

## Evaluation of Antypercholesterolemic Effect of *Allium cepa* L. var *cepa* in Atherogenic Induced Rats

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**Abstract.** Fermented onion is a type of onion that produced by heating onion bulbs at high temperature for 15 days by fermenter machine. This research is expected to produce new alternatives therapy for reducing cholesterol from onions especially *Allium cepa* L. var *cepa*. In this experimental laboratory used 25 male white rats that divided into five groups, group I: negatif control, group II: positif control (Atorvastatin), group III: 100 mg/Kg body weight (bw) of fermented onion extract, group IV: 200 mg/Kg bw of fermented onion extract and group V: 300 mg/Kg bw of fermented onion extract. The Rats was feeding by an atherogenic diet to makes them hypercholesterolemia before treatment for 7th days, 14th days and 21st days. All of data were analyzed by ANOVA method (significant 0,05). The result concludes that of all the doses tested, fermented onion extract of *Allium cepa* L. var *cepa* with a dose of 200 mg/Kg bw has the highest effect in decreasing total cholesterol levels of hypercholesterolemia rats (*Rattus novergicus*).

**Keyword:** *Allium cepa* L, Cholesterol, Fermentation, HMG CoA, Onion.

**Abstrak.** Bawang Bombay hasil fermentasi merupakan salah satu jenis bawang yang diolah dengan menyimpan umbi bawang pada suhu tinggi selama 15 hari di dalam mesin fermentasi. Penelitian ini diharapkan dapat menghasilkan terapi alternatif baru yang mampu menurunkan kadar kolesterol, khususnya dari bawang jenis *Allium cepa* L. var *cepa*. Pada penelitian ini digunakan 25 ekor tikus putih jantan yang dibagi menjadi 5 kelompok uji yaitu: Kelompok I (Kontrol negatif), kelompok II: Kontrol positif (Atorvastatin), Kelompok III: 100 mg/KgBB ekstrak fermentasi bawang Bombay, Kelompok IV: 200 mg/KgBB ekstrak fermentasi bawang Bombay, Kelompok V: 300 mg/KgBB ekstrak fermentasi bawang Bombay. Kemudian Tikus diberikan pakan aterogenik sampai hiperkolesterol sebelum diberikan terapi selama 7 hari, 14 hari, dan 21 hari. Semua data dianalisa menggunakan Metode ANOVA (signifikan 0,05). Kesimpulan dari penelitian menunjukkan bahwa dari semua dosis yang diuji, ekstrak fermentasi bawang Bombay dengan dosis 200 mg/KgBB dapat menurunkan kadar kolesterol total pada tikus hiperkolesterolemia (*Rattus novergicus*) lebih tinggi.

**Kata Kunci:** *Allium cepa* L, Kolesterol, Fermentasi, HMG KoA, Bawang Bombay.

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## 1. Introduction

There are cardiovascular diseases which are leading of death, and hypercholesterolemia is one of those cases [1]. The situation that shows high levels of cholesterol which exceeds from normal levels are called hypercholesterolemia [2]. Increased level of cholesterol caused by eating patterns and unhealthy lifestyles such as consuming food with high saturated fat and alcohol, smoking, pollution and others. Low-fat diet, exercise and taking cholesterol-lowering drugs in one of the therapies for hypercholesterolemia. Onions are rich of antioxidants such as flavonoid and organosulfur that effective for lowering cholesterol level. That is because both of flavonoid and organosulfur are helping the activities of HMG CoA reductase enzyme exhibited in order to reduce hypercholesterol level in bloods [3].

Commonly, onion used as ingredient and prescribed as antifungal, antiplatelet, antiatherosclerotic, antiobesity, antidiabetic and antihypercholesterolemic [4], it is because onion has some of bioactive compounds named thiosulfonates or volatile organosulfure compounds [5,3] and flavonoid (quercetin) [7,8] which can used to inhibit cholesterol formation. S-methyl cysteine sulfoxide as part of organosulfur that found in *Allium cepa* L. var *cepa* is chemical compound which is effective in reducing the level of cholesterol in the blood [3]. In another research found that onion contains the highest levels of flavonoids from other fruits and vegetables. They are 3,4'-O-quercetin diglucoside and 4'-O-quercetin glucoside [9], both of that two compounds mentioned above are important points in this fermented onion research.

Fermented onion is a type of onion that produced by heating raw onion at high temperature for 15 days by fermenter machine. The principle of this fermentation machine is to keep the humidity and temperature stable for long time so that microbial growth occurs from the tubers themselves that help the fermentation process.

