

RESEARCH ARTICLE

Activity of Javanese Ginger, Turmeric, Garlic, and Pomegranate Flower on LDL-C and Total-C on Dyslipidemia Model Rats

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Abstract

High levels of LDL cholesterol are risk factors for coronary heart disease. Different types of medicinal plants have hypolipidemic effects. The study aimed to compare the potential of Javanese ginger ethanol extract, turmeric, garlic, and pomegranate flowers with rosuvastatin on levels of LDL cholesterol (LDL-C) and total cholesterol (total-C) male Wistar rats dyslipidemia models. This experimental laboratory research was conducted in Maranatha Animal Research Laboratory Bandung and was carried out in January–December 2020. The experimental animals were divided into six groups (n=5): the control group, the Javanese ginger group, the turmeric group, the garlic group, the pomegranate flower group, and the comparison control group. The induction given to experimental animals was administering vitamin D₃, a high-fat diet, and propylthiouracil for 14 days. The results showed that the administration of 175 mg/kg BW of garlic ethanol extract (-44.85%), pomegranate flowers (-58.74%), and rosuvastatin (-40.00%) reduced LDL-C compared to control (p<0.05). The administration of 175 mg/kg BW of Javanese ginger ethanol extract (-15.16%), turmeric (-14.02%), garlic (-22.80%), pomegranate flower (-65.24%), and rosuvastatin (-18.70%) reduced total-C compared to controls (p<0.05). The conclusion is that garlic and pomegranate flowers lowered LDL-C, while Javanese ginger, turmeric, garlic, and pomegranate flowers reduced total-C.

Keywords: Garlic, Javanese ginger, LDL-C, pomegranate flower, total-C, turmeric

Aktivitas Temulawak, Kunyit, Bawang Putih, dan Bunga Delima terhadap K-LDL dan K-Total pada Tikus Model Dislipidemia

Abstrak

Kadar kolesterol LDL yang tinggi adalah faktor risiko penyakit jantung koroner. Berbagai jenis tanaman obat memiliki efek hipolipidemik. Penelitian ini bertujuan membandingkan potensi ekstrak etanol temulawak, kunyit, bawang putih, dan bunga delima dengan rosuvastatin pada kadar kolesterol LDL (K-LDL) dan kolesterol total (K-total) tikus Wistar jantan model dislipidemia. Penelitian laboratorium eksperimental ini dilakukan di Laboratorium Penelitian Hewan Maranatha Bandung dan dilakukan pada Januari–Desember 2020. Hewan coba dibagi menjadi enam kelompok (n=5), yaitu kelompok kontrol, kelompok temulawak, kelompok kunyit, kelompok bawang putih, kelompok bunga delima, dan kelompok pembanding. Induksi yang diberikan kepada hewan coba adalah pemberian vitamin D₃, pakan lemak tinggi, dan *propylthiouracil* selama 14 hari. Hasil penelitian menunjukkan bahwa pemberian 175 mg/kgBB ekstrak etanol bawang putih (-44,85%), bunga delima (-58,74%), dan rosuvastatin (-40,00%) mengurangi K-LDL dibanding dengan kontrol (p<0,05). Pemberian 175 mg/kgBB ekstrak etanol temulawak (-15,16%), kunyit (-14,02%), bawang putih (-22,80%), bunga delima (-65,24%), dan rosuvastatin (-18,70%) mengurangi K-total dibanding dengan kontrol (p<0,05). Kesimpulannya, bunga bawang putih dan delima menurunkan K-LDL, sedangkan temulawak, kunyit, bawang putih, dan bunga delima menurunkan K-total.

Kata kunci: Bawang putih, bunga delima, K-LDL, K-total, kunyit, temulawak

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Introduction

The number one cause of death in the world, according to WHO, is cardiovascular disease which causes the death of 17.9 million people each year. Cardiovascular diseases include coronary heart disease, blood vessel disease, and stroke.¹ Cardiovascular disease occurs because of the atherosclerosis process. The process of atherosclerosis begins with the formation of plaque on the walls of blood vessels. This plaque can grow to be large and cause narrowing of the arteries and cause blockage. Blockage of these blood vessels can cause a heart attack or stroke. Cardiovascular disease has several risk factors, non-modifiable risk factors, and modifiable risk factors. Non-modifiable risk factors for cardiovascular disease that cannot change include genetics and previous disease history. The other side modifiable risk factors can be changed, such as lipid profile levels, blood glucose levels, obesity, smoking habits, and high blood pressure. Several studies have shown hypercholesterolemia, and elevated LDL cholesterol (LDL-C) levels have shown a positive correlation with an increased risk of coronary heart disease.

