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Performance and economic parameters of broiler chickens fed baobab (*Adansonia digitata L.*) seed meal as replacement for soyabean meal in semi-arid zone of Nigeria

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Abstract

This study was carried out for eight weeks to investigate the effect of replacing soyabean meal with baobab seed meal in the diet of broiler chickens. Two hundred and twenty five (225) day-old broiler chicks were randomly assigned to five dietary treatments at both starter and finisher phases. At each phase, 0%, 25%, 50%, 75% and 100% of the soya bean in the diets were replaced with baobab seed meal (BSM); Each treatment was replicated thrice with 15 birds per replicate in a Completely Randomized Design (CRD). At the starter phase, feed intake, weight gain and feed conversion ratio (FCR) showed no significant difference ($p>0.05$) across dietary treatments. Significant ($p<0.05$) difference was however observed for feed intake at the finisher phase. Body weight gain per bird for both starter and finisher phases showed no significant difference. FCR showed no significant difference at the starter phase. At the finisher phase however, significant difference was observed. Birds on (25%) BSM consumed less feed (2.47 g/bird/day) to gain a unit weight, Birds on (75%) and (100%) BSM levels had significantly ($p<0.05$) poorer FCR than birds on (25% BSM). The cost benefit analysis showed that birds fed 0% BSM were the poorest in terms of cost-cutting measure. This study revealed that broiler chickens fed diets that contained BSM as well as those that received no BSM in their diets showed identical performance. It therefore suggests the dietary substitution of BSM at 100% for both the starter and finisher phases as most appropriate for optimum performance.

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Introduction

Poultry meat and eggs are the most highly demanded and most consumed animal protein in the world [1]. This may be due to some reasons such as the high turn-over rate within short period, low capital requirement, perceived healthiness and wide acceptability by many religions and cultures. The poultry industry in developing countries suffers from many challenges ranging from diseases, poor quality stock, inadequate and high cost of health services and incessant high feed cost which is the most important of these problems [1]. This is more worry-some because feed cost accounts for about 70% of the total cost of poultry production and is thereby considered as a major determinant of the profitability and to a large extent the viability of the enterprise [2].

According to some workers [3-6] the growing cost of conventional feedstuffs for poultry is caused by competition between poultry, humans and ever-expanding intensive livestock production. This has led researchers and feed manufacturers to search for alternative low-cost feed ingredients that are readily available, inexpensive and have less direct nutritional significance to human as one of the ways of reducing feed cost and maximizing the returns from poultry farming [7].

Many non-conventional feedstuffs (NCF) have been explored; research emphasis is now on the potentials of lesser-known, ignored and under-exploited trees and shrubs that are native to Africa [8,9] as protein and energy source; baobab (*Adansonia digitata L.*) belongs to such category.

The baobab (*Adansonia digitata L.*) is a decidous tree that is found throughout Africa, generally at low altitudes and in the hotter as well as drier areas. It is so widespread that to many people, it is an icon, symbolic of the continent itself. In Nigeria it is widely spread in the savannah regions [10,11] The baobab is widely utilised for food; The leaves can be used either fresh as a cooked vegetable or dried and powdered as a functional ingredient (thickener) of soups and sauces [12]. It is common in the sahelian region especially known as "miyarkuka" among the Hausas and other ethnic groups in northern Nigeria. The fruit contains a number of seeds embedded in a whitish pulp that can be either eaten as a sweet, or made into a refreshing beverage after soaking in water or milk. It is also used to adulterate and curdle milk [12].

The bark is used for fibre or as firewood, while the roots contain tannins that provide a useful red dye. Burning baobab fruit pulp produces an acrid smoke used to deter insects troublesome to livestock. Concoction made from the leaves, bark, roots and flowers are recommended for asthma, colic and intestinal infections [11]. Baobab oil is also known for many beauty benefits; it has taken a fractional proportion in the composition of creams, lotions, body butters and other skin care formulations.

Baobab seeds are not widely utilized as greater percentage of it goes to waste [13]. However they are used as thickening agent in soups or they can be roasted and eaten as snacks [11]. In some parts of Ghana and Nigeria they are also fermented and used as flavouring agents ("Kantong" and "daddawa" respectively) in soups.

