




The Lipid Profile and Aorta Histopathology On Hyperlipidemic Rat by *Saurauia vulcani* Korth. Leaves Extract

Debi Dinha Octora¹, Rosidah² , Jansen Silalahi³ , Denny Satria^{*4} 

¹Graduate Student of Faculty of Pharmacy, Universitas Sumatera Utara, Medan

²Department of Pharmacology, Faculty of Pharmacy, Universitas Sumatera Utara, Medan,

³Department of Pharmaceutical Chemistry, Faculty of Pharmacy, Universitas Sumatera Utara, Medan,

⁴Department of Pharmaceutical Biology, Faculty of Pharmacy, Universitas Sumatera Utara, Medan; Indonesia

*Corresponding Author: dennysatria@usu.ac.id

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ABSTRACT

Dyslipidemia is a pathological condition characterized by increased levels of total cholesterol, triglycerides and LDL and decreased levels of HDL. Dyslipidemia causes cardiovascular disease risk factors by increasing cholesterol levels, increasing triglyceride levels, lowering HDL levels, and increasing LDL levels, as well as decreasing the proliferation of cardiac aortic cells in dyslipidemic rats. The pirdot plant (*Saurauia vulcani* Korth.) has long been known by the Simalungun, Toba and Karo communities to have the potential to treat various diseases caused by disruption of lipid processes in the body. Pirdot leaves contain bioactive compounds of flavonoids, tannins and saponins that have the potential to improve lipid profiles and prevent cardiovascular disease. This study aims to determine the activity of EEDP on the lipid profile of dyslipidemic rats. Pirdot leaf simplicia powder was extracted by maceration with 96% ethanol solvent and the extract was used on 30 dyslipidemic rats which were divided into 6 groups. Group 1 (Na-CMC), group 2 (Atorvastatin), group 3, 4, 5, 6 EEDP doses of 50, 100, 200, 400 mg/kg BW were administered orally for 21 days. At the end of the treatment, the levels of total cholesterol (TC) and aortic cell proliferation were measured. The results showed that *Saurauia vulcani* Korth had water content (6.23%), water soluble extract (10.50%), simplicia content soluble in ethanol (14.77%), total ash content (7.05%) and acid insoluble ash content (0.48%). From the antidyslipidemic study it was shown that EEDP 400 mg/kg BW improved blood lipid to increase aortic cell proliferation dyslipidemic rats was 69.84 ± 0.27 . Based on the explanation above, it is concluded that EEDP has an antidyslipidemic effect.

Keyword: *Saurauia vulcani* Korth, extract, dose, cholesterol, *Dyslipidemia*, *Saurauia vulcani* Korth., Lipid profile, Proliferation, Aorta

ABSTRAK

Dislipidemia merupakan suatu keadaan patologis yang ditandai dengan peningkatan kadar kolesterol total, trigliserida serta LDL dan penurunan kadar HDL. Dislipidemia menyebabkan faktor resiko penyakit kardiovaskuler dengan meningkatkan kadar kolesterol, meningkatkan kadar trigliserida, menurunkan kadar HDL, dan meningkatkan kadar LDL, serta menurunkan proliferasi sel aorta jantung tikus dislipidemia. Tanaman pirdot (Saurauia vulcani Korth.) sejak lama dikenal oleh masyarakat Simalungun, Toba dan Karo memiliki potensi dalam mengobati berbagai macam penyakit yang disebabkan oleh terganggunya proses lipid dalam tubuh. Daun pirdot mengandung senyawa bioaktif flavonoid, tanin dan saponin yang berpotensi memperbaiki profil lipid dan mencegah penyakit kardiovaskuler. Penelitian ini bertujuan untuk mengetahui aktivitas EEDP terhadap profil lipid tikus dislipidemia. Serbuk simplisia daun pirdot diekstraksi secara maserasi dengan pelarut etanol 96% dan ekstrak digunakan pada 30 ekor tikus dislipidemia yang dibagi menjadi 6 kelompok. Kelompok 1 (Na-CMC), kelompok 2 (Atorvastatin), kelompok 3, 4, 5, 6 EEDP dosis 50, 100, 200, 400



