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Research Application Summary

Growth performance, feed utilization and carcass physical properties of broiler chicks fed graded levels of baobab seed meal instead of concentrate

Fatima, G. A. & Mekki, D. M.

1Deparment of Animal Production, Faculty of Natural Resources and Enviromental Studies, University of Kordofan, P.O. Box 160, Elobeid, Sudan

***Corresponding author:** Fatimagubrel@yahoo.com

Abstract

In order to determine the effect of feeding graded levels of baobab seed meal instead of concentrate on feed intake, growth rate, feed conversion rations, and physical properties of carcass of broiler chicks, 144 day old mixed-sex of broiler commercial hybrid chicks Ross 308 were purchased. The chicks were randomly allocated to six treatments groups A, B, C, D, E, and F. Each treatment was allocated 24 chicks with eight chicks per replicate in a completely randomized design (CRD). The inclusion level of replaced concentrate in the diets were 0%, 1%, 2%, 3%, 4% and 5% of baobab seed meal for groups A, B, C, D, E and F, respectively. Birds were weighed at the beginning and weekly up to the end of the experiment at six weeks of age. Three birds per replicate were randomly selected for blood samples and carcass physical characteristics measurements. Results showed significant ($p \leq 0.05$) lower live body weight, weekly body weight gain, feed intake and feed conversion rations for group F compared to other groups. However there were no differences between treatments for pH, lightness and yellowness, but significant ($p \leq 0.01$) difference for high cooking loss percentage and increased value of redness were recorded for birds in group F compared to birds in other groups. The gross margin analysis showed that the use of baobab seed meal as alternative of broiler concentrate in broiler chick diets reduced the total feed cost. Thus as a valuable local cheap ingredient it could be used up to 4% in broiler diets instead of concentrate to maximize financial returns.

Keywords: Baobab seed meal, broiler chicken, carcass weight, growth rate, Sudan

Résumé

Les poulets de chair hybrides commerciaux Ross 308 de 144 jours de sexe mixte étaient achetés afin de déterminer l'effet d'alimentation avec des niveaux gradues à base d'aliments de graines de baobab au lieu de se concentrer sur l'apport alimentaire, le taux de croissance, les rations de conversion alimentaire et les propriétés physiques de la carcasse de poussins de chair. Ces poussins ont étaient répartis de façon aléatoire dans six groupes de traitements A, B, C, D, E et F. Chaque traitement était constitué de 24 poussins en raison de huit poussins par répétition dans un dispositif complètement randomisée (CRD). Le niveau d'inclusion de concentré remplacé dans les régimes était de 0 %, 1 %, 2 %, 3 %, 4 % et 5 % de farine de graines de baobab pour les groupes A, B, C, D, E et F, respectivement. Ces poussins étaient pesés au début et à chaque semaine jusqu'à la fin de l'expérience à l'âge de six semaines. Trois poussins étaient sélectionnés de façon aléatoire dans chaque réplication pour prélever les échantillons de sang et mesurer les caractéristiques physiques de la carcasse. Les résultats ont montré une diminution significative ($p \leq 0,05$) du poids vif, du gain de poids hebdomadaire,

de l'apport alimentaire et des rations de conversion alimentaire pour le groupe F par rapport aux autres groupes. Cependant, il n'y avait pas de différences entre les traitements pour le pH, la clarté et le jaunissement, mais une différence significative ($p \leq 0,01$) pour le pourcentage de perte élevée à la cuisson et la valeur accrue de la rougeur ont été enregistrées pour les poussins du groupe F par rapport aux poussins des autres groupes. L'analyse de la marge brute a montré que l'utilisation de farine de graines de baobab comme alternative au concentré de poulet de chair dans l'alimentation des poussins de chair réduisait le coût total de l'alimentation. Ainsi, en tant qu'ingrédient local bon marché et précieux, il pourrait être utilisé jusqu'à 4 % dans l'alimentation des poulets de chair au lieu du concentré pour maximiser les rendements financiers.

