NUTRITIONAL VALUE OF FERMENTED BOVINE BLOOD AND RUMEN DIGESTA MIXTURE FOR BROILER CHICKENS

B.O. ESONU; J.C. AZUBUIKE; G.U. OKORO, and C.C. UBA

Department of Animal Science and Technology, Federal University of Technology, P.M.B. 1526, Owerri, Nigeria.

ABSTRACT

The experiments reported in this study were conducted to determine the nutritive value of fermented bovine blood and rumen digesta for broiler birds. Bovine blood and rumen digesta were mixed at a ratio of 1 : 3 in an air tight plastic container and allowed to ferment for 4 days. The fermented mixture was then sun dried and milled into a meal. In the first experiment, the sun dried fermented mixture of bovine blood and rumen digesta meal so produced was then used to formulate broiler starter diets at 2.5, 5, and 7.5% dietary levels respectively; these diets were then tested against a control (0%) diet using 240, 2-week-old young broiler chicks with three replicates of 20 chicks each per treatment. The trial lasted for 28 days. In the second experiment, the sun dried fermented mixture was as in experiment 1. The meal so produced was used to formulate broiler finisher diets at 5 dietary levels of 0, 5, 10, 15, and 20% inclusion levels respectively, using 225, 6-week-old broiler chicks, with three replicates of 15 chicks each per treatment. The feeding trial lasted for 21 days. At the end of the 21st day, four birds were randomly selected from each treatment for carcass and organ weight evaluation. Overall, birds on the fermented mixture performed generally better than the control groups. Feed intake increased with increased dietary levels of the fermented mixture and organ weights were comparable. Dietary inclusion of the fermented mixture at all levels reduced cost of producing one kilogramme of feed and this reflected in the feed cost savings (%), but the N/kg meat produced values were inconsistent with the dietary levels of the fermented mixture.

Key words: Fermentation, bovine blood, rumen digesta, performance, broilers.

INTRODUCTION

Poultry production in developed countries has become more intensive, animal performance has steadily improved since they no longer obtain parts, if not all of their feed requirements from scavenging waste by-products, crop residue, etc. However, in developing countries, traditional human foods have become the raw materials for animal production with the result that cereals are now mostly grown specifically for animal feeding (Hahn *et al*, 1988).

The competition for food between humans and animals has been a serious problem in developing countries. This has resulted in a continuous increase in production cost causing a phenomenal rise in the unit cost of livestock production. Thus, animal products have become too expensive for the majority of the population (Hahn *et al*; Esonu, *et al*, 2001). Hence, it has become necessary to replace these costly feed materials with alternatives.

Bovine blood and rumen digesta are by-products of cattle. Beef is the highest source of animal protein in Nigeria. It is estimated that about 1.873 million heads of cattle are slaughtered annually in Nigeria (Adeniji, 1996). The high demand for beef in Nigeria makes bovine by-products readily available. Bovine blood and rumen digesta mixture has great potential as an alternative feed ingredient in livestock production if properly processed. Recycling these by-

products will also reduce disposal and environmental pollution problems.

Different methods have been used to process bovine blood and rumen digesta mixture: application of heat (Adeniji and Balogun, 2002), Sun drying, oven drying and open air drying (Tukur *et al*, 2001). Although, these methods succeeded in slightly improving the nutritive value of bovine blood and rumen digesta mixture, there is still need to explore other ways of enhancing its nutritive value.

Fermentation has minimal production cost, it is competition free and increases digestibility of nutrients by animals (Adeniji, 2001).

The trials herein reported were therefore designed to evaluate the nutritional value of a mixture of fermented bovine blood and rumen digesta for broiler birds.

MATERIALS AND METHODS

Experiment 1: The bovine blood and rumen digesta were collected from the abattoir at Obinze in Imo State of Nigeria. The rumen digesta was collected by cutting open the rumen and collecting its content and the blood collected also at slaughter. The blood and rumen digesta were mixed at a ratio of 1 : 3 in an air tight plastic container and stored for 4 days for fermentation to take place. The fermented mixture was flavourised with curry powder to mask the inherent offensive odour. The material was then spread evenly on a concrete floor and sun dried for 5 days. The sun-dried material was ground in a hammer mill to produce finely ground dried bovine blood and rumen digesta meal. Sample of the material was subjected to proximate analysis according to AOAC (1995) (Table 1).

