Response of Broilers to Dietary Incorporation of Different Sorghum Varieties Fortified with Phytase

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Abstract. Dietary inclusion of local varieties of sorghum in poultry nutrition can greatly lower the cost of production in Sudan. The objective of the study was to evaluate the effect of dietary incorporation of different sorghum varieties fortified with phytase enzyme supplementation on broiler performance. A (2 x 5) factorial arrangement was used in a completely randomized design to study the effect of dietary incorporation of different levels sorghum variety Mogod (0, 25, 50, 75 and 100%) replacing the variety Feterita fortified with two levels of phytase supplementation (0 and 0.05%) on broiler performance. A total of 10 treatments were employed and each treatment was replicated three times with ten birds each. Weight gain (WG), Feed consumption (FC) and feed conversion ratio (FCR) were recorded. Carcass weights and tibial phosphorus content were measured. Blood samples were collected for blood parameters. The results showed that, FC was not affected by dietary inclusion of Mogod and phytase supplementation. There were significant (p≤0.01) effects of Mogod and phytase on weight gain. The greatest weight gain values were recorded with birds fed on diets contained 100% Feterita (p≤0.01). Supplementation of phytase improved WG and FCR (p≤0.01). The largest carcass weights were reported with birds fed on diets containing 50 and 100% Mogod (p≤0.05). Carcass weight values were increased with phytase supplementation. Tibial phosphorus content was improved by phytase supplementation. Total blood protein, cholesterol, calcium and phosphorus were not affected by phytase treatment. The study concluded that Mogod variety could be used as alternative energy source in broiler diets replacing Feterita variety. Moreover, phytase supplementation improved the broiler performance.

1. Introduction

Sorghum, groundnut cake, sesame cake and wheat bran are considered as the main source of energy and protein for poultry in Sudan [1]. Sorghum grain is an interesting energy ingredient in poultry diets due to its nutritional composition, which is very similar to corn [2]. However, in many reports sorghum has been documented to impaired the feed conversion ratio and breast meat yield which consequently depressed the profitability of broiler production [3]. Ebadi et al reported that the chemical composition and nutritional value of sorghum are affected by many factors such as genotype and soil type [4]. Sastry et al reported that tannin content and the deficiency of some essential amino acids such as lysine were the most important factors dictating the amount of sorghum could be included in the diet [5]. Asquith et al (1983) reported that sorghum can be categorized to three groups depending on tannin contents (tannin free, low tannin and high tannin sorghum) [6]. Low-tannin sorghum has metabolizable energy comparable or higher to that of maize [7]. Nyamambi et al reported that when sorghum tannin content
increased the poultry performance decreased due to its negative effects on endogenous enzymes secretion in the gastrointestinal tract [8]. In Sudan, there is a sharp competition between ruminants and monogastric animals (humans and poultry) in consumption of sorghum variety Fetarita. Different varieties of sorghum are available in Sudan containing different levels of tannin and kafirin. Many of Sudanese sorghum varieties could be cultivated in harsh conditions such as Mogod variety. Moreover, Mogod variety is not preferable to be consumed by humans. So, the current study was carried out to test the nutritive value of Mogod variety as alternative energy source replacing Fetarita. In cereal grains and oilseeds most of phosphorus is found as phytate phosphorus which is not available in poultry diets [9]. Phytate content can impair the digestibility of protein and phosphorus. Phosphorus is essential element in skeletal integrity of poultry. Selle et al reported that dietary supplementation of phytase to sorghum based diets for broilers improved the apparent metabolizable energy [10]. One of the aims of this study was to determine if dietary supplementation of phytase can improve the performance of broiler chickens.

2. Materials and methods

2.1. Bird’s housing management
A total of 300 day-old broiler chicks (Ross 308) were brought from Commercial hatchery. All birds were weighed and distributed to 30 pens (10 chicks each). The average weight of chicks in all pens was approximately the same (40±2 grams). A total of 30 small pens were constructed inside an environmentally controlled house with deep litter system. The pens dimensions were 1.0 x 1.0 x 1.0 meters for width, length and height, respectively. The broilers were exposed to 24 hours lighting throughout the experimental period.

2.2. Experimental diets
Sorghum varieties (Fetarita, and Mogad) were subjected to analysis of chemical composition and mineral content according to [11]. The experimental diets were formulated iso-energetic and iso-nitrogenous to meet or exceed the requirements of broilers according to [12].

2.3. Experimental design
A (2 x 5) factorial arrangement was used in a completely randomized design to study the effect of dietary incorporation of different levels sorghum variety Mogod (0, 25, 50, 75 and 100%) replacing the variety Fetarita fortified with two levels of phytase supplementation (0 and 0.05%) on broiler performance. A total of 10 treatments were employed and each treatment was replicated three times with ten birds each.

2.4. Parameters measured
Weight gain (WG), Feed consumption (FC) and feed conversion ratio (FCR) were recorded. Two representative birds from each experimental unit were selected and slaughtered to measure the carcass weights and tibial phosphorus content. Blood samples were collected for blood parameters. All tested blood cholesterol, protein, calcium and phosphorus were determined spectrophotometrically by using commercial kits. Tibial phosphorus content was measured by inductively coupled plasma – optical Emission spectrometry (ICP-OES) according to VDLUFA 4th Ed [13].

