PERFORMANCE AND NUTRIENT DIGESTIBILITY OF BROILER CHICKENS FED FERMENTED SHEA BUTTER CAKE BASED DIETS WITH SUPPLEMENTAL NUTRIZYME®(COCKTAIL OF ENYZMES+PROBIOTICS)

[*]Aguihe P.C, [+]Ilaboya I.I and [#]Ukom, S. K

[*]Department of Animal Production and Health Technology, Federal College of Wildlife Management New Bussa.[+]Department of Animal Production and Technology, Edo State College of Agriculture, Iguoriakhi.[#]Department of Agricultural Education, College of Education, Ikere-Ekiti.

[*]Corresponding email: aguihepc@gmail.com

Abstract

A 28-day feeding trial was conducted to evaluate the growth performance and nutrient digestibility of broilers fed fermented shea butter cake meal (FSBCM) with cocktail of enzyme+probiotic (Nutrizyme®) supplementation. A total of 240, 4-week old broiler chickens were distributed into 4 treatments with 5 replications of 12 birds each using a completely randomized design. The 4 treatments comprised T_1 as control diet without FSBCM; T_2 contained 20% FSBCM replacing maize in control diet; T_3 and T_4 contained T_2diet with 0.05% and 0.1% supplemental Nutrizyme, respectively. Each 100g of Nutrizyme contains protease, xylanase, lipase and Lactobacillus acidophilus. Performance parameters measured were body weight, feed intake, weight gain, and feed:gain ratio. At the end of feeding trial, 3 birds per replicate were selected and placed in a metabolic cage for nutrient digestibility trial. Data collected were statistically analyzed using one way analysis of variance (ANOVA) of general linear model procedures of SAS (2012) software package and treatment means differences were separated using Turkey test.The result showed that higher ($P<0.05$) weight gain was obtained in birds fed control and T_3 diets and improved ($P<0.05$) feed:gain was obtained in T_3 diets group. Feed cost/kg gain was lowest ($P<0.05$) in T_3 and T_4 diet. Crude protein, crude fiber and crude fat digestibility were similar ($p>0.05$) among control, T_3 and T_4 groups but higher ($p<0.05$) than T_2 group. In conclusion, minimum inclusion of 0.05% supplemental Nutrizyme improved performance and digestibility of nutrients with lower feed cost/kg gain in broiler finisher chickens fed FSBCM based diets.

Keywords: Feed additive, Shea butter cake, Performance, Digestibility, Broilers

Introduction

The intensive competition between man and his livestock for scarce conventional feed ingredients has resulted to high cost of producing poultry birds and its products, hence calling for urgent utilization of potential agroforestry by-products such as shea butter cake (SBC). The SBC, as a by-product obtained during the processing of shea nuts to produce shea butter, has been identified to spare these conventional feed ingredients in livestock diets because of their low price, availability and high nutritional potential (Orogun *et al*., 2015). Currently, probiotics and enzymes have been used as a feed additive in diets of different classes of poultry to enhance productive performance and immune responses (Patil *et al*., 2015**).** In this regard, the effect of addition of feed additives such as enzymes and probiotics to poultry diets of different nutritive values has been investigated and resulted in positive effects on live body weight, feed:gain, carcass yield and serum profile of the birds, regardless if it was added to a nutritionally-adequate diet or a diet of diminished nutritive value (Zhang *et al*., 2014). Studies have shown that enzymes and probiotics exhibit the potential to maintaining beneficial microflora in the gastrointestinal tract by inhibiting the growth of pathogenic microorganisms and increase the efficiency of nutrient utilization through improving the intestinal health resulting in higher activities of endogenous enzymes (Angel *et al*., 2011; Chiang and Pan, 2012; Dida, 2016; Getachew, 2016).The use of probiotics and exogenous enzymes in poultry feeds to improve bird performance is not a new practice but has long been documented but the information on the synergy of the two feed additives has been scanty**.** Based on this information, this present study was conducted to evaluate the performance of broiler chickens fed fermented shea butter cake meal with Nutrizyme (cocktail of enzymes+probiotics) supplementation.

Results

The nutrient composition of the experimental diets as shown in Table 1 depicted that they were all isonitrogenous and isocaloric. Performance characteristics of broiler finisher chickens fed experimental diets are presented in Table 2. Average final body weight and body weight gain of the

birds fed control diet were higher (P<0.05) than other treatment diets, while those fed T3 and T4 were similar (P>0.05) but higher than those fed T2 diet which recorded the lowest (P<0.05) mean values. Birds fed T4 recorded the lowest (P<0.05) average feed intake followed by those fed T3 while those fed control and T2 diets have similar (P>0.05) higher average feed intake. The FCR of birds fed control diet did not differ (P>0.05) from those fed T3 and T4 but significantly (P<0.05) lower than those fed T2. The feed cost/kg gain of birds fed T3 and T4 diets were similar but significantly lower (P<0.05) than those fed control and T2 diets.The apparent nutrient digestibility of broiler finisher chickens fed experimental diets are presented in Table 3. Birds fed control diet had similar (P>0.05) crude protein digestibility with birds fed T3 and T4, but were higher (P<0.05) than those group fed T2. Birds fed T3 had the highest (P<0.05) crude fiber and fat digestibility and was similar to those fed control and T4, while those fed T2 recorded the lowest (P<0.05) mean values.

