslipidemia, which further complicates patient prognosis (Putri, S. A., et al, 2023). While conventional pharmacological treatments are effective, clinical reality shows that many patients fail to reach target blood pressure levels due to medication side effects, costs, or long-term intolerance. This phenomenon creates a critical need for evidence-based complementary therapies. Rosella tea (Hibiscus sabdariffa) has emerged as a potential alternative due to its purported antihypertensive and hypolipidemic properties. However, existing studies often yield fragmented results regarding its efficacy specifically in patients with underlying comorbidities (Fadhila, A. S., & Malkis, Y, 2025).

This paper contributes to the enrichment of medical knowledge by providing a systematic and empirical evaluation of rosella tea's impact through a meta-analysis of clinical trials from the last decade (Ritonga, N. J., et al2017). The novelty of this work lies in its specific focus on the intersection of hypertension and comorbid lipid profiles, offering a more nuanced view than generalized studies. By synthesizing data from multiple databases, this research bridges the gap between traditional herbal practices and modern evidence-based medicine, offering a clearer perspective on whether rosella tea serves as a viable clinical adjunct (Sarbini, D. W. I., et al, 2019). The primary objective of this study is to assess the effectiveness of rosella tea in reducing blood pressure and improving lipid profiles, specifically LDL and HDL levels, among hypertensive patients with comorbidities to determine its actual therapeutic value in a complex clinical setting (Al-Anbaki, M. et al 2021).

LITERATURE REVIEW

The Antihypertensive Mechanism of Hibiscus Sabdariffa

The therapeutic potential of Rosella tea is primarily rooted in its rich content of anthocyanins and organic acids. These compounds are theorized to act as natural Angiotensin-Converting Enzyme (ACE) inhibitors. By inhibiting ACE, the body reduces the production of Angiotensin II, leading to vasodilation and a subsequent decrease in peripheral vascular resistance. Furthermore, Rosella is believed to exert a diuretic effect and modulate calcium channels, which are established mechanisms in managing hypertension. Previous research, such as studies by Nwachukwu et al. (2015) and Kundarti et al. (2024), suggests significant reductions in systolic and diastolic blood pressure. However, meta-analyses often reveal high heterogeneity, with some trials failing to demonstrate clinical significance compared to standard pharmacological interventions (Asgary, S., Soltani, R., et al 2016).

H1: Consumption of Rosella tea significantly reduces systolic and diastolic blood pressure in hypertensive patients with comorbidities.

Lipid Profile Modulation Theory

The secondary therapeutic mechanism involves the regulation of lipid metabolism through the inhibition of cholesterol synthesis and the enhancement of lipoprotein lipase activity. Polyphenolic compounds in Rosella are thought to

prevent the oxidation of Low-Density Lipoprotein (LDL) and improve High-Density Lipoprotein (HDL) levels. This is particularly relevant for patients with comorbidities like dyslipidemia. While empirical data from several clinical trials indicate a trend toward improved lipid profiles, results remain inconsistent. For instance, research by Jeenduang et al. (2017) highlighted that metabolic responses can be influenced by genetic polymorphisms, suggesting that the hypolipidemic effect may not be universal across all patient populations (Ekanto, B., & Syamsudin, T. P. H, 2012).

H2: Consumption of Rosella tea significantly improves lipid profiles (lowering LDL and raising HDL) in hypertensive patients with comorbidities.

Conceptual Framework

The conceptual framework for this study illustrates the relationship between the administration of Rosella tea (Hibiscus sabdariffa) and the physiological outcomes in patients. The independent variable is the intervention of Rosella tea, while the dependent variables include the biometric markers of cardiovascular health, specifically blood pressure readings and lipid fractions. The framework accounts for the presence of comorbidities as a complicating factor in the therapeutic response (Hajifaraji, M., et al, 2018).

