

STUDY OF EFFICACY LEMONGRASS (*Cymbopogon citratus*) EXTRACT AS LOWERING BLOOD CHOLESTEROL LEVEL AGENT

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ABSTRACT

Lemongrass (*Cymbopogon citratus*) is a rich plant containing compounds called polyphenols, especially flavonoids. Lemongrass has been widely used in many countries as antiinflammation, antibacteria, antifungal, antidiarrhoea and as repellent to insect also proven to lower blood glucose.

This study aims to determine the effect of the ethanol extract of lemongrass on blood lipids profile using 25 male albino rats Wistar strain, were divided into 5 groups, each group consisted of 5 rats, namely the control group (K), the standard group (S) and the treatment group ES100, ES200 and ES400. All rats made hyperlipidemic by administration of diet high in fat and egg yolk for 14 days, then assayed lipid profile include total cholesterol, LDL, HDL and triglyceride (pre test). Furthermore, the group K were without treatment, Sim group were give drug standard simvastatin 0,18 mg/200g bwt, ES100, ES200 and ES400 group treated with ethanol extract of lemongrass respectively 100, 200 and 400 mg/kg bwt with sonde for 14 days. On the 15th days all rats were fasted and then have blood drawn through orbital venous and made serum and defined serum lipid profile (post test).

The result showed the group of rat treated with ethanol extract decreased the levels of total cholesterol, LDL, and triglyceride as well as an increase in HDL cholesterol levels were significantly ($p < 0.05$). This study showed the ethanol extract of lemongrass has lowering cholesterol levels and improve lipid profile in hyperlipidemic rats.

Keyword : Cymbopogon, cholesterol, LDL, HDL and triglyceride

Introduction

Coronary Heart Disease (CHD) or cardiovascular disease (CVD) is currently one of the main and first causes of death in developed and developing countries, including Indonesia. World Health Organization (WHO) or the world health agency shows that in 2008, 39% of the 36 million deaths in the world were caused by cardiovascular disease ¹.

Coronary Heart Disease is caused by various risk factors. One of the main risk factors for CHD is abnormal cholesterol levels in the body. The habit of overeating and containing cholesterol or high fat can increase blood cholesterol levels. Foods that contain high cholesterol or high fat, for

example meat (chicken, beef, goat, pork), pork oil, egg yolks, cheese, organ meats (liver, brain), shrimp and milk ².

Cholesterol is needed by the body's tissue cells to grow and develop. However, the amount of cholesterol that can be accepted or absorbed by the body's cells is limited. If we eat a lot of saturated fat or cholesterol-rich foods, low density lipoprotein (LDL) cholesterol in the blood will increase. The excess LDL reacts with other substances and settles in the arteries, causing constriction and hardening known as atherosclerosis or plaque. This can cause a lack of blood supply to the heart muscle³. Situation where the concentration of cholesterol in the blood including elevated LDL cholesterol levels is called hypercholesterolemia⁴. World Health Organization said, 20% of stroke sufferers are caused by excess cholesterol, and 50% of coronary heart cases due to high cholesterol. Cholesterol is actually a substance that the body needs for fat transport and hormone formation. However, excessive amounts of cholesterol will inhibit blood circulation and cause various diseases⁵.

Drugs to reduce cholesterol levels have been widely produced, including statins, fibrates, cholesterol. Statin drugs have been developed so that there are several products such as simvastatin, lovastatin, atorvastatin which have a mechanism of action inhibiting the enzyme hydroxymethylglutaryl coenzyme-A reductase (HMG Co-A) so that cholesterol synthesis is inhibited. These statin drugs are widely used in society. However, the use of statin drugs can have adverse effects on muscles that have been reported including myositis and muscle pain (myalgia), muscle weakness and rhabdomyelitis. Rhabdomyelitis in the form of machete muscle damage and sometimes accompanied by kidney dysfunction⁶. Food and drugs administration (the FDA has also reported an adersion effect on the use of statins in the form of myopathy, and is reminiscent of the risk of diabetes (FDA, 2014). Therefore, drugs such as sitosterol (plant sterols) have been developed which work to block cholesterol absorption. It has also been reported that flavonoid compounds and saponins show the effect of lowering blood cholesterol, and several plants in several countries have been investigated and show hypolipidemic effects⁷.

