Growth performance and feed cost benefit of starter broiler chickens fed diet containing earthworm meal

¹Ekine, O. A. and ²Onunkwo, D. N.

¹Department of Animal Science, University of Port Harcourt, Rivers State

²College of Animal Science and Animal Production,

Michael Okpara University of Agriculture, Umudike, Abia State

Corresponding author: donunkwo1@gmail.com; 08033388622

Abstract

The study was carried out to evaluate the growth performance and feed cost benefit of starter broiler chickens offered graded levels of earthworm meal in replacement for fishmeal. A total of 120, one day old Anak broiler chicks were procured from a reputable hatchery and allotted to four treatment groups of 30 birds each. Each group was further divided into three replicates of 10 birds per replicate. A total number of four diets were used in the feeding trial. Diet 1 (control) has fish meal and no earthworm meal, while in diets 2, 3 and 4, the quantity of fishmeal in the control diet was replaced by 25%, 50% and 100% respectively with earthworm meal. No significant difference ($P > 0.05$) was observed in the performance of the birds. On the average daily feed intake of birds in diets 2 and 4 had high ($P > 0.05$) feed intake, followed by the birds in diets 3, while the birds in diet 1 had the lowest feed intake. But there was no significant difference ($P > 0.05$) in feed conversion ratio. The feed cost benefit analysis revealed a significant difference ($P < 0.05$) on cost of feed consumed. Feed cost per kg was reduced as the levels of earthworm meal increased. Replacement of fishmeal with earthworm meal at 25%, 50% and 100% has the potential to improve the growth performance of broiler birds. Therefore, it is recommended to commercial poultry farmers to use earthworm meals in their poultry feeding.

Keywords: Growth, Performance, Feed cost benefit, Starter broiler, Earthworm meal

Introduction

The cost of feed in poultry production accounts for about 70% of the running cost (Onunkwo *et al.*, 2019). This high cost of feed is generally as a result of competition between man and animals for the basic feed ingredients used by both man and animals. In order to reduce the cost of production, it is important that alternative feed ingredients that will mainly be consumed by animals are used in poultry feed formulation. The replacement of expensive conventional feed ingredients, particularly those of animal poultry source in feed formulation represents a suitable strategy at reducing the total feed cost in poultry production in Nigeria (Nsa *et al.*, 2009). Many nutritionists have therefore focused on efforts at finding alternative and proper feed ingredients to replace the more

expensive conventional feed ingredients like fish meal in poultry production. Fish meal is known to contain complete essential amino acids (EEAs) that need to meet the protein requirement of most poultry birds (Sogbesan and Ugwumba, 2008). Fish meal is however expensive as a feed ingredient, therefore, increases the cost of poultry production. There is the need to use cheaper and consumable feed ingredient as an alternative to fishmeal as a way of reducing the cost of production. One such alternative feedstuff which can be used is the earthworm meal. This experiment was therefore carried out to evaluate the growth performance and feed cost benefit of starter broiler offered graded levels of earthworm meal in replacement for fishmeal.

Location of study

The study was conducted at the Poultry Unit of the Teaching and Research Farm of the Michael Okpara University of Agriculture, Umudike, Abia State. Umudike is located on latitude 05°N 28' North and 07°E 32' East and lies at an altitude of 122 m above sea level. This area is situated within the tropical rainforest zone of West Africa which is characterized by long duration of rainfall (April - October) and short period of dry season (November-March). Average rainfall is 2169.8mm in 148 – 155 rain days. Average ambient temperature is 26°C with a range 22°C and 30°C. Its relative humidity ranges from 50 to 90%. These meteorological data were obtained from the meteorological station at the National Root Crops Research Institute, Umudike Abia State (NRCRI, 2019).

Experimental animals and management

A total of 120, one day old Anak broiler chicks were procured from a reputable hatchery. A week before the arrival of the chicks, the pens, feeders and drinkers were washed and disinfected with disinfectant. The pens were heated up with stove and lamp one hour before the arrival of the chicks, drinkers with 2 liters of water and

tray feeder with 0.3kg (300g) of feed were placed at their strategic positions. The chicks were weighed to get their initial live weight before introducing them into different treatments. The drinkers were cleaned twice daily (morning and evening) and other routine management practices were carried out. The birds were allotted to four treatment groups of 30 broilers each. Each group was further divided into three replicates of 10 birds each. A total number of four diets were used in the trial. Diet 1 (control) had fishmeal and no earthworm meal, while in diets 2, 3 and 4, the quantity of fishmeal in diet 1 was replaced by 25%, 50% and 100%, respectively of earthworm meal. The ingredients used to formulate the diets excluding of earthworm meal were purchased at Umuahia, Abia State. Earthworms were reared through vermin culture technology following the direction of Ranjendran *et al.* (2008). The worms were harvested 3 months after cultivation and processed according to Akpodiete and Okaghare (1999) and Sogbesan *et al.* (2007) into earthworm meal (vermim meal). The weight of the earthworms was taken after harvesting and processing. It was found that 1kg of earthworm (wet) gave about 150-160g (dried).

Table 1: Composition of starter broiler diet fed supplemental levels of earthworm meal

Ingredients	Treatments			
	T1	T2	T3	T4
Maize	53.00	53.00	53.00	53.00
Fishmeal	4.00	3.00	2.00	0.00
Earthworm meal	0.00	1.00	2.00	4.00
Soybean	28	28	28	28
Bone meal	2.5	2.5	2.5	2.5
Palm kernel cake	11.5	11.5	11.5	11.5
Salt	0.5	0.5	0.5	0.5
TOTAL	100	100	100	100
Crude protein	22.07	22.10	22.19	22.37
Me kcal/kg	2891.00	2849.18	2844.86	2836.23

Data collection

Feed samples (Table 2) as well as the samples of fishmeal and earthworm meal were analyzed for crude protein contents

according to the methods of Association of Official Analytical Chemist (AOAC, 1975). Feed and water were provided *ad-libitum* for the 5 weeks duration of the trial.

