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The Effect of Dietary *Alpinia officinarum* (Hance) Supplementation in Bovns-type Chicks

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Abstract: The galangal (the rhizome of *Alpinia officinarum*, Hance) is popular as a traditional herbal medicine. The present study investigates the effect of diet containing 2%, 5% and 10 % of *A. officinarum* (Hance) on the biochemical, haematological and histological parameters in Bovans-type chicks treated for 4 weeks. The body weight of the chicks revealed that feeding levels of 2, 5 and 10% dietary *A. officinarum* was significantly decreased ($p<0.05$ - 0.01) compared to the control chicks. Significant changes were observed in the activities of AST and ALT and the concentration of total protein, uric acid, albumin and globulin and cholesterol levels. Mild degenerative changes were observed in the liver and kidneys of chicks while no significant differences were recorded in haematological parameters.

Key words: *Alipinia officinarum*, bovans-type chicks, Zingiberaceae

INTRODUCTION

Alipinia officinarum belongs to the family Zingiberaceae and known as Galangal (Shin *et al*., 2002). The genus *Alpinia* was named by Plumier after Prospero Alpino, a famous Italian botanist of the early seventeenth century. The name Galangal is derived from the Arabic *Khalanjan*, perhaps a perversion of a Chinese word meaning 'mild ginger'. The plant is an annual plant and is distributed in Southern China.

Alpinia officinarum Hance, a famous traditional medicine, has been used as an aromatic stomachic, analgesic, and antiemetic. Its rhizome has long been used as an anti-arthritic, an antiphlogistic, a carminative and an anti-spasmodic in oriental medicine (Jung and Shin, 1990). Some bioactive components of this plant have been reported as diarylheptanoids, flavonoids and essential oils as 5-reductase inhibitors, PGD2 inhibitors, anti-emetic and anti-oxidative components (Heo *et al*., 2001; Kang *et al*., 2000; Kim *et al*., 2003; Ly *et al*., 2002; Sun *et al*., 2008; Shen *et al*., 1998; Shin *et al*., 2002; Lee *et al*., 2009);

The objective of the present study was to investigate the effect on Bovans-type chicks fed the plant with different levels through haematological, pathological and serobiochemical parameters in pursuance of our investigations of the toxicity of traditionally used medical plants (El Badwi *et al*., 1992; Bakhiet and Adam, 1996; Adam *et al*., 2000; Adam *et al*., 2001; Bakhiet and Ibrahim, 2006).

MATERIALS AND METHODS

Plant material: *Alpinia officinarum* Hance, was purchased from a local market in Omdurman, Sudan; ground separately with mortar and pestle and then mixed in a basal diet (Table 1).

Table 1: Percent composition of basal diet

Ingredients	%
Sorghum	58
Soybean	4
Sesame cake	14
Groundnut cake	12
Wheat bran	5
Marble dust	1
Declaim phosphate	1
Super concentrate	5
Total	100

Experimental design: Forty, 1- day-old Bovans chicks were purchased from Coral Company Ltd, Khartoum and housed within the premises of the College of Veterinary Medicine and Animal Production, Sudan University of Science and Technology, Khartoum-North, Sudan under illumination (23 h/day) with starter diet and water provided *ad Libitum*. The study was conducted in May 2009. After two weeks, the chicks were allotted at random to 4 groups of 10 chicks each. Group 1 was the control and fed normal basal diet. *Alpinia officinarum*, was finely ground, thoroughly mixed with the normal basal diet and fed to chicks at 2, 5 and 10% each group

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2, group 3 and group 4 respectively for 4 weeks. Average body weight and weight gain were measured weekly for each group. Chicks were slaughtered after 2 and 4 weeks for pathological examinations. Blood samples were collected from each chick at slaughter for haematology histopathology and serum chemistry analysis.