The mixture of fermented bovine blood and rumen digesta (FBBRD) meal so prepared was then included in broiler starter diets at 0, 2.5, 5 and 7.5% dietary levels respectively. The ingredients and chemical composition of the experimental diets are shown in Table 2.

Two hundred and forty (240) young broiler chicks of Hubbard breed were selected from a batch of 14-day-old broiler chicks such that their initial body weights were between 250 and 280gm. The chicks were divided into four groups of 60 birds each and randomly assigned to the four treatment diets in a completely randomized design (CRD) experiment. Each treatment group was further sub-divided into three replicates of 20 birds per replicate and kept in a 6m x 8m compartment. Feed and water were provided ad-libitum. Feed intake was recorded daily and the birds were weighed weekly.

The compartments were heated using kerosene stoves and electric light bulbs. Other routine poultry management procedures were maintained. The data collected were subjected to Analysis of Variance (Snedecor and Cochran, 1978). The trial lasted for 28 days.

Experiment 2: The processing procedures for of the mixture of fermented bovine blood and rumen digesta (FBBRD) meal and the chemical analysis were same as in experiment 1. Five broiler finisher diets were formulated to contain fermented bovine blood and rumen digesta 0, 5, 10, 15, and 20% inclusion levels respectively. The treatment diets were isocaloric and isonitrogenous. The ingredients and chemical compositions of the experimental diets are shown in Table 3.

Table 1: Proximate composition of Fermented Bovine Blood and Rumen Digesta mixture (FBBRD) (%DM)

Nutrient	Proximate Composition
Moisture content	7.20
Crude protein	29.86
Crude fibre	21.90
Ash	7.40
Ether extract	23.50
Nitrogen free extract	9.64

Table 2: Ingredient composition of the Experimental Diets: (Expt. 1: Starter chicks).

	Dietary Inclusion Levels of FBBRD (%)			
Ingredient	**0.00**	**2.50**	**5.00**	**7.50**
Maize	50.00	50.00	50.00	50.00
Soybean meal	30.00	30.00	30.00	30.00
FBBRD	0.00	2.50	5.00	7.50
Palm kernel cake	2.50	1.00	0.50	1.00
Brewers dried grains	8.00	8.00	7.50	4.50
Fish meal	2.00	2.00	2.00	2.00
Bone meal	3.50	3.50	3.50	3.50
Wheat offal	3.00	2.00	0.50	0.50
*Vitamin/Min. premix	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Chemical Composition (%DM)				
Crude protein	22.73	22.28	21.84	21.69
Crude fibre	4.53	4.56	5.00	5.55
M.E. (Kcal/g) (calc)	2.89	2.84	2.80	2.79

**To provide the following per kg of feed. Vitamin/Tm: To provide the following per kg of feed: vitamin A - 11,000,000iU, Vitamin D3-2,000.000iU, vitamin B1 – 0.75, vitamin B2-5g, Nicotinic acid – 25g, Calcium pantothenate 12.5g, vitamin B12 – 0015g, vitamin k2 –2.5g, vitamin E – 25g, Biotin – 0.50g, Folic acid m – 1g, Choline chloride – 25g, Cobalt – 0.400g, Copper – 8g, Iodine – 0.8g, following Cin – 100g, Spiramycin – 5g, Nitro – 5g, DL – methionine – 50g, Selenium 0.16g, 1, Lysine – 120g, BHT – 5g.*

Two hundred and twenty-five (225), 6-week-old broiler chicks also of Hubbard breed were selected from a batch of chicks such that their initial weights were between 1200 and 1400gm. Based on sex and weight, the birds were divided into five groups of 45 birds each and randomly assigned to the five treatment diets in a completely randomized design (CRD) experiment. Each treatment group was further sub-divided into three replicates of 15 birds per replicate and kept in a 4m x 6m compartment. Feed and water were provided liberally. Feed intake was recorded daily and the birds were weighed weekly. Other routine poultry management procedures were maintained.

