Use of dietary enzyme inclusion and seed germination to improve feeding value of sorghum for broiler chicks

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Several methods have been employed to reduce anti-nutritive factors of sorghum and improve nutritional value of it to use as an energy source in poultry feed. A study was conducted to assess the effects of enzyme supplementation and seed germination on the feeding value of sorghum for broiler chicks. Four iso-nitrogenous and iso-energetic NRC-recommended diets with and without sorghum (intact or germinated seed) were evaluated. Intact sorghum-included diet was tested with or without phytase and carbohydrase. Four hundred 3-day old unsexed Cobb broiler chicks were randomly distributed into 20 pens. Five pens of birds were randomly assigned to each of four dietary treatment groups. Body weight, feed intake was measured on 21, 42 and 49 days of age. Data were subjected to analysis of variance as a completely randomized design using the GLM procedure of SAS. Dietary treatment had no significant effect on body weight gain of chicks except for growing period. Chicks fed control (corn-) and germinated sorghum-based diets had higher body weight gain than other dietary treatment groups. Germination significantly improved feed to gain ratio of chicks. Enzyme supplementation had no statistically significant effect on chicks' performance.

Key words: sorghum; germination; phytase; carbohydrase; broiler chicks

Introduction

Metabolizable energy values of low tannin sorghum and maize are very close. This would make it possible to substitute sorghum for maize in poultry diets. However, high tannin sorghum cannot advantageously replace maize in broiler diets. This is based on the reported negative effects of tannins, with regard to depressed growth rate and reduced feed efficiency in comparison with maize (Armstrong et al., 1973, 1974a,b; Mitaru et al., 1983; Ibrahim et al., 1988; Elkin et al., 1990) and reduced nutrient digestibility (Mohammed and Ali, 1988).

Several methods have been employed to reduce tannins and improve the nutritional value of high tannin sorghum. Among these are dehulling (Chibber et al., 1978), high moisture storage (Mitaru et al., 1983), treatment with alkalis (Chavan et al., 1979) and germination (Elmalik et a., 1986).

Since the commercial introduction of exogenous enzymes over 15 years ago, their use has increased greatly, not only in traditional markets where wheat and barley are the principal grains, but also in countries where corn and sorghum form a major part of the poultry diet. Research related to the variability of corn and soybean meal (Leeson *et al*, 1993; Leske *et al*., 1993; Wyatt *et al*., 1999; Douglas *et al*., 2000) has helped to identify the significant feeding value variability among corn and soy samples and/or to show potential opportunities for improvement.

The inability of poultry to utilize phytate P, due to lack of endogenous phytase, results in the addition of inorganic feed P to poultry diets in order to meet the P requirements of poultry. However, P is the third most expensive nutrient in poultry diets after energy and protein and phytate P passed out in animal excreta leading to accumulation of P in soils. It has been well documented that phytase improves P utilization in poultry (Onyango, *et al.,* 2005; Ravindran, *et al*., 2006).

This study was conducted to assess the effects of seed germination and dietary enzyme supplementation on the feeding value of locally grown sorghum (Northern part of Iran) for growing broiler chicks.

Materials and methods

A total of 400 unsexed day-old Cobb broiler chicks were obtained from a local hatchery, weighed and randomly allocated to 20 pens. Twenty birds were placed in each pen. Any birds showing signs of ill health, injury or being in poor condition were discarded. There were a total of four iso-energetic and iso-nitrogenous experimental diets, each replicated 5 times. Sorghum (MEn= 3285 Kcal/ Kg, CP= 92 g/Kg, and Tannin= 2.45 g/ Kg) was included in corn-wheat-soybean based diets at 280, 330, and 360 g/kg as a partial replacement. Diets used were diet C, a corn-wheat-soybean based diet; diet I, a corn-wheat-sorghum (intact)-soybean based diet; diet G, a corn-wheat-sorghum (germinated)-soybean based diet; diet E, the diet similar to diet I plus two enzyme products (Grindazyme and Natuphos with carbohydrase and phytase activities, respectively). Diets were not pelleted and fed *ad libitum* from day 3 of age for a period of 46 days. All birds were fed diets of starter, grower and finisher during 3-21, 22-42, and 43-49 days of age, respectively. The composition of experimental diets is shown in table 1. Data were analyzed using the GLM procedures of SAS. Means were separated for significance by Duncan's multiple range test at significance level of $P < 0.05$ or as indicated.

Table 1 Ingredients and nutrient composition of the experimental diets (g/100g).