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mg/kg BB diberikan secara oral selama 21 hari. Pada akhir perlakuan, diukur kadar kolesterol total (KT), trigliserida (TG), LDL dan HDL serta proliferasi sel aorta. Hasil penelitian menunjukkan bahwa EEDP memiliki kadar air (6,23%), kadar sari larut dalam air (10,50%), kadar simplisia sari larut dalam etanol (14,77%), kadar abu total (7,05%) dan kadar abu tidak larut asam (0,48%). EEDP dosis 400 mg/kg BB adalah dosis terbaik dalam memberi pengaruh terhadap kadar kolesterol total serta meningkatkan proliferasi sel aorta jantung tikus dislipidemia adalah $69,84 \pm 0,27$. Berdasarkan pemaparan diatas disimpulkan bahwa EEDP memiliki efek antidislipidemia.

Keyword: Dislipidemia, *Saurauia vulcani* Korth., Profil lipid, Proliferasi, Aorta

1. Introduction

The use of natural materials, especially those derived from plant-grown materials used for the prevention and treatment of diseases has been known since ancient times by mankind. These natural ingredients are known as folk remedies because the principles of their use are still traditional. Generally, the efficacy of traditional medicines to date is based solely on empirical experience [1].

Some efforts made to lower cholesterol levels include early lifestyle changes, such as exercising regularly, reducing intake of fatty foods, and treatment with drugs that can lower cholesterol levels that can prevent severe complications from hypercholesteremia [2], [3]. Hypercholesterolemia is closely related to an increase in total cholesterol, an increase in LDL cholesterol, increased levels of triglycerides as well as a decrease in HDL cholesterol [4], [5].

According to WHO records about 20,000 plant species are used by the world's population as medicine. One of the medicinal plants is *Saurauia vulcani*, Korth. known as pirdot, Pirdot plant (*Saurauia vulcani* Korth.) based on previous research containing flavonoids, glycosides, saponins, tannins, and steroids/triterpenoids and also several in vivo studies have shown that pirdot leaves have activity as an antihyperglycemic and antihyperlipidemic [6], [7].

2. Materials and Method

2.1 Materials

Fresh *Saurauia vulcani* Korth leaves were collected from Tiga Lingga village, Dairi regency, Sumatera Utara province, Indonesia., Spctrophotometer (Shimadzu), all chemicals and reagents used in this work were of analytical grade unless otherwise stated. Sodium hydroxide, sodium sulfate anhydrous, and sodium carboxymethylcellulose were the products of Merck, Germany. Distilled water was purchased from Bratachem, Indonesia. n-Hexane was obtained from Macron Chemicals, Lard oil and quail egg yolk used to induce dyslipidemia in rats were obtained from the local market. Atorvastatin 20 mg tablets were purchased from the local pharmacy. ethanol 96%.

2.2 Methods

2.2.1 Preparation extract of *Saurauia vulcani* Korth leaves [8]

Saurauia vulcani Korth leaf powder (500 g) was extracted by maceration using ethanol as solvent 7 days, 5L. The filtrate was collected and evaporated with a rotary evaporator.

2.2.2 Preparation suspension of CMC-Na 0.5% (b/v)

A total of 500 mg of CMC-Na is sprinkled into a mortar containing 10 ml of hot distilled water, closed, and left for 15 minutes until the mass becomes transparent, snarled then diluted with distilled water up to 100 ml.

2.3 Paration suspension of *Saurauia vulcani* Korth Leaves

The leaves of pirdot ethanol extract are determined based on the orientation of the experimental animals, i.e. a dose of 50 mg/KgBB, 100 mg/KgBB, 200 mg/KgBB, 400 mg/KgBB. Ethanol extract of *Saurauia vulcani* Korth leaves was inserted into mortar containing a slight Na-CMC suspension of 0.5% homogeneous stirring and then adequacy with Na-CMC suspension 0.5% to 10 ml [12]

2.2.4 Preparation suspension of atorvastatin

A total of 20 mg of atorvastatin is stirring in a mortar, then added Na-CMC suspension 0.5% little by a little while constantly being stirring until homogeneous, then adequacy with Na-CMC suspension 0.5% to 100 ml. [10]

