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Toxicity of *Datura stramonium*, *Capsicum frutescens* and their mixture to Bovan chicks

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Summary

The effect of diet containing 10% *Datura stramonium*, 10% (w/w) *Capsicum frutescens* and their mixture (5+5%) to Bovan-type chicks treated for two weeks was investigated. No death among the chicks fed the tested diet was observed during the period of the experiment. Depression in growth, loss of appetite and hepatonephrotoxicity were observed in ckicks fed a diet containing 10% *Datura stramonium*, in addition to tremor in chicks fed 10% (w/w) *Capsicum frutescens*. The 10%(w/w) *Datura stramonium*, 10% (w/w) *Capsicum frutescens* and the mixture of the two plants were toxic but not lethal to Bovan-type chicks. Alterations of serum AST and ALT activities and total protein, albumin, globulin, cholesterol and uric acid were correlated with hematology and histopathological effects on vital organs.

Introduction

Datura stramonium, a member of the family Solanaceae (Nightshade family), has different common names, Jimson weed, Thorn apple, Devil's apple and Stink weed (Fuller and McClintoke1986). It is commonly found in moderately good soil but prefer rich light, sandy or a calcareous loam and an open sunny position (Huxley, 1992). All parts of the *D. stramonium* contain atropine alkaloid and are recognized officially as drugs in pharmacopoeias (Grieve, 1998). Scopolamine and hyoscyamine are also compounds of *D. stramonium* and have been used in medicine as they have antispasmodic effects on the gastrointestinal tract, anti-secretory effects used to control salivation during surgery and mydriatic effects facilitating ophthalmic examination. Traditionally smoked leaves of *D. stramonium* were used as an anti-spasmodic in the treatment of asthma, the seeds were used in the treatment of stomach and intestinal pain, toothache and fever and the fruit juice was applied to the scalp to treat dandruff (Foster and Duke, 1990)

Capsicum frutescens is a member of the family Solanaceae and is also known as Red pepper, hot pepper African chili and Paprika (Migahid 1996). It is a spicy flavoring for food and the pepper with removed seeds are eaten as a vegetable in many parts of the world. The active ingredients include oily compounds called oleoresins which

temporarily irritate the eyes. Traditionally, it is used topically as a rubefacient; gurgle for laryngitis and orally as a gastrointestinal stimulant.
The active ingredient is an irritant capsaicin which has been used in scientific studies to evaluate pain sensation and diverse effect of topical administration is burning following contact with moist mucous membranes (Barnes *et al*, 2002). The phytochemical extract of capsicum has been shown to exhibit more antioxidant activity than carrots, Broccoli or Spinach (Chu *et al*., 2002).

The objective of the present study was to investigate the effect of these two plants or their mixture on growth performance, some biochemical, haematological parameters and histopathological changes on Bovans-type chicks.

Materials and Methods

Plant material: *Datura stramonium* was collected from the farm of the farm of the Faculty of Agriculture, University of Khartoum and *Capsicum frutescens* was purchased from the local market, both dried in shade, cleaned and separately mixed in starter diet (Table 1).

Experimental design: Forty, one-day old male Bovans-type chicks obtained from Coral Company, Khartoum were used. They were reared in pens within the premises of the Collage of Veterinary Medicine and Animal production, Sudan University of Science and Technology, Khartoum North. They were fed starter and provided with free access to water for 14 days (adaptation period). The pens were illuminated at night and early morning throughout the experimental period. The experiment was carried out during the year 2006. At the age of 14 days the chicks were allotted at random to 4 groups each of 10 chicks. Group 1 chicks served as control and were fed starter ration, group 2 fed 10% (w/w) of ground *D. stramonium* diet, , group 3 fed was fed 10% of *C. frutescens* diet and group 4 fed the mixture of the two plants (5%(w/w) *D. stramonium* and 5%(w/w) *C. frutescens*) for 14 days. Average body weight and body weight gain were recorded weekly for each group and the clinical signs were recorded. Chicks from each group were slaughtered by the end of the experimental period and the blood was collected for haematological and biochemical examination and vital tissue specimen were fixed in 10% neutral buffered formalin for pathological examination.

