Tropical and Subtropical Agroecosystems, 5 (2005): 129 - 133

Tropical and Subtropical Agroecosystems

NOTA CORTA [SHORT NOTE]

NUTRITIVE VALUE OF LOCAL FISH INDUSTRY WASTE AS A REPLACEMENT FOR IMPORTED FISHMEAL IN BROILER FINISHER DIETS IN NIGERIA

[VALOR DE LOS SUBPRODUCTOS DE LA INDUSTRIA PESQUERA NIGERIANA COMO REEMPLAZO DE HARINA DE PESCADO IMPORTADA EN DIETAS FINALIZADORA DE POLLOS DE ENGORDA]

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SUMMARY

Two hundred four-week old broiler birds were randomly assigned to five dietary treatment groups in a completely randomized design to investigate the utilization of Local Fish Industry Waste (LFW) as a replacement for Imported Fish Meal (IFM) in a 28-day feeding trial. Four replacement levels (25, 50, 75 and 100%) of the 4kg IFM/100kg of the 20% CP Control broiler finisher diet were included with 1.18, 2.36, 3.54 and 4.72kg of the LFW. Each treatment group had four replicates of 10 birds each. The LFW consists mainly of dried fish fins, heads and tails, crabs, tadpoles, shrimps, lobsters and small whole fish. The replacement of IFM with this agro-industrial by-product (LFW) did not significantly affect the performance characteristics and the carcass yield of the birds but for slight variations observed at the 100% replacement level. Total replacement of IFM with LFW resulted in a decrease ($P<0.05$) in the average daily feed intake of the birds; the protein content of the diet was, however, efficiently utilized as shown by the highest ($P<0.05$) protein efficiency ratio (PER) value and the comparable gains recorded across the groups. This diet had the least ($P<0.05$) crude protein retention as well as the poorest dry matter and fibre digestibility (59.89, 67.59 and 45.46% respectively) although this did not significantly depress the gains of the birds, which were comparable across the groups. The body parts were not affected ($P>0.05$) by the dietary treatment but for the drumstick and gizzard. There was no specific trend followed by the variations observed with though a significantly lowered drumsticks and increased gizzard weight was recorded with the 100% LFW inclusion. It was concluded that LFW can be used to replace IFM in a broiler finisher diet, without any adverse effect on the performance of the birds.

Keywords: Fish industry waste, fish meal, broilers, nutritive value.

RESUMEN

Para evaluar la utilización de subproductos de la industria pesquera (SP) nigeriana en sustitución la harina de pescado (HP) importada, doscientos pollos de engorda de cuatro semanas de edad fueron empleados. Se evaluaron cuatro niveles de reemplazo (25, 50, 75 y 100%) de la harina de pescado (4 kg HP en una dieta con 20% PC) más la dieta control convencional en un prueba de comportamiento de 28 d. Cada tratamiento consistió de 4 replicas con 10 animales por replica. El SP contiene principalmente aletas, cabeza y colas de pescado, cangrejos, camarones, langostas y peces pequeños enteros de especies diversas que no pudieran ser vendidas para consumo humano. El reeemplazo de HP por SP no afectó el comportamiento productivo ni las características de la canal de las aves excepto por un decremento ($P<0.05$) en el consumo de alimento cuando el reemplazo fue de 100%. Sin embargo, eficiencia de utilización de la proteína fue mayor ($P<0.05$) y las ganancias de peso fueron similares entre los grupos. Este tratamiento tuvo también la menor retención de proteína y digestibilidad de materia seca y fibra (59.9, 67.6 y 45.5% respectivamente pero no afectó la ganancia de peso. La secciones de la canal no fueron afectadas excepto por la pierna y la molleja. No se observó una tendencia clara aunque el peso de la pierna fue menor y el peso de la molleja mayor ($P<0.05$) con el 100% de reemplazo. Se concluye que la HP puede ser substituida con SP en lasdietas de finalización de pollos de engorda sin efectos negativos en el comportamiento productivo de las aves.

Palabras clave: Subproductos de la industria pesquera, harina de pescado, pollo de engorda, valor nutritivo.

INTRODUCTION

In the recent past, poultry production witnessed a decline due to increases in feed costs in Nigeria. This has in turn resulted in lowered economic returns for the small holder farmers thereby rendering the feeding system unsuitable, similar to the observations of Manh *et al.* (2003). In order to have a good economic return in poultry production, the best solution is to take full advantage of unconventional, locally available and cheap feed resources (Agunbiade *et al*., 2003), especially in a developing economy, such as obtains in Nigeria. The use of by-products from agricultural and or industrial processing such as the local fish industry waste is one of such opportunities, which can help to improve farmers' economic returns.