The feeding trial lasted for 21 days. At the end of the 21st day, four birds were randomly selected from each treatment for carcass and organ weight evaluation. The birds were fasted for 24 hours before slaughter. Dressing percentage, weight of heart, liver and kidney were determined. The data collected were subjected to Analysis of Variance as in experiment 1 where significant effects were detected from the Analysis of Variance, means were compared using Duncan's New Multiple Range Test as outlined by Obi (1990).

RESULTS

Experiment 1: The chemical composition of fermented bovine blood and rumen digesta mixture (FBBRD) is shown in Table 1, while the nutrient composition of the experimental diets is shown in Table 2. Data on performance of the birds on the various dietary levels of fermented bovine blood and rumen digesta are presented in Table 3.

Feed intake of the birds on varying inclusion levels of fermented bovine blood and rumen digesta mixture were significantly ($P<0.05$) higher than the control (0%) group. The body weight gain of the groups followed the same trend as feed intake. Birds on diets containing the test material recorded higher body weight gain than the control group. However, this increase and feed conversion ratio were not significantly ($P>0.05$) different among the groups.

Dietary inclusion of fermented bovine blood and rumen digesta reduced cost of producing one kilogramme of feed and this reflected in the cost of meat (N/kg) produced.

Experiment 2: The chemical composition of fermented bovine blood and rumen digesta meal was the same as in experiment 1, while the nutrient composition of the experimental diets is shown in Table 3. Data on the performance of the treatment birds are shown in Table 5.

Feed intake and body weight gain of the groups were significantly ($P<0.05$) different. Birds on fermented bovine blood and rumen digesta containing diets recorded significantly ($P<0.05$) higher feed intake and body weight gain. Feed conversion ratio and relative organ weight of the groups were however not significant ($P>0.05$).

Dietary inclusion of fermented bovine blood and rumen digesta meal reduced cost of producing one kilogramme of feed and this reflected in the feed cost savings (%) but the N/kg meat produced values were inconsistent with the dietary levels of the test material.

Table 3: Ingredient Composition of the Experimental Diets (Expt. 2)

Ingredients	Dietary Inclusion of FBBRD (%)				
	0%	5%	10%	15%	20%
Maize	55.0	55.0	55.0	55.0	55.0
SBM	25.0	25.0	25.0	20.0	15.0
FBBRD	0.0	5.0	10.0	15.0	20.0
PKC	7.5	4.0	2.50	2.50	2.50
Fish meal	3.0	3.0	2.0	2.0	2.0
Bone meal	3.50	3.50	3.50	3.50	3.50
Wheat offal	2.0	0.50	0.50	0.50	0.50
BDG	3.0	1.0	0.50	0.50	1.00
*Vitamin/Tm Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Chemical Composition (%DM)					
Crude protein	20.04	20.06	20.04	20.05	20.6
M.E. (Kcal/g) (calc.)	2.83	2.82	2.83	2.82	2.81

*To provide the following per kg of feed. *Vitamin/Tm: To provide the following per kg of feed: vitamin A – 11,000,000iU, Vitamin D3-2,000,000iU, vitamin B1 – 0.75, vitamin B2-5g, Nicotinic acid – 25g, Calcium pantothenate 12.5g, vitamin B12 – 0015g, vitamin k2 –2.5g, vitamin E – 25g, Biotin – 0.50g, Folic acid m – 1g, Choline chloride – 25g, Cobalt – 0.400g, Copper – 8g, Iodine – 0.8g, following Cin – 100g, Spiramycin – 5g, Nitro – 5g, DL – methionine – 50g, Selenium 0.16g, 1, Lysine – 120g, BHT – 5g.*

Table 4: Performance of birds on the Experimental Diets (Expt. 1: Starter chicks)

