PERFORMANCE OF BROILERS AND LAYERS FED LOCALLY PRODUCED FISH WASTE MEAL IN WESTERN SAMOA

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Summary

Two experiments were conducted to evaluate the performance of broilers and layers fed locally produced fish waste meal (LFWM) in Western Samoa. LFWM, which was produced by mincing and oven drying of rejects from filleted fish, was included in both broiler and layer diets at the complete expense of imported meat and bone meal (MBM). The experiments were of a completely randomised design. In experiment 1, 120 day-old Strabro broiler chicks were raised to 49 days of age. In experiment 2, 80 Shaver 288 pullets, 20 weeks of age, were housed in pairs in cages and raised up to 72 weeks of age. There were no differences ($p > 0.05$) in performance of broilers as measured in terms of final bodyweights, feed intake, feed efficiency and carcass yield between the two diets. Similarly, no differences ($p > 0.05$) existed in egg production, egg weight and feed required per kilogramme of eggs. It is concluded that LFWM is nutritionally as good as imported MBM and could be used to completely replace MBM in broiler and layer diets.

(**Key Words**: Fish Waste Meal, Broilers, Layers, Performance, Western Samoa)

Introduction

There is keen interest at the moment in Western Samoa in using locally available feedstuffs in poultry feeding (Ochetim, 1987). This interest stems from the high costs of imported feed materials. One local feed resource that appears to have potential in poultry feeding is the by-product from filleted fish. Pacific Sea Foods company, Western Samoa Ltd, is currently involved in the export of filleted fish to New Zealand and other South Pacific countries. At the moment, about one tonne of fresh fish wastes are available following filleting of fish from the company every week. These wastes are not currently being utilized in poultry feeding. They are being used mainly as bait for catching fish. In view of the high dependence on imported meat and bone meal (MBM) as protein supplement in poultry feeds and the relatively large quantities of locally available fish wastes, this experiment was designed to evaluate the feeding value of such locally produced fish waste meal (LFWM) when used as complete substitute for MBM in diets of broiler chickens and layers.

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Received September 19, 1990
Accepted December 13, 1991

Materials and Methods

Fish Waste Meal

Fish waste meal was made from rejects obtained following filleting of Snappers and Yellow Fin fishes. The rejects from these fishes, which comprised mainly of intestines, heads, fins and reject whole fish, were minced using an augur machine. The minced fresh fish waste was dried in an oven at 70℃ for three days and then ground to pass through 2 mm sieve. The final product, called local fish waste meal, (LFWM), was used in the formulations of experimental diets.

Experiment 1

This was a broiler feeding trial and involved 120 Shaver Starbro, day-old unsexed chicks raised up to 49 days of age. Two diets were compared (table 1). The control diet was based on MBM and the test diet on LFWM. The diets were formulated to be isocaloric and isonitrogenous and were fortified with trace minerals and vitamins. The 120 day-old chicks were randomly divided into six groups with each group consisting of 20 birds. Three such groups of 20 birds each were randomly allocated to MBM Starter Feed

TABLE 1. COMPOSITION OF BROILER DIETS USED IN EXPERIMENT 1

	Diets			
	MBM-based		LFWM-based	
Ingredients (%)	Starter	Finisher	Starter	Finisher
Maize	50	50	50	50
Copra meal	10	16	10	16
Soyabean meal	18	15	18	15
Meat and bone meal	15	12	–	–
Local fish waste meal	–	–	15	12
Coconut oil	5	5	5	5
Dicalcium phosphate	1.2	1.2	1.2	1.2
Sodium chloride	0.5	0.5	0.5	0.5
Premix[1]	0.3	0.3	0.3	0.3
Calculated composition				
Metabolisable energy (kcal/kg)	3250	3120	3200	3100
Protein (%)	23.1	21.5	23.1	21.5
Calcium (%)	1.5	1.2	1.5	1.2
Phosphorus (%)	0.8	0.7	0.8	0.7

[1] Premix. Supplied per kilogramme of feed: manganese, 80 mg; zinc, 50 mg; iron, 25 mg; copper, 2 mg; iodine, 1.2 mg; cobalt, 0.2 mg; selenium, 0.1 mg; Vitamin A, 8500 IU; cholecalciferol, 1,700 ICU; DL tocopheryl acetate, 10 mg; menadione sodium bisulfite, 2 mg; riboflavin, 5 mg; Ca-pantothenate, 10 mg; niacin, 20 mg; Vitamin B_{12} 0.01 mg; folic acid 0.5 mg; pyridoxine, 1.5 mg; choline chloride, 200 mg; ethoxyquin, 125 mg; bacitracin, 10 mg.

and the other three to LFWM Starter Feed. From the beginning of week four, the feeds were changed over to respective Finisher Feeds. The 20 birds in each group were weighed as a group at the beginning of the experiment and once every seven days until the termination of the feeding trial at 49 days of age. Feed was available at all times from self feeders and water from automatic waterers. At the end of 49 days, five birds were randomly selected from each group of twenty birds, and slaughtered for the determination of dressed carcass weights. Dressing percentage was then calculated by expressing the weight of the dressed carcass as percentage of liveweight at slaughter time.