Coronary heart disease (CHD) and stroke are estimated to cause more than 470,000 deaths each year in Indonesia. The five main risk factors that can be changed are smoking, hypertension, diabetes, increased total cholesterol (total-C), and being overweight.² Dyslipidemia is a major risk factor for coronary heart disease in a patient with type 2 diabetes. Dyslipidemia includes an increase in LDL-C and total-C. The drugs such as statins are directly associated with a reduced risk of cardiovascular disease.³

Traditional Indonesian medicines can overcome hypercholesterolemia, including *Guazuma ulmifolia* leaves, *Cassia senna* leaves, *Sonchus arvensis* leaves, *Camellia sinensis* leaves, *Curcuma xanthorrhiza* rhizomes, *Curcuma longa* rhizomes, and *Phyllanthus niruri*.⁴ Some other agents used to inhibit cholesterol increase include rice bran, dragon fruit, soy powder, and oyster mushrooms.⁵⁻⁷ In addition, traditional medicines that can be used for hypercholesterolemia are garlic and pomegranate flowers.

The study aimed to compare the potential of Javanese ginger ethanol extract, turmeric, garlic, and pomegranate flowers with rosuvastatin on levels of LDL cholesterol (LDL-C) and total cholesterol (total-C) male Wistar rats

dyslipidemia models.

Methods

This study used male Wistar rats aged eight weeks with an average body weight of 150–200 grams obtained from the Faculty of Pharmacy Science and Technology, Institut Teknologi Bandung. The research was conducted in January–December 2020 at the Maranatha Animal Research Laboratory, Bandung. The Research Ethics Committee of the Faculty of Medicine, Universitas Kristen Maranatha Bandung, approved the study (Protocol Number: 144/KEP/X/2020).

This experimental laboratory research design used a randomized control group with male Wistar rats divided into six groups (n=5). In addition, groups were divided into control groups, the Javanese ginger ethanol extract group, the turmeric ethanol extract group, the garlic ethanol extract group, pomegranate flowers, and the comparator control group. The data measured were LDL-C levels and total-C levels in the treatment group and were analyzed using the one-way ANOVA analysis method and LSD test with $\alpha=0.05$.

The experimental animals were adapted for seven days and then induced single-dose vitamin D₃ 140,000 IU/200 g orally before intervention with standard feeding and distilled water ad libitum.⁸ The experimental animals were given high-fat feed (HFF) and drinking water with 0.01% propylthiouracil (PTU) for 14 days. The experimental animals were randomly assigned to six groups (n=5) with 14 days of treatment. Each treatment was given with a volume of 2 mL orally using an oral sonde: Group 1: given CMC 1% and HFF and water with 0.01% PTU for 14 days; Group 2: Javanese ginger ethanol extract at a dose of 175 mg/kg BW orally and HFF and water with 0.01% PTU for 14 days; Group 3: 175 mg/kg BW turmeric ethanol extract orally, HFF, and water with 0.01% PTU for 14 days; Group 4: 175 mg/kg BW garlic ethanol extract orally, HFF and water with 0.01% PTU for 14 days; Group 5: 175 mg/kg BW pomegranate flower ethanol extract of dose of orally, HFF, and water with 0.01% PTU for 14 days; and Group 6: rosuvastatin orally and PLT with water with 0.01% PTU for 14 days.

On the fifteenth day, after receiving treatment for 14 days, blood serum was taken from the infraorbital veins.

Results

The results in the form of LDL-C levels after 14 days of treatment were presented in Figure 1. Data on the percentage reduction in LDL-C in the treatment group were tested by one-way ANOVA and obtained a p value<0.05. It means that at least there was a pair of treatment groups that have a significant difference.

Table 1 showed that garlic (-44.85%) and pomegranate flowers (-58.74%) lowered LDL-C compared to the control with a significant difference. The potential of pomegranate flowers (-58.74%) in lowering LDL-C was better than rosuvastatin (-40.00%), while the potential of garlic (-44.85%) was equivalent to rosuvastatin which was used as a comparison.

The results in the form of total-C levels after 14 days of treatment were presented in Figure 2. Data on the percentage reduction in total cholesterol in the treatment group were tested by one way ANOVA and obtained a p value<0.05. It means that at least there was a pair of treatment groups that have a significant difference.

Table 2 showed that Javanese ginger (-15.16%), turmeric (-14.02%), garlic (-22.80%), and pomegranate flowers (-65.24%) reduced total-C compared to controls with significant differences. The potential of garlic (-22.80%) and pomegranate flowers (-65.24%) in lowering total-C were better than rosuvastatin (-18.70%), while the potential for Javanese ginger (-15.16%) and turmeric (-14.02 %) equivalent to rosuvastatin which was used as a comparison.

