

## Effect of curcumin and turmeric powder on lipid profile of wistar rats (*Rattus norvegicus L*) induced high fat diet

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### Abstract

Consumption of foods high in fat is a factor in the occurrence of hyperlipidemia. Hyperlipidemia is characterized by high levels of triglycerides, cholesterol, and Low Density Lipoprotein (LDL) in the blood. The use of curcumin and powder in many studies can reduce cholesterol, triglycerides (TG), and Low Density Lipoprotein (LDL) and increase High Density Lipoprotein (HDL) through antioxidant activity and increase cholesterol absorption. This study aims to compare the hypolipidemic activity of curcumin and turmeric powder in wistar rats fed by high-fat diet. Curcumin (dose 0.34 mg / 50 g BW) and turmeric powder (54 mg / 50 g BW) were given orally for 9 weeks to 2 week old Wistar rats which were fed high fat diet. Triglyceride, cholesterol, and LDL levels were at normal levels for all treatments. Wistar rats fed high-fat diets did not show hyperlipidemia conditions (TG 68.7 mg / dl, cholesterol 80.5 mg / dl, LDL 19.5 mg / dl). Cholesterol levels of wistar rats given curcumin 98.7 mg / dl. Cholesterol level of Wistar rats given turmeric powder was 86.5 mg / dl. The results showed that oral administration of curcumin or turmeric powder was not significant in reducing hyperlipidemia.

**Keywords:** Triglyceride, Cholesterol, LDL, HDL, Hyperlipidemia

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### Introduction

Hyperlipidemia occurs due to many factors, one of which is due to high-fat foods. The prevalence of hyperlipidemia in Asia-Pacific countries varies considerably, namely around 9-47% based on population survey results. Further studies show that the prevalence of consumption of high-fat foods reaches 42.4%, even this occurs in adolescence. In various health studies the effect of high-fat dietary intake is often associated with the risk of increased blood triglyceride, cholesterol, and Low Density Lipoprotein (LDL) levels. The use of test animals rats fed high fat feed is a representative test to determine its effect on lipid profile. Diets high in fat can contain 50% or more energy than fat. The provision of high-fat feed increases cholesterol levels by up to 10% compared to low-fat feed (dos Santos Lacerda et al., 2018). A high-fat diet given within 8 weeks increases blood cholesterol levels above 130 mg / dl. Various studies that have been conducted have shown that both turmeric and curcumin powder have hypolipidemic activity. Turmeric and curcumin powder can reduce hyperlipidemia as a result of high-fat feeding. Curcumin and turmeric powder can reduce Total Cholesterol (TC), Low Density Lipoprotein (LDL), and increase High Density Lipoprotein (HDL). Hypocholesterolemic activity of curcumin through cholesterol absorption, elimination or degradation mechanisms, not due to antioxidant activity. In contrast to previous studies, this study compared the hypolipidemic activity of curcumin and turmeric powder in wistar rats fed a high-fat diet. Based on this, it can be seen that the right choice in reducing hyperlipidemia, given that the cost of giving curcumin is expensive if used as an alternative in reducing hyperlipidemia [1].

### Materials and Methods

The research was carried out at the Laboratory of Animal Structure and Function Biology, Department of Biology, Diponegoro University. The curcumin used comes from Merck with catalog number 8.2034.0010. Turmeric powder is made based on the method used by. The simvastatin used is a product from Kimia Farma with a registration number C2KL0512522410B1. The wistar rat (*Rattus norvegicus L*) was obtained from the Ngaliyan White Rat breeding center, Semarang. The research carried out has received Ethical Clearance from the Ethical Commission for Health Research, Faculty of Medicine, Diponegoro University.

### Animal treatments

The wistar rats used were 2 weeks old and weigh 42-52 g. The test animals were acclimated for 1 week at a temperature of 22-24°C and a humidity of 60% -70%. Feed and drink were given ad libitum. High-fat feed was obtained from the Biochemistry Laboratory, Faculty of Veterinary Medicine, Gadjah Mada University. The composition of the high-fat feed is presented in table 1. Curcumin, simvastatin, and turmeric powder were given orally using 1 ml of distilled water every day at 08.00 for 9 weeks. The dose of curcumin given was 0.34 mg / 50 g BW. The dose of turmeric powder given is 54 mg / 50 g BW (Saraswati & Tana, 2015). The dose of simvastatin given is 0.045 mg / 50 g BW [2]. The dose taken is the dose with the optimal results based on the research that has been done (Table 1).