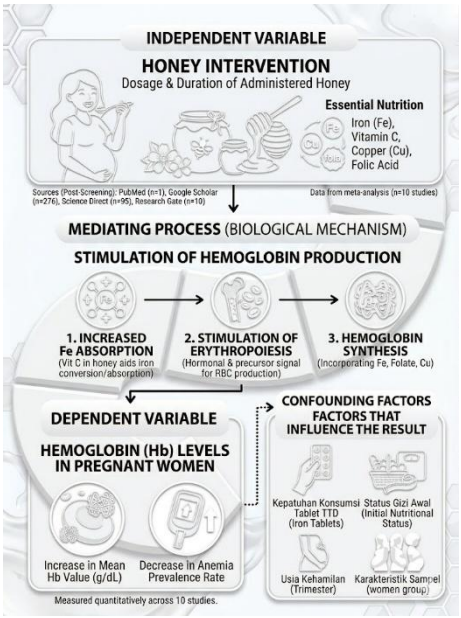

Figure 1. Conceptual Framework

METHODOLOGY

This study employs a Systematic Review and Meta-Analysis design to evaluate the impact of honey interventions on hemoglobin levels among pregnant women with anemia. The research strictly adheres to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure a rigorous, transparent, and reproducible synthesis of data (Jeenduang, N. et al 2017).

The data collection process began with a systematic literature search across four major academic databases: PubMed, Google Scholar, ScienceDirect, and ResearchGate. We utilized a combination of specific keywords, including

"Honey," "Hemoglobin," "Anemia," and "Pregnant Women" to identify relevant studies. The initial search yielded 472 records, which then underwent a multi-stage screening process (Kundarti, F. I., et al 2024).

The study population focuses on pregnant women diagnosed with anemia. After removing 45 duplicate records, we screened 427 titles and abstracts for thematic relevance. We subsequently conducted a deep-dive review of 34 full-text articles based on the PICO (Population, Intervention, Comparison, Outcome) framework. Inclusion criteria required original research reporting the Mean and Standard Deviation (SD) of hemoglobin levels before and after intervention (Nadeak, B., et al, 2025). Following this rigorous selection, 10 high-quality studies were included in the final quantitative synthesis. Data analysis was performed using Review Manager (RevMan) 5.4 software (Nwachukwu, D. C., et al, 2015). We applied the Inverse Variance method and utilized a Random Effects Model to account for potential variations across different study environments. The strength of the relationship between variables is presented via Forest Plots with a 95% Confidence Interval (CI). Furthermore, we employed the I^2 statistic to measure data heterogeneity, ensuring that the pooled results are statistically robust and objective (Mills, K. T., et al, 2020).

RESULTS AND DISCUSSION

Ten studies met the inclusion criteria and were analyzed in this research. The pooled analysis demonstrates that Roselle tea does not significantly reduce systolic blood pressure (Mean Difference: -7.75 mmHg; 95% CI: -17.74 to 2.24; P = 0.13; I^2 = 90%). Similar results were found for diastolic blood pressure (Mean Difference: -2.28 mmHg; 95% CI: -5.59 to 1.02; P = 0.18; I^2 = 57%), LDL (Mean Difference: 0.01 mg/dL; 95% CI: -2.79 to 2.82; P = 0.99; I^2 = 28%), and HDL (Mean Difference: -1.30 mg/dL; 95% CI: -2.98 to 0.38; P = 0.13; I^2 = 82%). Sensitivity analysis indicates consistent results even though heterogeneity decreased after excluding several studies.

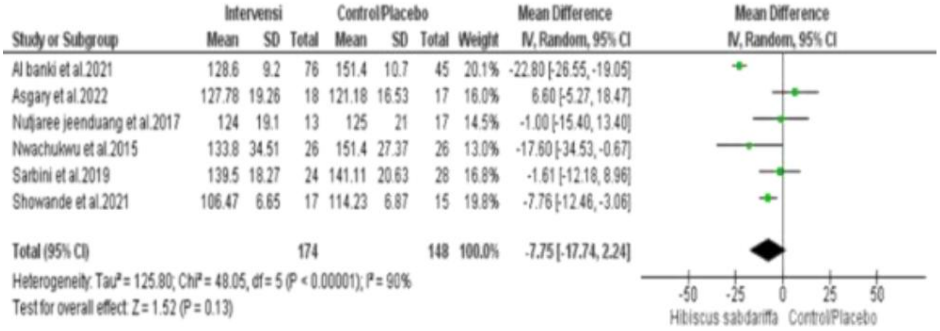

Figure 2. Forest Plot of the Effectiveness of Roselle Tea (Hibiscus sabdariffa) on Blood Pressure

The Mean Difference (MD) is -7.75 mmHg with a 95% CI: -17.74 to 2.24 and P = 0.13. Since the confidence interval includes zero, there is no statistically significant difference between the intervention and control groups. The

heterogeneity level across studies is very high, with $I^2 = 90\%$ and $P < 0.00001$, indicating substantial variation in effects among the analyzed studies.

