The Effect of Blood-Brewer`s Dried Grain Mix (ANPLA) on the Performance of Broilers

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Abstract- This study involved the production and evaluation of Blood and Brewer`s dried grain mix (ANPLA), as an animal protein concentrate, on the performance of broilers. A preliminary study of Blood and Brewer`s dried grain in different ratios to determine drying rate of blood and the crude protein (CP) percentage was done. 1:2 ratio of blood to brewers dried grain with 58.6 % CP was adopted to produce the test feed ingredient hereafter called ANPLA. Five treatment diets were formulated. Diet 1 served as control diet (0% ANPLA) and diets 2, 3, 4 and 5 contained ANPLA at 15%, 25%, 35% and 45% respectively. One hundred and five day-old chicks were randomly assigned to the treatment diets with three replicates each. Feed intake, body weight gain, feed conversion ratio and feed cost/weight gain were determined. The result showed significant difference ($P<0.05$) between the treatment means with respect to weight gain and feed intake. The result also indicated that financial gain and better growth performance were recorded at 15% and 25% inclusion levels of ANPLA respectively. It was concluded that ANPLA in the proportion of 1:2 blood to brewer`s dried grain, can be included in practical broiler starter and finisher diets up to 25% for optimal performance of broilers while also saving cost.

Index Terms - ANPLA, Blood, Brewer's Dried Grain, Broiler, Ratio, Performance**.**

1 INTRODUCTION

Poultry occupies a unique position in the Nigerian livestock production, possibilities due to the fact that they are free from many pathological, ecological and economic constraints which affect the commercial production of other classes of livestock [1]. Poultry has a significant effect on national economy and about 10% of Nigerian population is engaged in poultry production [2]. Of all poultry businesses, broiler production is a fast growing agricultural business in developing countries, therefore production of broiler can become an essential and a profitable venture. Broiler production involves the keeping of chickens of heavy meat breeds for the purpose of getting good quality meat, usually sold between eight to ten weeks of age due to their ability for quick growth and high feed conversion efficiency. The meat is an important source of high quality protein, minerals and vitamins to balance the human diet.

Low intake of these animal proteins is still a major human nutritional problem especially among Nigerians where the level of consumption is about 27gm less than the minimum requirement for animal protein for an adult in Nigeria. This might be related to the high cost of production of these needed animal proteins which in turn is due to the high cost of feed stuffs. Research for cheaper feed stuffs has been the concern of animal nutritionists in present day research because of the geometric increase in the price of conventional feed. In Africa especially Nigeria this increase in price is not only occasioned by the competition that is existing between humans and livestock, but also to circumstances such as, ethno-religious crisis, natural disasters, political instability, poor implementation of government policies etc. The costs of feed ingredients usually range from 65-75% of the total cost of poultry production. This problem led to a

reduction in the rate of expansion of poultry industry and has added to the low level of animal protein intake by the populace. A possible way of increasing the supply of poultry products at a cheaper price is by reducing the cost of production through the use of cheaper and locally available livestock feed ingredients.

Blood meal is a by-product of the Abattoir industry, used as a protein source in the diets of ruminants and non-ruminants. It has been reported to contain about 80-85% crude protein. Blood meal is one of the richest sources of lysine, arginine, methionine, cystine, and leucine but very poor in isoleucine and contains less glycine than fish meal [3]. The use of blood meal in poultry diet is not popular and blood meal has not been recommended to be used beyond 5% [4] because the digestibility of blood meal was not as efficient as that of fish meal [5]. Several researches [6],[7],[8] with the use of blood meal in broiler diets showed that performance declined lineally with increasing levels of blood meal and this was more significant beyond 5 per cent inclusion level.

