

Porang flour with keji beling maceration reduced total cholesterol levels in diabetic rats male wistar rats

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ABSTRAK

Latar belakang: Hiperkolesterolemia merupakan komplikasi pada DM yang ditandai dengan meningkatnya kadar kolesterol total. Prevalensi hiperkolesterolemia pada DM mencapai 20%-90%. Beberapa penelitian menyebutkan bahwa glukomanan dalam tepung porang yang merupakan serat dapat menurunkan kadar kolesterol.

Tujuan: Mengetahui efek tepung porang (*Amorphophallus oncophyllus*) dengan maserasi keji beling (*Strobilanthes crispera*) terhadap kadar kolesterol total pada tikus wistar jantan (*Rattus norvegicus*) DM tipe 2.

Metode: Penelitian ini bersifat eksperimen murni dengan rancangan pre post with control group design. Subjek penelitian adalah 35 ekor tikus yang dibagi dalam 5 kelompok yaitu kontrol negatif, kontrol positif, pembandingan, tepung porang murni, dan porang dengan ekstrak *Strobilanthes crispera*. Serum darah semua tikus diambil setelah 14 hari perlakuan untuk diukur kadar kolesterol total. Kemudian hasil dianalisis menggunakan ANOVA yang dilanjutkan dengan uji beda nyata (Duncan).

Hasil : Pemberian tepung porang ekstrak *Strobilanthes crispera* dapat menurunkan kadar kolesterol total lebih baik sebesar 28,76% dibandingkan tepung porang murni yang dapat menurunkan kadar kolesterol total sebesar 15,35% ($p=0,05$). Kadar air feses hari ke-1 dan hari ke-14 tidak berbeda nyata pada semua kelompok.

Kesimpulan : Dari hasil penelitian dapat disimpulkan bahwa pemberian tepung porang dengan maserasi ekstrak *Strobilanthes crispera* dapat menurunkan kadar kolesterol total lebih baik dibandingkan tepung porang murni.

Kata Kunci: diabetes melitus, keji beling, *Strobilanthes crispera*, kolesterol total, tepung porang,

ABSTRACT

Background: Hypercholesterolemia is a complication in DM characterized by increased of total cholesterol levels. Prevalence of hypercholesterolemia in DM reached 20% -90%. Several studies stated that glucomannan in porang flour which is a fiber may lower cholesterol levels.

Objective: To understand the effect of porang flour (*Amorphophallus oncophyllus*) with keji beling (*Strobilanthes crispera*) maceration of total cholesterol levels in male wistar rats (*Rattus norvegicus*) DM type 2.

Methods: This study used on experimental with pre post with control group design. The subjects were 35 rats divided into 5 groups: negative control, positive control, comparison, pure porang intervention, and porang flour with *Strobilanthes crispera* extract. The blood serum of all rats was taken after 14 days of treatment to measure total cholesterol levels. Then the results were analyzed using ANOVA followed by real difference test (Duncan).

Results: Porang flour with *Strobilanthes crispera* maceration decreased total cholesterol level by 28.76% compared to pure porang flour which only reduced total cholesterol level equal to 15.35% ($p=0,05$).

Conclusions: From the results of this study it can be concluded that the provision porang flour with *Strobilanthes crispera* maceration can lower total cholesterol level better than pure porang flour.

KEYWORDS: diabetes mellitus, keji beling, *Strobilanthes crispera*, total cholesterol, porang flour

INTRODUCTION

Type 2 diabetes mellitus is a complex endocrine and metabolic disorder. The interaction between several genetic and environmental factors results in a heterogeneous and progressive disorder with variable degrees of insulin resistance and pancreatic β -cell dysfunction (1). Prevalence rates of type 2 diabetes increased from 3.21% (3.19; 3.22) in 2004 to 5.26% (5.24; 5.29) in 2014. The incidence and prevalence of type 2 diabetes in patients aged 16 to 34 years increased over time. (2). Indonesia is the seventh country ranked with diabetes mellitus (DM) patients (8.5 million) after China, India and the United States, Brazil, Russia, Mexico. World health organized (WHO) also predicts DM patients in Indonesia may increase to 21.3 million patients by 2030. This will make Indonesia ranks fourth after the United States, China, and India in diabetes prevalence (3). Diabetics have a tendency to develop hypercholesterolemia in which fat is converted into energy because the sugar in the blood cannot be processed into energy. As a result cholesterol is formed in the fat metabolism chain has increased. The prevalence of hypercholesterolemia in DM is very high at 20-90% (4).

