Performance, organ growth and economics of finisher broiler fed neem (*Azadirachta indica*) leaf meal as replacement for maizeOlowu¹, O.P.A., Asaniyan,^{2*} E.K. and Agbede,³ J.O.

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Abstract

A 28-day feeding trial was conducted to evaluate the effects of dietary inclusion of neem (*Azadirachta indica*) leaf meal on the performance, organ growth and economics of finishing broilers. The harvested neem leaves were chopped and air dried under room temperature for ten days until they became crispy while retaining the greenish colouration. The dry leaves were hammer milled with 2mm sieve to produce leaf meal before being incorporated into broiler finisher diets. Four isonitrogenous finisher diets were formulated; containing 0%, 5%, 10% and 15% levels of neem leaf meal (NLM) as partial replacement for maize in the diets. A total of one hundred and eight (108) 4-week old birds were randomly selected, weighed and assigned to the four treatments in a complete randomised design. The four treatments were replicated three times with nine (9) birds per replicate. The birds were fed ad libitum with their respective diets and freely supplied with water. Results showed that the neem leaf levels significantly ($P < 0.05$) affected all the performance indicators. Birds on 5% NLM had similar average daily weight gain, average daily feed intake and feed conversion ratio (FCR) with birds on 0% neem leaf meal (control) but significantly ($P < 0.05$) superior to birds on 10% and 15% neem leaf meal levels. On the relative organ weight, except for the heart, all the organs were not significantly ($P > 0.05$) affected by the varying levels of neem leaf meal. The g/kg body weight of the heart reduces as the level of NLM increases; with 15% NLM having the least heart weight (7.50 ± 0.47 g/kg body weight). The cost analysis of replacing maize with neem leaf meal in the broiler finisher diets revealed that 15% level yielded least cost of feed consumed per bird (? 178.69), cost of feed consumed per kg body weight per day (? 6.38) and cost of feed per kg weight (? 55.84). It is concluded that 5% replacement level of maize will enhance optimum performance and organ growth while 10% NLM brings about the optimum cost benefit in feeding finisher broilers with neem leaf meal.

Key words: Neem leaf meal, maize, replacement level, performance, finisher broilers

Introduction

Poultry remains relatively affordable source of animal protein with high biological value for human consumption in both rural and urban societies of Nigeria. However, the high cost of poultry feed constituted a great challenge against poultry production and consumption. In facing this challenge, poultry nutritionists are unrelentingly making efforts in cutting down the high cost of feed. This led to several efforts in exploiting unconventional feed ingredients with little or no nutritional

competition from man as strategy against the existing situation with the conventional feed ingredients; that culminated to high cost of feed. The need for alternative sources of feed has led to the exploitation of leaf meals of some tropical legumes and browse plants as ingredients in poultry diets (Obikaonu, 2012). Neem has been identified among the tropical plant that can be used as livestock feed resource (Kausik *et al.*, 2008 and Ogbuwu *et al.*, 2009). Neem (*Azadirachta indica*) is an indigenous tropical plant, which

predominate in Nigeria. Commonly known as “don goyaro”; popular for its medicinal potentials in Southern Nigeria and grown in the North principally to reduce the rate of desertification. Neem has attracted worldwide prominence due to its vast range of medicinal properties such as antibacterial, antiviral, antifungal, antiprotozoal, hepatoprotective and various other properties without showing any adverse effects (Kale *et al.*, 2003). Neem leaves like most tropical tree leaves contain bioactive compounds (Kausik *et al.*, 2008) which may affect nutrient utilization. Neem leaf meal has nutritional and health improvement potential as a feed ingredient in broiler production without compromising the haematological parameters, carcass characteristics and meat taste (Bonsu *et al.*, 2012). Esonu *et al.* (2006) reported that neem leaf meal has a proximate composition of 92.40% dry matter; 7.58% moisture; 20.69% crude protein; 16.60% crude fibre; 4.13% ether extract; 7.10% Ash and 43.91% Nitrogen free extract but Bakshi *et al.* (2006) reported it to be low in metabolisable energy (0.34KJ / Kg DM). However, Ogbuwu *et al.* (2010) reported that neem leaves contain appreciable amount of proteins, minerals, carotene and adequate amount of trace minerals.

