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Original Research Article

Effects of ethanolic extracts of *Datura metel* on blood lipid profile of male albino rats

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ABSTRACT

Background: This study was carried out to investigate the effects of *Datura metel (*leaf, seed and fruit*)* on blood lipid profile of male albino rats.
Methods: Thirty-five albino rats (8 weeks old) weighing between 66g and 84g were purchased and randomly allotted into 7 groups. The normal control (group 1) received normal saline, while groups 2 to 7 received extracts of *Datura metel* at low (300 mg/kg body weight) and high doses (600 mg/kg body weight). The extracts were administered orally for seven consecutive days, while the animals were sacrificed on the 8th day; blood samples were collected, allowed to stand for fifteen minutes and then centrifuged.
Results: There was a general decreasing trend in the mean values of low density lipoprotein levels across the groups, however, group 7 (with lowest value) was found to be significantly lower ($p < 0.05$) than other groups when compared with the normal control. Also, there was a general decreasing trend in the values of high density lipoprotein compared with normal control group, however lowest value was recorded to be 1.35±0.06 mmol/l for group 5. There were no significant differences ($p > 0.05$) in triglyceride levels across the groups, while total cholesterol in groups 5 and 6 had significant differences with values of 2.05±0.06 mmol/l and 2.13±0.10 mmol/l respectively when compared with the normal control.
Conclusions: This study suggests that ethanolic extracts of *Datura metel* have active ingredients that are capable of improving blood lipid profile and this might be useful in the management of cardiovascular diseases.

Keywords: Albino rats, Blood, *Datura metel*, Ethanolic extract, Lipid profile, Body weight

INTRODUCTION

Datura metel which belongs to the family Solanaceae and commonly known as Thorn-apple and Devil's trumpet, is a Nigerian medicinal plant widely used in phyto-medicine to cure diseases such as asthma, cough, convulsion and insanity. The leaves and seeds are widely used in herbal medicine as anaesthetic, antispasmodic, bronchodilator and as hallucinogenic.[1] Various species of *Datura* are known and widely employed for their medicinal and toxic properties that are based upon more than 30 alkaloids. In China, it is known as "Yangjinhua" and used for the treatment of asthma, convulsions, pain, and rheumatism.[2] It is used in Italy to remove lice from hen bundles. *Datura stramonium* seeds are used for the treatment of acne and bronchitis in Sakarya province of north-west Turkey and locally called "Tatala", while the petroleum ether extract is reported to possess antimicrobial activities against *Esherichia coli* and *Trachystemon orientalis.*[3] It is also used commonly in ethno veterinary practices in Nepal, and by Gujjar community in India.[4,5] *Datura* seeds have been used as a prophylactic measure to treat animal bites, especially dog bites. A person bitten by mad dog is administered a juice

of *Datura* along with butter milk and jaggery. Also, the site of bite is smeared with a paste of the fruit.[6]

Datura metel, is an erect shrub with spreading branches. A perennial herbaceous plant, and can reach a height of 2.0 m. Its leaves are simple, alternate, dark green, broadly ovate, shallowly lobed and glabrous. Flowers are large, solitary and trumpet-shaped with a sweet fragrance usually appreciated in the mornings and evenings, with a wide range of colours (ranging from white to yellow and light to dark purple). The flowers are hermaphrodite and are pollinated by insects. The fruit is in the form of a capsule with short spines.

Datura can tolerate average soil, though prefers soil which is rich and moist or very alkaline soil, but hardly survives under shade. *Datura* probably is of American origin and widely cultivated in all tropical and subtro pical regions for its beautiful flowers.[7] *Datura metel* can also be found in East Asia or India, and is used in traditional herbal medicine. In Traditional Chinese Medicine, the flowers of *Datura metel* are known as baimantuoluo and used for skin inflammation and Psoriasis. In Ayurvedic medicine, seeds of *Datura metel* are used to treat skin rashes, ulcers, bronchitis, jaundice and diabetes.[7] In Brazil, the seeds are used for tea making which serve as a sedative, while the flowers are dried and smoked as cigarettes.[7] There are various species of *Datura* which are now cultivated for the production of secondary metabolites.

Excessive doses of *Datura metel* can cause hallucinations, intoxication and death. The window of toxic and medicinal effects may be quite small. With medium doses, recovery can occur in 12 - 24 hours, however, with loss of memory and confusion that may last for days, no other psychoactive substance has received as many severely negative experience reports as *Datura*. Children are especially vulnerable to atropine poisoning, and its prognosis is likely to be fatal. *Datura metel* is bitter tasting and is considered as an anaesthetic, anti-asthmatic, antispasmodic, hallucinogenic and hypnotic agent. Its dried seeds are considered a more powerful soporific than the leaves.[8]

In view of extensive traditional utilization of *Datura metel* and considering the fact that limited information is available on the lipid profile effects of *Datura metel*, this study was carried out to investigate the effects of administering ethanolic extracts of leaf, seed and fruit of this plant on blood lipid profile in male albino rats.

