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Full Length Research Paper

Dietary potentials of the edible larvae of *Cirina forda* (westwood) as a poultry feed

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An experiment was conducted to determine the performance of broiler chicks to the replacement of fishmeal with the larvae of *Cirina forda*. Three diets, namely Diet A (100% *C. forda* larvae and 0% Fish meal); Diet B (50% *C. forda* larvae and 50% Fish meal); and Diet C, which was the control (100% Fish meal and 0% *C. forda* larvae) were compounded and fed to the birds. The results showed that the consumption rate, the mean weight gain and specific growth rate of birds fed with Diets A and B did not differ significant (P > 0.05) when compared with the control. The potentials of the edible *C. forda* larvae as a protein source, which can replace and elicit similar growth trends in broiler chicks like the protein present in conventional fish meal, are discussed.

Key words: *Cirina forda*, Conventional feeds, Compounded feeds Fishmeal, Broiler chicks.

INTRODUCTION

The edible larvae of *Cirina forda* insect has a wide acceptability as a food source, and also serves as an important item of commerce in such Nigerian states like Oyo, Kwara, Kogi, Niger and Kaduna where it has become the most important and marketable insect (Ande,1991; Fasoranti and Ajiboye,1993). Meyer-Rochow (1978) analyzed the insect's larvae as composed of digestible protein, fats and small but significant amount of carbohydrate, minerals and vitamins. The same worker also reported that the dried form of the larvae contains 57.96% crude protein, 10.89% crude fat, major mineral elements like zinc, calcium, potassium, magnesium, sodium, iron and trace elements like copper and manganese.

A major problem facing poultry industry is the provision of feeds that will contain all the necessary diet components needed by the birds to grow rapidly within a short period of time. There is also the need of meeting up with the protein requirements of poultry birds which has become a constant problem (Halley and Soffe, 1988). One of the main conventional sources of protein for poultry birds is fish meal. It is known to possess good amino-acid profile and higher essential minerals (Ayinla, 1991). In their own investigation, Halley and Soffe (1988) reported that fish meal contains between 59-72% crude proteins. Despite the high nutritional composition, quality and availability, fish meal is still relatively expensive, especially to small-scale farmer (Tacon, 1994). Various attempts have been made to search for locally available substitutes for fish meal in animal feeds. A list of materials of animal origin that has been used includes fish silage, blood meal, poultry by-products, meat and bone meal and tadpole meal (Ayinla, 1991).

Apart from being a widely acceptable food source, a number of factors are known to enhance the availability of the larvae of the insect. Such factors include its capability for artificial rearing, the short-lived larval stage, and the high conversion rate (Ande, 1991). It is therefore important to investigate whether the confirmed dietary attributes of *C. forda* larvae could be exploited in

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Table 1. Gross composition of diet for starter phase.

Ingredients g/100g	Feed A 100% *C. forda* : 0% Fishmeal	Feed B 50% *C. forda* : 50% Fishmeal	Feed C 0% *C. forda*: 100% Fishmeal
Bone meal	2.00	2.00	2.00
Maize	45.00	45.00	45.00
Palm Kernel cake	20.00	20.00	20.00
Soya bean	2.00	2.00	2.00
Groundnut cake	18.00	18.00	18.00
Oyster shell	1.00	1.00	1.00
Maize bran	8.00	8.00	8.00
Lysine	1.00	1.00	1.00
Methionine	0.45	0.45	0.45
Salt	0.35	0.35	0.35
Premix	0.35	0.35	0.35
Fish meal	-	2.00	4.00
C. forda larvae	4.00	2.00	-
Crude Protein	20.24	20.52	20.80
Energy (kcal)	2,709.50	2,766.70	2,823.90

compounding feed rations to replace fish meal in conventional feeds of poultry birds.

MATERIALS AND METHODS

Experimental site

This experiment was conducted in a cage house located at Saja Area, Ogbomoso (8^0 $15^/$ N and 4^0 $15^/$ E), Oyo State, Nigeria. The cage house has a dimension of $3.6 \times 2.7 \times 2.1$ m^3.

