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THE NUTRITIONAL EVALUATION OF BOVINE BLOOD MIXED WITH PROCESSED BROLERS FEATHERS ON HAEMATOLOGY AND GROWTH PERFORMANCE OF RABBITS

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Abstract

This study investigated the nutritional evaluation of bovine blood mixed with processed broiler's feather meal on growth performance and hematology of rabbits. The experiment was conducted at the Department of Animal Science, Livestock Section (Rabbitary Unit) of the Teaching and Research Farm, University of Uyo, Uyo, AkwaIbom State. The sum of 40 weaner rabbits was used for the study. The rabbits were divided into 5 groups based on average initial weights (20-25kg) and each group of weaner rabbits were respectively allocated to each of the five treatment diets using a completely randomized design (CRD). Each treatment group contained 2 replicates of 4 rabbits (2male and 2 female). These rabbits were fed twice daily and water supplied adlibitium. The treatment diets consisted of the following of BBFM at 0% (controlled), 10%, 20%, 30% & and 40% (controlled) replacement of maize in the control diet were formulated. The 50:50 ratios of digesta and processed broiler's feather meal was derived by equal weighing (kg) of the two test ingredients percentage in the diet using a manual scale, all diets were formulated to be iso-nitrogenous and iso-caloric. During the feeding trial, weekly feed consumption, weight changes, and hematology were recorded for all the levels, while weight gain, feed conversion ratio and protein efficiency ratio were estimated to assess performance of the weanerrabbits. The results from the study shows significant ($p<0.05$) differences on the performance characteristics of grower pigs, while animals on 40%% diet gave the best compared to other diets in final weight gain, feed conversion ratio and protein efficiency ratio (25.67kg, 2.06 and 2.52) respectively. There were no significant differences ($P>0.05$) on the haematology of the rabbits. It was concluded that BBFM could completely replace maize without adversely affecting the overall growth performance of the rabbits. Implications and recommendations were made from the findings of the study.

Keywords: *Bovine rumen content, Growth Performance, Processed broiler's feather meal, Rabbits*

INTRODUCTION

Inadequate supply of feeds, nutritionally unbalanced rations, adulterated ingredients or stale feeds are some of the factors responsible for low productivity of livestock in Nigeria (Ogundipe*et al.,* 2003) and when it comes to livestock management nutrition is actually the most important consideration. Apart from nutrition, livestock industry contributes significantly to family income (Ogundipe and Sanni, 2002). Livestock production especially the production of rabbits offers the greatest scope for increasing the quality and quantity of protein intake in Nigeria because of the short generation interval and prolificacy. Rabbit production is regarded as a means of sustainable livelihood and a way of achieving a certain level of economic independence. Rabbits are good sources of meat that is tasty, of good quality and similar to poultry meat with few or no religions taboo attached to its consumption. They grow rapidly because they are efficient at converting feed, forage and vegetative materials into meat besides

their high productivity. Therefore the major interest of the farmer is to reduce feed cost, which usually accounts for 60 to 70% of the total cost of production (Ogundipe, *et al;* 2003). Research efforts are now geared towards evaluating alternative feed ingredients for poultry and other livestock like rabbits. Investigations has being carried out for the use of other alternative energy sources (Agunbiade*et al,* 2004 and Ajaja, 2005). Okosun and Eguaoje, (2017) recently reported the inclusion of 66.6% cassava grit and 5% supplementation of moringa leaf meal as substitute for maize in cockerel diet. This study tends to look at an unconventional feed ingredient such as bovine blood and processed broiler feathers.

Rumen Content as well as well as bovine blood is abattoir by-products which if not properly handled, can cause nuisance in the environment. With the present advocacy to reduce greenhouse gases which has been impacting on the environment negatively, any efforts made at reducing them in the environment will reduce the effect on climate change. According to Adeniji and Balogun 2001, 2002; Mann 1984 and Dairo 2005;the composition and potentials of rumen content and bloodrumen content mixture qualifies them as good sources of protein for monogastric animals. Their availability all year round is confirmed by the report of Adeniji (1996) that rumen content of bovine origin is about 9634 metric tons per annum in Nigeria. Study on the use of bovine rumen-blood meal on rabbit has been done by Togun*etal.,* (2009) and Dairo*et al.,* (2005) using the mash feed. In the study with mash feed, it was reported that inclusion of BRC-BM resulted in significant drop in feed intake and consequently weight gain was adversely affected.