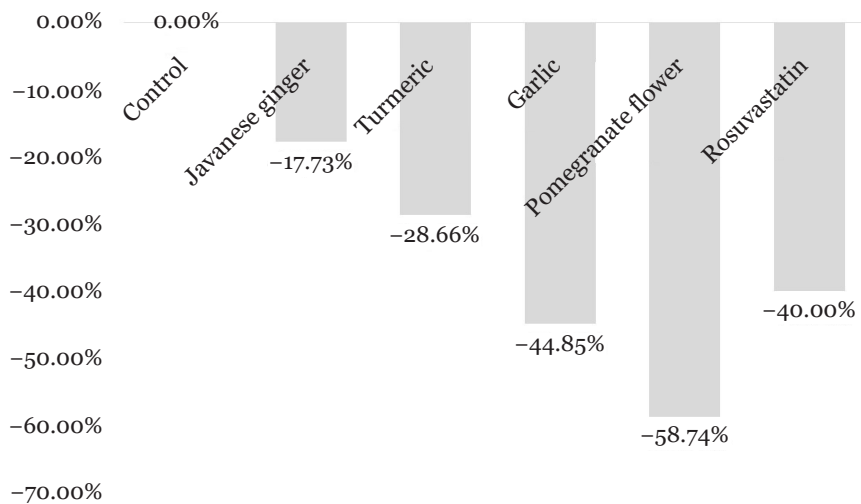


Figure 1 Percentage Reduction in LDL-C Compared to Controls

Table 1 LSD Test Results in Lowering LDL-C Data of the Six Treatment Group

	Control	Javanese Ginger	Turmeric	Garlic	Pomegranate Flower	Rosuvastatin
	0.00%	-17.73%	-28.66%	-44.85%	-58.74%	-40.00%
Control		NS	NS	**	**	**
Javanese ginger			NS	**	**	**
Turmeric				**	**	**
Garlic					NS	NS
Pomegranate flower						*
Rosuvastatin						

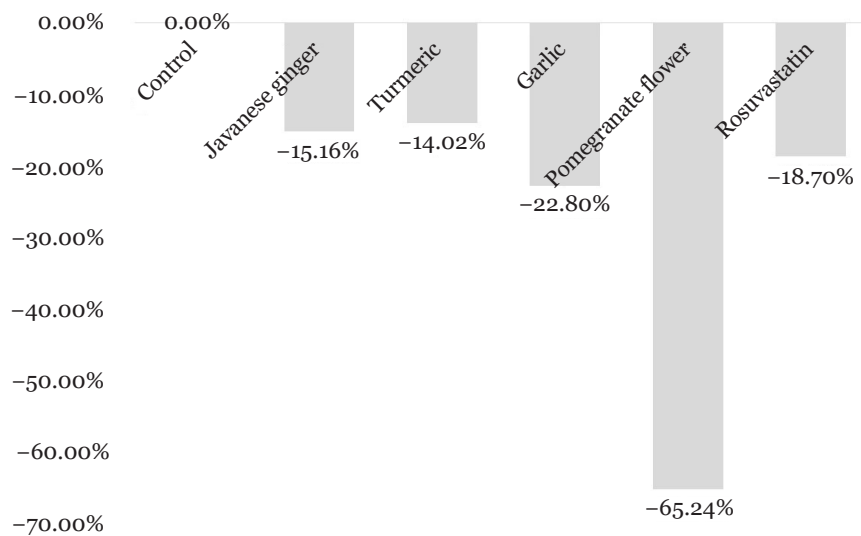


Figure 2 Percentage Reduction in Total-C Compared to Controls

Table 2 LSD Test Results in Lowering Total-C Data of the Six Treatment Group

	Control	Javanese Ginger	Turmeric	Garlic	Pomegranate Flower	Rosuvastatin
	0.00%	-15.16%	-14.02%	-22.80%	-65.24%	-18.70%
Control		**	**	**	**	**
Javanese ginger			NS	*	**	NS
Turmeric				*	**	NS
Garlic					**	**
Pomegranate flower						**
Rosuvastatin						

Discussion

This study showed that garlic and pomegranate flowers lowered LDL-C compared to the control with a significant difference. The potential of pomegranate flowers in lowered LDL-C is better than rosuvastatin. The potential for garlic is equivalent to rosuvastatin which was used as a comparison. In addition, Javanese ginger, turmeric, garlic, and pomegranate flowers reduced total-C compared to controls with significant differences. The potential of garlic and pomegranate flowers in lowering total-C is better than rosuvastatin. The potential for Javanese ginger and turmeric is equivalent to rosuvastatin which was used as a comparison.