The *porang* tuber (*Amorphophallus oncophyllus*) belongs to the Araceae family which contains high fiber (glucomannan) and can be used in industry, pharmacy and food (5). Glucomannan also can be used as a therapy for insulin resistance patients because it can fix lipid profile. The most widely consumed by the community is glucomannan. Use of tuber or *porang* flour is still a polemic because of the content of Ca-oxalate. One of the efforts to remove Ca-oxalate in *porang* flour is by immersion of *porang* flour with *Strobilanthes crispata* leaf extract. According to previous research that the *Strobilanthes crispata* leaf can dissolve the cumulation of Ca-oxalate, so that the *Strobilanthes crispata* leaf can be used to reduce kidney stone because of Ca-oxalate commulation (6). Other Study said that the consumption of keji beling that followed in *porang* after the soaking process may also have the advantage effect in the body (7).

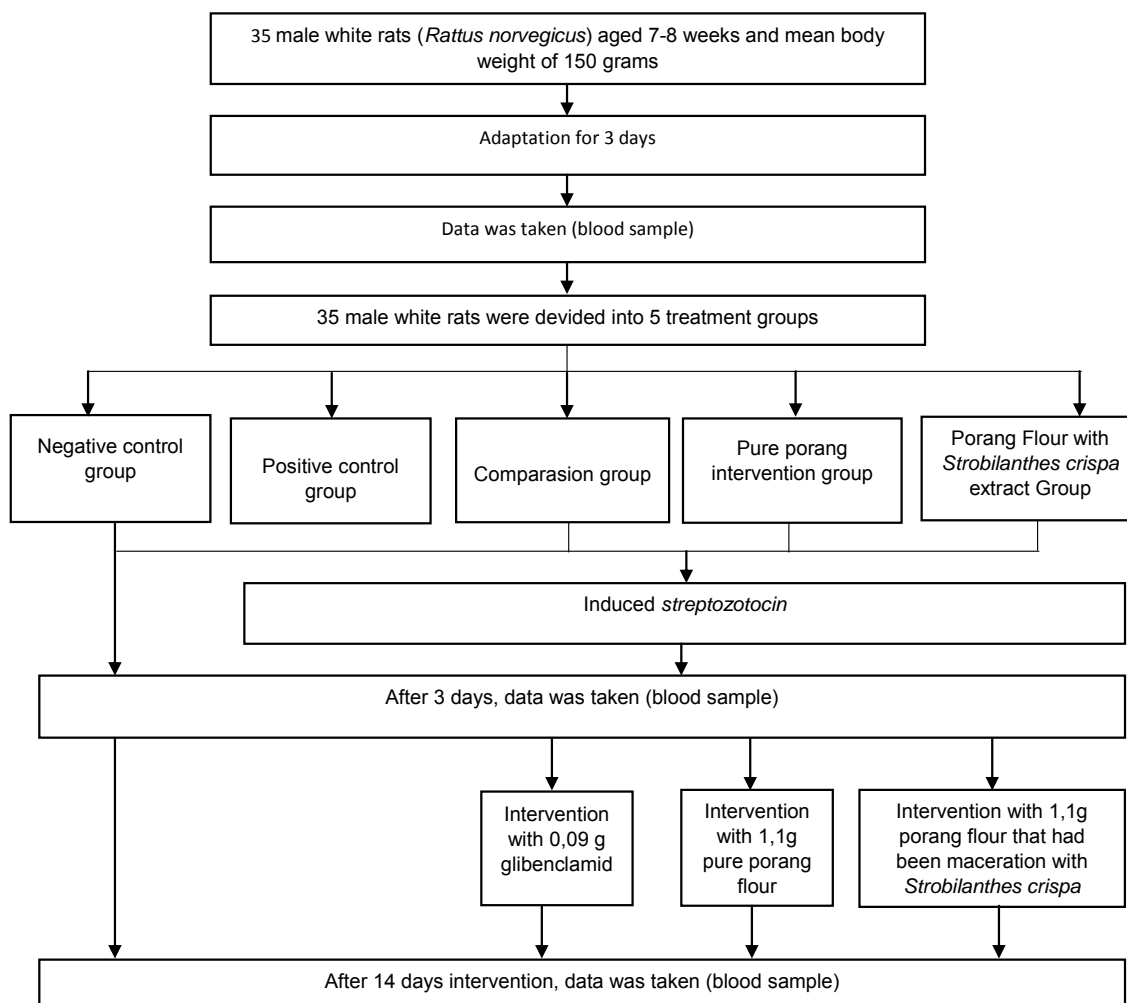
Application of *porang* flour to lower cholesterol level is unknown by the public and also there is no

scientific evidence about the efficacy of *porang* flour in lowering cholesterol levels. This led the authors to study the effects of *porang* flour with *Strobilanthes crispata* maceration to lowering total cholesterol levels in wistar rats (*Rattus norvegicus*) with DM type 2. We are expected to study the effect of *porang* flour *Strobilanthes crispata* maceration of total cholesterol levels in male wistar rats (*Rattus norvegicus*) with type 2 DM.

