NUTRITIVE VALUE OF LOCALLY PREPARED FISHMEALS FOR BROILER CHICKENS

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SUMMARY

Three experiments were conducted with broiler chickens to study the effects of replacing commercial Herring fishmeal with fishmeals prepared from crayfish, sardine, mudskeeper and mullet. In the first experiment, there were no significant differences in the performance, carcass dressing percentages and the composition of the hearts and livers when any of the locally prepared fishmeals replaced the commercial fishmeal in rations. Rations without fish meal depressed performance and carcass/neck dressing percentages significantly but did not affect the composition of the hearts and livers. In Experiment 2, the fishmeals were fed at a supplementary level of 7.5% and at a level (20%) in which they constituted the only source of supplementary protein. In this experiment, performance of birds fed 7.5% of the different fishmeals were similar to those observed in the first experiment. When the fishmeals constituted the sole source of supplementary protein, performances of the birds were similar for all fishmeals and were better than when 7.5% fishmeal was fed in the ration in addition to groundnut meal. The ration containing groundnut meal as the sole supplementary protein source depressed performance of birds. In Experiment 3, the total protain efficiency ratios (TPE) of the different fishmeal rations were assessed. The TPE for all the fishmeal rations were not significantly different and were significantly better than that of rations without fishmeal.

INTRODUCTION

Good quality fishmeal is generally accepted as a high quality protein supplement for chicks. Many investigations have indicated that the nutritive value of chick rations could be enhanced if reasonable levels of fishmeals were included in the ration in addition to plant protein supplements usually employed in formulating chick rations (Avila and Balloun, 1972; Hinners and McKinney, 1972; Olomu, 1976). However great variation exists in the quality of different fishmeals depending on the type of fish employed and the pre-treatment of the fishmeal before use in the rations (Anderson, Wisutheron and Warrick, 1968; Apandi *et. al.* 1974). Most studies have involved conventional fishmeals which include Anchovy, Herring, Menhaden and White fishmeals. These fishmeals are expensive and not usually readily available. Recently, satisfactory fishmeals were prepared from *Tilapia mossambica* and *Trichogaster pectoralis* (Apandi, Atmadilaga and Bird, 1974) and also from Pilchard (Wessels and Moodie, 1975). The nutritive values of local fishmeals that can easily be obtained in Nigeria have not been assessed for poultry.

The present report deals with the effects of fishmeals made from crayfish, Mullet, Mudskeeper and Sardine on the growth, feed consumption, feed efficiency, carcass dressing percentages, composition of the livers and hearts of the chickens and total protein efficiency ratios. The fishes selected for these studies had gross chemical composition close to that of commercial fishmeal usually employed in ration formulation in Nigeria. In addition, the fishes are always available in the smoked dried and fresh forms from local suppliers.

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MATERIALS AND METHODS

Sardine, Crayfish, Mullet and Mudskeeper used in these studies were purchased in the smoked form from the local market. They were then ground into meal without further processing before incorporating into the rations.

The certificate of analysis of the commercial fishmeal showed that it was Herring fishmeal. All the fishmeals were analysed for their gross chemical composition by AOAC methods (1970).

Indian River broiler-type chicks purchased from a commercial farm were used in these studies. The chicks were pre-fed a commercial type ration for six days (experiments 1 and 2) or for 13 days (experiment 3). On the seventh day or fourteenth day, the chicks were divided into similar groups of 40 chicks per group. Two such groups were placed at random on each experimental treatment.

The birds were reared on the floor and heat was provided for the first 4 weeks of age by Kerosene-heated lamps. Food and water were supplied *ad* libitum. The weights of the birds and feed consumed were determined each week. A record of mortality was kept. At the conclusion of the experiments, the data were subjected to analyses of variance and significance of differences were assessed by applying Duncan's Multiple Range Test at the 5% level of significance (Steel and Torrie, 1960).

EXPERIMENT 1

Four local fishmeals (Crayfish, Sardine, Mudskeeper and Mullet) were compared with imported fishmeal. The fishmeals were added at a level of 7.5% to contribute approximately 4.5% supplementary protein to the ration. A sixth ration without fishmeal was also included as one of the dietary treatments. The rations were maintained isocaloric and isonitrogenous with similar contents of calcium and phosphorus. The composition of the basal rations used (Rations 1 and 3) are shown in Table 1. The average starting weight of birds used in this experiment was 80 grams. At 9 weeks of age, 20 birds from each replicate were randomly selected, slaughtered and bled individually in slaughtering cones. The carcasses were defeathered, eviscerated and cleaned. The weights of the carcass plus neck, leg, head, gizzard, liver and heart were obtained. The livers and hearts were examined for any abnormalities and then stored in plastic bags at -15°C until ready for analysis. At the time of analysis, the livers and hearts were prepared and analysed for dry matter, protein and fat as previously described (Olomu, Robblee and Clandinin, 1975).

