

MAIZE REPLACEMENT VALUE OF SHEA BUTTER CAKE (*Vitellaria paradoxa*) WITH OR WITHOUT ENZYME SUPPLEMENTATION ON PERFORMANCE OF BROILER CHICKENS

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ABSTRACT

Maize has traditionally been a staple ingredient in broiler diets as major energy source, but the increasing demand for it has led researchers to explore alternative feed ingredients to reduce reliance on maize and promote sustainable poultry production through reduction in production cost. Shea Butter Cake (SBC), a by-product of shea butter extraction, can be a promising substitute for maize in broiler diets. The study investigated the maize replacement value of SBC with or without enzyme supplementation on performance of broiler chickens at the starter phase. Two hundred and sixteen (216) Ross 308 day-old broiler chicks were weighed and distributed into six (6) treatment groups of thirty-six birds, with four (4) replicates each involving three (3) replacement levels (0, 10, 20% SBC maize replacement without enzyme and 0, 10, 20% shea butter cake maize replacement with enzyme supplementation) in a 3 by 2 factorial arrangement. The data collected on performance characteristics were analyzed using one way analysis of variance. Results showed that Treatment 1 (control group) had higher ($P < 0.05$) final weight (670.92g), daily weight gain (15.02g), daily feed intake compared to other treatments. However, treatment 3 had the lowest feed:gain (2.17) with least feed cost per kilogramme of feed (₦991.12) which is similar to the ₦967.82 obtained in Treatment 6. It was concluded that 20% SBC can replace maize without enzyme supplementation at the starter phase because of the resultant lower feed gain ration and consequent lower feed cost per kg weight gain.

Keywords: Enzyme, Growth performance, Shear butter cake, Replacement, Ross 308

INTRODUCTION

The poultry industry in most developing countries is a significant contributor to the economy and food security. However, the high cost and increasing demand for maize, a primary ingredient in broiler diets, due to keen competition between man and livestock, pose significant challenges to the sustainability and profitability of poultry production in these countries.

Maize in broiler diets, accounts for approximately 50-60% of the total diet (Baurhoo *et al.*, 2017). However, over dependence on maize can lead to many challenges; this is because maize is a staple food crop in many developing countries, and its use in poultry feed competes with human consumption, driving up prices and exacerbating food insecurity (Rosegrant *et al.*, 2014). In addition, the high cost of maize can account for up to 70% of the total feed cost, making it difficult for small-scale poultry farmers to remain profitable (Adeyemo *et al.*, 2017). Added to the challenge of competition is the natural problem of climate change and weather-related shocks which can significantly impact maize yields and prices, further threatening the sustainability of poultry production in developing countries (IPCC, 2013). Exploring alternative sources of energy becomes inevitable. Several studies have investigated the use of alternative energy sources, such as sorghum, millet, and cassava, in broiler diets (Omojola *et al.*, 2010; Adeyemo *et al.*, 2017). These alternatives offer several benefits, including reduced feed costs, improved feed security, and enhanced sustainability. Shea butter cake, a by-product of shea butter extraction, can be a promising substitute for maize in broiler diets. This study investigated the feasibility of replacing maize with SBC in broiler diets, with a focus on growth performance and economic viability at the starter phase.

MATERIALS AND METHODS

Experimental site: The experiment was carried out at the Poultry and Research Unit, Teaching and Research Farm of the Ladoké Akintola University of Technology, Ogbomosó, Nigeria.

Tests Ingredients: The Shea Butter Cake (SBC) was procured from a reputable feed mill at Durbar area of Oyo town in Oyo state, Nigeria. The Treatments 1, 2 and 3 comprised dietary inclusion of Shea butter cake replacing maize at the rate of 0, 10 and 20% by weight respectively without enzyme supplementation while Treatments 4, 5 and 6 comprised dietary inclusion of SBC replacing maize at the rate of 0, 10 and 20% by weight respectively with enzyme supplementation (Table 1).

Experimental Animals and Management: Two hundred and sixteen (216) Day-Old Ross 308 Strain of broiler chicks were used for the experiment. The birds were weighed at the commencement of the experiment and randomly distributed into six (6) treatments of four (4) replicates each. Each replicate had nine (9) birds to make a total of thirty six (36) birds per treatment. Each replicate was housed in a pen measuring 122cm x 90cm x

90cm in dimension. The birds were offered adequate feed and clean water *ad-libitum* on a daily basis throughout the experiment which lasted three (3) weeks while all necessary vaccination and medications were administered appropriately for all the birds.