Mots clés : Farine de graines de baobab, poulet de chair, poids de la carcasse, taux de croissance, Soudan

Introduction

Poultry industry is considered as the second largest industry in many African countries (Austic and Nesheim, 1990). Most of the chicken eaten today come from broiler chickens which grow very rapidly and have been selected for traits that are desirable for meat production (Havenstein *et al*., 2014). Poultry is now by far the largest livestock species worldwide accounting for more than 30 % of all animal protein produced. However, the high cost of animal products that is being witnessed in most African countries is attributed to high cost of livestock feed which generally accounts for 60 – 70 percent of the total cost of production (Ojo *et al*., 2013). Utilization of non conventional feedstuffs especially when it encourages shift to other ingredients such as leaf meals, and tree seed cakes that are not edible by man but readily available will reduce the cost of feed and maximize the returns from poultry farming. Research on low-cost and locally available indigenous feed resources is thus fundamental, particularly those which do not attract competition with human beings and ever expanding intensive livestock production. One such potential alternative is the use of local indigenous multipurpose tree products and by products, such as seeds, cakes, and leaf meals of baobab (Oladunjoye *et al*., 2014). It produces seeds that are not only rich in protein (20-36 % CP) and energy (1 898 - 4 465 k Cal/kg) but also provides some necessary fiber, vitamins, minerals and amino acids, particularly, lysine and methionine which are limited in most cereals but essential for livestock growth and development (Saulawa *et al*., 2015).

The two major factors for a successful and economic broiler production are fast growth rate, feed efficient and feed conversion (Bale *et al*., 2013). On the other hand the development of broiler chickens depend on optimal feed intake during the growing period. Feed intake is dependent on a number of factors such as environmental temperature, diet nutrient density, and physical form of diet (Lokman *et al*., 2008) is growth performance of broiler chicken. According to Jahan *et al*., 2006, in terms of body weight, birds varried with mash, pellet and crumble group. Indeed the success of poultry meat production has been strongly related to improvements in growth and carcass yield, achieved mainly by increasing breast proportion and reducing abdominal fat (Dou *et al*., 2009; Oyeleke *et al*., 2012). The purpose of this study was therefore to assess the effect of different levels of baobab seed meal on feed utilization and growth rate in broiler chicken, determine the effect of using graded levels of baobab seeds meal on carcass characteristics in broiler chickens, determine the optimum inclusion of baobab seed meal in broiler diets, and to compare the carcass yield and physico-chemical quality of meat of broiler chickens.

Materials and methods

The experiment was conducted in the poultry farm, Department of Animal Production, University of Kordofan, in North Kordofan State, Elobid, Sudan.

Baobab seeds were collected from traditional juice shops as residual products in Elobied Town. The produced seeds were subsequently washed and sun dried. The seeds were then crushed to obtain the baobab meal. The produced Baobab meal was then subjected to chemical analysis to estimate the approximate nutrients. Amino acids content of baobab meal was determined using HPLC according to AOAC (2000) protocol; additionally minerals contents were also determined.

Six rations were formulated as A, B, C, D, E and F for each starter diet and finisher. This was done to ensure that the rations were iso-nitrogenous and iso-caloric (similar in energy and crude protein). Ration A was considered as a control with 2.5% super concentrate and 0% baobab seed meal; ration B had 2% concentrate and 0.5% baobab seed meal; ration C had 1.5% concentrate and 1% baobab seed meal; ration D had 1% concentrate and 1.5% baobab seed meal; ration E had 0.5% concentrate and 2.0% baobab seed meal; and ration F had 0% concentrate and 2.5% baobab seed meal (Table 1). The gross composition of each diet is shown in Table 2.

Table 1. Gross composition of the experimental diets starter

Ingredients%	A (%)	B (%)	C (%)	D (%)	E (%)	F (%)
Sorghum	60	60	60	60	60	60
Groundnut cake	30	30	30	30	30	30
Wheat bran	4.5	4.5	4.5	4.5	4.5	4.5
Salt	0.5	0.5	0.5	0.5	0.5	0.5
Concentrate	5	4	3	2	1	0.0
Boabab meal	0	1	2	3	4	5
Total	100	100	100	100	100	100

Table (2) Gross composition of the experimental diets finisher

Ingredients%	A (%)	B (%)	C (%)	D (%)	E (%)	F (%)
Sorghum	65	65	65	65	65	65
Ground nut cake	25	25	25	25	25	25
Wheat bran	4	4	4	4	4	4
Salt	0.5	0.5	0.5	0.5	0.5	0.5
DCP	0.5	0.5	0.5	0.5	0.5	0.5
concentrate	5	4	3	2	1	0.0
Boabab meal	0.0	1	2	3	4	5
Total	100	100	100	100	100	100

Experimental birds: One hundred and forty four (104) day old mixed-sex broiler commercial hybrid chicks were purchased. All chicks were vaccinated against Newcastle and Comboro diseases. Chicks were fed the same diet for a week at the beginning as adaptation period. Birds were subsequently divided randomly into six groups A, B, C, D, E, and F. The groups were fed the formulated rations A, B, C, D, E, and F consecutively.

