



Effect of *Rosella* (*Hibiscus sabdariffa*. L) Consumption on Total Cholesterol Levels

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ABSTRACT

Heart disease is the leading cause of death in developed and developing countries. Increased and imbalanced cholesterol in plasma is a factor that can increase coronary heart disease incidence up to 2.52 – 3.20 at productive age. Drinks from *Rosella* can be used to treat hypercholesterolemia and hypertension. *Rosella* extract, containing anthocyanins with antioxidant properties, has been shown to reduce fat, Hyperlipidaemia, and heart disease. This study aimed to determine the effect of *rosella* (*Hibiscus sabdariffa*. L) infusion on body total cholesterol levels. The experimental method involves a pretest-posttest approach which measures plasma cholesterol values before and after a once-a-day intake of a glass of *rosella* steeping for 14 days. The result of the study shows an inverse relationship between the consumption of *rosella* steeping and cholesterol values, with an R-value of -0.378. The R Square value = 0.143 suggests that *rosella* steeping consumption affects total cholesterol levels by 14.3%. The study concludes a direct correlation between the consumption of *Rosella* infusion on total cholesterol values, with a decrease in serum cholesterol values after *Rosella* infusion compared to before intake.

Keywords: Heart Disease, Hypercholesterolemia, *Rosella*, *Hibiscus sabdariffa*. L.

Introduction

Heart disease is the leading cause of death in developed and developing countries¹. The WHO reported in 2005 that heart disease was the most common cause of death and will increase to more than 23.6 million deaths in 2030.^{2,3} Hyperlipidaemia is the second most common risk factor for heart disease after hypertension. Hyperlipidaemia increases cholesterol, triglycerides, or both⁴, and hypercholesterolemia is a significant factor in arteriosclerotic disease.⁵ Cholesterol is a hydrophobic molecule that circulates through the bloodstream in proteins called lipoproteins.⁶ Increased and imbalanced cholesterol in blood plasma has been associated with increased coronary heart disease up to 2.52 – 3.20 at productive age.^{2,5,6}

Generic drugs are often used to treat diseases. Most of these drugs have associated side effects.⁷ Recently, more people have found interest in traditional medicine, which is still commonly used in most rural areas and developing countries.⁸ Herbal medicine has many benefits, such as easy availability, cheap, little or no side effects, and safer when compared to synthetic drugs.⁹

Hibiscus Sabdariffa L., also known as *rosella*, has been used in traditional medicine as an antihypertensive, laxative, antidiabetic, anti-inflammatory, and antibiotic. It is an ideal plant for developing countries because it is easy to grow as part of a multi-crop system and can be used as food and fibre.¹⁰ *Hibiscus Sabdariffa* L is commonly consumed as a warm or cold drink for various therapies, including lowering cholesterol and hypertension.¹¹

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The many health benefits of *Rosella* have been associated with its phytochemicals, including anthocyanins, ascorbic acid, and carotenoids. Drinks from *Rosella* can treat heartache, heat, and hypercholesterolemia

Gosain et al. evaluated the effect of *rosella* flower extract on hyperlipidaemic rats. The animals were treated with 300 mg/kg of the extract for four weeks. The result of the study revealed that at the given oral dose, the levels of hyperlipidaemia reduced from an average of 162.4 mg/dL to 126.3 mg/dL.¹² This study aimed to determine the effect of *rosella* (*Hibiscus sabdariffa*. L) infusion on total cholesterol levels in human volunteers.

Methods

Study Design and Participants

The design of this study used a pre-experimental with a one-group pretest-posttest approach to measure cholesterol values before and after the administration of *rosella* infusion. The inclusion criteria were subjects' willingness to participate in the study, consuming a 2-gram *rosella* infusion of 1 glass/day for 14 days, while the exclusion criteria included: if subjects are sick and women taking contraceptive drugs. The study period was from May to June 2019.

Ethical approval

Ethical approval was obtained from the ethics committee of the Health Polytechnic of the Pontianak Ministry of Health with ethical license number No. 235/KEPK-PK.PKP/V/2019. Written informed consent was obtained from all subjects participating in this study.