Haematological parameters: Blood samples were collected into dry test tube containing heparin and examined for Haemoglobin (Hb) concentration, Packed Cell Volume (PCV), Red Blood Cell (RBC) count, Mean
Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), and Mean Corpuscular Haemoglobin Concentration (MCHC).

Serobiochemical method: Sera were analyzed for the activities of Aspartate transaminase (AST), Alanine transaminase (ALT) and for the concentration of total protein, albumin, globulin, uric acid and cholesterol using commercial kits (Linear Chemicals, Barcelona, Spain).

Table 1: Composition of the starter diet

Ingredient	Percentage
Sorghum	62
Sesame cake	14
Groundnut cake	12
Wheat bran	05
Marble dust	01
Dicalcium phosphate	01
Super concentrate	05
Total	100

Source: Commercial ration from local market.

Pathological methods: Post-mortem findings were recorded and specimens of tissues (liver, heart, kidney, and intestines) were collected immediately after slaughter of chicks, fixed in 10% neutral buffered formalin and imbedded in paraffin wax, sectioned at 5µmand stained with Haemotoxylin and Eosin (H & E).

Statistical methods: The significance of differences between means was compared at each time point using Duncan's multiple range tests after ANOVA for one -way classified data (Snedecor and Cochran, 1989).

Results

Clinical observation: Chicks on the 10% (w/w) *D. stramonium* diet (group 2) and those on the 5% (w/w) mixture of the two plants (group 4) showed loss of appetite and reduced food consumption. One chick in-group 4 showed tremor and inability to move but there was no mortality among the test groups along the period of the experiment.

Effect on growth: The growth changes in chicks receiving 10 % (w/w) *D. stramonium*, 10% *C. frutescens* and 5% mixture of the two plants for two weeks are shown in Table 2. In all test chicks there was depression in mean body weight and weight gain ($p<0.05$) at the end of the experiment, as compared with the control chicks (group 1).

Histopathological changes: The liver of the chicks in groups 3 and 4 showed fatty change, congestion and haemorrhage in addition to lymphocytic infiltration and individual cell necroses in group 3 (Fig 1). Only mild fatty change was observed in the liver of the chicks fed 10 %(w/w) *D. stramonium* (group 2).

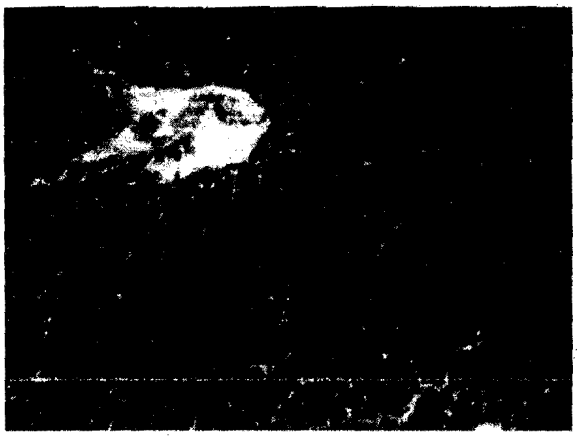

Fig. 1: Lymphocytic infiltration and individual cell necrosis in the liver of chicks fed 10% *Capsicum Frutescens* for 2 weeks (H & E X100)

Haematological changes: No significant differences in the values of Hb, RBC, PCV, MCH or MCHC were observed during the 2 weeks feeding in the test chicks than the controls.

Serobiochemical data: The effects of dietary *D. stramonium* (group 1) and *C. frutescens* (group 2) and their combination (group 4) on AST and ALT activities and the concentration of total protein, albumin, globulin, cholesterol and uric acid concentration in the serum of Bovan-type chicks are given in Table 3. Significant differences ($p<0.05$) were observed in ALT, total protein, albumin between the chicks fed 10% (w/w) *D. stramonium* (group 2), 10% (w/w) *C. frutescens* (group 3), and their combination (group 4) and the controls (group 1). AST activity was higher ($p<0.05$) in group 2 but there was a significant lower concentration of cholesterol and globulin in group 4 compared to the other two groups.

Discussion

The results of the present study revealed that feeding Bovans chicks with diet containing 10% (w/w) *D. stramonium*, 10 %(w/w) *C. frutescens* or their combination at 5%, each of the plants were toxic but not lethal as evidenced by impairment of growth, lesions in vital organs and serobiochemical alterations.