The cost of animal proteins, especially imported fish meal in the face of dwindling economy in Nigeria cannot be down played. Most studies have involved the conventional fishmeals which include Anchovy, Herring, Menhaden and White fishmeals (Olomu and Nwachukwu, 1977). High costs of importation and near complete reliance on these imported fishmeals have made their inclusion in diets uneconomical. However, great variation have been reported to exist in the quality of different fishmeals depending on the type of fish employed and the pre-treatment of the fishmeal before use in rations (Apandi *et al.,* 1974; Olomu and Nwachukwu, 1977). There is therefore the need to assess the nutritive values of local fishmeals that can easily be obtained in Nigeria.

The aim of the study was therefore to assess the nutritive value of replacing 65% imported fish meal with local fish industry waste as a protein source for broiler finishers.

MATERIAL AND METHODS

The Local Fish Industry waste and other ingredients used in this study were sourced locally from fish processors and feed company respectively. Two hundred four-week old Isa Brown broiler finisher birds hitherto on the same diet were randomly assigned to five dietary treatment groups of 0, 1.18, 2.36, 3.54 and 4.72kg of local fish industry waste (LFW) in a completely randomized design in a 28-day feeding trial. These represented the replacement of 0, 25, 50, 75 and 100% of the 4kg imported (65% crude protein) fish meal (IFM) per 100kg of the 20% crude protein Control broiler finisher diet. The test ingredients and experimental diets were analyzed for proximate components according to the method of AOAC (1995).

The control diet comprised (kg/100kg): Maize, 53.55; Groundnut cake, 23.80; Imported Fishmeal, 4.00; Brewers Dried Grain, 15.00; Bone Meal, 2.50; Oyster Shell, 0.50; Vit./Min. premix, 0.25; Salt, 0.25; Methionine, 0.10; Lysine, 0.10. The diets were formulated to contain 20% crude protein (CP) and 3200kcalME/kg, in order to satisfy the requirement of this class of birds (National Research Council, 1979). Each dietary treatment group had four replicates of 10 birds each. The birds were raised on a deep litter housing system with the floor adequately covered with wood shavings throughout the five week experimental period (between the ages of four and nine weeks). The diets and clean drinking water were made available to the birds *ad libitum* while records of feed intake, weight gain and other productive performance parameters were measured weekly for each of the treatment groups. Conventional poultry management practices were observed in all the 5 treatment groups (0, 1.18, 2.36, 3.54 and 4.72kg LFW) and all the birds were housed in an open-sided naturally ventilated broiler house.

At 8 weeks of age, a digestibility trial was conducted during which excreta was collected quantitatively. Two birds per replicate were randomly selected and transferred into the metabolic cages. Weighed quantities of the diets were supplied and excreta were collected over a period of 3-days. A two-day acclimatization period was allowed prior to the collection of droppings. Experimental diets, ingredients and oven-dried excreta (at 65^0C) from each replicate were analyzed for proximate components according to the method of AOAC (1995). Crude protein retention and digestibility of dry matter, crude fibre, ether extract and ash were determined. At the end of the experiment, two birds from each replicate (eight birds per treatment) were randomly selected, fasted overnight, weighed the following morning and slaughtered by severing the carotid artery and jugular vein. The carcasses were eviscerated and dissected, and data collected include dressing percentage (carcass yield), weights of thigh, breast, drumstick, back, wing, gizzard.

All the data obtained were subjected to analysis of variance and where statistical significance was observed, the means were compared using the Duncan's Multiple Range (DMR) test. The SAS Computer software package (SAS, 1999) was used for all statistical analysis.

RESULTS AND DISCUSSION

The proximate composition of the LFW as shown in Table 1 indicated higher fibre, ether extract and ash contents than IFM, while a lower value of CP content was observed. The higher crude fibre, ether extract and ash contents of the LFW conferred slight numerical increases on the values observed with the test diets as the level of inclusion increased. The highest values were obtained with the total replacement of IFM with

LFW. This may be as a result of the "carry over" effects conferred on the diets by the test ingredient (LFW). The chemical composition of the experimental diets revealed that the crude protein contents were almost the same as the calculated values, both for the IFM-control and the test diets. This decreased as the levels of LFW increased, as a result of the lower CP content of LFW.

From the performance results, (Table 2), it appears that the requirements of the broiler finisher for amino acids were adequately met by the test diets, but for the total replacement of IFM with LFW, even though the amino acid profile of LFW was not investigated. The results thus indicate that the protein quality of the LFW was comparable to that of IFM. However, total replacement of the IFM depressed the feed intake by about 8%, but this did not significantly influence the gains of the birds, as the values observed were comparable across the groups.

There was a decline in the feed intake of the birds at the 100% inclusion level of the LFW. This could be attributed to the inclusion of the waste (LFW) at a higher rate, taking into consideration its slightly higher crude fibre content compared to IFM (Table 1). However, this did not bring about a significant drop ($P > 0.05$) in the gains of the birds in the group even though a gradual numerical decline in values was observed. The results of the effects of dietary treatment on the carcass characteristics of the finisher birds were not statistically significant (Table 3) except for the drumstick and gizzard.

Table 1. Proximate composition of test ingredient and diets.