Globally, feathers are produced in large quantities annually as a by-product of poultry processing (Fakhfakh et al., 2010). Feathers could account for about 6% of the live weight of the mature chicken. They are rich in a keratinous protein, which is a fibrous and insoluble protein (Swetlana and Jain, 2010). Feathers have uses in erosion control, diaper filling, biodegradable composites, green house industry, animal feeds, upholstery, artwork, paper alternatives, light-weight structural materials, water filtration fibers, fabric, aircraft and automotive industries and thermal insulation (Comis, 1998; Schmidt, 1998). Feather protein is not easily degradable, thereby affecting its digestibility and use as livestock feed. Hence, it becomes necessary to develop effective, easy and cheap processing techniques that will hydrolyse feathers. Feather meal is rich in protein which is under-utilised for animal nutrition, particularly in the developing countries. Its major limitation is that little information exists regarding its nutrient composition as well as the effective processing techniques that could enhance its nutritional values. Previous attempts to provide information about the nutrient composition of feather meal are either too complicated for rural livestock farmers in developing countries or they provided incomplete information on chemical composition and amino acid (NRC, 1994; Cotanch et al., 2007). Several researchers have investigated chemical or enzymatic methods for the hydrolysis of feathers (Steiner et al., 1983; Onifade, 1998; Moritz and Latshaw, 2001). Wood ash is used traditionally by gardeners as a good source of potash for domestic gardens and it is used to soften food stuffs such as locust bean seeds for making seasoning. It has been reported that potassium hydroxide can be made directly from wood ash (Anonymous, 2016), potassium hydroxide made in that form is known as a caustic potash or lye. NaOH and KOH are caustic chemicals which can be interchangeably used in a variety of situations. NaOH reacts with water to give lye solution.

However, this experiment is aimed at examining the nutritional evaluation of bovine blood mixed with processed broiler feathers on the haematology and growth performance of rabbits.

METHODS AND MATERIALS

Site of study

The experiment was carried out in the Department of Animal Science, Livestock Section (Rabbitary Unit) of the Teaching and Research Farm, University of Uyo, Uyo, AkwaIbom State for the period of seven weeks. AkwaIbom state is in Nigeria. It is located in the coastal southern part of the country, lying between latitudes $4^{0}32^{1}$N and $5^{0}33^{1}$N, and longitudes $7^{0}25^{1}$E and $8^{0}25^{1}$E. The state is located in the south-South geographical zone, and is bordered on the east by Cross River State, on the west by Abia State, and on the south by Atlantic Ocean and the south most tip of Cross Rivers State.

Processing of Bovine blood meal and processed broilers feathers meal and experimental diets

Fresh feathers from 8-wk white feather broilers (arbor acre) were obtained from slaughterhouse waste processing industry in Uyo.They were washed severally with distilled water later the raw feathers pre-soaked in distilled water for 24 hr, boiled at 150oC for 1 hr, then dried in a circulating air-drying oven at 50oC for 24 hr to form the feather meal. Also, the bovine blood was collected fresh from the abattoir at Akpanadem market, Uyo,AkwaIbom state and sun dried for 7 days depending on the intensity of the sun and grinded and sieved. Finally, both the broiler's feather meal and the bovine blood meal were then mixed in equal proportion Bovine Blood Feather Meal (BBFM) based on their chemical composition to prepare the compound experimental rations.

Experimental Design and Treatments

The design of the experiment was a completely randomized design (CRD) with 4 dietary treatments each with three replications. The sum of 40 rabbits were used for the study. The rabbits were divided into 5 groups based on average initial weights (10-15kg) and each group of rabbitswere respectively allocated to each of the five treatment diets. Each treatment group contained 2 replicates of 4 rabbits (2male and 2female). These rabbits were fed twice daily and water supplied adlibitium. There were five diet groups comprising;

T1 = 0% of Bovine Blood Feather Meal (BBFM)(control)
T2 = 10% of Bovine Blood Feather Meal (BBFM)
T3 = 20% of Bovine Blood Feather Meal (BBFM)
T4 = 30% of Bovine Blood Feather Meal (BBFM)
T5 = 40 of Bovine Blood Feather Meal (BBFM)

Statistical analysis

Data were subjected to analysis of variance using the procedure outlined by SAS (2002) and significantly different means were separated using the multiple range test by Duncan (1955).

