# The Effect of Pagoda Flower Extract (*Clerodendrum paniculatum*) on Reducing Cholesterol Levels and Histopathological Features of the Liver of Male Wistar Strain White Rats with Obesity Model

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## ABSTRACT

The study aimed to investigate the effects of pagoda flower extract (Clerodendrum paniculatum L) on reducing cholesterol levels and histopathological features of the liver of obese rats. This study used 24 white rats (Rattus norvegicus) Wistar strain into 4 groups, namely Control, Treatment 1, Treatment 2, and Treatment 3, with different doses. The results of the phytochemical test of pagoda flower extract contained secondary metabolites such as alkaloids, flavonoids, saponins, and tannins. This study was conducted with an initial stage of testing a high-fat diet for 14 days. The results showed that the rats got a Lee index value of 0.31 in treatment groups 1, 2, and 3. The study demonstrated that pagoda flower extract significantly reduced cholesterol levels and improved liver histopathology in obese rats, particularly at 150 mg/kg and 200 mg/kg. Microscopic images of the liver of mice in treatment group 3 given a dose of 200 mg/kg bb extract looked normal, no inflammation was seen, cells began to improve, and no necrosis and fatty deposits were seen. Data analysis using the Kolmogorov-Smirnov test The results of each group's data were normally distributed.

***Keywords**: Pagoda flower, Cholesterol, Liver, SGOT, SGPT*

## INTRODUCTION

In a healthy diet, macronutrients are consumed correctly to meet the body's energy and physiological needs without consuming too much. Foods high in fat and sugar stimulate

appetite because the addictive nature of fat and sugar can make it difficult for someone to stop. Additional excess energy with high fat and sugar content continuously without being balanced with adequate physical activity can cause obesity. Cholesterol is a lipophilic molecule that plays an important role in human life. Although cholesterol is central to many healthy cell functions, it can also harm the body if allowed to reach abnormal concentrations in the blood. Special attention is important to inform patients with high cholesterol levels about the harmful effects of high cholesterol and how to reduce serum cholesterol levels. To lower cholesterol, patients can make lifestyle changes such as exercising, quitting smoking, and reducing saturated and trans fats while increasing total calories and fiber. To avoid the risk of obesity, safe alternative treatments are needed. In addition to synthetic drugs, medicinal plants/herbs can also be used as an alternative to lower blood cholesterol levels. The pagoda flower plant (Clerodendrum paniculatum L.) is one of the species of the genus Clerodendrum, which is one of the verbenacea tribes that is rich in the diversity of secondary metabolite content. In Indonesia, herbs have become a hereditary heritage used to treat various diseases, one of which is as an anti-cholesterol. Although there has been no research on reducing cholesterol levels, researchers are interested in creating a research title using this chemical compound. The effect of administering pagoda flower extract (Clerodendrum paniculatum) on reducing cholesterol levels and histopathological features of the liver of male Wistar strain white rats.

## LITERATURE REVIEW

The distribution of fat caused by weight gain influences the risks associated with obesity and the diseases it causes, allowing us to differentiate between those at high risk (Widyastuti, 2014). Obesity occurs when you consume more calories than you burn through exercise or regular activity. As a result, the body stores the excess calories as fat (Abbott, 2022).

Cholesterol is fat that is naturally produced by the liver. This fat can also be found in foods that come from animals, such as meat and milk. In the body, cholesterol is needed to form healthy cells, produce several hormones, and produce vitamin D (Kurniadi, H, 2014). However, if the levels are too high, then it is dangerous for the body because it will cause various diseases and complications. The liver is a chemical factory in the body whose function is to carry out complex tasks to keep the body healthy (Francis, 2021). However, high cholesterol levels in the blood increase the risk of heart disease and stroke (Wahyuni FS, 2017).

The liver has many functions, such as bile secretion, nutrient metabolism, metabolic detoxification, and storage of minerals and vitamins. One of the functions is to break down cholesterol. If the liver is not functioning correctly, cholesterol can build up in the body. Too much cholesterol can also trigger fat buildup in the liver area, which increases the risk of chronic diseases, such as diabetes, stroke, and heart disease. The liver makes and produces cholesterol constantly. About 70% of the cholesterol in the blood comes from liver synthesis, and the rest comes from the food we eat. Steroid hormones are also made from cholesterol (Anies, 2015).

