THE EFFECTS OF REPLACING FISHMEAL WITH BLOODMEAL IN BROILER FINISHER RATIONS

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SUMMARY

Experiments were conducted with Ross-type broiler chickens to determine the optimum level of inclusion of fish meal and the replacement value of blood meal for fish meal in broiler finisher rations. The optimum level of inclusion of fish meal was found to be 5%. Fish meal levels beyond 10 per cent tended to produce unacceptable fishy taste and odour in the meat. This level was successfully replaced by 4% blood meal without adverse effect on growth performance and taste or odour of the meat. The use of blood meal resulted in lower feed costs and feed cost per kg weight gain.

INTRODUCTION

Blood meal may be a valuable ingredient for poultry feeds because of its high protein and lysine content. Its use in broiler chicken rations has been limited because its inclusion as the only animal protein supplement has often resulted in depressed growth performances (Grau and Almquist 1944; Fisher, 1968; Hassan Mukhtar and Nazir, 1974 and Galal Baker, Norton and Becker 1977).

Fish meal is known to be a excellent source of supplementary protein in poultry rations. It is however expensive and often scarce in most tropical countries. Blood meal appears to be a possible substitute for fish meal because of its high protein and lysine content. In view of its availability and cheapness relative to fish meal, studies were conducted to determine the optimum level of inclusion of fish meal and the replacement value of blood meal for fish meal in broiler finisher rations.

MATERIALS AND METHODS

Unsexed Ross-type broiler chicks purchased from a local hatchery at day old and raised on standard broiler starter rations (Dafwang, Offiong and Olomu, 1979) containing 7.5% fish meal for the first 6 weeks were used in these studies. All rations were isocaloric (3000 kcal/kg) and isonitrogenous 20 per cent crude protein and formulated to meet energy and protein requirements in accordance with the recommendations of Olomu (1978).

Ingredients were analysed for their proximate chemical composition using AOAC methods (1975). The amino acid composition of the ingredients were analysed using a Technicon Amino Acid Analyser. Commercial grade imported fish meal (FM) purchased from Pfizer (Nig.) Ltd. was used in these studies. The blood meal (BLM) was obtained commercially from a local processor. The composition of the ingredients have previously been reported (Dafwang *et al* 1979).

Two experiments were conducted. At the beginning of each experiment, the six weeks old birds were randomly allocated into similar groups of 50 birds per group. Two such groups were placed on each of the experimental rations in Experiment 1 while three such groups were placed on each treatment in Experiment 2.

In Experiment 1, seven graded levels of fish meal (0,2.5, 7.5, 10, 12.5 and 15 per cent) were tested. The composition of the rations used is shown in Table 1. Experi-

TABLE 1

Percentage Composition of Broiler Finisher Rations Containing Fishmeal

Ingredients	Rations						
	1	2	3	4	5	6	7
Guinea corn	53.25	53.55	53.85	54.15	54.75	54.75	55.05
Groundnut cake	32.50	28.60	24.70	20.80	16.90	13.00	9.10
Fish meal	—	2.50	5.00	7.50	10.00	12.50	15.00
Wheat bran	6.75	8.10	9.45	10.80	12.15	13.50	14.85
Palm oil	2.95	2.95	2.95	2.95	2.95	2.95	2.95
Bone meal	2.75	2.50	2.25	2.00	1.75	1.50	1.25
Oyster shell	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Common salt	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Premix[1]	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Calculated analysis							
Ca (%)	1.23	1.23	1.23	1.23	1.23	1.23	1.23
P (%)	0.76	0.77	0.78	0.79	0.80	0.81	0.82
Crude Fibre (%)	5.98	5.68	5.40	5.12	4.83	4.54	4.25
Lysine (%)	0.70	0.77	0.86	0.94	1.02	1.10	1.18
Methionine + Cystine (%)	0.58	0.61	0.65	0.68	0.71	0.75	0.78

[1]Premix - a commercial vitamin-mineral product (from J.L. Morrison & Jones) supplying the following per kg of ration:— Vit. A, 15000 I.U.; Vit. D_3, 3000 I.U.; D. Calcium pantothenate, 10mg; Vit. B_{1U}, 10kg; Vit. E, 5mg; Vit. K, 3mg; Vit. B_1, 2mg; choline chloride, 120mg;

ment 2 was conducted to study the replacement value of blood meal for fish meal. Blood meal replaced fishmeal on an equiprotein basis. The rations containing blood meal (Table 2) were compared with those containing 0,5, 7.5. and 10 per cent fishmeal (Table 1). Details of the experimental treatments involved are presented in Table 5. Feed and water were supplied ad libitum. Birds were observed daily and a record of mortality was kept. Weekly records of weight gain and feed consumption were kept. The experiments were terminated when the birds were 9 weeks old.