Experiment

Two local fishmeals (Sardine and Mullet) were compared with the imported fishmeal at 2 levels of inclusion (7.5% and 20%) in the ration. In the rations containing 20% fishmeals, the fishmeals constituted the only source of supplementary protein. Two other rations without fishmeal were also included in the treatments. The basal rations used are shown in Table 1 (Rations 1, 2, 3 and 4). The average starting weight of the birds was 75 grams. The experiments were terminated when the birds were 42 days old.

Experiment

In this experiment, the Total Protein Efficiency (TPE) of Sardine, Mullet, Mudskeeper and Groundnut meal were evaluated according to a previously described method (Woodham, 1968). The protein sources were made to contribute 12% protein to the total dietary protein. In this method, the chicks were first fed a commercial type broiler ration for 2 weeks and then the experimental rations for further 2 weeks. Total protein efficiency ratio was calculated by dividing average weight gain by the total protein consumed during the experimental period. The compsotion of the basal rations (Rations 3 and 4) used are shown in Table 1.

TABLE 1
Percentage Composition of Basal Rations

Ingredients	*Basal Ration number*			
	1	2	3	4
Maize	67.30	73.45	60.50	63.35
Groundnut Meal	20.65	—	32.15	27.30
Fish Meal	7.50	20.00	—	—
Palm Oil	1.30	0.15	3.35	3.35
Bone Meal	2.00	2.00	2.75	2.75
Oyster Shell	0.50	0.50	0.50	0.50
Vitamin-Mineral Premix[1]	0.50	0.50	0.50	0.50
Salt	0.25	0.25	0.25	0.25
Wheat bran	—	3.15	—	2.00
Calculated analysis:-				
Crude protein (%)	19.7	18.7	19.7	18.2
M.E.[2] (Kcal/Kg diet)	3175	3175	3175	3175
Lysine[3]	0.75	1.35	0.62	0.56
Methionine[3]	0.67	0.91	0.57	0.54

[1] The vitamin-mineral premix contained all the vitamins, trace minerals and antibiotic necessary for optimum growth of broiler chickens.

[2] M.E. = Metabolizable energy of ration; based on ME values of the individual gredients (University of Alberta, Canada).

[3] Lysine and Methionine content based on the individual lysine and methionine contents of the ingredients (Unpublished data of University of Alberta, Canada).

RESULTS

The gross composition of the fishmeals (Table 2) showed that all the fishmeals studied in the experiments had protein content very close to that of the commercial fishmeal, with Mullet fishmeal having the lowest percent protein (56.7%) and the Mudskeeper fishmeal, the highest (62.4%). The commercial fishmeal had a higher ether extract (18.8%) than showed in the certificate of analysis (6.7%) accompanying it. All the other fishmeals had ether extract content lower than that observed for commercial fishmeal, with the highest ether extract reported for Mullet fishmeal and lowest reported for Mudskeeper fishmeal. The ash contents were higher for the local fishmeal than for the commercial fishmeal.

TABLE 2
Composition of ingredients used in ration formulation (Air dry basis)

Ingredient	*Moisture* %	*Crude protein* %	*Ether Extract* %	*Ash* %	*Others*[1] %
Commercial fishmeal	10.9	61.3	18.8	8.8	0.20
Crayfish meal	14.0	60.0	13.3	12.3	0.40
Sardine Fishmeal	11.4	60.1	15.4	13.0	0.10
Mudskeeper fishmeal	14.3	62.4	11.7	11.4	0.20
Mullet fishmeal	12.8	56.7	16.2	13.9	0.40
Groundnut meal	8.5	44.9	11.1	5.5	30.0
Yellow maize	9.5	8.8	6.9	1.1	73.70
Wheat bran	11.0	15.3	4.1	6.2	63.40

[1]Others = 100-(% moisture + % crude protein + % ether extract + %.ash).