Lemongrass is a plant that has been widely used as a spice in cooking, drinks, extracted essential oils which are then used in the food and cosmetics industries. Research that has been done has also found the content of bioactive compounds in lemongrass plants both from the roots, stems and leaves. The compounds that have been identified include flavonoids in the form of citral, geranial, citronella, and α -mircene. Bioactive compounds from lemongrass plants have been proven to have properties as antibacterial-antifungal, antidiarrheal, anti-inflammatory, anti-diabetic, antidiarrheal, antioxidant, antiprotozoal, anti-malarial and antihepatotoxic⁸. In addition, lemon grass extract was reported to reduce blood glucose and cholesterol in diabetic rats⁹.

METHODS

Tools: analytical balance, test tube, measuring flask, gastric tube, capillary pipette, micropipette, sample tube, tube rack, centrifuge, spectrophotometer.

Ingredients and reagents: lemongrass plants obtained from Imogiri, Bantul, Yogyakarta, ethanol, cholesterol reagent kits, LDL and triglycerides from Diasys, distilled water

Lemon grass leaf ethanol extract

Lemongrass cleaned, washed with running water, cut into pieces ± 0.5 cm, dried in a drying cupboard temperature of 45 °C for 48 hours. Pollinated using a pollinating machine with a filter hole diameter of 1 mm. 70% ethanol added, stirred with ultraturaq for 30 minutes, allowed to stand for 24 hours, then filtered (repeated 2 times). The filtrate was evaporated with a vacuum rotary evaporator heating waterbath at 70°C. The thick extract is poured in a porcelain cup, heated with a water temperature of 70°C while stirring occasionally. Pack the lemongrass extract results.

Treatment of experimental animals

: white rat used was male white rat *Rattus norvegicus* Wistar strain 8 weeks old, not deformed, body weight 150-200 grams as much as twenty-five tails.

Mice were adapted for 3 days, fed with standard BR-II and drinking water ad libitum. Then the rats were divided into five groups randomly: one control group (K), three treatment groups (ES100, ES200, ES400), and one comparison group (Sim). In each group there are five white rats, placed by the single cage method. The five groups were given a high-fat and high-cholesterol diet consisting of 80% standard pellets, 15% pork fat and 5% quail egg yolks for 2 weeks. The positive control group received the feed standard BR-II in 2 weeks later, for the treatment group ES1, ES2 and ES3 were given the standard feed BR-II and citronella ethanol extract at a dose of 100 mg / kg BW, 200 mg / kg BW and 400 mg / kg BW every day while the Sim group received standard BR-II feed and simvastatin drug 0.18 mg / 200 grams BW. On the 15th day all rats were fasted for 12 hours and then their blood was drawn. Blood collection through the orbital vein with a 3 ml microhematocrit tube, blood collected in a centrifuge tube. Blood was centrifuged for 15 minutes at a speed of 3000 rpm, blood serum was obtained for the determination of total cholesterol, LDL and triglyceride levels. Measurement of total cholesterol, LDL and triglyceride serum of white rats was carried out with the Diasys reagent kit.

RESULTS AND DIACUSSION

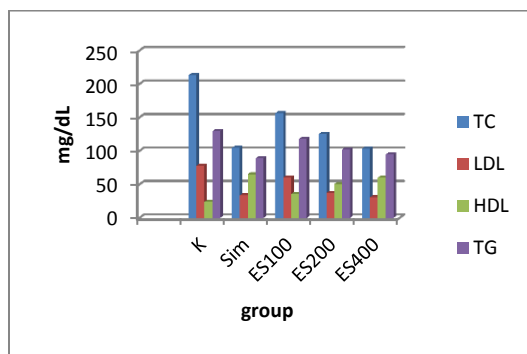
In vivo cholesterol reduction testing was conducted at the Laboratory of the Center for Food and Nutrition Studies UGM, Yogyakarta, the results obtained as shown in Table 1 and Figure 1.