At the end of the experiments, thirteen birds (seven males and six females) were randomly selected from each replicate and processed for carcass and taste panel evaluation. The carcasses were then stored in a deep freezer at -5°C until ready for taste panel evaluation.

At the time of tasting, the carcasses were thawed overnight at room temperature, neatly packed into roasting pans and both pan and carcass weighed.

The carcasses were cooked in electrically heated ovens at temperature of 190°C. An allownace of about 60 minutes cooking time per kg of carcass was made. The meat was confirmed cooked when the internal temperature of the carcasses reached 75°C.

After cooking, the pan was allowed to cool down, the drippings drained, and the pan weighed together with the roasted chicken. The difference between the fresh and cooked weights were expressed as cooking loss. Deboning was done manually. The flesh and bones were weighed separately in order to calculate the meat to bone ratio. The thigh meat was chopped into slices of approximately 1.5cm long by 1cm wide and 0.5cm thick. Four pieces plus a piece of the skin made up the taste sample for each group. Samples

were coded with random numbers, arranged circularly on a plate and given to each panelist to evaluate for fishy taste, fishy odour and acceptability and to rank them for those qualities on a hedonic ranking system. Panelists were asked to rinse their mouths with water after each sample and to allow an interval of not less than 2 minutes in between samples.

All data collected during the experiment were subjected to the analyses of variance and significance of differences between means assessed by applying the Duncan's Multiple Range Test at the 5% level of significance (Steel & Torrie, 1960).

RESULTS

Experiment 1:

Apart from the ration containing 5% fish meal, weight gain tended to improve with increase in levels of fish meal up to 10% (Table 3), although no two consecutive groups had weight gains that were significantly different. Fishmeal levels of 12.5 and 15 per cent tended to depress weight gain and feed efficiency. The differences in feed efficiency between treatments containing 7.5, 10, 12.5 and 15% were not significant.

Feed cost per kg weight gain was lowest on the all vegetable ration and highest on the ration containing 15% fish meal.

Dietary treatment had no significant effects on carcass dressing percentages, cooking loss and meat to bone ratio (Table 4). There was a strong correllation between fishy taste and treatment (r = 0.905) and fishy odour and treatment (r = 0.914). Compared to the ration without fishmeal (Lot 1), fishmeal levels of 12.5 and 15%, significantly increased fishy taste and odour (Lots 6 and 7), and the meat from there rations were least acceptable in terms of taste and odour.

Experiment 2.

The results of this experiment are summarised in Table 5. There were no significant differences between treatments for weight gain and efficiency of feed conversion. Thus the replacement of fish meal with blood meal resulted in similar

TABLE 2

Percentage composition of Broiler Finisher rations containing blood meal

	Rations					
Ingredients	1	2	3	4	5	6
Guinea corn	54.85	55.65	56.45	55.15	55.35	55.95
Groundnut cake	24.70	20.80	16.90	20.80	16.90	16.90
Fish meal	—	—	—	2.50	5.00	2.50
Blood meal	4.00	6.00	8.00	4.00	4.00	6.00
Wheat bran	8.95	10.05	11.15	10.30	11.66	11.40
Palm oil	2.95	2.95	2.95	2.95	2.95	2.95
Bone meal	2.75	2.75	2.75	2.50	2.50	2.50
Oyster shell	1.00	1.00	1.00	1.00	1.00	1.00
Common salt	0.30	0.30	0.30	0.30	0.30	0.30
Prexix[1]	0.50	0.50	0.50	0.50	0.50	0.50
Calculated analysis:						
Ca (%)	1.23	1.23	1.23	1.23	1.23	1.23
P %	0.75	0.75	0.77	0.79	0.76	0.76
Crude Fibre %	5.36	4.88	4.40	5.10	4.80	4.78
Lysine (%)	0.83	0.81	0.80	0.91	0.99	0.99
Methionine + cystine (%)	0.58	0.57	0.57	0.61	0.64	0.61

[1]Premix with composition as shown on Table 1.