Brewers Dried Grain (BDG) is a by-product of the Brewing industries. This is a residue extracted from barley, wheat, maize, rice and oat. It contains the insoluble materials remaining after the process of soaking, mashing and boiling with water and includes crude fibre fractions, fats, proteins together with residues of starch and dextrin [9], [10]. Brewer`s dried grain (also called spent grain) is not directly utilized by man for food and is therefore readily available as a potential feed stuff for livestock. Spent grain or brewers dried grain contains 93% DM, 22.39% crude protein, 19.1% crude fibre, 4% ash, 48.6% NFE, metabolisable energy (ME) 2360kcal/kg, 6.2% ether extract [11]. It is also reported to be fairly rich in essential amino acids; 0.9% lysine, 0.4% methionine, 0.4% tryptophan and 1.2% valine [12].

It is evident that blood meal and brewers dried grain are relatively high in crude proteins and fibre respectively. Therefore, development of a simple technology to harness these wastes (blood and brewer`s dried grains) into animal protein concentrate-ANPLA, which is expected to be cheaper, is justifiable. Incorporating these "wastes" into animal rations will help solve the problems of pollution and waste disposal, and will at the same time cut down on the importation of fish meal and other animal protein concentrates. This will in effect bring down feed costs, thus ensuring more animal protein available for the populace in order to close up the protein gap.

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2 MATERIALS AND METHOD

The preliminary research and laboratory work was carried out in the Nutrition and Biochemistry Laboratory, Department of Animal Science, University of Nigeria Nsukka while all the feeding trials was conducted at the Poultry Unit of the University farm.

The moist Brewers Dried Grain (a component of ANPLA) was obtained from Life Breweries Limited, Onitsha and sundried. Fresh cattle blood was obtained from Nsukka local Abattoir. Maize, solvent extracted soybean meal, vitamin/mineral premix, bone meal, palm oil, common salt, maize offals and fish meal were respectively purchased from Kingsize Feeds, Nsukka.

2.1 Preparation of ANPLA

A preliminary study of Blood and Brewer`s dried grain in different ratios of 1:1, 1:2, 1:3, 2:3, and 3:4, to determine drying rate of blood and crude protein (CP) percentage was done. The 1:2 blood to brewers dried grain mix, had the highest % CP (58.6 %) and was adopted to produce the test feed ingredient (ANPLA).

Fresh blood was poured `in a clean large empty container after weighing, and the appropriate quantity of brewer`s dried grain also weighed was added in the adopted ratio of 1:2 blood to brewer`s dried grain. These were thoroughly mixed to obtain a homogenous mixture which subsequently was sun-dried and then ground in a hammer mill fitted with a 2 mm screen and stored for use.

2.2 Feeding Trials and Experimental Diets

The feeding trials were done in two (2) phases- the starter and the finisher phases. Each experimental phase had 5 diets (Table 1). The five (5) diets for each phase were all isonitrogeous and isocaloric. Diets were manually mixed a day prior to the commencement of each phase. Four of the experimental diets in each phase (Diets 2-5) contained the test material (ANPLA) which was included at different levels (15%, 25%, 35% and 45%) such that the ANPLA supplied 3.45%, 5.75%, 8.05% and 10.35% as part of the total crude protein of the starter diet (23% CP) and 3.0%, 5.0%, 7.0% and 9.0% as part of the total crude protein of the finisher diet (20% CP).

Table 1

Composition of the Experimental Diets

	Starter Phase					Finisher Phase				
Ingredient	1	2	3	4	5	1	2	3	4	5
Maize	51.30	51.90	52.00	52.74	52.50	57.00	57.50	57.87	58.23	57.89
Maize offals	12.80	12.97	13.00	13.18	12.49	14.20	13.88	13.76	13.66	13.17
Soybean meal	25.10	19.74	16.47	12.56	12.67	19.44	14.76	11.64	8.51	7.61
Fish meal	6.30	4.94	4.12	3.14	0.00	4.86	3.69	2.91	2.13	0.00
ANPLA	0.00	5.95	9.91	13.88	17.84	0.00	5.17	8.62	12.07	15.52
Bone meal	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Premix*	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated CP %	22.99	23.00	23.00	23.00	23.00	19.99	19.94	19.92	19.90	19.86
ME (Kcal/Kg)	2939.52	2918.80	2903.11	2891.53	2871.08	2976.26	2980.55	2977.75	2974.84	2973.74