**Table 1:** Nutritional composition of high fat diet.

Components	Composition (%)
Maizena	29,67
Casein	14
Fructosa	25
Solid oil	21,4
Alfa sellulosa	5
Minerals mix	3,5
Vitamins mix	1

### Blood lipid profile analysis

Blood was collected from the heart using a 3 cc syringe. Before taking the rat blood was fasted for 12 hours. Cholesterol analysis used the CHOD-PAP method, triglycerides were analyzed using the GPO-PAP method, while HDL was analyzed using the HDL-cholesterol separation method.

### Experimental design

The study used a completely randomized design (CRD) consisting of 5 treatments and 4 replications as follows:

- C0 = Wistar rats are fed standart diet
- C1 = Wistar rats are fed high fat diet
- C2 = Wistar rats fed high fat diet + curcumin 0.34 mg / 50 g BW
- C3 = Wistar rats fed high fat diet + turmeric powder 54 mg / 50 g BW
- C4 = Wistar rats fed high fat diet + simvastatin 0.045 mg / 50 g BW

Data were analyzed using One Way Anova and Duncan's continued test at the 95% significance level. Data analysis application using SPSS 17.

### Results and Discussion

High-fat diets given for 9 weeks did not cause hyperlipidemia. The levels of triglycerides, cholesterol, Low Density Protein (LDL), and High Density Protein (HDL) in rats fed high fat feed or standard feed were in the normal range (data are presented in table 2). Triglyceride levels in all treatments were in the range below 108 mg / dl. Based on previous research, the triglyceride levels of hyperlipidemic wistar rats were in the range above 108 mg / dl. Cholesterol levels are in the range below 100 mg / dl. This result is different from previous research that high-fat diets cause blood cholesterol levels to range from 130-280. Other studies have also stated that high-fat diets do not always cause cholesterol levels above 100 mg / dl. Based on the results of statistical analysis of standard feed and high fat feed, there was no significant difference. However, the levels of triglycerides, cholesterol, and LDL were higher in the high-fat diet than the standard feed [3] (Table 2).

**Table 2:** Lipid profile of wistar rats (*Rattus norvegicus L*) fed high fat diet. Data are displayed as mean values followed by

SD ( $n = 4$ ). Superscript equal sign on one line indicates no significant difference ( $P > 0.05$ ).

standart diet	High fat diet	Fed high fat diet + curcumin 0.34 mg / 50 g BW	High fat diet + turmeric powder 54 mg / 50 g BW	High fat diet + simvastatin 0.045 mg / 50 g BW	
Triglyceride (mg/dl)	64,5a 14,31 ±	68,7a 29,82 ±	83,5a ±23,62	104,5a 28,15 ±	69,5a ±16,98
Total Cholesterol (mg/dl)	68,5a 4,79 ±	80,5a 25,78 ±	98,7a ±24,93	86,5a 7,32 ±	92,0a ±12,19
LDL (mg/dl)	15,5a 3,10 ±	19,5a 7,00 ±	23,2a±7,18	23,7a 2,62 ±	31,00a ±18,52
HDL (mg/dl)	26,2 a 4,50 ±	30,0a 8,83 ±	36,2a±7,88	32,2a±2,62	27,2a ±10,17

The addition of curcumin and turmeric powder to high fat feed did not differ significantly compared to high fat feed and standard feed. Although hyperlipidemia did not occur, the addition of curcumin and turmeric powder did not show any hypolipidemic effect. This is different from previous research which states that curcumin and turmeric powder have hypolipidemic activity. Several studies have given different results regarding the hypolipidemic effects of curcumin. Some say that curcumin can reduce cholesterol, triglyceride, and LDL levels [4]. However, several studies have also stated that curcumin administration has no significant impact. In contrast to curcumin, almost all studies show that turmeric powder can reduce cholesterol, triglyceride, and LDL levels. Turmeric powder contains 7.97% curcumin [5]. Turmeric and curcumin powder are compounds that are soluble in organic solvents such as ethanol. One of the weaknesses of turmeric powder is its low absorption capacity, this is because turmeric powder contains curcumin and curcuminoids [6]. Curcumin and curcuminoids have a low absorption capacity by the body, which causes hypolipidemic activity to be not maximal. Various studies have stated that curcumin has low bioavailability, in the oral administration of curcumin bioavailability of less than 1%.

### Conclusion

The administration of curcumin or turmeric powder on high-fat diets did not significantly differ in reducing hyperlipidemia. However, these results may be different if using the right method of administration.

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