## 2. Methods

### 2.1 Chemical

Fresh onion (*Allium cepa* L. var *cepa*) were collected from Pancur Batu, Deli Serdang, Indonesia. Total cholesterol enzymatic colorimetric method of Glory Diagnostic (ISO 9001-13485), ethanol 96 were used in this research.

### 2.2 Extraction of Fermented Onion

Fermented onion was produced by placing onion bulbs in automatic fermentation machine (Intelligent fermenter) among fifteen days without removing the layers. Naturally, onion bulbs' color will be changed from white to chocolate and black at the end. The texture will

become juicy, and sweet-sour taste. The fermented onion tissue was ground in mortar and macerated by ethanol 96%, filtered and recovered by rotary evaporator.

### 2.3 Experimental animals and production of hypercholesterolemia

The animal protocol was approved by Ethical Clearance of Universitas Sumatera Utara, Medan, Indonesia. About 25 male white rats were divided into five groups, group I: Negatif control which was given Na CMC only, group II: positif control were given doses of 20 mg/Kg bw of Atorvastatin suspension, group III: 100 mg/kg bw of fermented onion extract, group IV: 200 mg/Kg bw of fermented onion extract, group V: 300 mg/Kg bw of fermented onion extract.

All of rats are feeding by an atherogenic diet for a month to make them hypercholesterolemia and then treated with fermented onion extract. Total cholesterol level of rats' serum were measured on 7th day, 14th day and 21st day by spectrophotometer [Microlab 300 Inc].

### 2.4 Statistical analysis

All data were analyzed by computerizing SPSS 24 subjected to one-way of variance (ANOVA) and  $p > 0,05$  the among means determined by Duncan. Result of analysing were expressed as Mean+SD.

## 3. Result and Analysis

### 3.1 Fermented onion

Fermented onion which is presented in figure 1 and 2 produced from fresh onion by placing the bulbs in the automatic fermenter machine for 15 days, during that process whole of bulbs were heated at high temperatur. Fermentation bulbs were indicated by blakish brown color, the odorius of onion, fermentation flavor (swetness and sour taste), soft layer's tuber and juicy. These characteristic were related to effect of maillard browning reaction [10].



**Figure 1.** The appearance of onion's bulb after 15 days of fermentation.



**Figure 2.** The appearance of fermented onion's bulb after halving.

The result was in agreement with Louis Maillard [1912] who stated that Maillard's reaction is due to the amine acid reaction to sugar reduction which caused the changes of color and texture of foods. But in the other research, Ok-Ju Kang [12] found that maillard browning reaction in fermented onion to be responsible for the reduction of moisture content during thermal processing and also the cause of decline in pH level which is responsible to sweetness and sour taste [13,14].

### 3.2 Total cholesterol level in rats' serum

Twentyfive males of white rats (*Rattus norvegicus*) were induced for 1 month by feeding atherogenic diet to enhance concentration of total cholesterol level in rats' bloods until they were hypercholesterolemia. Hypercholesterolemic rats treated by Na CMC, atorvastatin, 100, 200 and 300 mg/Kg BW of fermented onion extract. Total cholesterol level of rats' serums were measured on 7th day, 14th day and 21st day. The whole data of laboratory test analysed and displayed as Mean  $\pm$  SD. Before analysing of variance (ANOVA), all data were examined using Shapiro Wilk test followed by Levene test to determine the homogeneity, so that ANOVA is applied.

Mean of total cholesterol level in rats (Table 1), shows that the elevated of total cholesterol raising after feeding rats by an atherogenic diet. Enhancement of total cholesterol in rats' blood more than 100,25 mg/dL indicated that all of the rats already hypercholesterolemia, because the hypercholesterolemia is the situation which is total cholesterol increase higher than normal. Hypercholesterolemia level in blood significantly reduced in treated groups. However, the reducing of total cholesterol level were lowered close to normal either in control positive (PC) and extracts. The extracts were more effective in lowering the serums' cholesterol level compared to the control.