Table 1 Results of Statistical Analysis Effect of Ethanol Extract of Lemongrass on Lipid Profile

Group	Total cholesterol (mg/dL)	LDL (mg/dL)	HDL (mg/dL)	Triglyseride (mg/dL)
K	213.19 \pm 3.15 ^a	78.20 \pm 1.89 ^f	24.09 \pm 1.48 ^k	129.39 \pm 1.96 ^p

Sim	104.76 ± 2.14 ^{b*}	33.77 ± 1.58 ^{g*}	65.33 ± 1.60 ^l	88.94 ± 1.82 ^q
ES100	156.63 ± 3.79 ^c	60.50 ± 6.22 ^h	35.83 ± 1.29 ^m	117.88 ± 2.31 ^r
ES200	125.27 ± 3.51 ^d	37.54 ± 1.57 ^{g*}	50.81 ± 2.34 ⁿ	102.57 ± 3.29 ^s
ES300	103.30 ± 1.87 ^{b*}	30.82 ± 1.70 ^{g*}	60.08 ± 1.48 ^o	94.85 ± 1.82 ^t

Note: Letters in the same column with different superscript letters show significant differences ($p < 0.05$) the same superscript letters and asterisk marks show significant differences ($p > 0.05$)



Effect of citronella ethanol extract on total cholesterol levels

Groups of rats treated with lemongrass ethanol extract at doses of 100, 200 and 400 mg / kg body weight respectively showed a decrease in cholesterol levels with a reduction in the range of 28.16% to 50.97% compared to total cholesterol levels before treatment (214.04 mg / dL). The decrease was influenced by the dose and was statistically significant ($p < 0.05$). The highest decrease in total cholesterol levels in the treatment group with a dose of 400 mg / kb body weight by 50.97% (103.3 mg / dL), equivalent to a decrease in the control group given simvastatin dose of 1.8 mg / kg ($p > 0.05$). The cholesterol level has reached the biological reference value of 113.99 mg / dL¹⁰.

The results of this study are in accordance with research conducted by Agbafor (2007) which uses ethanol extract of fresh lemongrass leaves. Other studies conducted by Ademumuwiya et al. (2015) also showed that the administration of lemongrass ethanol extract reduced cholesterol levels by diabetic rat model¹¹.

According to Prohp and Onoagbe (2012) in Ademuwiya (2015), flavonoid compounds and saponins play a role in reducing blood cholesterol and triglyceride levels. Flavonoids affect lipids in the body including steroids and bile acids and affect lipid metabolism. The mechanism is to increase the excretion of bile acids because cytochrome P-450 binds to bile acids so that it lowers cholesterol in the body (Di Carlo et al. In Oleivera (2007). Flavonoids also act as co-factors in the cholesterol esterase enzyme, thereby increasing cholesterol hydrolysis activity¹².

Cholesterol is a compound needed by the body, among others, as an important component of cell membrane formation, as a precursor for the synthesis of steroid hormones such as estrogen, progesterone, cholecalciferol (pro vitamin D), and bile acids. The human body is able to synthesize cholesterol from fatty acids through the process of steroidogenesis (endogenous

cholesterol), so a diet that is high in cholesterol (exogenous) can be a cause of high blood cholesterol levels. Besides genetic factors, the condition of metabolic disorders such as diabetes also causes an increase in cholesterol levels. The results of this study indicate that ethanol extract of lemongrass has the effect of reducing blood cholesterol levels.