In addition to synthetic drugs, medicinal plants/herbs can also be used as an alternative to lower blood cholesterol levels. The pagoda flower plant (Clerodendrum paniculatum L.) is one of the species of the genus Clerodendrum, which is one of the verbenacea family that is rich in the diversity of secondary metabolite content (KF Barus, 2013). Because the content has antioxidants that are good for maintaining body health to avoid diseases caused by free radicals and unhealthy foods (Syaputri, 2022), by utilizing the power of pagoda flowers, you can improve your quality of life and maintain your body's health naturally and effectively.

## METHODS

This study used a pre-test and post-test group design to determine and analyze the effects before and after administration of Pagoda Flower extract (Clerodendrum paniculatum L.) in reducing cholesterol levels and how the histopathological appearance of the liver in male Wistar strain obese rats (Rattus norvegicus). The research site is the Department of Pharmacology and Therapeutics Laboratory, Faculty of Medicine, Universitas Sumatera Utara in May - July 2024. Ethical Clearance will be submitted to the Health Research Ethics Commission (KPEK) Universitas Prima Indonesia. The samples of this study were male Wistar rats (Rattus norvegicus) weighing 160-250 gr and 2-3 months old. Researchers chose Wistar male rats as research test subjects because these animals have characteristics and physiology almost the same as humans and are one of the most widely used animals in biomedical research. The sample in this study used 24 Wistar rats for each experimental group, which was divided into 4 groups, namely (Control (K) Treatment 1, 2, and 3). The research procedures such as acclimation of test animals for 7 days in the laboratory, making pagoda flower extract with a control group dose without administration, treatment 1 (P1) 100 mg/kg bb, treatment 2 (P2) 150 mg/kg bb, treatment 3 (P3) 200 mg/kg bb. Then, the researcher tested the phytochemical content of pagoda flower extract. Before treatment using

pagoda flower extract (Clerodendrum Paniculatum L), The control group (K) was fed standard feed while groups P1, P2, and P3 were fed quail egg yolks daily. Then, after 14 days, the cholesterol levels, body weight, and obesity of the mice were measured again using the Lee index. Treatment was carried out by administering pagoda flower extract, and the mice's cholesterol levels and body weight were measured again as a comparison. After that, histopathological observations of the liver of mice were carried out in each group to determine how much liver function damage was caused by obesity in the control group (K) without treatment and in treatment groups 1, 2, and 3 with different doses of pagoda flower extract. Then, presented descriptively with the withKolmogorov-Smirnov test data normality analysis, continued by testing the significance between trial groups using the one-way variance analysis technique or Way ANOVA at a 95% confidence level ($p < 0.05$), and further testing was carried out using the Post Hoc Test with the LSD technique (Ghozali, 2018).

## RESULTS

The study uses a pre-test and post-test group design. Based on the data obtained before the high-fat diet, the Lee index value in the treatment group obtained an average of 0.28. After consuming a high-fat diet in the form of quail egg yolk for 14 days in the treatment group, the Lee index value changed to 0.31, proving that the entire group was obese and it was to be the pre-test. The control group was only given standard pellet feed and distilled water. In contrast, the treatment group was given a high-fat diet and pagoda flower extract (ClerodendrumPaniculatum) at different doses, namely 100 mg/BB, 150 mg/BB, and 200 mg/BB.

Furthermore, measuring body weight with the results of an average body weight that increased from the previous average, the average body weight of the group of rats fed high-fat feed was 306-310 gr. The control group (K) had an average of 258.7 gr. After these observations, extract treatment was given with the provision that the control group (K) was not given extract, groups P1, P2, and P3 were each given pagoda flower extract of 100 mg/kg BW, 150 mg/kg BW, and 200 mg/kg BW orally using a gastric tube.

To ensure the secondary metabolite content in pagoda flowers, phytochemical tests were carried out. The results showed that pagoda flower extract contains alkaloids, flavonoids, saponins, and tannins, which are antioxidants and can be used as medicinal plants.