2.2.5 Preparation of animal studies

The experimental animals used in the study were male white rat weight 180 – 200 g. Before testing, mice were acclimatized for 7-14 days, as many as 30 mice were divided into 6 groups of 5% to 625 ml. Each cage is given bedding (chaff) and fed regularly. The experimental animals were grouped into 6 groups, each consisting of 4 rats. After acclimatization period, rats were fasted for 18 h and blood TC was measured using strip test. Then, rats were given with 2 ml/kg BW quail egg yolk and lard oil twice a day. After 30 days of induction, blood TC of each rats was measured and rats with TC higher than 200 mg/dl were used for the test. Group 1 (CMC suspension), group 2 (atorvastatin), group 3 (50 mg/KgBB), group 4 (100 mg/KgBB), group 5 (200 mg/KgBB), group 6 (400 mg/KgBB) [7]

2.2.6 Cholesterol, HDL, LDL, triglyceride, SGOT, SGPT, SOD and LDH levels testing

Cholesterol level testing, HDL, LDL and triglycerides Saurauia vulcani Korth leaves extract doses of 50 mg/KgBB, 100 mg/KgBB, 200 mg/kgBB, 400 mg/KgBB with atorvastatin suspension comparison dose 1.8 mg/KgBB in white rats and 0.5% CMC-Na suspension control for 21 days.

2.2.7 Measurement of cholesterol, HDL, LDL and triglycerides levels [15], [18]

After the end of treatment, rats were fasted for 18 h and anesthetized with 70 mg/kg BW of ketamine intraperitoneally. Blood was collected directly from the heart and centrifuged for 10 min at 3000 rpm to obtain serum. Serum collected was then analyzed for lipid profile. [10]

2.2.8 Statistical analysis

The results are presented as mean \pm SD of five animals per group and statistical levels of significance were determined using the one – way ANOVA ($p < 0.05$ was considered significant).

2.2.9 Preparation of Microscopic Preparations (Histopathology)

Mice were dissected and the aorta was taken to observe the proliferating cells. Observation of cell proliferation was carried out using the immunohistochemistry (IHC) method, which began with the manufacture of paraffin blocks, preparation of HE preparations, and continued with immunohistochemistry (IHC) using the Ki-67 protein.

3. Results and Discussion

3.1 Result Of Treatment Lipid Profile

After 21 days of treatment, all rats were sacrificed for blood from the heart vein. This test is carried out to see total cholesterol levels in the blood in mg/dl units, The average value of total cholesterol levels after induction was higher than before induction. This shows that the induction can increase total cholesterol levels in the blood of rats.

Table 1. Results of decreased total cholesterol levels every week

Group	Day 7 Average cholesterol levels (mg/dl)	Day 14 Average cholesterol levels (mg/dl)	Day 21 Average cholesterol levels (mg/dl)
CMC Natrium	300.20 \pm 8.136	312.20 \pm 3.633	346,60 \pm 4,561
Atorvastatin	223.8 \pm 4.919	190.60 \pm 6.877	172,40 \pm 6,542
EEDP 50 mg/KgBB	288.8 \pm 6.380	263.60 \pm 4,775	238,20 \pm 5,119
EEDP 100 mg/KgBB	255.2 \pm 2.950	227.00 \pm 4,359	200,00 \pm 3,162
EEDP 200 mg/KgBB	220.6 \pm 4.450	182.60 \pm 6,066	163,20 \pm 6,058
EEDP 400 mg/KgBB	225.8 \pm 5.933	189.60 \pm 3,782	171,60 \pm 3,847