The inclusion of neem leaf meal in the diet of starter broiler chickens should not exceed 5% since inclusion levels beyond this suppressed their feed intake and growth rate (Obikaonu, 2009). Obikaonu (2012) similarly reported the same 5% inclusion level of neem leaf meal in the diet of finisher broilers. However, this study is designed to appraise the performance, organ growth and economics of finishing broiler chickens fed diets containing graded levels of neem leaf meal in partial replacement of maize.

Material and Methods

Experimental plan: This study was carried out at the Poultry Unit of the Teaching Farm of Federal College of Agriculture, Akure; located at latitude 07° 17' N and longitude 05° 18' E. The mean annual rainfall and mean annual temperature for the location were 133mm and 29°C respectively. Fresh matured neem leaves were harvested within the College compound. The leaves were chopped without the petioles for effective drying. The chopped leaves were air dried at room temperature for ten days until they became crispy while retaining the greenish colouration. The dry leaves were milled into 2mm size using a locally manufactured hammer mill to produce leaf meal before being incorporated into broiler finisher diets. Four isonitrogenous finisher diets were formulated; containing different levels of neem leaf meal (NLM). The four experimental diets (treatments) were composed of 0%, 5%, 10% and 15% neem leaf meal as partial replacement for maize in the diets (Table 1). One hundred and fifty (150) day old Anak broiler chicks purchased from Zartech Nigeria Limited, Ibadan were electrically brooded. The birds were majorly vaccinated against Newcastle disease and given appropriate prophylactic medications against coccidiosis and stress; feed (commercial starter diet with 22%CP and 2900Kcal/KgME) and water were given *ad libitum*. At the end of the pre-experimental period that lasted four weeks (4); a total of one hundred and eight (108) of the birds were randomly selected, weighed and assigned to the four treatments in a completely randomised design. The four treatments were replicated three times with nine (9) birds per replicate. The birds were brooded and raised in nine equi-dimensional pens (1m x1m) within a deep litter house. The birds were fed *ad libitum* with their respective diets and freely

Table 1: Percentage composition of ingredients in the experimental diets

Ingredients	Percentage level of neem leaf meal inclusion			
	0%	5%	10%	15%
Maize	56.95	45.45	41.94	38.55
Neem leaf meal	0.00	11.50	15.01	18.40
Soybean meal	33.02	33.02	33.02	33.02
Brewer dry grain	5.00	5.00	5.00	5.00
Palm oil	1.00	1.00	1.00	1.00
Bone meal	2.50	2.50	2.50	2.50
Oyster shell	0.50	0.50	0.50	0.50
Methionine	0.03	0.03	0.03	0.03
Broiler premix	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50
Total	100	100	100	100
Proximate composition (%)				
Dry matter	86.22	86.85	87.04	87.23
Crude protein	20.48	20.25	20.63	20.32
Crude fibre	4.27	4.59	4.68	4.78
Ether extract	3.97	4.50	4.67	4.82
Ash	2.38	2.95	3.12	3.29
Nitrogen free extract	54.35	52.30	51.68	51.07

supplied with water under healthy management practices. The record of average weekly weight gain and average daily feed consumption were kept and feed conversion ratio computed. The feeding trial lasted 28 days.

Organs measurement: At the end of the feeding trial, two birds were randomly selected per replicate; weighed, stunned and slaughtered by severing the jugular veins with a sharp surgical knife. After slaughtering and bleeding, the carcasses were scalded at 65°C in water bath for 30 seconds before defeathering. The carcasses were later eviscerated, dissected and organs measured. The organs measured were the liver, heart, lungs, spleen, pancreas, kidney, bursa, crop and gizzard. All the organs measured were expressed as g/kg body weight.