According to Proll, et al [14], baobab seed have high digestibility, biological value (BV), and high net protein utilization (NPU) among unconventional tropical crop seed. The seeds are rich in protein (20-36% CP) and energy (1898-4465 kcal/kg) and also provide some necessary fibre, vitamins (vitamin C), minerals (Calcium and Iron) and amino acids, particularly, lysine and methionine which are limiting in most cereals but essential for livestock growth and development [7,15,16]. Despite its high nutritive value, there is dearth of information on the potential of baobab seed as a source of protein for poultry [17].

In order to reduce the cost of feeding in broiler chickens at both starter and finisher stage, one of the alternatives available is the prospect of using baobab seed meal (BSM) due to its availability and low cost. There for it is necessary to investigate the effect of replacing soya bean meal with baobab seed meal in the diet of broiler chickens for both starter and finisher. The aim of the study is to determine the optimum performance as well as the optimum cost level for replacing soyabean meal with baobab seed meal in the boriler starter and finisher ratio. The hypothesis of the study is that if soyabean meal is replaced with baobab seed meal the broiler chickens optimum performance will be acquired, and the feed cost at both starter and finisher will be reduced due to the availability and low cost of the baobab seed.

Materials and Methods

Study area

This study was conducted at the poultry unit of the Teaching and Research Farm of the Department of Agricultural Education, Umar Suleiman College of Education Gashua, Yobe state. Gashua is located between Latitude 12.52°-13°N, Longitude 11.24°-11.30°E and Altitude of 299 m above sea level. The mean temperature ranges from 38°C-40°C, the maximum being 40.6°C (March-April) and the lowest 23°C-28°C (December-January). The area is characterized by short duration of rainfall (June to September) which varies from minimum of 500 mm to maximum 1000 mm [18].

Seed collection and processing

The baobab seed used for the experiment was purchased from a local market in Gashua. The seed was washed, drained, and then sun dried after which it was milled with a hammer mill to produce baobab seed meal (BSM).

Experimental birds and their management

A total of two hundred and twenty-five (225) broiler chicks were used for the experiment. On arrival, the chicks were brooded for one week using kerosene stove as a source of heat after which they were individually weighed and randomly assigned to various dietary groups. The birds were also vaccinated with Gumboro vaccines at the age of two weeks, Newcastle disease vaccine (lasota) at three weeks, and a second dose of Gumboru disease vaccine (booster) at five weeks. Similarly all the necessary routine husbandry management practices were duly observed. The experiment lasted eight weeks.

Experimental diets and design

Baobab seed meal (BSM) was used to formulate five diets for the starter and finisher phases. During the two phases, 0, 25, 50, 75 and 100% of the soya bean was replaced with baobab seed meal. These were designated as T1 (0% BSM), T2 (25% BSM), T3 (50%BSM), T4 (75% BSM), and T5 (100% BSM), respectively. Two hundred and twenty five broiler chicks were randomly assigned to five dietary treatments. Each treatment was replicated thrice with 15 birds per replicate in a Completely Randomized Design (CRD). Feed and water was provided *ad libitum*. The birds were weighed at onset of the experiment and thereafter on a weekly basis while feed intake was recorded daily. The composition and calculated analysis of the experimental diets for both starter and finisher stages are presented in Tables 1 and 2, respectively.

Table 1: Composition and calculated analysis of the experimental starter diets.

	Percent of full-fat soya bean replaced with baobab seed meal				
Ingredients (%)	**T1 (0)**	**T2 (25)**	**T3 (50)**	**T4 (75)**	**T5 (100)**
Maize	50.3	50.3	50.3	50.3	50.3
Full-fat soya bean	31	23.25	15.5	7.75	0
Baobab seed meal	0	7.75	15.5	23.25	31
Wheat offal	10	10	10	10	10
Fish meal	5	5	5	5	5
Bone meal	3	3	3	3	3
Common salt (NaCl)	0.25	0.25	0.25	0.25	0.25
Min-vit-premix*	0.25	0.25	0.25	0.25	0.25
Methionine	0.1	0.1	0.1	0.1	0.1
Lysine	0.1	0.1	0.1	0.1	0.1
Total	100	100	100	100	100
	Calculated analysis				
Crude protein (%)	23	23.28	23.54	23.82	24.09
Crude fibre (%)	4.28	5.13	5.96	6.83	7.68
Ether extract (%)	4.71	8.62	8.74	8.87	8.98

Methionine (%)	0.43	0.39	0.49	0.46	0.42
Lysine (%)	1.23	1.33	1.41	1.48	1.56
Calcium (%)	1.31	1.31	1.32	1.32	1.32
Phosphorus (%)	1.11	1.09	0.94	1.04	1.01
ME (kcal/kg)	2834	2842.5	2938.9	35.2	3131.5

ME=Metabolisable energy. ME=%CP x 37 +%EE x 81+%NFE x 35.5 (Pauzenga, 1985).