Parameters	Inclusion Level of FBBRD (%)				
	0%	2.5%	5.0%	7.5%	SEM
Initial body weight	270.00	270.00	270.00	270.00	0.00
Final body weight (g)	1245.00	1337.50	1340.63	1390.63	5.50
Body wt. change (g)	975.00	1067.50	1070.63	1120.63	8.03
Daily body Wt. gain	34.82	38.13	38.24	40.02	0.60
Daily feed intake (g)	90.21	101.56	108.42	115.54	1.25
Feed conversion ratio (g. feed/g. gain)	2.59	2.66	2.84	2.89	0.08
Feed efficiency (g wt. Gain/g. feed)	0.39	0.38	0.35	0.35	0.01
Mortality	-	-	-	-	
Cost Benefit Analysis:					
Cost of feed (N/kg)	55.59	44.58	44.27	50.27	-
Meat produced (N/kg)	135.31	128.90	128.13	131.36	-
Feed cost savings (%)	-	11.01	11.32	5.32	-

Table 5: Performance, Organ Characteristics and Economic Analysis of finisher broilers fed Different Levels of FBBRD (Expt. 2)

	Dietary Inclusion Levels (%)					
Parameters	**0.0**	**5.0**	**10.0**	**15.0**	**10.0**	**SEM**
Average initial body wt. (g)	1230	1350	1390	1400	1380	5.88
Average final body wt. (g)	2280	2377	2509	2624	2430	10.25
Average body wt. gain (g)	1050	1027	1119	1224	1050	5.02
Average daily wt. gain (g)	50	48.9	53.3	58.2	50	4.08
Average daily feed intake (g)	140	160	160	170	170	3.58
Feed conversion ratio	2.9	3.5	3.1	3.0	3.3	0.50
Mortality %	4.4	2.2	0.0	0.0	0.0	
Relative Organ Weight:						
Live wt (g)	2080.0	2180.0	2209.0	2404.0	2130.0	0.80
Carcass (%)	93.07	95.67	96.09	96.75	95.69	2.24
Dressing (%)	76.29	76.43	77.39	74.82	76.19	0.55
Heart (%)	0.45	0.46	0.51	0.45	0.40	0.60
Gizzard (%)	2.92	3.02	3.45	3.42	3.50	0.19
Liver (%)	1.41	1.44	1.58	1.80	1.77	1.03
Kidney (%)	0.12	0.09	0.15	0.13	0.16	1.03
Economic Analysis:						
Cost of feed (N/kg)	56.90	55.40	5040	49.30	48.79	
Meat produced (N/kg)	165.19	155.74	160.54	161.70	162.01	
Feed cost savings (%)	-	7.86	5.47	7.60	8.11	

ab = means in different rows bearing different superscripts are significantly different (P<0.05)

DISCUSSION

The increased feed intake of the birds on the diets containing fermented bovine blood and rumen digesta meal is understandable, fermented bovine blood and rumen digesta contain high fibre which tend to increase the total fibre content of the diets and dilute other nutrients.

Birds must therefore eat to meet their energy requirements to sustain rapid growth and development, hence the increased feed intake. This agrees with earlier reports from Ash and Akoh (1992), Opara (1996), Omekam (1994) and Esonu *et al* (2002).

Birds on fermented bovine blood and rumen digesta diets performed generally better than the control (0%) group.

This improved performance could be attributed to higher protein component of the test material due to the influence of the microbial protein, undigested fermented starchy and fibrous carbohydrates, long chain fatty acids, partially digested feed proteins and other fermented products. (Okorie, 2005, Ekwuoma, 1992; Whyte and Wadak, 2002; Aganga and Aganga, 1985 and Odunsi, 2003). The improved performance could also probably be due to adequate dietary crude

fibre level. Crude fibre activates the intestine and more occurrence of peristaltic movement, more enzyme production resulting in efficient digestion of nutrients (Kekeocha, 1984; Esonu *et al*, 2001; Adeniji, 2001; Esonu *et al*, 2004; Esonu *et al*, 2005).

Dietary inclusion of fermented bovine blood and rumen digesta at all levels reduced feed cost which was also reflected in the feed cost savings (%) but the N/kg meat produced values were inconsistent with the dietary levels of the test material.

REFERENCES

Adeniji, A.A. (1996): The value of bovine blood rumen content meal as a feedstuff for pullets. Ph.D Thesis University of Ilorin.

Adeniji, A.A. (2001): The potential of bovine blood rumen content meal as a feedstuff for livestock. Tropical Animal Production Invest, 4 : 151 – 156.