In white rats of the Wistar strain (Rattus norvegicus), normal blood cholesterol levels are 10-54 mg/dl (Smith & Mangkoewidjojo, 1998). After treatment in the form of pagoda flower therapy (ClerodendrumPaniculatum) for 14 days, In the control group, the average cholesterol level was 37.78mg/dl; after 14 days, it became 38.35mg/dl. Total cholesterol levels in the control group were included in the normal category because they did not undergo a high-fat diet. In treatment group 1, namely, the administration of pagoda flower extract (ClerodendrumPaniculatum) at a dose of 100mg/KgBW decreased from the initial level of 68.28mg/dl to 58.47mg/dl. Treatment group 2, namely the administration of pagoda flower extract (ClerodendrumPaniculatum) with a dose of 150 mg/KgBB, also experienced a decrease from the initial level of 68.47 mg/dl to 50.35 mg/dl, and finally, treatment group 3, with a dose of 200 mg/dl experienced the most significant decrease, namely from the initial level of 68.7 mg/dl to 38.5 mg/dl. The results showed that the group was given pagoda flower extract (ClerodendrumPaniculatum) with a dose of 150 mg/KgBB and 200 mg/KgBB no longer experienced high cholesterol levels because their cholesterol levels were <54 mg/dl, and it is the result of the post-test.

This study hypothesizes that administering pagoda flower extract (Clerodendrumpaniculatum) reduces cholesterol levels and histopathological features of the liver of male Wistar strain white rats.

The pagoda flower plant (Clerodendrum paniculatum L.) is medicinal because of its many properties. The results of the phytochemical test of pagoda flower extract can be seen in the following table.

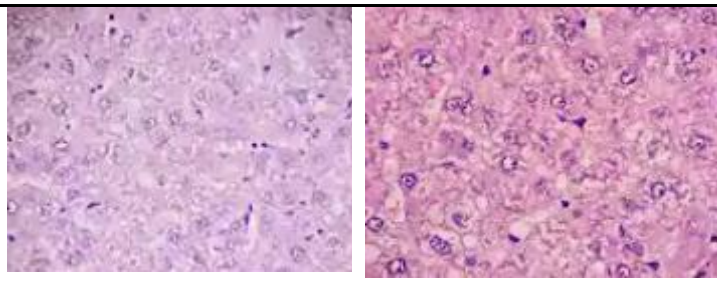
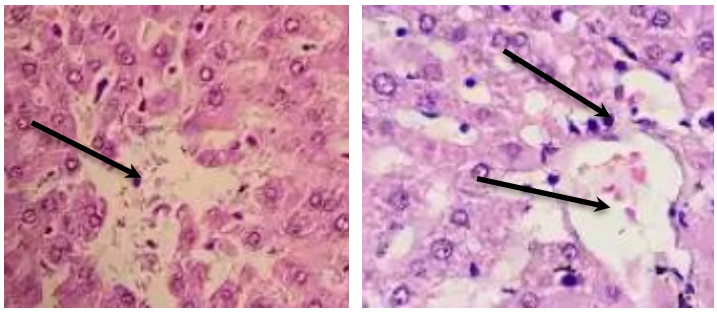
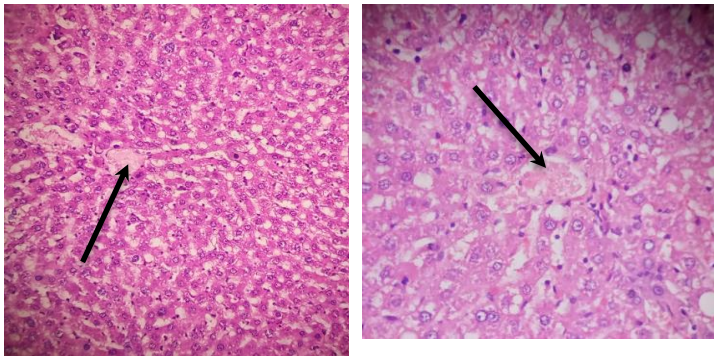
**Table 1.** Phytochemical Screening Results of Pagoda Flower Extract

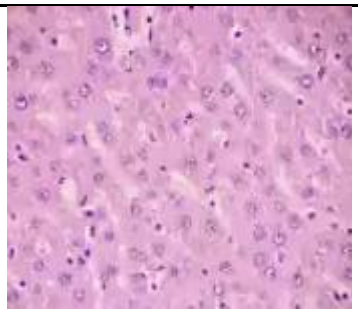
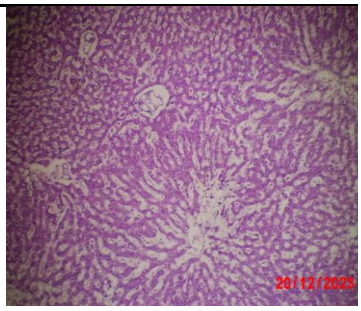
| Secondary Metabolites | Results |
|---|---|
| Alkaloid | + |
| Flavonoid | + |
| Saponins | + |
| Tannin | + |
| Steroid | - |
| Terpenoid | - |

The research results in Table 1 prove that the pagoda flower extract (Clerodendrum paniculatum L.)has pharmacological activities such as anti-aging, antioxidant, anticancer, anti-inflammatory, and bacterial activities. Its content of alkaloids, flavonoids, saponins, and tannins is good and can be categorized as medicinal plants.