*1 kg of premix contains: Vitamins A (5, 000, 000 I.U), Vitamin D3 (1000000 I.U), Vitamin E (16000 mg), Vitamin K3 (800 mg), VitaminB1 (1200 mg), Vitamin B2 (22000 mg), Niacin (22000 mg), Calcium pontothenate (4600 mg), Vitamin B6 (200 mg), Vitamin B12 (10 mg), Folic acid (400 mg), Biotin (32 mg), Choline chloride (200000 mg), Manganese (948000 mg), Iron (40000 mg), Zinc (32000 mg), Copper (3400 mg), Iodine (600 mg), Cobalt (120 mg), selenium (48 mg), Anti-Oxidant (48000 mg)

ME: Metabolisable energy.

Table 2: Composition and calculated analysis of the experimental finisher diets.

Percent of full-fat soya bean replaced with baobab seed meal					
Ingredients (%)	T1 (0)	T2 (25)	T3 (50)	T4 (75)	T5 (100)
Maize	55.88	55.88	55.88	55.88	55.88
Fullfat soya bean	24.42	18.32	12.21	6.11	0
Baobab seed meal	0	6.11	12.21	18.32	24.42
Wheat offal	13	13	13	13	13
Fish meal	3	3	3	3	3
Bone meal	3	3	3	3	3
Common salt (NaCl)	0.25	0.25	0.25	0.25	0.25
Min-vit-premix*	0.25	0.25	0.25	0.25	0.25
Methionine	0.1	0.1	0.1	0.1	0.1
Lysine	0.1	0.1	0.1	0.1	0.1
Total	100	100	100	100	100
Calculated analysis					
Crude protein (%)	20	20.22	20.44	20.66	20.86
Crude fibre (%)	4.37	4.53	5.19	5.87	6.53
Ether extract (%)	3.69	4.68	5.66	6.64	7.63
Methionine (%)	0.43	0.47	0.51	0.56	0.6
Lysine (%)	1.03	1.08	1.16	1.23	1.34
Calcium (%)	1.24	1.25	1.25	1.25	1.26
Phosphorus (%)	1.07	1.05	1.03	1	0.99
ME (kcal/kg)	2906.7	2965.7	3024.2	3083.3	3141.7

ME=Metabolisable energy. ME=%CP x 37 +%EE x 81+%NFE x 35.5 (Pauzenga, 1985)

*1 kg of premix contains: Vitamins A (5, 000, 000 I.U), Vitamin D3 (1000000 I.U), Vitamin E (16000 mg), Vitamin K3 (800 mg), Vitamin

B1 (1200 mg), Vitamin B2 (22000 mg), Niacin (22000 mg), Calcium pontothenate (4600 mg), Vitamin B6 (200 mg), Vitamin B12 (10 mg),

Folic acid (400 mg), Biotin (32 mg), Choline chloride (200000 mg), Manganese (948000 mg), Iron (40000 mg), Zinc (32000 mg), Copper

(3400 mg), Iodine (600 mg), Cobalt (120 mg), selenium (48 mg), Anti-Oxidant (48000 mg); ME: Metabolisable energy.

Measurement of response criteria

Feed intake: Feed consumption from each treatment was determined on daily basis by subtracting left-over from feed given per group. Adequate measures were taken to safeguard against spillage and related wastage. The mean daily feed intake was calculated by dividing the amount consumed by the number of birds in the group.

Body weight: Experimental birds were weighed individually (weekly) using a weighing balance to determine their weight. The mean live weight of each treatment group was determined by dividing total weight by the total number in that group.

Body weight gain: The body weight gain of each of the treatment group was obtained by calculating the difference between the mean live weight of the current week from the mean live weight of the preceding week and dividing by seven days to obtain daily weight gain.

