Assessment of Anti-lipidaemic Effects of Aqueous and Ethanolic Seed Extracts of *Datura stramonium* on Male Albino Rats

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Authors' contributions

This work was carried out in collaboration among all authors. Author JY designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors GOS and MM managed the analyses of the study. Authors AAA and KBT managed the literature searches. All authors read and approved the final manuscript.

ABSTRACT

Aim: This study was carried out to investigate anti-lipidaemic effects of aqueous and ethanolic seed extracts of *Datura stramonium*.

Methods: A total of twenty five albino rats weighing between 150 – 180 g were used. They were divided into five groups each contained five rats. Group 1, was the normal control and thus
received normal saline. Groups 2 and 3 were treated respectively with aqueous extract at doses of 300 mg/kg and 600 mg/kg while groups 4 and 5 respectively received 300 mg/kg and 600 mg/kg ethanolic extract. The extracts were administered orally and the animals were sacrificed on the day 8 and the blood samples collected via retro-orbital plexus. The blood was then centrifuged after fifteen minutes and serum obtained for lipid profile analysis.

**Results:** The total cholesterol level generally decreased significantly (p < 0.05) in test groups, except in group 2 (0.502 ± .008 mg/dl) which received lower aqueous extract dose of 300 mg/kg. There was a significant decrease (p < 0.05) in triacylglycerol (TG) levels in groups of 2 and 3 (groups treated with aqueous extract) but indicated a significant (p < 0.05) increase in group 4 (0.15 ± .003 mg/dl) which received high ethanolic extract dose. The high density lipoprotein cholesterol (HDL-C) levels increased significantly (p < 0.05) in groups 4 and 5 with the mean values of 0.164 ± .002 mg/dl and 0.147 ± .004 mg/dl respectively. The mean values of the low density lipoprotein cholesterol (LDL-C) level generally indicated a significant (p < 0.05) decrease in all test groups, the decrease was more significant in groups 4 and 5 with mean values of 0.065 ± .00 mg/dl and 0.069 ± .00 mg/dl, when compared with groups 2 and 3.

**Conclusions:** This study proves that both aqueous and ethanolic extracts of *Datura stramonium* possess anti-lipidaemic property. The ethanolic extract had higher anti-lipidaemic property than the aqueous extract. Both extracts might be useful in the treatment of some cancers and cardiovascular diseases.

**Keywords:** *Datura stramonium*; aqueous extract; ethanolic extract; anti-lipidaemic; medicinal plants; cardiovascular diseases.

**1. INTRODUCTION**

Plants are known to have great potential for the treatment and management of certain diseases. Medicinal plants are becoming well-known in some countries of the world due to its efficacy and fewer side effects [1]. Approximately 80% of people from developing countries use traditional medicines for primary healthcare [2]. One of such plants is *Datura stramonium*. It belongs to family *Solanaceae*. It is native to Asia and Africa; widely cultivated and naturalized in tropic. In Nigeria especially in Kogi State, it is found growing as a weed in abandoned farmlands and dumpsites. Among its common names are Devil’s apple, Angel’s trumpet and Jimson weed but its indigenous names in Nigeria include: Zakami-Hausa, Gegemu – Yoruba and Myaramuo – Igbo [3]. In Igala it is called “Jegemi”. According to Shobha et al. [4], *Datura stramonium* contains different classes of phytoconstituents such as alkaloids, steroids, terpenoids, phenolics, flavonoids, saponins and glycosides. It is also found to contain carbohydrates and tannins [5]. It has been used to treat skin rashes, ulcers, bronchitis, jaundice and diabetes [6]. Recent insights have found role of anticancer of nutraceuticals, probably as a result of optimization of antioxidant agents by plant’s extracts [7]. The findings of Arowora et al. [8] revealed that the oral administration of ethanolic seed extract of *Datura stramonium* led to a significant improvement in the levels of blood lipid profile which was depicted in significant decrease in low density lipoprotein as well as total cholesterol level of some of treated groups. Cancers and cardiovascular diseases are a leading cause of morbidity and mortality in many countries [9]. Blood lipid levels have been identified as reliable determinants of risk factors for both cancer and cardiovascular diseases. This is because lipid metabolism plays a role in the biological processes driving the development of cancer [10]. Experimental evidence largely suggests that “statins”, a commonly used drug to lower cholesterol levels, reduce cancer risk, though further trials are needed [11]. Mehta et al., [12] also reported that hyperlipidaemia has been shown to be involved in colorectal tumour development; and initiation and progression of breast and prostate cancers. According to Jacob and Gastur [13], the immune system is thought to play a role in the link between HDL, APO A-1 and tumorigenesis. HDL was also proved to decrease free proinflammatory cytokine, tumour necrosis factor alpha (TNFα) which consequently reduces tissue damage, infiltration of macrophages and neutrophils, hence attenuates tumour formation [14]. The link between plasma lipids and coronary atherosclerosis, the underlying cause of cardiovascular diseases, has been established during past decades [15]. Among the controllable risk factors of cardiovascular diseases are hypertension, hyperlipidaemia, diabetes, stress and depression [16,17,18]. Despite a lot of investigation for novel
risk factor dyslipidaemia including high, low density lipoprotein cholesterol (LDL-C), low, high density lipoprotein cholesterol (HDL-C) and fasting triacylglycerol (TG) still remain and play major role for cardiovascular diseases [19].