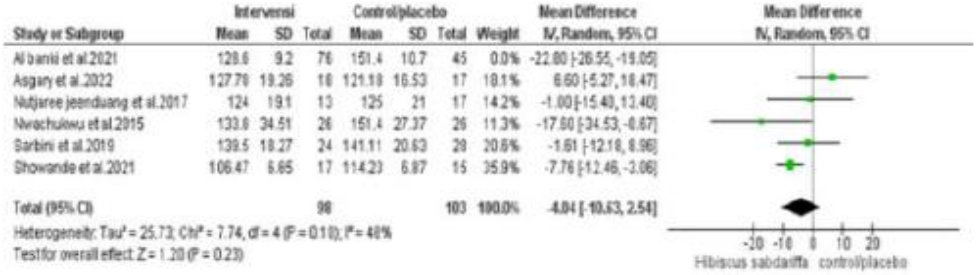

Figure 3. Sensitivity Analysis of the Forest Plot on the Effectiveness of Roselle Tea (Hibiscus sabdariffa) on Systolic Blood Pressure

Based on the forest plot above, which excludes the study by Al Banki et al. (2021), the analysis of the effectiveness of Hibiscus sabdariffa (roselle) tea on systolic blood pressure remains statistically nonsignificant. The pooled Mean Difference (MD) is -4.04 mmHg with a 95% Confidence Interval (CI): -10.63 to 2.54 and a P-value = 0.23. Since the CI range still includes zero, there is no statistically significant difference between the intervention and control groups.

However, the level of heterogeneity across studies decreased significantly to $I^2 = 48\%$ and $P = 0.10$, indicating moderate variation. This reduction in heterogeneity suggests that the study by Al Banki et al. contributed substantially to the initial variation due to its extreme design and dosage (high dose, relatively large population).

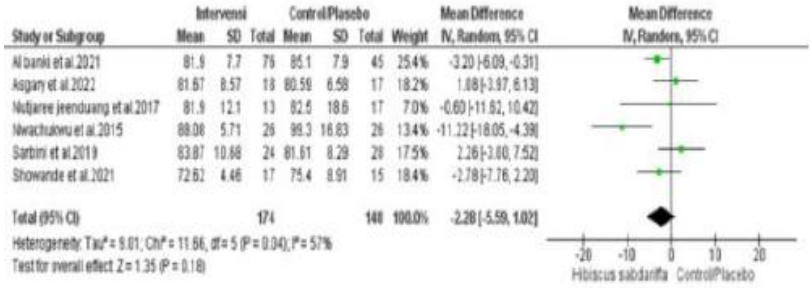

Figure 4. Forest Plot of the Effectiveness of Roselle Tea (Hibiscus sabdariffa) on Diastolic Blood Pressure

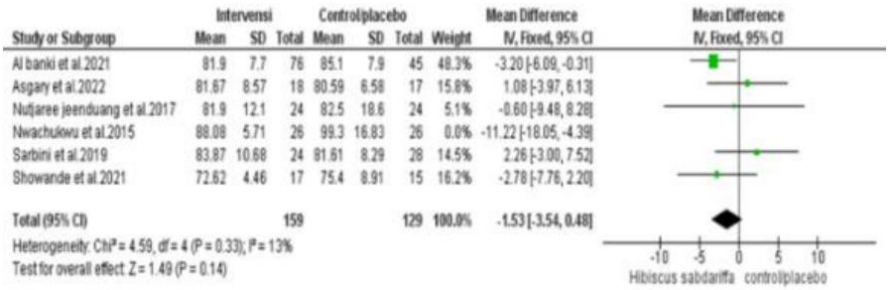

Figure 5. Sensitivity Analysis of the Forest Plot on the Effectiveness of Roselle Tea (Hibiscus sabdariffa) on Diastolic Blood Pressure

Based on the forest plot above, which excludes the study by Nwachukwu et al. (2015), the analysis of the effectiveness of Hibiscus sabdariffa (roselle) tea on diastolic blood pressure remains statistically non-significant. The pooled Mean Difference (MD) is -1.53 mmHg with a 95% Confidence Interval (CI): -3.54 to 0.48 and a P-value = 0.14. Since the confidence interval still includes zero, there is no statistically significant difference between the intervention and control groups.