Cost Analysis: The cost analysis of the birds' consumption level in relation to the formulated experimental diets was carried out based on the estimated cost of milling the dried neem leaf and prevailing prices of

the other component ingredients.

Proximate and Statistical Analysis: The proximate composition of the neem leaf meal (Table 2) and the experimental diets were determined as described by AOAC (1995) methods. Data collected in the course of the study were subjected to analysis of variance and treatment means separated by Duncan's Multiple Range Test using SPSS 17.0.1 Version (2008).

Results

The result of the treatment effects on the broiler performance showed that average final body weight, average weight gain, average daily body weight gain, average daily feed intake and feed conversion ratio were significantly ($P < 0.05$) affected by varying dietary levels of neem leaf meal as presented in Table 3. The 0 and 5% dietary levels of neem leaf meal were not significantly ($P > 0.05$) different from one another in their influence on all the performance indicators. Birds on 0 and 5%

Table2: Proximate composition of neem leaf meal

Components	Percentage
Dry matter	93.66
Crude protein	19.79
Crude fibre	5.46
Ether extracts	6.74
Ash	5.68
Nitrogen free extract	55.99

neem leaf meal were significantly ($P<0.05$) different from those on 10 and 15%. However, birds on 10 and 15% neem leaf meal showed significant ($P<0.05$) difference in average body weight gain and average daily weight gain while other performance indicators were not significantly affected. Table 4 presents relative organ weight of broiler chicken as affected by varying levels of neem leaf meal. Except for the heart, all the organs were not significantly ($P>0.05$) affected by the varying levels of neem leaf meal. Birds on 0% neem leaf meal had the highest heart weight, significantly ($P<0.05$) different from others. The heart weights on 5 and 10% neem leaf meal were not significantly different from one and another but 15% neem leaf meal had the least heart weight

(7.80 ± 0.47 g/kg body weight), significantly ($P<0.05$) different from others. Table 5 presents the cost analysis of replacing maize with neem leaf meal in the broiler finisher diets. For the 28 days period of the trial, diet with 0% neem leaf meal (control) had the highest cost of feed/kg (₦64.40) followed by 5% (₦59.24), 10% (₦57.56) neem leaf diets while 15% neem leaf diet had the least cost of feed/kg (₦55.84). The cost of feed consumed/kg weight of bird (CFC/kg weight of bird) and cost of feed/kg weight/day followed the same trend as cost of feed/kg. The 0% neem leaf meal diet numerically had the highest value (₦223.47) for CFC/kg weight of bird while 15% neem leaf meal diet had the least value (₦178.69).

Discussion

The non significant influence of dietary treatments on the performance indicators of the broilers tend to show that neem leaf meal inclusion in broiler diets at the finisher phase seems to have similar contribution to broiler performance; with birds under 5% NLM exhibited optimum performance that compared favourably with the control diet (0% NLM). Also, the performance pattern

Table 3: Performance of Broiler Chicken fed varying dietary levels of Neem Leaf Meal (NLM)

Parameter	Dietary Treatments (% Inclusion level of NLM)			
	0	5	10	15
Average Initial Body Weight (g)	1460.00 ^a ±57.82	1442.59 ^a ±60.94	1470.37 ^a ±87.20	1453.70 ^a ±77.44
Average Final Body Weight (g)	2242.00 ^a ±114.17	2197.21 ^a ±56.48	2014.81 ^b ±99.59	1790.74 ^b ±167.08
Average Body Weight Gain (g)	782.22 ^a ±9.34	754.21 ^a ±6.53	544.53 ^b ±3.51	336.84 ^c ±3.81
Average Daily Body Weight Gain (g)	37.24 ^a ±2.95	35.01 ^a ±0.65	25.93 ^b ±1.34	16.04 ^c ±0.32
Average Daily Feed Intake Weight (g)	165.56 ^a ±0.45	160.15 ^a ±2.91	157.86 ^b ±1.39	152.51 ^b ±0.32
Feed Conversion Ratio (FCR)	4.44 ^a ±0.50	4.57 ^a ±0.92	6.08 ^{bc} ±0.82	9.55 ^c ±21.01

