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# ANALYSIS OF THE EFFECT OF CURCUMA LONGA ETHANOL EXTRACT AS ANTI-DYSLIPIDEMIA IN MALE WISTAR RATS

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***Abstract:*** **Dyslipidemia is a lipid metabolism disorder characterized by increased or decreased lipid fractions in plasma. It is a risk factor for diseases still an essential problem in Indonesia, such as coronary heart disease (CHD). Curcumin is one of the compounds derived from turmeric extract, giving the turmeric plant its yellow color. Turmeric, with the scientific name Curcuma longa linn, is one of the spice plants and is also a medicinal plant. This study aims to analyze the anti-dyslipidemia effectiveness of turmeric ethanol extract (Curcuma longa) in Wistar male white rats. This type of research is an experimental Pre-test and Post-test group-only control design conducted in February 2023. Based on the results of these calculations, it can be concluded that a minimum of 4 male Wistar rats (Rattus norvegicus) are needed in each treatment group and analyzed by One-Way Anova if the data is usually distributed with further tests in the form of Post Hoc Tukey HSD test to see fundamental differences between treatments. However, as an alternative test, if the data were not normally distributed, the Kruskal-Wallis test was used. Turmeric (Curcuma longa) ethanol extract III significantly reduced total cholesterol compared to the control group (P value <0.05). Turmeric ethanol extract (Curcuma longa) III significantly reduced triglyceride levels compared to the control group (P value = 0.023). Turmeric ethanol extract (Curcuma longa) IV significantly reduced LDL levels compared to the control group (P value < 0.05). Turmeric ethanol extract (Curcuma longa) III significantly increased HDL levels compared to the control group (P value = 0.023). Turmeric ethanol extract (Curcuma longa) III significantly decreased SGOT and SGPT levels (P value < 0.05) compared to the control group.**

***Keywords:*** **turmeric, anti-dyslipidemia.**

## 1. INTRODUCTION

### Background

Dyslipidemia is a lipid metabolism disorder characterized by an increase or decrease in lipid fractions in plasma. It is a risk factor for diseases still a significant problem in Indonesia, such as coronary heart disease (CHD) (1). It is also one of the risk factors for atherosclerosis, which can lead to Coronary Heart Disease (CHD) (2). Cardiovascular disease (which includes coronary heart disease and stroke) is the most common non-communicable disease in the world and was the cause of 17.8 million deaths in 2017 (3). Triglyceride levels in the blood are said to be high if they exceed 199 mg/dL. The higher the triglyceride level in the blood of an individual, the higher the risk of cardiovascular disease in that individual (2). Antioxidants are widely researched today, one of which is curcumin. Curcumin is one of the compounds derived from turmeric extract and gives a yellow color to the turmeric plant.

Turmeric, with the scientific name Curcuma longa linn, is one of the spice plants and is also a medicinal plant. The original habitat of this plant covers Asia, especially southeast Asia, and then this plant spread to the Indo-Malaysia region, Indonesia, Australia, and even Africa (4). Almost every Indonesian, Indian, and Asian person has consumed turmeric as a spice, herbal

medicine, or for beauty (5). The main compounds of turmeric are curcuminoids, which give turmeric its yellow color (6). Curcuminoids are the center of attention for researchers to study their safety, antioxidant properties, anti-inflammatory, and ability to reduce the risk of heart attack (7). Besides being an antioxidant, curcumin can reduce cholesterol levels by inhibiting the reabsorption of cholesterol from outside (exogenous) and increasing the enzyme HMG-CoA reductase inhibitor so that fat synthesis can run well (8).

The function of curcumin has been proven in a study of dyslipidemia patients in the Sawotratap village area of Sidoarjo Regency who were given turmeric extract for 12 days. Cholesterol levels were measured before and after the administration of turmeric rhizome extract. Based on the research results obtained with the Paired t-test analysis test, it states a significant difference in changes in blood lipid levels in research respondents (9). This study aims to analyze the anti-dyslipidemia effectiveness of turmeric ethanol extract (Curcuma Longa) in Male Wistar rats.