Housing and experimental procedure: The birds were raised in open sided-deep litter floor house measuring 11x5x3.5 m. The house was divided internally into six sections of 2x5 m to accommodate the six groups A, B, C, D, E and E. The groups were divided into three sub group. Six floor pens was provided with plastic containers for water and rectangular trough feeders. The house was provided with florescent lambs to give continuous artificial light (24 hrs.). Water and feed were provided *ad libitum*

The birds were weighted after one week to obtain initial weight and thereafter at weekly interval, up to the end of the experimental period. The diets were also weighted weekly early in morning and, the remaining feed was weighted at the end of the week to determine the feed consumption.

Table 3. Experimental design and bird mangement (lay out)

Treatments	Replications	No. 0f Birds/Unit
A	3	8
B	3	8
C	3	8
D	3	6
E	3	8
F	3	8

Carcass characteristicsation procedures. At the end of the experiment (6 weeks of age) representative samples of 18 (3 chicken from each group) were selected randomly for slaughter and dissection. Samples of blood were taken from selected chicken to determine the level of cholesterol. Head, feet, viscera, and shanks were removed. Non-carcass fat, abdominal fat, including fat surrounding gizzard, heart fat, fat trimmed from alimentary tract ,visceral fat, and pad fat was removed and weighed. Carcass yield dressing percentage was obtained by expressing the dressed carcass weight as a percentage of live body weight. In each carcass the skin and subcutaneous fat also were removed from the surface of the superficial muscles, and intramuscular fat was removed from the indentation of their origin and insertion.

Data Collection and Analysis: The data recorded during the experimental period included growth performance, live body weight gain, feed consumption and feed conversion ratio, carcass characteristics and meat quality. The data collected were analyzed according to complete randomized design (CRD) using Statistical Analysis System (SAS) to determine the significant differences between and within the measured parameters.

Result and discussion

Weekly live body weight and weight gain. Body weight of birds of different treatments from 2nd to 6th weeks of age showed significant differences ($P<0.01$) but the initial body weight of the birds did not differ significantly (Table 3). Similar observations were reported by Jahan *et al*. (2006) who indicated that feeding broiler mash diets had no significant effect on initial weight. In termes of weight gain (Table 4) significant ($P<0.01$) differences were recorded as previoursly reported by Saulawa *et al*. (2015) where feeding raw baobab seed meal up to 10% gave significantly increase in body weight but Oladunjoye *et al*. (2014) on the contrary reported that final weight and average daily gain (ADG) of the rabbits that received 5% and 10% baobab seed meal were not different.

Feed intake and feed conversion ration. Feeding of graded levels in the baobab seed meal instead of concentrate of 1- 4% to broiler starter had no significant ($p> 0.01$) effect on feed intake Bale *et al*. (2013) found similar results, except that feeding level of baobab seed meal (5%) had significant effect in treatment F(5%) of baobab they cosumed lower than other groups of treatments may be due high

content of fiber in the diet (highest feed consumed was 399.98 ± 0.36/ and lowest 208.33 ± 0.21g/ bird/week respectively), feed conversion rations result of this study indicate that there were some differences but not significant except for treatment F which offered different significantly from other treatments, contrary to what was report by Bale *et al*. (2013).

Table 4. Feed intake ($\bar{x} \pm sd$) per bird per week of the experimental broiler chicks fed on graded levels of baobab seed meal rations

	Feed intake (bird /week) gm				
Treatment	W2	W3	W4	W5	W6
A	399.98 a± 0.26	600.00 a ± 0.29	700.00 a ±0.35	769.57 a ± 0.45	991.30 a ±0.26
B	362.46 a± 0.26	616.67 a ± 0.21	713.64 a ± 0.25	759.00 a ± 0.10	972.73 a ±0.32
C	399.98 a ± 0.36	595.83 a ± 0.49	626.09 a ± 0.35	786.36 a ± 0.51	995.45 a ± 0.87
D	299.95 ab ± 0.85	536.67 a ± 0.90	668.18 a ±0.53	763.36 a ± 0.79	963.64 a ±0.75
E	385.33 a ± 0.15	525.00 a ± 0.72	581.81 a ±0.20	722.73 a ± 0.43	904.54 a ±0.71
F	208.33 b ± 0.21	241.67 b ±0.81	247.83 b ± 0.35	321.74 b ±0.42	486.95 b ± 0.50

