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Okra (*Abelmoschus esculentus* L. Moench) as Anti-cholesterol, Anti-diabetic and Anti-obesity in White Male Rats

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Abstract: Hypercholesterolemia is cholesterol elevation condition in blood serum. Type 2 Diabetes Mellitus is a metabolic disorder increasing significantly around the world, associated with obesity and lipid accumulation in the body. Okra (*Abelmoschus esculentus* L. Moench) is used as anti-obesity and anti-cholesterol empirically. The objective of the study was to determine the anti-obesity, anti-diabetic and anti-cholesterol activity of okra ethanolic extract in animal high-fat diet model. We conduct short- and long-term anti-obesity, anti-diabetic and anti-cholesterol test. The blood sample was collected from all rats after 8 hours fasting previously. Short- (p = 0.000) and long-term test (p = 0.005) showed significantly different parameter between the negative and positive group. Dose III showed no significant differences compared to positive group (p > 0.05) in the short-term test while, Dose I, II and III showed no significant differences compared to positive group in decreasing cholesterol level in the long-term test, Dose III showed the best activity in decreasing cholesterol level in blood serum and was equivalent with the positive group.

Key words: Anti-cholesterol, diabetic, obesity, okra.

1. Introduction

Obesity is a chronic disorder which becomes a global pandemic and hard to control [1]. Totally, 39% (> 18 y.o) people in the world are obese [2] while, 15.5% Indonesia people are obese [3]. People who have obesity are at increased risk for many serious diseases such as all cause of death, high blood pressure, dyslipidemia, type 2 diabetes mellitus, coronary heart disease, stroke, sleep apnea, osteoarthritis, mental illnes and some cancers [4, 5]. Okra (*Abelmoschus esculentus* L. Moench) is a tropical plant which is used empiricaly as herbal medicine. Anti-obesity, anti-cholesterol and anti-diabetic activity of this plant have not been studied yet. Therefore, anti-obesity, anti-cholesterol, and anti-diabetic activity studies are necessary for the development of this herbal medicine.

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2. Materials and Methods

2.1 Materials

Rotary evaporator, analytical scales (mettler toledo), centrifuge, photometer (intherma 168), okra fruit, ethanol 70%, orlistat, aquadest, gluco-dr, and dyasis cholesterol reagent.

2.2 Plant Preparation

Okra fruits obtained from Agro Plantation, Jakarta. Plant identification and authentification were done at Herbarium of Padjadjaran University, Indonesia. The fruits were washed in tap water, cut into pieces and reduced into fine powder. The powder was macerated for 72 hours in ethanol (70% v/v) at room temperature and filtered with Whatman filter paper. The filtrate was subsequently concentrated using rotary vacuum evaporator to obtain the solid extract.

2.3 Animals

White male rats were used. The animals were

purchased from animal laboratorium Institut Teknologi Bandung and housed in the standard condition (temperature 25 °C, humidity 40-70%, 12 hours light/dark cycle) with ad libitum of water.

2.4 Experimental Procedure

We divided eighteen animals in six groups consisting of normal group, negative group (high fat diet/HFD), positive group (HFD and Orlistat), dose I group (HFD and okra extract dose 87.5 mg/200 g rat body weight), dose II group (HFD and okra extract dose 175 mg/200 g bw) and dose III group (HFD and okra extract dose 350 mg/200 g bw). High fat diet consists of 49% carbohydrate, 30% lipid (sheep fat), 18% protein (egg protein) and 3% oil. The testing was conducted in short- (2 weeks) and long-term (4 weeks) condition. When the short- and long-term treatments were over, we conducted cholesterol serum level, blood glucose level, and body weight determination.

2.5 Analysis Statistical

All data were presented as table and figure. Non-parametric testings Kruskal-Wallis and Mann Whitney were used (SPSS 16).

3. Results and Discussion

3.1 Results

Results of this research can be seen from Table 1 (phytochemical screening), Fig. 1 (short and long term body weight), Fig. 2 (blood glucose concentration), and Fig. 3 (cholesterol concentration) in discussion section.

