

Studies on the Lipid Profiles of Wistar Rat Models Treated with Aqueous and Methanolic Leaf Extracts of *Alchornea Cordifolia* and *Thaumatococcus Daniellii*

Osuocha, K. U.¹, Ewa, O.¹, Nweke, E. O.², Ejiofor, D. C.³ & Njoku, P.¹

¹ Department of Medical Biochemistry, Gregory University Uturu Nigeria, Nigeria

² Department of Human Anatomy, Chukwuemeka Odumegwu Ojukwu University Uli, Nigeria

³ Department of Human Physiology, Imo State University Owerri Nigeria, Nigeria

Correspondence: Ewa Ogonnaya, Department of Medical Biochemistry, Gregory University Uturu, Nigeria.

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Abstract

This study aims at establishing the effect of *T. daniellii* and *A. cordifolia* leaf extracts on the lipid profile of experimental rat models. A total of twenty five (25) adult male wistar rats were used for the study. The rats were divided into five groups of five rats each. Group I (normal control) was administered with 2ml/kg distilled water p.o. Group II was administered with 200mg/kg aqueous leaf extract of *T. daniellii* p.o. Group III was administered with 200mg/kg methanolic leaf extract of *T. daniellii* p.o. Group IV and V were administered with 200mg/kg aqueous and methanolic leaf extracts of *A. cordifolia* respectively. Administration of extracts lasted for 14 days after which animals were sacrificed and serum developed from blood samples was collected and used for analysis to evaluate the lipid profiles of experimental models using standard methods. Results obtained from the study show that the highest level of Low Density Lipoprotein (LDL) (31.21±0.04 mg/dL) was recorded on Group II and was not significantly different from the control group (33.20±0.10 mg/dL). However, for High Density Lipoprotein (HDL), the highest level was recorded on Group IV (48.14±0.08mg/dL). Similarly, this was not significantly different from the Control group (51.80±0.10mg/dL). Group II presented the highest level of Triacylglyceride (TG) (48.80±0.02mg/dL), which however, was considered not significantly different from the control group (51.17±0.08mg/dL). For Total Cholesterol (TC), highest level (64.64±0.49mg/dL) was recorded on Group II and value was not significantly different from that recorded on the normal control (63.83±0.10mg/dL). In conclusion, it can be deduced from this study that extracts of *T. daniellii* and *A. cordifolia* lacks the potential to alter the lipid profile of patients depending on them for one medicinal use or the other and may thus be considered potential candidates for drug development.

Keywords: Alchornea cordifolia, Thaumatococcus daniellii, drug, lipid

1. Introduction

The plant *Alchornea cordifolia* is a small shrubby tree which originates from Senegal, East to Kenya, Tanzania and South throughout Central Africa to Angola. The various parts of the plant are used in the African traditional medicine practices. *A. cordifolia* is richly endowed with diverse phytochemicals. This is evident by the fact that the leaves, roots and stem bark have terpenoids, steroid, glycosides, flavonoids, tannins, saponins, imidazopyrimidine alkaloids, alchorneine, alchornidine and several guanidine alkaloids. The leaf is a rich source of hydroxybenzoic acids, gallic acid, ethyl ester, gentisic acid, anthranilic acid (vitamin L1) protocatechuic acid, as well as also ellagic acid (Agbor et al., 2004).

The globally prominent plant *Thaumatococcus daniellii* Benn (Benth.) belongs to the family Maranthaceae (Makinde and Taiwo, 2004). It predominates in Southern Ghana, Cote d'Ivoire as well as Nigeria (Yeboah et al., 2003). It has long, slender stalks that can grow up to two or three meters high, each bearing a single tough, ovoid shaped leaf of varying sizes depending on the plant's age and habitat (Makinde & Taiwo, 2004). The leaf has been found to contain high amount of phytochemicals such as flavonoids, alkaloids, saponin, tannin anthraquinones and steroids. Traditionally, the leaf sap of this plant is used in the treatment of venoms, stings and bites, while the leaf and root sap have been used successfully as sedatives as well as in the treatment of mental illness (Onwueme et al., 1979).

Lipids are chemically heterogeneous group of compounds which are insoluble or sparingly soluble in water but however are soluble in non-polar solvent (Dhaliya et al., 2013). The biological relevance of lipids cannot be overemphasized as they function in varying capacities such as structural components of all membrane, medium for storage and transportation of metabolic fuel, carriers of fat soluble vitamins A, D, E and K etc (Newton, 2001). Lipids are classified as Total Cholesterol (TC), Triglycerides (TG), Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL) and Very Low Density Lipoprotein (VLDL) cholesterol which generally play essential role in the movement of cholesterol around the body (Ginsberg, 2001).

The human body is a complex machinery in which the homeostasis of various organs must be consistently maintained as any undesirable change will distort the balance and consequently results to diseased condition. It is pertinent to note that several medications and medication classes have been reported to affect the lipid profile of an exposed individual (Megan, 2018). Therefore, it is imperative to experimentally evaluate the effects of *T. daniellii* and *A. cordifolia* on the lipid profiles of rat model to ascertain their suitability as candidates for drug development.

2. Materials and Methods

2.1 Collection and Preliminary Processing of Plant Material

Leaves of *T. daniellii* and *A. cordifolia* were harvested from a farm located in Achara Uturu Isiukwuato Local Government Area of Abia State, Nigeria after which they identified at the herbarium unit of the Department of Forestry, Micheal Okpara University of Agriculture Umudike, Abia State Nigeria. The leaves separately washed thoroughly with clean water before being dried at room temperature. Dry leaves were ground to powder, sieved with a suitable wire mesh to obtain a fine powder which was subsequently stored in an air tight container.

