



## The Effect of Binahong Leaf Extract on Reducing Cholesterol and Histopathological Features in the Liver

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### Abstract

Being overweight or obese raises your risk of elevated cholesterol, triglycerides, and fatty liver. The liver is crucial to metabolic regulation. Essential to preserve liver health. Maintaining your diet, exercising, and eating antioxidants are all options. Many plants contain antioxidants, like Binahong (*Anredera cordifolia*). This study examines how Binahong leaf extract reduces cholesterol and improves liver function in high-fat-fed Wistar rats (*Rattus norvegicus*) and their liver histology. An actual experiment or laboratory experimental study is quantitative. 24 Wistar rats were sampled. Binahong leaf extract was the independent variable, cholesterol levels liver histological features were the dependent variable, and a high-fat diet was the precondition. The test animals were put into four groups: control, groups 2, 3, and 4 with Binahong leaf extract at 30mg/BW, 50mg/BW, and 70mg/BW. SPSS normality, homogeneity, and ANOVA tests. If  $p > 0.05$ , research results are generally distributed with 0.200 significance. Significant homogeneity was  $0.176 > 0.05$ . Effective One-Way ANOVA test results ( $0.000 < 0.05$ ). Post Hoc LSD test analysis yielded important values of  $0.000.0001$  and  $0.024 < 0.05$ . The phytochemical test found flavonoids, alkaloids, saponins, steroids, and tannins in Binahong leaf extract. Binahong leaf extract at 70 mg/BW reduced cholesterol, body weight, and LDL in hypercholesterolemic male white mice best. The study found that Binahong leaf extract's secondary metabolites—flavonoids, alkaloids, saponins, steroids, and tannins—reduce cholesterol, LDL, and body weight in Wistar strain white rats (*Rattus Norvegicus*) with hypercholesterolemia.

## Introduction

Everybody needs food, and the quality of it affects health. Dietary quality is based on national nutritional recommendations and guidelines that promote health, meet nutritional needs, and avoid disease. Some fast food can cause weight gain, making a person overweight or obese according to body mass index. Excess weight gain increases the risk of fatal diseases (Amith et al., 2021).

Being overweight or obese raises the risk of elevated cholesterol, triglycerides, and fatty liver (Vekic et al., 2019). Most human cells, notably liver cells, generate cholesterol, the most essential sterol. It is a precursor of steroid hormones, vitamin D, and bile acids and a vital cell membrane component. Plasma cholesterol is low-density, primarily lipoprotein (LDL), and HDL transports it from tissues to the liver, where it is excreted by bile. Healthy cholesterol levels are under 200mg/dL. 200–239mg/dL is borderline high, while 240mg/dL and higher are biomarkers for cardiovascular disease, heart attack, stroke, peripheral artery disease, type 2 diabetes, and high blood pressure (Narwal et al., 2019).

Cholesterol is a precursor molecule for multiple metabolic pathways, including vitamin D, steroid hormones (cortisol, aldosterone, and adrenal androgens), and sex hormones. Bile salts contain cholesterol, which helps digest lipids, fats, and fat-soluble vitamins A, D, E, and K (Huff et al., 2023). Cholesterol is essential for numerous cell processes, yet high blood levels can harm the body. Fatty liver disease can result from one of these.

Nonalcoholic Fatty Liver Disease (NAFLD) has become a global public health issue due to its rising prevalence (Mitra et al., 2020). NAFLD is characterized by hepatic steatosis without subsequent hepatic fat buildup. Steatosis, inflammation, and hepatocyte ballooning characterize Nonalcoholic Steatohepatitis (NASH), which can develop into fibrosis (Van Herck et al., 2017). Nutrition and processed food consumption are linked to NAFLD prevalence. Hepatocyte lipid accumulation is abnormal and linked to obesity, insulin resistance, and type 2 diabetes (Younossi et al., 2016). Thus, NAFLD is a symptom of metabolic liver disease and encompasses many liver diseases (Van Herck et al., 2017).

The triangular liver is below the diaphragm in the abdominal cavity. The largest gland in the body weighs 2.5% of the body and is formed of soft, reddish-brown tissue covered by a connective tissue capsule (Murel, 2017). Bile production, bilirubin metabolism, vascular and haematological function, food metabolism, metabolic detoxification, and vitamin and mineral storage are all liver activities (Ozougwu, 2017). Lipid metabolism relies heavily on the liver. Lipoprotein synthesis is a significant liver function in lipid metabolism. Chylomicrons, VLDL, LDL, and HDL are the four main types of plasma lipoproteins. Lipoproteins with different chemical compositions are extracted from plasma by flotation (Salih, 2021).