3.2 Discussion

Okra (*Abelmoschus esculentus* L. Moench) ethanolic extract showed anti-obesity, anti-diabetic and anti-cholesterol activity from this research. Phytochemical screening results were shown in Table 1. Table 1 showed that both simplicia and extract showed the same results of phytochemical screening contains alkaloid, flavonoid, tannin, polyphenol, steroid, monoterpenoid and sesquiterpenoid.

Fig. 1 showed that both positive groups of short- and long-term (two and four weeks) showed significant differences in weight loss compared to negative groups of short- and long-term observation. The results were important to show that orlistat was making the animal going through weight body loss like expected, and that weight body lost did not happen significantly in negative groups. Dose 1, dose 2, and dose 3 (both in short- and long-term observation) gave significantly different weight body loss value which indicates that okra ethanol extract has activity in weight body loss. Still in both short- and long-term observation, dose 3 gave the best activity in weight body loss compared to dose 1, dose 2 even compared to positive group.

Fig. 2 showed that short- and long-term testing showed significant differences ($p < 0.05$) in blood glucose concentration for all dose groups compared to negative group. Blood glucose elevation in negative group showed succes of induction. There were no correlations between increasing in dosage of okra ethanol extract and hypoglicemic activity. Dose II showed the best hypoglicemic activity compared to positive group, dose 1 and dose 3.

Fig. 3 showed that both in short- and long-term testing showed significant differences ($p < 0.05$) in decreasing cholesterol serum from all dose groups (except for long-term treatment in dose 2) compared to negative group. There were no correlations between increasing dosage and anti-cholesterol activity. Dose 3 showed the best anti-cholesterol activity compared to positive group, dose 1 and dose 2.

From Figs. 1-3 we can conclude that okra ethanol extract has activity in body weight loss, anti-diabetic and as anti-cholesterol. As for okra ethanol extract anti-diabetic activity (shown in Fig. 2), it gave the same feature shown by antidiabetic drugs such as biguanide group, glucagon like-peptide 1 and sodium glucose transpoter-2 inhibitor. Therefore, the mechanism of action of okra may be related to these

Table 1 Phytochemical screening.

No.	Secondary metabolite	Simplicia	Extract
1	Alkaloid	+	+
2	Saponin	-	-
3	Flavonoid	+	+
4	Tannin	+	+
5	Poliphenol	+	+
6	Triterpenoid	-	-
7	Steroid	+	+
8	Monoterpenoid sesquiterpenoid	+	+
9	Quinon	-	-

+ = identified, - = not identified.

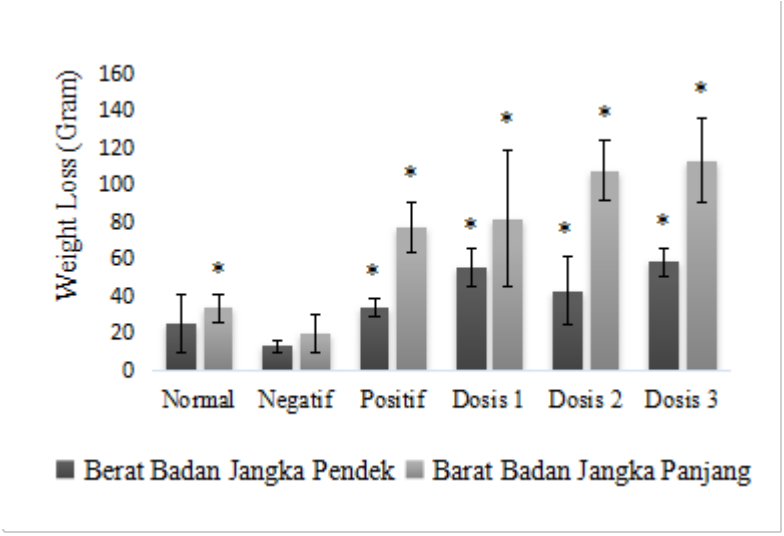

Fig. 1 Short- and long-term body weight.

