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Effect of Decoction Extract of *Whitfieldia lateritia* on Lipid Profiles in Hypercholesterolemic Albino Rats

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Abstract: The effect of decoction extract of *Whitfieldia lateritia* on egg yolk induced hypercholesterolemia in albino rats was carried out using 20 albino rats. The rats were randomly assigned to three experimental groups A, B and C. Group A with four rats received only water and feed and served as the positive control, Group B received egg yolk, water and feed and served as the negative control while group C received egg yolk, water, feed and decoction extract of *Whitfeldia lateritia* for seven days and served as treated groups. Group C was further sub-grouped into three different sub-groups with four rats each. The sub-groups were treated daily with decoction extract of *Whitfieldia lateridia* at 100, 200 and 400 mg/kg body weight respectively for seven days. The lipid profiles were determined using spectrophtometric method. The result of the study showed significant (P<0.05) reductions in the level of cholesterol, triglyceride and low density lipoprotein cholesterol. The result also revealed a significant (P<0.05) increase in the level of high density lipoprotein-cholesterol. The study demonstrated that decoction extract of *Whitfieldia lateritia* possesses a hypolipidaemic activity and could be used in the management of cardiovascular problem.

Key words: Lipid Profiles · Hypercholesterolemia · Egg York · *Whitfeldia lateritia*

INTRODUCTION

Cardiovascular diseases particularly coronary artery disease (CAD), have become a growing problem especially in developing countries. According to WHO, Cardiovascular diseases (CVDs) are the number one causes of death globally. More people die annually from CVDs than from any other cause [1]. An estimated 17.3 million peoples died from CVD in 2008, representing 30% of all global deaths. Of these deaths, an estimated 7.3 million were due to coronary heart diseases and 5.2 million were due to stroke [1]. It is also estimated, that the number of people who die from CVDs mainly from heart diseases and stroke will reach 23.3 million by 2030 [2].

Cardiovascular diseases are projected to remain the single leading cause of death [3]. Hypercholesterolemia is widely known as a dominant risk factor for the development of cardiovascular diseases [4]. Meanwhile, hypertension, hyperlipidemia, insulin resistance and glucose intolerance are also known as cardiac risk factors that cluster in obese individual [5]. The persistence of hypercholesterolemic state causes enhanced oxidative stress, leading to the development of atherosclerosis, coronary artery disease and other complications of obesity [6]. To lower high blood cholesterol, a number of lifestyle changes are recommended including smoking cessation, limiting alcohol consumption, increased physical activity and diet control [7]. However, most people could not successfully control their blood cholesterol level because of the modern lifestyle [7]. Medication is therefore considered their last choice. Although several synthetic drugs are available, they have been reported to have serious adverse effects particularly liver damage [8].

Moreover, they lack several desirable properties such as efficacy and safety on long-term use, cost and simplicity of administration. These factors do not fulfill condition for patients' compliance. Therefore, attention is being directed to the medicines of herbal origin with hypolipidemic activity [9]. There are several kinds of medicinal plants that contain lipid lowering effect according to ethno pharmacological surveys [10]. Among

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them, *Whitfieldia lateritia* is very promising as it is routinely used as cooking vegetable for the purpose of boosting haematological parameters by local people in various local governments' areas like Ikwo, Izzi, Afikpo South and Ivo in Ebonyi State of Nigeria.

Whitfieldia lateritia commonly called blood plant is a flowering plant belonging to the family of *acanthaceae* [11]. *Whitfieldia lateritia* is native to Sierra Leone but recently has been observed in several parts of the world like Nigeria. In Nigeria per say, it can be found in large number in places like Ivo, Ikwo and Izzi Local Government Areas of Ebonyi State, Nigeria. The leaves are simple, opposite and decussate; stipules are lacking. The flowers are bisexual, zygomorphic and usually are associated with conspicuous, often brightly coloured bracts [12]. The calyx is usually deeply 4-5 lobed or sometimes is highly reduced with more numerous minute teeth. The corolla is sympetalous, usually 5-merous and mostly zygomorphic and commonly 2 lipped [12]. The androecium usually consists of 4 didynamous stamens only 2 stamens adnate to the corolla tube or epigynous zone, alternate lobes. The gynoecium consist of a single compound pistil of 2 carpels, a single style and a superior ovary with locules, each with usually 2-10 axile ovules in one or two collateral vertical tiers [12]. An annular nectar disk is usually found around the base of the ovary. The fruit is commonly an elastically dehiscent loculicidal capsule. The seed stalk or funiculus of each seed is modified into a hook shaped jaculator or retinaculu that functions in flinging out the seeds during dehiscent [12]. The shrub prefers a half-shady to shady situation on moist soil. They tolerate temperatures only above at least 1°C [12]. It is usually called by different names in several regions where they are found as "Ogwu obara" in Igbo, "Ogu`n eje" in Yoruba and "Magani jinni" in Hausa language.