METHODS

Experimental animals

Thirty-five male albino rats (8 weeks old) were used for the laboratory experiment. They were housed in properly sanitized cages under natural light and dark cycles at room temperature in the animal house of the Department of Biochemistry, Federal University Wukari, Taraba State. The animals were purchased from National Veterinary Research Institute (NVRI), Vom, Jos, Plateau State. They were fed for one week on rat grower mash in order to acclimatise them environmentally and on feed intended for experimentation. During the experiment, they had access to feed and water *ad libitum.*

Plant collection

The plant materials were harvested for four days from a dump site at Wapan-Nghaku (popularly known as T-junction), Wukari local government area of Taraba State. The harvesting took place in the morning between 9.00 and 11.30 a.m. for the period between 1st and 4th March, 2016. The leaves, seeds and whole fruit were collected and sun-dried till they are properly dried and then ground into powder.

Extract preparation

Seventy per cent (70%) ethanol solution was prepared and it was used to soak the three ground samples separately. Three hundred (300) ml of 70% ethanol solution was used to soak 114 g of leaf sample, 100 ml of the solution was used to soak 38 g of seed, while 110 ml was used to soak 48 g of fruit. The mixtures were then filtered after 48 hours and the filtrates were collected separately. The filtrates were concentrated using a water bath set at 78°C in order to evaporate the ethanol. The concentrated extract was diluted with normal saline at the rate of 100 mg per ml.

Experimental design

The animals were grouped into seven (7) and received the extracts as follows:

Group 1- The normal control (they were administered normal saline only).
Group 2- Received 300 mg/kg body weight of leaf extract.
Group 3- Received 600 mg/kg body weight of leaf extract.
Group 4- Received 300 mg/kg body weight of seed extract.
Group 5- Received 600 mg/kg body weight of seed extract.
Group 6- Received 300 mg/kg body weight of fruit extract.
Group 7- Received 600 mg/kg body weight of fruit extract.

The extract was administered to the animals orally for seven (7) consecutive days.

Blood collection

The animals were starved for 12hrs before sacrifice. On the 8th day, they were anaesthetised, sacrificed and the blood samples collected via cardiac puncture. It was allowed to stand for about 15 minutes and further spun in

a centrifuge. Serum was separated and used for the biochemical analysis.

Biochemical analysis

The concentrations of the lipid profile parameters (total cholesterol, HDL, LDL, TG and VLDL) were determined using an auto-analyser: Selectra ProM.

Statistical analysis

Statistical analysis was carried out with the use of standard student-t-distribution test: using Statistical package for social sciences (SPSS) version 21 and group means were compared for significance at ($p \leq 0.05$). Data were presented as mean±standard deviation (n=5).

RESULTS

The concentration of plasma lipid profile of the experimental albino rats is as shown in Table 1. The total plasma cholesterol and LDL-cholesterol of rats administered low and high doses of leaf, seed and fruit extract decreased across the group compared with control with exception of group 2 treated rats for total plasma cholesterol. Also, plasma HDL-cholesterol decreased non-significantly ($P > 0.05$) across the groups compared with the normal control group, whereas the plasma VLDL-cholesterol increased non-significantly across the groups compared to the control. However, no definite trend was observed in the plasma triglycerides of treated groups (2-7), compared to the control.

Table 1: Concentrations of lipid profile parameters (mmol/l).

Groups	HDL	LDL	VLDL	Total Cholesterol	Triglycerides
Group 1	1.78±0.17[a]	0.38±0.10[a]	0.20±0.14[a]	2.40±0.08[a]	0.75±0.08[a]
Group 2	1.53±0.13[a]	0.34±0.16[a]	0.35±0.06[a]	2.40±0.18[a]	0.83±0.10[a]
Group 3	1.65±0.06[a]	0.25±0.13[a]	0.33±0.05[a]	2.18±0.10[a]	0.70±0.08[a]
Group 4	1.55±0.13[a]	0.33±0.10[a]	0.35±0.06[a]	2.23±0.17[a]	0.75±0.13[a]
Group 5	1.35±0.06[b]	0.30±0.08[b]	0.40±0.08[a]	2.05±0.06[b]	0.80±0.16[a]
Group 6	1.45±0.13[a]	0.33±0.15[a]	0.38±0.05[a]	2.13±0.10[c]	0.83±0.10[a]
Group 7	1.53±0.10[c]	0.20±0.00[c]	0.28±0.05[a]	2.16±0.31[a]	0.73±0.10[a]

Results represent mean±standard deviation of group results obtained (n=5). Mean in the same column, having different letters of the alphabet are statistically significant ($p < 0.05$) compared with the normal control (group one). HDL = High density lipoprotein, LDL = Low density lipoprotein, VLDL = Very low density lipoprotein.