Effect of Ethanol Extract on LDL Cholesterol Levels

Groups of rats treated with lemongrass ethanol extract at doses of 100, 200 and 400 mg/kg body weight each showed a decrease in LDL cholesterol levels with a range of 14.99% to 58.47% compared to total cholesterol before treatment. The decrease was statistically significant ($p < 0.05$). The reduction in LDL cholesterol levels in the treatment group at a dose of 200 mg / kg body weight by 51.09% (37.54 mg/dL), was already lower than the biological reference value of 49.54 mg/dL¹⁰. At a dose of 400 mg / kgBB the decrease in LDL levels was higher than the decrease in the group given simvastatin dose of 0.18 mg / 200 g ($p > 0.05$).

Low density lipoprotein is lipoprotein synthesized in the liver with its dominant composition being cholesterol, which functions to transport cholesterol to the periphery. High LDL levels are a risk factor for plaque atherosclerosis which can cause blockages in blood vessels. A decrease in LDL cholesterol levels significantly reduces the risk of atherosclerosis if a decrease in total cholesterol levels is accompanied by an increase in HDL cholesterol.

Effect of Ethanol Extract on HDL Cholesterol Levels

Groups of rats treated with lemongrass ethanol extract at doses of 100, 200 and 400 mg/kg body weight each showed an increase in HDL cholesterol levels. The increase in HDL cholesterol levels in the treatment group at a dose of 200 mg/kg body weight, was higher than the biological reference value of 49.14 mg/dL¹⁰, although it was still lower when compared to the increase in the control group given simvastatin dose 0.18 mg/200 g ($p > 0.05$).

High density lipoprotein is a carrier of cholesterol from the peripheral to the liver, thereby reducing cholesterol that circulates peripherally. Therefore, HDL lipoprotein is to reduce the risk of atherosclerosis plaque so it is called cardioprotective. A high HDL value is associated with a low risk of heart and blood vessel health problems, so it is called "good cholesterol"¹³.

Effect of Ethanol Extract on Triglyceride Levels

The group of rats treated with lemongrass ethanol extract at doses of 100, 200 and 400 mg / kg body weight each showed a significant decrease in triglyceride levels, but the decrease was still lower when compared to the comparison group given simvastatin dose 0.18 mg / 200 g ($p > 0.05$). Decreased triglyceride levels in treated mice also have not yet reached the biological reference value in albino *Rattus norvegicus* mice¹⁰.

According to Baghavan in Oleivera et al. (2007) the mechanism of reducing triglycerides by flavonoids is through the activation of cyclic-AMP synthesis which activates protein kinase and

this enzyme increases the hydrolysis of triglycerides thereby reducing levels in the blood and liver. Flavonoids also activate LDL receptors, where LDL contains 7 - 10% triglycerides¹².

Besides individually, lipid profiles are also used to predict the risk of coronary heart disease by calculating the ratio of HDL cholesterol levels to total cholesterol (HDL/Total cholesterol) levels. The reference value stated as not at risk for heart disease is > 0.24 . While the reference value of the ratio of triglyceride levels to HDL cholesterol levels (TG / HDL) is < 2 ¹⁴.

Thus the results of this study indicate that ethanol extract of lemongrass has the effect of reducing total cholesterol and LDL cholesterol levels, increasing HDL levels equivalent to simvastatin, and decreasing triglyceride levels but decreasing lower than simvastatin.

Conclusion

Lemongrass ethanol extract at a dose of 400 mg/kg body weight can reduce total cholesterol, LDL cholesterol, triglycerides and can increase HDL cholesterol levels in mice made hyperlipidemic. It can be concluded that the ethanol extract of lemongrass can improve the condition of dyslipidemia in hyperlipidemic mice.

Suggestions

1. Need further research to trace the content of active pharmacological substances that have the effect of reducing cholesterol, LDL and triglyceride levels and can increase HDL cholesterol
2. Need to further trace the mechanism of improving the condition of dyslipidemia due to lemongrass ethanol extract.

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