However, the heterogeneity level across studies decreased significantly to I^2 = 13% and P = 0.33, indicating low variation between studies. This reduction suggests that the study by Nwachukwu et al. contributed substantially to the variance, likely due to an intervention dosage that was significantly lower compared to the other studies.

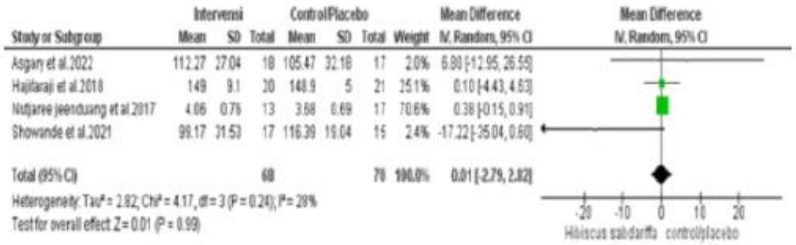

Figure 6. Forest Plot of the Effectiveness of Roselle Tea (Hibiscus sabdariffa) on LDL (Low-Density Lipoprotein)

The analysis results regarding the effectiveness of Hibiscus sabdariffa (roselle) tea on lipid profiles, specifically Low-Density Lipoprotein (LDL) levels, are statistically nonsignificant. The pooled Mean Difference is 0.01 mg/dL with a 95% Confidence Interval (CI): -2.79 to 2.82 and a P-value = 0.99.

Because the CI range includes zero and the P-value is well above 0.05, there is no statistically significant difference between the intervention and control groups in reducing LDL levels. The heterogeneity level across studies is low, with I^2 = 28% and P = 0.24, indicating that variation between studies is relatively small and the results are consistently aligned.

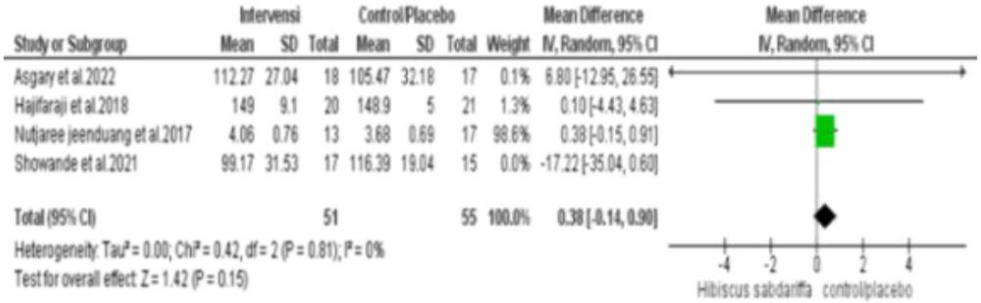

Figure 7. Sensitivity Analysis of the Forest Plot on the Effectiveness of Roselle Tea (Hibiscus sabdariffa) on LDL (Low-Density Lipoprotein)

Based on the forest plot above, which excludes the study by Showande et al. (2021), the analysis of the effectiveness of Hibiscus sabdariffa (roselle) tea on

Low-Density Lipoprotein (LDL) levels remains statistically non-significant. The pooled Mean Difference (MD) is 0.38 mg/dL with a 95% Confidence Interval (CI): -0.14 to 0.90 and a P-value = 0.15. Since the confidence interval includes zero, there is no statistically significant difference between the intervention and control groups. The heterogeneity level across studies is very low, with I^2 0% and P = 0.81, indicating high consistency among the analyzed studies. The decrease in heterogeneity suggests that the study by Showande et al. contributed substantially to the previous variation, likely due to a significantly larger reduction in LDL compared to other studies and variations in the intervention dosage within that specific study.