Site preparation

The cage house whose battery shells had been previously removed was cleaned to facilitate its usage for deep litter system. Towards this, the cage house was disinfected with Commercial Izal once every week for two weeks. Thereafter, an allowance of another week was made to remove possible side effects of the disinfectant.

Ingredients procurements

Dried *Cirina forda* larvae were purchased from Akande market in Ogbomoso, Oyo State. All other feed ingredients like maize, groundnut cake, methionine, and soya bean used during the investigation were obtained from Adeke's Feeds Store in Ogbomoso.

Feed formulation

The larvae were first sun-dried for a week and then milled into powder form using a blender. From the powdered larvae, three different feeds tagged A, B, and C were compounded by varying the concentrations of the *C. forda* larvae in each. Feed A contained 100% *C. forda* larvae and 0% fish meal. Feed B contained 50% fish meal and 50% larvae, while Feed C contained 100% fish meal and 0% *C. forda*. All the diets were compounded to provide 20-23% crude protein for the starter phase and 17-19.5% crude protein for the finisher phase (Pfizer Nutrient Master Plan, 1992).

Each of the feeds was calculated to contain energy levels of 2,600 kcal and 2,800kcal for the starter and the finisher phases, respectively (Moreson Feed Formulation Guide, 1998).

Broiler procurement

Ninety day-old broiler chicks of the white leghorn breed were bought from Ajanla farms in Ibadan. The chicks were separated into 3 equal parts of 30 birds with each diet group having 3 replicated of 10 chicks. The chicks were housed on deep litter with wood shavings acting as litter.

Feed administration

The chicks were fed twice daily. Tray feeders and drinks were used for drinking and feeding activities. The feeds given to the chicks were weighed daily and the weights of leftover feeds were also recorded daily.

Weighing

The chicks in each of the groups were pre-weighed at the beginning of the experiment and thereafter on daily basis. The daily weighing was done early in the morning, while the weekly weighing was done every Saturday.

Growth determination

The growth parameters determined during the course of the experiment were rate of food consumption per week, mean weight gain and specific growth rate. Each of the three parameters is defined as follows:

Rate of food consumption per week: The rate of food consumption per week for the broilers in each group was determined by adding all the daily foods supplied to the birds together during the week and subtracting the left over feeds, the weight obtained was divided by the numbers of birds in the group. This was done for 12 week.

Table 2. Gross composition of diets for finisher phase.

Ingredients g/100g	Feed A 100% *Cirina forda* : 0% Fishmeal	Feed B 50% *C. forda* : 50% Fishmeal	Feed C 0% *C. forda*: 100% Fishmeal
Bone meal	2.00	2.00	2.00
Maize	47.00	47.00	47.00
Palm Kernel cake	20.00	20.00	20.00
Soya bean	1.00	1.00	1.00
Groundnut cake	10.00	10.00	10.00
Oyster shell	2.00	2.00	2.00
Maize bran	14.00	14.00	14.00
Lysine	1.00	1.00	1.00
Methionine	0.45	0.45	0.45
Salt	0.35	0.35	0.35
Premix	0.35	0.35	0.35
Fish meal	-	2.00	4.00
C. forda larvae	4.00	2.00	-
Crude Protein	17.08	17.52	17.80
Energy (kcal)	2,689.98	2,747.18	2,846.38

Mean weight gain: This was determined as the difference in the mean final weight and the mean initial weight of birds in each diet group.

$$\textbf{Specific growth rate} = \frac{\text{Log (final weight)} - \text{Log (initial weight)} \times 100}{\text{Time}}$$

The means of all the parameters considered were subjected to analysis of variance.

RESULTS

Growth performance

The compositions of the three diets supplied to broiler chicks at the starter and finisher stages are shown in Tables 1 and 2. The weekly weight gain, mean weight gain, and specific growth rate values are shown in Table 3 and 4 for the starter and the finisher phases, respectively.