* A, B, C, D, E and F are birds fed 0%, 1%, 2%, 3%, 4% and 5% baobab meal instead of concentrate in broiler starter and finisher rations, respectively.
* W2, W3, W4, W5 and W6 are live body weight at second, third, fourth, fifth and sixth weeks of age, respectively.
* Figure with different superscripts in same column are significantly differ (DMRT 1%)

Table 5. Feed conversion ratio (feed/body weight gain) of the experimental broiler chicks fed on graded levels of baobab seed meal

	Feed conversion ratio (feed/gain in kg)					
Treatment	W2	W3	W4	W5	W6	Average
A	2.19	2.29a	2.20	2.21	3.07 a	2.39
B	2.26	2.77a	2.03	2.22	3.34 a	2.52
C	2.87	3.54a	2.28	2.71	3.42 a	2.96
D	1.88	3.05a	2.47	2.34	2.79 a	2.50
E	2.51	2.69a	2.23	2.26	2.90 a	2.51
F	2.43	5.09b	3.21	2.65	4.31 b	3.54

* A, B, C, D, E and F are birds fed 0%, 1%, 2%, 3%, 4% and 5% baobab meal instead of concentrate in broiler starter and finisher rations, respectively.
* W2, W3, W4, W5 and W6 are feed conversion rations at second, third, fourth, fifth and sixth weeks of age, respectively.
* Figure with different superscripts in same column are significantly differ (DMRT 1

Body weight gain/week. The results are shown in Figure 1. Treatment A birds grew fast from the beginning of the experiment and the chicks had the highest gain in week five, then Treatment B birds gained weight form the beginning of the experiment and got maximum weight gain in week five similar to treatment A. Treatment C birds gained in five week of age then weight again droped as recorded. For birds in group D, they had the highest weight gain in week five of age then continue gaining weight, for treatment E the weight gain of birds counten gaining and continued to gain weight after week four then had dropped in week six at the end of the experiment. Birds in group F it are differed from all other treatments in body weight aging, recording slow increase in body weight gain, then dropped in week three of the experiment.