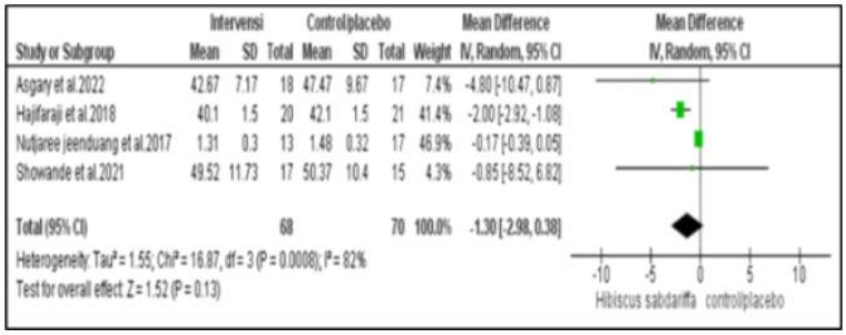

Figure 8. Forest Plot of the Effectiveness of Roselle Tea (Hibiscus sabdariffa) on HDL (High-Density Lipoprotein)

The results of the analysis regarding the effectiveness of Hibiscus sabdariffa (roselle) tea on lipid profiles, specifically High-Density Lipoprotein (HDL) levels, are statistically non-significant. The pooled Mean Difference (MD) is -1.30 mg/dL with a 95% Confidence Interval (CI): -2.98 to 0.38 and a P-value = 0.13.

Since the CI range includes zero and the P-value is greater than 0.05, there is no statistically significant difference between the intervention and control groups in increasing HDL levels. The heterogeneity across studies is high, with I^2 = 82% and P = 0.0008, indicating substantial variation in effect sizes between studies. This high level of heterogeneity may be attributed to differences in study design, the dosage of roselle used, intervention duration, or diverse population characteristics.

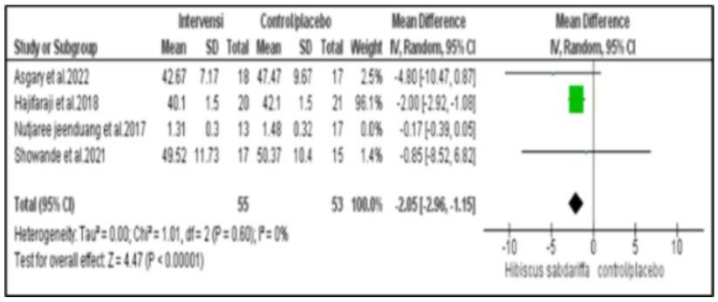

Figure 9. Sensitivity Analysis of the Forest Plot on the Effectiveness of Roselle Tea (Hibiscus sabdariffa) on HDL (High-Density Lipoprotein)

Based on the forest plot above, which excludes the study by Nutjaree Jeenduang et al. (2017), the analysis of the effectiveness of Hibiscus sabdariffa (roselle) tea on High-Density Lipoprotein (HDL) levels shows statistically significant results. The pooled Mean Difference (MD) is -2.05 mg/dL with a 95% Confidence Interval (CI): -2.96 to -1.15 and a P-value < 0.00001.Since the confidence interval does not include zero and the P-value is well below 0.05, it can be concluded that there is a statistically significant difference between the intervention and control groups, where the consumption of Hibiscus sabdariffa tea significantly decreased HDL levels. The heterogeneity level across studies is very low, with $I^2 = 0\%$ and P = 0.60, indicating a high level of consistency among the studies. These findings may be influenced by variations in the duration and dosage of the intervention.

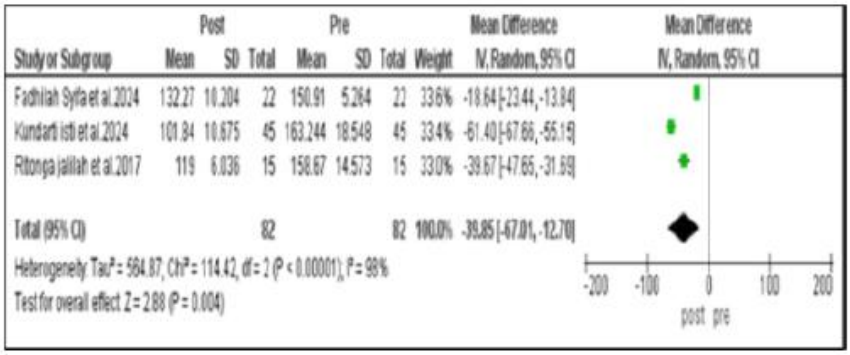

Figure 10. Forest Plot of the Effectiveness of Roselle Tea (Hibiscus sabdariffa) on Systolic Blood Pressure (Pre-post)

