The effect of neem (*Azadirachta indica*) leaf meal on the growth performance and carcass characteristics of broiler chickens

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Abstract

A feeding trial was conducted for 56 days to investigate the effect of neem (*Azadirachta indica*) leaf meal on the growth performance and carcass traits of broiler chickens. The neem leaf meal was used in replacing parts of wheat offal in the diets of 192 day-old broiler chickens fed ad libitum at 0.1, 0.2 and 0.3% levels of inclusion. The experimental birds were randomly distributed into four treatments. Each treatment was sub-divided into three replicates of sixteen (16) birds. Medications were administered only to the birds in treatment 1 (control group) while vaccination was administered across the treatment during the course of the experiment. Growth parameters were taken on weekly basis and data obtained were subjected to one way analysis of variance (ANOVA) in a completely randomized design. There was a significant ($P < 0.05$) effect of varying dietary inclusion of NLM only on average weight gain among the birds at the starter phase. Groups fed 0.3% NLM recorded the highest average weight gain (430.63g) as against 421.00, 392.57 and 394.97g recorded for the control, 0.1% and 0.2% NLM groups, respectively. Neem leaf meal had no significant ($P < 0.05$) effect on broiler performance at the finisher phase across the treatment groups. Mortality was not affected ($P > 0.05$) at any of the growth phases. Carcass traits; cut- parts (except neck) and organs showed no influence ($P > 0.05$) of NLM inclusion. It can then be recommended that the neem leaf meal inclusion up to 0.3% in the diets of the broiler chickens can be used as growth promoters during the chick phase of growth.

Keywords: Neem, Performance, Carcass and Broilers

Introduction

The use of antibiotic growth promoters (AGP) to improve animal performance has been a usual practice for more than half a century (Gollnisch *et al.*, 2001). However, due to human and animal health issues resulting from antimicrobial resistance and residual effect of these antibiotic growth promoters, their use are being discouraged. After 2005 in the European Union (Reglamento, 2005), the use of all such antibiotics was banned by regulatory measures, and for this reason, it is important

to research AGP replacements (Griggs and Jacob, 2005).

Phytogenic plants or herbs generally contain chemical compounds (such as saponins, tannins, oxalates, phytates, trypsin inhibitors and cyanogenic glycosides) known as secondary metabolites, which are biologically active (Soetan and Oyewole, 2009). Secondary metabolites may be applied in nutrition and as pharmacologically-active agents (Soetan and Oyewole, 2009). They are also known to have high amounts of essential nutrients,

vitamins, minerals and fatty acids and fibre (Gafar and Itodo, 2011). They could be expected to serve as feed additives due to their suitability and preference, reduced risk of toxicity and minimum health hazards (Devegowda, 1996). Research works on herbal formulations as feed additives have shown encouraging results as regards weight gain, feed efficiency, lowered mortality and increased liveability in poultry birds (Deepak *et al.*, 2002; Jahan *et al.*, 2008).

Neem (*Azadirachta indica*) belongs to the *Meliaceae* and is a fast growing evergreen tree with a potential to provide medicinal and nutritive value of broilers (Schmutterer, 1990). Various parts of the tree have been reported to contain chemicals like *azadirachtin nimbini*, *nimbini*, *quercetin*, etc (Makeri *et al.*, 2007; Gandhi *et al.*, 1988; Blaney *et al.*, 1990). The chemicals are said to have antimicrobial, antihelminth, antioxidant, antifungal, insecticidal, antiprotozoal and spermicidal properties (Elangovan *et al.*, 2000). Hence, this study was designed to investigate the effect of neem leaf meal as a phytobiotic growth promoter on the performance of broilers birds.

Materials and Methods

Experimental site - This experiment was carried out at the poultry unit of the Directorate of University Farms (DUFARMS), Federal University of Agriculture, Abeokuta, Ogun state. The area lies on latitude 7°10'N and longitude 3°2'E, it is 76m above sea level and located in the tropical rainforest vegetation zone with an average temperature of 34.7°C and relative humidity of 82% (Google Earth, 2014).

Collection and Preparation of Neem Leaf Meal

Fresh green leaves of Neem (*Azadirachta indica*) were harvested from within the

University environment. The leaves were air-dried in a well-ventilated room until it is crispy. The crispy leaves were ground into fine particles using the Attrition mill.

Determination of proximate composition of Neem Leaf Meal

Crispy Neem leaves were taken to laboratory to determine the proximate composition using AOAC, (2005) method.

