EFFECT OF PROBIOTIC SUPPLEMENTATION ON HAEMATOLOGICAL INDICES AND SERUM METABOLITES OF BROILER CHICKENS FED SHEA KERNAL CAKE MEAL BASED DIET

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Abstract

A 49-day experiment was conducted with a total of one hundred and twenty (120) day old Arbor Acre broiler chicks to determine the effect of probiotic (Biovet-YC®) supplementation on the haematology and serum biochemistry of broilers fed graded levels of Shea kernel cake meal (SKCM). A completely randomized design was adopted and the birds were grouped into four (4) dietary treatments comprising of 0%, 5%, 10% and 15% inclusion levels of SKCM as T_1, T_2, T3 and T_4 respectively. The treatments were replicated thrice with 10 birds each. Diet T_1 served as the control without SKCM and probiotic addition, while diet T_2, T_3 and T_4 were supplemented with 0.5g/kg Biovet-YC®. Feed and water were given ad-libithum. Blood was collected into two different carefully labeled bottles with or without an anti-coagulant (EDTA) for haematological and serum biochemical evaluations respectively. The results showed that birds fed probiotic supplemented SKCM and control diets have similar values for packed cell volume, haemoglobin, red blood cells, mean corpuscular haemoglobin and mean corpuscular haemoglobin concentration whereas, white blood cell count showed significantly differences ($p<0.05$) among treatments as birds on 5 and 15% SKCM diets had lower values compared to birds on control and 10% SKCM diet. However, SKCM with probiotic supplementation had no effect on the serum metabolites of the broiler chickens. Therefore, the study showed that incorporation of SKCM with probiotic supplementation in diet of broiler chickens did not have any adverse health implications.

Key words: Probiotic, shea kernel cake, broiler, haematology, serum biochemistry.

Introduction

Maize constitute high proportion of poultry ration as energy source for growth, maintenance and heat; it is consume by man and serve as raw materials for food processing industries which tend to make it demand and cost high (Bolu and Adekeja, *2008*). In view of this high cost of grain (maize) in poultry production, the use of agro-industrial by-products that are not consumed by man and are available and cheap can substitute for maize in poultry diet. Shea kernel cake (SKC) is an agro-industrial by product obtained after Shea butter, a fat extracted from the fruit of Shea tree (*Vitellaria paradoxa*). Shea kernel cake (SKC) has been found to contain some anti-nutritive factors such as saponins, tannins and theobrimine (Annongu *et al, 1996,* Rhule, *1999*, Oddoye *et al, 2007*). Based on its composition, shea kernel cake (SKC) has been sampled as potential feed stuff as replacement for dietary maize in poultry ration (Atuahene *et al.*, 1998, Dei *et al.* 2007, Dei *et al.*, 2008). However, the presence of anti-nutritional factor has limited it use (Oddoye *et al., 2012*). With the advent of biotechnology, there are opportunities for economic utilization of agro-industrial residues such as shea kernel cake (Obadina *et al.*, 2006), hence probiotic supplementation can be useful to minimize the effect of these anti-nutritional factors to allow increase use of shea kernel cake (SKC) in poultry and livestock diet (Owosibo *et al.* 2013). Probiotic bacteria are used in a wide range of nutritional techniques in order to support the host organism during physiological strain and combat diarrheal syndromes (Lan *et al.*, 2003). Proposed mechanisms of pathogen inhibition by the probiotic microorganisms include competition for nutrients, production of antimicrobial conditions and compounds (volatile fatty acids, low pH and bacteriocins), competition for binding sites on the intestinal epithelium and stimulation of the immune system (Rolfe, 2000). The increasing use of unconventional feedstuffs as feed for livestock calls for the evaluation of the effect of these feedstuffs on the health status of the livestock. Madubuike and Ekenyem (2006) stated that haematology and serum chemistry assay of livestock suggest the physiological disposition to their nutrition. Therefore, the present study is aimed at evaluating blood parameters of broilers chickens fed graded level of shea kernel cake meal

supplemented with probiotic.

Materials and Methods

Study Site: This study was conducted at the Poultry Unit of Teaching and Research Farm, Federal College of Wildlife Management, New Bussa, Niger State, Nigeria. New Bussa is located at a longitude 4° 31°E and 4° 33°E and latitude 7.3°N and 10.00°N.

Collection and processing of Shea kernel cake: The Shea kernel cake used for this experiment was collected from local Shea nut processing centers at New Bussa, Niger State. The SKC was then sundried for three days and milled with a hammer mill to obtain the meal.

Experimental diets: Four experimental diets were formulated with SKC meal included at 0%, 5%, 10% and 20% respectively, replacing dietary maize and presented as SKC0, SKC5, SKC10, and SKC15 (Tables 1 and 2). The SKC based diets were supplemented with probiotic at dose rate of 0.5g/kg feed.

