

**COMPARATIVE STUDY OF ANTI-HYPERLIPIDEMIC EFFECT OF
ZINGIBER OFFICINALE, MOMORDICA CHARANTIA, TRIGONELLA
FOENUM-GRAECUM, DILLENIA INDICA AND TAMARINDUS INDICA.**

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ABSTRACT

This dissertation aimed to compare the antihyperlipidemic effects of methanolic extract of *Zingiber officinale*, *Momordica charantia*, *Trigonella foenum-graecum*, *Dillenia indica* and *Tamarindus indica* in hyperlipidemic animal models. Atorvastatin was used as standard drug. The crude extract (100 mg/kg) of these significantly prevented the increase in low density lipoprotein (LDL), total cholesterol (TC), triglyceride (TG) and significantly increased the HDL level in blood serum. The reduction in serum level of above parameters was compared with atorvastatin and then within themselves. Among the five samples, *Zingiber officinale* extract showed significant Cholesterol reduction property ($p < 0.001$) compared to other extracts. *Momordica*

charantia & *Dillenia indica* ($p < 0.001$) significantly increased the blood HDL cholesterol level. *Zingiber officinale*, *Dillenia indica* & *Tamarindus indica* significantly reduced LDL level in blood ($p < 0.001$). *Momordica charantia* & *Trigonella foenum-graecum* significantly reduced TG level ($p < 0.001$) in blood serum of rats. So, the above results confirmed that all extracts are potent against hyperlipidemia.

KEYWORDS: Atorvastatin, LDL, TC, TG, HDL, Hyperlipidemia.

INTRODUCTION

Hyperlipidemia is a metabolic disorder, specifically characterized by alternations occurring in serum lipid and lipid protein profile due to increased concentration of total cholesterol (TC), low density lipoprotein cholesterol (LDL-C) and triglycerides (TG) with a concomitant decrease in the concentration of high density lipoprotein cholesterol (HDL-C) in the blood circulation.^[1,2] In recent years, hyperlipidemia is currently growing at rapid rate throughout the world, which increases the risk of cardiovascular diseases, fatty liver, diabetes mellitus and carcinogenesis.^[3,4,5] Hyperlipidemia significantly contributes to the manifestation and development of atherosclerosis and coronary heart diseases, which are the most common causes of morbidity and mortality worldwide.^[6,7] A sedentary lifestyle and poor eating habit with high calorie consumption which alters the cholesterol and TG levels in plasma and tissues are the major causes of hyperlipidemia.^[3,8,9,10,11] So far, management of hyperlipidemia with pharmacotherapy with a bare minimum side effect is still a challenge for the current medical system. Hence, finding the novel agents from the natural drugs which could effectively improve the lipid metabolism and possess minimal side effects is a very promising approach.

In this present study, we report the antihyperlipidemic activities of the extract of different plants such as *Zingiber officinale*, *Momordica charantia*, *Trigonella foenum-graecum*, *Dillenia indica* and *Tamarindus indica* and some of them possessed prominent antihyperlipidemic activity.

METHODS AND MATERIALS

Collection of plant materials: Roots of *Zingiber officinale*, fruits of *Momordica charantia*, seeds of *Trigonella foenum-graecum*, fruits of *Dillenia indica* and fruits of *Tamarindus indica* were collected and were sun dried for several days. Then those were oven dried for 24 hours at considerably low temperature for better grinding. At last, dried samples were then ground in coarse powder using high capacity grinding machine in the Phytochemical Research Laboratory, University of Dhaka.

Extraction of samples

1000 gm of the powdered material of roots of *Zingiber officinale*, 800 gm of the powdered material of fruits of the plant *Momordica charantia*, 500 gm of the powdered material of the plant *Trigonella foenum-graecum*, 500 gm of the powdered material of fruits of the plant *Dilleniaindica*, 1000 gm of the powdered material of fruits of the plant *Tamarindu sindica*

were soaked in 3L, 3L, 2L, 2L and 3L of methanol in a round bottom flask respectively which was sealed and kept for 21 days accompanying occasional shaking and stirring. Then whole mixture was filtered and concentrated at 39°C with a rotary evaporation to get 86.5 gm, 44.2 gm, 31.6 gm, 43.4 gm and 36.5 gm of extracts respectively.

