Growth performance of broiler starter chicks fed diets containing graded levels of soaked and boiled bambara nut (*Vigna subterranean* L. Verde) seed meal

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Abstract

Deficit of conventional feed ingredients in meeting increased demand has led to an alarming hike in their prices culminating in sky rocketing cost of livestock feed. This has necessitated an urgent search for low cost and more readily available alternatives. This study was conducted to investigate the performance of broiler chicks fed diets containing graded levels of soaked and boiled Bambara nut seed meal (BNSM). One hundred and five (105), 2 week-old broiler starter chicks were used for the experiment. The birds were randomly allotted into four dietary treatments with each treatments replicated thrice at seven birds per replicate in a completely randomized design. Five experimental diets were formulated containing processed BNSM designated as T1 (control diet with 0 % BNSM), while T2, T3, T4 and T5 had 5 % soaked BNSM, 10 % soaked BNSM, 5 % boiled BNSM and 10 % boiled BNSM, respectively. The experiment lasted for four (4) weeks. Feed and water were provided ad libitum. The results showed that birds fed processed BNSM diets had significantly ($P<0.05$) higher final weight and weight gain comparable to 702.38g and 19.99 g/bird/day in the control group. The values obtained from feed intake showed that T2 (64.74 g) had significantly ($P<0.05$) least value compared to other dietary treatments. Feed conversion ratio and feed cost per kg gain (N) were significantly ($P<0.05$) better in birds fed processed BNSM diets compared to 3.39 and N215.85 respectively in the control group.. It was therefore concluded that processed BNSM improved performance of broiler chickens.

Keywords: Broilers, performance, Bambara nut, soaking, boiling

La Performance de croissance des poussins de départ de poulets de chair nourris avec des aliments qui contiennent des niveaux échelonnés de farine de graines de noix de bambara trempées et bouillies (*Vigna souterrain* L. Verde)

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Résumé

Le déficit d'ingrédients alimentaires conventionnels pour répondre à la demande accrue a conduit à une hausse alarmante de leurs prix, aboutissant à une flambée du coût des aliments

pour le bétail. Cela a nécessité une recherche urgente d'alternatives peu coûteuses et plus facilement disponibles. Cette étude a été menée pour étudier la performance des poussins de départ de poulets de chair nourris avec des régimes contenant des niveaux échelonnés de farine de graines de noix de Bambara trempées et bouillies. Cent cinq (105) poussins de départ âgés de 2 semaines ont été utilisés pour l'expérience. Les oiseaux ont été répartis au hasard en quatre traitements diététiques, chaque traitement étant répliqué trois fois à raison de sept oiseaux par réplique dans une conception complètement aléatoire. Cinq régimes expérimentaux ont été formulés contenant du 'BNSM'-Bambara nutseed meal (Aliment de farine de graines de noix de bambara)- traité désigné comme T1 (régime témoin avec 0% de BNSM), tandis que T2, T3, T4 et T5 contenaient 5% de 'BNSM' imbibé, 10% de 'BNSM' imbibé, 5% de 'BNSM' bouilli et 10% de 'BNSM' bouilli, respectivement. L'expérience a duré quatre (4) semaines. L'alimentation et l'eau étaient fournies ad libitum. Les résultats ont montré que les oiseaux nourris avec des régimes 'BNSM' transformés avaient un poids final et un gain de poids significativement plus élevés ($P < 0,05$) comparables à 702,38 g et 19,99 g / oiseau / jour dans le groupe témoin. Les valeurs obtenues à partir de la consommation alimentaire ont montré que T2 (64,74 g) avait une valeur significativement moindre ($P < 0,05$) par rapport aux autres traitements diététiques. Le taux de conversion alimentaire et le coût alimentaire par kg de gain (N) étaient significativement meilleurs ($P < 0,05$) chez les oiseaux nourris avec des régimes 'BNSM' transformés par rapport à 3,39 et N215,85 respectivement dans le groupe témoin. Il a donc été conclu que le 'BNSM' transformé améliorerait les performances des poussins de départ de poulets de chair.