The liver is crucial to metabolic regulation. This organ controls the nourishment supply throughout the body. This meets the brain's high energy and nutritional needs (Hepburn & von Roenn, 2023). Maintaining liver health is crucial. Keeping your diet, exercising, and eating antioxidants are all options. Foods and the body contain antioxidants (Upadhyay et al., 2022). Antioxidants protect health. This is because antioxidants scavenge free radicals. One or more unpaired electrons make free radicals reactive. Human metabolism continually produces reactive oxygen compounds (Souhoka et al., 2021). Many plants, like Binahong, have antioxidants.

Binahong (*Anredera cordifolia*) is a basellaceae plant with fleshy leaves and dense aerial tubers. This plant is frequently utilized in Indonesian medicine. Binahong leaves relieve headaches, reduce blood pressure, and heal wounds. The ether component of binahong leaf extract has antioxidant activity, as assessed by DPPH (Ardianti et al., 2014). Binahong (*Anredera cordifolia*), a Binahong plant, is known for its nutritional and medicinal characteristics. This annual has underground and aerial tubers, simple leaves without spots, and succulent, herbaceous, or lignified stems. This plant is a food crop because its leaves and tubers are high in protein and fibre. The tubers can be fried or boiled, and the leaves produce bread. As a hedge plant, this plant is ornamental (Alba et al., 2020).

The medicinal herb Binahong is used to make medicines. In addition to vitamins A, B, and C, binahong includes flavonoids, alkaloids, terpenoids, saponins, anthocyanins, glucans, carotenes, organic acids, and mucopolysaccharides such as L-arabinose, D-galactose, L-rhamnose, and aldonic acid. Leaf, stem, root, and flower organs can be employed, but leaves are more common in herbal therapy. This study examines the effects of binahong (*Anredera cordifolia*) leaf extract on cholesterol levels, liver function, and liver histopathology in Wistar rats (*Rattus norvegicus*) fed a high-fat diet.

## Methods

This type of research is included in Quantitative research. The type of research used is an actual or laboratory experiment (Notoatmodjo, 2022). Up to using 24 Wistar rats (*Rattus norvegicus*). Variables refer to characteristics or attributes that can be measured or observed and vary among

the people or organizations studied (Suwarno & Nugroho, 2023). The independent variable is the administration of Binahong (*Anredera cordifolia*) leaf extract, the dependent variable is the reduction in cholesterol levels and liver histopathological features, and the precondition variable is a high-fat diet.

After that, SPSS 25.0 was used to examine the study data. With a p-value greater than 0.05, the Kolmogorov-Smirnov test was used to explore the data for normality. To determine if there was a significant relationship between the groups, a one-way analysis of variance (One-way ANOVA) was used with a 95% confidence level ( $p < 0.05$ ) (Ghozali, 2018). To do further analysis or testing, the Post Hoc Test with the LSD approach was employed.

## Result and Discussion

### Results of Test Animal Treatment Procedures

The 24 white Wistar rats used in the study were distributed among four groups, with six rats each. Their weight ranged from 180 to 260 grams. The control group's Lee index was 0.3 (Lee et al., 2011). In the first treatment group, this dropped to 0.29 mg/kgBW after 30 mg/kgBW of Binahong leaf extract. A reduction to 0.28 mg/BW was also observed in treatment groups 2 and 3 mice, precisely 50 mg/BW and 70 mg/BW. According to the researchers, the weight of the obese mice was found to be altered by the Binahong leaf extract.

White Wistar rats (*Rattus norvegicus*) have typical cholesterol levels of 10-54 mg/dl (Smith & Mangkoewidjojo, 1988). Cholesterol > 54mg/dl is high. The data above shows that high-fat meals increased cholesterol in mice. The high-fat diet raised cholesterol from 52.4mg/dl to 57.6mg/dl in the control group. Treatment group 1's cholesterol raised from 52.2mg/dl to 58.4mg/dl following 14 days of high-fat meals. Treatment group 2 started with 52.5mg/dl cholesterol and grew to 58.6mg/dl, while treatment group 3 started with 52.7mg/dl and rose to 57.8mg.