Experimental Animals

40 male Healthy *Swiss Albino* rats weighing 90-100 g were collected from International Centre for diarrheal Disease Research, Bangladesh (ICDDR`B) animal house, Dhaka and were kept in dry polypropylene cages with 12 hours light dark cycle at 25±2°C and 45-55% relative humidity. The experiments on animals were performed in accordance with guidelines of the Animal Ethics Committee, Faculty of Pharmacy, University of Dhaka.

Preparation of sample dose

The samples were taken in 0.9% saline water and 1-2 drops of Tween 80 was added. Concentration of each of the 5 plant extracts was made 100mg/ml.

Experimental design

The *Swiss Albino* rats were divided into eight separate groups of 5 rats in each. Group 1 and 2 considered as normal and hyperlipidemic and were administered regular diet and pure cholesterol. Whereas, group-3, 4, 5, 6, 7 and 8 were administrated Atorvastatin and Cholesterol, extract of *Zingiber officinale* and Cholesterol, extract of *Momordica charantia* (MCM) and Cholesterol, extract of *Trigonella foenum-graecum* and Cholesterol, extract of *Dillenia indica* and Cholesterol, extract of *Tamarindus indica* and cholesterol, respectively. These 8 groups were administrated 3 times daily at 100 mg/kg/ml dosage for 30 days. After 30 days the animals were killed by decapitation, and blood was collected.

Biochemical analysis

The total serum cholesterol was estimated by enzymatic end point (CHOD-PAP) method^[12] whereas TG and HDL-C were estimated by enzymatic colorimetric GPO-PAP method^[13] and enzymatic colorimetric phosphotungstate magnesium method^[14] respectively.

Statistical Analysis

The results were expressed as Mean ± SEM. The statistical analysis was carried out using t-test and one way analysis (ANOVA). Statistical P value ≤ 0.05 was considered to be significant.