Experimental Birds and their Management

A total of 192 day-old broiler chicks (Anak breeds) were purchased from a reputable hatchery in Abeokuta, Ogun State. The birds were randomly distributed into four treatments. Each treatment was further divided into three replicates with each consisting sixteen (16) birds. The birds were brooded on replicate basis for two weeks. Birds were given necessary vaccinations such as Coccidiostat, Gumboro (1st and 2nd shots) and Lasota during the course of the experiment. Antibiotics were administered to the birds in treatment 1 (control group) alone during the experiment.

Experimental Treatment Diet

The feed was compounded at a reputable feed mill in Abeokuta, Ogun state. The neem leaves meal (NLM) was included into the diets at 0.1%, 0.2% and 0.3% levels in treatments 2, 3 and 4 respectively to replace wheat offal. Treatment 1 had no NLM and served as the control group. Birds were fed diet containing 23% CP during the starter phase (1-28 days) and 20.01% CP diet during the finisher phase as shown in Tables 1 and 2. The feeding trial lasted for eight (8) weeks.

Data Collection

Weight gain: The initial weights of the birds were taken at the beginning of the study and subsequent live weight measurement was carried out on weekly basis with the use of weighing scale.

Feed intake: The feed intake was

Table 1: Composition (%) of starter diets (1-21 days)

Ingredients	Inclusion level of NLM (%)			
	0	0.1	0.2	0.3
Maize	47.00	47.00	47.00	47.00
Soya bean meal	18.50	18.50	18.50	18.50
Fish meal	2.00	2.00	2.00	2.00
Groundnut cake	17.50	17.50	17.50	17.50
Wheat offal	10.00	9.90	9.80	9.70
<i>Azadirachta indica</i>	0.00	0.10	0.20	0.30
Bone meal	3.00	3.00	3.00	3.00
Oyster shell	1.00	1.00	1.00	1.00
Vitamin/Min. premix	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	100	100	100	100
Calculated Analysis				
Crude protein (%)	23.00	23.00	23.00	23.00
Crude fibre (%)	3.61	3.61	3.61	3.61
Fat (%)	4.04	4.04	4.04	4.04
ME (MJ/kg)	11.47	11.47	11.47	11.47
Calcium (%)	1.28	1.28	1.28	1.28
Phosphorus (%)	0.56	0.56	0.56	0.56
Lysine (%)	1.33	1.33	1.33	1.33
Methionine (%)	0.59	0.59	0.59	0.59

determined on weekly basis as the difference between the feeds supplied and leftover.

Feed intake = Feed supplied – left over.

Feed conversion ratio: The feed conversion ratio of the birds was calculated using the relation:

$$FCR = \frac{\text{feed intake}}{\text{weight gain}}$$

Protein efficiency ratio (PER): The protein efficiency ratio was calculated as:

$$\frac{\text{Weight gain}}{\text{Protein intake}}$$

Carcass Yield Evaluation: At the 8th week, two (2) birds per replicate (24 birds in all) were selected and slaughtered via the

jugular vein, allowed to bleed for two minutes followed by scalding at 60°C. The feathers were removed and the plucked weight was recorded. The heads and shanks were removed and evisceration was carried out. After evisceration, the dressed weight was recorded. The eviscerated carcass was cut into parts (neck, back, thigh, drumstick, breast) and offals. The cut-up parts and all organs (kidney, lungs, liver, heart and gizzard) were expressed as a percentage of the live weight.

Statistical Analysis

The data collected were subjected to one way analysis of variance (ANOVA) in a completely randomized design. Significantly ($P < 0.05$) means were separated using Duncan's multiple range

Table 2: Composition (%) of the finisher Diets (28-56 days)

Ingredients	Inclusion level of NLM (%)			
	0	0.1	0.2	0.3
Maize	53.50	53.00	53.00	53.00
Soya bean meal	16.50	16.50	16.50	16.50
Fish meal	0.40	0.40	0.40	0.40
Groundnut cake	13.80	13.80	13.80	13.80
Wheat offal	10.80	10.70	10.60	10.50
<i>Azadirachta indica</i>	0.00	0.10	0.20	0.30
Bone meal	3.00	3.00	3.00	3.00
Oyster shell	1.00	1.00	1.00	1.00
Vitamin/Min. premix	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	100	100	100	100
Calculated Analysis				
Crude protein (%)	20.01	20.01	20.01	20.01
Crude fibre (%)	3.51	3.51	3.51	3.51
Fat (%)	3.88	3.88	3.88	3.88
ME (MJ/kg)	11.62	11.62	11.62	11.62
Calcium (%)	1.23	1.23	1.23	1.23
Phosphorus (%)	0.53	0.53	0.53	0.53
Lysine (%)	1.13	1.13	1.13	1.13
Methionine (%)	0.54	0.54	0.54	0.54

test (SAS, 1999).