In the control group, cholesterol averaged 57.6 mg/dl following a high-fat diet and distilled water, but after 14 days, it dropped to 54.8 mg/dl. This number is still high cholesterol. In treatment group 1, Binahong (*Anredera cordifolia*) leaf extract at 30 mg//BW decreased from 55.8 to 53.2 mg/dl. Treatment group 2, Binahong (*Anredera cordifolia*) leaf extract at 50 mg//BW, also reduced from 58.6 mg/dl to 50.5 mg/dl, and treatment group 3, at 70 mg//BW, decreased the most from 58.1 to 46.7 mg/dl. The Binahong leaf extract group showed reduced cholesterol levels at <54mg/dl.

High-fat diets raised LDL in rats. After the high-fat diet, the control group's LDL level rose to 29.4mg/dl from 19.8mg/dl. Like the other groups, treatment group 1's LDL cholesterol jumped from 17.1 to 29.7mg/dl following 14 days of high-fat meals. Treatment group 2 started with 20.9mg/dl LDL and grew to 30.1mg/dl, while the last group started with 19.9mg/dl and rose to 29.55mg/dl. Researchers decided the test animals had hypercholesterolemia since LDL was > 27.2mg/dl.

After re-evaluating the LDL levels of all the animals, researchers found that they had all decreased. It was determined that the control group continued to have hypercholesterolemia or high LDL levels since their levels increased from 29.4 mg/dl to 27.2 mg/dl after receiving the high-fat diet. A reduction from an initial level of 29.7 mg/dl to 26.6 mg/dl was observed in treatment group 2, specifically with Binahong (*Anredera cordifolia*) leaf extract at a dose of 30 mg/BW. Similarly, treatment group 2 saw a reduction from 30.1 mg/dl to 23.3 mg/dl with a dose of 50 mg/BW, while treatment group 3 had the most significant decline from 29.5 mg/dl to 18.6 mg/dl with a dose of 70 mg/BW. The results show that the group treated with Binahong leaf extract no longer had hypercholesterolemia or high LDL levels since their LDL levels were less than 27.2 mg/dl. The Binahong (*Anredera cordifolia*) leaf extract included secondary

metabolite components, including tannins, steroids, flavonoids, alkaloids, and saponins, according to the phytochemical tests.

### Normality Test

Table 1. Normality Test Results

Group		Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Result	Control	.193	6	.200*	.940	6	.661
	P1	.156	6	.200*	.955	6	.781
	P2	.153	6	.200*	.945	6	.703
	P3	.233	6	.200*	.950	6	.737

\*. This is a lower bound of the true significance.

#### a. Lilliefors Significance Correction

By definition, data is said to be regularly distributed if the p-value is more significant than 0.05 and not normally distributed if the p-value is less than 0.05 (Sugiyono, 2019). Table 1 shows the results of the Kolmogorov-Smirnov test for normalcy, which yielded a significance level of 0.200 across the board. If the p-value exceeds 0.05, we say the data follows a normal distribution. The data is thus assumed to follow a normal distribution.

### Homogeneity Test

Table 2. Homogeneity Test Results

<i>Levene static</i>	<b>df1</b>	<b>df2</b>	<b>Sig</b>
.956	3	20	.176

We used the Levene test to check for group homogeneity at the 5% significance level. When the significance value is less than 0.05, it indicates that the data is not homogeneous, but when it is more significant than 0.05, it indicates that the data is homogeneous (Ghozali, 2018). Table 2 displays the outcomes of the homogeneity test conducted using the Levene test. In the significance column, the probability value is 0.176. We can conclude that the control group, treatment group-1, treatment group-2, and treatment group-3 come from populations with the same variance or that the two groups are homogeneous because the obtained significance probability value is more significant than 0.05.

### One-Way ANOVA Test

Table 3. One-Way ANOVA Test Results

	<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
Between Groups	262.015	3	75.422	58.410	.000
Within Groups	31.790	20	1.291		
Total	293.805	23			

The resulting significant value is 0.000 or less than 0.05 (Ghozali, 2018), as shown in Table 3, which contains the results of the One-Way ANOVA test. It is clear from these numbers that the treatment group differs significantly from the control group.

### LSD Post-Hoc Test Results

When looking for statistically significant differences between groups, the LSD Post Hoc Test is an excellent tool to use. Results from the Post Hoc LSD test analysis in this study indicated significant differences between the groups, with significance values of 0.000.0001 and 0.024, more diminutive than 0.05.