Adeniji, A.A. and Balogun, O.O. (2002): Utilization of treated blood rumen content mixture in the diets of lying hens. Nig. J. Anim. Prod., 29(1) 34 – 39.

Aganga, A.O. and Aganga A.A. (1985): Prospects of Abbattoir by-products utilization in Nigeria. A review version spectrum 1(1) : 8 – 11.

Ash, A.J. and Akoh Petaia, L. (1992): Nutritional value of Sesbania grandiflora leaves for monogastrics and ruminants. Tropical Agriculture (Trinidad). 69 : 223 – 228.

AOAC. (1995): Official Methods of Analysis, 7th Edition, Washington, D.C.

Ekwuoma, C. (1992): The chemical composition of ruminal contents of cattle, sheep and goats. B.Sc. project Report. University of Agriculture, Abeokuta, Nigeria.

Esonu, B.O.; Iheuwkumere, F.C.; Iwuji, T.C.; Akanu, N and Nwugo, O.H. (2001): Evaluation of *Microdesmis puberula* leaf meal as feed ingredient in broiler starter diets. Nig. J. Anim. Prod. 30 : 3 – 9.

Esonu, B.O.; Iheukwumere, F.C.; Emenalom, O.O.; Uchegbu, M.C. and Etuk, E.B. (2002): Performance, Nutrient Utilization and Organ characteristics of broiler finisher fed *Microdesmis puberula* leaf meal. Livestock Research for Rural Development. 14(6): 15 (http:www.cipav.org.co/lrrd/lrrd14/6/eson146.htm.

Esonu, B.O.; Azubuike, J.C.; Emenalom, O.O; Etuk, E.B.; Okoli, I.C.; Ukwu, H.O. and Nneji, C.S. (2004): Effect of enzyme supplementation on the performance of broiler finisher fed *Microdesmis puberula* leaf meal. International Journal of Poultry Science. 3(2): 112 – 114.

Esonu, B.O.; Emenalom, O.O.; Udedibie, A.B.I.; Anyanwu, A.; Madu, U. and Inyang, A.O. (2005): Evaluation of Neem (Azadirachta indica) leaf meal on performance, carcass characteristics and egg quality of laying hens. Int. J. Agric. Rural Dev. 5: 208 – 212.

Hahn, S.K.; Reynolds, L. and Egbunike, G.N. (1988): Use of Cassava for feeding livestock in Africa. University of Ibadan, Nigeria.

Kekeocha, C.C. (1984): Pfizer Poultry Production Handbook. Pfizer Corporation, Nairobi in Association with Macmillan Publishers, London.

Obi, I.U. (1990): Statistical Methods of detecting differences between treatment means. 2nd edition. Snaap Press, Enugu, Nigeria.

Odunsi, A.A. (2003): Blend of Bovine Blood and Rumen Digesta as a replacement for fish meal and groundnut cake in layer diets. International Journal of Poultry Science. 2(1): 58 – 61.

Okorie, K.C. (2005): The effects of Dried Pulverized rumen content on the performance, carcass and organ characteristics of finisher broiler. Animal Production Research Advances (2).

Omekam, V.N. (1994): Studies on Nutritional and Health Implications of dietary inclusion of dried poultry waste for broilers. M.Sc. Thesis, Federal University of Technology, Owerri, Nigeria.

Opara, C.C. (1996): Studies on the use of Alchornia cordifolia leaf meal as feed ingredient in poultry diets. M.Sc. thesis, Federal University of Technology, Owerri, Nigeria.

Snedecor, G.W. and Cochram, W.G. (1978): Statistical Methods. 6th edition. Iowa State University Press, Ames, Iowa, USA.

Tukur, H.M.; Maignandi, S.A. and Mohammed, A.A. (2001): Effect of different drying methods on chemical composition of fore-stomach digesta. Proc. Of the Animal Nutrition Studies of Agric.

Whyte, E.P. and Wadak, L. (2002): Evaluation of Rumen content on the growth performance of Weaner Rabbits. Proc. 7th Ann. Conf. Animal Sci. Assoc. of Nig. (ASAN), Sept. 16 – 19. University of Agric, Abeokuta, Nigeria.