RESULT AND DISCUSSION

Table1.Composition of Experimental Diet for growers Pig

Ingredients	T1 (0%)	T2 (10%)	T3 (20%)	T4 (30%)	T% (40%)

Maize	50.00	10.00	20.00	30.00	40.00
Bovine Blood/Processed broiler's feathers	0.00	15.00	30.00	32.00	33.30
Ground Nut Cake	25.60	26.78	27.92	29.06	30.21
Wheat Offal	14.10	40.72	11.51	10.26	9.02
Bone Meal	1.50	1.50	1.50	1.50	1.50
Limestone	2.00	2.00	2.00	2.00	2.00
Palm Oil	1.00	2.00	2.20	2.40	2.60
Weaner Premix*	0.25	0.25	0.25	0.25	0.25
Salt	0.35	0.35	0.35	0.35	0.35
Ronozyme**	0.20	0.20	0.20	0.20	0.20
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Analysis:					
Crude Protein (%)	**25.00**	**25.00**	**25.00**	**25.00**	**25.00**
ME(Kcal/Kg)	**2878**	**2847**	**2815**	**2810**	**2781**
Fibre (%)	5.35	6.99	8.63	10.26	11.90
Ash (%)	5.94	9.11	12.34	15.57	18.80
Calcium (%)	0.80	0.80	0.80	0.80	0.80
Starch (%)	39.20	36.14	32.99	29.85	26.70
Fat (%)	6.48	7.74	8.99	10.25	11.50

The table above shows an increase in each of the ingredients of the experimental diets.

Table 2:Proximate and energy composition of Bovine Blood Feather Meal (BBFM)

Ingredients	T1 (0%)	T2 (10%)	T3 (20%)	T4 (30%)	T% (40%)	SEM
Dry matter(%)	69.49b	76.90b	87.39c	98.10a	108.53	0.03
Crude protein (%)	8.39d	9.87c	10.18a	12.85b	14.18a	0.01
Crude fibre (%)	9.98c	12.59a	7.94d	10.52b	7.94d	0.21
Ether Extract (%)	4.72a	5.12c	5.33b	5.71a	5.33b	0.02
Ash (%)	5.78d	14.80b	12.78c	17.53a	12.78c	0.06
NFE (%)	44.55d	43.86b	52.27a	50.94b	52.27a	1.17
Metabolized energy Kcal/100g	3617.00	3290.00	3832.00	3932.00	3788.00	11.40

a,b,c,d Means on the same row with different superscripts are significantly different ($p<0.05$).

Table 2 shows the results of the proximate and energy composition of the processed forms of DUPPM. The nutrient composition of T1BBFM was significantly lower than that of other processed forms. The crude protein of fermented BBFM was significantly ($p<0.05$) higher than that of other forms. The range of crude protein in T1, T2, T3, T4and T5BBFMobtained in this study (8.93-14.18%) was higher than the values reported by Agbabiaka et al (2013) (13.73%) for 0%bovine blood feather meal and Uwalakaet al (2013) (10.64%) for bovine blood feather meal respectively. However, the values of crude protein were comparable with the value 9.86% recorded for 20% of bovine blood feather meal reported by Akinmutimiet al (2006). However, the values of crude fibre, ether extract, nitrogen free extracts (NFE) and metabolizable energy did not agree with the reports of Uwalakaet al (2013) and Ighodaro, (2012). Cotanch et al. (2007) earlier reported a range of 90.40%–97.40% for dry matter, 84.10%–92.00% for crude protein content, 6.10%–14.80% for fat and 1.50%– 3.60% for ash content for feather meal from various plants, while methionine, lysine, histidine and tryptophan were very low when compared with other amino acids. Wang and Parsons (1997) reported an average of 88.70% for crude protein while Morel et al. (2003) reported a range of 82.20%–84.60% for protein content. Ajayi and Iyayi (2014) earlier reported that feather meal contained 83.80%– 89.90% crude protein, 0.30–0.60% ash and 5.00%–10.30% ether extract. The results of the present study revealed that lysine, methionine and tryptophan contents were lower across the treatments when compared with other amino acids studied. Moritz and Latshaw (2001) earlier observed a similar trend for methionine (0.50%–0.56%) and lysine (1.74%–1.91%).