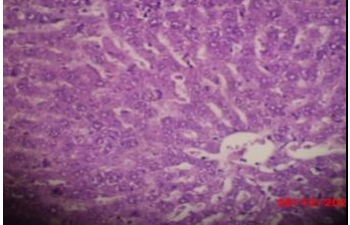
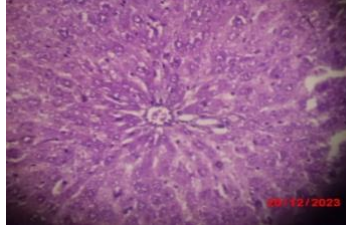
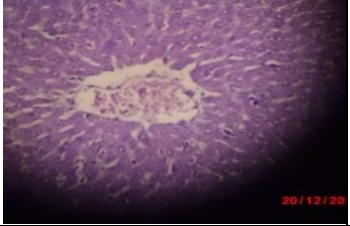
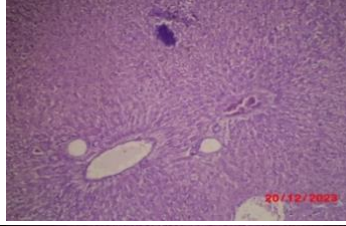
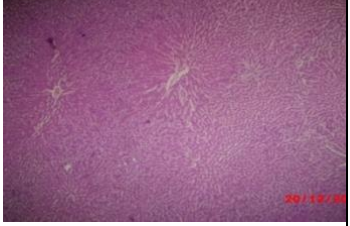
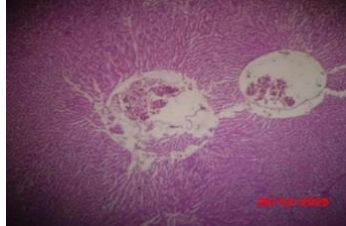
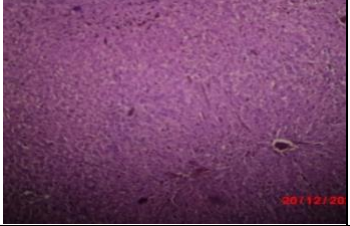
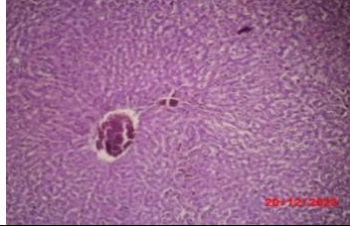
Table 4. LSD Post-Hoc Test Results

(I) Groups	(J) Groups	(I-J) Mean Difference	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Control	P1	1.60000*	.65606	.024	.2315	2.9685
	P2	4.23333*	.65606	.000	2.8648	5.6019
	P3	8.11667*	.65606	.000	6.7481	9.4852
P1	Control	-1.60000*	.65606	.024	-2.9685	-.2315
	P2	2.63333*	.65606	.001	1.2648	4.0019
	P3	6.51667*	.65606	.000	5.1481	7.8852
P2	Control	-4.23333*	.65606	.000	-5.6019	-2.8648
	P1	-2.63333*	.65606	.001	-4.0019	-1.2648
	P3	3.88333*	.65606	.000	2.5148	5.2519
P3	Control	-8.11667*	.65606	.000	-9.4852	-6.7481
	P1	-6.51667*	.65606	.000	-7.8852	-5.1481
	P2	-3.88333*	.65606	.000	-5.2519	-2.5148

\*. The mean difference is significant at the 0.05 level.

**Histopathological Observation Results**

Table 5. Histopathologic Features of Testicular Tissue

No	Group	Histopathological Image of Fibroblasts	
1	Control (giving pelleted feed and distilled water)		
2	Treatment 1 (pellet feed and Binahong leaf extract at a dose of 30 mg/BW)		
3	Treatment 2 (pellet feed and Binahong leaf extract at a dose of 50 mg/BW)		
4	Treatment 3 (pellet feed and Binahong leaf extract at a dose of 70 mg/BW)		

The presence of fibroblasts indicates wound healing. Fibroblast cells were rarer in the pellet feed group without Binahong leaf extract. Fibroblasts increased in treatment group 1 with

pelleted feed and Binahong leaf extract at 30 mg/BW. Group 2 received pellet feed and Binahong leaf extract at 50 mg/BW and had more and closer-together fibroblast cells. Treatment group 3, with pelleted feed and 70 mg/BW Binahong leaf extract, had the highest number and density. According to histological findings, the group fed Binahong leaf extract pellets at 70 mg/BW had the most and densest fibroblasts.

