The Activity of Bali Andong Rhizome Extract of Cordyline Terminalis Kunth as Hypolipidemia Agent in Wistar Rats with High-Cholesterol Diet

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ABSTRACT

Objective: Andong rhizome extract has inhibited the absorption of lipids in the intestine and was shown to decrease blood lipid profile levels in Wistar rats. This study was conducted to prove that intake containing saponins, can inhibit the absorption of lipids in the intestine, thus lowering blood plasma lipids in Wistar rats with high-cholesterol diet. Methods: The study has a randomized post-test design along with control group, using twenty-four male Wistar rats that were divided into four groups (six rats per group). Group I served as the control with standard diet. Group II, III, IV rats were given high-cholesterol diet. Group III and IV rats were treated with 30 mg/kg.b. w & 70 mg/kg.b. w of andong rhizome extract. After 28-day treatment, rats were fasted for 14 hrs, blood samples were taken and plasma was separated to evaluate the lipid profile. Results: The andong rhizome extract has shown a significant decrease ($p<0.05$) in plasma levels of total cholesterol, LDL cholesterol, triglycerides, VLDL, and the ratio of total cholesterol to HDL cholesterol and an increase in HDL cholesterol in groups III and IV compared to high-cholesterol group. Conclusion: Based on the results of this study, it can be concluded that intake of andong rhizome extract inhibited the absorption of lipids in the intestine, thus lowering blood plasma lipid of Wistar rats with a significant difference.

Key Words: Andong Rhizome Extract, Ldl Cholesterol, Total Cholesterol, Diet High In Cholesterol, HDL Cholesterol, Cordyline Terminalis

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INTRODUCTION

The effect of urbanization and modernization as well as the lack of sport activities have made most people change life style, including eating patterns. In terms of diet, people tend to choose things that are fast and instant without regard to side effects caused, so that it can lead to the emergence of various diseases, such as cancer, diabetes mellitus, hypertension, stroke, atherosclerosis, cataracts, and coronary heart disease[1, 2]. One of the causes of degenerative diseases is an excess of cholesterol in the body.

Excessive levels of cholesterol in the body has caused health problems, incuding dyslipidemia and cardiovascular diseases [3, 4]. There was a positive correlation between increased concentrations of serum cholesterol and risk of coronary heart disease (CHD) [2, 4]. Heart disease was the leading cause of death in the United States [5]. Based on the results of research in animals and humans, it was showed that an increase in plasma cholesterol due to the intake of cholesterol, saturated fats, and trans fats, cause dyslipidemia [4-7].

Prevention of dyslipidemia and atherosclerosis was done by lowering cholesterol levels in the body by consuming natural medicine that can lower blood cholesterol levels to normal limits. Reduction in blood cholesterol can be done by lowering food intake, inhibiting the absorption of cholesterol, lower endogenous synthesis, as well as increasing spending bile and excreta [8-10].

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Andong plant is one of the plants containing natural medicine that can be used to lower cholesterol in the blood. Based on phytochemical test, it was showed that the andong rhizome exract contains steroid saponins. In general, saponins have active nature of the surface, where their molecular structures composed of aglycone are sapogenin hydrophobic and glikon containing one or more sugar chain that is hydrophilic [11-16].

Saponin can affect substance of fat soluble in digestion, which includes the formation of micelles mixtures containing bile salts, fatty acids, diglycerides and vitamins that are fat soluble and saponin is capable of forming a complex with metals such as Fe, Mg, Zn, and Ca [17, 18]. Some researchers have reported that saponins from other plants such as garlic steroidal glycoside [16], and chloragin of Chlorophytum nimonii [19], and also glycosides triterpen of alfalfa from Medicago sativa L. [20], soyasaponins [21], Quillaja saponaria [17], and ginseng [22] had activity as hypokolesterolimea, inhibiting the absorption of cholesterol, and lowering the concentration of plasma cholesterol that has been tested on animals and humans [23-25], Cordyline terminalis Kunt leaves containing steroidal saponins [26, 27] and saponins have proved active as hypolipidemia [28].

The result of observation showed that andong plant also has high religion value, being unique for culture and religion in Bali, Indonesia. Andong plants have been used as a complementary religious ceremony in Bali. Andong plants have also been used as traditional medicine material contained in Usada Bali and Taru Pramana. Hence, this research was done to prove how much andong rhizome extract is capable of acting as hypolipidemia at two different dose levels.