	Starter diets		Grower diets		Finisher diets	
	Corn	Sorghum	Corn	Sorghum	Corn	Sorghum
Ingredients	C	I[1, 2], or G	C	I or G	C	I or G
Corn	53.66	28.29	63.81	33.91	72.22	36.08
Wheat	10.14	7.53	5.71	2.63	-	-
Sorghum[3]	-	28.00	-	33.00	-	36.00
Germinated sorghum	-	-	-	-	-	-
Soybean meal	32.38	32.31	26.96	26.88	24.22	23.96
Sunflower oil	-	-	-	-	0.39	0.72
DCP	1.34	1.46	1.00	1.14	0.84	1.00
Oyster shell	1.23	1.14	0.13	1.12	1.26	1.15
Common salt	0.50	0.50	0.50	0.50	0.50	0.50
Premix (Vit + Min)	0.50	0.50	0.50	0.50	0.50	0.50
D,L-Methionine	0.13	0.13	0.05	0.06	0.02	0.03
Lysine-Hcl	0.13	0.13	0.16	0.16	0.05	0.07
Calculated analysis						
ME (Kcal Kg^{-1})	2800	2800	2900	2900	3000	3000
Crude protein %	20.13	20.13	18.13	18.13	16.87	16.87
Arginine %	1.32	1.29	1.14	1.11	1.09	1.01
Lysine %	1.16	1.14	1.04	1.01	0.87	0.86
Methionine %	0.43	0.43	0.34	0.34	0.30	0.30
Cysteine %	0.33	0.32	0.30	0.29	0.28	0.28

[1] I: Intact sorghum seed, and G: Germinated sorghum seed

[2] Diet E has the same composition as diet I and supplemented with two commercial enzyme products (Natuphos and Grindazyme which have phytase and carbohydrase activities, respectively.

[3] MEn= 3285 Kcal/ Kg, CP= 92 g/Kg, and Tannin= 2.45 g/ Kg

Results and discussion

Dietary treatments had no statistically significant effect on broilers' performance except for growing period. Feeding diets C (control diet) or G (germinated sorghum-included diet) improved body weight gain (BWG) and feed conversion ratio (FCR) of chicks in growing period (22 to 42 days of age). Dietary enzyme supplementation did not affect broilers' performance. Kyarisiima et al. (2005) has also reported that dietary germinated sorghum by soaking in ash extract improved chicks' performance.

When reviewing the literature on the use of sorghum in broiler diets a wide variation in results in noted. Luis et al. (1982), Douglas et al. (1990), Elkin et al. (1990) as well as a number of other researchers have reported a depression in BWG and FCR while other reported a depression of only BWG (Change and Fuller, 1964) or FCR (Kim et al., 1986). In addition, other publications report no effects of sorghum on performance of chicks (Cao et al., 1985; Smith et al., 1989). These differences are at least partially due to variation in tannin content or the level of sorghum replacement. It can be concluded that broiler chicks can tolerate partially replacement of dietary corn by low tannin sorghum and germinated sorghum seed could be a better alternative than intact seed.

Table 2. Performance of broiler chick fed on experimental diets

	Body weight (g)				Body weight gain (g/chick/day)			
	Day 3	Day 21	Day 42	Day 49	3-21 d	22-42 d	43-49 d	3-49 d
C (Corn)	50.43	561	1877	2121.25	61.66	70.69[a]	32.90	53.72
I (Intact S[1])	50.71	531	1887	2154.53	58.14	67.78[b]	30.64	51.98
G (Germinated S)	50.34	569	1944	2172.18	62.57	76.73[a]	32.32	53.03
E (I + Enzyme)	50.31	584	1985	2186.25	62.70	68.64[b]	32.23	55.94
Pooled MSE	0.55	43.37	132.06	324.51	5.37	4.6	1.83	0.76
P values	0.87	0.10	0.31	0.15	0.30	0.04	0.52	0.08
	Feed intake (g/chick/day)				Feed conversion efficiency (g: g)			
	3-21 d	22-42 d	43-49 d	3-49 d	3-21 d	22-42 d	43-49 d	3-49 d
C (Corn)	106.89	208.43[b]	116.48	153.23	1.74	2.90[b]	3.3	2.8
I (Intact S)	109.08	212.35[b]	111.88	155.47	1.82	3.14[a]	3.6	3.1
G (Germinated S)	111.94	227.94[ab]	120.17	160.28	1.75	3.01[b]	3.4	2.9
E (I + Enzyme)	112.58	248.55[a]	123.13	165.48	1.80	3.12[a]	3.7	3.2
Pooled MSE	5.03	6.14	4.50	9.15	0.14	0.11	0.18	0.10
P values	0.06	0.05	0.06	0.06	0.05	0.04	0.77	0.20

[1] I: Intact sorghum seed, and G: Germinated sorghum seed
[2] Diet E has the same composition as diet I and supplemented with two commercial enzyme products (Nataphous and Grindazyme which have phytase and carbohydrase activities, respectively.

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