## 2. RESEARCH METHODS

This type of research is an experimental Pre-test and Post-test group-only control design which was carried out in February 2023. The size of the sample in this study was calculated by Federer's formula and found the following results:

$(r-1)\ (t-1) \geq 15$

$(r-1)(6-1) \geq 15$

$r-1 \geq 15/5$

$r \geq 3+1$

$r \geq 4$

Based on the results of these calculations, it can be concluded that at least 4 male Wistar rats (Rattus norvegicus) are needed in each treatment group. Surgical tools, laboratory glassware, aluminum foil, blender (Miyako), porcelain dish, desiccator, incubator, object-glass, cover glass, porcelain crutch, drying cabinet, microtube, light microscope, analytical balance sheet (Vibra AJ), oral sonde, electric oven (Stork), water bath (Yenaco), tube clamp, test tube rack, rotary evaporator, centrifugation, a set of water content determination tools, UV spectrophotometer (Microlet 2000), injection syringe, furnace (Nabertherm), test tubes, animal scales. The ingredients used in this study were turmeric (Curcuma Longa), ethanol, Aquades, Na-CMC (Sodium-Carboxyl methylcellulose), simvastatin, husk, rat food pellets, phytochemical screening reagents, and ketamine. Turmeric simplistic (Curcuma Longa) was then weighed as much as 200 grams each, then extracted using a maceration technique with a 96% ethanol solvent. Allowed to stand for 5 days, the container should be protected from direct rays of light while stirring frequently, serkai, squeeze and wash the pulp with enough visceral liquid until 4 L is obtained. Then the simplistic is transferred into a closed vessel, leave in a cool place, protected from light for 2 days. Then this simplicity is filtered. The results obtained are concentrated using a Rotary Evaporator tool until most of the solvent evaporates which is then continued the evaporation process on a water bath until a viscous extract is obtained (turmeric ethanol extract / Curcuma Longa).

**Table 1. Description of the Treatment of Each Group**

| No | Test Group | Treatment |
|---|---|---|
| 1. | Normal | Test animals were not given a specific treatment and were only given to eat and drink ad libitium. |
| 2. | Control | Test animals were given 1 ml of 0.5% Na CMC suspension once a day for 14 days. Food and drinks are given on an ad libitum basis. |
| 3. | Standard (25 mg/kgBB) | Test animals were given oral suspension simvastatin 5 ml / kgBB once a day for 14 days. Food and drinks are given ad libitum. |
| 4. | Turmeric Extract (Curcuma Longa) - I (150 mg/ kgBB) | The test animals were given Turmeric Extract (Curcuma Longa) at a dose of 1.5 ml / kgBB once a day for 14 days. Food and drinks are given ad libitum. |
| 5. | Turmeric Extract (Curcuma Longa) - II (250 mg/kgBB) | The test animals were given Turmeric Extract (Curcuma Longa) at a dose of 2.5 ml / kgBB once a day for 14 days. Food and drinks are given on an ad libitum basis. |
| 6. | Turmeric Extract (Curcuma Longa) - III (350 mg/kgBB) | The test animals were given Turmeric Extract (Curcuma Longa) at a dose of 3.5 ml / kgBB once a day for 14 days. Food and drinks are given ad libitum. |

The data from the study were analyzed descriptively (Central tendency and Dyspersi) from the research data in the form of lipid profiles (LDL, HDL, Total Cholesterol, and Triglycerides), color, texture, and weight. Then the research data in the form of lipid profiles were analyzed with One-Way Anova if the data were normally distributed with a follow-up test in the form of a Post Hoc Tukey HSD test to see real differences between treatments. However, as an alternative test, if the distributed data is abnormal, the Kruskal-Wallis test is used as an alternative test.

