POSSIBLE EFFECT OF DIETARY PHYTASE SUPPLEMENTATION ON BROILER SODIUM REQUIREMENT

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ABSTRACT

An exploratory trial was conducted to evaluate the possibility of phytase effect on sodium requirement in broiler. The enzyme effect hypothesis was evaluated throughout a broiler free choice feeding trial from 14 up to 28 days, testing two combinations of diets (two feeders per floor pen): T1 = Diet with 0.20% sodium (D1) and a diet with 0.12% sodium (D2); T2 = Diet with 0.12% sodium (D2) and a diet with 0.12% sodium + phytase (500 FTU) (D3). Diets were based on corn and soybean meal, to meet broiler nutritional requirements except for sodium, inclusion of raw materials was maintained the same except for common salt. Feed consumption behavior indicated that birds were able to select diets more adequate in relation to sodium content (consumption rate D1:D2 was 1.454$\pm$0.245) or low sodium level in combination with phytase (consumption rate D3:D2 was 1.248$\pm$0.245).

KEYWORDS: poultry, enzyme, free choice.

INTRODUCTION

Phytic acid, a common P storage molecule present in vegetable raw materials, have been associated with lowering the bioavailability of P and Ca. Cowienson et al (2004), reported that phytate increased the excretion of endogenous minerals and amino acids in broiler. The researchers comment as well that part of the beneficial effects of the addition of exogenous phytase to the poultry diets appears to be mediated through a reduction in endogenous losses of these nutrients.

Cowienson et al (2011) performed a trial evaluating the interaction of sodium levels coming from sodium chlorine, phytate content and phytase levels. The outcome of this trial was that dietary sodium concentrations play a role in the severity of phytate anti-nutritional effect and consequently interfere in the phytase efficacy.

Free choice feeding of poultry has been explored since thirty decade (Grahan, 1934). According to Emmans (1991) the three key parameters in the feed choice are protein, energy and minerals. The birds are able to select food for a nutritional purpose.

The objective of the present study was to investigate the ability of broiler to select diets with different sodium content and the presence of phytase.

MATERIAL AND METHODS

The trial was carried out at the SEA (Section of Poultry Experimentation) – Embrapa Swine and Poultry, Concórdia, SC, Brazil, November 2011. One hundred and twenty 14 days old broiler, male, Cobb were installed in floor pens, 10 birds/pen. Animals were previously reared consuming a corn soybean meal basal diet, adequate to the growing phase. At day 14, animals were individually weighed and selected by weight (273,8±4,9g). A commercial phytase (3- phytase myo-inositol-hexaphosphate-phosphohydrolase) (EC 3.1.3.8), produced by *Aspergillus niger* was used. No nutritional value was attributed to the phytase. The enzyme effect hypothesis was evaluated throughout broiler feed choice from 14 up to 28 days, testing two combinations of diets (two feeders per floor pen, each containing one type of diet: D1, D2 or D3): T1 = Diet with 0,20% sodium (D1) and a diet with 0.12% sodium (D2); and T2 = Diet with 0.12% sodium (D2) and a diet with 0.12% sodium + phytase (500 FTU) (D3). Dailly feeder were alternate in place.

The composition and the nutritional profile of the experimental diets, fed from 14 up to 28 days, are presented at Table 1 and Table 2.

Table 1 – Experimental diets composition (%).

Ingredient	Diet 1 (D1)	Diet 2 (D2)	Diet 3 (D3)
Corn	57,70	57,70	57,70
Soybean meal	35,00	35,00	35,00
Filler (Caolin)	0,507	0,707	0,702
Dical Phosphate	1,61	1,61	1,61
Limestone	0,48	0,48	0,48
Salt, NaCl	0,48	0,28	0,28
Soy oil	3,08	3,08	3,08
Mineral Premix	0,05	0,05	0,05
Vitamin Premix	0,10	0,10	0,10
L-Lysine	0,24	0,24	0,24
DL-Methionine	0,26	0,26	0,26
L-Threonine	0,12	0,12	0,12
Choline Chloride	0,10	0,10	0,10
Coban 200	0,06	0,06	0,06
Toxin Binder	0,20	0,20	0,20
Zinc Bacitracin	0,003	0,003	0,003
BHT	0,01	0,01	0,01
Phytase 10000 FTU/g	---	---	0,005

Table 2 – Nutritional profile of experimental diets (14 up to 28 days).

Nutrient	Diet 1 (D1)	Diet 2 (D2)	Diet 3 (D3)
AMEn (kcal/kg)	2,980	2,980	2,980
Crude protein (%)	20,33	20,33	20,33
Calcium (%)	0,67	0,67	0,67
Total Phosphorus (%)	0,67	0,67	0,67
Available Phosphorus (%)	0,42	0,42	0,42
Sodium (%)	0,20	0,12	0,12
Digestible Lysine (%)	1,18	1,18	1,18
Digestible Methionine (%)	0,58	0,58	0,58
Digestible Met+Cys (%)	0,85	0,85	0,85
Digestible Threonine (%)	0,74	0,74	0,74
Digestible Tryptophan (%)	0,22	0,22	0,22
Phytase FTU/kg	---	---	500

A completely randomized block arrangement was used, where block corresponded to chick weight at 14 days age, with six replicates per treatment. Data were submitted to GLM procedure analysis, using Test F to compare means (SAS, 2008).