Feed conversion ratio (FCR): This was obtained on a weekly basis. It was measured by dividing the mean feed intake per bird in grams by the mean live weight gain per bird for each treatment group.

$$FCR = \frac{\text{Feed intake}}{\text{Body weight gain}}$$

Protein efficiency ratio (PER): Protein efficiency ratio (PER) was determined based on the mean weight gain (g) of the bird divided by its mean protein intake (g) during the experiment.

$$FCR = \frac{\text{Body weight gain}}{\text{Protein consumed}}$$

Chemical analysis: Dry matter, Crude protien, Crude fibre, Ether extract, Nitrogen-free extract and ash content of baobab seed meal, was determined using AOAC (1990) methods of analysis [19].

Cost benefit: Feed cost per kilogram was calculated from the cost of ingredients used in the feed preparation. Feed cost per kilogram live weight gain was determined using prevailing market prices of each ingredient at the time of the study [20].

Statistical analysis: All the data collected were subjected to analysis of variance using the Statistical Package for Social Sciences [21]. Significant difference among treatment means were compared using Least Significant Difference (LSD) according to Steel and Torrie, [20].

Results and Discussions

Proximate composition of baobab seed

The proximate composition of baobab seed is presented in Table 3. This study revealed that baobab seed is rich in protein (48.43% CP). The crude protein (CP) level is comparable to CP values of conventional feed ingredients such as soya bean (45%) and groundnut cake (45%) which are highly expensive and competed for by human.

Table 3: Proximate composition of baobab seed meal.

Parameters	Percentages (%)
Dry matter	97.5
Crude protein	48.43
Crude fibre	17.5
Ether extract	19.6
Nitrogen-free extract	10.47
Ash	4
ME (kcal/kg)	3734

Although the value obtained in this study is higher than 20%-36% CP reported for the seed by some workers [7,15,16] it corresponds with 48.3% as reported by Adubiaro, et al. [22] Crude fibre (CF) value (17.5%) obtained in this study is similar to 16.50% and 16.20% reported for the seed by Sola-Ojo, et al. [23] and Osman [24] respectively. However, Nkafamiya, et al. [25] and Yusuf, et al. [9] reported lower values of 5.73 and 6.71% for the seed, respectively. However, Sola-Ojo, et al. [23] related the high CF content of baobab seed to the relatively hard pericarp. Ether extract value (19.6%) obtained in this study falls within the range of 12.20 to 29.60% reported for the seed by many authors (Osman, 2004; Ezeagu, 2005b; Yusuf et al., 2008 and Sola-Ojo, et al.) [23]. Similarly, the nitrogen free extract (NFE) level (10.47%) is close to 11.20 and 14.23% as reported by [9,16], respectively. It is however, lower than 30-57% as reported by other workers [8,14,24,25] for the seed. Ash content of the seed (4.0%) is within the ranges of 3.60 to 8.50% as reported previously [23,24,26] The high level of protein recorded in this study qualifies baobab seeds as potential protein supplement in broiler diet.

Great variation in nutritional composition is reported for baobab seed in literature. Chadare, et al. [27] assumed that the variations may be due to the quality of the sample, the provenance (origin) of the sample, the age of the sample, treatment before analysis, the storage conditions, the processing methods, a probable genetic variation, and the soil structure and its chemical composition. Apart from the variability in the material, accuracy and precision of analytical methods used may also be a factor.

Productive parameters

Feed intake: The performance of birds fed varying levels of Baobab Seed Meal (BSM) - based diets are presented in Tables 4 and 5, respectively, for both starter and finisher phases. At the starter phase, feed intake, weight gain and feed conversion ratio showed no significant difference (p>0.05) across the dietary treatments.

Table 4: Productive performance of broiler chickens fed baobab seed meal as replacement for soya bean meal at the starter phase.