Mean±SD

Mean with different superscript on the same row are significantly different ($P<0.05$)

of the birds revealed that various inclusion levels of neem leaf meal experimented in this study might have enhanced the health integrity of the bird. This can be attributed to the presence of quercetin (flavonoid) in neem leaf, reported to have antibacterial and antifungal properties (Elangovan *et al.*, 2000). Hence, promotes the medicinal benefits that culminated into good performance in broiler chickens. The heart significantly decreased in weight at 15% NLM level. Implying that NLM inclusion had the potential of preventing finisher broilers against cardiac hypertrophy and

enhances the functional integrity of the heart. This tends to reveal the benefit of reported anti-inflammatory properties of neem (Schumacher *et al.*, 2011). This tends to corroborate the report of Bonsu *et al.* (2012) that neem leaf meal has both nutritional and health improvement potential as a feed ingredient in broiler production. The NLM inclusion levels are inversely proportional to cost variables; cost of feed consumed/kg weight of bird and cost of feed consumed / kg weight of bird/day, this tend to show that replacement of maize with neem leaf meal will possibly

Table 4: Relative organ weight of broiler chicken fed Neem Leaf Meal (NLM) (g/kg body weight)

Parameters	Dietary treatments (% Inclusion level of NLM)			
	0%	5%	10%	15%
Heart	12.25 ^a ± 1.75	10.60 ^b ± 0.91	9.26 ^b ± 1.18	7.80 ^c ± 0.47
Lungs	15.21± 2.20	12.59 ±1.12	10.99 2.09	11.85± 1.71
Liver	55.64± 5.34	43.66± 3.17	43.44 1.80	41.70± 2.36
Spleen	2.55± 0.60	2.34± 0.58	1.81 0.37	1.82± 0.50
Pancreas	4.66± 0.72	5.46± 1.02	3.73 0.22	5.01± 0.55
Kidney	9.25 ±5.49	13.51± 1.68	6.38 2.84	14.07± 0.61
Gizzard	57.01± 3.29	48.93± 5.91	43.23 4.41	52.00± 0.29
Bursa	0.94± 0.28	2.30± 1.01	1.03 0.74	1.89± 0.85
Crop	9.92± 0.88	9.22± 1.91	6.43 0.26	6.62 ±0.31
Means±SD				

^{a,b,c} Means with different superscript in the same row are significantly different (P<0.05)

Table 5: Cost analysis of Neem Leaf Meal (NLM) utilization in place of maize

Inclusion level of NLM (%)	TFC/kg body weight	Cost of feed/kg (₦)	CFC/kg body weight (₦)	CFC/kg body weight/day (₦)
0	3.47	64.40	223.47	7.98
5	3.36	59.24	199.05	7.11
10	3.31	57.56	190.52	6.80
15	3.20	55.84	178.69	6.38

TFC – Total Feed Consumed

CFC – Cost of Feed Consumed

reduce the cost of feeding broilers at finisher phase. This confirmed the report of Esonu *et al.*, 2002; that leaf meal is one of the possible cheap feed resources.

Conclusion

The outcome of this study revealed that 5% replacement level of maize with neem leaf meal (NLM) promoted optimum performance and organ growth but 10% level yielded optimum cost of feed consumed per kg weight of bird, cost of feed consumed per kg weight of bird per day and cost of feed per kg weight. It can then be concluded that within the limit of this study, 5% neem leaf meal inclusion will enhance optimum performance and organ growth in finisher broilers. However, sustainable optimum cost of using neem leaf meal can be achieved when neem plant is grown as ornamental crop within the immediate environment rather than collecting the leaves or paying the producers to gather it.

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