TABLE 3

Effect of Different Levels of Fishmeal on the Performance of Broiler Chickens (6 — 9 Weeks)

Lot No.	Level of FM (%)	Weight gain/g. g.	Feed intake g.	EFC[2] (g feed) (g gain)	Feed Cost/kg gain ₦	Mortality %
1	0.0	690[c]	2288[b]	3.32[bc]	1.37[a]	2
2	2.5	744[bc]	2448[ab]	3.29[bc]	1.45[ab]	1
3	5.0	712[bc]	2569[a]	3.60[c]	1.66[cd]	0
4	7.5	806[ab]	2542[ab]	3.16[ab]	1.55[bc]	0
5	10.0	856[a]	2526[ab]	2.96[a]	1.52[abc]	0
6	12.5	784[ab]	2403[ab]	3.07[ab]	1.65[cd]	0
7	15.0	758[bc]	2349[ab]	3.10[ab]	1.75[d]	0
	SEM[3]	26	74	0.10	0.03	0.35

[1]Means within each column with same superscript are not significantly different (P<0.05).
[2]EFC = Efficiency of feed conversion.
[3]Standard Error of Means.

TABLE 4

Effect of Different Levels of Fishmeal on Carcass Characteristics

Lot No.	Dietary Treatment % FM	Carcass + necks (%)	Cooking loss %	Meat/ Bone	Fishy[2] Taste	Fishy[2] Odour	Accept[3] ability
1.	0.0	67.07	24.87	3.42	1.20[c]	1.28[c]	5.67[ab]
2.	2.5	65.65	14.84	2.67	1.25[c]	1.39[bc]	6.07[a]
3.	5.0	68.49	17.36	2.71	1.65[bc]	1.44[bc]	5.57[ab]
4.	7.5	65.43	20.02	2.75	1.80[bc]	1.92[bc]	6.14[ab]
5.	10.0	67.13	18.71	3.01	2.20[abc]	2.25[ab]	5.61[ab]
6.	12.5	67.27	14.02	3.19	2.37[ab]	2.32[ab]	4.79[b]
7.	15.0	67.93	12.72	2.68	3.13[a]	3.09[a]	5.05[b]
	SEM	1.44	3.95	0.31	0.30	0.27	0.25

[1]Means within each column with same superscript or no superscript are not significantly different (P<0.05).

[2]*Fishy taste and Odour*

Very Fishy	4
Moderately Fishy	3
Slightly Fishy	2
No Fishy Taste	1

[3]*Acceptability*

Highly acceptable	7
Moderately acceptable	6
Slightly acceptable	5
Undecided	4
Slightly un-acceptable	3.

weight gains and feed efficiency. Of interest is the fact that the abscence of fish meal and blood meal did not significantly depress weight gain and feed efficiency. No two consecutive treatment groups had feed consumption values that were significantly different. Thus the birds tolerated up to eight per cent blood meal without adverse effects on their performance. The total replacement of fish meal with blood meal significantly depressed feed cost/kg gain (Lots 5 to 7 vs lots 2 to 4). The all vegetable protein ration (Lot 1) also gave feed cost/kg gain that was significantly lower than that given by rations containing fishmeal as the only source of animal protein. Partial replacement of fish meal with bloodmeal also tended to reduce feed cost/kg gain. Dietary treatments had no significant effects on

mortality.

There was no significant differences between treatments for carcass dressing percentages, cooking loss, meat to bone ratio, fishy taste and fishy odour and the acceptability of the meat from these treatments (Table 6).

