



Turmeric Powder Gavage Improves Lipid Profile of Albino Rats

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Dyslipidemia is one of the key risk factors for cardiovascular diseases, which is a leading cause of global morbidity and mortality. This study was designed to investigate the effect of powdered *Curcuma longa* (turmeric) tubers on lipid profile of albino rats. Twenty-four (24) male albino rats were randomly divided into four groups (A-D), receiving once daily administration of distilled water, 50, 100 and 200 mg/kg of the powder respectively. The body weights of the animals were measured weekly, while lipid profile was determined after three weeks. The result showed that daily oral administration of graded doses of the *C. longa* powder for three weeks resulted in a non-significant increase in the body weights of the animals. Daily oral turmeric powder (200 mg/kg) treatment significantly ($p \leq 0.05$) lowered the serum total cholesterol and triglyceride concentrations, while those that received 100 mg/kg significantly increased HDL-Cholesterol and reduced LDL-Cholesterol. Turmeric powder lowered total cholesterol, triglyceride and increasing HDL cholesterol in albino rats at the indicated doses and duration.

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1. INTRODUCTION

Hyperlipidemia originates from abnormality of lipid metabolism sequel to the manifestation of atherosclerosis. Currently, in developing countries, hyperlipidemia and consequently atherosclerosis is one of the major causes of cardiovascular diseases and death [1]. Hypercholesterolemia and hypertriglyceridemia are the independent risk factors that are jointly or separately responsible for the development of atherosclerosis and a sequence of atherosclerotic lesions [2]. Many hypolipidemic synthetic drugs are available for clinical use, but they have adverse side effects including harmful syndromes such as diabetes and cardiovascular disease [3,4]. In most parts of the world, spices are therapeutically useful in management of atherosclerotic disease. These spices occupy important position in the diet and usually originate from seed, fruit, bark or root of a plant which possess high fragrance and pungent aroma, being valued for their taste or smell and

when added to foods make them more palatable and stimulate digestion. Plants used as spices and condiments are usually aromatic and pungent and have and continued to provide human kind with medical remedies [5]. Spices and condiments are products of plants, which are mostly used for seasoning, flavouring and thus enhancing the taste, nutritional content, color, texture or shelf life of foods and beverage [6]. Turmeric (*Curcuma longa*) is a herbaceous perennial plant, belonging to the Zingiberaceae family. It is widely known in most parts of the world and a major ingredient in spices such as curry powder and as a source for curcumin or curcuminoids. According to Shruti and Pratiti [7,8], turmeric contains upto 5% essential oils and 5% curcumin, of which curcumin is the active substance. Today, there is increasing consciousness on the existence of cheap and nutritious local spices such as turmeric and the need to use them. This research work is therefore designed to evaluate the impact of turmeric on lipid profile of male albino rats.



Fig. 1. Turmeric powder

2. MATERIALS AND METHODS

Plant Collection: Turmeric rhizome (*Curcuma longa*) harvested from the Departmental research farm of the Department of Crop Science, Imo State Polytechnic, Umuagwo- Owerri (**Latitude:** 5°18'12.60"N; **Longitude:** 6°56' 26.39" E) was processed into powder between October and November. Exactly 500g of the powder was purchased from the Departmental shop of the Crop Science Department and stored in an air tight container at room temperature prior to the time of the study.

Animals: Twenty-four healthy weaned four weeks old male albino rats of comparable weights were procured from the Faculty of Veterinary Medicine, University of Nigeria Nsukka. Upon arrival the animals were housed in an environmentally controlled room with a 12h light/12h dark cycle and acclimatized for one week with free access to water and commercial pellets of growers' mash produced by Guinea Mill Plc, Ibadan – Nigeria. The ethical committee of the School of Agriculture, Imo State Polytechnic, Umuagwo approved the use of the animals. The principles of laboratory animal care were followed in accordance with the guidelines of the National Institute of Health on the care and use of laboratory animals (NIH, 1985) [9].

2.1 Experimental Design

The rats were randomly divided into four groups of six animals each. Group A served as the normal control receiving distilled water only, while groups B, C and D received distilled water (1ml/kg) and the Turmeric powder (50, 100, 200mg/kg body weight) respectively once daily for 3 weeks. All the administrations were given intragastrically using an intubator. All the animals were weighed on the first day and thereafter weekly, till the end of the experiment.

2.2 Collection of Blood Samples/Determination of Biochemical Parameters

At the end of the experiment the animals were sacrificed and blood samples were collected

through the orbital sinus of the eyes into EDTA tubes and centrifuged at 3000 rpm for 10 min; for the assessment of Lipid parameters.

Determination of total cholesterol, triglyceride, HDL cholesterol and LDL -cholesterol were carried out by modified enzymatic procedures using commercially available diagnostic assay kits (BioSystems), based on Friedwald's method [10].