After observing the cholesterol levels of mice given pagoda flower extract, all groups of mice were examined for liver organ observation through mouse liver histopathology, as seen in Table 2. This observation aimed to see the structure and morphology of the cells in each testicular tissue specimen in the control group and the treatment group that was given the extract. Pagoda flower (Clerodendrum paniculatum L.)with different doses, namely 100 mg/BW, 150 mg/BW, and 200 mg/BW. The extract was given every morning. The following is a histological picture of the testicular tissue of each treatment group.

**Table 2.** Histopathology of Rat Liver

| No | Group | Histopathology of the Liver |
|---|---|---|
| **1** | Control |  |
| **2** | Treatment 1 (100mg/Kg BW) |  |
| **3** | Treatment 2 (150mg/Kg BW) |  |

| | | | |
|---|---|---|---|
| **4** | Treatment 3 (200mg/Kg BW) |  |  |

Next, to analyze the data, the normality test in this study used the Kolmogorov-Smirnov test with the following results:

**Table 3.** Normality Test Results

| Group | df | Sig |
|---|---|---|
| Control | 6 | .995 |
| P-1 | 6 | .837 |
| P-2 | 6 | .847 |
| P-3 | 6 | 1.00 |

The result of the test in **table.3** is p> 0.05 which is 0.200 then the data has been normally distributed. Furthermore, homogeneity testing is carried out using the Levene test with a significance level of 5%, the following table:

**Table 4.** Homogeneity Test

| ***Levene static*** | **df1** | **df2** | **Sig** |
|---|---|---|---|
| 1.128 | 3 | 20 | .361 |

The probability value of significance obtained in **table.4** is greater than 0.05, which is 0.361, so it can be concluded that the control group, treatment group 1, treatment group 2, and treatment group 3 come from a population that has the same variance. Furthermore, testing the significant effectiveness between the trial groups with one way anova

**Table 5.** One Way Anova Test Results

| | Amount | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| **Inter Group** | 1727.348 | 3 | 575,783 | 582.285 | .000 |
| **In Group** | 19,777 | 20 | .989 | | |
| **Total** | 1747.125 | 23 | | | |

The results of the One-Way Anova test in **table.5** show that the significance value produced is 0.000 or <0.05. Based on these data, it can be concluded that there is a significant difference between the control group and the treatment group. Then the Post-hoc LSD further test was conducted to analyze the differences in the average levels of total cholesterol between groups with the following results:

**Table 6.** Results of LSD Post-Hoc Test

**Table 12 Results of LSD Post-Hoc Test**

| LSD Group | | Mean Difference (IJ) | Sig. |
|---|---|---|---|
| control | P1 | -20.11667* | .000 |
| | P2 | -12.00000* | .000 |
| | P3 | -.18333 | .753 |
| P1 | control | 20.11667* | .000 |
| | P2 | 8.11667* | .000 |
| | P3 | 19.93333* | .000 |
| P2 | control | 12.00000* | .000 |
| | P1 | -8.11667* | .000 |
| | P3 | 11.81667* | .000 |

| | | | |
|---|---|---|---|
| P3 | control | .18333 | .753 |
| | P1 | -19.93333* | .000 |
| | P2 | -11.81667* | .000 |

Post Hoc LSD in **table.6**, test is used to determine whether the group has a significant difference with other groups. From the table, it can be seen that there is a significant difference in cholesterol levels between the control group and treatment groups 1 (p = 0.000), 2 (p = 0.000) and 3 (p = 0.000). While treatment group 3 and the control group did not have a significant difference (p = 753).

## DISCUSSION

Obesity occurs when you consume more calories than you burn through exercise or regular activity. As a result, the body stores the excess calories as fat. (Abbott, 2022). By far, the most significant risk factor contributing to the burden of chronic disease is obesity. Cholesterol is a lipophilic molecule that plays a vital role in human life and does many things to help cells function properly. For example, cholesterol is an essential part of the cell membrane, helping to structure the membrane and modulate its fluidity. (Yang ST, 2016). The pagoda flower plant (Clerodendrum paniculatum L.) is one of the species of the genus Clerodendrum, which is one of the verbenacea family and is rich in the diversity of secondary metabolite content. (KF Barus, 2013).