Binahong and other anti-cholesterol agent compounds are effective treatments for hypercholesterolemia. *Araucaria cordifolia*, or Binahong leaves. Binahong leaves have several positive effects on health, such as lowering LDL cholesterol, raising HDL cholesterol, decreasing blood sugar, and enhancing immunity (Kismiati et al., 2020). The antihypercholesterolemia properties of Binahong leaves are well-known. Glucomannan, anthraquinone, folic acid, lignin, vitamin B3, and vitamin C are all present in Binahong leaves, which have an anti-cholesterol effect (Taslim et al., 2021). Anthraquinones, polysaccharides, carbs, coumarins, tannins, chromones, alkaloids, organic compounds, pyrones, phytosterols, antrones, sterols, vitamins, proteins, and minerals are among the phytochemicals found in Binahong leaves (Ardianti et al., 2014; Dwitiyanti et al., 2019; Kismiati et al., 2020; Souhoka et al., 2021; Taslim et al., 2021). Based on the benefits of Binahong leaf extract, researchers are interested in testing the notion that high-fat-fed Wistar white rats (*Rattus norvegicus*) can have their cholesterol levels reduced by taking Binahong leaves (*Anredera cordifolia*).

This 14-day observation approach yielded data that needed processing and testing, requiring various data analyses. First, data is processed and normality tested. The Kolmogorov-Smirnov test in SPSS determined normality. All test groups have typically distributed data with a significance value of 0.000. Thus, the data is regularly distributed or represents the population. The Levene test determines if normally distributed data comes from a population with the same variance. Results indicate 0.176 significance. With a significance probability greater than 0.05, the control and treatment groups 1, 2, and 3 are homogeneous or from the same population. One-way ANOVA assessed this customarily distributed and homogeneous data for efficacy and significance.

One-way ANOVA test results demonstrate 0.000 or greater than 0.05 significance. Based on this data, a follow-up post-hoc LSD test is needed because the control group, treatment group 1, treatment group 2, and treatment group 3 differ significantly. A post-hoc LSD test was used to compare the group's average LDL cholesterol levels. This study's Post Hoc LSD test analysis indicated significance values of 0.000, 0.024, and 0.001 or less than 0.05, indicating that all groups differed.

To support their findings, researchers examined weight. The Lee index was used to compare the body weight of Wistar strain white rats (*Rattus norvegicus*) fed a high-fat diet to those provided distilled water and Binahong leaf extract at varied doses. In the control group, the Lee index remained at 0.3. Group 1 received 30 mg/BW Binahong leaf extract, which decreased to 0.29. In treatment groups 2 and 3, mice received 50 mg/BW and 70 mg/BW, respectively, and fell to 0.28. The researchers found that Binahong leaf extract affected the weight of obese mice.

In each experimental group, mice with hypercholesterolemia showed lower cholesterol, body weight, and LDL levels. Different average post-test values show lowering LDL levels. The control group given only distilled water had an intermediate LDL level of 27.2 mg/dl, indicating hypercholesterolemia. Binahong (*Anredera cordifolia*) leaf extract at 30 mg/BW (26.6mg/dl) was used in treatment group 2. Treatment group 2 had 23.2 mg/dl LDL with 50 mg/BW, and treatment group 3 with 70 mg/BW had 18.6 mg/dl. After receiving Binahong leaf extract, the group's LDL levels dropped to < 27.2mg/dl, indicating no hypercholesterolemia. Treatment group 3 received 70 mg/BW Binahong (*Anredera cordifolia*) leaf extract and had the best LDL reduction.

According to the research, Binahong (*Anredera cordifolia*) leaf extract reduced LDL levels more than distilled water. This is because binahong (*Anredera cordifolia*) leaf extract contains flavonoids, alkaloids, saponins, steroids, and tannins. Tannin lowers blood pressure and serum lipids and has excellent antioxidant potential, which helps obese mice lose weight. Tannins, flavonoids, alkaloids, and saponins lower LDL. This study found that Binahong (*Anredera cordifolia*) leaf extract lowers cholesterol, body weight, and LDL in hypercholesterolemia-afflicted Wistar white rats (*Rattus norvegicus*).

## Conclusion

The study found that Binahong (*Anredera cordifolia*) leaf extract reduced cholesterol, body weight, and LDL in male Wistar white rats (*Rattus norvegicus*) fed a high-fat diet. Flavonoids, alkaloids, saponins, steroids, and tannins are secondary metabolites in Binahong leaf extract. These chemicals significantly lower cholesterol, LDL, and body weight in Wistar-strain white rats (*Rattus Norvegicus*) with hypercholesterolemia. According to the results and analysis of the research data on lowering cholesterol, body weight, and LDL levels in male rats with hypercholesterolemia, the most effective dose of Binahong leaf extract was 70 mg/BW, followed by 30 mg/BW and 50 mg/BW.

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