MATERIALS AND METHODS

List of chemical materials used

Duck eggs were obtained from duck breeder, lipid profile kit for cholesterol, trigliseride (TG), and high-density lipoprotein (HDL) (AGAPPE Diagnostic Ltd). All reagents in this study were of analytical grade.

Collection of plant materials

Andong rhizome (2 kg) was obtained from local area in and around Klungkung Regency of Bali, Indonesia, in the month of April-May. The andong rhizome (2 kg) were cleaned from soil and other materials, and then, it was dried under the shade for 21 days. Moreover, the dried rhizomes (350 g) were pulverized in blender dan passed through Sieve No.40. The powdered materials (350 g) with weter content (5%) were subjected to maceration. Plant identification was done in Laboratory of Taxonomy, faculty of Mathematics and Natural Sciences, Institut Technology Bandung (ITB), Bandung, Indonesia.

Preparation of extract (methanolic)

The powder (350 g) was extracted with methanol by maceration method for 24 hrs, and maceration process was repeated 5 times and then evaporated by Rotary Evaporator until semisolid consistency was obtained. Methanolic extracts (reddis-brown color) had the weight about 60 g, and stored in a desicator. These andong rhizome methanol extracts (60 g water- soluble) were used for the invivo assays.

Diet of animal

Extract dose was given 30 mg / kg b.w. / d and 70 mg / kg b.w. / d. Diet control as standard diet for rats is CP 551 having a composition of 13% water; 18.50 to 20.50% protein; fat, 4%; fiber 6%; ash 8%; 0.90% calcium and 0.70% phosphorus. Diet of high in cholesterol is the standard meal (50%) and a duck egg yolk (50%).

Experiment animal

Male wistar white rats (150-200 g) of either sex approximately 11-12 weeks, procured from the research laboratory center study of animal disease (CSAD), Faculty of Veterinary Medicine of Udayana University. They were housed in polypropylene cage and fed with standard rodent pellet diet (Cp551) and water ad libitum. The animals from each group individually housed at room temperature, with cycles of light: dark 12:12 hrs. All the experimental works with the animal, were curried out after obtaing approval from organization of Animal Ethics Committee (ethical Clearance) No: 0142/KE-PH/VIII/2016.

Design of experimental

Twenty-four Wistar rats were divided into 4 groups (six rats per group), Group I and II were given a standard diet and high-cholesterol controls, respectively, and other groups received their respective agents (extract 30 mg/kg.b.w/d and 70 mg/kg.b.w/d) and all the groups were given high-cholesterol except standard diet control group. After 28-day treatment, rats were fasted for 14 hrs. Blood is collected through orbital sinus, accommodated in the tubes of blood containing EDTA solution was then centrifuged at 5000 g for 15 min at 4 ° C to obtain plasma and then freeze until analysis.

Analysis of plasma lipids

Analysis of plasma total cholesterol was done by CHOD-PAP method. CHOD-PAP method is an enzymatic-colorimetric test being highly specific for measurements in the area of light that can be seen by the eye, and can be distinguished from the others. Total cholesterol was calculated by absorbance of the sample divided by the absorbance of the standard cholesterol (0.240) multiplied by a constant standard cholesterol (200 mg / dl)

High-density Lipoprotein-cholesterol (HDL) analysis was done to use the provision of phosphotongstic acid and magnesium ions into the sample so that chylomicrons, very low-density lipoprotein-cholesterol (VLDL) and LDL-C will settle. HDL-C levels are calculated with the absorbance of the sample multiplied by 318 (mg / dl) [29]. Low-Density Lipoprotein-cholesterol (LDL) checks was done by reducing the total cholesterol in VLDL and HDL, while VLDL calculation is done by using triglycerides, VLDL which is equal to one-fifth (1/5) of triglycerides.

Analysis of triglycerides (TG) was conducted by GPO-PAP method. Triglycerides are determined after enzymatic hydrolysis with lipase. Quinoneimin indicator formed from hydrogen peroxide, 4-aminoantipirin and 4-chlorophenol under the influence of peroxide catalysis. Triglyceride levels calculated by: absorbance of the sample divided by the standard absorbance triglycerides (0.145) multiplied by a constant triglyceride (200 mg / dl).