Experiment 1

Effects of treatments on weight gains, feed consumption and efficiency of feed conversion are shown in Table 3. Replacement of the commercial fishmeal by any of the fishmeals studied had no significant effects on the performance of the birds at both periods (1—6 weeks and 1—9 weeks). The absence of fishmeal in the ration led to significant depression in performance of the birds. The percentages of the heads, legs, hearts, livers and gizzards were not significantly affected by dietary treatments (Table 4). The percentage of the carcass and neck was significantly depressed when fishmeal was not added to the ration, while the type of fishmeal used had no significant effect on the percentage of carcass and neck of the chickens. The percentage composition of the dry matter, protein and fat of the hearts and livers of the chickens were not significantly affected by dietary treatments (Table 5).

TABLE 3
Effects of different fishmeals on the performance of broiler chickens

Dietary Treatment	7—42 days			7—63 days		
	Wt. gain g	*Feed consump. g/bird*	*Feed efficiency g feed/g gain*	*Wt. gain g*	*Feed consump. g/bird*	*Feed efficiency g feed/g gain*
Commercial fishmeal ...	525.7[a]	1425.2[a]	2.71[a]	1300.0[a]	3748.7[a]	2.89[a]
Crayfish meal	520.4[a]	1493.2[a]	2.87[a]	1165. [a]	3468.5[a]	2.98[a]
Sardine fishmeal ...	572.0[a]	1426.8[a]	2.49[a]	1295.5[a]	3800.0[a]	2.93[a]
Mudskeeper fishmeal ...	590.0[a]	1572.5[a]	2.66[a]	1252.6[a]	3644.5[a]	2.91[a]
Mullet fishmeal	568.2[a]	1383.0[a]	2.43[a]	1150.0[a]	3359.9[a]	2.92[a]
Groundnut meal ration ...	297.3[b]	1063.5[b]	3.58[b]	853.5[b]	2825.8[b]	3.31[b]

Column values followed by same superscripts are not statistically significantly different (P. 0.05).

TABLE 4
Dressing percentages of broiler chickens as affected by type of fishmeal in the ration (7—63 days)[1]

Dietary treatment	*Heads %*	*Legs %*	*Carcass and neck %*	*Giblets*		
				Heart %	*Liver %*	*Gizzard %*
Commercial fishmeal ...	4.55	5.77	67.85[a]	0.30	1.75	2.39
Crayfish meal	4.54	5.80	68.24[a]	0.30	1.86	2.22
Sardine fishmeal ...	4.28	5.91	68.55[a]	0.30	1.53	2.27
Mudskeeper fishmeal ...	4.21	5.58	69.58[a]	0.28	1.67	2.23
Mullet fishmeal	4.69	6.12	69.48[a]	0.32	1.78	2.38
Groundnut ration ...	5.10	5.90	65.26[b]	0.37	1.94	2.78

Column values followed by same superscripts or no superscripts are not statistically significantly different (P. .05).

TABLE 5

Effects of type of fishmeal on the composition of the hearts and livers of chickens

Dietary treatment	Hearts[1]			Liver[1]		
	Dry matter %	*Protein %*	*Fat %*	*Dry matter %*	*Protein %*	*Fat %*
Commercial fishmeal ...	23.93	71.59	17.67	26.63	64.58	14.95
Crayfish meal	22.76	72.75	18.25	27.05	62.82	14.80
Sardine fishmeal ...	23.31	74.82	16.22	27.00	67.25	16.57
Mudskeeper fishmeal ...	23.30	71.30	17.70	27.10	63.10	15.65
Mullet fishmeal	23.50	73.24	19.11	26.53	64.52	17.74
Groundnut ration ...	22.98	71.73	19.04	26.87	68.16	14.71
	n.s.[2]	n.s.	n.s.	n.s.	n.s.	n.s.

[1]Values for protein and fat are expressed on a dry matter basis.

[2]n.s. = Not statistically significant.

Experiment 2

Results of Experiment 2 are shown in Table 6. When the fishmeals were added to the ration at a level of 7.5% as in Experiment 1, performances of the birds were similar to those obtained in Experiment 1. When the fishmeals constituted the only source of supplementary protein in the ration, the weight gains and feed efficiency were further improved, significantly so in the case of the commercial fishmeal and Sardine fishmeal. The dietary level of fishmeal had no significant effects on feed consumption and mortality rates of the birds. Again, as in Experiment 1, the groundnut meal ration (without added fishmeal) significantly depressed performance and significantly increased mortality of the birds.

Experiment 3

Results of Experiment 3 are presented in Table 7. As was observed in Experiments 1 and 2, the type of fishmeal used did not have a significant effect on the weight gains, feed consumption and feed efficiency. The rations without fishmeal significantly depressed growth rates and feed efficiency. Mortality rates were not sifnificantly affected by dietary treatments. Although on the fishmeal rations, the TPE values were not significantly affected by dietary treatments, the highest TPE ratio was obtained on the ration containing Mudskeeper fishmeal closely followed by that containing Sardine fishmeal. The lowest TPE ratio was obtained on the ration to which no fishmeal was added.

