

## Oral administration of bitter gourd (*Momordica Charantia*) extract prevent dyslipidemia on male wistar rats (*rattus norvegicus*) fed with high-fat diet

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**Introduction:** Dyslipidemia is one of the most prevalent health conditions and often leads to development of many chronic diseases such as coronary artery disease, heart failure, and stroke. This study was conducted to investigate the effects of bitter gourd (*Momordica Charantia*) extract on lipid profiles in male wistar rats fed with high-fat diet.

**Methods:** This study was an experimental research using *randomized post-test only control group* design. The subjects were 36 male Wistar rats (*Rattus norvegicus*) randomly divided into 2 groups. The first group was the control group (P0) and fed with placebo while the treatment group (P1) received bitter gourd (*Momordica Charantia*) ethanol extract at 1g/kg

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body weight/day. Both groups were fed with high fat diet. The experiment was lasted for 35 days and lipid profiles were measured at the end of the experiment.

**Results:** Statistical analysis results revealed the *mean* of total cholesterol, triglyceride, and low-density lipoprotein (LDL) in the treatment group were significantly lower than control group while high-density lipoprotein (HDL) was significantly higher in the treatment group ( $p < 0.05$ ).

**Conclusion:** This study concluded that bitter gourd extract significantly prevent dyslipidemia on male Wistar rats fed with high-fat diet.

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### INTRODUCTION

Dyslipidemia is a condition where there is an abnormal amount of lipids in the blood. The abnormal lipids often are increased total cholesterol, triglycerides, LDL-C, and lower of HDL-C concentration. Basic Health Research from the Ministry of Health of the Republic of Indonesia on 2013 stated that 60.3% of Indonesians above the age of 15 years old suffers from dyslipidemia.<sup>1</sup> Dyslipidemia still the main risk of atherosclerosis which can lead to cardiovascular disease.<sup>2</sup> Free radicals can also cause lipid peroxidation and lead to cell membranes damage. This process then can further influence the normal cell function leads to metabolic syndrome such as dyslipidemia and diabetes mellitus.<sup>3</sup>

Bitter gourd (*Momordica Charantia*) was a type of plants that can be found in the tropical and subtropical region. Since the ancient times, bitter gourd has been used as an alternative medicine to cure several diseases including reducing blood sugar level in diabetic patients. The plant was believed to possess various benefits as traditional herbal medicines with various pharmacological functions, from anti-diabetic, anthelmintic, antimalarial and also laxative.<sup>4,5</sup> Bitter gourd contain

various antioxidants, such as tannin, vitamin C, triterpenoids, and also flavonoids.<sup>4</sup> Previously, ethanol extract from bitter gourd was proven to have effects on lipid profiles and also a hypolipidemic effect.<sup>6</sup> In other study, Alam *et al.*, also reported that supplementation of bitter gourd have an effect to lipid profiles, obesity, and other complication related to metabolic disease.<sup>7</sup> In our study, we found that bitter gourd contains high concentration of tannin as well as vitamin C (*ascorbic acid*), and flavonoid. Tannin is one of the major groups of antioxidant polyphenols and have been reported to have various beneficial health properties, including anti-diabetic and lipid-lowering effect.<sup>8</sup> Flavonoids, another major antioxidant polyphenols, also have been reported to improve serum LDL-C and HDL-C concentration.<sup>9</sup> Therefore, this study was conducted to prove that *Bitter gourd* extract was capable to prevent dyslipidemia in male Wistar rats fed with high-fat diet.

### METHODS

#### Extract preparation

*Bitter gourd* were bought at a traditional market and then dried for several days. Afterwards, the *Bitter gourd* was cut and soaked with 95% ethanol with ratio of 1:9 for 24 hours. Submerged gourds were

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then filtered by filter paper and then evaporated with vacuum rotator to obtain crude extract.

### Animal Subjects

This study used 36 white male Wistar (*Rattus norvegicus*) breed rats, aged between 10-12 weeks and weighed between 160-180 grams. After 7 days of adaptation process, the rats were then divided randomly into 2 groups with 18 rats for each group. Every rat was placed one by one into its own cage with the dimension of 30x20x20cm and has free access to water. The first group or control group was fed with high-fat diet and placebo for 35 days. The second group or treatment group was also fed with high-fat diet but treated with bitter gourd extract which administered by using feeding tube for 35 days. For the treated groups, the given dose of bitter gourd was 1g/kg body weight/day. LD50 for the *Bitter gourd* ethanol extract is 362.34 mg/100 gram of body weight.<sup>10</sup> The normal range of total cholesterol concentration in Wistar rats is 57 – 200 mg/dL.<sup>11</sup>

### Sample collection

Blood samples were collected on the 36<sup>th</sup> day. Prior to the sample collection, the rats were previously anesthetized with a mixture of ketamine and zylanine with the ratio of 1:1. Each rat received 0.2 cc of the solution. Blood samples were then collected from orbital sinus and stored in EDTA tube. The tube was centrifuged at 3000rpm for 30 minute to obtain blood plasma. The plasma was then sent to the clinical pathology's laboratory of Sanglah Hospital, Denpasar, Bali to underwent lipid profiles examination.