Statistical analysis

Statistical analysis was performed with statistical analysis system [30]. Values are expressed as mean ± SD. Results were analyzed by one-way ANOVA, and differences among the treatments were determined by least-significant-difference test (LSD). Alpa 0.05 was used to determine statistically significant differences.

RESULTS AND DISCUSSION

Results

Total cholesterol, HDL cholesterol, LDL cholesterol, TG , VLDL, and ratio total cholesterol to HDL cholesterol

Wistar rats were given treatment for 28 days and on the last day of the study, rats were fasted for 14 hrs with pull all food and drink from his cage, and then have blood drawn and evaluated according to the study protocol. An average of total cholesterol, LDL cholesterol, HDL cholesterol, TG, VLDL, and the ratio of total cholesterol to HDL cholesterol are given in Table 1.

Table 1. The average of rats' blood plasma lipid profile

Group	Control	P	High-Cholesterol	P	P30	P	P70	P
Chol. Total (mg/dl)	84.33±1.63^{bcd}	0.000 0.000 0.000	102.83±1.17^{acd}	0.000 0.000 0.000	62.00±1.55^{ab}	0.000 0.000 0.430	62.67±1.37^{ab}	0.000 0.000 0.430
LDL-C(mg/dl)	12.35±1.68^{bcd}	0.000 0.000 0.000	44.52±2.17^{acd}	0.000 0.000 0.000	8.80±1.28^{ab}	0.001 0.000 0.329	7.90±0.72^{ab}	0.000 0.000 0.329
HDL-C (mg/dl)	53.75±0.93^{bcd}	0.000 0.000 0.000	31.52±2.51^{acd}	0.000 0.000 0.000	38.17±1.47^{ab} ^{d}	0.000 0.000 0.000	42.00±0.63^{abc}	0.000 0.000 0.000
TG (mg/dl)	91.00±0.89^{bcd}	0.000 0.000 0.000	134.00±1.79^{acd}	0.000 0.000 0.000	75.17±0.75^{ab} ^{d}	0.000 0.000 0.000	64.67±4.72^{abc}	0.000 0.000 0.000
VLDL(mg/dl)	18.20±0.18^{bcd}	0.000 0.000 0.000	26.80±0.36^{acd}	0.000 0.000 0.000	14.93±0.16^{ab} ^{d}	0.000 0.000 0.000	12.93±0.94^{abc}	0.000 0.000 0.000
Chol.t /HDL-C	1.57±0.04^{b}	0.000 0.351 0.297	3.20±0.24^{acd}	0.000 0.000 0.000	1.64±0.04^{b}	0.351 0.000 0.056	1.49±0.05^{b}	0.297 0.000 0.056

Mean ± SD (n =6) followed by superscript letters in the same row indicate significant differences p<0.05. group III (P30=andong rhizome extract as 30 mg/kg b.w.), and group IV (P70= treatment groups with consentration 70 mg/kg b.w.). b.w. = body weight; Chol.t = cholesterol total; HDL-C (high density lipoprotein cholesterol); LDL-C (Low density lipoprotein-cholesterol; VLDL (very low density lipoprotein; TG (triglyserides)

[a] represents significant difference from control p<0.05

[b]Represent significant difference from High- cholesterol p<0.05

[c] Represents significant difference from P30 p<0.05

[d] Represents significant difference from P70 p<0.05

The result (Table 1) has shown that high-cholesterol groups increase in average total cholesterol, LDL cholesterol, TG, VLDL, and total cholesterol/HDLcholesterol ratio with significant difference (p <0.05) than control. Group of high-cholesterol also decreased the average HDL cholesterol with a significant difference (P <0.05) than control. The effect of high cholesterol diet on Wistar rats led to an increase in average total cholesterol (21.94%); LDL cholesterol (260.49%); TG (47.25%), total cholesterol / HDL cholesterol ratio (103, 82%), VLDL (47.25%) and decreased HDL cholesterol (41.36%) respectively, in plasma compared with control group which potentially occurs atherosclerosis. Feeding andong rhizome extract at

30 mg / kg bb./d and 70 mg / kg b.w. / d in successive rats prevented an increase in average total cholesterol (39.71%, 39.05%); LDL cholesterol (80.23%, 82.25%); TG (43.90%, 51.74%); VLDL (44.29%, 51.75%); the ratio of total cholesterol/HDL cholesterol (48.75%; 53.44%) and decrease in HDL cholesterol (21.10%; 33.25%) respectively, compared with the high-cholesterol group.