TABLE 5

The Effects of Replacing Fish Meal with Blood Meal on Performance of Broiler Chickens (6 — 9 Weeks)

Lot No.	Level of FM (%)	Level of BLM (%)	Weight gain (g)	Feed intake (g)	EFC (g feed) (g gain)	Feed Cost/ kg. gain (₦)	Mortality (%)
1	0	—	868	2322^{bc}	2.68	1.10^{d}	0.67
2	5	—	902	2320^{bc}	2.58	1.19^{bc}	0.
3	7.5	—	910	2272^{c}	2.52	1.22^{bc}	0.67
4	10	—	911	2383^{ab}	2.62	1.34^{a}	2.00
5	—	4	907	2416^{ab}	2.67	1.10^{d}	1.33
6	—	6	919	2411^{ab}	2.62	1.08^{d}	0.67
7	—	8	935	2461^{a}	2.63	1.09^{d}	0.
8	2.5	4	938	2483^{ab}	2.65	1.16^{cd}	0.
9	5	4	884	2380^{abc}	2.69	1.24^{b}	0.
10	2.5	6	889	2346^{abc}	2.64	1.13^{cd}	0.
	SEM		25	41	0.06	0.02	0.21

[1]Means within each column with same superscript are not significantly different ($P<0.05$).

TABLE 6.

Effect of Replacing Fish Meal with Blood Meal on Carcass Characteristics

Lot No.	Dietary Treatment	Carcass neck (%)	Cooking loss (%)	Meat/Bone ratio (%)	Fishy[2] taste	Accept[2] ability	Fishy[2] odour	Accept[2] ability
1	0% FM	67.65	24.61	2.66	1.71	5.96	1.83	5.67
2	5% FM	67.60	28.45	3.05	1.97	5.18	1.89	5.40
3	7.5% FM	68.00	24.98	3.01	2.28	5.31	1.85	5.59
4	10% FM	67.80	23.00	3.49	2.21	5.37	2.11	5.67
5	4% BLM	67.67	26.10	3.24	1.85	5.21	2.03	5.00
6	6% BLM	68.20	30.72	3.29	1.77	5.55	1.62	5.64
7	8% BLM	67.50	25.70	2.94	2.06	5.56	1.92	5.56
8	2.5 FM + 4% BLM	69.35	31.10	3.29	1.68	5.31	1.72	5.29
9	5% FM + 4% BLM	67.50	30.37	3.55	1.82	5.57	1.85	5.64
10	2.5% FM + 6% BLM	67.34	30.77	3.17	2.07	5.84	1.68	5.70
	SEM	0.96	3.87	0.32	0.18	0.33	0.28	0.12

[1]All treatment means are not significantly different ($P<0.05$)

[2]Rankings are as outlined in Table 4.

DISCUSSION

More feed is consumed during the finishing stage 5 or 6 — 9 weeks) than during the starting stage (0 — 5 or 6 weeks). Surprisingly however, this finishing stage has been neglected in most studies. This accounts for the near absence of reports on the optimum level of fish meal and value of blood meal in broiler finisher rations. It is widely recognised that the essential amino acid requirement decreases with the age of the bird, hence lower values are usually recommended for finisher rations in comparison to that of starter rations (NRC 1971; Boomgaardt and Baker 1973). The present studies show that where fish meal is to be used in broiler finisher rations, it need not be added beyond 5%. Levels above this either resulted in performance not different from the recommended level or to less desirable carcasses with fishy taste and odour.

In this study, 4 per cent blood meal successfully replaced the recommended fish meal level of 5 percent, contrary to earlier report in which blood meal successfully replaced only 67 percent of the recommended level of fishmeal (7.5 percent) for broiler starters (Dafwang *et al,* 1979). This may be due to the fact that the older birds were less sensitive to problems of amino acid imbalance and palatability which were implicated in the earlier report of Dafwang *et al,* (1979). Of interest is the observation that the all vegetable ration also resulted in similar growth and feed efficiency as the ration containing the recommended level of fish meal (5 per cent). This obervations agrees with the report of Olomu (1978).

Blood meal is being produced cheaply in many tropical countries (Hassan *et al,* 1974; Galal *et al,* 1977; Rathore and Charturvedi, 1971). The present studies show that blood meal can be used to replace fishmeal in rations for finishing broiler chickens without adversely affecting performance. The use of blood meal in place of fish meal was also shown to result in lower feed costs and lower cost of production of poultry meat.

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