RESULTS AND DISCUSSION

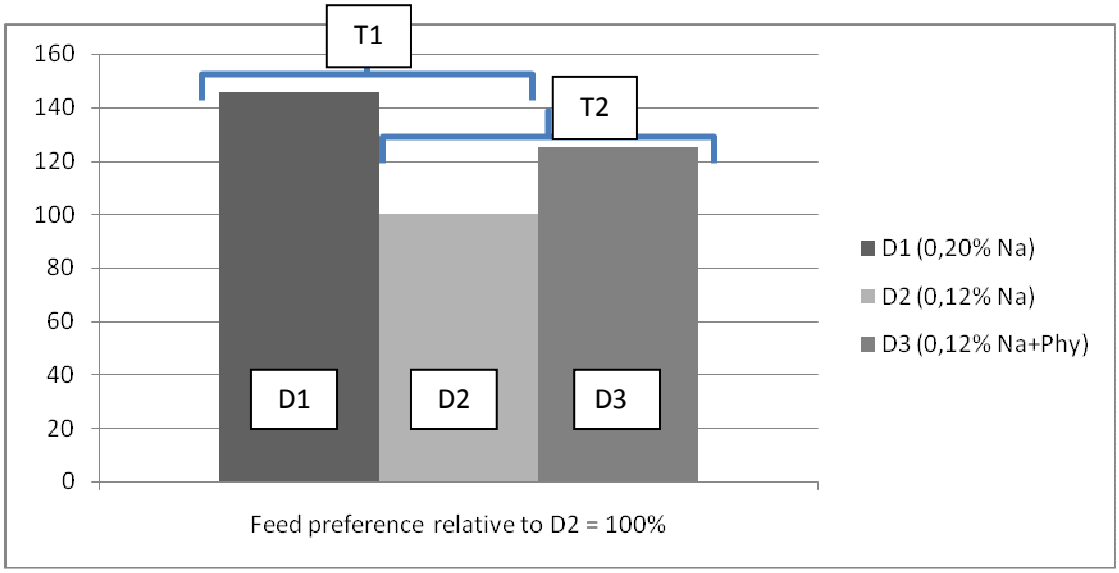
Based on the experimental data (Table 3), the general performance data indicate that there was no difference for feed intake when birds were submitted to free choice, however birds that had access only to low sodium content diets (0.12% Na) with or without phytase showed significant loss of weight gain and consequently lower body weight. Feed conversion ratio tend to be worse for birds eating low sodium diets, evean not statically significant.

Table 3 – Feed intake (FI), body weight (BW), body weight gain (BWG) and feed conversion ratio (FCR) of broiler from 14 up to 28 days.

Treatment	FI (g)	BW (g)	BWG (g/bird)	FCR (g/g)
T1 (D1 vs D2)	1,387±0,018	1,315±0,008	991±6	1.425±0,015
T2 (D2 vs D3)	1,366±0,012	1,263±0,009	937±7	1.458±0,014
Prob> F	0,3618	0,002	0,0003	0,1444
CV, %	2,77	1,56	1,64	2,49

Feed consumption behavior indicated that birds were able to select diet with more adequate sodium content (consumption ratio D1:D2 was 1.454±0.245) or low sodium level in combination with phytase (consumption ratio D3:D2 was 1.248±0.245). Those data indicate that even with no statistical difference, animals were able to choose diet with higher sodium level or low sodium plus phytase, but even so, T2 group was not able to reach similar weight gain T1, (937±7 g) vs (991±6 g), respectively. However, data suggest an interaction phytase and sodium requirement (Figure 1).

Figure 1 – Relation of feed choice (expressed in percentage assuming D2 as 100%) of broiler from 14 up to 28 days.



CONCLUSION

The data indicate that a choice feeding trial can maybe be helpful to understand whether enzyme influence or not sodium metabolism. Consuming low sodium diets broiler showed a preference for diets containing phytase that demonstrates that for an unknown reason birds choose diets low in sodium content in combination with phytase. However, this was just an exploratory trial and further research has to be done to validate such method for enzyme effect evaluation.

REFERENCES

COWIENSON, A.J., BEDFORD, M.R., RAVINDRAN, V. and SELLE, P.H. (2011). Increased dietary sodium chlorine concentrations reduce endogenous amino acid flow and influence the physiological response to the ingestion of phytic acid by broiler chickens. British Poultry Science **52**(5):613-624.

COWIENSON, A.J., ACAMOVIC, T. and BEDFORD, M.R. (2004).The effects of phytase and phytic acid on the loss of endogenous aminoacids and mineral from broiler chickens. British Poultry Science **45**(1):101-108.

GRAHAM, J.C. (1934). Individuality of pullets in balancing the ration. Poultry Science **13**:34-39.

EMMANS, G.C. (1991). Diet selection by animals:Theory and experimental design. Proceedings of the Nutrition Society.pp.59-64.

SAS INSTITUTE INC. System for Microsoft Windows, Release 9.2, Cary, NC, USA, 2003-2008. (cd-rom).