Experimental birds, design management: One hundred and twenty (120) day-old broiler chicks were used for this experiment. The birds were therefore allocated to four (4) experimental treatments of 30 birds each, replicated three times with 10 birds in a completely randomized design (CRD). The birds were raised in a deep litter system using wood shavings as litter material in an open sided poultry house. Feed and water were supplied *ad-libitum.*

Haematological Studies and Serum biochemistry Analysis: At the end of week 7 of feeding trials, two (2) birds per replicate were randomly sampled to determine serum biochemical and haematological responses. 5ml samples of blood were taken at randomly from selected birds and 2.5ml of the sampled blood was put in labeled sterile universal bottles containing anti-coagulant (Ethyl Diamine-Tetra-Acetate Power, EDTA) to determine haematological indices such as packed cell volume (PCV) (%). Red blood cells (RBC) (g/L), white blood cells (WBC) (g/L) and heamoglobin (g/L), according to the procedure of Jaime and Howlett (2008). The remaining 2.5ml of the sampled blood was put in labeled sterile universal bottles without anti-coagulant to determine serum biochemical indices such as total protein (mg/dl), Albumin (g/dl), globulin (mg/dl), cholesterol (mg/dl), triglyceride (mg/dl) and glucose (mg/dl) asdescribed by the procedure of Jerry *et al.* (1997).

Data Analysis: All data obtained were subjected to analysis of variance (ANOVA) using SAS (2008) statistical package and means were separated using Duncan multiple range test of the same package at 5% probability level.

Results and Discussion

Results of the effects of probiotic supplementation on haematological parameters (Table1) revealed that except for white blood cell (WBC), there were no significant ($p>0.05$) influence of the experimental treatments on the Hb, PCV, RBC, MCH and MCHC of the broilers. The mean values for all haematological parameters in broilers obtained in this study fell within the normal physiological range for chickens according to (Mitruka and Rawnsley, 1977). The values obtained for all treatment groups indicate nutritional adequacy of all the diets due to probiotic supplementation. The similarity in the PCV mean values indicates that the diets had no adverse effect on the blood level and birds were not anemic. This is attributed to the effect of probiotic addition which has the capacity of neutralizing the feed toxins and promotes an environment in the gut where anti-nutritional factors and toxins are minimized (Patterson and Burkholder, 2003, Owosibo *et al.* 2013). Also, RBC values were similar for all treatment and shows that the blood level and immunity status of birds were not negatively affected due to probiotic supplementation. The lower WBC counts obtained in birds fed 5 and 15% SKCM diets could be explained by an increased need to challenge the foreign body in form of anti-nutritional factors in SKCM based diets by the action of probiotic addition. WBCs are involved in antibody formation and cell mediated immunity (Iheukwemere and Odinamuo, 2009) and also plays major role in defending the body against disease-producing microbes. This observation could be attributed to the evidence that probiotic had improved the immune system by producing high level of blood antibody via increasing the health status of the birds (Altaf-Ur-Rahman *et al.*, 2009). The blood biochemistry of broilers fed experimental diets as presented in Table 2 shows no significant ($p>0.05$) difference in all the parameters. The non-significant mean values of total protein, albumin, globulin and glucose was an indication that probiotic supplementation suppress the effect of the anti-nutritional contents of SKCM diets from precipitating inadequacy of nutrients which could create an anemic condition. This is an indication that probiotic supplemented diets had not pose any chronic disease on the birds; hence, it must have stimulated the immune system and increase natural resistance to disease (Tellez *et al.*, 200, Owosibo *et al.* 2013).

Conclusion

Therefore, the results suggest that probiotic supplementation to shea kernel cake meal had no effect on blood and serum biochemistry except for white blood cell counts of the broiler chickens.

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Table 1: Gross composition of the experimental broiler diets

Ingredients	T_1 (0%)	T_2 (5%)	T_3 (10%)	T_4 (15%)
Maize	61.45	56.50	52.00	47.65
SKCM	0.00	5.00	10.00	15.00
Soya beans meal	32.05	32.00	31.50	30.85
Fish meal	3.00	3.00	3.00	3.00
Wheat offal	0.00	0.00	0.00	0.00
DCP	2.00	2.00	2.00	2.00
Oyster shell	0.50	0.50	0.50	0.50
Premix	0.40	0.40	0.40	0.40
Salt	0.20	0.20	0.20	0.20
Lysine	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20
Probiotic	0.00	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00
Calculated Analysis				
ME kcal/kg	3000.14	3013.39	3031.28	3050.71
CP%	22.72	22.94	22.98	22.96

Table 2: Effect of graded levels of probiotic supplemented shea kernel cake meal (SKCM) on haematological indices on broiler chickens (n=49days).

Parameters	T1	T2	T3	T4	SEM
PVC (%)	24.25	25.74	25.59	25.86	1.13
Hb (g/dl)	8.03	8.58	8.61	8.29	1.10
WBC (10^3/L)	23.53^a	20.55^b	21.67^{ab}	20.56^b	0.83
RCB (10^6/L)	3.23	3.78	3.70	3.50	0.74
MCH (ug)	34.95	32.94	37.92	35.43	1.95
MCHC (%)	49.71	43.35	43.11	45.15	3.72

^{ab} means on the same row with different superscript are significantly ($P<0.05$) different

Table 3: Effect of graded levels of probiotic supplemented shea kernel cake (SKCM) on serum biochemistry of broiler chickens

Parameters	T1	T2	T3	T4	SEM
Total protein (g/dl)	5.82	6.16	5.12	5.46	0.35
Albumin (g/dl)	2.24	2.01	2.10	2.24	0.48
Globulin (g/dl)	3.58	4.15	3.01	3.26	0.54
Glucose (mg/dl)	150.33	176.33	145.67	118.67	23.45
Cholesterol (mg/dl)	308.00	334.33	252.33	353.00	14.80
Triglyceride (mg/dl)	141.58	147.67	114.17	152.03	13.23