Discussion

Based on the results, a significant increase ($p < 0.05$) in average of total cholesterol, LDL cholesterol, TG, VLDL, and total cholesterol / HDL cholesterol ratio and decrease ($p < 0.05$) in average of plasma HDL cholesterol in groups given a high-cholesterol diet, compared with controls is shown. Increased plasma lipid profiles in the high cholesterol group showed that there was not barrier to absorption of cholesterol in the gut. Excess fat diet increases the profile of plasma lipids that have caused hardening of the

Increased total cholesterol, LDL cholesterol, TG, VLDL, total cholesterol / HDL cholesterol ratio and HDL cholesterol reduction are a sign of potentially dyslipidemia that tends to form atherosclerosis which is a risk factor for coronary heart disease [20, 31]. Atherosclerosis is a condition in which the walls of the arteries thicken as a result of the accumulation of fatty materials such as cholesterol which is a risk factor for cardiovascular diseases [2, 8, 19, 28, 32, 33].

Increased total cholesterol and LDL cholesterol also occurred in rabbit blood serum treated with a high cholesterol diet for 28 days [20]. Increased total cholesterol, LDL cholesterol and decreased HDL cholesterol in serum blood of laying chickens were given high. A cholesterol diet for 60 days also occurs significantly [25].

Andong rhizoma extract (30 mg / kg.bw and 70 mg / kg / b.w) had lowered lipid plasma levels in mice, respectively, preventing an increase in mean cholesterol (39.71%, 39.05%); LDL (80.23%, 82.25%); TG (43.90%, 51.74%); VLDL (44.29%, 51.75%); ratio of total cholesterol / HDL-C (48.75%; 53.44%) and decreased HDL cholesterol (21.10%; 33.25%) compared with high cholesterol group. The effect of lipid reduction may be due to the presence of saponins. Saponin reduces cholesterol absorption and is known to have antihyperlipidemic activity, thereby increasing steroid fecal excretion resulting in a decrease in body lipid reduction of 1% cholesterol resulting in a 2-3% reduction in the risk of coronary heart disease [2, 9]. It has been established that nutrition plays an important role in the etiology of hyperlipidemia [10, 33].

The results of this study are supported by findings reported by Al-Matubsi et al., 2011, that diosgenin saponin can lower total cholesterol, LDL cholesterol and increase HDL cholesterol by a very significant difference ($p < 0.01$). Karaya saponin is also able to lower total cholesterol, LDL cholesterol and increase blood serum HDL cholesterol of laying hens [30]. Steroids saponin from Chlorophytum nimonii can also lower total cholesterol, LDL cholesterol, TG and increase HDL cholesterol significantly ($p < 0.01$) [19]. Soyasaponin, alfalfa saponin, and platycodin saponins were also shown to lower total cholesterol, LDL cholesterol, TG, and total cholesterol / HDL cholesterol ratio significantly ($p < 0.05$) [20, 21, 24, 28, 34].

Intake andong rhizome extracts with treatment of 30 mg / kg and 70 mg / kg were also able to lower total cholesterol, LDL cholesterol, TG, and total cholesterol / HDL cholesterol ratio and to increase HDL cholesterol by a significant difference ($p < 0.05$) with high cholesterol treatment. From the results of this study, it was showed that rhizome andong extract is suspected to have biological activity as hipolipidemik which can prevent the occurrence of atherosclerosis which is one of the risk factors of coronary heart disease. Intake of andong rhizomes extract is thought to not only bind cholesterol from food consumed, but also bind cholesterol originating from the liver that is secreted into the intestine along with bile. Andong rhizome extract also contains saponins that are able to bind bile acids that cause blood plasma lipid concentration of wistar rats to decrease.

CONCLUSIONS

Based on the results and the above discussion, the conclusions can be drawn as follows:

The intake of andong rhizome extract can act as hipolipidemia by lowering total cholesterol, LDL cholesterol, triglycerides, VLDL, the ratio of total cholesterol/HDL cholesterol and increased HDL cholesterol of Wistar rats blood plasma which were given high-cholesterol diet with significant difference.

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