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AN ECONOMIC ANALYSIS OF MAGGOT AS AN ALTERNATIVE SOURCE OF ANIMAL PROTEIN IN BROILER PRODUCTION

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Target Audience: Broiler producers, feed millers, academic and policy information and implementors.

ABSTRACT

Poultry feed represents a major cost component in poultry business. In particular, protein sources are expensive and have conflicting uses. Recent studies have shown that maggot which, hitherto, is a waste from poultry dung is fast becoming an important source of protein. Against this background, this study examined the economic efficiency of maggot as a substitute for fish meal in broiler feed formulation.

The data were collected on two different Diets (Diet A contained maggot meal while Diet B contained fish meal) fed to broilers. These diets were formulated using linear programming technique while the cost-benefit implications were examined with the aid of budgetary techniques. Diets A and B cost N24.50/kg and N30.65/kg respectively. Results show that Diets A and B also contain 23.71 percent and 20.01 percent crude protein of broiler feed. The economic efficiency of the two diets showed that Diet A is more efficient with a figure of 0.29 compared with only 0.22 for diet B. In this instance, an additional net return of 7 kobo was obtained from every naira invested in the production of broiler with Diet A compared with Diet B. Based on the findings of the study, this paper recommends that the use of maggot meal as protein source in broiler feed should be made popular among farmers in Nigeria.

Keywords: Economic efficeincy, maggot, alternative source, diets and broiler production

DESCRIPTION OF PROBLEM

The poultry industry is the most veritable source of protein supply for human consumption in Nigeria. This is so because the industry produces a wide variety of poultry meat and eggs that are the main supplier of protein to human beings. Qualitatively, poultry meat surpasses many animal protein. It contains about 19grams of protein, 7 grams of fat, 75 milligrams of calcium and insignificant amount of carbohydrate per 100grams weight. On the other hand, an average poultry egg contains 13 percent protein 12 percent fat with negligible amount of carbohydrates (1). Arising from the foregoing, the reform of the Nigerian

commercial poultry industry, hold the greatest promise to the reduction of protein malnutrition which is present in every parts of Nigeria. However, the cost of feeding is the major menace delimiting the expansion and output of the industry nation wide. A study (2) noted that feed cost accounts for 70 percent of total production in the poultry industry. Therefore, if protein consumption per head is going to increase faster than or at the pace of the population growth, efforts must be geared toward improving the present efficiency level in the poultry industry. Significant reduction in the cost of feeds in the poultry industry is quite essential. One way of going about this is by looking for replacement of the expensive ingredients of these feeds and to ensure that the new ingredient is more efficient than the former.

Quite a lot of studies has been carried out to identify suitable ingredients that can replace the expensive ones. Studies by (2) and (4) were able to contribute significantly to knowledge in two of these studies by identifying an alternative source of animal protein in poultry production. The studies were able to proof that maggot (an environmental nuisance) can be used to replace fish meal (a major protein source) in poultry ration. These studies also showed that maggot is more efficient than fish meal whose use in the poultry industry has been seriously threatened by the ever persistent competing demand for fish between man and livestock. Such high level of competition does not however exist between man and livestock for maggot.

In as much as the studies by Ifelaja and Folorunsho have been able to proof the technical efficiency of maggot in feed items, there still remains the fact that further studies should be carried out on the economic efficiency of their findings. This is so since cost consideration is paramount to any business outfit and as such an average farmer is interested in determining the cost implication of new technology being passed across to him for adoption. Within the context of the need for economic assessment of substituting maggot for fishmeal in poultry feed, this paper focuses on determining the economic efficiency of the two protein sources in broiler feed formulation. This will be achieved by comparing the profitability of broiler production under different animal protein sources and proposing the least cost feed formulation using the two protein sources.

MATERIALS AND METHODS

The experiment from which the data for this paper were collected, was carried out at the Teaching and Research Farm, University of Ibadan, Oyo State. The data for this paper were collected from 1998/99 research project of final year students of the Department of Animal Science, University of Ibadan. Price list of feed ingredients and material used for maggot production were obtained from Adam (Nig) enterprises at Orogun and Bere respectively. The Linear programming technique was used to determine the least cost combination for

the Diets containing fish meal and maggot meal as animal protein source respectively. The individual objective and constraints for the two different rations are presented below:

Minimize Z_m = $c_1x_1 + c_2x_2 + c_3x_3 + c_4x_4 + c_5x_5 + c_6x_6 + c_7x_7 + c_8x_8 + c_9x_9$ ..... maggot meal (1)

Minimize Z_f = $c_1x_1 + c_2x_2 + c_3x_3 + c_4x_4 + c_5x_5 + c_6x_6 + c_7x_7 + c_8x_8 + c_9x_9$ ..... fish meal (2)

subjecting individual equation to the following constraints.