The weight of the birds was taken at the commencement of the experiment and on weekly basis. Feed consumption values were recorded daily. Data collected were

subjected to analysis of variance (Steel and Torrie, 1980) and Duncan multiple range test was used to detect differences among means.

Table 2: Proximate composition of experimental diets (% dry matter)

Parameters (%)	T1	T2	T3	T4
Dry matter	86.50	85.80	86.50	21.90
Crude protein	21.75	21.77	21.79	21.83
Crude fiber	4.01	4.02	4.03	40.05
Nitrogen free extract	51.00	51.10	51.24	51.46
Ether extract	4.20	4.21	4.22	4.24
Ash	5.08	4.97	4.86	4.64
Calcium (g)	1.00	1.00	1.00	1.00
Phosphorous (g)	0.85	0.83	0.82	0.79

Table 3: Proximate composition of fishmeal and earthworm meal (% dry matter)

Parameters (%)	Fishmeal	Earthworm meal
Dry matter	90.21	88.54
Crude protein	50.06	58.43
Crude fiber	2.75	0.79
Nitrogen free extract	9.40	12.50
Ether extract	10.52	3.50
Ash	1.33	10.05
Calcium (g)	3.64	0.55
Phosphorous (g)	2.28	0.79

Results and discussion

The proximate composition of experimental diets, fish meal and earthworm meal are presented in Tables 2 and 3. The result showed that experimental diets (T₁, T₂, T₃ and T₄) had the same level of crude protein, while fishmeal used for the diets have 50.06 crude proteins, 2.75% crude proteins, 2.75% crude fibre, 9.40% nitrogen free extract, 10.52% ether extract and 1.33% ash against 58.43%, 0.79%, 12.50%, 3.50%, and 10.05 of earthworm meal respectively. This shows that earthworm meal has higher crude protein content than the local fish meal used in this study. The results of performance of starter broiler birds fed diet containing earthworm meal is presented in Table 4. The result showed no significant differences ($P>0.05$) on the growth performance of birds subjected to the different treatments. Data on initial weight,

final weight, total weight gain, average daily weight gain and feed conversion revealed no significant differences ($P>0.05$) among the means. It could mean that any of the treatments could be used to improve the growth performance of starter broiler. The birds allotted to 25% and 100% earthworm meal had better feed intake followed by 50% earthworm meal while birds allotted 0% earthworm meal had lowest feed intake. With cost of feed consumed and cost/kg of feed, there were significant differences ($P>0.05$) recorded as earthworm meal replaced fishmeal in the diets. The findings from this study corroborate with Vielma-Rondon (2003) which stated that vermi meals rich source of protein ($>60\%$). Sogbegen *et al.* (2007) reported that vermimeal contains 63.04% crude protein, 6.35% lysine and 5.30% methionine, also, the study of Dedeke *et al.*

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(2010) revealed that vermi meal has meeting up animal requirement (mostly essential amino acids that are capable of monogastric animals).

Table 4: Growth performance characteristics of starter broilers fed graded levels of earthworm meal

Parameters	Treatment				SEM
	T1	T2	T3	T4	
Initial Body Weight (g)	58.73	58.50	58.57	58.87	0.27
Final Body Weight (g)	775.67	764.33	772.33	754.00	28.87
Total Weight gain (g)	716.93	705.80	713.77	659.13	28.88
Av. Daily Body Wt. gain (g)	20.48	20.17	20.39	19.86	0.82
Av. Daily Feed Intake (g)	50.52 ^b	50.94 ^a	50.86 ^{ab}	51.13 ^a	0.11
Feed conversion ratio	2.47	2.53	2.50	2.59	0.10
Mortality rate (%)	0.00	0.00	0.00	0.00	0.00

^{abc} Means on the same row with different superscripts are significantly ($p < 0.05$) different.

SEM = Standard error of mean

Table 5: Feed cost benefit of starter broilers fed graded levels of earthworm meal

Parameters	Treatment				SEM
	T1	T2	T3	T4	
Cost/kg feed (N)	70.15a	68.75b	67.35c	64.55d	0.000
Cost of feed consumed (N)	124.05a	122.59b	199.89c	115.52d	0.000
Cost/kg weight gain (N)	0.36	0.17	0.17	0.17	0.09
Cost of production (N)	123.96a	122.65b	120.01c	115.34d	0.19
Revenue/bird (N)	465.40	494.06	499.64	486.59	20.22
Gross margin (N)	399.56	371.41	379.62	371.25	20.62

^{abc} Means on the same row with different superscripts are significantly ($p < 0.05$) different.

SEM = Standard error of mean

Conclusion

The findings from this study revealed that replacement of fishmeal with graded levels of earthworm meal when included at 25% 50% and 100% respectively has the potential to improve the growth performance of starter broiler. It also indicated that utilization of the feed formulated with earthworm meal and fishmeal have the same feed conversion ratio. The use of earthworm at various levels also has positive influence in reducing the cost of production in poultry feeding. Therefore, commercial poultry farmers may be advised to use earthworm meal as a source of animal protein in feed formulation.

Recommendation

It is recommended that Nigerian

government and other stakeholders in livestock industry should encourage the massive production of earthworm meal which showed a very high potential in reduction of cost of production. All the waste generated in Nigeria should be channeled into vermiculture and vermocomposting, thereby making earthworm meal available in poultry feeding this will enhance the availability of animal protein to the populace. However, vermitechnology and vermicomposting should be included in University curriculum as one of the courses for B. Agric. students.

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