
The effect of dietary tannins on incidence of leg abnormalities in chicks fed different calcium : phosphorus ratios

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Summary

Experiments were conducted to determine the effect of tannic acid or tannin (from sorghum gluten feed) on incidence of leg abnormalities in broiler chicks fed low and high calcium : phosphorus ratios.

Experiment 1 was 2x2 factorial arrangement utilizing 0.8 : 0.3 and 2 : 0.9 Ca : P ratio without and with 0.5% tannic acid. 35% of the chicks fed the diet containing low Ca : P ratio with 0.5% tannic acid showed leg abnormalities whereas the incidence of leg abnormalities was eliminated by widening Ca : P ratio in the presence of tannic acid. In experiment 2 the same Ca : P ratio of experiment 1 with 0.1% tannin showed leg abnormalities. The incidence of leg abnormalities was reduced to 6% in chicks given high Ca : P ratio with tannin.

Neither widening Ca : P ratio nor adding tannic acid or tannin had significant effect on tibia ash or tibia Ca, P, Mg, Mn, Zn and Cu content. Results of this study indicate that widening Ca : P ratio counteracts the adverse effect of tannin in legs of broiler chicks.

Introduction

Sorghum is the main cereal crop used in poultry feeding in the Sudan. Its use is faced by problems such as poor performance and leg problem; only high tannin sorghum produces these adverse effects on poultry. Most of the literature pertaining to the use of sorghum grain in poultry feeding and trials conducted to overcome the negative effects of sorghum tannins on broiler legs have been reviewed by Gualtieri and Rapaccini (1990).

The present study was conducted to reverse the adverse effect of tannins on broiler chicks legs by feeding different calcium : phosphorus ratios.

Materials and Methods

In both experiments three replicate of 5 male commercial broiler type chicks (Lohman) were offered each of the test diets at 1-day old of age for a 4-week period.

Experiments were designed as a factorial arrangement involving two ratios of calcium and phosphorus and two levels of tannin either as tannic acid added to a maize basal diet or tannin from sorghum gluten feed (SGF). The composition of the basal diets used in these experiments is shown in Table 1. A common batch of ingredients was used in all experiments. Dicalcium phosphate was used to alter Ca : P ratio in the diets. The birds were housed in pens in a deep litter poultry house and offered feed and water *ad libitum*.

At the end of the 4-week experimental period the birds were examined for leg abnormalities by subjective evaluation

Table 1: Composition of Experimental Diets.

Ingredients (%)	Basal diet Expt. 1 ¹	Basal diet Expt. 2 ¹
Maize	61.3	27.3
Soybean meal	35.0	5.8
Sesame oil	1.5	
Dicalcium phosphate	0.3	
Oyster shell	1.5	1.0
Salt	0.3	0.3
Vitamin & mineral premix	0.1	0.1
Sand.		5.5
Sorghum gluten feed		60.0
	100	100
Determined analysis		
Dry matter (%)	94.6	95.1
Crude protein (%)	22.3	20.8
Calcium (%)	0.8	0.8
Phosphorus (%)	0.5	0.6
Copper (mg/kg)	15.4	15.1
Zink (mg/kg)	62.4	65.0
Manganese (mg/kg)	846.0	822.0
Magnesium (mg/kg)	2850.0	2840.0
Phytic acid (%)	0.15	0.69
Calculated energy (MJ/kg)	12.6	12.6

1: Ca : P ratio of the diets were altered by addition of dicalcium phosphate.

of each bird, only birds showing medium or severe degree of bowing were considered abnormal. Then the birds were weighed weekly, feed intake was recorded weekly. And three birds were slaughtered at the end of the experiment. The left tibia was removed for bone ash and minerals determination. Chemical composition of the basal diets and tibia ash were determined according to procedures of Association of Official Analytical Chemists (1980). Manganese, magnesium, zinc, copper and calcium content of the experimental diets and tibia ash were assayed in triplicate using atomic absorption spectrophotometre model Perkin Elmer 2380. Tannin, as czitechin equivalent, of sorghum gluten feed and the experimental diets was determined by the method of Price *et al.* (1978). Phytic acid content of the experimental diets was determined by the method described by Wheeler and Ferrel (1971).

Experiment 1:

This experiment was 2x2 factorial arrangement of treatments utilizing 0.8 : 0.3 and 2 : 0.9 Ca : P ratios, 0 and 0.5% tannic acid.

Experiment 2:

Sorghum gluten feed was used at 60% as a source of tannin (0.1%). Ca : P ratios were the same as described for experiment 1.

Data obtained were statistically analysed using 2x2 factorial arrangement to detect tannic acid, tannin, Ca : P ratio and interaction effects (Little and Hills, 1978).