Table1: Gross composition of experimental diets for broiler chickens (21-49 d)

Ingredients	**Control**	**FSBC-Nz**	**FSBC+0.05%Nz**	**FSBC+0.1%Nz**
Maize	58.85	46.85	46.80	46.75
Soybean meal	31.00	30.00	30.00	30.00
Fishmeal	3.00	2.70	2.70	2.70
Shea butter waste	0.00	12.00	12.00	12.00
Vegetable oil	2.70	4.00	4.00	4.00
Di Calcium Phophate	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00
Salt	0.25	0.25	0.25	0.25
Vitamin-Premix	0.25	0.25	0.25	0.25
Mineral-Premix	0.25	0.25	0.25	0.25
DL-Methionine	0.30	0.30	0.30	0.30
Lysine	0.20	0.20	0.20	0.20
Threonine	0.20	0.20	0.20	0.20
Nutrizyme	0.00	0.00	0.05	0.10
Total	100	100	100	100
Determined Nutrients				
CP (%)	20.24	20.43	20.43	20.43
ME (kcal/kg)	3089.88	3060.53	3060.53	3060.53

FSBC – Fermented shea butter cake; Nz - Nutrizyme

Table 2: Performance of broiler chickens (21 - 49 d) fed Nutrizyme supplemented shea butter cake based-diets

Parameters	Control	T_2	T_3	T_4	SEM	P-values
Average initial weight (g/bird)	760.42	756.25	754.17	758.33	1.68	0.680
Average final body weight (g/bird)	2400.00^{a}	2072.92^{c}	2283.33^{b}	2237.50^{b}	46.22	0.042
Average weight gain (g/bird)	1639.58^{a}	1316.67^{c}	1529.17^{ab}	1479.17^{b}	45.77	0.039
Average feed intake (g/bird)	2075.00^{a}	2029.17^{a}	1908.33^{b}	1856.25^{b}	35.58	0.018
Feed:gain ratio	1.27^{b}	1.54^{a}	1.24^{b}	1.25^{b}	0.07	0.083
Feed cost/kg	185.94	177.65	177.65	177.65	--	--
Feed cost/kg gain	236.14^{b}	273.58^{a}	220.29^{c}	222.06^{c}	0.34	0.036

^{ab} Means in the same row with different superscript differ significantly (P<0.05)

T_2 - FSBC: Fermented sheabutter cake without Nutrizyme supplementation, **T_3 - FSBC+0.05% Nz:** Fermented sheabutter cake with 0.05% Nutrizyme supplementation,**T_4- FSBC+0.1% Nz:** Fermented sheabutter cake with 0.1% Nutrizyme supplementation

Table 3: Apparent nutrient digestibility of broiler chickens (21-49 d) fed Nutrizyme supplemented shea butter cake based diets

Nutrients	**Control**	T2	T3	T4	SEM	P-values
Crude protein %	76.56[a]	63.57[b]	75.98[a]	78.01[a]	3.23	0.021
Crude fiber %	74.34[a]	66.86[b]	76.87[a]	73.83[a]	1.09	0.039
Crude fat %	68.75[b]	52.87[c]	85.85[a]	87.93[a]	5.98	0.018
Nitrogen Free Extract (NFE) %	88.09	82.35	86.92	85.87	4.87	0.823

[ab ab] Means in the same row with different superscript differ significantly (P<0.05)

T_2 - FSBC: Fermented sheabutter cake without Nutrizyme supplementation, **T_3 - FSBC+0.05% Nz:** Fermented sheabutter cake with 0.05% Nutrizyme supplementation, **T_4- FSBC+0.1% Nz:** Fermented sheabutter cake with 0.1% Nutrizyme supplementation

Discussion

Supplementation of Nutrizyme in FSBC based diets revealed significant improvement in live body weights, weight gain, feed intake and FCR as well as crude protein and fiber digestibility of birds compared to the group without supplemental Nutrizyme. Higher growth rate of birds in Nutrizyme group may be attributed to inhibition of growth of the enteropathogens in the gut by decreasing the intestinal pH and efficient utilization of nutrients by the beneficial microbes. Edwin *et al.* (2002), reported improved live weight due to multi-enzymes in diet. The increased weight gain observed in T3 and T4 may be due to the activities of the probiotic microbes. This is supported by the report of previous findings (Mansoub, 2010; Amer and Khan, 2012) that probiotic microbes elaborate digestive enzymes which help the host enzymes to increase digestibility and improve efficiency of feed utilization and weight gain. Also, it has been demonstrated that probiotics and enzymes have the potential to breakdown complex feed into smaller substances making their digestion and absorption by the host animal easier (Ghomi *et al*., 2012; Chuka, 2014). Moreover, birds receiving the diet with supplemental Nutrizyme had improved feed conversion ratio similar to control group than those on FSBC diet without supplemental Nutrizyme. This is attributed to enhancement of feed utilization efficiency and bioavailability of nutrients due to combined effect of supplemental enzymes and probiotics in the broiler's diet (Craig *et al*., 2008; Chiang and Pan, 2012; Dida, 2016). These findings are in accordance with Elongvan *et al*. (2004) who also reported better feed:gain on addition of probiotic and enzymes in diet of quails. In addition, earlier studies have shown that availability of better quality nutrients may increase the release of endogenous enzymes (Zhou *et al*., 2013); thus improving the nutrient digestibility and performance in broiler chicken (Tazi et al., 2014).