Percent of full-fat soya bean replaced with baobab seed meal							
Productive performance	**T1 (0)**	**T2 (25)**	**T3 (50)**	**T4 (75)**	**T5 (100)**	**MEAN**	**SEM**
Initial Live weight (g)	69.5	68.77	68.3	67.33	67.03	68.15	3.91NS
Final Liveweight (g)	592.53b	540.40b	670.07a	659.13a	543.07b	601.04	28.95*
Feed intake (g/bird/day)	42.68	41.31	45.41	50.18	44.78	44.87	10.24NS
Daily weight gain (g/bird)	18.7	16.81	21.69	21.14	17.01	19.07	4.67 NS
Feed conversion ratio	2.43	2.63	2.42	2.47	2.86	2.56	0.23NS
Protien efficiency ratio	1.89ab	1.81ab	2.02a	1.95ab	1.71b	1.87	0.13*

a,b,c=Means on the same row with different superscripts differ significantly (p<0.05); SEM=Standard error of means; NS: Not significant (p>0.05); *=Significant (p<0.05)

Table 5: Productive performance of broiler finisher chickens fed baobab seed meal as replacement for soyabean meal.

Percent of full-fat soya bean replaced with baobab seed meal							
Productive performance	**T1 (0)**	**T2 (25)**	**T3 (50)**	**T4 (75)**	**T5 (100)**	**MEAN**	**SEM**
Initial Live weight (g)	592.53b	540.4b	670.06a	659.13a	543.06b	601.04	28.95*
Final Liveweight (g)	1817.04b	1820.09b	2083.35a	1930.30ab	1839.31ab	1898.07	116.67*
Feed intake (g/bird/day)	123.89ab	110.96b	127.74ab	130.70a	130.00a	124.6	9.17
Daily weight gain (g/bird)	43.73	45.69	50.47	45.35	46.29	46.31	5.93NS
Feed conversion ratio	2.85ab	2.47b	2.72ab	2.97a	3.08a	2.82	0.22*
Protien efficiency ratio	1.78b	2.10a	1.72b	1.63b	1.76b	1.8	0.13*

a,b,c=Means on the same row with different superscripts differ significantly (p<0.05); SEM=Standard error of means z; NS: Not significant (p>0.05); *=Significant (p<0.05).

This revealed that the test material did not adversely affect the feed intake of the birds despite the hard pericarp as opined by some authors [23] However, other workers reported significant decrease in feed intake in broilers [7,28] guinea fowl keets fed BSM. Similarly, Bale, et al. [19] reported no significant difference with increasing levels (0%-40%) of BSM in broilers at the starter phase and Oladunjoye, et al. [28] made similar observation in rabbits fed baobab pulp and seed meal. These reports also agree with the findings of Ezeagu (2005b) who also observed no difference in the feed intake of albino rats fed raw baobab seed protein and those fed casein.

Significant (p<0.05) difference amongst the treatment groups was however observed for feed intake at the finisher phase. Although feed intake was slightly higher (130.70 and 130.00 g/bird) respectively, for birds on 75% and 100% BSM levels, the value is statistically similar to 123.89 g/bird obtained for the control group. Birds on 25% BSM recorded the least feed intake (110 g/bird), the value being similar to those obtained for birds on 0 and 50% BSM groups.

This observation is in agreement with the findings of Bale, et al. [19] and that of Ojo, et al. [29] who reported increased feed intake with increase in level of inclusion of BSM in broilers. It is however, inconsistent with earlier findings of [23] in layers, Mwale, et al. [17] in guinea fowl keets and albino rats. These authors observed decreased feed intake with increasing dietary inclusion levels of baobab seed which they attributed to probable effect of the highly fibrous pericarp which has indirect effect on gut-fill thereby limiting space for further intake.

However, Mwale, et al. [17] is of the opinion that high energy content (3000-4500 kcal/kg) of baobab seed due to relatively high fat content may be responsible for the low feed intake since birds are known to consume feed to satisfy their energy requirement.