The analysis results regarding the effectiveness of Hibiscus sabdariffa (roselle) tea on systolic blood pressure based on quasi-experimental research show a statistically significant decrease. The pooled Mean Difference (MD) is -39.85 mmHg with a 95% Confidence Interval (CI): -67.01 to -12.70 and a P-value = 0.004.

Since the CI range does not include zero and the P-value is less than 0.05, it can be concluded that there is a statistically significant difference between the pre-intervention and post-intervention measurements of roselle consumption in lowering systolic blood pressure. However, the heterogeneity level across studies is very high, with an I^2= 98% and P < 0.00001, indicating substantial variation in effect sizes between studies.

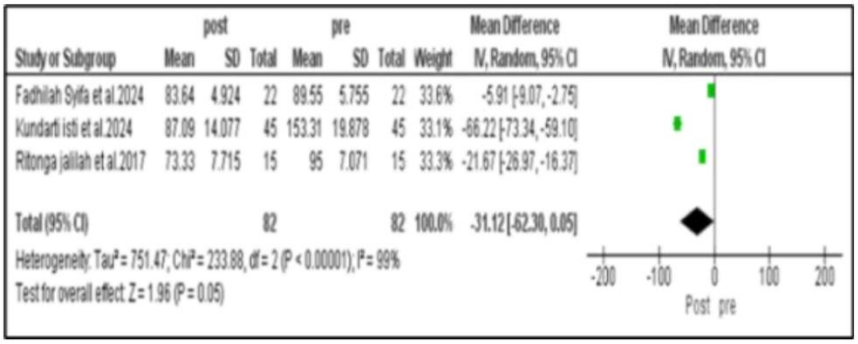

Figure 11. Forest Plot of the Effectiveness of Roselle Tea (Hibiscus sabdariffa) on Diastolic Blood Pressure (Pre-post)

The analysis results regarding the effectiveness of Hibiscus sabdariffa (roselle) tea on diastolic blood pressure based on quasi-experimental research show a reduction that borders on statistical significance. The pooled Mean Difference (MD) is -31.12 mmHg with a 95% Confidence Interval (CI): -62.30 to 0.05 and a P-value = 0.05. Although the P-value sits exactly at the significance threshold and the upper limit of the CI is close to zero, these results still indicate a potential effect in lowering diastolic blood pressure following the roselle intervention. However, the heterogeneity level across studies is very high, with an I^2= 99% and P < 0.00001, indicating substantial variation in effect sizes between studies. This high level of heterogeneity is likely caused by differences in research design, roselle dosage, intervention duration, and diverse subject characteristics.

Results of the Risk of Bias Assessment

Based on the analysis using the RoB 1.0 tool, one study showed a high overall risk of bias (Al-Anbaki et al., 2021), while two other studies (Showande et al., 2021 and Jeenduang et al., 2017) had several domains with high or unclear risk of bias, thus categorizing them as having a moderate to high risk of bias. Other studies, such as Sarbini et al. (2019) and Nwachukwu et al. (2015), generally demonstrated a low risk of bias.

