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Utilization of Shea (*Vitellaria paradoxa*) Butter Cake in the Diets of Broiler Birds in Semi- arid Zone of Nigeria

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Abstract

A Study was conducted to evaluate shea butter (Butyrospamum paradoxa) cake (SBC) on growth performance of broiler birds. The study was divided into two phases. Phase one was determination of proximate and phytochemical composition of shea butter cake while in the second phase, is on the performance of broiler birds. In the first phase, AOAC procedure was used to evaluate chemical composition of the SBC. For the growth performance, one hundred and fifty day old broiler chicks were used to evaluate SBC on performance of broiler. The animals were divided into three (3) treatment groups in each experiment (each treatment replicated five times with 10 birds per replicate). The animals were fed diets containing 0%, 5% and 10% SBC in the second experiment. Results (first phase) showed that proximate compositin indicated high dry matter (89.5%), crude protein (14.5%) with lower cellulose content (2.3%). Evaluation of SBC for phytochemicals showed high presence of tannins and saponins (+++) and low content of alkaloids and Saponin glycosides (+). Results from second feeding trials (SBC levels of between 0 and 10% for broiler birds) indicated no significant difference (P>0.05) for all the performance parameters. It was concluded that, dietary inclusion of shea butter cake up to 10 % is safe and reduce cost of broiler production. It was recommended that shea butter cake can be as feed ingredient for broiler birds. The aim of this study is to determine the performance of broiler bird fed diets containing shea butter cake . **Keyword:** Utilization, Shea Butter Cake, Broiler Birds

Introduction: Feed accounts for 70 - 80% of the total cost of broiler production in Nigeria with the high cost of the conventional poultry feed stuffs stemming directly from their competition with human staple of the total cost of feed, about 95% is used to meet energy and protein requirements, about 3-4% for major minerals, trace mineral and vitamin requirements, and 1 to 2% for various feed additives (FAO, 2011). Recent advances in modern poultry production have further increased the competition for conventional feedstuffs between livestock industry, agricultural product-dependent industries (confectioneries and distillers) and humans. Although the intensive system is expensive due to management cost with feeding taking over 80% of the total cost, there is an urgent need for a new cost effective and sustainable approach to livestock production, particularly the food animals like poultry production. This could be achieved through the use nonconventional. One of the possible solutions to the escalating cost of these ingredients is to explore the potentials of alternative feedstuffs as part replacement for the more expensive conventional feed ingredients. The alternative protein supplements like shea butter is highly resistant to diseases and pest and exhibit good nutritional qualities (Pousga S, Boly H, Lindberg J E and Ogle B. 2007). Shea nut is rich in oil and serve as an energy booster in concentrate ration. One of the key agroforestry specie in Africa, particularly Nigeria is the shea butter tree, *Vitellaria paradoxa* syn. *Butyrospermum paradoxum* (Sapotaceae). The shea tree produces fruits which is cherished and eaten by humans and animals; the nut of which is processed to give shea butter, while the residue or by product is the shea nut residue. (Dei,H.K, Rose, S.P, Mackenzie, A.M, and Amarowics, R, 2007).The shea nut residue is an end product; available in large quantity and generally disposed off via incineration, because it is considered as “useless”. Approximately 500,000 metric tone of this cake are produced annually in the savanna region of West Africa. The fermented shea nut meal is sundried for four days on polythene sheets spread on concrete platform to prevent contamination with stones and dusts and re-milled to break the lumps before use. Shea nut meal is an alternative cheap source which can reduce the cost of feed and invariably reduce the cost of production.

~~**Materials and Methods**~~: **Study area:** The experiment was conducted at the Teaching and Research Farm Federal University of Agriculture, Zuru, Kebbi State. Zuru is located in the South Eastern region of Kebbi State of Nigeria with a total land mass of 653km^2.It lies between latitude 11^0 35’ and 11^0-55’ North and longitude 4^0-35’and 5^0-25’East. Zuru is bounded in the west by Gwandu and Yauri in the East, it shares boarder with Kuyanbana. Zuru has a population of about 165, 547 (NPC, 2006). The major economic activity in Zuru is farming and rearing of animals. The average rainfall is about 1825mm with a mean temperature of 27^{0}C. Wet season starts from April to October. The Hamattan period is between November and January. **Experimental birds:** The birds used for this experiment were sourced from Zarm Tech. Farm in Oyo State, Nigeria. Onehundred and

Experimental design: One hundred and fifty (150) day old broiler chick was used for the experiment. They were randomly divided into three treatment groups of 50 chicks each. Each treatment was further being divided into 5 replicates, with ten chicks per replicate in a Completely Randomized Design (CRD). Each treatment was be fed one of the experimental diets for eight weeks.

Statistical analysis: The data generated from this experiment was subjected to analysis of variance (ANOVA) completely randomized design (Steel and Torrie, 1980) using Startview Statistical Package (SAS, 2003). Where significant differences exist, least significant difference (LSD) will be used to separate the means as described by Steel and Torrie (1980).