Table 3: Growth Performance characteristics of weanerrabbits fed experimental die*t*

Levels of inclusion (%)					
	T1 (0%)	T2 (10%)	T3 (20%)	T4 (30%)	T% (40%)

Parameters	1	2	3	4	5	SEM (±)
Ave. initial weight(kg)	10.05	10.06	10.00	10.01	10.00	
Ave. final weight(kg)	28.84[b]	32.67 [a]	37.00 [c]	40.50 [d]	44.84 [d]	0.03
Ave. total weight gain(kg)	12.52 [b]	23.79 [a]	25.00 [d]	30.50 [cd]	35.84 [d]	0.44
Ave. weekly weight gain(kg)	2.07 [b]	2.40 [a]	3.86 [c]	4.78 [cd]	5.69 [d]	0.64
Feed intake(kg)	35.00	35.00	35.00	35.00	35.00	0.01
Feed conversion ratio	2.41 [c]	3.06 [d]	3.69 [b]	4.80 [b]	4.96 [a]	0.68
Protein efficiency ratio	2.18 [b]	2.52 [a]	2.95 [c]	3.88 [cd]	4.78 [d]	0.08
Mortality (%)	-	-	-	-	-	-

a , b, c, d, e means along the same row with different superscripts are significantly (p< 0.05) different from each at her, Ave: Average, SEM: Standard error of mean.

Initial live weight of weaner rabbits ranged from 10.00kg to 10.06kg, average final weight gain of the weaner rabbits obtained are shown in table 3 revealed that, experimental animals were significantly (P<0.05) affected by the experimental diets. Increasing levels of BBFM resulted in steady increase in body weight of 32.67g, 37.50g, 40.50g and 44.84kg for rabbits on diets 2, 3, 4 and 5 respectively. Weight gains of rabbits fed concentrate feed deprived of forage (Diet 1) dropped significantly (P<0.05) to 28.84g. Therefore, 40% of BBFMMixed supported the highest daily live weight gain in the pigs respectively. Feed intake values were significantly affected at grower phase as results keep increasing across the groups.

Feed conversion ratio differed significantly (P<0.05) in the experimental animals, while animals on 10% (3.06) diet gave the best compared to other diets with corresponding values of 20(3.41), 30(4.69), 40(4.80) respectively. Protein efficiency ratio of weanerrabbits was significantly (P<0.05) influenced by the experimental diets, highest value was recorded in 40 %(4.78) diet, followed by 30% (3.88), 20%(2.95), 10%(2.52) and 0% (2.18) in that order. There was no mortality throughout this phase of feeding trial.
The effect of feeding BBFM meal resulted in steady increase on the Performance characteristics such as average final weight, average total weight gain, average weekly weight gain, and feed conversion ratio and protein efficiency. There was no credible study to backup this findings but the result looks real because protein concentrates either in humans or animals is known for growth. However, this study did was not in line with the stidy of Xavier et al. (2011) who observed that the inclusion level of 6.0% in broiler pre-starter diet worsened performance up to 21 days of age, eliciting a negative linear response from weight gain and feed intake, but no changes in feed conversion.

Table 4: Haematological indices of parameter of weaner rabbitsfed with Bovine blood feather meal (BBFM)