## 3. RESULTS AND DISCUSSION

From the data of table 2. it can be seen that turmeric ethanol extract (Curcuma Longa) contains several phytochemical compounds including Alkaloids, Saponins, Flavonoids, Tannins, as well as Steroids and Terpenoids.

**Table 2. Results of Data Normality Test with Shapiro-Wilk Test on All Research Parameters**

| Parameters | | P-value | Data Distribution |
|---|---|---|---|
| Weight | | 0.391 | Normal |
| Total Cholesterol Before Induction | | < 0.05 | Abnormal |
| Total Cholesterol After Induction | | < 0.05 | Abnormal |
| Lipid Profile After Treatment | Total Cholesterol | 0.431 | Normal |
| | Triglycerides | 0.002 | Abnormal |
| | HDL levels | < 0.05 | Abnormal |
| | LDL levels | 0.132 | Normal |
| SGOT levels | | < 0.05 | Abnormal |
| SGPT Levels | | 0.057 | Normal |

From the data of the table above, it can be seen that the data on body weight, total cholesterol and LDL levels from the lipid profile after treatment, and SGPT levels have a normal data distribution, while other parameters include: total cholesterol before and after induction, triglyceride levels, HDL levels, and abnormally distributed SGOT levels. Based on the distribution of these data, data with normal data distributions are analyzed with parametric cynics while abnormal data is analyzed with non-parametric statistics.

**Total Cholesterol**

In evaluating the anti-dyslipidemia effect of turmeric ethanol (Curcuma Longa), a high-fat diet was given to the control group, standard, turmeric ethanol extract (Curcuma Longa)-I, II, and III. Before and after the PTU administration, total cholesterol in all mice was measured and all total cholesterol data were analyzed with non-parametric statistics. The results of the analysis can be seen in the following table.

**Tabel 3. Comparison of Total Cholesterol Before and After PTU (Propylthiouracil) Administration in All Treatment Groups**

| Treatment Groups | Total Cholesterol (mg/dL) | |
|---|---|---|
| | Before Induction | After Induction |
| Normal | 116.00 (110-113) | 116.50 (112-125)b |
| Standard | 112.00 (110-113) | 211.00 (202-215)a |
| Control | 114.50 (110-112) | 200.00 (204-205)b |
| Turmeric Ethanol Extract (Curcuma Longa) -I | 115.00 (110-115) | 205.50 (205-209)b |
| Turmeric Ethanol Extract (Curcuma Longa) -II | 114.50 (100-110) | 207.00 (206-210)b |
| Turmeric Ethanol Extract (Curcuma Longa) -III | 111.00 (117-125) | 207.50 (207-212)b |
| **P-Value** | **0.844** | **0.028** |

The data is displayed as a Median (Range). The P-value is obtained from kruskal-wallis analysis; Different superscripts in the same column show significant differences.

From the data in the table above, it can be seen that before being given a high-fat diet, the total cholesterol of rats before giving a high-fat diet in the entire treatment group did not show a significant difference (P-value = 0.844). This suggests that the total cholesterol data of rats before being given a high-fat diet were uniform. However, total cholesterol in the entire group of rats after administration of a high-fat diet showed a different distribution, whereas only the control group, standard, Turmeric extract (Curcuma Longa)-I, II, and III showed uniform total cholesterol.