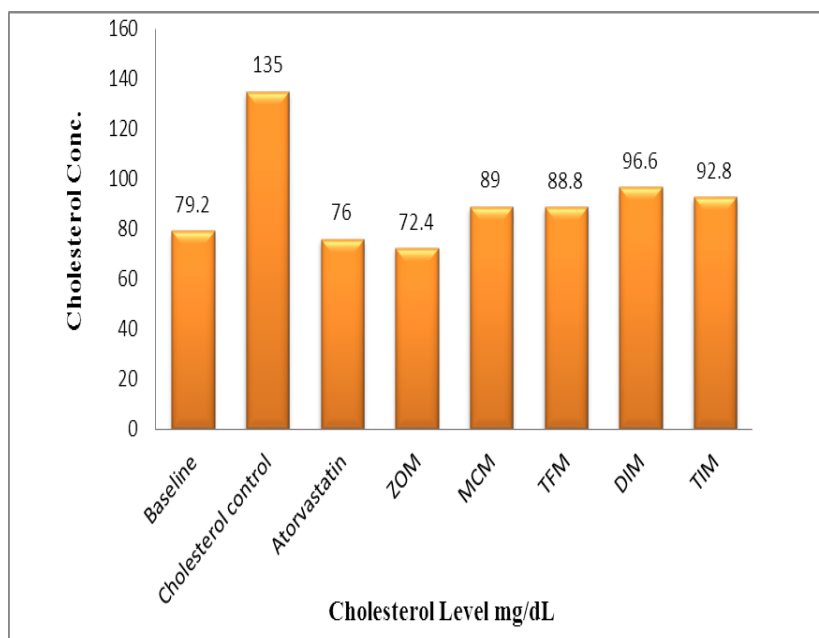
RESULTS

Effects of methanolic extract of *Zingiber officinale*, *Momordica charantia*, *Trigonella foenum-graecum*, *Dillenia indica* and *Tamarindus indica* on serum TG, cholesterol, LDL cholesterol and HDL cholesterol (mg/dL; mean \pm SEM) levels in pure cholesterol induced rats after 30 days of extract administration are given in table 1. The serum levels of TG of group treated with 100 mg/kg extract of *Zingiber officinale*, *Momordica charantia*, *Trigonella foenum-graecum*, *Dillenia indica* and *Tamarindus indica* were found to be significantly lowered as compared to atorvastatin induced hyperlipidemic rats. *Momordica charantia* and *Dillenia indica* significantly increase the HDL cholesterol. Whereas, the serum levels of total cholesterol, LDL cholesterol of group treated with 100 mg/kg extract of *Zingiber officinale*, *Momordica charantia*, *Trigonella foenum-graecum*, *Dillenia indica* and *Tamarindus indica* were also found to be significantly lowered as compared to atorvastatin induced hyperlipidemic rats.

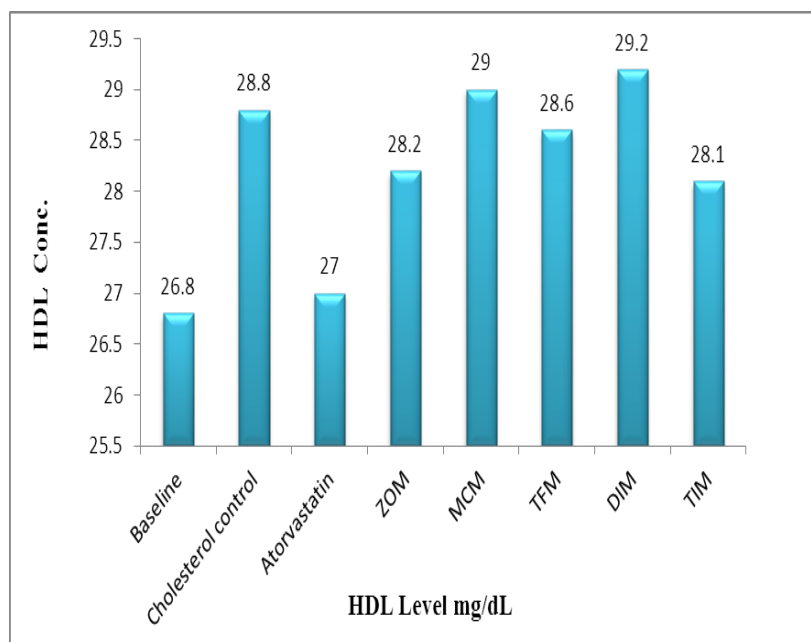
Table 1. Effects of methanolic extracts of *Zingiber officinale*, *Momordica charantia*, *Trigonella foenum-graecum*, *Dillenia indica* and *Tamarindus indica* on serum TG, cholesterol, LDL cholesterol and HDL cholesterol (mg/dL) levels in pure cholesterol induced rats after 30 days of extract administration.

Groups	Cholesterol mg/dL	HDL cholesterol mg/dL	LDL cholesterol mg/dL	TG mg/dL
Normal control	79.20 \pm 2.56	26.8 \pm 1.16	38.06 \pm 2.66	86.2 \pm 3.89
Cholesterol control	135 \pm 3.57	35.8 \pm 1.43	53.96 \pm 3.79	168.2 \pm 4.68
Atorvastatin	76.0 \pm 1.70	27.0 \pm 0.71	39.76 \pm 2.42	124.6 \pm 3.89
ZOM	72.4 \pm 0.81 ^a	28.2 \pm 1.71 ^b	34.64 \pm 0.78 ^a	131.8 \pm 3.38 ^c
MCM	89.0 \pm 3.20 ^c	29.0 \pm 2.83 ^a	41.60 \pm 2.71 ^b	113.8 \pm 4.18 ^a
TFM	88.8 \pm 3.15 ^c	28.6 \pm 2.68 ^b	41.84 \pm 1.61 ^b	113.4 \pm 2.80 ^a
DIM	96.6 \pm 3.73 ^c	29.2 \pm 3.11 ^a	31.32 \pm 2.61 ^a	129.8 \pm 3.73 ^b
TIM	92.8 \pm 3.18 ^c	28.1 \pm 1.74 ^b	26.36 \pm 2.17 ^a	133.2 \pm 4.16 ^c