Sample Size and Data Collection

Of the 40 subjects recruited for the study, only 36 met the inclusion criteria. Interviews were used to collect respondent data. Blood samples (3 mL) were withdrawn from each subject right radial vein into Gel separator tubes and stored in a refrigerator at 4-6°C.

Serum Cholesterol Assay

The collected blood samples from each subject were centrifuged (Hana Centrifuge 402-08 CE, Indonesia) at 3000 – 4000 rpm for 15 minutes to separate the serum from the plasma. The serum cholesterol

concentration (mg/dL) was measured in a photometer (Photometer 5010 v5+, Germany) using an analytic on cholesterol reagent as standard.

Statistical analysis

Collected data were analysed using Statistical Product and Service Solution (SPSS) v.25, 2019 software for Windows with a Simple Linear Regression test.

Results and Discussion

Of the total 36 subjects who participated in this study, female to male ratio was 5:1 (30 women and 6 men). Table 1 shows the demographics of the study group. From the parameters, most subjects are still in their productive age (30-56 age range), involved in daily physical activities (66.60%), with 58.40% having BMI above normal. Similarly, 77.80% of the subjects have no history of cholesterol-related illness and unhealthy eating habits.

Table 2 shows a statistical decrease in serum cholesterol levels after a 2-gram (a glass) rosella infusion daily for 14 days. The values were statistically significant, $p < 0.05$, compared to values before the intake (222.78 -199.06 mg/dL mean value). Also, Figure 1 illustrates the total cholesterol value before (blue) and after (red) consuming the *rosella* infusion. Table 3, on the other hand, revealed an inverse relationship between the consumption of *rosella* steeping and cholesterol values ($R = -0.378$). From these results, it could be inferred that each additional consumption of *rosella* could reduce total serum cholesterol levels.

The R Square (coefficient of determination) value = 0.143, as shown in Table 4, indicates that rosella steeping consumption affects total cholesterol levels by 14.3%, while other factors influence 85.7%. From the regression equation $y = 246.5 + (-23.722x)$, Table 5 reveals that the total serum cholesterol concentration is 246.5 mg/dL under the same experimental conditions. However, consuming 2 grams (1 cup) of brewed Rosella daily decreases the serum total cholesterol level by 23.722 mg/dL.

Hibiscus Sabdariffa L is easily found in Asia. *Hibiscus Sabdariffa* contains various phytochemicals, including polyphenols, flavonoids, and anthocyanins which are known to reduce blood cholesterol levels. (13). The plant extract can reduce dyslipidemia and glycemic values in rats. In humans, the extract has been shown to reduce total cholesterol, blood glucose and increase HDL values.¹⁴ The current study compares cholesterol values before and after consuming a 2-gram infusion of *Hibiscus Sabdariffa L*. (1 glass) per day for 14 days.

The result of the study shows that *Hibiscus Sabdariffa L* infusion can lower cholesterol after 14 days of consumption compared to before the intake. Statistical analysis shows a decrease in serum total cholesterol concentration with long-time usage of *Hibiscus Sabdariffa L* infusion. This view is supported by the study of Chen et al., which showed that the administration of *Hibiscus Sabdariffa L* extract to mice reduced serum triglyceride and LDL cholesterol levels by possible inhibition of reactive oxygen species in water from the arterial walls, with subsequent inhibition of LDL oxidation and reduction of risk of heart disease.¹⁵

Table 1: Demographics of the study population

Study Population Characteristics	Subject n (%)
Observation (n)	36
Age	*44.1 (30 – 56)
Sex	
Male	6 (16,6%)
Female	30 (83.4%)
BMI	
Normal	15 (41.6%)
Up Normal	21 (58.4%)
Daily Physical Activity	
Do	24 (66.6%)
Do not	12 (34.4%)
Disease History Cholesterol-related	
Have	8 (22.2%)
Do not have	28 (77.8%)
Dietary habit	
Good	14 (38.8%)
Bad	22 (61.2%)

*Mean (min-max)

Table 2: Descriptive Data on Total Cholesterol Levels Before and After 14 Days of Consuming *Rosella* Stew

	N	Min	Max	Mean	Std Dev
Cholesterol before	36	152	301	222.78	34.922
Cholesterol after	36	151	264	199.06	22.688