Blood analyses: Red Blood Cell (RBC) count, Haemoglobin (Hb) concentration, Packed Cell Volume (PCV) were evaluated (Schalm *et al*., 1975).
Serum samples were analyzed for the activities of Aspartate Transaminase (AST) and Alanine Transaminase (ALT), total protein, albumin, globulin, cholesterol and uric acid concentrations using commercial kits (Linear Chemicals, Spain)

Pathological examinations: Post-mortem examinations were conducted on all chicks to identify gross lesions and specimens of intestine, liver, spleen, proventriculus, kidneys and heart were fixed in 10% neutral buffered formalin, embedded in paraffin wax, sectioned of 5µm and stained with haematoxylin and eosin (H&E) for histopathological examinations.

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

RESULTS

Clinical observations: All treated groups were clinically healthy and there were no mortality along the feeding period of *A. officinarum*.

Effect on growth: The effects of dietary levels of *A. officinarum* when fed at 2%, (group 2), 5% (group 3) and 10% (group 4) of the basal diet on mean body weights is presented in Table 2. The body weights of the control chicks (group 1) were significantly higher ($p<0.05$) than chicks in group 2, 3 and 4 at the feeding period. Significant decrease in body weight was observed in all fed group 2 , 3 and 4 throughout the feeding period of *A. officinarum*.

Pathological changes: No significant changes were observed in the control chicks group 1. Group 2 (2% *A. officinarum*) showed congestion in liver, enlarged heart and slight congestion in muscle. In group three (5% *A. officinarum*) there was enlarge spleen and congested in intestine. Group four (10% *A. officinarum*) showed fatty changes in the liver and congestion of the sinusoids and lymphocyte infiltration. The lungs in group 4 showed congestion while no changes were seen in the spleen or heart muscle.

Haematological changes: There were significant decreased ($p<0.05$ - 0.01) in Hb, PCV and RBCs in the test groups when compared to control groups (Table 2) and no significant change was observed during the 2-weeks and the 4-weeks feeding in the control chicks

Serum chemistry: The effects of *A. officinarum* on AST and ALT activities and concentrations of total protein, albumin, cholesterol and uric acid in the serum of Bovans - type chicks are given in Table 3. Analysis showed significant differences ($p<0.05$) in AST and ALT between the *A. officinarum* -fed chicks groups 2, group 3 and group 4 and the controls group 1. Total protein concentration was slightly higher ($p<0.05$) in group 2, 3 and 4at week four. There were no significant changes in albumin and cholesterol; concentration during the 4 weeks. Uric acid concentration was higher ($p<0.05$) in groups 2, 3 and 4 than the control group during the whole experimental period.

Table 2: Growth changes in chicks fed *A. officinarum* for 4 weeks

	Body wt/gm			
Group	Week 1	Week 2	Week 3	Week 4
G1 Control	98±3.12^{ns}	150.6±1.98*	179±3.12*	290.11±2.54*
G2 2% *A. officinarum*	94±3.61^{ns}	141± 2.31*	183±1.21*	270±2.81*
G3 5% *A. officinarum*	92±2.21^{ns}	149±2.23^{ns}	173±2.35*	249±3.13*
G4 10% *A. officinarum*	95±1.13^{ns}	141±1.9*	161±3.13*	259±2.24*

Values are expressed as mean ± SE. NS not significant. *The significant is ($p<0.05$)

Table 3: Haematological changes in chicks fed *A. officinarum* for 4 weeks

Week	Group	RBC (x10^6)	PCV (%)	Hb (g/dl)
2	G1 Control	2.76±1.21	38.00±1.50	10.77±2.8
	G2 2% *A. officinarum*	3.13±2.02^{ns}	30.10±1.20*	12.3±1.5^{ns}
	G3 5% *A. officinarum*	1.43±1.73*	28.5±2.03%	6.17±1.73*
	G4 10% *A. officinarum*	1.83±1.14*	16.72±2.75*	8.40±1.03*
4	G1 Control	2.76±1.20	38.00±1.50	10.77±2.80
	G2 2% *A. officinarum*	1.91±3.10*	22.00±1.32*	7.40±1.09*
	G3 5% *A. officinarum*	1.63±1.75*	21.50±1.98*	7.00±2.01*
	G4 10% *A. officinarum*	1.63±1.75*	22.50±1.05*	7.50±1.73*