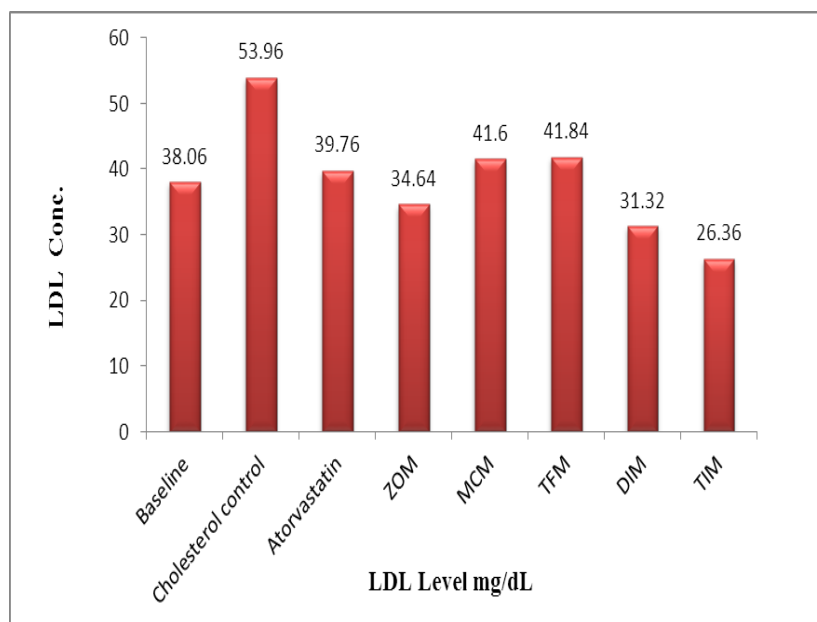
Values are expressed as mean \pm SEM; n=5, ^ap < 0.001, ^bp < 0.01, ^cp < 0.05 and ^dp > 0.05 considered statistically significant as compared to atorvastatin induced hyperlipidemic group. ZOM= *Zingiber officinale*, MCM= *Momordica charantia*, TFM= *Trigonella foenum-graecum*, DIM= *Dillenia indica* and TIM= *Tamarindus indica*.



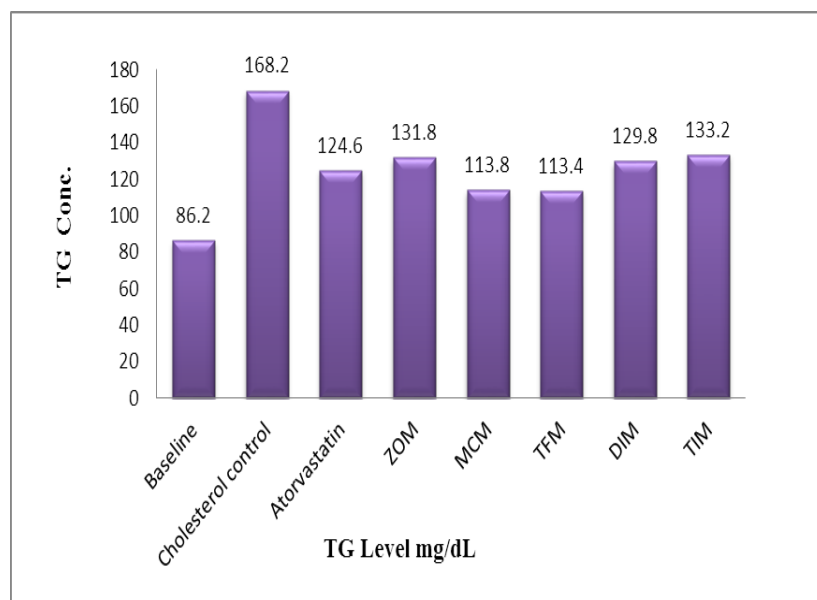
"Fig. 1"Change in cholesterol level in different treatment groups. ZOM= *Zingiber officinale*, MCM=*Momordica charantia*, TFM= *Trigonella foenum-graecum*, DIM= *Dillenia indica* and TIM= *Tamarindus indica*.