a_ix_i = 2800 ME.kcal/kg
b_ix_i = 22.25% Crude Protein
c_ix_i Σ= 4.15% Crude Fibre
d_ix_i Σ= 3.25% Ether Extract
e_ix_i Σ= 0.79% Lysine
f_ix_i Σ= 0.27% Methionine
g_ix_i Σ= 01.71% Calcium
h_ix_i Σ= 0.40% Phosphorus
i_ix_i Σ= 0.25% Premix
Σ

The result was subjected to gross margin (GM) analysis. The Gross margin analysis of the two Diet were compared. The Gross margin equation is given as:

$$GM = P_iQ_i - C_jx_j \quad (3)$$

While the profitability of the different feeds was determined by

$$p = GM - TFC \quad (4)$$

Where:

X_1 = Maize,
X_2 = Groundnut cake
X_3 = Soybean meal
X_4 = Wheat bran
X_5 = Bone meal
X_6 = Oyster shell
X_7 = Premix
X_8 = Salt
X_9 = Maggot meal in equation 1 and fishmeal in equation 2.
GM = Gross margin
P_1 = Price per unit of matured broiler
Q_i = Total number of broilers
C_j = Cost of jth input
X_j = Quantity of jth input
Π = Profit Level
TFC = Total fixed cost

a_i, b_i, c_i, d_i, e_i, f_i, g_i, h_i, and j_i are input -output coefficients

RESULTS AND DISCUSSION

This section presents the findings of the study. In subsequent sub-sections we present least cost combination of feed formulation and profitability by the different feed composition.

Least Cost Feed Formulation Using Two Protein Sources

The two tables below reveal the comparison of cost and inclusion level of ingredients in diets A and B and the nutrient contents of diets A and B.

Table 1: Cost and Inclusion level of Ingredients in Diets A and B

Ingredients	DIET A				DIET B			
	Quantity Use (Kg)	Value ₦	Quantity Unused (Kg)	Value ₦	Quantity Use (Kg)	Value ₦	Quantity Unused (Kg)	Value ₦
Maize	56	840	-	-	33.625	521.19	22.375	346.81
G. nut Cake	20	640	-	-	20	640	-	
S. bean meal	10	460	-	-	10	460	-	
Wheat Bran	3.46	15.57	-	-	5	22.5	-	
Bone Meal	3	30	-	-	3	30	-	
Oyster Shell	15	6	-	-	1.5	6	-	
Premix	25	156.25	-	-	25	156.25	-	-
Salt	25	3.75	-	-	25	3.75	-	-
Maggot Meal	5.54	277	-	-	4	520	-	
Total	100	2456.57	-	-	77	2359.69	-	346.81

Source: Computed from Linear Programming Analysis Result

Table 2: Nutrient Contents of Diets A and B

Nutrient	DIET A				DIET B			
	Required Nutrient Level	Recommended Nutrient Level	Nutrient in Excess Supply	Nutrient in Limited Supply	Required Nutrient Level	Recommended Nutrient Level	Nutrient in Exess Supply	Nutrient in Limited Supply
Energy ME. Kcal/kg	2944.18	2794.517	149.663	-	2800	2160.582	639.418	-
Crude Protein (%)	23.3	22.7122	0.5877993	-	22.25	20.0125	2.375	-
Crude Fibre (%)	5.7	3.20732	2.492968	-	4.15	2.7875	1.3625	-
Ether Extract (%)	4.43	4.42632	0.036799	-	3.25	3.25	-	-
Lysine (%)	0.77	0.911302	-	0.141302	0.79	0.9090625	-	0.1190625
Methionine (%)	0.27	0.339794	-	0.69794	0.27	0.300025	-	0.030025
Calcium (%)	1.7	1.711816	-	0.0118155	1.71	1.947362	-	0.2373625
Phosphorus (%)	0.39	0.690556	-	0.300556	0.4	0.7152625	-	0.3152625