The test materials for this study consisted of Javanese ginger, turmeric, garlic, and pomegranate flowers, each of which had been previously studied. Here are some studies that have been done before. Previous research of Javanese ginger with a 560 mg/kg BW showed a decrease in LDL-C and increased HDL-C with experimental mice.⁹ Research on herbal medicine containing *Cassia sennae* dried leaves, *Sonchus arvensis* dried leaves, *Guazuma ulmifolia* dried leaves, *C. longa* dried rhizomes, *C. xanthorrhiza* dried rhizomes, *Camellia sinensis* dried leaves, and *Phyllanthus niruri* dried herb in human research subjects have been done previously. This study showed a decrease in plasma cholesterol levels from 212.42 mg/dL to 196.6 mg/dL after

28 days of treatment.⁴ The main content of Javanese ginger (*Curcuma xanthorrhiza* Roxb.) is curcuminoid which in several studies has shown its role as an anti-hypercholesterolemic agent.¹⁰

The content of turmeric, which plays a role in reducing total cholesterol and LDL cholesterol, is curcumin. This main ingredient also has an antioxidant effect that maintains SOD activity.¹¹ Research using curcumin can lower total cholesterol and LDL cholesterol and reduce cardiovascular disease risk.¹² Curcuminoids are the main components, especially in turmeric, and the mechanism of action of turmeric is mainly through this curcumin. The pharmacological effects of curcuminoids include lowering cholesterol levels and also having a hypoglycemic effect.¹³ Research on turmeric effects conducted on human research subjects showed that a turmeric dose of 1 gram/day for 28 days reduced total cholesterol from 234.44 mg/dL to 202.06 mg/dL.¹⁴ Turmeric has anti-adipogenesis potential by inhibiting the synthesis of triglycerides and cholesterol and inhibiting fat droplet formation in HepG2 cells.¹⁵ Another study with human research subjects, acute coronary syndrome patients, were administrating by low doses of curcumin showed a trend of decreasing total cholesterol and LDL cholesterol levels.¹⁶ Turmeric is a yellow spice with curcumin as its active ingredient. Turmeric affects Akt, growth factor, NF-kB, metastatic and angiogenic pathways. Turmeric also modulates cancer cells in humans, lowers the risk of cardiovascular disease, and suppresses inflammatory reactions. Turmeric also has antimicrobial, anti-obesity, prevents tumor formation, has antidepressant and anti-anxiety effects.¹⁷

Garlic has been used as a medicinal plant for thousands of years. Research shows garlic reduces total cholesterol levels by 7% and LDL cholesterol by 0.01% compared to controls.¹⁸ Garlic is known as an agent used for the prevention and treatment of cardiovascular diseases and metabolic diseases such as diabetes, dyslipidemia, and hypertension. Research has shown that the active ingredient of garlic, allicin, can reduce cholesterol, thereby reducing the risk of disease due to atherosclerosis.¹⁹ Garlic has active content, namely sulfur compounds, such as S-allyl cysteine, alliin, ajoene, and diallyl disulfide. This active ingredient has pharmacological effects. Some of the pharmacological effects of garlic include reducing the risk of cardiovascular

disease, having antimicrobial, antioxidant effects, and reducing cancer risk. Previous research has shown that garlic lowers total cholesterol and LDL cholesterol but has no effect on HDL cholesterol and triglycerides.²⁰ Garlic with a dose of 900 mg/day reduces total cholesterol and LDL cholesterol. Garlic can also be used for the prevention of oral thrush in children.²¹ Research on the effects of garlic with human research subjects in a village in Surabaya shows that consumption of four grams of garlic can reduce cholesterol levels and is recommended for hypercholesterolemia patients as a complementary therapy.²²

Previous research has shown that consumption of pomegranate juice reduces LDL cholesterol and reduces oxidized LDL. The results showed reduced cholesterol accumulation in the cells and fewer foam cells.²³ Pomegranate has antioxidant activity, both in infusion and in the form of ethanol extract.²⁴ Previous research shows that giving pomegranate ethanol extract at a dose of 30 mg/200 g BW/day for 15 days reduces LDL cholesterol levels.²⁵

Conclusions

The conclusion is that garlic and pomegranate flowers lowered LDL-C and total-C, while Javanese ginger, turmeric, garlic, and pomegranate flowers reduced total-C.

Conflict of Interest

The authors have read the manuscript and agreed to submit it in its current form for publication in the journal. There are no conflicts of interest to declare.

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