Constituents	Test ingredients		Test diets				
	Imported fishmeal	Local fish ind. waste	0% LFW	25% LFW	50% LFW	75% LFW	100% LFW
Dry matter	89.20	88.00	90.55	90.50	90.20	91.50	90.60
Crude protein	66.80	51.50	20.70	20.65	20.50	20.00	19.50
Ether extract	4.70	6.55	8.67	9.03	9.10	9.30	9.65
Crude fibre	1.00	2.95	7.18	7.39	7.60	7.80	7.95
Ash	18.60	22.50	13.04	13.30	13.55	13.65	13.80
ME Kcal/kg (calculated)	-	-	3200	3200	3190	3190	3170

Table 2. Performance characteristics of broiler finisher fed experimental diets.

Parameters	0% LFW	25% LFW	50% LFW	75% LFW	100% LFW	SEM
Av. Daily weight Grain/bird (g)	41.71	39.84	39.71	39.57	37.06	2.44
Av. Daily feed intake / bird (g)	128.20 ^{a}	131.00 ^{a}	121.60 ^{a}	122.90 ^{a}	119.00 ^{b}	5.64
Feed conversion ratio	3.04	3.44	3.10	3.16	3.21	0.75
Protein efficiency ratio (PER)	1.14 ^{bc}	1.05^{c}	1.22^{b}	1.18^{bc}	1.41^{a}	0.05
Mortality (number)	-	2	-	-	-	-

a, b, c. means within rows with different superscript are significantly different ($P< 0.05$)
SEM: standard error of means

Table 3. Carcass analysis of broiler finisher fed graded levels of LFW.

Component	0% LFW	25% LFW	50% LFW	75% LFW	100% LFW	SEM
Live weight (kg)	2.05	2.00	1.80	1.78	1.98	0.05
Eviscerated carcass (kg)	1.43	1.33	1.30	1.25	1.30	0.15
Carcass yield (%)	69.76	66.50	72.22	71.43	65.66	3.20
Thighs (g)	189.50	210.00	211.50	185.00	210.00	5.22
Drumsticks (g)	204.50^{b}	254.50 ^{a}	222.50^{ab}	187.00^{b}	139.50^{c}	5.12
Breast (g)	275.00	312.50	262.50	237.50	267.50	4.62
Wings (g)	175.00	187.50	160.50	141.50	154.00	3.46
Back (g)	287.50	287.50	312.50	275.00	262.50	5.28
Gizzard (g)	62.50 ^{b}	63.00 ^{b}	64.00 ^{b}	69.00 ^{b}	75.00 ^{a}	2.40
Heart (g)	12.50	9.50	10.00	6.50	8.50	1.08
Liver (g)	43.00	39.00	34.00	32.00	36.00	1.38

a, b, c. means within rows with different superscript are significantly different ($P< 0.05$)

There was a significant reduction in the size of the drumstick and an increase in the gizzard weight. This was in agreement with the findings of Fanimo *et al.* (1996). They reported impairment of nutrient digestion and absorption in the gastro-intestinal tracts of broilers (Table 4) resulting in increased gizzard size ($P < 0.05$) as observed in this study. In spite of these observations, it is noteworthy that the dressing percentages obtained across the various groups were comparable and within the range reported by Oluyemi and Robert (1988) as the optimum for meat chicken.

It was observed that the digestibility of nutrients decreased with increasing levels of LFW (Table 4). The efficient utilization of a diet has been reported to be dependent on the digestibility of the diet and its constituents (Kidder and Manners, 1978). Since the diets were iso-nitrogenous, the protein intake became a function of the dry matter intake (Adesehinwa and Ogunmodede, 2004). Nutrient intake and its utilization have also been shown to be closely related to the rate and efficiency of gains (Fetuga *et al*, 1975), hence the comparable gains are not surprising.

CONCLUSION

It could therefore be concluded that LFW can be used to replace IFM in a broiler finisher diet, without any adverse effect on the performance of the birds and gains to the farmer.

Table 4. Nutrient retention and digestibility of broiler finishers fed experimental diets (%).

Constituents	0% LFW	25% LFW	50% LFW	75% LFW	100% LFW	SEM
Crude protein retention	75.23 [a]	72.23 [ab]	70.84 [b]	70.42 [b]	59.89 [c]	4.28
Dry matter digestibility	69.55[bc]	70.10[bc]	74.60 [ab]	76.88 [a]	67.59 [c]	5.37
Crude fibre digestibility	67.43 [a]	64.30 [a]	59.16 [b]	58.64 [b]	45.46 [c]	5.05
Ether extract	88.60	87.62	87.85	86.55	84.51	2.78
Ash digestibility	77.10 [a]	75.85 [a]	69.44 [b]	67.27 [b]	66.73 [b]	4.40

a, b, c. means within rows with different superscript are significantly different ($P< 0.05$).

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Submitted March 01, 2005 – Acepted August 03, 2005
Revised received August 23, 2005