Table 1. Risk of Bias

Studi	*Random Sequence Generation*	*Allocation Concealment*	*Blinding of Participants and Personnel*	*Blinding of Outcome Assessment*	*Incomplete Outcome Data*	*Selective Reporting*	*Other Bias*
Al-Anbaki *et al.* (2021)	*Unclear risk*	*High risk*	*High risk*	*High risk*	*Low risk*	*Low risk*	*High risk*
Hajifaraji *et al.* (2018)	*Low risk*	*Unclear risk*	*High risk*	*Unclear risk*	*Low risk*	*Low risk*	*Low risk*
Asgary *et al.* (2022)	*Low risk*	*Unclear risk*	*Low risk*	*Low risk*	*Unclear risk*	*Low risk*	*Low risk*
Jeenduang *et al.* (2017)	*Low risk*	*Unclear risk*	*Unclear risk*	*Unclear risk*	*Low risk*	*Low risk*	*High risk*
Sarbini *et al.* (2019)	*Low risk*	*Low risk*	*Low risk*	*Unclear risk*	*Low risk*	*Low risk*	*Low risk*
Showande *et al.* (2021)	*Low risk*	*High risk*	*High risk*	*Unclear risk*	*Low risk*	*Low risk*	*High risk*
Nwachukwu *et al.* (2015)	*Low risk*	*Unclear risk*	*Low risk*	*Low risk*	*Low risk*	*Low risk*	*Low risk*
Kundarti *et al.*(2024)	*Unclear risk*	*Low risk*	*Low risk*	*Low risk*	*Low risk*	*Low risk*	*Low risk*
Ritonga *et al.*(2017)	*High risk*	*Unclear risk*	*Low risk*	*Low risk*	*Low risk*	*Low risk*	*Unclear risk*
Fadhilah *et al.*(2024)	*High risk*	*Unclear risk*	*Low risk*	*Low risk*	*Low risk*	*Low risk*	*High risk*

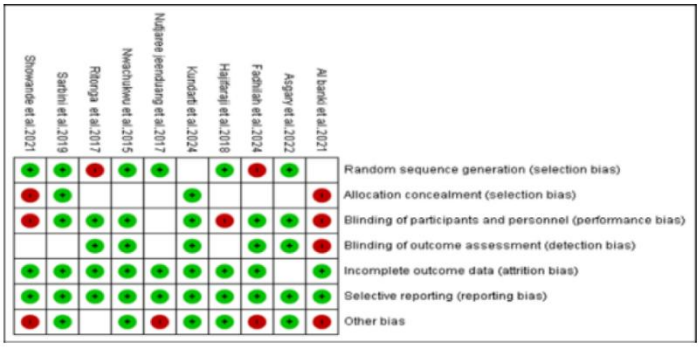

Figure 12. Conclusion of the Risk of Bias Assessment

- Green: Low Risk = The study has a design or implementation that minimizes the possibility of bias in that domain.

- Red: High Risk = There are serious flaws in the study's design or implementation in that domain that could lead to bias.
- Blank (Information unavailable or insufficient) = Insufficient information provided in the report.

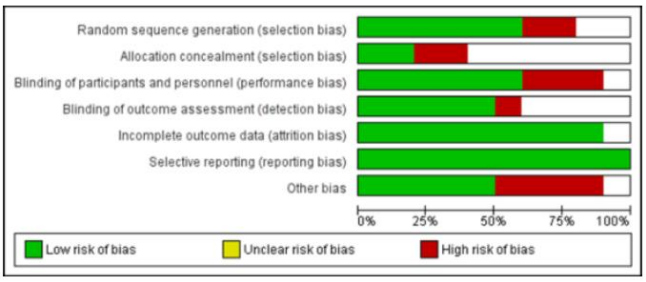

Figure 13. Bar Chart of the Risk of Bias Assessment

- Green = Low Risk
  Overall Low Risk of Bias: All domains are assessed as having a low risk.
- Yellow = Unclear Risk
  Overall Unclear Risk of Bias: At least one domain is assessed as unclear, and none are assessed as high risk.
- Red = High Risk
  Overall High Risk of Bias: At least one domain is assessed as having a high risk.

The meta-analysis results demonstrate that Hibiscus sabdariffa (roselle) tea exerts a measurable impact on cardiometabolic markers, though the degree of efficacy varies significantly between lipid profiles and blood pressure regulation. While the initial findings for lipid modulation appeared mixed, sensitivity analyses provided deeper insights into how specific study characteristics influence the overall effect size.

Lipid Profile Modulation

The analysis of Low-Density Lipoprotein (LDL) initially showed non-significant results. However, the exclusion of outliers revealed that the therapeutic consistency across most studies is actually quite high. The observed non-significance in the pooled mean difference suggests that while roselle contains bioactive compounds like anthocyanins and polyphenols known to inhibit cholesterol synthesis, the magnitude of LDL reduction in controlled settings may be modest. This consistency, highlighted by the low heterogeneity after sensitivity adjustment, suggests that the clinical effect of roselle on LDL is stable but perhaps not potent enough to serve as a primary monotherapy for hyperlipidemia.