Although, research studies that provide evidence for the above assumption as well as its hypolipidemic and anti-oxidative effects to protect the primary risk organs from hypercholesterolemia are still lacking. The study therefore aimed at evaluating the effect of *Whitfieldia lateritia* decoction extract of the leaf on the lipid profiles in hypercholesterolemic albino rat.

MATERIAL AND METHODS

Materials

Biological Materials: The biological materials used for this study are male albino rats and *Whitfieldia lateritia* leaf.

Collection of Biological Materials: The male albino rats of about 8 to 12 weeks old with average weight of 80 to 160g were obtained from animal house at Nnamdi Azikiwe University (UNIZIK) Akwa, Anambra State, Nigeria and acclimatized for seven days in the animal house of the Department of Biochemistry, Ebonyi State University, Abakaliki. The rats were allowed access to feed *ad libitum*. The animals were housed in cages at room temperature with a 12-12 hours light-dark cycle. *Whitfieldia lateritia* leaves were obtained at Ndiagu Umota, Ikwo L. G. Area, Ebonyi state, Nigeria and were identified and authenticated by a taxonomist in the Department of Applied Biology, Ebonyi State University, Abakaliki, Nigeria.

Experimental Design and Administration: Twenty (20) Albino rats after 7days of acclimatization were randomly divided into three groups A, B and C. Group C was further sub grouped into C1, C2 and C3 of four rats each. The route of administration of the extract was oral. Group A with four rats which served as the positive control was fed with the normal diet and distilled water *ad libitum*. Group B with four rats which served as the negative control was fed with egg yolk *ad libitum* without treatment for seven days. Groups C1, C2 and C3 were fed with egg yolk for seven days and later treated daily separately with 100, 200 and 400 mg/kg body weight respectively of the decoction extract of *Whitfieldia lateritia* for seven days.

Methods

Preparation of the Extract: Fresh leaves of *Whitfieldia lateritia* were collected in July-August. The fresh leaves that weighed 100g was boiled in 1000ml of distilled water at a temperature of 100°C to extract the active ingredients inform of decoction. Thereafter, a bloody solution of the extract was filtered off from the water bath into a cleaned container and stored in a refrigerator.

Induction of Experimental Hypercholesterolemia in Albino Rats: This was achieved by the method of Bopanna *et al*. [13]. The rats in groups B and C were fed egg yolk for seven days. According to Moghadasian *et al.* [14] and Moghadasian [15], the continuous ingestion of high amount of fat seems to be directly related to hyperlipidemia in humans as well as laboratory animals like pigeon, chickens, swine, rats, cats, mice and rabbit.

Lipid Profile Determination: Twenty-four hours after the last dose administration, whole blood (2ml) was collected from each of the albino rats through the femoral artery into a test tube. The blood was later spun in a centrifuge at 5000 revolution for 10minutes. Serum was separated from the clot with Pasteur pipette into another clean EDTA bottle and stored at -20°C for the measurement of the biochemical parameters. Total cholesterol (T-C), triglycerides (TG), low density lipoprotein cholesterol (LDL-C) and high density lipoprotein cholesterol (HDL-C) levels were determined using the methods described by Roschlaw *et al.* [16], Buccolo and David [17].

Statistical Analysis: Results were expressed as mean ± standard deviation. The significant difference between the controls and treated groups were determined using one-way analysis of variance (ANOVA) at $p<0.05$.

RESULTS

Percentage Yield of the Extract: The percentage yield of decoction extract of *Whitfieldia lateritia* leaf is 42.86 % as shown in Table 1. This means that boiling the leaf of *Whitfieldia lateritia* over a narrow range of temperature is a good means through which the active ingredient of the plant can be extracted.

Result of the Weight of Rats after Administration of Extract for Seven Days: The result showed some level of variation on the body weight of the albino rats during the seven days of treatment with decoction extract of *Whitfieldis lateritia* (Figure 1). The result revealed a significant ($P<0.05$) decrease in the weights of rats in the positive control and the treated groups while a significant ($P<0.05$) increase was observed in the negative control. This indicates that egg yolk increases the weight of the albino rat but the decoction extraction of *Whitfieldia lateritia* reverses the trend.

Result of the Lipid Profiles in Egg Yolk Induced Hypercholesterolemic Albino Rats Treated with Decoction Extract of *Whitfieldia lateritia*: The treatment of egg yolk induced hypercholesterolemic albino rat with

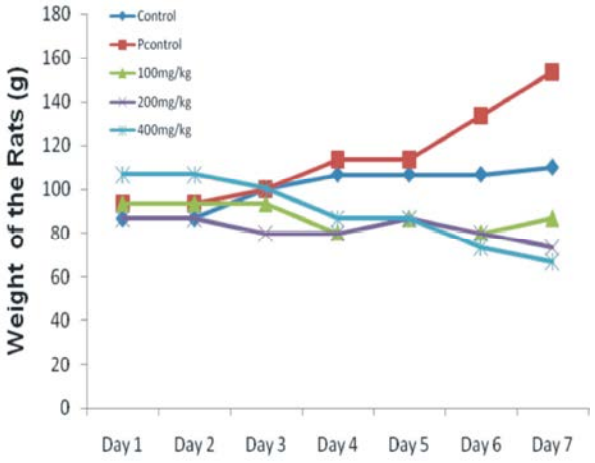

Fig. 1: Weight of Albino Rat during the seven (7) Days Treatment with Decoction Extract of *Whitfieldia lateritia*