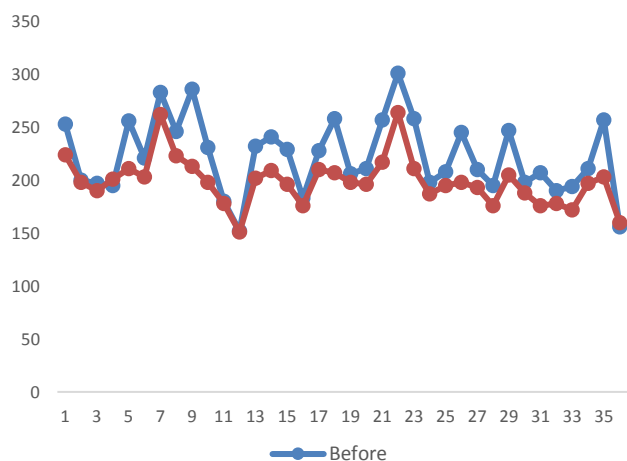


Figure 1: Descriptive analysis diagram of total cholesterol levels before and after intake of *Rosella* infusion

Table 3: Correlation of the results of simple linear regression analysis of the effect of steeping *rosella* on total cholesterol levels

	Total Cholesterol Levels	Consumption of <i>Hibiscus Sabdariffa L</i> infusion
Pearson Correlation	1.000	-0.378

Several studies show that anthocyanins, the highest components of *Hibiscus Sabdariffa L*, may be responsible for reducing cholesterol and preventing heart disease and hyperlipidemia.^{10,16} Intake of *Hibiscus Sabdariffa L* extract may reduce LDL, triglyceride, and total cholesterol values, increase HDL, reduce foam cells' presence, and inhibit smooth muscle cell migration.¹⁰ HDL-C mediates cholesterol transport from the blood vessels to the liver for catabolism (reverse cholesterol transport) because increased HDL-C can reduce atherosclerotic formation.¹⁷

Table 4: Summary Model of Simple Linear Regression Analysis Results of the Effect of Consumption of *Rosella* Stem on Total Cholesterol Levels

Model	R	R Square	Adjusted R Square	Std. error in the Estimate
1	0.378 ^a	0.143	0.131	29.447

Table 5: Coefficients Results of Simple Linear Regression Analysis Effect of Consumption of Roselle Stew on Total Cholesterol Levels

Model	Unstandardised Coefficients		Standardised Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	246.500	10.974		22.461	0.000
Consumption of <i>Hibiscus Sabdariffa L.</i> infusion.	-23.722	6.941	-0.378	-3.418	0.001

Another theory that supports a decrease in cholesterol is from the findings that *Hibiscus Sabdariffa L.* phytochemicals inhibit pancreatic α -amylase enzymes and small intestinal α -glucosidase enzymes, thereby inhibiting the absorption of carbohydrate metabolism for cholesterol disassembly, which may help reduce hyperlipidemia. Polyphenols can also reduce liver lipid levels and hepatocyte lipid content. In addition, polyphenols can regulate lipid synthesis and phosphorylation of adenosine monophosphate-protein kinase (AMPK).¹³ Polyphenols and flavonoids in *Hibiscus Sabdariffa L.* can reduce oxysterols in bile to prevent the accumulation of cholesterol in the liver and the expression of fatty acid synthesis in liver cells.^{13,14}

Lipase activation is one of the studies in determining the potency of herbal medicines as anti-hypercholesterolemia. *Hibiscus Sabdariffa L.* infusion showed inhibitory activity against lipase. Lipase inhibition hampers fat hydrolysis because lipase hydrolyses 50% - 70% of total dietary fat.¹³ Also, hydroxyl citric acid in *Hibiscus Sabdariffa L.* inhibits citrate lyase, which prevents the breakdown of acetyl-CoA with an eventual reduction of hepatic cholesterol

Conclusion

The study concluded that a daily glass intake (2 g) of Rosella infusion significantly reduces total serum cholesterol concentration. Thus, *Hibiscus Sabdariffa L.* extract may contain phytochemicals that can reduce blood cholesterol levels and may be used to manage cholesterol-related heart diseases.

Conflict of Interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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