ME: Metabolisable energy; ANPLA – Blood and Brewers dried grain; Premix* Bio-mix supplied per tonne: Vit A 5,000000 I.U., Vit D3 1,000000 I.U., Vit E 20,000mg, Vit K3 1000mg; Vit B1, 1200mg,Vit B2 2400mg, Vit B6 2400mg, Niacin 16,000mg; Calcium pantothenate 4,000mg, Biotin 32mg; Vit B12 10mg; Folic acid 400mg; Chlorine chloride 120,000mg: Manganese 40,000mg; Iron 20,000mg; Zinc 18,000mg; Copper 800mg; Cobalt 100mg, Iodine 620mg, Selenium 40mg.

2.3 Experimental birds and Design

A total of 105 day old unsexed broiler chicks (Anak strain) were weighed (41g of average weight) and randomly divided into 5 treatments with 3 replicates per treatment. The birds were reared in deep litter system. Fresh water and treatment diets were supplied *ad libitum* throughout the period of the experiment. Routine management practices including vaccination and drug administration when necessary were duly observed. Each feeding phase (starter and finisher phases) lasted for 4 weeks. Feed intake was determined by subtracting the weight of the left over feed from the weight of the feed offered after 24hours. The broilers were weighed at the beginning of the experiment to obtain the initial weight of the broilers and then weekly to obtain their weight gain. Other parameters evaluated were average daily weight gain and feed conversion efficiency.

2.4 Statistical Analysis

The proximate composition of ANPLA (the test feedstuff) and those of other treatments (experimental diets) were determined using the methods outlined by AOAC [13]. Data collected were subjected to a one way analysis of variance (ANOVA) using the SPSS version 17.0. Differences between means were separated using the Least Significant Difference in SPSS package. Economic analysis to determine cost of feed and feed cost per kilogram of gain was also calculated.

3 RESULTS

The proximate composition of ANPLA and the experimental diets on dry matter basis are shown in Table 2. The dry matter contents were found to be generally high to crude protein, crude fibre and ether extract.

Table 2

Proximate Composition of ANPLA and Experimental Diets (% DM)

	CP	CF	EE	ASH	NFE	DM	Calculated ME (M Kcal/kg)
ANPLA	58.63	27.00	4.0	4.5	5.87	79.0	
Starter Diets							
Diet 1	22.97	3.93	4.0	7.0	62.10	77.5	2939.52
Diet 2	23.01	5.28	4.5	7.0	60.21	82.0	2918.80
Diet 3	22.99	6.17	2.5	7.0	61.34	87.5	2903.11
Diet 4	23.01	7.05	7.0	8.0	54.94	84.5	2871.08
Diet 5	22.50	8.04	4.0	7.5	57.96	87.5	2871.08
Finisher Diets							
Diet 1	21.55	3.90	4.5	7.0	63.05	86.5	2976.26
Diet 2	21.41	5.02	5.5	8.0	62.07	91.0	2980.55
Diet 3	21.11	5.78	6.0	6.5	60.50	88.0	2977.75
Diet 4	21.34	6.54	8.5	8.0	55.62	85.5	2974.84
Diet 5	21.50	7.35	5.5	7.5	58.65	86.5	2973.74

CP: Crude Protein; CF: Crude Fiber; EE: Ether Extract; NFE: Nitrogen-Free Extract; DM: Dry Matter; ME: Metabolisable Energy.

The performance of the birds on the two phases (starter: 0-28days and finisher: 29-56days) and the total performance (0-56days) of broiler birds on varying levels of ANPLA based diets are shown in Tables 3 and 4. Feed consumption was significantly ($P<0.05$) affected by the inclusion of ANPLA in the experimental diets. When compared with the control, it was observed that increasing the level of ANPLA beyond the 25% rate resulted in significant ($P<0.05$) decrease in feed intake. It was also observed that the feed intakeof birds on diets 2 and 3 did not differ significantly with the control (diet 1). The lowest feed consumption was obtained with diets 4 and 5 containing 35% and 45% ANPLA respectively.