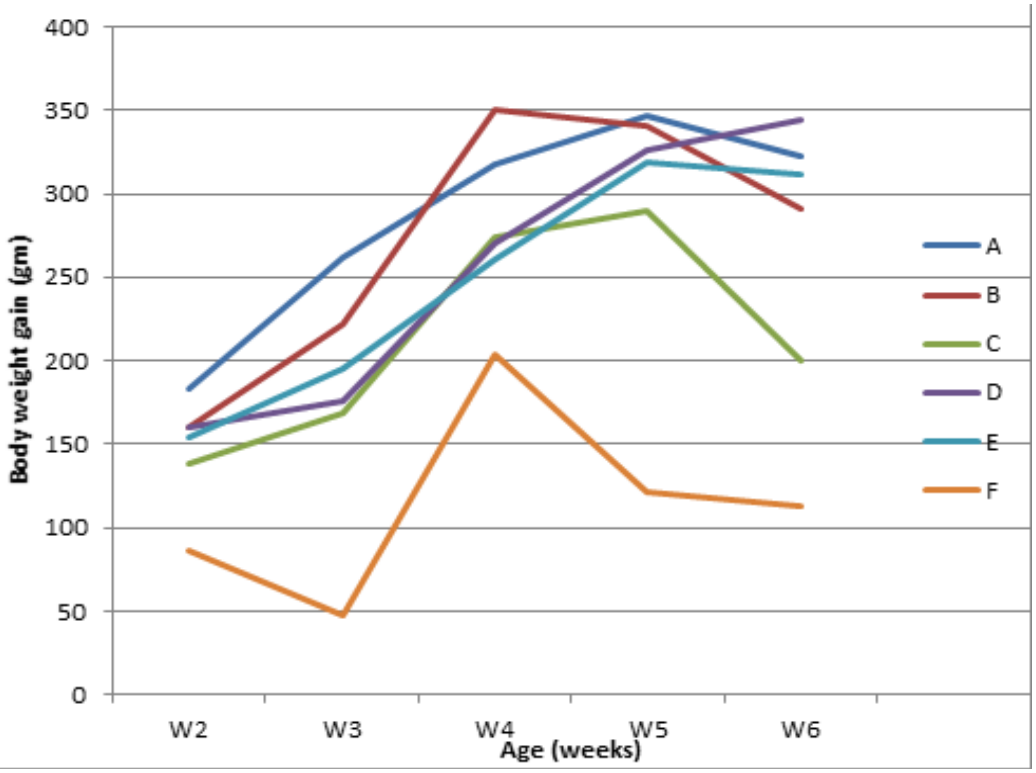

Figure 1. Body weight gain/week for broilers fed on different diets
Where A, B, C, D, E, and F were gropus of chickes fed graded levels of baobab seed meal.
Where: W1, W2, W3, W4, W5, & W6 age of experimental chicks

Carcass physical properties and organs weight. In terms of carcass characteristics, drum, wing, and back weight thet results were statictically similar except for treatment F (highest content of babobab seed meal) The results are similar to those reported by Oladunjoye et al. (2014). The carcass weight and dressed weight of the rabbits fed 0% (control), 5% and 10% baobab seed meal were similar. The result of breast weight indicate there were significantly different between all treatments as similarly reported by Dou et al. (2009) who found out that breast and thigh meat content of carcass both increased when birds had access to outdoor space and their stocking density was lower in an organic production system.

Table 6. Carcass physical properties of the experimental broiler chicks fed on graded levelsof baobab seed meal

Treatments	pH	Cooking loss %	WHC %	Lightness (L)	Redness (a)	Yellowness (b)
A	5.51bc ± 0.04	25.78e ± 0.32	1.12c ± 0.02	61.21a ± 0.53	4.71b ± 0.48	14.24ab ± 0.97
B	5.46c ± 0.02	28.43d ± 0.71	1.35a ± 0.03	59.14a ± 1.55	5.25ab ± 0.41	12.82b ± 1.36
C	5.56b ± 0.01	29.29d ± 0.12	1.23b ± 0.03	53.28b ± 1.39	6.88ab ± 1.63	15.35ab ± 1.02
D	5.56b ± 0.02	31.74 c± 0.36	1.13c ± 0.03	59.82a ± 0.79	6.50ab ± 1.05	13.95ab ± 2.31
E	5.46c ± 0.03	34.18b ± 0.19	1.02d ± 0.05	55.31b ± 0.37	7.79ab ± 1.00	16.63a ± 0.62
F	5.71a ± 0.04	36.42a ± 0.23	0.87e ± 0.05	55.34b ± 0.32	8.07a ± 1.82	15.96ab ± 1.34

* A, B, C, D, E and F are birds fed 0%, 1%, 2%, 3%, 4% and 5% baobab meal instead of concentrate in broiler starter and finisher rations, respectively.
* Figure with different superscripts in same column are significantly differ (DMRT 1%)

Table 7 Organs weight ($\bar{x}$ ± sd) gm of the experimental broiler chicks fed on graded levels of baobab seed meal

Characters	Liver	Heart	Gizzard
A	40.00a ± 1.00	9.00a ± 1.00	31.00 ± 4.00
B	33.67ab ± 6.03	7.67ab ± 1.53	23.67 ± 11.03
C	33.67ab ± 6.03	8.00ab ± 1.00	32.67 ± 6.03
D	34.67ab ± 5.51	7.33ab ± 1.15	25.67 ± 0.58
E	40.33a ± 3.06	9.00a ± 1.00	31.33 ± 2.52
F	23.00b ± 5.29	4.67b ± 2.08	22.33 ± 6.11

Conclusions

Findings from this study show that the treatment (A) of broiler chick fed control diet (0% baboab seed meal) performed better than other groups of treatments in terms of feed intake, growth rate, and carcass quality although had hight cost of feeding. The commercial broilers chicken in treatment (A) consumed about twice more feed than treatment (F) fed diet content 5% of baboab seed meal in place of concentrate. However, treatments B, C, D perform better than treatment F in terms of feed consumed, body weight gain, and carcass quality. The gross margin analysis showed that the use of baobab bseed meal as alternative of broiler concentrate in broiler chick diets economically reduced the total feed cost. Thus as a valuable local cheap ingredient it could be used up to 4% in broiler diets instead of concentrate to maximize financial returns.

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