**Tabel 4. Comparison of Lipid Profiles across Rat Treatment Groups**

| Treatment Groups | Profil Lipid | | | |
|---|---|---|---|---|
| | Total Kolestrol* | Trigliserida** | LDL* | HDL** |
| Normal | 125.00 ± 2.40a | 98.00 (97-100)a | 52.10 ± 1.44a | 61.50 (61-64)a |
| Standard | 146.50 ± 0.52b | 104.00 (101-105)b | 64.00 ±1.24b | 60.50 (60-63)a |
| Kontrol | 179.20 ± 6.20c | 166.00 (162-179)c | 107.50 ±3.20c | 27.90 (37-45)b |
| EEK -I | 168.25 ± 1.50d | 133.50 (133-135)d | 83.75 ±2.62d | 57.50 (56-59)b |
| EEK II | 163.25 ± 2.22e | 120.50 (119-122)e | 77.50 ± 1.29e | 62.50 (61-63)a |
| EEK -III | 152.34 ± 0.94e | 115.00 (108-131)f | 68.00 ±1.24f | 61.00 (61-63)a |
| **P-Value** | **< 0.05** | **0.023** | **< 0.05** | **0.023** |

*Data is displayed as Mean ± SD. The P-value is obtained from the One Way ANOVA analysis; **Data is displayed as Median (Range). The P-value is obtained from kruskal-wallis analysis; Different superscripts in the same column show significant differences.

From the data table above, it can be seen that all lipid profile data in all treatment groups show significant differences.

a. Total cholesterol in all rat treatment groups showed significant differences; this can be seen from the P value <0.05. The lowest average total cholesterol was found in the standard group, which was 125.00 ± 2.40 mg/dL, followed by the legal group at 146.50 ± 0.52 mg/dL, Turmeric (Curcuma Longa) ethanol extract group I, II, III, and the group with the highest total cholesterol was the control group at 179.20 ± 6.20 mg/dL;

b. Triglyceride levels in all treatment groups also showed significant differences; this can be seen from the P value <0.05 (P value = 0.023). The trend of the lowest triglyceride levels was found in the standard group at 98.00 mg/dL, followed by the legal group at 104.00 mg/dL, Turmeric (Curcuma Longa) ethanol extract groups I, II, III, and the group with the highest triglyceride levels was the control group at 166.00 mg/dL.

c. LDL levels also showed significant differences in all treatment groups; this can be seen from the value of P < 0.05. The lowest average LDL level was found in the standard group at 52.10 ± 1.44 mg/dL, followed by the legal group at 64.00 ± 1.24 mg/dL, the turmeric ethanol extract group (Curcuma Longa) I, II, III, and the group with the highest LDL level was the control group at 107.50 ± 3.20 mg/dL.

d. HDL levels also showed significant differences in all treatment groups; this can be seen from the P value <0.05 (P value = 0.023). The trend of the highest HDL levels was found in the standard group, which was 71.50 mg/dL, followed by the usual group of 69.00 mg/dL, Turmeric (Curcuma Longa) extract group I, II, III, and the group with the lowest HDL levels was the control group of 26.20 mg/dL.

**Table 5. Comparison of SGOT and SGPT Levels in All Treatment Groups**

| Treatment Groups | SGOT (U/L) levels | SGPT (U/L) levels |
|---|---|---|
| Normal | 25.20 (28-30)$^{a}$ | 40.50 ± 1.60$^{a}$ |
| Standard | 110.00 (106-110)$^{b}$ | 160.50 ± 1.28$^{b}$ |
| Control | 165.20 (161-173)$^{c}$ | 97.25 ± 1.50$^{c}$ |
| Turmeric Ethanol Extract (Curcuma Longa) -I | 117.50 (116-120)$^{d}$ | 100.75 ± 3.56$^{d}$ |
| Turmeric Ethanol Extract (Curcuma Longa) -II | 121.00 (120-124)$^{e}$ | 115.00 ± 4.50$^{e}$ |
| Turmeric Ethanol Extract (Curcuma Longa) -III | 129.50 (128-130)$^{f}$ | 142.00 ± 2.08$^{b}$ |
| **P-Value** | **0.009** | **< 0.05** |

*The data is displayed as Mean ± SD. The P-value is obtained from the One Way ANOVA analysis; **Data is displayed as Median (Range). The P-value is obtained from kruskal-wallis analysis; Different superscripts in the same column show significant differences.

