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Evaluation of the Nutritive Value of Mixture of Fermented Bovine Blood and Rumen Digesta for Broiler Finisher

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Abstract
A 35-day feeding trials involving three hundred (300) 5 week old broilers was carried out in a completely randomized design to evaluate the performance, organ characteristics, nutrient utilization and economic analysis of broiler finishers fed diets containing a mixture of fermented dried bovine blood and rumen digesta (FBBRD) at dietary levels of 0, 5, 10, 15 and 20% respectively. At the end of the feeding trials, two birds were randomly selected from each treatment and transferred to a metabolism cage for faecal collection and determination of nutrient digestibility. Another set of five (5) birds were randomly selected from each treatment for carcass and organ weight evaluation. Birds on the test material performed generally better in all the parameters measured than the control group. There were no significant ($P<0.05$) difference among the groups in relative organ weight. The groups on the test materials (FBBRD) also recorded better nutrient nutrient utilization values than the control group. The results suggest that up to 20% inclusion level of FBBRD meal could be tolerated by broiler finisher without any adverse effects on performance.
Keywords: Fermented Bovine Blood and Rumen Digesta, Performance, Broiler Finisher.

INTRODUCTION

The prices of animal products have soared in the last two decades; this is as a result of increases in the prices of protein feedstuffs used in livestock feed formulation (Adeniji, 2000; Esonu *et al*., 2005). This is also mainly due to competition between human beings, industries and livestock for the available feedstuffs. These crippling realities that are characteristics of third world countries has led to the use of locally available, and cheap industrial by-products, novel crops and animal wastes as feed ingredients. The products of livestock industry are meat, milk, wool, hair and hides and skin. The by-products are blood, rumen digesta, hooves, bones etc. recycling these by-products will reduce disposal and environmental pollution problems. Different methods have been used to process bovine blood and rumen digesta mixture : application of heat (Adeniyi and balogun, 2002), sun-drying, oven drying and open air drying (Tukur *et al*., 2001). These methods slightly improved the nutritive value of bovine blood and rumen digesta mixture. There is still need to explore other ways of enhancing the nutritive value and biosafety of the material. Fermentation has minimal cost, and increases bioavailability of nutrients by increasing the digestibility of nutrients by animals. The mixture of bovine blood and rumen digesta is rich in nutrients including food particles, micro-organisms and fermentation products (Preston and Leng, 1991, Emmanuel, 1978; Abubakar and Yusuf, 1991 and Dangmo, *et al*., 2000). This study is, therefore aimed at evaluating the performance, organ characteristics, nutrient utilization and economic analysis of broiler finishers fed diets containing a mixture of fermented dried bovine blood and rumen digesta.

MATERIALS AND METHODS

The bovine blood and rumen digesta were procured from the abattoir at Obinze following a hygienic procedure, in which clean disinfected containers were used in the collection. The blood and the rumen digesta were mixed at the ratio of 1:3 by volume respectively and allowed to ferment for 4 days and sun dried for 3-4 days depending on the intensity of the sun. The mixture of the fermented bovine blood and

rumen digesta (FBBRD) was flavoured with curry powder to mask the inherent offensive odour. The mixture was then ground in a hammer mill to produce fermented bovine blood and rumen digesta meal. Sample of the material was subjected to proximate analysis according to AOAC (1995).

Table 1:Proximate analysis of mixture of fermented bovine blood and rumen digesta (%DM).

Parameters	Proximate composition
Moisture	7.20
Crude fibre	21.90
Crude protein	29.86
Ash	7.40
Ether extract	23.50
Nitrogen free extract	12.14

DM = Dry Matter

Five experimental broiler finisher diets were formulated incorporating the mixture of processed bovine blood and rumen digesta meal at five dietary levels of 0%, 5%, 10%, 15% and 20% inclusion levels respectively (Table 2).Three hundred (300) five-week old Hubbard broiler birds were divided into five (5) groups of sixty (60) birds each and randomly assigned to the five experimental diets (0, 5, 10, 15 and 20%) in a completely randomized design (CRD). Each treatment was sub-divided into four (4) replicates of 15 birds each and housed in a compartment measuring 12 x 10m. Feed and water were offered *ad-libitum* to the birds. The birds were weighed at the beginning of the trial and subsequently on weekly basis. Feed intake was determined by obtaining the difference between the quantity of feed offered and the quantity left over the next morning. Feed conversion ratio was also computed. The trial lasted for 35 days.At the end of the 8^{th} week, two birds were randomly selected from each treatment and transferred to a metabolism cage for faecal collection and determination of nutrient digestibility. Another set of 5 birds were selected from each treatment group starved of feed but not water for 24 hours and then slaughtered and eviscerated for organ weight determination as outlined by Adeniji and Balogun (2002).Data collected from the experiment were subjected to analysis of variance (ANOVA) as outlined by Snedecor and Cochran (1978), where ANOVA indicated significant effects means were compared using Duncan's New Multiple Range Test (DNMRT) as outlined by Obi (1990).