2.2 Extraction of Plant Materials

One hundred gram (100g) each of the powdered sample materials was soaked separately in 1000ml of methanol and water and macerated at room temperature for a period of 72h. The mixture was agitated thrice daily. The mixture was strained and the damp solid material, pressed, and the combined liquids were filtered using cheesecloth and Whatman No. 1 filter paper. The filtrate was extracted using soxhlet apparatus for 5-6h and concentrated under pressure to dryness in rotary evaporator at 25-30°C (Phrompittayarat et al., 2008). The extracts were placed in the refrigerator and maintained at 5-10°C.

2.3 Animal

Twenty five (25) adult male albino rats (116-122g) were obtained from the Animal House of the Department of Pharmacology, University of Nigeria Nsukka and subsequently housed in plastic cages in a well ventilated room with a 12/12hr light/dark cycle and ambient temperature for three weeks to acclimatize.

2.4 Median Lethal Dose 50% Test (LD50)

Acute toxicity test was separately conducted on *T. daniellii* and *A. cordifolia* leaf samples. Three groups of three rats each were orally administered with 10mg, 100mg, and 1000mg/kg of sample substance before being observed for 24hrs. In the absence of mortality in any of the groups, another three groups of one rat each were administered with 1600, 2900 and 5000mg/kg of extract respectively and the animals were observed for 48 hrs (Lorke, 1983).

2.5 Experimental Design

Twenty five adult male wistar rats used for the study were grouped into five groups of five rats each and were subjected to treatment for 14 days as follows:

Group I (normal control) – 2ml/kg distilled water (p.o)

Group II – 200mg/kg aqueous extract of T.d (p.o)

Group III – 200mg/kg methanolic extract of T.d (p.o)

Group IV – 200mg/kg aqueous extract A.c (p.o)

Group V – 200mg/kg methanolic extract A.c (p.o)

2.6 Sample Collection and Determination of Lipid Profile

At day 14 of treatment, animals were sacrificed and blood collected via cardiac artery into plain bottle and allowed to clot. Serum was harvested from the clotted blood after centrifugation at 1500 rpm. The lipid profile such as Total cholesterol (TC), Triglycerides (TG), high density lipoproteins (HDL) and low density lipoproteins were estimated by standard methods (Rifai and King, 1986).

3. Statistical Analysis

Statistical analysis was carried out using IBM Statistical Package for the Social Sciences Statistical Package (SPSS)V 23.0. Data were expressed as means±SEM of three replicates

4. Result

Table 1. Lipid profiles of rats administered with aqueous and methanolic extracts of *T. daniellii* and *A. cordifolia*

Groups	LDL (mg/dL)	HDL(mg/dL)	TG(mg/dL)	TC(mg/dL)
Group I(Normal control)	33.20±0.10	51.80±0.10	51.17±0.08	63.83±0.10
Group II (200mg/kg aq. T.d)	31.21±0.04	47.31±0.10	48.80±0.02	64.64±0.49
Group III (200mg/kg met. Td)	30.15±0.04	40.23±0.01	47.40±0.23	62.27±0.28
Group IV (200mg/kg aq.Ac)	30.04±0.04	48.14±0.08	47.29±0.12	61.92±0.06
Group V (200mg/kg met. Ac)	30.12±0.05	46.21±0.06	46.09±0.12	61.42±0.13

Values are expressed as mean ± SEM from three determinations

5. Discussion

Lipids are organic compounds which are chemically heterogeneous and are insoluble or sparingly soluble in water but can dissolve in non-polar solvent (Dhaliya et al., 2013). Lipids function in varying capacities such as structural components of all membrane, medium for the storage and transportation of metabolic fuel, carriers of fat soluble vitamins A, D, E and K etc (Newton, 2001).

Table 1 shows the lipid profiles of rats administered with aqueous and methanolic leaf extracts of *T. daniellii* and *A. cordifolia*. Results obtained from the study indicate that group II administered with 200mg/kg aqueous leaf extract of *T. daniellii* manifested the highest level of Low Density Lipoprotein (LDL) (31.21±0.04 mg/dL) among the treatment groups i.e. (groups II-V) though not significantly differently from the control (33.20±0.10 mg/dL). Group IV administered with 200mg/kg aqueous leaf extract of *A. cordifolia* presented a higher level of High Density Lipoprotein (HDL) compared to other treated groups. It is important to note that the value recorded on the HDL level of Group IV is not significantly different from that of the control group (group I). Group II manifested the highest level of Triacylglyceride (TG) (48.80±0.02mg/dL) but however, was considered not significantly different from the control group (51.17±0.08mg/dL). For Total Cholesterol (TC), highest level (64.64±0.49mg/dL) was recorded on Group II and value was also not significantly different from that indicated on the normal control (63.83±0.10mg/dL). These results are consistent with the findings of Ama et al., (2015) and Shalom et al., 2018 which have shown the hypolipidemic potentials of ethanolic leaf extracts of *A. cordifolia* and *T. daniellii* respectively.

6. Conclusion

In conclusion, this research has shown that extracts of *T. daniellii* and *A. cordifolia* leaves have no adverse effects to on the lipid profiles of experimental model, a virtue which has presented them as ideal candidates for drug development.

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