Values are expressed as mean ± S.E. NS = not significant. *The significant is ($p<0.05$)

Table 4: Serobiochemical changes of Bovans- type chicks fed *A. officinarum* for 4 weeks

Group	Total protein (g/dl)	Uric acid (mg/dl)	Albumin (g/dl)	Cholesterol (mg/dl)	ALP (i.u)	AST (i.u)
Week 2						
G1 Control	4.20±1.01	6.90±0.23	2.50±1.23	157.73±3.12	50.12±1.77	11.35±1.35
G2 2% *A. officinarum*	4.31±1.30^{ns}	6.48±1.89^{ns}	1.96±2.05^{ns}	166.28±2.15^{ns}	57.04±1.53*	15.00±2.11*
G3 5% *A. officinarum*	4.89±1.51^{ns}	8.64±1.11*	2.42±1.75^{ns}	141.83±2.17^{ns}	55.2±1.91*	14.60±2.14*
G4 10% *A. officinarum*	4.19±1.05^{ns}	16.21±1.35*	2.18±1.14^{ns}	160.71±2.53^{ns}	57.96±2.04*	14.60±1.45*
Week 4						
G1 Control	2.40±1.01	6.90±0.23	2.05±1.23	157.73±3.12	50.12±1.77	11.35±1.35
G2 2% *A. officinarum*	3.78±0.31*	10.95±1.23*	2.79±1.33^{ns}	146.58±2.24^{ns}	55.54±1.67*	14.50±0.03*
G3 5% *A. officinarum*	5.25±1.13*	9.00±1.30*	2.49±1.07^{ns}	149.38±2.13^{ns}	59.80±1.76*	15.00±1.05*
G4 10% *A. officinarum*	3.14±0.39*	9.18±1.54*	2.21±1.79^{ns}	151.44±2.15^{ns}	55.20±1.33*	14.60±1.05*

Values are expressed as mean ± S.E. NS = not significant. *The significant is ($p<0.05$)

DISCUSSION

The results of the present study indicated that feeding of *A. officinarum* to Bovans-type chick at 2, 5 and 10 % of the normal diet is toxic but not lethal as evidenced by impairment of growth, lesions in vital organs and haematological and serobiochemical alterations. Impairment of growth may be due to reduce feed intake and/or in efficiency of feed utilization

For chickens, these dietary levels represent non-toxic concentrations of some plants exemplified by *Nigella sativa* (Al-Homidan *et al*., 2003; Bakhiet and Ibrahim, 2006). On the other hand, concentrations of 2% or 5% of dietary *Azadirachta indica* and *Rhazya stricta* have been found toxic to chickens (Ibrahim *et al*., 1992) and rodents (Adam, 1999). It seems, therefore, that the susceptibility of animal to feeding with plant materials is dependent at least on the type of the active constituents and 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.

The results of the present study suggested that feeding *A. officinarum* is related to the concentration and characteristics of the active constituents in the plant. In the chicks fed a diet consisting of 5% and 10% *A. officinarum* damage to liver could explain the depression of growth. The mechanism whereby the plant constituents injure body tissues cannot be derived from the present investigation but the damage to these vital organs probably contributed to the increased serum AST and ALT activities and uric acid concentrations.

There were no changes in Hb, RBC and PCV in this study while in other previous studies showed macrocytic anemia in chickens which had been fed a diet containing 10% *Cassia italica* seed (Bakhiet and Adam, 1996) or in rats which had been fed a diet consisting of 10% *Artemisia abyssinica* (Adam *et al*., 2000).

Conclusion: This study demonstrated that *A. officinarum* at 5% or 10% may cause toxicity when used for long time.

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