MATERIALS AND METHODS

This research was part of research that coordinated by ACHEAF (Alma Ata Center For Healthy Life and Food). Thus, there are similarities of methods performed by other researchers, but the difference lies in the dependent variable of blood glucose, HDL and LDL, and triglycerides. This research was experimental research with pre post-control group design. The research was conducted at the Laboratory of Food and Nutrition Study Center (PSPG) Universitas Gadjah Mada (UGM) from June to July 2017. This research was approved with ethical clearance from Universitas Alma Ata with number: KE/AA/N/172/EC/2017. We used 35 male white rats (*Rattus norvegicus*) aged 7-8 weeks and mean body weight of 150 grams. *Porang* flour (*Amorphophallus oncophyllus*) was obtained from Madiun, East Java province. *Porang* flour was soaked by *Strobilanthes crispata* extract and ethanol 96% for 1 day with 2 times rinsing using 96% ethanol. Soaking devices include containers and covers, filters, and dryers. The instruments that used are cannula, measuring glass, microhaematocrit, Eppendorf tube, manual scales, cholesterol kit, centrifugation, spectrophotometer, and vortex.

Thirty five rats were divided into 5 treatment groups: negative control group was a group that not induced with streptozotocin, positive control group was a group that induced with streptozotocin, comparison group was a group with 0.09 mg glibenclamide, pure *porang* flour intervention group was a group with pure *porang* flour dosage 1.1 g, and *porang* flour with *Strobilanthes crispata* extract was an intervention group with 1.1 g. *porang* flour



Picture 1. Experiment Flow Chart

that had been maceration with *Strobilanthes crisper* extract. Intervention was administered by mixing *porang* flour into standard AIN 93 feed. Treatment was performed for 14 days (2 weeks). Blood rats sampling was take 3 times, the first was take after 3 days adaptation (as control), second was take after 3 days induction of streptozotocin (STZ) (control with DM), and the third was take after 14 days treatment. Streptozotocin (STZ) is diabetogenic agent due to selective destruction of pancreatic islet β -cells. As a result of this action, the animals experience insulin deficiency, hyperglycemia, polydipsia, and polyuria, all of which are characteristic of human

type 1 diabetes mellitus (8). The data were analyzed using ANOVA followed by Duncan test.

RESULTS

Water content and feces consistency

Water content and consistency of rat's feces are characteristic data in this research. The moisture content and consistency of the feces were measured on 1st day (early intervention) and 14th day (end of intervention). The following statistical results of moisture content and consistency of rat feces on 1st and 14th day.

Table 1. Result of feces moisture level statistics test on rats - 1st day (early intervention) and 14th day (final intervention)

Group	Feses Moisture Level		Feses Consistency	
	1 st day	14 th day	1 st day	14 th day
Negative control	39.40±22.09 ^a	48.60±22.98 ^a	Quite solid	Quite solid
Positive control	76.20±5.26 ^a	75.00±47.30 ^a	Soft	Soft
Comparison	71.40±3.04 ^a	67.40±3.36 ^a	Soft	Soft
Pure <i>porang</i> flour	78.80±51.03 ^a	60.60±15.97 ^a	Soft	Soft
<i>Porang</i> flour with <i>Strobilanthes crispera</i>	70.20±26.79 ^a	52.60±15.01 ^a	Soft	Soft

Description : Superscript of the same letter in the same column shows no significant difference.

Total cholesterol levels

Table 2. Total serum cholesterol level before induction of Streptozotocin (STZ)

Group	Total Cholesterol
Negative control	80.44 ± 2.50 ^a
Positive control	79.70±4.25 ^a
Comparison	81.61±3.53 ^a
Pure <i>porang</i> flour	77.36±5.54 ^a
<i>Porang</i> flour with <i>Strobilanthes crispera</i>	82.49±2.23 ^a

Description: The data are mean± Std.Deviation. Superscript of the same letter in the same column shows no significant difference.

DISCUSSION

Water Content and Feces Consistency

The content of water in rat’s feces was measured to see the incidence of diarrhea in rats. Based on the result of statistical test of water content of rat’s feces on 1st and 14th day in **Table 1** and **Table 2** shows that there is no significant difference of their water content in all groups. The consistency of feces on 1st and 14th day are the same, i.e. consistency of soft feces in Positive control, Comparison, Pure *porang* flour, *Porang* flour with *Strobilanthes crispera* groups. While in the Negative control group the consistency of feces is little hard.