2.3 Statistical Analysis

Results were expressed as mean \pm standard deviation (S.D). The data were subjected to one-way analysis of variance (ANOVA) and differences between means were calculated using student-t test and considered significant if $p \leq 0.05$.

3. RESULTS AND DISCUSSION

There was a progressive and significant ($p \leq 0.05$) increase in the body weight of all the treated rats (Table 1). The progressive increase in the body weight may be as a result of normal growth owing to food and water intake. Since changes in body weight have been used as an indicator of adverse effects of drugs and chemicals. Our results therefore suggest that oral doses of turmeric powder administered for 21 days did not elicit any toxic response. However, during the third week there was a significant increase in the mean body weight of the animals which may be attributed to administration of the turmeric powder.

Table 1. Effect of graded doses of *C. longa* powder on the body weight (g) of rats \pm S.D (n = 5)

Body weights	Group A	Group B	Group C	Group D
Week one	55.2 \pm 5.81	50.38 \pm 3.16	50.28 \pm 5.36	53.52 \pm 5.24
Week two	101.29 \pm 13.96	94.78 \pm 12.55	94.78 \pm 12.55	99.90 \pm 15.26
Week three	126.61 \pm 22.26	136.99 \pm 13.12	136.74 \pm 29.5	132.43 \pm 35.76

Table 2. Effect of daily administration of *C. longa* powder on the lipid profile of control and treated rats

Parameters	Group A	Group B	Group C	Group D
Total Cholesterol (mMol/l)	2.06 \pm 0.03	2.29 \pm 0.01	2.4 \pm 0.01	1.6 \pm 0.04
Triglyceride (mMol/l)	1.04 \pm 0.04	1.1 \pm 0.03	1.4 \pm 0.04	0.79 \pm 0.01
HDL-Cholesterol (mMol/l)	0.88 \pm 0.04	0.89 \pm 0.01	1.56 \pm 0.04	0.48 \pm 0.02
LDL-Cholesterol (mMol/l)	0.7 \pm 0.02	0.9 \pm 0.03	0.2 \pm 0.05	0.81 \pm 0.03
HDL:LDL Ratio	0.79	1.01	0.12	1.68
VLDL-Cholesterol (mMol/l)	0.48 \pm 0.02	0.5 \pm 0.01	0.63 \pm 0.02	0.36 \pm 0.00

Legend: Group A= control, group B =50mg/kg, Group C=100mg/kg, Group D=200mg/kg

4. DISCUSSION

Increased circulating lipid in blood also known as hyperlipidemia includes elevated total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and total triglyceride (TG) levels in the blood. This process involves cholesterol packaging into HDLs and LDLs, referred to as good and bad cholesterol respectively. HDL removes excess cholesterol from cells, including arterial linings, where it is transported to the liver for further processing while LDL delivers cholesterol to cells and can lead to lipid accumulation within the linings of blood vessels. This occurs when LDL crosses over the endothelial barrier and then becomes oxidized, before being taken up by macrophages [8]. Hyperlipidemia is associated with a number of complications which include atherosclerosis, coronary artery disease, myocardial infarction, and ischemic stroke. It is associated with an increase in oxidative stress leading to the production of oxygen free radicals [11]. These oxygen free radicals lead to oxidative modifications in LDLs, which play a major role in the initiation and progression of atherosclerosis and associated cardiovascular diseases [12]. Most herbal preparations have excellent hypolipidemic activities and are devoid of side effects, thus people prefer herbs to synthetic drugs because of its safety and less expensive [1,13]. Findings from the study showed that daily oral turmeric powder (200 mg/kg) treatment significantly ($p \leq 0.05$) lowered the serum total cholesterol and triglyceride concentrations, while those that received 100 mg/kg significantly increased HDL-Cholesterol and reduced LDL-Cholesterol which has been posited to have strong association with coronary heart diseases [14]. This may have resulted from active compounds Curcumin [15] contained in Turmeric which reduces cholesterol by interfering with intestinal cholesterol uptake, increasing the conversion of cholesterol into bile acids, and increasing the excretion of bile acids. Similar findings have also been reported by Santoshkumaret al., [16] who posited that turmeric powder possess hypolipidemic activity that probably results from increased elimination of cholesterol in the form of bile acids. Also its bioavailability may have been enhanced by its absorption rate by the gastrointestinal tract and its glucuronidation in the liver.

5. CONCLUSION

This study has shown that daily oral turmeric powder especially at 200 mg/kg treatment

significantly ($p \leq 0.05$) lowered the serum total cholesterol and triglyceride concentrations, while those that received 100 mg/kg significantly increased HDL-Cholesterol and reduced LDL-Cholesterol in albino rats at the indicated doses and duration. Hence, positing that turmeric powder can be used in the management of lipid related diseases.

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