Experiment 2

This was a layer feeding trial. The feeding trial started when birds were 20 weeks old. Prior to this time, birds had been raised on our standard Chick Starter and Pullet Grower feeds up to 17 weeks of age. At 18 weeks of age, seventy two, Shaver 288 pullets were randomly divided into 36 groups with each group consisting of two birds. Eighteen such groups were allocated to diet MBM and the other 18 groups to the LFWM diet (table 2). Birds were kept on these diets, initially for two weeks, representing acclimatisation period. The experimental period was from 20 weeks of age up to 72 weeks of age when data were collected on the performance of layers fed MBM and LFWM based diets. Birds were weighed at 20, 42 and 72 weeks of age. Data on egg production and feed consumption were kept on daily basis. Egg weights and measurements for internal egg quality were determined at 20, 42 and 72 weeks of age. Mortality was recorded whenever it occured.

Chemical and Statistical Analyses

Locally produced fish waste meal and imported MBM were analysed for proximate principles, calcium and phosphorus contents according to standard procedures (AOAC, 1980). Gross energy was determined using Oxygen Parr Bomb calorimeter. Amino acid levels in the LFWM and MBM were determined by the method of Niece (1975). These analyses were carried in triplicates.

Data on performance of broilers and layers were analysed as completely randomised design

TABLE 2. COMPOSITION OF LAYER DIETS USED IN EXPERIMENT 2

	Diets	
	MBM-based	LFWM-based
Ingredients (%)		
Maize	45	45
Copra meal	33	33
Soyabean meal	5	5
Meat and bone meal	10	
Local fish waste meal	–	10
Coral sand	6.5	6.5
Sodium chloride	0.3	0.3
Premix[1]	0.2	0.2
Calculated composition		
Metabolisable energy (kcal/kg)	2900	2900
Protein (%)	17.5	17.5
Calcium (%)	3.25	3.25
Phosphorus (%)	0.66	0.65

[1] Premix. Supplied per kilogramme of diet: cobalt, 0.2 g; iodine, 1.0 mg; iron, 55 mg; copper, 6 mg; zinc, 55 mg; vitamin A, 8,000 IU; vitamin E, 8 IU; menadione, 2.0 mg; riboflavin, 5.5 mg; pantothenic acid, 13.0 mg; niacin, 36 mg; choline, 500 mg; vitamin B_{12}, 0.02 mg; folic acid, 0.5 mg; thiamin, 1 mg; pyridoxine, 2.2 mg.

with differences reported at the 5 percent level of probability (Steel and Torrie, 1980).

Results

Chemical Analysis

Data on nutrient characteristics of LFWM and MBM are presented in table 3. The results show that both LFWM and MBM were fairly similar in many nutrient characteristics. The only major differences of significance noted were in the levels of the following amino acids, namely; methionine, cystine, lysine, isoleucine and valine, which were at least 50 percent higher in LFWM than in MBM, Ether extractives values appeared, however, to be slightly higher on MBM than LFWM.

The formulated broiler and layer diets which were based on either LFWM or MBM, satisfied the nutrient requirements of the birds. However, although the calcium levels in broiler diets appeared to be higher than required, Ca: P ratios were maintained at about the 2 : 1 favourable ratios in the diets.

TABLE 3. CHEMICAL ANALYSIS OF LFWM AND MBM

	Ingredients	
	LFWM	MBM
Dry matter (%)	90.3	89.1
Protein (N×6.25) (%)	46.3	46.2
Ether extractives (%)	6.4	7.1
Gross energy (kcal/kg)	3270	3280
Calcium (%)	9.9	10.0
Phosphorus (%)	4.2	4.4
Methionine (%)	1.43	0.64
Cystine (%)	0.63	0.25
Lysine (%)	5.20	2.38
Valine (%)	3.91	2.39
Isoleucine (%)	1.71	1.72
Threonine (%)	1.95	1.93
Histidine (%)	1.61	1.55
Arginine (%)	2.73	2.71
Metabolisable energy (kcal/kg), calculated	2650	2660

Experiment 1. Broiler Performance

Data on the performance of experimental broilers are indicated in table 4.

Mortality level was low on the two dietary treatments and did not appear ($p > 0.05$) to be diet related. Except for the mortality, birds appeared to be in good health during the feeding period.

Final bodyweights at the end of the feeding period, 1.98 vs 2.05 kg, noted respectively, on MBM and LFWM, did not differ ($p > 0.05$) between the two diets. Similarly, no differences ($p > 0.05$) were found in feed intake, 4.35 vs 4.35 kg; feed to gain ratios 2.25 vs 2.16 and carcass yields 1.40 vs 1.44 kg, in birds fed MBM and MBM based diets, respectively. Feed to gain ratio and final bodyweights, however, tended to be numerically better in birds fed on LFWM diet compared to those fed on MBM feed.

Experiment 2. Layer Performance

In table 5 are presented data on the performance of laying birds fed on either MBM or LFWM based diets.