* showed more significant difference ($p < 0.05$) than negative group.

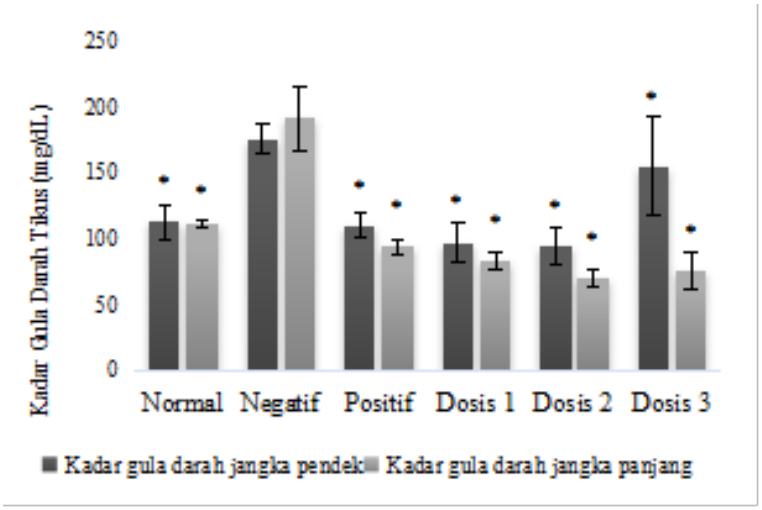

Fig. 2 Blood glucose concentration.

* showed more significant difference ($p < 0.05$) than negative group.

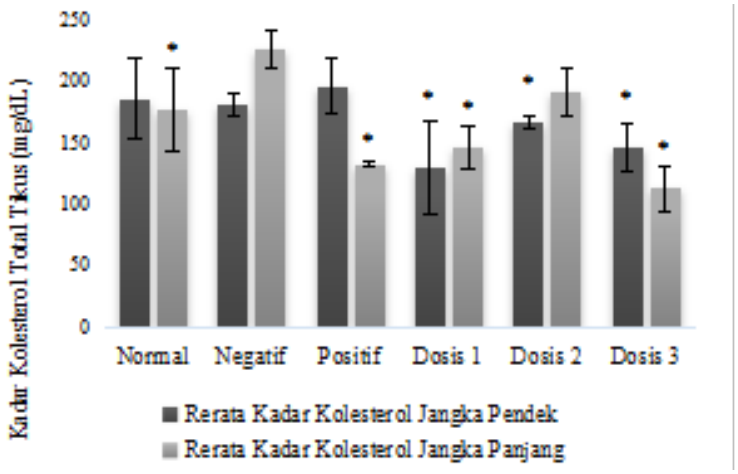

Fig. 3 Cholesterol concentration.

*showed more significant difference ($p < 0.05$) than negative group.

antidiabetic drugs [6]. Obesity is related with diabetic and cholesterol. Obesity increases the risk of type 2 diabetes mellitus through induction of insulin resistance due to low and chronic grade of inflammation [7]. Obesity also correlates with high LDL (low-density lipoprotein) and low HDL (high-density lipoprotein) level [8]. Anti-cholesterol of okra (shown in Fig. 3) may be related to absorption inhibition of the cholesterol in the intestinal [9]. The majority of these complications are related to comorbid conditions that include as all cause of death, high blood pressure, dyslipidemia, type 2 diabetes mellitus, coronary heart disease, stroke, sleep apnea, osteoarthritis, mental illnes and some cancers [4, 5]. Safety study of okra showed no significant difference with acarbose safety profile in mortality [9]. Therefore triple activity of okra ethanolic extract with good safety profile proves the potential beneficial effects of okra (*Abelmoschus esculentus* L. Moench) and its properties can be useful as remedy to manage obesity, diabetic and high cholesterol condition.

4. Conclusions

Okra ethanol extract has potential activity of anti-obesity, anti-diabetic and anti-cholesterol. Dose 3 gave the best activity in weight body loss and anti-cholesterol activity and dose 2 gave the best activity as anti-diabetic.

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