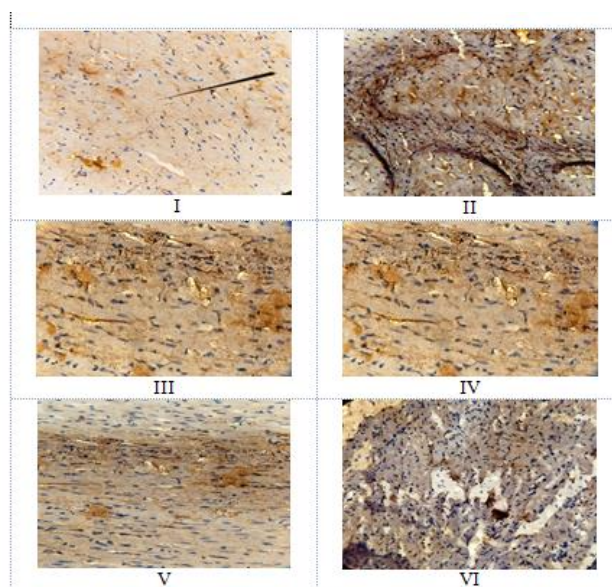
Based on Table. 1 and Table. 2 above obtained the results of the average lipid profile value shows the administration of *Saurauia vulcani* Korth ethanol extract has the effect of decreased total cholesterol levels, LDL, triglyceride, as well as increased HDL. *Saurauia vulcani* Korth leaves have some activated content such as flavonoids, tannins, saponins. Flavonoids can lower total cholesterol levels, triglyceride levels, and LDL levels. Flavonoids have known to inhibit the increase in total cholesterol levels by inhibiting the activity of the HMG KoA reductase enzyme which plays an important role in cholesterol biosynthesis [14], [15]. Flavonoids play a role in the prevention of coronary heart disease based on the effects of biological processes that include the process of inhibition of lipid peroxidation and platelet aggregation. Flavonoids have believed to lower atherosclerosis and inhibit LDL oxidation, by inhibiting the formation of free radicals and protecting α -tocopherol in LDL from oxidation [17], [18].

The saponin content of *Saurauia vulcani* Korth leaves has a mechanism of hypolipidemia through increased excretion of bile acids due to the increasing conversion of cholesterol into bile acids, saponins are also able to inhibit the absorption of cholesterol and bile acids in the intestines by forming micelle formation, so cholesterol cannot be absorbed [19].

Saurauia vulcani Korth leaves also contain tannins that have the same activity as flavonoids in lowering total cholesterol by inhibiting the HMG KoA reductase enzyme which plays a role in synthesizing cholesterol. The inhibited activity of HMG KoA reductase will decrease the synthesis of apo B 100 and increase LDL receptors on the surface of the liver. Thus blood LDL cholesterol will be attracted to the liver and lower LDL and VLDL [16], [21]. The decrease in total cholesterol levels in the blood after the administration of *Saurauia vulcani* Korth leaves was due to the flavonoid content in the extract. This can be seen in Table 4.2 results of phytochemical screening of *Saurauia vulcani* Korth leaves, indicating that *Saurauia vulcani* Korth leaves contains a number of flavonoids, glycosides, saponins, tannins and steroids/terpenoids. In an in vitro study [23], flavonoids have been shown to reduce lipid peroxides by inhibiting the HMG-CoA reductase enzyme which causes a decrease in cholesterol synthesis. Flavonoids as natural polyphenolic antioxidant compounds can lower cholesterol levels in the blood, protect arteries from damage, and reduce the amount of cholesterol accumulation on the surface of the arterial endothelium. The presence of saponins in *Saurauia vulcani* Korth leaves can form complex bonds with bile acids and form micelles so that cholesterol cannot be absorbed by the intestine. The tannin content in *Saurauia vulcani* Korth leaves can also inhibit the absorption of cholesterol in the intestine by reacting with mucosal and intestinal epithelial proteins.

3.2 Result of Cardiac Aortic Cell Proliferation Was Performed Using Ki-67

Assay on cardiac aortic cell proliferation was performed using Ki-67 as an antibody to clarify the slide staining process in viewing the level of cell multiplication in cardiac aortic tissue. The higher the proliferation of cells, the less the formation of foam cells in the heart aorta. The formation of foam cells in the heart aorta occurs as a result of LDL oxidation which will increase fat deposits inside and outside the cells. A microscopic picture of cardiac aortic cells stained with Ki-67 antibody can be seen in Figure 4.4.