**Table 1.** The averages of total cholesterol level in rats' blood (Statistically analysed by Anova method and continued by Posthoc Duncan,  $p < 0,05$ ,  $n=5$ )

Group	Normal	Hyper cholesterolemi a	7 <sup>th</sup> day	14 <sup>th</sup> day	21 <sup>th</sup> day
NC <sup>a</sup>	60.4 $\pm$ 6.23	147.8 $\pm$ 14.74	142.8 $\pm$ 14.30	140.6 $\pm$ 16.65	135.8 $\pm$ 16.27
PC <sup>b</sup>	57.6 $\pm$ 8.68	156.4 $\pm$ 16.71	96.4 $\pm$ 15.57	86.4 $\pm$ 15.18	80.2 $\pm$ 14.81
FOE1 <sup>c</sup>	55.6 $\pm$ 5.27	177.6 $\pm$ 9.69	82.8 $\pm$ 7.92	67.8 $\pm$ 8.5	62.8 $\pm$ 23.78
FOE2 <sup>d</sup>	57.2 $\pm$ 6.46	187.6 $\pm$ 25.18	86.6 $\pm$ 23.68	67.8 $\pm$ 23.57	62.6 $\pm$ 8.14
FOE3 <sup>e</sup>	56.4 $\pm$ 4.16	174 $\pm$ 1.58	68 $\pm$ 3.16	67.8 $\pm$ 3.49	638 $\pm$ 2.86

<sup>a</sup>Negative control (Na CMC)

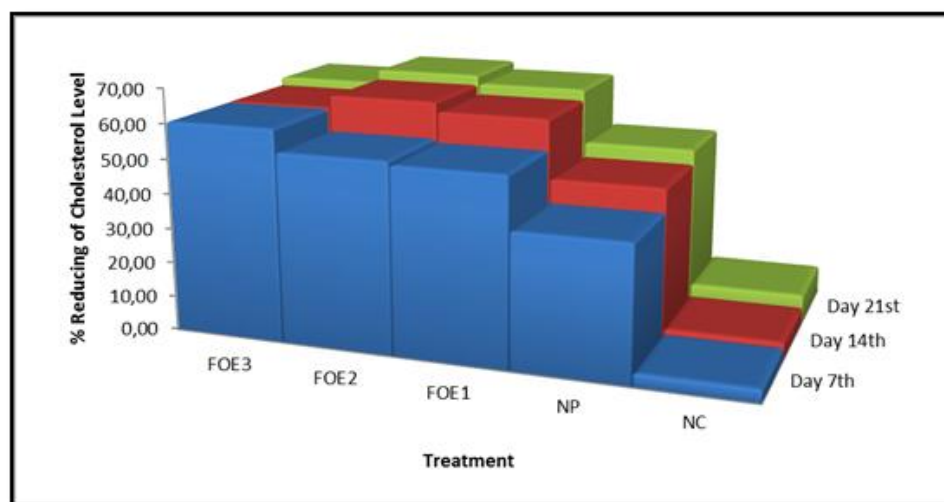
<sup>b</sup>Positive control (Atorvastatin)

<sup>c</sup>Fermented onion extract dose 100mg/Kg body weight

<sup>d</sup>Fermented onion extract dose 200mg/Kg body weight

<sup>e</sup>Fermented onion extract dose 300mg/Kg body weight

After 7th days of treatment, the data shows that orally fermented onion extract at dose 300 mg/Kg bw (FOE3) decreased more total cholesterol level when it is compared to NP, CP, FOE1 and FOE2. But after 14th and 21st days feeding fermented onion extract at dose 200mg/Kg bw (FOE2) decreased total cholesterol level higher followed by FOE1, FOE3, PC and NC.



**Figure 2.** Persentation of reducing total cholesterol in rats after treatment by fermented onions (*Allium cepa* L. var *cepa*) with values are Mean $\pm$ SD and n=5.

The Treatment by fermented onion extract at dose of 200 mg/Kg bw after 14th and 21st day was more effective then other treatment groups. The result of this research was in agreement with Kumari and Agusti (2007) who reported that orally administration of 200 mg/Kg BW of onion reduced cholesterol level when it is compared to untreated groups [3]. The activity of HMG CoA reductase responsible to inhibit synthesis of mevalonate so formation of cholesterol is reduced [13].

Regarding to bioactive compounds, the other research reports that onion have a quercetin [14,15,16] and isoalliin [17,18,19]. The existance of quercetin decreased the activity of HMG CoA in liver, it is because quercetin helps hepatic cholesterol metabolism to promote the cholesterol to form bile acid [20]. On the other hand, quercetin either prevented the increasing total cholesterol and alteration of high cholesterol diet-induced in lipid profile [21]. But also, Isoalliin or S-Methyl cysteine sulfoxide (SMCS) were a major chemical compounds found in onion wich effectively inhibites the activity of HMG CoA reductase [3].

#### 4. Conclusion

Onion can be fermented without additive in temperature controlled. Extract of fermented onion has the strongest hypocholesterolemic effect at dose of 200 mg/kg BW in rats as compared to the control and other samples tested.

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