Results and Discussion: Proximate and mineral composition of shea butter cake: The result (Table 2) showed that on dry matter (DM) basis, Shea butter cake contained 14.5% crude protein (CP), 7.6% crude fibre (CF), 7.5% ash and 7.6% nitrogen free extract (NFE). The mineral composition of SBC was Ca (1.85mg/100g), K (0.99mg/100g), Mg (0.38mg/100g), Na (1.05mg/100g), Fe (1.06mg/100g), P (0.40mg/100g), Zn (5.676mg/100g), and Cu (0.55 mg/100g). The NDF, ADF, ADL, hemicellulose and cellulose (%) were 49.90, 39.20, 36.90, 2.30, and 10.70 in shea butter cake (Table 2)

Phytochemical composition of shea butter cake: Phytochemical analysis indicated a higher content (+ + +) of tannins and saponins. Presence of flavonoid, glycosides and saponin glycosides (+ +). Cardiac glycoside, alkaloids and volatile oil were also found (+) (Table 3). Quantitative analysis of the SBC showed that tannins, saponins and glycosides were found at 8.24%, 3.34% and 1.40% respectively.

Proximate and phytochemical composition of shea butter cake

The dry matter (DM) content of the shea butter cake (SBC) recorded in the present study was lower than the reported values by Atuahene, C. C., Donkoh, A. and Asante, F. (1998); Pousga *et al*. (2007); Sreenivasa-Kumar, D., Devasena, B. and Rama –Prasad, J. (2007) Ravindra-Reddy, Y., Sarjan-Rao, K., Sudhakar, K., Ramesh, Gupta and Gnana- Prakash M. (2009); Kishan-Kumar, M., Sudhakar, K., Nagalakshmi D., Mahender M. Gupta, Ramesh Rao B., Viroji S.T. (2010) and Elemo, G. N, Oladimeji, O, Elemo, B. O. and Erukainure, O. L. (2011). The SBC contain 14.5% CP comparable to the value obtained by Atuahene *et al*. (1998) and Ewing (2000). Lower values (6.7-9.4%) are also reported by Pousga *et al*. (2007) and Elemo *et al*. (2011). The difference in the CP contents might be due to variety of shea tree, processing method adopted and part of the fruit involved in the processing as well as source of collection of shea nuts. The EE content of the SBC in the present study was 6.5% similar to the values reported by Sreenivasa-Kumar *et al*. (2007), Rami-Reddy *et al*. (2008) and Ravindra-Reddy *et al*. (2009), but lower than the values (6.5-13.8%) reported by Atuahene *et al*. (1998), Rhule (1998), Ewing *et al*. (2000) and Pousga *et al*. (2007). The difference in the ether extract content might be attributed to the processing method adopted for extraction of shea butter cake and variety of sheanut tree. The CF content of the SBC is high comparable to the values reported by Rhule (1998) and Rami-Reddy *et al*. (2008). On the contrary, the observed value is lower than the reported value (6.2-9.8%) by Atuahene *et al*. (1998); Ewing *et al*. (2000); Kishan-Kumar *et al*. (2010) and Elemo *et al*. (2011). This variation might be attributed to the parts of tree and fruits involved in the shea butter extraction. The present study revealed 7.5% of ashing in SBC, Rami-Reddy *et al*. (2008) and Elemo *et al*. (2011) also observed similar value, whereas the other reports were in the range of 4.2- 12.0% (Atuahene *et al*., 1998; Rhule,1998; Sreenivasa-Kumar *et al*., 2007 and Kishan-Kumar *et al*., 2010). The difference might be attributed to the amount of minerals present in ash.

The cell wall constituents of shea butter cake (SBC) obtained in the present study as presented in Table 2 showed that shea butter cake contained 49.9% NDF, similar to values reported by Ravindra-Reddy *et al*. (2009) and Kishan-Kumar *et al*. (2010). It is however, higher than the value (10.1%) reported by

Atuahene *et al*. (1998). The ADF content (39.20%) is also comparable to the value indicated by RavindraReddy *et al*. (2009) and Kishan-Kumar *et al*. (2010), but higher than the observed value (9.2%) observed by Atuahane *et al*. (1998). The hemicellulose content (10.70%) of SBC obtained in the present study is lower than the values (19.1-19.4%) reported by Ravindra-Reddy *et al*. (2009) and Kishan-Kumar *et al*. (2010), but higher than the reported value (0.8%) by Atuahane *et al*. (1998). The cellulose content (2.30%) of the SBC is lower than the value (7.2-7.4%) reported by Ravindra-Reddy *et al*. (2009) and Kishan-Kumar *et al*. (2010). This variation might be attributed to the parts of tree and fruits involved in the shea butter extraction. The difference might also be attributed to the amount of minerals present in ash.