Parameters	A	B	C	D	E	SEM
HB(g/dl)	8.97	8.77	9.68	9.73	9.73	0.88
PVC (%)	33.08	31.63	31.88	31.88	31.88	2.66
RBC(x106/UL)	2.56	2.59	2.69	2.53	2.53	0.27
MCV (fl)	131.98 [a]	125.18 [b]	126.85[ab]	126.85[ab]	126.85[ab]	5.23
MCH (pg)	38.88 [a]	38.88 [b]	37.53 [b]	37.53[b]	37.53[b]	1.19
MCHC (%)	29.03 [b]	31.02 [a]	29.33 [b]	29.55[ab]	29.55[ab]	1.38
PLT (x103/UL)	22.67 [a]	20.83 [a]	18.33 [a]	20.50 [a]	20.50 [a]	1.37
WBC (x103/UL)	83.78 [a]	73.13 [ab]	82.00 [ab]	75.33 [b]	75.33 [b]	6.15
LYM(%)	77.67 [c]	83.83 [abc]	81.00 [bc]	87.67[ab]	87.67[ab]	7.76
NEUT (%)	22.33 [a]	16.17 [abc]	19.00 [ab]	12.33[bc]	12.33[bc]	8.00

a,b,c Means in the same row with different super script are significantly different

Table 4 above shows the haematological parameters of weaner rabbits fed bovine blood meal mixed with processed broiler's feather meal. There were no significant (*P*>0.05) differences in

all the parameters measured. The packed cell volume (PCV), haemoglobin, red blood cell (RBC) and white blood cell values (WBC) decreased numerically across the dietary treatments as the inclusion of BBFM increased. The values observed for pack cell volume (PCV) in this study fell within the range of values (15.0 -30.0%) reported by (Orheruata et al, 2004). The variation in PCV values obtained in this study might be associated with the location, environmental and nutritional stress as being suggested by (Balikei et al, 2007). The haemoglobin values of the experimental animals on 0% to 60% BBFM inclusion level were in agreement with the reports of (Daramola et al, 2005; Lazorro et al, 2014; Belewu et al, 2016). Since haemoglobin function as a carrier of oxygen to target organs by forming oxyhaemoglobin hence animals on 0% to 60% MSPW inclusion are at advantage. The values of red blood cell (RBC) reported herein agreed with the values reported by (Beliwu, 2010; Orheruata et al, 2014) for similar animal. The value of the white blood cell (WBC) obtained in this study supported the reports of(Beliku, 2014) that weaner rabbits possess a protective system providing a rapid and potent defense against any infectious agent and this probably form the physiological basis for the adaptation of the West African eco-zone which is characterized with high prevalence of diseases. This probably shows that animals placed on 0% to 40% BBFM inclusion levels, maintained an active immune system that defends the body against infection, allergic reactions, parasites and antigens.

Table 5: Serum chemistry of experimental rabbits fed with Bovine blood feather meal (BBFM)

Parameters	Diet 1 (0%)	Diet 2 (10%)	Diet 3 (20%)	Diet4(30%)	Diet 5(40%)	SEM
Calcium (Mg/dl)	10.15 ^{a}	9.72 ^{a}	8.97 ^{b}	8.97 ^{b}	8.43 ^{b}	0.52
Phosphate (Mg/dl)	2.65 ^{ab}	2.13 ^{bc}	2.68 ^{a}	2.68 ^{a}	2.09 ^{c}	0.45
Glucose (Mg/dl)	143.07	152.50	156.02	156.02	145.00	27.08
Uric acid (Mg/dl)	2.80^{b}	2.32 ^{c}	3.57 ^{a}	3.57 ^{a}	2.18 ^{c}	0.46
Cholesterol (Mg/dl)	92.52	99.18	105.85	105.85	106.37	15.77
Triglyceride (Mg/dl)	20.42	24.90	27.25	27.25	24.38	35.88
Cl (Mmol/L)	119.40	112.70	104.83	104.83	104.77	21.47
Na (Mmol/L)	145.00	143.77	135.68	135.68	137.72	20.30
K (Mmol/L)	5.30 ^{a}	4.88^{ab}	3.98 ^{b}	3.98 ^{b}	4.37 ^{ab}	0.88
HC03 (Mmol/L)	28.83	28.50	26.50	26.50	28.33	2.15
Urea (Mg/dl)	10.40 ^{c}	12.03 ^{ab}	12.50 ^{a}	12.50 ^{a}	12.40 ^{a}	1.45
Creatinine (Mg/dl)	0.24^{b}	0.35 ^{a}	0.28 ^{ab}	0.28 ^{ab}	0.30 ^{ab}	0.04
Total Bilirubin (Mg/dl)	0.11	0.13	0.07	0.07	0.13	0.08
Conj. Bilirubin (Mg/dl)	0.05 ^{a}	0.06 ^{a}	0.03b ^{c}	0.03b ^{c}	0.02 ^{c}	0.01
ALT (IU/L)	2.50	2.42	2.50	2.50	2.42	0.211
AST (IU/L)	35.22 ^{a}	22.27 ^{c}	32.38 ^{ab}	32.38 ^{ab}	21.00^{c}	0.63
ALP (IU/L)	175.10	163.40	157.90	157.90	156.31	553.30