Source: Computed from Linear Programming Analysis Result

Table 1 presents a summary of optimum combination of various ingredients needed in the production of Diets A and B at minimum cost possible, subject to nutrient constraints as specified in the linear programming model. The result indicates that all the ingredients are important in the feed mixture. Hence, to minimize cost, the inclusion level of each of these ingredient must not exceed the level specified in table 1. A marginal increase in the level of ingredient with high value/unit will result in high marginal cost, hence an increase in the total production cost. The results indicates that a total of 100kg of feed at a cost of ₦2,456.57 (i.e. ₦24.57/kg) should be produced to keep cost of diet A at minimal level . The cost of diet A/kg is therefore lower than that of diet B which recommended the production of a total of 77kg of feed at N2359.69 averaging N30.64/kg. In diet A, 5.54kg of maggot meal is used up at a cost of N277 in the feed mixture. This constitutes 11 percent of cost of producing diet A. In contrast to the situation in diet A, 4kg of fish meal at a cost of N520.00 was recommended in diet B, this translates to 22 percent of total cost of producing diet B. This finding reveals that maggot meal is more efficient protein source than fish meal in the diets of broiler. The nutrient resource constraints are displayed in table 2. From this table, it can be deduced that energy, crude protein and crude fibre contents of diets A and B must be reduced in order to minimize the production cost. For example 22.71 percent crude protein is recommended by the linear programme for diet A as against the 23.3 percent required level. Though ether extract content in diet A was reported to be in excess, its content in diet B was not. However, the recommended level of lysine, methionine, calcium and phosphorus was not met in the programme at the least cost level. Hence a supplement must be sought for these nutrients in order for it to meet the recommended least cost level.

Comparison of the Profitability of Broiler Production under Different Animal Protein Sources

The gross margin analyses of broilers diet formulated with maggot meal and fish meal are presented in tables 3 and 4 below. The diet formulated with maggot meal is referred to as Diet A while the one formulated with fish meal is referred to as Diet B.

Results highlighted in table 4 reveals the returns from the sales of broiler fed with diet A (N7740.00) and Diet B (N8400.00). Though the revenue from broilers fed with Diet A is lower than that of broilers fed with diet B, the cost of production of broiler fed diet B is significantly higher than that of the broiler fed diet A. Hence, the higher cost of production incurred from using diet B instead of diet A reduces the net income derived from the sale of broiler fed with diet B from N1757.74 to N1508.40. The low cost of production and a reasonable return gives diet A edge over diet B in broiler production. Hence, N909.34

Table 3: Production Cost of Broiler Using different Diet

Items	Value (₦)	
	Diet A	Diet B
40 Day old broiler chicks	2600.00	2600.00
Feed	2584.76	3494.10
Drugs and vaccinations	46.00	465.00
Brooding	100.00	100.00
Depreciation		
I Rent	125.00	125.00
II Drinkers	15.00	15.00
III Feeders	12.5	12.5

Source: (3) and (4)

Table 4: Gross Margin Analysis of the Two Diet

Item	Broiler Fed Diet A	Broiler Fed Diet B
Total Revenue	₦7740.00	₦8400.00
Total Variable Cost	₦5982.26	₦26891.60
Gross Margin	₦1910.24	₦1660.90
Total Fixed Cost	₦152.50	₦152.50
Profit	₦1757.74	1508.40
Economic Efficiency	0.29	0.22

Source: (5)

would be saved by using diet A in production. An additional income would have been generated if the saved N909.34 is ploughed back into the broiler production business. Further comparative analysis shows that forty-six broiler chickens would be produced using diet A with the same cost of producing forty broilers with diet B and a net income of N2009.40 would be obtained. However, (2, 4) rated diet B to be more technically efficient, (in terms of average digestibility of feed by broilers, average weekly feed consumption by broiler and average body weight change 'g'/week/bird)

This study estimated the economic efficiency of diet A (0.29) to be higher than that of diet B (0.22). Their economic efficiency figures implies that for every one naira invested in production of broiler with diets A and B, a return of N0.29 and N0.22 respectively are obtainable. Hence, diet A is more profitable when included in broilers feed than diet B. Mortality was however not recorded throughout the period of the experiment for birds fed on both diets. This implies that maggot meal is free from any toxin, which is capable of killing the birds when substituted for fish meal as source of animal protein in poultry.

CONCLUSION AND APPLICATIONS

This paper examined the economics of the use of maggot meal in replacing fish meal in broiler diet. Findings showed that the use of maggot meal as a substitute for fish meal in broiler diet is economically efficient. Findings also revealed that maggot is of great potential in poultry diet since it is not toxic. Result of the study further revealed that the quantity of nutrients like lysine, methionine, calcium and phosphorus should be increased in order for these nutrients to meet up with the recommended least cost level. Based on the findings itemized, this paper recommends that institutions of higher learning, research stations and government own farms should popularise the use of maggot as substitute for fish meal in poultry diet to increase the productivity of this livestock sub-sector. This can be achieved through the use of extension agents, who are expected to demonstrate the potentials of this ration to farmers on their farm. Secondly, poultry farmers should integrate poultry production (broiler) with maggot production to optimize labour output since labour in poultry industry are under utilized when compared with the way they are being used in the industrial sector. This will in no small way increase their net income since the same labour force is being use for two production activities and will also serve as an effective and economic way of reducing disease incidence among human beings and the livestock sector.

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