"Fig. 2"Change in HDL level in different treatment groups. ZOM= *Zingiber officinale*, MCM= *Momordica charantia*, TFM= *Trigonella foenum-graecum*, DIM= *Dillenia indica* and TIM= *Tamarindus indica*.



"Fig. 3"Change in LDL level in different treatment groups. ZOM= *Zingiber officinale*, MCM=*Momordica charantia*, TFM= *Trigonella foenum-graecum*, DIM= *Dillenia indica* and TIM= *Tamarindus indica*.



"Fig. 4"Change in TG level in different treatment groups. ZOM= *Zingiber officinale*, MCM=*Momordica charantia*, TFM= *Trigonella foenum-graecum*, DIM= *Dillenia indica* and TIM= *Tamarindus indica*.

DISCUSSION

The possible mechanism by which *Z. officinale* lowered the serum TG, LDL and Cholesterol level maybe is the presence of [6]-gingerol. The extent of activity appears to be dependent on the concentration of [6]-gingerol present in the extract.^[15] Increased removal of LDL by

peripheral tissues^[16] and an increased excretion of bile in the feces^[17] are examples of mechanism by which plant products may lower cholesterol, phospholipid and triglyceride levels.

M. charantia significantly reduced the level of serum TG, LDL cholesterol level compared to the cholesterol control group showed in figure 1, figure 2, figure 3 and figure 4. It significantly increased the serum HDL cholesterol level. One of the mechanisms of the extract to give antihyperlipidemic effect may be *M. charantia* potentiates lipoprotein catabolism which through different consequences resulted in the lowering of blood TG level in DE rats compared with the level in DC rats. A high level of HDL might have also caused the lowering of TG and LDL level as it has been reported to pick up LDL from the circulation and deliver them to the liver for elimination.^[18]

The exact reason of antihyperlipidemic activity of *T. foenum-graecum* is yet to be established.^[19] Ribes found that the sub-fraction of fenugreek rich in saponin has hypocholesterolemic and hypotriglyceridaemic effects in alloxan-induced diabetic dogs, without inducing a significant change in HDL cholesterol concentration. Those authors also observed a decrease in the LDL-cholesterol, and suggested that the hypolipidemic effects are due to the fraction rich in saponin. Decrease in TG could be due to a lesser synthesis of LDL in the liver, since fenugreek seeds are known to affect insulin secretion.^[20]

D. indica significantly reduced the level of serum LDL cholesterol level, TG level and increased the HDL cholesterol level. The mechanism of hyperlipidemic activity of *D. indica* may be due to the fact it sensitizes insulin receptors which consequently triggers other reactions that result in decrease of lipid level in blood. Extract of *D. indica* decreased serum cholesterol level by inhibiting cholesterol biosynthesis.^[21]

T. indica significantly decreased significantly decreased the LDL level of the blood serum by almost 50% and increased the blood HDL level. It also significantly decreased the blood TG level. It was found to impart a significant impact in lowering total cholesterol level and LDL-cholesterol level in body without altering the level of HDL-cholesterol. Since tamarind reduced the total cholesterol level, there is probably a decrease in intracellular cholesterol, and it is known that a decrease in intracellular cholesterol level causes an upregulation of LDL-receptor.^[22] Thus it might exert the antihyperlipidemic activity.

CONCLUSION

Thus the antihyperlipidemic effect of methanolic extract of *Zingiber officinale*, *Momordica charantia*, *Trigonella foenum-graecum*, *Dillenia indica* and *Tamarindus indica* might be due to presence of certain hypolipidemic, pathway regulators related to lipid metabolism and enzyme inhibitor constituents presence in these plants.

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