The consistency of soft feces is caused by mixed with urine, because in groups Positive control, Comparison, Pure *porang* flour, and *Porang* flour with *Strobilanthes crispera* groups are a group of DM rats. Where one of the symptoms of DM is polyuria (frequent urination) (9). So that excessive urine is released and mixed with feces. While in

the Negative control group the consistency of feces was little hard because the rats in the group were healthy rats. Based on observations of feces form in groups Positive control, Comparison, Pure *porang* flour, *Porang* flour with *Strobilanthes crispera* are oval-shaped feces, black and soft. Likewise in the Negative control group with oval, black, and little hard feces form. In general, feces with oval, black, soft, and little hard forms are included in normal feces criteria (10).

Total cholesterol levels

The average total cholesterol of rats before induction of streptozotocin (STZ) was 80.32 mg/dL. Where the levels exceed the normal limit of total cholesterol in rats is 10.0-54.0 mg/dL. This is because in normal white mice resistant to hypercholesterolemia conditions because white rats have hyperthyroid properties. Thyroid hormone will activate the lipase-sensitive hormone so that the process of lipid catabolism in the body of the rat is high (11). Eprotirome (thyroid hormone analog) lowered serum LDL-cholesterol for dyslipidaemia, liver-selective activation of the thyroid hormone receptor (TR) although the mechanism underlying this pharmacological selectivity is incompletely understood (12)

Total cholesterol levels before and after the intervention where there are three distinct groups of total cholesterol levels i.e. group Comparison, Pure *porang* flour, and *Porang* flour with *Strobilanthes crispera*. The *porang* flour with *Strobilanthes crispera* group was *porang* flour with *Strobilanthes crispera* maceration intervention group, decreased total cholesterol level by 28.76% (p <0.05). This is due to the glucomannan

Table 3. Total serum cholesterol before and after intervention

Group	Total Serum Cholesterol(mg/dl)		p	ΔK
	Pre	Post		
Negative control	80.96±2.35	84.93±3.53	0.063	3.96 ^a
Positive control	175.80±3.20	177.71±3.51	0.039	1.91 ^a
Comparison	171.95±5.26	113.06±2.36	0.000	-58.89 ^a
Pure <i>porang</i> flour	171.54±3.28	145.20±3.70	0.000	-26.34 ^a
<i>Porang</i> flour with <i>Strobilanthes crispera</i>	175.18±2.13	126.21±1.75	0.000	-50.97 ^a

content of *porang* and *Strobilanthes crispera* maceration which is antidiabetic. Glucomannan can reduce postprandial plasma glucose rise, suppress the liver in synthesizing cholesterol, and clearing cholesterol containing bile acids (13). *Strobilanthes crispera* is also able to lower total blood cholesterol levels since it contains antioxidants that is flavonoids. Based on the study, flavonoids can capture free radicals and can prevent the process of lipid dosage liposomes and liposomes (14).

In the Pure *porang* flour group which was a group of pure flour intervention, the decreased of total blood cholesterol level was at 15.35% (p=0.05). This is in line with previous research that the use of glucomannan significantly reduced total cholesterol (13). Glucomannan is a water soluble fiber. Where soluble fiber can bind fat in colons so that cholesterol can be decreased. Bile acids are generally synthesized from cholesterol. The end of bile acids in the small intestine will be taken back by the body to the liver. Fiber can bind bile acids from cholesterol in the liver causing a decrease in cholesterol levels in the liver (15).

However, *porang* with *Strobilanthes crispera* intervention can lower cholesterol level than the pure *porang* flour intervention to the effect of decreased total cholesterol levels. Next was the glibenclamide group comparing group which decreased total cholesterol level by 34.24% after intervention (p <0.05). Glibenclamide does not have a decreasing effect on total cholesterol levels. However, glibenclamide is able to optimize insulin secretion. The mechanism of glibenclamide is to stimulate the secretion of insulin from the granules of Langerhans pancreas β cells. Its interaction with ATP-sensitive K channel on the membrane β cells can depolarize membrane and then open the Ca

channel. Thus the Ca²⁺ ions will enter the β cells then stimulate the β cell granules and insulin secretion (16) will occur. Therefore, the produced insulin can inhibit lipolysis in adipose and muscle tissue that LDL will decrease followed by the decreased of total cholesterol levels.

CONCLUSION & RECOMMENDATION

Based on the result of this research, it can be concluded that *porang* flour extract decreased the total cholesterol level of rat blood equal to 28.76%. It is expected that further research on *porang* with *Strobilanthes crispera* extract may be able to decrease total cholesterol content and identify othersubstances that most influence to the decrease of total cholesterol level.

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