Observation of the histopathological picture of rat aorta induced by pork oil and quail egg yolk and given CMC Sodium suspension, showed the presence of a lot of foam cells in the tunica intima (figure I). In mice treated with atorvastatin, there were still few foam cells in the tunica intima (figure II). Meanwhile, mice treated with EEDP showed a small amount of foam cells in the tunica intima indicating cell repair (Figure V and Figure VI). [11], [12].

Table 2. Average Value of Allred Score Calculation on Rat Aortic Cell Proliferation (value in mean±SEM)

Groups	Proliferation (Mean±SEM)
I	41,35 ± 0,20
II	71,07 ± 0,34
III	42,60 ± 0,16
IV	56,81 ± 0,12
V	67,07 ± 0,14
VI	69,84 ± 0,27

Based on Table 2, it is known that the administration of Atorvastatin and EEDP at a dose of 50 mg/kg BW, 100 mg/kg BW, 200 mg/kg BW and 400 mg/kg BW can increase the proliferation of rat aortic cells. The best increase in rat aortic cell proliferation was in group VI with the average value of Allred's calculation on rat aortic cell proliferation, which was 69.89 ± 0.12 . The mean value of Allred's calculations on aortic cell proliferation of rats group VI and group II (71.09 ± 0.12) was significantly different ($p < 0.05$) compared to group I as a negative control, this proves that the effectiveness of EEDP dose 400 mg/kg BW was comparable to atorvastatin in increasing the proliferation of aortic cells in rats induced by lard oil and quail egg yolk. [13].

4. Conclusion

Based on the results obtained, it can be concluded that the ethanol extract of *Saurauia vulcani* Korth leaves at a dose of 50 mg/KgBB, 100 mg/KgBB, 200 mg/KgBB, 400 mg/KgBB with atorvastatin suspension comparison dose 0.80 mg/KgBB and 0.5% CMC-Na suspension control can lower total cholesterol levels and increase the value of rat aortic proliferation but the best dosage is 400 mg/KgBB.

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6. Conflict of Interest

Competing interests: No relevant disclosures.

References

- [1] Mulyono dan Mulyanti. Khasiat dan Manfaat Daun Sirih Obat Mujarab Dari Masa ke Masa, Edisi ke-1. Jakarta:Agromedia Pustaka. 2004: 1-11.
- [2] Ali RA dan Hariadi. Hubungan Obesitas dengan Beberapa Faktor Resiko Penyakit Jantung Koroner (PJK) di Laboratorium Klinik Prodia Makassar. Jurnal obesitas dan jantung coroner. 2005: 5-9.
- [3] Sarvesh CN, Jennifer F, Suresh J, Yogesh HS, Shivakumar S. Antihyperlipidemic activity of *Achyranthes aspera* Linn leaves on cholesterol induced hyperlipidemia in rats. Research Journal of Pharmacy and Technology, 2017; 10(1): 201 – 204
- [4] Adib M. Memahami dan mencegah kolesterol. Yogyakarta: Kota Buku Indonesia. 2010: 11-15.
- [5] Olaiya CO, Omolekan TO. Antihypercholesterolemic activity of ethanolic extract of *Buchholzia coriacea* in rats. International Journal of Environmental Research and Public Health, 2015; 11549 0 115599.