Mots clés : Poulets de chair, performance, noix de bambara, trempage, ébullition

Introduction

There is a serious shortage of feed ingredients such as wheat, corn, soybeans, groundnut and others because of rapidly increasing human population (Okeke, 2000). This has led to the sky rocketing of prices of these conventional protein and energy sources and subsequently, the attendant increase in the cost of animal protein. Hence, a wide gap is created between the demand and supply of animal protein in Nigeria and many under developed countries of the world. Serious malnutrition is therefore widespread because of the deficiency of protein particularly animal protein, in human diets. Poultry products (meat and egg) offer considerable potential for bridging the gap of animal protein because of its incomparable competence in transforming nutrient to high quality animal protein (Ekenyem and Madubuike, 2006). There is therefore, an

urgent need to close the gap between this explosive population increase and the availability of food. Hence, the search for non – conventional sources of energy and protein with great potential to improve and sustain livestock production.

Bambara nut (*Vigna subterranea L. Verde*) is a leguminous plant and is a native of Africa. It is one of the underutilized legumes with crude protein values 16 % and is desirable due to its high nutrient profile. Enwere (1998) reported that Bambara nut has the following composition: Moisture (9.7 %), Crude protein (16 %), Crude fat (5.9 %), Ash (2.9 %) and Carbohydrates (64.9 %). It is widely cultivated in the Northern part of Nigeria. It is not an oily seed since it contains only about 6 percent of ether extract. The colour of the seed may vary from black to white or the seeds may be mottled with various colours. It is widely consumed in Nigeria, especially in Enugu State and some Northern states (Enwere, 1998). It is fairly well supplied with

calcium (Ca) and iron (Fe) though poor in phosphorus (P). It contains thiamine, riboflavin, niacin and carotene but very low in ascorbic acid. It has been reported that Bambara nut has appreciable amount of lysine and contains minimum amount of trypsin and chymotrypsin (Rose, 2014; Olomu, 2011).

Bambara nut has been used in the feeding of poultry (Okeke, 2000) and rabbits (Ani and Okafor, 2004; Ani, 2006). However, despite its nutritional potential in the feeding of monogastric animals the presence of anti-nutritional factors such as protease inhibitors, haemagglutinins, tannins, cyanogenic glycosides and flatulence factors limits its use in the raw bean (Sogbesan, *et al.*, 2006). Besides anti-nutritional factors, another limitation is its high fibre content. Poultry cannot fully utilize high fibre diets because they lack the digestive framework that can elaborately digest large amount of fibre. However, remarkable improvement in the nutritive quality of legume seeds have been achieved through various processing methods such as cooking, roasting, soaking and germination, fermentation, dehulling and chemical treatment which exerts beneficial effects by destroying the inherent anti-nutritional factors (Omeje, 1999; Kaankuka *et al.*, 2000; Matthew *et al.*, 2010). According to Akinmutimi and Okwu (2006), most processing methods employed in improving the feeding values of non-conventional feedstuffs reduce the concentration of these anti nutritional factors to tolerable levels in feedstuffs.

Bambara nut seed meal therefore becomes an attractive replacement as the inclusion of graded levels of soaked and boiled Bambara nut in the diets of growing broiler chicks will help to enhance production by reducing the cost of production. The objective of this study therefore was to investigate the growth performance of broiler chicks fed diets containing graded levels of soaked and

boiled Bambara nut (*Vigna subterranean l. verde*) seed meal.

Materials and methods

Experimental site

This study was conducted at the Poultry Unit of the Teaching and Research Farm of the Department of Animal Science, Taraba State University, Jalingo, Ardo-kola Local Government Area. It lies between latitude 8°11' to 8° 50'N and longitude 11° 05' to 11°25'E. It is located within the Guinea Savannah Zone. The State is characterized by tropical climate marked by dry and rainy season. The rainy season usually commences in the Month of March and ends up in October. The dry season then starts in late October and ends in March. The annual rainfall is between 1000-1500 mm with an average minimum temperature of 30°C and maximum temperature of 38°C depending on the season (Taraba State Diary, 2008).

Source of experimental birds and Bambara nut

One hundred and five (105) 2-week old broiler chicks were purchased from the National Veterinary Research Institute Vom, Plateau State. Bambara nut seeds were purchased from Zing main Market, Zing L.G.A, Taraba State.

Processing of bambara nut seeds

Processing of seeds was done by soaking for 24 hours and boiling for 30 minutes. For soaking, 15 kg Bambara nut seeds were poured into 75 litres of water at room temperature (20°C). Thereafter, the water was drained and the seeds were sun dried for 3 days on a concrete floor. The seeds were then milled and bagged. For boiling, 15 kg Bambara nut seeds were also boiled for 30 minutes. The 45 litres of water was allowed to boil at a temperature of 100°C using firewood as the source of heat. The seeds were then poured into the boiling water, covered and then allowed to boil again for duration of 30 minutes.