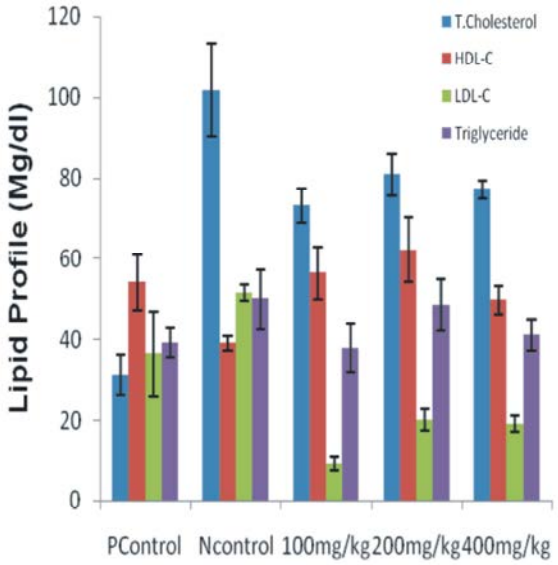

Fig. 2: Lipid Profiles of Albino Rat Treated with Decoction Extract of *Whitfieldia lateritia*

decoction extract of *Whitfieldia lateritia* leaf at 100, 200 and 400 mg/kg body weight to the albino rats significantly ($P<0.05$) reduced in the levels of cholesterol, triglyceride and low density lipoprotein cholesterol. It also showed that there was a significant ($P>0.05$) increase in the levels of HDL-Cholesterol (Figure 2).

Table 1: Percentage yield of extract of fresh leaf of W*hitfieldia lateritia*.

Solvent	Plant part	Mass of leaf before extraction	Mass of leaf after extraction	Volume solvent useful	Mass of extracted	% yield
Water	Leaf	100g	70g	1000ml	30g	42.86

DISCUSSION

The effect of *Whitfieldia lateritia* on the lipid profile in hypercholesterolemic albino rat was evaluated in this study. *Whitfieldia lateritia*, a Sierra leonian and Indian herbal plant possesses cardio-protective and lipid lowering properties. Treatment with *Whitfieldia lateritia* decoction extract produced a significant (p<0.05) decrease in the levels of cholesterol, triglyceride and low density lipoprotein cholesterol in atherogenic diet induced hypercholesterolemia in rats (Figure 2). According to Hanak *et al*. [20], the feeding of *Adenanthera pavonina* and *Terminalia cheula* lowered the total cholesterol and its fractions in lipoprotein. [20], also reported hypolipidemic activity of saponin, flavonoids and polyphenolic compounds from *A. pavonina.* Beta-sitosterol and phytosterol are reported as useful in the treatment of hyperlipidemia [21]. Kulkarni and Gurpreet [22], earlier reported that total cholesterol, triacylglycerol and LDL-cholesterol levels were significantly (p<0.05) reduced by ethanol leaf-extracts of *Vernonia amygdalina* and *Azadirachta indica* while HDL-cholesterol levels were increased significantly. They also reported dose-dependent reductions in the body weights of all the animals that received the extracts [19], reported no significant (P > 0.05) increase in total cholesterol (TC), high density lipoprotein – cholesterol (HDL–C) and low density lipoprotein–cholesterol (LDL–C) levels in rats administered ethanol extract of *Cajanus cajan* leaves.

Use of diet rich in saturated fats and an increase in coronary heart disorder has been observed in the developing countries for the past few decades [22]. Meanwhile, the decrease in serum lipid profile and increase in HDL- cholesterol in *Whitfieldia lateritia* treated groups (Figure 2) may be due to the presence of antioxidant phytochemicals. Lipid lowering effect of *Whitfieldia lateritia* could be due to inhibition of hepatic cholesterol biosynthesis, increased fecal bile acid secretion and stimulation of receptor-mediated catabolism of LDL-cholesterol and increase in the uptake of the LDL from blood by the liver [23-25] The atherogenic index (TG/HDL-C ratio) used to predict risk of CHD and marker of small dense LDL-C (an atherogenic lipoprotein) were significantly (p<0.05) reduced by the decoction extract of *Whitfieldia lateritia* indicating its beneficial effect in treatment of cardiovascular disease [20].

CONCLUSION

In this study, an increase in serum HDL- cholesterol with a concomitant decrease in other lipids was observed. It can be concluded from the present data that the levels of total cholesterol, triglyceride, LDL- cholesterol which are increased when the rats were fed atherogenic diet are reduced significantly with the decoction extract of *Whitfieldia lateritia*. Hence, decoction extract of *Whitfieldia lateritia* can be utilized for the prevention of cardiovascular diseases management such as atherosclerosis, obesity and others.

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