3. Results and discussion
The results showed that, FC was not affected by dietary inclusion of Mogod and phytase supplementation (Table 1). There were significant (p≤0.01) effects of Mogod and phytase on weight gain. The greatest WG values were recorded with birds fed on diets contained 100% Fetarita (p≤0.01). Tannin content of Mogod was higher than Fetarita (data not presented) which consequently impaired the weight gain. The current study agreed with Pour-Reza and Edriss, who reported that sorghum contained high tannin has been shown to reduce the broiler performance [14]. Supplementation of phytase improved WG and FCR (p≤0.01). The largest carcass weights were observed with birds fed on diets containing 50 and 100% Mogod (p≤0.05). Carcass weight values were increased with increasing
phytase supplementation. Synergistic interaction effect was reported between Mogod variety and phytase. Tibial phosphorus content was improved by phytase supplementation (Table 2). Dilger et al., reported that when male broilers fed on diet containing 1.2 g/kg of nonphytate P fortified with 500 or 1,000 phytase units/kg, tibial ash was increased [15]. Table 2 showed similarity in values of tibial phosphorus content and blood constituent of birds fed on 0 or 25% Mogod. Although, the dietary inclusion of Mogod variety impaired the WG and FCR, good results have been recorded for carcass weight, tibial P and blood constituents. The study concluded that Mogod variety could be used as alternative energy source in broiler diets up to 25% replacing Feterita variety when fortified with phytase supplementation.

Table 1. Effect of dietary incorporation of different levels of sorghum varieties Mogod and Feterita fortified with phytase on growth performance and carcass weight of broilers (0-42 day of age)

| Treatment | Weight gain (g) | Feed consumption (g) | Feed conversion ratio (g:g) | Carcass weight (g) |
|-----------|-----------------|----------------------|-----------------------------|-------------------|
| Mogod variety effect | | | | |
| 0 % | 416.6<sup>a</sup> | 744.5 | 1.7<sup>a</sup> | 1726.7<sup>B</sup> |
| 25 % | 386.5<sup>b</sup> | 750.5 | 1.9<sup>b</sup> | 1747.5<sup>B</sup> |
| 50 % | 388.5<sup>c</sup> | 740.9 | 1.9<sup>b</sup> | 1815.0<sup>AB</sup> |
| 75 % | 386.3<sup>c</sup> | 743.1 | 1.9<sup>b</sup> | 1709.6<sup>B</sup> |
| 100 % | 395.8<sup>c</sup> | 751.7 | 1.9<sup>b</sup> | 1892.5<sup>A</sup> |
| S E M | 2.5 | 3.1 | 0.02 | 41.81 |
| Sig | ** | NS | ** | * |

| Phytase effect | | | | |
| 0 % | 389.7<sup>b</sup> | 747.1 | 1.9<sup>b</sup> | 1727.0<sup>B</sup> |
| 0.05 % | 399.8<sup>a</sup> | 745.1 | 1.8<sup>a</sup> | 1829.5<sup>A</sup> |
| S E M | 1.6 | 2.0 | 0.01 | 26.4 |
| Sig | ** | NS | ** | * |

| Mogod × enzyme | | | | |
| Interaction | ** | ** | ** | * |

<sup>A,B</sup>Means in a column and main effect with no common superscript differ significantly (P≤0.05).
<sup>a,b</sup>Means in a column and main effect with no common superscript differ significantly (P≤0.01).
**: Significant with (P≤0.01).
*: Significant with (P≤0.05).
NS: Not significant.

Table 2. Effect of dietary incorporation of different levels of sorghum varieties Mogod and Feterita fortified with phytase on tibial phosphorus content and some blood constituents

| Treatment | Tibial phosphorus (%) | Cholesterol (g/dL) | Calcium (mg/dL) | Phosphorus (mg/dL) | Total protein (g/dL) |
|-----------|-----------------------|-------------------|-----------------|--------------------|---------------------|
| Mogod variety effect | | | | | |
| 0 % | 8.5<sup>a</sup> | 75.5 | 8.3<sup>A</sup> | 3.3 | 5.6<sup>ab</sup> |
| 25 % | 8.7<sup>a</sup> | 75.2 | 8.2<sup>A</sup> | 3.4 | 5.8<sup>a</sup> |
| 50 % | 8.1<sup>b</sup> | 82.2 | 7.9<sup>B</sup> | 3.3 | 5.5<sup>b</sup> |
| 75 % | 7.2<sup>c</sup> | 73.9 | 7.9<sup>B</sup> | 3.3 | 5.5<sup>ab</sup> |
| 100 % | 8.0<sup>b</sup> | 78.0 | 7.9<sup>B</sup> | 3.3 | 5.6<sup>b</sup> |
| S E M | 0.13 | 2.5 | 0.07 | 0.052 | 0.12 |
| Sig | ** | NS | * | NS | NS |

| Phytase effect | | | | | |
| 0 % | 7.99<sup>b</sup> | 74.8 | 8.00 | 3.34 | 5.6 |
| 0.05 % | 8.23<sup>A</sup> | 79.1 | 8.07 | 3.25 | 5.6 |
| SEM      | 0.081 | 1.6  | 0.046 | 0.033 | 0.07  |
|----------|-------|------|-------|-------|-------|
| Sig      | *     | NS   | NS    | NS    | NS    |
| Mogod × enzyme | **    | NS   | **    | *     | NS    |

**a,b**: Means in a column and main effect with no common superscript differ significantly (P≤0.05).

**: Significant with (P≤0.01).

*: Significant with (P≤0.05).

NS: Not significant

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