- [6] Sitorus P. Characterization Simplisia and Ethanolic Extract of Pirdot (Saurauia Vulcani, Korth) Leaves and Study of Antidiabetic Effect in Alloxan Induced Diabetic Mice. *Int.J. ChemTech Res*, 2015; 8(6): 789-794.
- [7] Sitorus P, Rosidah, dan Satria D. Hypoglycemic activity of ethanolic extract of Saurauia vulcani Korth. Leaves. *Asian J Pharm Clin Res*, 2018; 11(1): 35-36.
- [8] Hutahaean S, Tanjung M, Sari DP and Ningsih VE. Antihyperglycemic and Antihyperlipidemic Effects of Pirdot (Saurauia vulcani Korth.) Leaves Extract in Mice. *IOP Conf. Series: Earth and Environmental Science*, 2018; 130: 1-7.
- [9] Satria, D, Silalahi J, Haro G, Ilyas S, Hasibuan PAZ. *Asian Pacific Journal of Cancer Prevention*, 2017; 18(2).
- [10] Margata, L, Sialahi, J, Harahap, U, Satria, D. The Effect of Hydrolyzed Virgin Coconut Oil on Lipid Profile and Liver Enzymes in Dyslipidemic Rats. *Asian J Pharm Clin Res*, 2018; Vol 11, Issue 10.
- [11] Hassan S, El-Twab SA, Hetta M, Mahmoud B. Improvement of lipid profile and antioxidant of hypercholesterolemic albino rats by polysaccharides extracted from the green alga *Ulva lactuca linnaeus*. *Saudi J Biol Sci*, 2011; 18:333-40.
- [12] Hall IH. In: Paoletti R, Kritchevsky D, Holmes WL, editors. *Drugs Affecting Lipid Metabolism*. Berlin: Springer. 1987: p. 451.
- [13] Reddy NV, Raj P, Raju G, Anarthe SJ. Antihyperlipidemic activity of Cassia fistula bark using high fat diet induced hyperlipidemia. *Int J Pharm Pharm Sci*, 2015; 7:61-4.
- [14] Peng IW, and Kuo SM. Flavonoid Structure Affects the Inhibition of Lipid Peroxidation in Caco-2 Intestinal Cells at Physiological Concentrations. *The Journal of Nutrition*, 2003; Issue 7: 2184 – 2187.
- [15] Joni T, Rama D, Purwaningsih, Hadi K. Effect of Ethanol Extract from Purple Eggplant Skin (*Solanum melongena* L) On Blood Glucose Levels and Pancreatic B Cells Regeneration on White Rats Male Hypercholesterolemia-Diabetic. *Research Journal of Pharmacy and Technology*, 2019; 12(6): 2936 – 2942.
- [16] Puttaswamy NY, and Urooj. In Vivo Antihypercholesterolemic Potential of Swietenia mahagoni Leaf Extract. *Hindawi*, 2016; p. 6.
- [17] Muflikhatur SR, dan Murwani HR. Perbedaan Pengaruh Antara Ekstrak dan Rebusan Daun Salam (*Eugenia polyantha*) Dalam Pencegahan Peningkatan Kadar Kolesterol Total Pada Tikus Sprague Dawley. *Journal of Nutrition College*, 2014; 3(1): 148.
- [18] Thilakavathu A, Arjun P, Samiraj R. Hypocholesterolemic Effect of Dietary Fish Oil in Albino Wistar Rats. *Research Journal of Pharmacy and Technology*, 2019; 12(9): 4161 – 4164.
- [19] Amany MM, Tawfik MF, Hikal MS, Tag ED. Hypocholesterolemic Effect of Saponin Extracts in Experimental Animals. *Arab Universities Journal of Agricultural Sciences*, 2019; 26(6): 2463 – 2478.
- [20] Silalahi J. *Makanan Fungsional*. Yogyakarta: Kanisius. 2006: Hal. 85-98.
- [21] Salvamani S, Gunasekaran B, Shahrudin NA, Ahmad SA, Shukor MY. Antiartherosclerotic Effects of Plant Flavonoids. *BioMed Research International*, 2014; (11): 1 – 3.
- [22] Morakinyo AO, Iranloye BO, Oyelowo OT, Nnaji J. The mechanism of increasing the enzymes SGOT and SGPT are caused by the inclusion of excess toxic substances into the body that will be metabolized by the enzyme cytochrome P450 in the liver into free radicals. *Biology and Medicine*, 2012; 4 (3): 134 – 140.
- [23] Perdana, F., W.S. Deden, dan R.D. Rahmi. 2016. Penapisan Fitokimia Dan Uji Aktivitas Antioksidan Ekstrak Metanol Daun Jambu Bol (*Syzygium malaccense* (L.) Merr. & Perry), Daun Salam (*Syzygium polyanthum* (Wight.) Walpers), Serta Daun Jamblang (*Syzygium cumini* (L.) Skeels) Asal Arboretum Garut. *Jurnal Farmako Bahari*. Vol. 7, No. 2.