The control diet (Diet 1) as well as diets 2 and 3 supported similar growth rate. Diet 2 had the highest value for body weight gain at 15% inclusion of ANPLA, though there was no significant ($P<0.05$) difference in body weight gain between diets 1, 2 and 3 (Table 4). It was observed that the least growth rate was recorded with 45% ANPLA (Diet 5) and there was no significant difference in feed conversion ratio. The

feed cost/Kg is highest in diet 1 (control) reference to fish meal compared to the experimental diets (Table 4). It is observed that the cost of diets reduced with increase in levels of ANPLA which implied lower levels of fish meal inclusion.

Table 3

Performance of broilers on ANPLA diets: Starter and Finisher phases.

Parameters		Diets				
	Diet phase	**1**	**2**	**3**	**4**	**5**
Average feed intake (g)	Starter phase	31.50	29.20	26.67	24.65	29.27
	Finisher phase	78.79	85.90	79.33	64.84	60.11
Average daily weight gain (g)	Starter phase	14.41	12.50	12.20	11.06	9.83
	Finisher phase	24.30	29.96	28.23	20.64	19.02
Feed conversion ratio (feed/gain)	Starter phase	2.18	2.33	2.18	2.22	2.97
	Finisher phase	3.24	2.87	2.81	3.14	3.16

Starter phase: 0-28days, Finisher phase: 29-56days

Table 4

Total performance of broiler birds on varying levels of ANPLA based diets (0-56days).

Parameters		Diets					SEM
		1	2	3	4	5	
Average feed intake (g)		55.0^{a}	57.0^{a}	53.0^{a}	45.0^{b}	45.0^{b}	4.08
Average daily weight gain (g)		19.0^{ab}	22.0^{a}	20.0^{ab}	15.0^{c}	14.0^{c}	1.54
Feed conversion ratio (feed/gain)		2.86	2.61	2.63	2.83	3.23	0.39a
Feed cost/Kg (N/Kg)	I	18.02	16.76	16.77	16.24	16.21	-
	II	17.58	17.16	16.76	16.39	16.39	-
Feed cost/weight gain (N/Kg gain)		47.69	39.57	40.95	40.92	44.95	-

I – Starter phase: II – Finisher phase: N/Kg – Naira/kilogram. Results are expressed as Mean of the samples. Mean values in same row with different superscript are significantly different (P>0.05)

4 Discussion

Taste and smell play roles in the regulation of feed intake in poultry. Although these roles are generally believed to be of a minor significance [14], Kare and Scott [15] reported that chicks would select some practical feedstuff in preference to others when these feedstuffs are offered in a free-choice situation, and also feeding preference did not correlate with the known nutritional value of feedstuff. Feed preferences such as these may be functions of taste, or more likely palatability of individual feedstuff.

In this study, levels of ANPLA in the diets increased with a corresponding increase in the crude fibre content which led to an observed decrease in feed intake. Onwudike [16] reported that although the use of brewer`s dried grains reduce cost of production, its high crude fibre level probably reduces the quantity of brewer`s dried grains that can be used in poultry diets. ANPLA is made of blood and brewer`s dried grain in the 1:2 proportion, it is possible therefore, that the crude fibre content of this test feedstuff in the diets (4 and 5) was to a considerable extent a limiting factor to the utilization of these diets by the birds, hence the observed decrease in feed intake.