Table 1: Gross Composition of Experimental diets for broiler Starters (g/100kg)

Ingredient	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	Diet 6
Shea butter cake	—	5.40	10.80	—	5.40	10.80
Maize	54.00	48.60	43.20	54.00	48.60	43.20
Fixed ingredient [#]	46.00	46.00	46.00	46.00	46.00	46.00
Total	100.00	100.00	100.00	100.00	100.00	100.00

[#] Fixed ingredients: Fish meal 3.00kg, Soyabean, 32.00, Soy oil 2.00, Wheat offal 5.00, Limestone 1.00, Di-calcium phosphate 2.00, Salt 0.25, *Premix 0.25, Lysine, 0.25, Methionine, 0.25

*Premix- Vitamin A (IU) 1250000, Vitamin D3 (IU) 2500000, Vitamin E (Mg) 40000, Vitamin K3 (Mg) 2000, Vitamin B1 (Mg) 3000, Vitamin B2 (Mg) 5500, Niacin (Mg) 55000, Calcium Pantothenate (Mg) 11500, Vitamin B6 (Mg) 5000, Vitamin B12 (Mg) 25, Choline chloride (Mg) 5000000, Folic acid (Mg) 1000, Biotin (Mg) 80, Manganese (Mg) 120000, Iron (Mg) 100000, Zinc (Mg) 80,000, Copper (Mg) 8500, Iodine (Mg) 1500, Cobalt (Mg) 300, Selenium (Mg) 120, Antioxidant (Mg) 120.000

Data Collection

Data on feed intake, weight gain, feed:gain, feed cost per kg weight gain and mortality were collected according to the procedure of Ojebiyi *et al.*, (2022).

Statistical analysis

All data collected were subjected to one-way analysis of variance and treatment means were separated using Duncan's Multiple Range Test as contained in SAS (2010) package.

RESULTS AND DISCUSSION

The growth of broiler chickens fed diet containing maize replacement with Shea butter cake with or without enzyme supplementation is presented in Table 2.

Table 3: Main effect of replacing maize with Shea butter cake with or without enzyme supplementation

Parameters	T1	T2	T3	T4	T5	T6	SEM	P-value
Initial weight (g)	40.03	40.42	40.17	40.11	40.33	40.25	0.48	0.74
Final weight (g)	670.92 ^a	499.08 ^b	295.58 ^c	668.22 ^a	485.92 ^b	279.19 ^c	11.67	0.03
Daily weight gain (g)	15.02 ^a	10.92 ^b	6.08 ^c	14.96 ^a	10.64 ^b	5.72 ^c	0.27	0.04
Daily feed intake (g)	35.22 ^a	28.19 ^b	14.26 ^c	36.54 ^a	27.07 ^b	14.44 ^c	0.48	0.04
FC/KGfeed (₦)	1059.30 ^a	1032.30 ^b	991.12 ^c	1063.65 ^a	1007.85 ^c	967.82 ^c	16.29	0.04
Feed: Gain	2.38 ^b	2.54 ^a	2.17 ^c	2.48 ^a	2.49 ^a	2.32 ^b	0.10	0.02
FC/KGWT	2521.30 ^b	2624.96 ^a	2157.15	2632.40 ^a	2587.98 ^b	2317.84 ^c		
Mortality (%)	0.00	0.03	0.08	0.00	0.03	0.08	0.03	0.62

^{abc} Means on the same row with different superscripts are significantly different (p<0.05)

S.E.M: Standard Error of Mean

All parameters measured, except percentage (%) mortality were significantly (P<0.05) affected by dietary treatment. Broiler chickens fed 0% SBC without enzyme supplementation (T1) and 0% SBC with enzyme supplementation had similar higher (P<0.05) final weight values (670.92g and 668.22g), respectively while the lowest weights (P>0.05) (295.58 and 279.19g) were observed in broilers fed 20% SBC without enzyme supplementation (T3) and 20% SBC with enzyme supplementation (T6), respectively. A similar trend was obtained in daily weight gain. The decrease in growth performance of birds fed the shea butter cake could be due to the effect of residual tannins. This result conforms with the findings of Matthew *et al.*, (2017) who reported that the SBC inclusion in the diets of chicks reduced the final live weight of chicks significantly.

The observed higher (P<0.05) daily feed intake in broilers fed 0% SBC without enzyme supplementation (35.22g) and 0% SBC with enzyme supplementation (36.54g) are similar (P>0.05). The lower feed intake (14.26g and 14.44g) observed in broilers fed 20% SBC with and without enzyme supplementation respectively can also be due to the effect of residual tannins. Broiler chickens fed 10% SBC without enzyme supplementation has the highest (P<0.05) value (2.54) of feed conversion ratio while the lowest value (2.17) was observed in broilers fed 20% SBC without enzyme supplementation. The result of low performance of birds fed SBC without enzyme supplementation obtained in this study corroborates the findings of Orogun *et al.* (2015) who reported that high dietary tannins result in lower body weight gains and poor feed efficiencies in birds fed shea butter based diets; this is as a result of the pronounced deleterious effect of tannin on protein and energy digestibility as well as bioavailability of amino acids (Iji *et al.*, 2004). However, the comparatively poor performance of birds fed SBC with enzyme supplementation negate the findings of Aguihe *et al.* (2020) who reported that supplementation of nutrizyme in fermented shea butter cake based diets had significant improvement in live body weights, weight gain, feed intake and FCR of birds compared to the group without supplemental Nutrizyme. However, broiler chickens fed 20% SBC with or without enzyme supplementation had the lowest daily feed

intake which is proportional to the final weight gain which in turns the best FCR. Highest ($P>0.05$) feed cost per kg weight gain value of ₦2632.40 was recorded in broiler chickens fed 0% SBC with enzyme supplementation (T4) while lowest value (₦2157.15) was obtained in birds fed 20% SBC without enzyme supplementation (T3).

CONCLUSION

It was concluded inclusion of SBC in broiler starter diets to replace 20% maize will reduce the cost of feed which may ultimately lead to increased revenue and profitability.

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