TABLE 4. PERFORMANCE OF BROILERS IN EXPERIMENT 1

	Diets		
	MBM-based	LFWM-based	SEM[1]
Average initial weight (gm)	50	50	1.02
Mortality (%)	2	2	0.02
Average final bodyweight (kg)	1.98	2.05	0.04
Average feed intake per bird (kg)	4.35	4.35	0.10
Feed conversion ratio	2.25	2.16	0.01
Dressing percentage	70.3	70.5	2.17
Carcass yield (kg)	1.40	1.44	0.01

[1] SEM. Standard error of treatment means. All dietary treatment means were not significantly different ($p > 0.05$).

TABLE 5. PERFORMANCE OF LAYERS IN EXPERIMENT 2

	Diets		
	MBM based	LFWM-based	SEM[1]
Number of birds	36	36	
Average weight of birds (kg):			
20 weeks	1.65	1.66	0.01
42 weeks	1.90	1.95	0.91
72 weeks	2.20	2.24	0.92
Mortality (%)	2.8	2.8	1.12
Average number of eggs laid per bird	225	226	4.67
Average hen house production (%)	61.9	62.2	1.70
Average egg weight (at 42 wks of age) (gm)	56.2	58.7	0.10
Average daily feed intake per bird (gm)	112	112	0.91
Feed per kilogramme of eggs (kg)	1.99	1.91	0.10
Percentage of cracked egg incidence	0.7	0.8	0.01
Percentage of double egg yolk condition	0.6	0.7	0.01
Percentage of blood spotted eggs	0.1	0.1	0.01

[1] SEM. Standard error of dietary treatment means. All dietary treatment means did not differ ($p > 0.05$).

Although bodyweights tended to be higher in birds fed LFWM based diet compared to those on MBM feed, the differences were not significant.

The replacement of MBM with LFWM did not affect ($p > 0.05$) total egg production (225 vs 226). Similarily, average daily feed consumption (112 vs 112 gm) and feed requirement per kilogramme of eggs produced (1.99 vs 1.91 kg) were not affected ($p > 0.05$). However, while there was a tendency for pullets fed LFWM based diet to produce heavier eggs (58.7 vs 56.2 gm), and to be more efficient in converting feed into eggs, these differences were not statistically significant. Other egg quality measurements such as the incidence of cracked shells, blood spots, doubled-yolked condition did not differ between the dietary treatments. Similarly, mortality was typically low, less than three percent, on both diets.

Discussion

The results obtained on the nutrient characteristics of LFWM and MBM are interesting. It revealed, for example, that with the exception of the rather lower level of energy in LFWM, which was possibly due to its slightly lower level of ether extractives, and being higher in lysine, methionine, cystine, isoleucine and valine, and in calcium and phosphorus probably due to the higher proportion of bones found in the materials used in producing LFWM, both feed ingredients were fairly similar in nutrient contents. These kinds of similarities and differences noted in nutrient levels between different types of fish meal and meat and bone meal have also been reported in the literature (Pond and Maner, 1974; Balogun et al., 1986).

The formulated broiler and layer diets based on either LFWM or MBM satisfied nutrient requirements of the birds (NAS-NRC, 1986). The higher than normal level of calcium in broiler diets was because of the desire to maximise the use of LFWM in the diet. However, the Ca: P ratio was maintained at the favourable ratio of 2 : 1 in the broiler diets.

Data obtained on the performance of broilers and layers indicated no significant differences between diets based on LFWM from those containing imported MBM. In part, these similarities in performance must have been a reflection of the similarities noted in the nutrient characteristics between LFWM and MBM. Secondly, the observed tendency for better feed efficiency in broilers and slightly heavier eggs produced by layers fed on LFWM feeds, compared to those fed on imported MBM diets, appeared to reflect the generally higher levels of essential amino acids noted in LFWM. According to Olomu and Offiong (1985), at a constant energy and protein level in the feed, diets containing higher levels of lysine, methionine and cystine tend to support better feed efficiency in broilers and layers. In layer feeds, the use of such diets also results in the production of heavier eggs. Our results tend to support these earlier observations.

The results of these trials have potential value for the poultry industry in Western Samoa. The fact that the locally produced fish waste meal had nearly very similar nutrient characteristics to imported MBM, and that its use produced similar performance in broilers and layers as using diets based on imported meat and bone meal suggests, at least in part, that LFWM could be used to completely replace the currently imported MBM. One advantage of such replacement would be a reduction in the dependency on imported protein feed materials for use in poultry feeding. This could reduce foreign exchange expenditure on feed resources. Secondly, the use of LFWM could create more income and more employment opportunities for the local fish company, while at the same time consolidating the government intention of utilizing locally available feed resources in poultry feeding. However, for the successful utilization of LFWM in poultry feed formulations, it will be necessary to undertake a feasibility study on cost and level of production of LFWM, and to tie these issues with protein feed requirements of the poultry feed industry of the country. If the outcome of such a study is favourable, then an economic-sized, processing plant could then be set up to produce fish waste meal for use in poultry and other livestock feed production programmes.

Acknowledgements

Thanks are due to South Pacific Sea Foods, Western Samoa Ltd., for providing fish waste. Mr Uga cared for experimental birds. Funds were provided by University of the South Pacific.

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