Thereafter, the water was drained and the seeds were sun dried for 3 days, milled and bagged.

Design and management of experimental birds

A total of one hundred and five (105) 2-week old broiler chicks purchased from N.V.R.I. Vom, Jos were used. Twenty one (21) birds were weighed and randomly assigned to each of the five treatment groups which had seven (7) birds per replicate in a completely randomized design (CRD). The birds were reared on deep litter housing system. Kerosene stoves were used to provide additional heat while electricity bulb were installed in each pen to provide light and heat during the brooding period. Feed and water were provided *ad libitum*. Drugs were administered as at when necessary and all other routine management practices duly observed. The experiment lasted for four weeks. The birds were weighed at the beginning of the experiment and their average initial weights were taken. The chicks were subsequently weighed every week to determine the weight gained. Feed supplied and the left over were also weighed daily to determine the daily feed intake. Average final weight, daily weight gain, daily feed intake, feed to gain ratio, and percentage mortality (where it occurred) were computed. The cost /per kg of feed and cost of feed /kg (N) gains were computed for each dietary treatment.

Experimental diets

Five experimental diets were formulated which contained 23 % crude protein based on the standard requirements (NRC, 1994) as shown in Table 1. The processed Bambara nut seed meal was incorporated at the inclusion level of 0 %, 5 and 10 % (Soaked), 5 and 10 % (Boiled) designated as treatments T₁ (control), T₂, T₃, T₄ and T₅, respectively.

Chemical analysis

The proximate composition of the test

ingredient (Bambara nut seeds) and experimental diets were determined using the procedures of the Association of Analytical Chemist (AOAC, 1990).

Statistical analysis

All data obtained in this study were subjected to analysis of variance using the general linear model procedure of Statistical Analytic System (SAS, 2008). Significant differences among treatment means were separated using Tukey model.

Results and discussion

The results of the growth performance of the broiler starter chicks fed graded levels of processed Bambara nut seed meal (BNSM) diets are presented in Table 2. The dietary treatments had significant ($P>0.05$) effect on all the parameters measured. The result showed that the final weight ranged between 702.38 – 988.62 g, total weight gain (559.52 g - 847.60 g) and daily weight gain (19.99 – 30.0 g/b/d) followed the same trend across the treatments. These were similar for birds fed diets T₂ (5% soaked BNSM), T₃ (10 % soaked BNSM) T₄ (5% boiled BNSM) and T₅ (10% boiled BNSM) but significantly ($P<0.05$) higher than those in the control group (T₁). This result may be attributed to good nutrient utilization by birds fed BNSM based diets which resulted from better detoxification of anti-nutrients and hence availability of proteins and their constituent amino acids, leading to improved weight gains by birds. This may also indicate that the experimental diets met the recommended energy and protein requirements of the broiler chicks. The observed values of daily weight gain (19.99 – 30.00 g/bird) in this study is higher than values (18.10 – 21.65g/bird/day) reported by Pfetter *et al.* (2002) for broiler chicks. The total feed intake (TFI) and daily feed intake (DFI) also followed similar trend across the treatments. Birds fed the diet T2 had significantly ($P<0.05$) lower values (1812.67 and 64.74 g/bird) respectively

Table 1: Composition of broiler starter diets containing graded level of processed bambara nut seed meal (2 – 6 weeks)

Ingredients (%)	0% Control	5% SBNSM (24 hours)	10% SBNSM (24 hours)	5% BBNSM (30 minutes)	10% BBNSM (30 minutes)
Maize	58.36	55.06	51.73	55.06	51.73
GNC	35.64	33.94	32.27	33.94	32.27
BNSM	0.00	5.00	10.00	5.00	10.00
Fish meal	2.00	2.00	2.00	2.00	2.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Common Salt	0.30	0.30	0.30	0.30	0.30
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Vitamin premix	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Calculated analysis					
ME (kcal/kg)	2963	2902	2839	2902	2839
Crude protein (%)	23.00	23.00	23.00	23.00	23.00
Crude fibre (%)	2.08	3.08	3.17	3.08	3.17
Ether extract (%)	5.74	5.79	5.83	5.79	5.83
Calcium (%)	1.22	1.23	1.26	1.23	1.26
Phosphorus (%)	0.67	0.66	0.65	0.66	0.65
Lysine (%)	1.06	1.09	1.12	1.09	1.12
Methionine (%)	0.57	0.58	0.58	0.58	0.58
Cysteine (%)	0.36	0.37	0.38	0.37	0.38
Feed Cost/kg (₦)	62.61	48.14	50.75	42.99	48.83