2. MATERIALS AND METHODS

2.1 Experimental Animals

Twenty-five male albino rats weighing between 150 – 180 g were used. They were kept in sanitized cages under natural light and darkness at room temperature in the Animal House of the Department of Pharmacology, Prince Abubakar Audu University Anyigba, Kogi State. They were fed for seven days starter mash to acclimatize, and allowed unrestricted access to clean water.

2.2 Plant Collection

The ripe seeds of the plant were collected from dump site at Anyigba central market, Dekina Local Government, Kogi State, Nigeria.

2.3 Extraction Procedure

Ethanolic extraction: The ethanolic seed extraction was done according to the method described by Arowora et al. [8]. 38 g of the seed powder was soaked in 100 ml of 70% (v/v) ethanol for 48 hours and the filtrate was concentrated using water-bath. The concentrated extract was diluted with normal saline at 100 mg per ml.

Aqueous extraction: The aqueous seed extraction was carried out following the method of Sofowara, [20]. 5.0 g of the seed powder was soaked in 500 ml of water. The filtrate was evaporated on the water-bath to a weight of 15.8 g and diluted with normal saline at 100 mg per ml.

2.4 Sample Preparations

The seeds were air-dried and weighed to a constant weight and then ground into powder using an electrical grinder.

2.5 Experimental Design

The animals were grouped into five (5) and received the extracts as follows:

Group 1: The normal control (administered normal saline)
Group 2: Received 300 mg/kg body weight aqueous extract
Group 3: Received 600 mg/kg body weight aqueous extract
Group 4: Received 300 mg/kg body weight ethanolic extract
Group 5: Received 600 mg/kg body weight ethanolic extract

2.6 Blood Collection

On the 8th day, the rats were sacrificed after 12 hours of starving. The blood samples were collected from retro-orbital plexus for serum obtained for lipid profile analysis.

2.7 Biochemical Analysis

The concentrations of total cholesterol, triacylglycerol, high density lipoprotein (HDL) and low density lipoprotein (LDL) were determined using an auto-analyser URIT-810.

2.8 Statistical Analysis

The data obtained were analysed using one-way analysis of variance (ANOVA) and results were expressed in mean ± standard deviation (Mean±SD). Post hoc was employed to separate and compare means. A value of p < 0.05 was considered significant for all the results.

3. RESULTS

Table 1 shows the concentrations of some serum lipid profile of the experimental albino rats. The total serum cholesterol decreased significantly (p < 0.05) in groups 4 and 5 but non-significant (p > 0.05) in group 3 compared to the normal control; except in group 2 where it showed significant (p < 0.05) compared to the control. The serum triacylglycerol decreased significantly (p < 0.05) in groups 2 and 3 but indicated a non-significant (p > 0.065) increase in group 4 compared to control. HDL-cholesterol in groups 4 and 5 showed a significant (p < 0.05) increase however decreased significantly (p < 0.05) in groups 2 and 3 when compared to the control. LDL-cholesterol decreased across the test groups significantly (p < 0.05) compared to the normal control.
4. DISCUSSION

The search for effective pharmaceuticals for prevention and treatment of cancers and cardiovascular diseases (CVDs) has been a major part of biomedical scientists’ efforts. Blood lipid profiling could help greatly in achieving this objective, for its ability to reveal the extent of risk to which individuals are faced [18]. In this study effect of administration of aqueous and ethanolic seed extracts of *Datura stramonium* on lipid profile of albino rats were investigated. The total cholesterol in groups 4 and 5 decreased significantly (P < 0.05) compared to the normal control (group 1) and with groups 2 and 3. This might be due to difference in concentration of the active anti-cholesterol compounds which appeared to be higher in ethanol than in aqueous, is in line with work of Imo et al. [21]. The reduction in cholesterol level could be as a result of high level of HDL which might have transported it to the periphery [20,22]. As observed in the table, there is an inverse relation in the levels of total cholesterol (0.156±0.000, 0.186±0.010) and corresponding HDL (0.164±0.002, 0.147±0.004) of groups 4 and 5. The low density lipoprotein also decreased significantly (p < 0.05) with treatment using both extracts. Consequently, transport of cholesterol from the body into the blood stream is greatly reduced. Increased HDL cholesterol implicates that the extract can prevent atherosclerosis which initiates cardiovascular diseases and kill tumour [12,11]. It was also observed that the decrease in LDL-cholesterol level was more significant (p < 0.05) in the groups treated with aqueous extract than with ethanolic one. Conversely, the increase in HDL-cholesterol level was significantly (p < 0.05) higher in groups administered ethanolic extract compared to HDL-cholesterol level of the groups treated with aqueous extract. It could be inferred that the anti-LDL-C agent(s) was probably more available in water medium than ethanol, whereas anti-HDL-C agent(s) had higher concentration in ethanol than in water.

5. CONCLUSION

The results of this study indicated that both aqueous and ethanolic extract of *Datura stramonium* seeds are potential source of agent(s) that could reduce cholesterol, triacylglycerol and low density lipoprotein (LDL) but increase the high density lipoprotein (HDL). The extract has a desirable property that improves disorders associated with lipid profile such as cancers and cardiovascular diseases.

ETHICAL APPROVAL

As per international standard or university standard ethical approval has been collected and preserved by the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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