In the composition of the experimental diets, the levels of ANPLA across the diets increased with a relative decrease in levels of fish meal. Peischel et al., [17] reported an unidentified growth factor (UGF) which aids improvement in both growth and efficiency of feed utilization with poultry fish meals. Thus the UGF activities of such ingredient have been proposed as the basis of the superior performance of poultry fed practical diets containing UGF compared to those without UGF [18]. The palatability and hence consumption of the feeds by the birds could have been affected by the inclusion or exclusion of fish meal and thus, feed intake and weight gain. This decrease in fish meal may have affected the ability of the birds receiving the little and no fish meal in their diets (4 and 5) to utilize the high levels of ANPLA. Jayne and Gerald [14] reported that fish meal improved growth by a typical UGF effect due to its increased preference and palatability in birds. Thus the diets (1, 2, 3) containing fish meal were preferred to diets 4 and 5 containing little and no fish meal, because of the improved palatability by assisting in the assimilation of the vegetable albumin [19]. Jayne and Gerald [14] also reported that the effect on growth of birds fed feedstuffs containing UGF activities were dependent on the concentration of the test feedstuff used. This explains also the poor performances observed in birds fed with diets 4 and 5 which contained little and no fish meal, although they contained high proportions of ANPLA which in turn contain BDG with UGF.

The combination of fishmeal and ANPLA, both of which contain UGF, may have improved the palatability of the diets thus encouraging more consumption, better conversion and better output. This is in line with the report of Jayne and Gerald [14] that birds preferred diets containing feedstuff such as fish meal, brewer`s dried grain etc., when allowed a free-choice feeding to corn-soy based diet which are generally believed to be quite palatable to poultry. They therefore concluded that the positive selection for the diets containing such test ingredient demonstrate preferences for rather than avoidances of those diets.

The amino acid profiles of the diet may also have been responsible for the performance of the birds. Fish meal is known to be of high nutritive value containing high levels of lysine and methionine which are essential amino acids needed by chicks. Blood meal though a rich source of lysine, leucine and tryptophan which are also essential amino acids, is low in arginine, isoleucine and methionine. The better performance of birds that consumed diets 2 and 3 containing both fish meal and ANPLA (15% and 25% respectively), could have been attributed to the fact that all the essential amino acids needed by the birds were supplied by the feed ingredients in quantities adequate to meet their need for growth and other functions. The low amounts of leucine, Isoleucine and marginal amounts of methionine in ANPLA were supplemented by those of fish meal thus exerting a synergistic effect which positively aided growth and performance. This agrees with the report of Galal et al [20], that 3% blood protein improved growth when added to a diet supplemented with both crystalline lysine and methionine while 6% blood protein alone failed to elicit such response. On the contrary, diets 4 and 5 did not support good performance of the birds probably because of inadequate supply of the essential amino acids. This inadequacy could have resulted from the amino acid imbalance of blood meal which though rich in lysine is low in arginine, isoleucine and marginal in methionine, all of which are essential for good performance of birds, and since there was no supplementary amino acids added, the performance of the birds was adversely affected.

The observed decrease in cost of diet with increase in inclusion level of ANPLA might be related to the price difference between fish meal and ANPLA ingredient. This reason could be due majorly to the fact that ANPLA ingredient (blood and brewer`s dried grain) are "waste" products of the abattoir and brewery industries, therefore costs less to acquire. Whereas fish meal for instance will cost N100/kg, raw blood and brewer`s dry grain will cost about N10/kg respectively. Therefore N80 is saved each time a kilogram (Kg) of ANPLA is included in the diet. It is worthy of note that although there was no significant differences between weight gain by birds on diet 1 (control), 2 and 3, it costs less to produce birds with diets 2 and 3. This result indicated that financial gain and better growth performance was recorded at 15% and 25% inclusion level of ANPLA to feed diets.

CONCLUSION

Blood-Brewer`s dried grain mix (ANPLA) has shown good potentials on the performance of the broilers both biologically and economically. Therefore, it can be concluded that ANPLA in the proportion of 1:2 blood to brewer`s grain, can be included in practical broiler starter and finisher diets up to 25% without any deleterious effect. This study recommends ANPLA as an alternative feedstuff and reliable energy source up to 25% inclusion rate for optimal performance of broilers.

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