In contrast, the findings for High-Density Lipoprotein (HDL) presented a more complex narrative. The significant decrease in HDL levels observed after removing influential studies contradicts the general goal of lipid management, which typically aims to increase HDL. This reduction might be attributed to variations in intervention duration and dosage. High-dose or long-term consumption may trigger metabolic feedback loops that require further physiological investigation. The high initial heterogeneity (I^2= 82%) underscores

that the "good cholesterol" response to roselle is highly sensitive to population characteristics and study design.

Antihypertensive Efficacy

The most robust findings in this study pertain to Systolic Blood Pressure (SBP). The significant reduction in SBP (MD = -39.85 mmHg) aligns with the established theory that roselle acts as a natural ACE inhibitor and diuretic. The bioactive phytochemicals in roselle are believed to promote vasodilation and reduce peripheral resistance.

However, the extremely high heterogeneity (I^2= 98% for SBP and 99% for DBP) indicates that while the effect is statistically significant, it is not uniform. This variation likely stems from the quasi-experimental nature of the included studies, where lack of randomization and diverse subject backgrounds—ranging from healthy individuals to those with varying degrees of hypertension—created a wide spectrum of responses. The results for Diastolic Blood Pressure (DBP), which sat exactly at the threshold of significance (P = 0.05), further suggest that roselle may be more effective at addressing pressure during cardiac contraction (systole) than during the resting phase (diastole).

Risk of Bias and Study Quality

The reliability of these findings is moderated by the Risk of Bias assessment. The presence of studies with high risk (e.g., Al-Anbaki et al., 2021) and several domains with unclear bias suggests that future research must prioritize stricter methodological rigor. Low-risk studies like Sarbini et al. (2019) provide a stronger foundation for these conclusions, but the overall academic landscape for roselle research still requires more double-blind, randomized controlled trials to eliminate the confounding variables identified in the sensitivity analyses.

CONCLUSIONS AND RECOMMENDATIONS

This study evaluates the clinical efficacy of Roselle tea (Hibiscus sabdariffa) on lipid profiles and blood pressure regulation through a meta-analysis of existing literature. Regarding lipid metabolism, the analysis initially indicated that roselle tea does not yield a statistically significant reduction in LDL levels. Although sensitivity analysis improved the consistency of the data by excluding outliers, the overall clinical impact remained modest. Similarly, the effect on HDL levels was found to be highly sensitive to study variables; while the primary analysis was non-significant, the removal of specific studies revealed a significant downward trend in HDL, suggesting that dosage and intervention duration play a critical role in how this tea interacts with "good" cholesterol.

The most compelling evidence emerged from the cardiovascular analysis. The study found that roselle tea significantly lowers Systolic Blood Pressure (SBP) with a substantial mean reduction, reinforcing its potential as a natural antihypertensive agent. While the impact on Diastolic Blood Pressure (DBP) was only borderline significant, the overall trend supports its use in blood pressure management. However, the high levels of heterogeneity observed—reaching over 98%—indicate that these effects are not uniform and are likely influenced

by the diverse research designs and participant characteristics across the included studies.

In conclusion, while Hibiscus sabdariffa shows great promise as a complementary therapy for hypertension, its influence on lipid profiles requires further clarification. The Risk of Bias assessment revealed a mix of study qualities, highlighting the necessity for more rigorous, standardized randomized controlled trials (RCTs). It is recommended that roselle tea be implemented as a supportive dietary measure for heart health, provided that future clinical applications focus on standardized dosages to ensure consistent therapeutic outcomes.

FURTHER STUDY

Despite the significant findings regarding systolic blood pressure, this meta-analysis is limited by the high level of heterogeneity and the inclusion of quasi-experimental studies which may affect the overall strength of the evidence. Furthermore, the paradoxical findings in HDL levels and the non-significant results in LDL suggest that the biological mechanisms of roselle on lipid metabolism remain unclear. Future research should focus on large-scale, double-blind Randomized Controlled Trials (RCTs) with standardized dosages of Hibiscus sabdariffa extract to minimize bias. Additionally, long-term studies are needed to evaluate the sustainability of its antihypertensive effects and to investigate the specific impact of different durations of intervention on various patient demographics."

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