### Statistical Analysis

All lipid profile data were then analyzed to obtain data description, data normality, data homogeneity, and comparison of mean. Lipid profiles comparative data were tested using t-independent test. All statistical analysis was performed using Spss 21.

## RESULTS

In this study, the mean total cholesterol from the control group was 209.33±4,728 while the mean total cholesterol from the treatment group was 146.44±10,467. The mean triglyceride level in the control group was higher (157.61±10.885 mg/dl) than in treatment group (112.89±10.454). In addition, the mean LDL level was also higher in control group (167.22±4,493 mg/dl) compared to treatment group (110.78±9.277 mg/dl). However, mean HDL level was lower in the treatment group (65.39±7.808 mg/dl) than in control group (52.67±5.531 mg/dl). The mean concentrations of all variables are presented in Table 1.

Independent sample t-test was performed to evaluate the significance of the difference of concentrations in all variables. Indeed, the analysis showed that the difference between treatment and control group were significant in all of the variables ( $p < 0.05$ ).

### Discussion

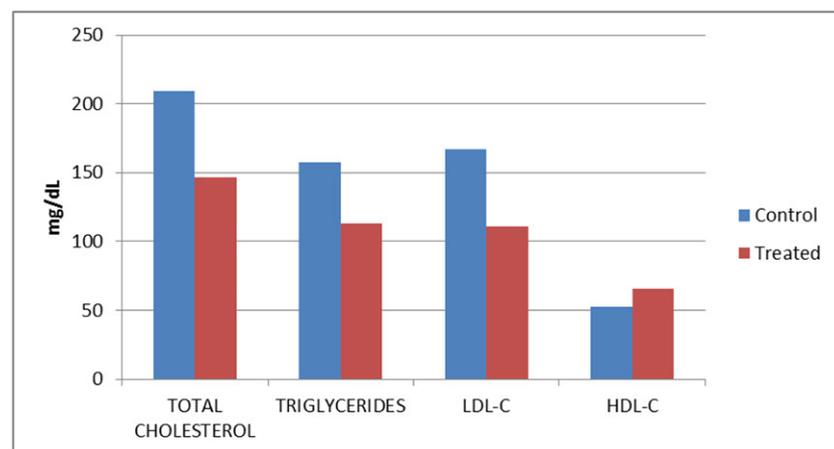
*Bitter gourd* contains various antioxidants which mainly composed of tannin, vitamin C and also flavonoids. This study showed that the bitter gourd extract could significantly lower the level of total cholesterol, triglyceride, and LDL while significantly improved HDL level. This finding is in line with several other previous studies. Most notably, Wang *et al.* and Mahwish *et al.*, also presented identical results with this study.<sup>6,10</sup>

The possible mechanism on how bitter gourd extract works in improving lipid profile can be explained by

**Table 1.** Tabulation of the mean value of each component of lipid profile in treatment and control group. Comparison was conducted using independent sample t-test.

Variabel	Groups	Mean (mg/dL)	Min (mg/dL)	Max (mg/dL)	p-value
Total Cholesterol	Control	209.33±4.728	201	217	<0.05
	Treated	146.44±10.467	132	168	
Triglycerida	Control	157.61±10.885	134	172	<0.05
	Treated	112.89±10.454	98	141	
LDL	Control	167.22±4.493	159	175	<0.05
	Treated	110.78±9.277	91	129	
HDL	Control	52.67±5.531	44	61	<0.05
	Treated	65.39±7.808	48	84	

The value presented represents mean ± SD (n=18).



**Figure 1.** Graphic representation of the effect of Bitter gourd extract to the lipid profile. Each value is expressed as mean ± SD (n=18).

looking on several other mechanistic studies. The tannin in *bitter gourd* extract can inhibit cholesterol absorption by inhibiting pancreatic lipase activity which hamper fat digestion and, thus, also its absorption.<sup>12</sup> Other study also reported that tannin has a fairly good HMG-CoA reductase inhibitor activity.<sup>13</sup> The inhibition of this enzyme will lower the synthesis of endogenous cholesterol which will also lower the level of circulating cholesterol. In another study, Sunga *et al.* found that supplementation of vitamin C, which also composed a major part in bitter gourd extract chemistry, for 3 months could also improve the lipid profiles.<sup>14</sup> Vitamin C within the bitter gourd acted as a co-factor to increase bile acid conversion from cholesterol which then increase LDL reuptake from the blood and lowering LDL-C level. On the other hand, vitamin C and flavonoid also act as antioxidants that work in cooperation with the internal bodily free radical “scavenger” system, reducing the possibility of lipid peroxidation.<sup>15</sup>

## CONCLUSION

In conclusion, we demonstrated that *Bitter gourd* extract could prevent dyslipidemia on male wistar rats fed with high-fat diet. Further study with more control groups and dose separation is needed to identify the optimal dosage of this extract as well as to identify the role of each component of the extract toward lipid metabolism.

## CONFLICT OF INTEREST

All authors declared that there is no conflict of interest regarding this publication

## AUTHOR CONTRIBUTION

All authors contributed equally in the writing of this article

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This study was self-funded without any contribution from third party.

## ETHIC APPROVAL

This study had been ethically approved by ethical commission of Faculty of Medicine Udayana University with approval letter number 416/KE-PH-Lit-2/VII/2019

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