Table 2. Changes in body weight and weight gain of Bovans chicks given *D. stramonium* and *C. frutescens* or their mixture for 14 days.

Groups	Parameters		
	Body weight day (0) of treatment	Weight gain at week one	Weight gain at week two
G1 (control)	94.6±6	24±1.2	45± 6.3
G2 (*D. stramonium*)	87±3.6 NS	22 ± 3.3 NS	15± 0.9*
G3 (*C. frutescens*)	90± 5.2 NS	9± 2.9 NS	25±2.9*
G4 (mixture)	85± 2.1 NS	21± 4.1 NS	16±1.2*

Values are expressed as means=±SE. N.S= Not significant. *=Significantly at $p<0.05$

Table 3: Serobiochemical changes in chicks fed *D. stramonium* and *C. frutescens* or their mixture for 14 days

Parameters	Groups			
	1 Control (normal diet)	2 10%*D.stramonium*	3 10% *C.frutescens*	4 5% Mixture of two plants
Total protein (g/dl)	2.54± 0.13	0.95±0.28*	1.14± 0.17*	0.91± 0.13*
Albumin (g/dl)	1.5± 0.08	0.28±0.09*	0.28± 0.2*	0.62± 0.05*
Globulin (g/dl)	1.04±0.2	0.67± 0.4 NS	0.86+0.28 NS	0.29± 0.09*
Cholesterol (g/dl)	156.5±5.7	91.8±5.1*	162.9± 5.5 NS	157± 11.4 NS
Uric acid (g/dl)	4.04±0.19	3.25±0.82 NS	2.13±0.06 NS	2.06± 0.12 NS
AST (iu)	18.2±0.6	31.2±4.9*	17+2.2 NS	16.7+2.4 NS
ALT (iu)	15.6±0.93	6± 0.82*	7.75± 3.5*	5.5±0.59*

Values are expressed as means=±SE. N.S= Not significant. *=Significantly at $p<0.0$

It is well known that the susceptibility of animals to feeding plant materials is dependant, at least, on the type of the active constituents and the concentration in the amount added to the diet as well as on the rate of their metabolic conversion in the liver to metabolites and consequent excretion. For chicks the dietary levels of (2 and 10 % (w/w)) represented non-toxic concentration of plants exemplified by *N. sativa* (Al-Homidan *et al.*, 2002), *Cassia obtusifolia* (Herbert and Flory 1983) and *C. Occidentalis* (Mercer *et al,.* 1967). On the other hand, concentrations of 5% of dietary *Azadirachta*

indica and *Rhazya stricta* have been found toxic to chickens (Ibrahim *et al.*, 1992) and rodents (Adam, 1999).

Body weight and weight gain were decreased in birds on 10% *D. stramonium*, 10% *C. frutescens* diets which suggests that the plant seeds contain one or more toxic substances that impaired growth and decreased their rate of excretion by the injure kidneys. The mechanisms whereby the plant constituents exerted their effects can not be stated from the present study, but injury of vital organs probably contributed to the increased serum AST or ALT activities and decreased serum total protein, albumin and globulin concentration. Necropsy findings and serum chemistry indicate that *D. stramonium* and *C. frutescens* caused hepatic damage in chicks. It is necessary, however, to consider the possibility of injury to other organs such as the heart and kidneys as a factor contributing to the changes in the activity of AST in serum of the experimental chicks since this enzyme is not liver specific.

On the other hand, the significant decrease of serum total protein level was noticed in chicks which had been fed *Ricinus communis* or *Arbus precatorius* (El Badwi *et al*, 1992; Omer *et al.* 1993). The absence of changes in uric acid concentration in serum of the plant fed chicks indicates non significant nephropathy.

There were no changes in Hb, RBC, PCV, MCH, and MCHC in this study. Bakhiet and Adam (1996) stated the occurrence of macrocytic anaemia in chickens fed a diet containing 10%(w/w) *Cassia italica* seeds. The same sign were observed in rats which had been fed *Artemisia abyssinica* (Adam *et al.*, 2000).

In conclusion this study demonstrated that *D. stramonium* and *C. frutescens* are toxic but not lethal to Bovan-type chicks at the concentration used in the test diet.

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