Rate of food consumption per week

From the tables obtained, the rate of food consumption per week of the chicks fed with the control diet (Feed C) did not differ significantly (P ≥ 0.05) from the values obtained for chicks fed with the compounded larvae diets (Feeds A and B). This observation was repeated in both the starter and finishers' phases (Tables 3 and 4).

Mean weight gain

Mean weight gain at substitution levels of 50% larvae (Feed B) and 100% larvae (Feed A) were not significant different (P ≥ 0.05) from the control. This observation was repeated in both the starter and the finisher phases (Tables 3 and 4).

Specific growth rate

The specific growth rates recorded by the larvae diets, Feeds A and B, were not significantly different (P ≥ 0.05) from that obtained in the conventional fish meal diet (Feed C). This trend was repeated in all the growth phases of the birds whether starter or finisher (Tables 3 and 4).

DISCUSSION

There were no significant differences between the growth performances of the broiler chicks fed on the compoundded larval diets and those fed on the conventional fish meal. Whether at the starter or finisher phases, the larval diets (containing 50% and 100% *C. forda* larvae) gave comparable growth values in the broiler chicks like the conventional fish meal diet. This suggested that the compounded larval diets contained a protein source, which is comparable in quality to that present in the conventional fish meal.

The mean weight gains obtained in the broiler chicks fed on the larval diets (A and B) did not differ significantly from those fed with the fish meal diet. A similar trend was repeated in both the starter and the finisher phases respectively. This observation shows that the broiler chicks were able to utilize larval diets efficiently like the conventional fishmeal, as the diets were able to effect relatively large weight gains within a short period of twelve weeks. From these, it can be inferred that, diets A and B were satisfactorily acceptable to the birds just like the fish meal.

Table 3. Performance characteristics of broiler chicks (starter phase).

Parameters	Feed A	Feed B	Feed C
Consumption weekly weight gain (g)	80.95[a]	70.29[a]	76.17[a]
Mean weight gain (g)	337.21[b]	366.87[b]	367.57[a]
Specific growth rate	86.79[c]	84.50[c]	85.39[a]

Means with same superscripts in the same row are not significantly different from one another (P > 0.05).

Table 4. Performance characteristics of broiler chicks (finisher phase).

Parameters	Feed A	Feed B	Feed C
Weekly weight gain (g)	121.30[a]	120.33[a]	116.62[a]
Mean weight gain (g)	753.25[b]	759.23[b]	758.88[b]
Specific growth rate	52.23[c]	52.30[c]	52.36[c]

Means with same superscripts in the same row are not significantly different from one another (P > 0.05).

C. forda meals were able to effect specific growth rates comparable to fish meal. Hence, there was no significant difference between the specific growth rates of the two diets. The dried forms of most insects are known to be high in crude protein with values ranging above 60% (DeFoliart, 1991). Also, the calorific values of insect caterpillars of some species are high, with their protein contents ranging from 45-80% (Gullan and Cranston, 1994). *C. forda* larvae in dried form had been confirmed to contain 57.96 % crude protein (Ande, 1991). Leclercq and Guadin-Harding, (1987) have also analyzed three species of saturniid caterpillars (larvae) prepared by the traditional techniques of smoking and drying and found them to be high in riboflavin and niacin. *C. forda* larvae was able to cause specific growth rate comparable to that observed in the fish meal probably because of its high protein content and presence of essential minerals and vitamins like sodium, potassium, zinc and manganese (Ande,1991).

The fact that there were no significant differences in all the three parameters determined showed that *C. forda* larvae can be used in compounding feed rations for broiler birds. The additional advantages of the insect's high fecundity rate, availability, and artificial rearing potentials, are attributes that could be exploited in poultry industry. However, the cost effectiveness in the usage of the larvae as compared to conventional fishmeal needs to be investigated.

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