a, ab Means with different superscripts along the same row are significantly different (P<0.05)
BUN: Blood Urea Nitrogen, AST: Aspartate Aminotransferase, ALT: Alanine Aminotransferase
*Merck Veternary Manual, 2015

Table 5 above shows the Serum Biochemical Indices of weaner rabbits fed bovine blood meal mixed with processed broiler's feather meal. There were no significant differences (P > 0.05) in all the parameters observed in this study except for albumin, Conj. Bilirubin and creatinine. Rabbits fed T (20% BBFM) 3 exhibited the highest values of albumin (3.52g/dl) while the lowest value of (2.63g/dl) was observed in those fed T 2 (10% BBFM) (Dairo, 2005) reported that albumin is an important blood clot factor due to its ability to prevent haemorrhage, therefore the higher the value, the better it is for the animals. However the values observed in this study were within the normal range recommended for normal healthy Rabbits. The creatinine values obtained in this study varied significantly across the dietary treatments in which the highest

value (1.50mg/dl) was obtained in rabbits fed T1 (0% BBFM) while the lowest value (0.90mg/dl) was observed in rabbits fed T 3 (20% BBFM). The creatinine values obtained in this study fell within the normal range of values (0.7-1.5 mg/dl) reported by Fraser et al,(2016) but significantly higher than values reported by Ikhimioya et al, (2017) for an healthy grower rabbits. Prvulovic et al, (2012)reported that creatinine level in serum has direct correlation with muscle mass and kidney function in animals. It was general concluded that Bovine Blood meal Mixed with processed Broiler's feather meal (BBFM) has a very nutritive value for weaner rabbits.

CONCLUSION

This study was conducted to examine the nutritional evaluation of bovine blood mixed with processed broiler's feather meal on growth performance and hematology of rabbits. A total of 40 weaner rabbits were randomly selected at the Department of Animal Science, Livestock Section (Rabbitary Unit) of the Teaching and Research Farm, University of Uyo, Uyo, AkwaIbom State for the period of seven weeks.The rabbits were divided into 5 groups based on average initial weights (20-25kg) and each group of weanerrabbits were respectively allocated to each of the five treatment diets in a completely randomized design (CRD). Each treatment group contained 2 replicates of 4 rabbits (2male and 2female). These rabbits were fed twice daily and water supplied adlibitium. The treatment diets consisted of the following of BBFM at 0% (control), 10%, 20%, 30% and 40% replacement of conversional feeds stuffs in the control diet were formulated. The study utilized a randomized design and the statistics used in analyzing the result in the study were mean+ stem and one way Analysis of variance (ANOVA). The following were the concluded:

Total (100%) replacement of maize with BBFM was significant with the growth, economic evaluation, and growth performance of rabbits ($P < 0.05$). Dietary treatment had effect on the feed conversion ratio and feed cost per unit weight gain. Rabbits fed the control diet (0% BBFM) were lowest in dressing percentage whereas counterparts on 80% maize replacement with BBFM where highest in abdominal fat compared to pigs on other dietary treatments. Results also showed that the replacement did not have an effects on the blood chemistries ($P > 0.05$).

The findings of this study therefore implies that bovine blood mixed with processed broiler's feather meal can be a great meal in for all monogastric animals as it will increase the body weight, aid growth and promote large meat production. Also, it will reduce the cost expenses on the farmers as the cost of making or getting this feed is relatively easy and low. It is therefore recommended that;

1. Organic waste products like BBFM should be used in rabbits nutrition to reduce over as it aids in improving the growth performance of rabbits.
2. Public extension/ advisory staff should be mobilized to convey these results to practicing farmers.
3. Further studies on how to harnessed different unconversional waste products to feedstuffs should be conducted.

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