The outcome of the research on performance of boiler birds fed diet containing shea butter cake as protein supplement at starter phase revealed that birds fed diets 1 (0%) inclusion level of shea butter cake consumed less feed with total amount of 661.64/gram/bird) there was significant difference ($P<0.05$) compared to diet 2 (5%) and diet 3 (10%) inclusion level (712.24 and 870.63 gram/bird) respectively. Similarly, birds placed on (0%) inclusion level recorded the lowest body weight gain (312.83 gram/bird) compare to 5% and 10% inclusion level (335.77 and 331.64 gram/bird) respectively. The value recorded for diet 2 and 3 (5% and 10%) inclusion level differ significantly ($P<0.05$) even though the highest value was recorded for diet 2 (5%) (Table 4). However, the result of mortality is similar ($P>0.05$) and result of Feed conversion ratio (FCR) follow a similar pattern there was no significant difference ($P>0.05$) and it decreases with increase in shea butter cake inclusion level from 2.63 in diets 3 (10%) to 2.12 in diets 2 (5%) and 2.11 in diet 1 (0%) inclusion level. Even though the best value was recorded for diet 3 (Table 4) Table 4: Performance of broiler fed diets containing shea butter cake at starter phase

Performance characteristics: Feed intake was inversely related to the increasing levels of shea butter cake in the diets, and higher inclusion of SBC does not favour the feed intake of the birds. Esonu *et al.* (2001) and Onu *et al.* (2011) reported that reduction in feed intake is associated with palatability arising from residual anti-nutritional factors and likely high fiber content. Body weight gain has a similar trend to feed intake. The decreased weight gain at higher SBC inclusion level was partly due to low feed intake, which is related to the poor palatability of shea butter cake diets (Zanu *et al.*, 2012). The overall feed conversion ratio (FCR) for birds in 0 and 5% inclusion level (2.11) and (2.12) respectively in this study was relatively low compared to 2.62 this finding is similar to the report of Zanu *et al*. (2012) for cockerels fed shea butter diet. Dei *et al.* (2008) had earlier reported lower FCR of 1.79 for broiler fed unfermented shea butter meal.

Conclusion: The study concluded as follows: 0 - 7.5 % graded levels of SBC does not have effect on growth performance of broiler birds; There was improved feed intake and growth performance of bucks at 7.5 to 12.5% SBC inclusion.

Recommendations: The study recommended use of shea butter cake as feed ingredient for broiler birds **;** The study recommended incorporation of shea butter cake up to 12.5% in the diets of broiler enhanced their growth performance.; Larger experiments should be carried out using various strains of broiler at levels above 12.5% to ascertain the optimum inclusion level.

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fifty (150) Ross 308 broiler chicks was purchased and used for this research.

Table 1: Gross and chemical composition of the experimental diets

	Starter diets		
	Treatments (Shea butter cake)		
	T1 (0 %)	T2 (5 %)	T3 (10 %)
Maize 45.00	48.00	48.00	
SBM	**22.23**	**18.00**	**15.00**
Shea butter cake	0.00	5.00	10.00
Groundnut cake	22.00	16.40	14.40
Wheat offfal	5.22	8.00	8.00
Limestone	0.40	0.40	0.40
Bone meal	2.50	2.50	2.50
Premix	0.25	0.25	0.25
Salt	0.30	0.30	0.30
Methionine	0.30	0.30	0.30
Lysine	0.35	0.20	0.20
Total 100.0	**100.0**		**100.0**

Calculated chemical c omposition

ME (kcal/kg)	3,000	3,000	3,000
CP (%)	23	23	23
Lysine (%)	1.2	1.2	1.2
Methionine (%)	0.6	0.6	0.6
Ca (%)	1.2	1.2	1.2
P (%)	0.7	0.7	0.7

Table 2: Proximate and mineral composition of shea butter cake (% dry matter)

Composition	%
Dry matter	**89.5**
Crude protein	14.5
Crude fibre	7.6
Ash	7.5
Nitrogen free extract	7.6
Calcium	1.85
Potassium	0.99
Magnesium	0.38
Phosphorus	0.40
Sodium	1.05
Iron	1.06
Zink	5.67
Copper	0.55

NDF	49.90
ADF	39.20
Cellulose	2.30
Hemicellulose	10.70

NDF:- Neutral detergent fibre, ADF:- Acid detergent fibre

Table 3: Qualitative and Quantitative Phyto-chemical composition of SBC

Qualitative	
Constituents	Levels
Tannin	+ + +
Saponin	+ + +
Balsm	+ + +
Flavonoid	++
Glycoside	+ +
Saponin glycoside	+ +
Cardiac glycoside	+
Alkaloids	+
Volatile oil	+
Quantitative (%)	
Tannin	8.24
Saponin	3.34
Glycoside	1.40

Key:- +++ Higher, ++ Mede rate, + Lower

Parameters	**T1**	**T2**	**T3**	**SEM ±**
Initial body weight (g/b)	50.00	50.00	50.00	0.00
Final body weight (g/b)	362.83^{b}	385.77^{a}	381.64^{a}	33.70
Feed intake (g/r)	6616.40^{b}	6366.80^{a}	7599.40^{a}	68.87
Feed intake (g/b)	661.64^{b}	712.24^{a}	870.63^{a}	29.19
Body weight (g/b)	312.83^{b}	335.77^{a}	331.64^{a}	24.10
Mortality (%)	0.00	0.00	0.00	29.19
Feed conversion ratio	2.11	2.12	2.62	0.13

^{ab} mean in the same row followed by different super scripts are significant difference (P<0.05)