Table 2: Composition of experimental broiler finisher diets.

Ingredients	Dietary Levels (%)				
	0.00	**5.00**	**10.00**	**15.00**	**20.00**
Maize	55.00	55.00	55.00	55.00	55.00
*FBBRD	0.00	5.00	10.00	15.00	20.00
Palm kernel cake	7.50	4.00	2.50	2.50	2.50
Soyabean meal	25.00	25.00	25.00	20.00	15.00
Fish meal	3.00	3.00	2.00	2.00	2.00
Bone meal	3.50	3.50	3.50	3.50	3.50
Wheat offal	2.00	0.50	0.50	0.50	0.50
Brewers Dried grain	3.00	1.00	0.50	0.50	0.50
**Vit/Min premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00

*FBBRD = Fermented bovine blood and rumen digesta

**To provide the following per kg of diet; Vit A, 10,000iu; Vit D2, 1,500iu; Vit E, 3iu; Vit K, 2mg; Riboflavin, 3mg; Vitamin B_{12}, 0.08mg; Folic acid, 4mg; Mn, 8mg; Zn, 0.5mg; Iodine, 1.0mg; Co, 1.2mg; Cu, 10mg; Fe. 20mg.

Table 3: Analyzed chemical composition of experimental broiler finisher diet

Parameters	Dietary Levels (%DM)				
	0.00	5.00	10.00	15.00	20.00
Crude protein	21.10	20.65	20.60	20.61	20.61
Crude fibre	5.40	5.90	6.00	6.04	6.34
Ether extract	5.19	4.64	4.38	4.10	4.00
Calcium	1.65	1.65	1.54	1.53	1.52
Phosphorus	0.91	0.91	0.85	0.82	0.72
ME (Kcal/Kg)	2888.82	2881.05	2880.70	2835.00	2806.20

RESULTS

The groups on the test material recorded significantly (P<0.05) higher feed intake values than the control group. The feed intake values for the different groups were 134.14g, 140.76g, 148.14g, 143.12g, and 145.06g for 0%, 5%, 10%, 15% and 20% dietary levels respectively. The group on 10% dietary inclusion level of fermented bovine blood and rumen digesta (FBBRD) recorded the highest feed intake values of 148.12g, while the group on 0% has the lowest value of 134.14g.The groups on the test material recorded higher weight gain than the group on the control diet. Although, there were observable differences in weight gain among the groups, this was however, not significant (P>0.05).The body weight gain of the birds were 48.00gm, 49.00g, 51.14g, 48.47g and 48.14g for 0%, 5%, 10%, 15% and 20% dietary levels respectively. There was no trend in the body weight gain. However, the group on 10% dietary level gave the highest body weight gain (51.14g), while the group on the control (0%) diet gave the least weight.The group on the control diet recorded the best feed conversion ratio of 2.79 while the group on 20% gave the poorest feed conversion ratio of 3.13. There was no significant difference (p>0.05) among the groups. Feed conversion ratio were similar (p>0.05) for all treatment groups.

Mortality

A bird died in each of the treatments and a veterinary diagnosis revealed the case to be of bacterial infection and not due to the treatment.

Table 4: Performance of broiler finishers on different levels of FBBRD

Performance	Dietary level (%) 0.00	5.00	10.00	15.00	20.00	SEM
Initial body weight	1370.0	1390.0	1400.0	1480.0	1370.0	3.58

Final body weight	3050.0	3000.0	3190.0	3080.0	2880.0	5.88
Body weight gain	1680.0	1610.0	1790.0	1600.0	1510.0	2.30
Daily body gain(gm)	48.00	46.00	51.14	45.71	43.14	0.066
Daily feed intake(gm)	134.14^{b}	140.76^{ab}	148.12^{a}	143.12^{ab}	145.06^{ab}	4.08
Feed conversion ratio	2.79	2.84	2.9	2.95	3.36	0.8
Mortality (number)	1.0	1.0	1.0	1.0	1.0	_

^{ab} means within rows with different superscripts are significantly different.

SEM = Standard Error Mean.

FBBRD = Fermented Bovine Blood and Rumen Digesta.

Economic Analysis

Table 5 shows the economic analysis of this experiment. The dietary inclusion of FBBRD reduced cost of producing one kilogram of feed and this reflected in the cost of meat (N/kg) produced. Based on the economy of producing a kilogram of body weight, the 15% and 20% FBBRD diets were the cheapest feed while the 0% FBBRD diet was most expensive. Feed cost declined with increasing dietary level of FBBRD. Feed cost saving increased with dietary level of FBBRD.