Conclusion and Recommendation

Supplementation of the fermented sheabutter cake meal based diet with Nutrizyme (cocktail of enzymes and probiotics) at a minimum inclusion of 0.05% showed an improved performance and nutrient digestibility in broiler finisher chickens. Therefore, utilization of agroforestry byproducts in poultry diets allows for the option of combined supplementation of enzymes and probiotics to enhance growth and feed:gain with lower net feed costs.

References

Angel, C.R., Saylor, W., Vieira, S.L. and Ward, N. (2011). Effects of a monocomponent protease on performance and protein utilization in 7- to 22-day-old broiler chickens. *Poultry Science*, 90:2281-2286.

Amer, M. Y. and Khan, S. H. (2012). A comparison between the effects of a probiotic and antibiotic on the performance of Desi chickens. *Veterinary World*, 5(3): 160-165.

Chiang, S. S and Pan, T. M. (2012). Beneficial effects of *Lactobacillus paracesei* subsp. Paracasei and its fermented products. *Applied Microbiology and Biotechnology*, 93(3): 903-916.

Chuka E. (2014). Comparative study of the effects of probiotic and commercial enzyme on growth rate, haematology and serum biochemistry of broiler chicken. *J. Food Process.Technol.5: 367*-374

Dida, M. F. (2016). Review paper on enzyme supplementation in poultry ration. *International Journal of Bioorganic Chemistry*, 1(1): 1-7.

Edwin, S. C., Vishwanathan,K.,.Mohan, B. and Purushottaman, M. R. (2002). Effect of replacing maize with broken rice on growth of performance of broilers. *Indian Journal of Poultry Sci*., *37 (2):187-189.*

Elangovan, A. V., Mandal, A. B.,Tyagi, P.K.,Tyagi,P.K.,Tappo, S. and. Johri, T. S. (2004). Utilization of sorghum and finger millet with or without feed enzymes in broiler chickens. *J. of Appli. Anim. Res*. 26*(1): 33-38.*

Getachew, T. (2016). A review on effects of probiotic supplementation on poultry performance and cholesterol levels of eggs and meat. *Journal of World Poultry Research*, 6(1): 31-36.

Ghomi, M.R., Shahriari, R. Langroudi, H.F., Nikoo, M., Von, E.E. (2012). Effects of exogenous dietary enzyme on growth, body composition and fatty acid profiles off cultured great sturgeon *Husohuso* fingerlings. *Aquatic International*, 20: 249-254.

Mansoub, N. H. (2010). Effect of probiotic bacteria utilization on serum cholesterol and triglycerides contents and performance of broiler chickens. *Global Veterinaria*, 5(3): 184-186.

Matsui, I., Matsui, E., Ishi, K.K., Miyairi, S. and Honda, K. (1990). The enzymatic and molecular characteristics of saccharomycopsis α-amylase secreted from saccharomyces cerevisiae. *Agric. Biol.Chem.,54: 2009-2015.*

Orogun, A.J., Oniye, S.J. and Olugbemi, T.S. (2015). Growth and Hematological Response of broiler starter chickens fed diets containing shea butter cake. *J. Sci. Res.* 1 (2): *304-310.*

Patil, A. K, Kumar, S., Verma, A. K. and Baghel, R. P. S. (2015). Probiotics as Feed Additives in Weaned Pigs: A Review. *Livestock Research International, 3(2): 31-39.*

SAS.(2012). Statistical Analysis system. SAS Version 9.2 user's guide. Cary, NY, SAS institute.

Tazi, S. M.A. Mukhtar, E.l., Mohamed, K.A. and Tabidi, M.H. (2014). Effect of using black pepper as natural feed additive on performance and carcass quality of broiler chicks. *Global Advanc. Res. J. of Agric. Sci., 4(2): 108-113.*

Zhang, Z. F. and Kim, I. H. (2014).Effects of multistrain probiotics on growth performance, apparent ileal nutrient digestibility, blood characteristics, caecal microbial shedding, and excreta odor contents in broilers. *Poultry Science, 93(2): 364–370.*

Zhou, Y., Yuan, X., Liang, X. F., Fang, L., Li, J., Guo, X. Z., Bai, X.L. and He, S. (2013). Enhancement of growth and intestinal flora in grass carp: The effect of exogenous cellulose. *Aquaculture, 416-417(2): 1-7.*