*Vita premix provided per kg of diet: Vit A 10,000 I.U; Vit D₃ 32,000 I.U; Vit E 23,000mg; Vit K 2,000mg; Vit. B₁, 1,800mg Vit B₂ 5,000mg; Pantothenic acid 7,500mg; Vit B₁₂ 150mg; Folic acid 750mg; Biotin 100mg; Choline chloride 30,000mg; Cobalt 3,000mg; Iodine 1,000mg; Iron 20,000mg; Manganese 40,000mg; Selenium 200mg; Zinc 30,000mg; Antioxidant 1250mg, ME = Metabolizable Energy, GNC = Groundnut Cake, SBNSM = Soaked Bambara Nut Seed Meal, BBNSM = Boiled Bambara Nut Seed Meal

compared to those in other treatment groups. The increased feed intake of the broiler chicks fed processed BNSM diets could be attributed to the influence of processing which enhanced the palatability and aroma of the diets. This observation also agreed with the findings of Nidaullah *et al.* (2010) who reported that smell and taste were critical traits in food selection by animals. The feed conversion ratio showed no significant ($P>0.05$) difference among birds fed processed BNSM diets T2 (2.48), T3 (2.49), T4 (2.21) and T5 (2.40). However, the value (3.39) obtained in the

control group (T1) was significantly ($P<0.05$) higher FCR than all other dietary treatments. The significantly better feed conversion ratio observed with birds fed BNSM diets compared to those in the control group could be attributed to improved rate of utilization of the dietary nutrients and conversion to gains. This observation agrees with the findings of Gebhart and Kabanov (2001) who reported that better feed conversion ratio signified that more feed was retained in the animals and less waste to the environment.

Table 2: Growth performance of broiler starter chicks fed diets containing processed Bambara nut seed meal (2-6 weeks)

Parameters	0%	5% BNSM	10% Soaked BNSM	5% Boiled BNSM	10% Boiled BNSM	SEM
Initial Weight (g/bird)	142.86	140.48	140.48	140.48	140.48	2.13
Final Weight (g/bird)	702.38 ^b	878.57 ^a	911.90 ^a	947.62 ^a	988.10 ^a	43.15
Total Weight Gain (g/bird)	559.52 ^b	738.10 ^a	771.43 ^a	807.14 ^a	847.60 ^a	42.74
Daily Weight gain (g/bird/day)	19.99 ^b	26.36 ^a	27.55 ^a	28.83 ^a	30.30 ^a	1.52 [*]
Total Feed intake (g/bird)	1873.33 ^a	1812.67 ^b	1895.14 ^a	1875.10 ^a	1930.10 ^a	40.70 [*]
Daily feed intake (g/bird/day)	66.91 ^a	64.74 ^b	67.69 ^a	66.97 ^a	68.93 ^a	1.45 [*]
Feed conversion ratio	3.39 ^a	2.48 ^b	2.49 ^b	2.21 ^b	2.40 ^b	0.18 [*]
Feed cost per Kg gain (₦)	215.85 ^a	120.07 ^b	127.99 ^b	95.17 ^b	117.22 ^b	21.58 [*]
Mortality (%)	0.02	0.05	0.02	0.00	0.07	0.03 ^{NS}

a, b = means on the same row with different superscript differ significantly (P<0.05), SEM = Standard Error of Mean

The significantly ($P<0.05$) better FCR observed in the processed BNSM diets may be attributed to the palatability and efficient utilization of the diets nutrient utilization and better conversion of feed to gain by birds fed BNSM dietary treatments. The feed cost/kg gain (N) were also similar and significantly ($P<0.05$) lower among birds fed BNSM based diets (T_2 , T_3 , T_4 and T_5) compared to those fed the control diet. This may be due to lower feed to gain recorded in those treatments. Hence, reduction in feed cost per kg gain of the diets. Few mortality was observed among birds across the treatment groups except those in T_4 where no mortality was recorded.

Conclusion

Based on the findings of this study, it was revealed that processed Bambara nut seed meal diets improved performance of broiler chicks. However, boiled BNSM at 10 % level incorporated in the diets of broiler chicks gave a better performance.

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Received: 24th August, 2020

Accepted: 18th November, 2020