Table 5: Economic Analysis (Broiler Finishers)

	Dietary levels				
Economic Analysis	**0**	**5**	**10**	**15**	**20**
Cost of feed (₦/g)	69.09	67.09	66.33	60.67	56.4
Feed cost savings (%)	-	2.89	3.99	12.19	18.34
Meat produced (₦/kg	192.76	190.54	192.36	1788.98	176.50

ORGAN WEIGHT CHARACTERISTICS

Data on carcass analysis and organ weight expressed as percentage of live weight are shown on Table 6. There was no significant differences (P>0.05) in the live weight and dressing percentage of birds. There was also no significant difference (P>0.05) in the organ weights of the groups. There was observable decrease in the weights of the heart and kidney, this decrease was however, not significant (P>0.05), the intensity of yellow colouration of the shank, skin and beak of the birds increased with increasing levels of FBBRD in the diet.

Table 6: Relative organ weight (broiler finisher).

	Dietary Levels (%)						
Organ parameters	**0.00**	**5.00**	**10.00**	**15.00**	**20.00**	**SEM**	Live weight
(gm)	3300	3100	3350	3200	370	0.75	

Dressing (%)	71.21	70.9771.04	69.54	70.90	0.001
Heart (%)	0.47	0.50 0.40	0.40	0.06	0.003
Liver (%)	1.51	1.54 1.58	1.60	1.59	0.001
Gizzard (%)	3.33	3.353.35	3.35	3.33	0.20
Kidney (%)	0.12	0.130.11	0.10	0.10	0.16

SEM = Standard error mean

Nutrient utilization values of the different groups for crude protein were 72.06, 68.23, 66.65, 58.56 and 58.05 for 0%, 5%, 10%, 15% and 20% respectively. The group on the control diet gave better nutrient utilization values for crude fibre, dry matter, crude protein, ether extract and ash than those on the test material. Also, there was no significant difference (P>0.05) in the Dry Matter, Ash and Ether extract values amongst the groups, but there were significant differences (P<0.05) among the groups in crude protein and crude fibre (Table 7).

Table 7: Effect of fermented bovine blood and rumen digesta on nutrient utilization of broiler finishers.

Nutrient	**Dietary Levels (%)**					
utilization	**0.0**	**5.0**	**10.0**	**15.0**	**20.0**	**SEM**
Dry Matter	89.37	89.2788.99	89.85	89.66	0.58	
Crude protein	72.06[a]	68.23[b]	66.65[b]	58.56[c]	58.05[c]	2.90
Crude fibre	76.00[a]	63.00[b]	65.56[b]	60.97[b]	60.13[b]	2.11
Ether extract	74.70	74.6674.42	72.44	71.20	0.44	
Ash	73.70	73.2672.12	72.08	71.30	1.03	

SEM = Standard error mean

[abc] means within rows with different superscripts are significantly different (P<0.05).

DISCUSSION

The improved performance of birds fed FBBRD could be attributed to the higher protein content of the test material. It could also be due to the influence of microbial protein, undigested starchy and fibrous carbohydrates, long chain fatty acids and partially undigested proteins of the test materials (Esonu *et al*., 2006; Okorie, 2005; Ekwuoma, 1992; Whyte and Wadak, 2002; Aganga and Aganga, 1985 and Odunsi, 2003). It could also be due to adequate dietary crude fibre level, since FDBBRD is high in fibre.

Crude fibre activates the intestine and more occurance of peristaltic movement and enzyme production resulting in efficient digestion of nutrients (Kekeocha, 1984; Esonu *et al*., 2004; Esonu *et al*., 2005).

Adult birds utilize high fibre materials than chicks (Esonu *et al*., 2004). This suggests that the finisher birds could tolerate FBBRD diets better than the chicks, because at this stage, they have a more developed gastro intestinal tract to handle the fibre contents of the diets (Adeniji and Balogun, 2000 and Esonu *et al*., 2004).

Furthermore, the apparent nutrient digestibility of the diets containing FBBRD for both crude protein and crude fibre was slightly lower than the control group. This could be attributed to the higher crude fibre content of the test material which tends to increase the total fiibre content of the diets and dilute other nutrients, which may probably have interrupted the digestibility and effective utilization of the nutrients in the diets. These results agree with earlier studies at this station and others with broilers, layers and rabbits (Esonu *et al*., 2007; Esonu *et al*., 2006 and Addeniji and Balogun, 2001). The low mortality recorded during the trial period suggests that the test material, FBBRD as a feed ingredient, when properly processed could be used to improve performance of broilers in the tropics without adverse effects. Dietary inclusion of fermented bovine blood and rumen digesta at all levels reduced feed cost savings (%), but the meat values produced were inconsistent with the dietary levels of the test materials.

CONCLUSION

The inclusion of fermented dried bovine blood and rumen digesta as feed ingredient in broiler finisher diets up to 20% dietary level is recommended since it enhanced production, reduced cost of production and control environmental pollution and hazards that accrue from inadequate waste disposal.

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