DISCUSSION

The global world today is challenged with cardiovascular diseases. Some of the key manifestations include coronary heart diseases, stroke and hypertension. Elevated concentrations of plasma lipids are risk factors in cardiovascular problems and important lipids whose elevations are implicated in these conditions are cholesterol and triglycerides.[9] Lipids are transported in the blood by combination of lipids and proteins complexes called lipoproteins.[10] The main identified determinants of hyperlipidemia are increased LDL-cholesterol and reduced HDL-cholesterol.[11] Thus, any attempt to lower serum concentrations of LDL and increase HDL concentration is considered as one of the strategies that can hinder or delay the on-set of chronic disorders that are associated with hyperlipidaemia in humans.[12] In this study, the effects of administering *Datura metel* on seven groups of albino rats were investigated. It was revealed that the levels of Total plasma cholesterol and LDL-cholesterol decreased across the groups (except group 2) compared to the normal control (group 1). This observation is an indication that there is reduction of cholesterol transported by LDL-cholesterol from extracellular fluids to the blood vessels, hence this would reduce accumulation of plasma cholesterol in the blood vessels in a process that would lead to retrogression of atherosclerosis. This observation is similar to the researches on lipoprotein and lipid studies which emphasised a positive relationship between the plasma total cholesterol, LDL-cholesterol, VLDL-cholesterol and triglycerides on one hand and the risk of cardiovascular disease on the other.[12-15]

There was general decrease in the levels of HDL-cholesterol across the groups compared to the control (group 1), this might be due to the effects of administration of *Datura metel* on the reduction of synthesis of HDL in albino rats. Although increasing concentration of HDL particles are strongly associated with decreasing accumulation of atherosclerosis within the walls of arteries. This is important because atherosclerosis eventually results in sudden plaque ruptures, cardiovascular disease, stroke and other vascular diseases. However, the HDL decrease which was observed in this study across the treatments could be seen to have slight semblance with the study which showed that HDL-lacking mice still have the ability to transport cholesterol to bile, suggesting that there are alternative mechanisms for cholesterol removal from the blood.[16]

The levels of plasma VLDL- cholesterol in this study increased non-significantly (P >0.05) across treatment groups compared to the control group. VLDL is a type of protein synthesised by the liver, hence it could mean that *Datura metel* extracts had varying influence on its synthesis. VLDL-cholesterol and LDL-cholesterol are referred to as bad cholesterol, since they transport cholesterol from extracellular body fluids to the blood vessels. However, the highest value was shown by group 5 rats that had 0.40±0.08 mmol/l, while the lowest value was recorded for normal control (group 1) to be 0.20±0.14 mmol/l. The increased levels observed in the levels of VLDL-cholesterol across treatment groups in this study is at variance with the reports of some Researchers who did similar work on lipid study.[12-15]

There was no definite trend in the levels of plasma triglycerides across treatment groups compared to the control. This observation could be as a result of varying responses (in terms of synthesis of triglycerides in the liver) of the groups administered the extracts of *Datura metel* which contain tropane alkaloids. It is therefore necessary to carry out further research with the view of elucidating or establishing the mechanism of action of extracts of *Datura metel* on lipid research. The observation in this study is similar to the research carried out by who reported that diets rich in vegetables did not affect total plasma triglycerides in twelve healthy Eskimos with ages ranging from 21 to 56 years and also to that of experimental rats fed rat cubes and extracts of leafy vegetable formulated diets, as it showed non-significant levels in the plasma triglycerides of the experimental rats.[15,17] The highest level of triglycerides in this study was obtained in groups 2 and 6 experimental rats with the value of 0.83±0.80 mmol/l, while the lowest was recorded for group 3 Albino rats with the value of 0.70±0.08 mmol/l. Triglycerides is the most common type of lipid synthesised in animals. The body converts any form of excess calories into triglycerides for long term storage. High levels of triglycerides are related to a higher risk of heart and blood vessels.

CONCLUSION

The findings from this study showed that oral administration of ethanolic extract of *Datura metel* led to a significant improvement in the levels of blood lipid profile, which depicted in significant decrease in LDL as well as total cholesterol level of some treated groups. However, no significant differences (P >0.05) were observed on the levels of triglycerides and VLDL among treatments. It was found that the blood lipids of the rats were within normal range, hence administration of extracts of parts of *Datura metel* may have no negative or deleterious effects on the lipid profile of the animals. This research work showed that the oral administration of the fruit and seed of the plant extract possess some degree of hypolipidemic activity and may be useful in the management of cardiovascular disease.

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