Body weight gain: Daily body weight gain per bird for both starter and finisher phases showed no significant difference (P>0.05) across the treatments (Tables 4 and 5). Numerically however, birds on 50% BSM gained more weight (21.69 and 50.47 g/bird respectively) for the starter and finisher phases compared to other treatment groups. The non-significant difference between the control and the other treatment groups shows that BSM did not adversely affect nutrient utilization in the diets. Similar results were also observed by Bale, et al. [19] who noted no significant difference in weight gain of broilers fed graded levels (0%, 10%, 20%, 30% and 40%) of baobab seed during the starter phase. The authors also noted that weight gain was statistically similar between broilers fed 0,20 and 30% baobab seed meal at the finisher phase. This is also similar to the reports of Oladunjoye, et al. [28] who observed no significant effect of diets on average daily gain and total weight gain of rabbits fed baobab seed and pulp meal and that of Ezeagu (2005b) who also reported that raw baobab seed however, contrary to the reports of [30] in broilers, in layers, in guinea fowl and in albino rats. The authors reported decline in weight gain with increased levels of baobab seed. It is also contrary to the reports of Ojo, et al. [29] who noted increase in weight gain with increase in dietary inclusion of decorticated undefatted roasted baobab seed meal (DURBSM) which they attributed to the processing methods (soaking and roasting) and the positive effect of DURBSM on feed intake and weight gain in broilers.

Feed conversion ratio (FCR): Results of feed conversion ratio (FCR) for both starter and finisher phases are presented in Tables 4 and 5, respectively. FCR showed no significant (P>0.05) difference at the starter phase. At the finisher phase however, significant difference was observed. Birds on T2 (25%) BSM consumed less feed (2.48) to gain a unit weight and this value is statistically similar to 2.85 and 2.72 obtained for birds on the control (0%) and 50% BSM inclusion. Birds on T4 (75%) and T5 (100%) BSM had significantly poorer FCR (2.97 and 3.08) than birds on (25% BSM). The value is however, similar to the control (0%) and 50% BSM levels. This observation is in consonance with the reports of Saulawa, et al. [30] who respectively showed that feed conversion ratio of broilers at starter phase and albino rats were significantly depressed with baobab seed meal (BSM) inclusion. Similarly, the work also revealed that laying chickens on the control diet (0% BSM) consumed less feed to produce a dozen eggs. The work however, revealed better FCR with increase in BSM inclusion. On the contrary, the findings revealed that feeding graded (0%, 10%, 20%, 30% and 40%) levels of baobab seed meal- based diets had no significant (p<0.05) effect on feed conversion ratio of broiler chickens at both starter and finisher phases. It was also revealed that feed conversion was similar between the rabbits that received diets containing baobab seed and pulp and the control diets. On the other hand, Ojo, et al. [29] reported the best FCR for birds on the highest (7.5%) BSM level. The similarity in feed conversion ratio (FCR) observed between birds on the control and those on BSM treatments in this study is a testimony of the efficacy of BSM to replace conventional soya bean meal in broiler diets.

Protein efficiency ratio (PER): Protein efficiency ratio showed significant (P<0.05) difference for both the starter and finisher phases (Tables 4 and 5). At the starter phase, bird on 50% BSM recorded the highest PER (2.02) while the least value (1.71) was recorded for birds on 100% BSM. However, the value obtained for birds on 25 and 75% BSM groups were statistically similar to the control

(0%BSM) group. At the finisher phase, PER was significantly (P<0.05) higher for birds on 25% BSM (2.10). The remaining groups had statistically similar values (1.63–1.78). This reveals that protein is as efficiently utilized in the treatment groups. The findings of this study is consistent with the reports of Saulawa, et al. [30] and Saulawa, et al. [31] in broiler chickens fed raw baobab seed meal (RBSM) based diets. It is also similar to the report of Adamu, et al. [32] in broilers fed baobab leaf meal diets and Rafiu, et al. [33] in broilers fed baobab pulp and seed meal based diets.

Final body weight: The final body weights of the chickens are presented in Tables 4 and 5. The result of the final body weight obtained in this study showed significant differences (p<0.05) among the treatments at the starter and finisher phases, respectively. For the starter phase, birds on 50% and 75% BSM levels were significantly heavier (670.07 g and 659.13 g respectively) than other groups (540.40-592.53 g). At the finisher phase, birds on 50% BSM were significantly heavier (2083.3 g) than birds on 0% (1817.0 g) and 25% (1820.0 g) BSM inclusion. The value is however, similar to those on 75% and 100% BSM levels. At starter and finisher phases, birds on 0, 25, 75 and 100% BSM are statistically similar. This result is consistent with the report of Bale et al. who recorded heavier final weight for birds on 20% and 30% (2638 and 2605 g respectively) BSM levels and the least (2033 g) for groups on highest inclusion (40%). This result is however contrary to the reports of Saulawa, et al. [31] who reported significant decline in final body weight with increase in dietary BSM inclusion and Oladunjoye, et al. who reported no significant effect of diets on the final weight of rabbits fed baobab seed and pulp meal. Better performance recorded for birds on 50% BSM in terms of daily weight gain and final weight for both the starter and finisher phases and its similarity to the control in feed conversion ratio and protein efficiency ratio suggests that BSM has some complementary effect on performance at that level.