From the data table above, it can be seen that the SGOT and SGPT levels in all rat treatment groups show significant differences; this can be seen from the P value <0.05. The trend of the highest SGOT level was found in the control group, 165.20 U/L, and the lowest in the standard group, 25.20 U/L. Meanwhile, a similar picture was found in the SGPT level; the group with the highest SGPT level was found in the traditional group, 160.50 U/L, and the lowest was found in the standard group, 40.50 U/L.

## 4. DISCUSSION

The anti-dyslipidemia effect of ethanol extract of turmeric (Curcuma longa) may be related to the content of various phytochemicals in turmeric rhizomes. Several studies have shown the potential of phytochemicals as anti-dyslipidemia (10). Polyphenol content can cause down-regulation of pro-inflammatory cell signal modulation such as nuclear factor-κB, activated protein-1, and mitogen-activated protein kinase by inhibiting the arachidonic acid cascade and eicosanoid derivatives (11). Turmeric extract contains curcumin compounds, which are antioxidants. Curcumin can reduce the oxidation of LDL, which plays a role in foam cell formation, suppresses the inflammatory process in blood vessels, and protects the vascular endothelium from free radicals (2). Besides being an antioxidant, curcumin can reduce cholesterol levels by inhibiting the reabsorption of cholesterol from outside (exogenous) and increasing the enzyme Hmg-CoA reductase inhibitor so that fat synthesis can run well (12).

Treatment and prevention of diseases with curcumin is one of the therapeutic modalities that are not inferior to pharmacological approaches (13). This study showed that turmeric ethanol extract (Curcuma Longa) showed significant lipid profile improvement at the end of the study. At the highest dose, ethanol turmeric (Curcuma Longa) showed the most optimal lipid profile improvement. This can be seen from the decrease in total cholesterol, triglyceride, and LDL levels and the increase in HDL levels of the turmeric ethanol (Curcuma Longa)-II and III groups. However, these improvements in the lipid profile of Turmeric (Curcuma Longa)-III ethanol rats did not exceed the gains shown in the standard group.

In this study, the SGOT and SGPT levels in the rats receiving turmeric (Curcuma Longa) ethanol extract were lower than the SGOT and SGPT levels of the control group. This indicates that turmeric (Curcuma Longa) ethanol extract can protect liver tissue from NAFLD compared to the group that did not receive turmeric (Curcuma Longa) ethanol extract, significantly reducing SGOT and SGPT levels compared to the control group. This decrease in SGOT and SGPT levels is associated with improved Non-Alcoholic Fatty Liver Disease (NAFLD). Several studies have shown that NAFLD is a risk factor for the formation of arteriosclerosis (14); (15). This is because NAFLD causes dysfunction of the vascular endothelium. Thong and Quynh (2021) reported that both SGOT and SGPT correlate with NAFLD, but the use of SGOT and SGPT separately may show errors in confirming mild NAFLD. In severe NAFLD cases, SGOT will increase slightly; in milder cases, SGOT levels can be found in average amounts. Therefore, using SGOT and SGPT unilaterally may allow errors in confirming mild NAFLD (16).

## 5. CONCLUSIONS AND SUGGESTIONS

The conclusions that can be drawn from the results of this study are as follows:

a. Turmeric ethanol extract (Curcuma Longa) III significantly reduced total cholesterol compared to the control group (P value <0.05)

b. Turmeric ethanol extract (Curcuma Longa) III significantly reduced triglyceride levels compared to the control group (P value = 0.023)

c. Turmeric (Curcuma Longa) ethanol extract significantly reduced LDL levels compared to the control group (P value < 0.05)

d. Turmeric (Curcuma Longa) ethanol extract III significantly increased HDL levels compared to the control group (P value = 0.023)

e. Turmeric ethanol extract (Curcuma Longa) III significantly reduced SGOT and SGPT levels (P value < 0.05) compared to the control group.

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