Results and Discussion

Though not presented herein the growth depression observed in chicks fed diets with tannic acid or tannin was alleviated by widening calcium : phosphorus ratio.

Leg abnormalities reported in experiment 1 and 2 were characterized by bowing of the legs with a swelling of the hock joints. Similar anomalies were reported in broiler chicks fed high tannin sorghum (Armstrong *et al.*, 1973; Rostango *et al.*, 1973; Elkin *et al.*, 1978 and Giles, 1981). Results of experiment 1 are presented in Table 2. The incidence of leg abnormalities is high among chicks given low Ca : P with 0.5% tannic acid. On the other hand, chicks given low Ca : P ratio without tannic acid exhibited no leg problems.

Results of experiment 2 are shown in Table 3. The high incidence of leg abnormalities observed in experiment 1 was successfully reproduced in experiment 2. No leg problems were noted in chicks given low and high Ca : P without tannin. Chicks given high Ca : P ratio with 0.1% tannin exhibited a low number of leg problems than those given high Ca : P ratio with 0.5% tannic acid (experiment 1). Tibia ash values and mineral determination of calcium, phosphorus, zinc, copper, magnesium and manganese revealed no difference between tannic acid and tannin containing diets and the control (Tables 2 and 3).

These studies show that widening Ca : P ratio reduces leg abnormalities associated with feeding tannin to broiler chicks.

Increasing P level was observed to exert a similar effect (Ibrahim *et al.*, 1988). The insignificant difference in tibia ash values and its mineral content indicates that the leg

Table 2: Effect of the dietary treatments on tibia ash and minerals content (in mg/kg).

Experiment 1.										
Diet	Calcium : Phosphorus	Tannic aid	Incidence of leg abnormalities	Tibia ash %	Ca	P	Mn	Mg	Zn , Cu	
							g mg/kg	mg/kg	mg/kg	mg/kg
(A)	Low (0.8 : 0.3)	0.0	0.0	38.3	383.0	175.4	84.5	0.028	0.416	0.014
(B)	Low	0.5	35.0	36.9	368.0	175.8	84.5	0.028	0.416	0.014
(C)	High (2 : 0.9)	0.0	0.0	38.4	383.6	176.8	84.5	0.028	0.416	0.014
(D)	High	0.5	0.0	39.7	379.0	176.6	84.5	0.028	0.416	0.014
	± SEN.1		2.99	1.69	19.4	1.2	0.03	0.0	0.00	0.001
	Sours of variation, level of significance	**	ns	ns	ns	ns	ns	ns	ns	ns
	Calcium : Phosphorus (Ca: P)	**	ns	ns	us	ns	ns	ns	ns	ns
	Tannic Acid (TA)	**	ns	ns	ns	ns	ns	ns	ns	ns
	Ca : Px TA									

** Significant at 1% . ns Not significant at 5%

Dietary tannins and leg abnormalities in chick

Table 3: Effect of the dietary treatments on tibia ash and minerals content (in mg/kg).
Experiment 2.

Diet	#	Calcium : Phosphorus	Tannic acid	Incidence of leg abnormalities	Tibia ash %	Ca mg/kg	P mg/kg	Mn mg/kg	Mg mg/kg	Zn mg/kg	Cu mg/kg
(A)	Low (0.8 : 0.3)		0.0	0.0	38.3	382	175.7	84.5	0.028	0.415	0.013
(B)	Low		0.1	13	39.7	3%	175.3	84.5	0.028	0.415	0.014
(C)	High (2 : 0.9)		#	0.0	38.4	383	176.7	84.5	0.028	0.416	0.014
(D)	High		0.1	6	40.1	401	176.1	84.5	0.028	0.416	0.014
	± SEM			2	1.69	16.9	0.6	0.8	0.0003	0.0002	0.002
	Sources of variation,	level of 1									
	*nificance			**	ns	ns	ns	ns	ns	ns	ns
	Calcium: Phosphorus (Ca:P)			ns	ns	ns	ns	ns	ns	ns	ns
	Tannic Acid (TA)		s	ns	ns	ns	ns	ns	ns	ns	ns
	Ca: P x TA		1								

** Significant at 1% . ns Not significant at 5%

abnormalities observed in chicks fed tannic acid or tannin are not a result of tannins interfering with bone mineralization. A similar conclusion was drawn by Elkin et al., (1978) and Giles (1981). Since tannin did not affect bone mineralization it is possible to assume that the leg problems occurred as a result of changes in the organic matrix of bones. The mechanism through which widening Ca : P ratio counteracts the effect of tannin in broiler legs need to be resolved.

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