This study aimed to analyze and test the effectiveness of Pagoda Flower (Clerodendrum paniculatum L.) extract on reducing cholesterol levels and liver histopathology in male Wistar rats (Rattus norvegicus). A sample of 24 rats was divided into 4 different groups. The first group was the control group; in this group, the rats were only given regular pellet feed and distilled water. The treatment group was given a high-fat diet and pagoda flower (Clerodendrum paniculatum L.) extract with 100mg/KgBW, 150mg/KgBW, and 200mg/KgBW.

Based on the results obtained, this study generally showed a decrease in total cholesterol levels in obese male white rats (Rattus norvegicus) of the Wistar strain in each test group. The difference in the decrease in total cholesterol levels was seen from the different average values. There was an increase in cholesterol in each group. The average cholesterol level in

the control was 37.78 mg/dl; after 14 days, it became 38.35 mg/dl. Total cholesterol levels in the control group were included in the normal category because they did not undergo a high-fat diet. In treatment group 1, namely, the administration of pagoda flower extract (ClerodendrumPaniculatum) at a dose of 100 mg / KgBW decreased from the initial level of 68.28 mg/dl to 58.47 mg/dl. Cholesterol levels in treatment group 1 decreased but were still included in the high category. Treatment group 2, namely the administration of pagoda flower extract (ClerodendrumPaniculatum) with a dose of 150 mg/KgBB, also experienced a decrease from the initial level of 68.47 mg/dl to 50.35 mg/dl, and finally, treatment group 3, with a dose of 200 mg/dl experienced the most significant decrease, namely from the initial level of 68.7 mg/dl to 38.5 mg/dl. The results showed that the group was given pagoda flower extract (ClerodendrumPaniculatum) with a dose of 150 mg/KgBB and 200 mg/KgBB no longer experienced high cholesterol levels because their cholesterol levels were <54 mg/dl.

The histopathological picture in the control group did not show fatty liver; the organ looked clean, and there was no inflammation, so the score for the standard group was 1. In treatment, group 1, with mice fed high-fat feed and given a 100 mg/kg bb pagoda flower extract dose, showed a relatively large and widespread fatty degeneration of the liver and inflammatory cell infiltration. The scoring in group P1 was 3, namely Hydropic degeneration. Namely, there were changes in hydropic degeneration or fatty liver cells. In the treatment group 2 with mice fed high-fat feed and given a dose of 150 mg/kg bb pagoda flower extract showed that the liver experienced fatty degeneration, congestion, and inflammatory cell infiltration; the scoring for group P2 was 2 if there were changes in the form of parenchymatous degeneration or bleeding in liver cells. Microscopic picture of the liver of mice in treatment group 3 with mice fed high fat and given a dose of 200 mg/kg bb pagoda flower extract looked normal, no inflammation was seen, cells began to improve, no necrosis and fatty deposits were seen. The scoring for this picture is 1, which is normal.

Based on the results of this study, it was found that pagoda flower extract (ClerodendrumPaniculatum) can reduce cholesterol levels and improve liver function compared to the group that was only given distilled water. These results align with previous research conducted by(Ihsanul Hafiz, 2019), which states that the content of pagoda flowers has many medicinal properties and is proven by this study, which shows a decrease in cholesterol levels in obese mice.

## CONCLUSION

In this study, it was found that administering pagoda flower extract (Clerodendrumpaniculatum) reduced cholesterol levels and histopathological features of the liver of obese male Wistar strain white rats. Secondary metabolite content in pagoda flower extract (Clerodendrum paniculatum L.)positive contains active compounds such as alkaloids, flavonoids, saponins, and tannins. These compounds are antioxidant, antidiabetic, antibacterial, and anti-inflammatory compounds. The group was given pagoda flower extract (ClerodendrumPaniculatum) at 150 mg/KgBW and 200 mg/KgBW. They no longer experienced high cholesterol levels because they were <54mg/dl. The histopathological picture of the liver of mice in treatment group 3 with mice fed high-fat feed and given a dose of 200 mg/kg bb pagoda flower extract appeared normal, no inflammation was seen, cells began to improve, and no necrosis or fatty deposits were seen.

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