Cost benefit analysis: The cost of feed per kilogram, total feed cost and cost per kilogram weight gain for both the starter and finisher phases are presented in Figures 1 and 2, respectively. Feed cost per kg linearly decreased with increasing levels of baobab seed meal. The cost benefit analysis showed that birds fed 0% BSM were the poorest in terms of the economy (cost-cutting measure) of production while 100% BSM inclusion level produced the least cost of production.

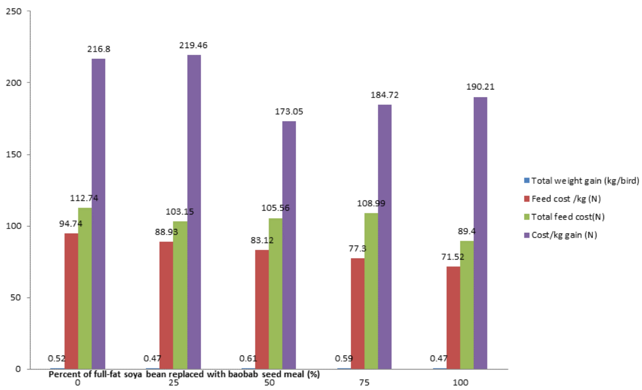

Figure 1: Cost-benefit analysis of replacing soya bean meal with baobab seed meal in the diets of broiler chickens at the starter phase.

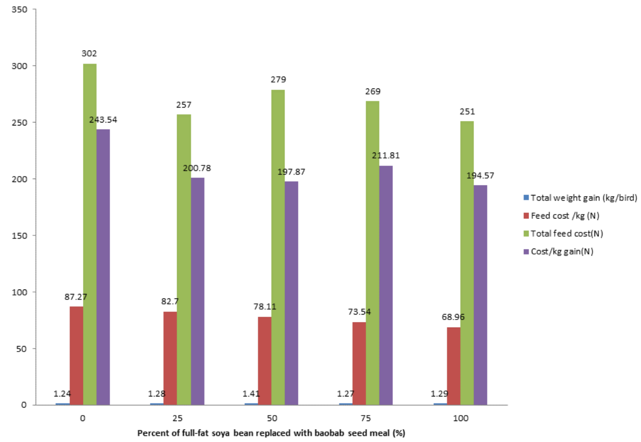

Figure 2: Cost benefit analysis of replacing soya bean meal with baobab seed meal in the diets of boiler chickens at the finisher phase.

Cost per kilogram weight gain tended to decrease with increase in BSM level. The control group recorded the most expensive cost per kilogram weight gain (N 216.80 and N 247.2) for both starter and finisher phases while the cheapest feed cost per kg gain (N 174.0 and N 193.6) were respectively recorded for birds on 50% and 100% BSM levels for the starter and finisher phases.

The findings of this study are supported by the reports of some workers in broilers, in guinea fowl and in rabbits). The authors reported significant reduction in feed cost with increasing levels of baobab seed meal based diets compared to control diet. The findings of Ekenyen [34], Lamidi, et al. [35] suggest that reducing feed cost/kg was only justifiable when production results are comparable with the control [36]. This study proved that including BSM at the highest level during the starter phase is justified because no significant difference existed between the control and the BSM based group in terms of feed intake, weight gain, FCR and final live weight. The same trend was observed for the finisher phase since many of the performance criteria of those on BSM treatments were similar to the control. This is in line with the main objectives of usage of unconventional feedstuffs as reported by some authors [3-6].

Conclusion

In general, this study revealed that broiler chickens fed diets that contained BSM performed as well as those that received no BSM in their diets. It is also an indication that broiler chickens can tolerate up to 100% BSM in their diets without negative impact on productive parameters and with economic benefits. The dietary substitution of baobab seed meal at 100% for soya bean meal for both the starter and finisher phases is however, recommended to poultry farmers as most appropriate for optimum performance and reduction in feed cost.

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