TABLE 6

Effects of different levels of different fishmeals on performance of broiler chickens (7—42 days)

Dietary treatment	*Weight gain (g)*	*Feed consump. g/bird*	*Feed efficiency g/feed/g gain*	*Mortality %*
Commercial fishmeal (7.5%)	517.1^{d}	1452.3^{a}	2.63^{b}	0.0^{a}
Commercial fishmeal (20%)	624.9^{ab}	1437.0^{a}	2.30^{a}	0.0^{a}
Sardine fishmeal (7.5%)	516.8^{d}	1404.6^{a}	2.72^{b}	0.0^{a}
Sardine fishmeal (20%)	649.8^{a}	1445.8^{a}	2.22^{a}	0.0^{a}
Mullet fishmeal (7.5%)	529.3^{cd}	1455.1^{a}	2.75^{b}	2.5^{a}
Mullet fishmeal (20%)	587.1^{abc}	1445.4^{a}	2.46^{ab}	2.5^{a}
Groundnut meal	366.1^{e}	1268.3^{b}	3.47^{c}	10.0^{b}
Groundnut meal	390.4^{e}	1261.1^{b}	3.23^{c}	7.5^{b}

[1]Column values with same superscripts are not significantly different (P. 0.05).

DISCUSSION

The present results indicate that the nutritive quality of ground-based rations was improved by the inclusion of fishmeal in the ration. This finding agrees with previous observation (Rajaguru, Vohra and Kratzer, 1966; Olomu, 1976) in that there is a need to supplement ground-based rations meant for starting broiler chickens with a high quality protein source like fishmeal.

The results also indicate that satisfactory fishmeals could be prepared from other kinds of fishes like Crayfish, Sardine, Mullet and Mudskeeper reported in this paper. Earlier, Apandi, Atmadilaga and Bird (1974) reported the preparation of satisfactory fishmeals from three kinds of fish *(Stelophorus spp., Tilapia mossambica* and *Trichogaster pectoralis)* available in Indonesia. The commercial fishmeal used in the present studies had a protein level of 61.3%, a figure less than that (70.2%) contained in the certificate of analysis that came with the fishmeal consignment. This perhaps clearly demonstrates the need for constant analysis of feed ingredients before they are used in formulating poultry rations.

TABLE 7

Effects of different fishmeals on the performance and total protein efficiencies (TPE) of broiler Chicks (14—28 days)

Dietary treatment	Weight Weight gain (g)	Feed consump. g feed/ bird	ciency g ciency g feed/g gain	Morta- Morta- lity %	TPE
Commercial fishmeal	229.6[a]	502.0	2.10[a]		2.44[a]
Sardine fishmeal	221.6[a]	455.8	2.06[a]		2.60[a]
Mullet fishmeal	210.4[a]	520.4	2.47[a]	2.5	2.19[a]
Mudskeeper fishmeal	225.1[a]	486.4	2.16[a]		2.62[a]
Groundnut ration	116.0[b]	463.8	4.00[b]	2.5	1.39[b]

[1]Column values followed by the same superscripts or no superscript are not significantly different (P. 0.05).

The rations containing 20% fishmeal contained levels of lysine and methionine (1.35 and 0.91% respectively) which were close to those recommended by NRC (1971) for broiler chicks (1.25 and 0.86% respectively) and higher than those contained in the rations with 7.5% fishmeal. Sinece lysine and methionine are the most limiting amino acids in practical poultry rations, the higher levels of these amino acids in the 20% fishmeal rations may have accounted for their superiority over those rations containing 7.5% fishmeal. The same argument may serve to explain the superiority of fishmeal containing rations as compared to those without fishmeal.

The TPE rations found for the various fishmeals were high and comparable with TPE values reported earlier for fishmeals (Woodham, 1968).

All the local fishes used in these studies were cheaper and more easily available than the imported fishmeal. The most expensive local fishmeal (Crayfish) costs about two-thirds of the cost of commercial fishmeal during periods of the year when these fishes are available in large quantities. The local fishes are available all year round though in diminishing quantities at certain times of the year. Sardine fish meal was the cheapest and most easily available in large quantities all year round. It is therefore the kind of fish which could be considered in any commercial production of fishmeal in Nigeria.

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