Results

The result of the proximate composition of the NLM presented in Table 3 revealed that moisture content was 5.80%; crude protein was 17.10%; crude fibre content was 13.69%; ether extract was 0.91%; 9.77% was the ash content while 52.73% was the value of the Nitrogen Free extract.

Performance of broiler chicken fed varying level of *A. indica* leaf meal at starter phase is presented in Table 4. The results revealed that only weight gains were significantly ($P < 0.05$) influenced by the inclusion level of *Azadirachta indica*. It was shown that the average weight gain of the birds fed 0.3% NLM inclusion level were highest (430.63g) among the groups. Birds fed 0.1% and 0.2% NLM inclusion level had

statistically similar ($P > 0.05$) average weight gain (392.57 and 394.97g, respectively).

Table 5 showed the effect of neem leaf treatment on the performance of broiler chickens at the finisher phase of growth. All growth parameters measured were not significantly ($P > 0.05$) influenced. The final weight ranged from 1571.77g to 1790.57g. Carcass yield (cut-up parts and organs) of broiler birds fed varying levels of dietary NLM inclusion are presented in Table 6. The eviscerated and dressed weight were not significantly ($p > 0.05$) different. The eviscerated weight values ranged from 0.92 to 1.04 kg, and control had numerically highest value (1.04 kg) while 0.2% NLM had the numerically least value (0.92 kg). Dressed weight value ranged from 0.80 kg (0.2% NLM) to (0.92% NLM) across the

Table 3: Proximate composition of the neem (*Azadirachta indica*) leaf meal

Components	Percentage (%)
Moisture	5.80
Crude Protein	17.10
Crude Fibre	13.69
Ether extract	0.91
Ash	9.77
Nitrogen Free Extract	52.73

treatment. Dressing percentage values presented were not significantly ($p < 0.05$) different and ranged from 51.01 (0.1% NLM) to 54.40% (0.3% NLM). No significant ($p > 0.05$) difference in the values of cut-up parts except neck. The percentage weight for the head ranged from 2.32 to 2.88%. The shank weight ranged from 4.24 to 4.72%, while the wings values ranged

Table 4: Performance of broiler starter birds fed varying Dietary levels of Neem (*Azadirachta indica*) leaf meal

Inclusion level of NLM (%)				
Parameters	0	0.1	0.2	0.3
Initial weight(g/bird)	56.00±0.000	55.00±1.732	54.00±1.732	54.00±1.732
Final weight (g/bird)	477.00±13.78 ^a	447.57±19.55 ^b	448.97±115.87 ^b	484.63±4.84 ^a
Av. total weight gain (g/bird)	421.00±13.78 ^{ab}	392.57±20.51 ^b	394.97±14.20 ^b	430.63±6.21 ^a
Weight gain (g/bird/day)	20.05±0.66 ^{ab}	18.69±0.98 ^b	18.81±0.68 ^b	20.51±0.30 ^a
Av. total feed intake (g/bird)	874.49±50.70	895.80±44.73	821.93±59.75	888.31±55.05
Feed intake(g/bird/day)	41.64±2.42	42.66±2.13	39.14±2.85	42.30±2.62
Protein Efficiency Ratio	2.10±0.06	1.91±0.16	2.10±0.15	2.11±0.14
Feed Conversion Ratio	2.08±0.07	2.29±0.20	2.08±0.16	2.08±0.16
Mortality (%)	0.33±0.58	0.67±0.58	0.00±0.00	0.00±0.00

Means with different superscript on the same row differ significantly ($p < 0.05$).

Table 5: Performance of broiler birds fed varying dietary levels of Neem (*Azadirachta indica*) leaf meal at finisher phase

Inclusion level of NLM (%)				
Parameters	0	0.1	0.2	0.3
Av. initial weight (g/bird)	477.00±13.78 ^a	447.57±19.55 ^b	448.97±15.87 ^b	484.63±4.84 ^a
Av. final weight (g/bird)	1790.57±42.47	1594.97±178.17	1571.77±72.87	1714.97±164.31
Av. weight gain (g/bird)	1313.57±55.92	1147.40±197.63	1122.80±80.50	1230.33±169.14
Weight gain (g/bird/day)	46.91±1.99	40.98±7.06	40.10±2.87	43.94±6.04
Av. total feed intake (g/bird)	4125.73±518.36	4016.33±639.82	3967.40±240.84	3945.23±531.82
Feed intake (g/bird/day)	147.33±18.51	143.4±22.85	141.67±8.58	140.90±18.99
Protein Efficiency Ratio	1.40±0.15	1.24±0.02	1.24±0.14	1.38±0.29
Feed Conversion Ratio	3.13±0.31	3.50±0.04	3.54±0.43	3.26±0.70
Mortality (%)	2.00±1.73	2.00±2.65	4.00±2.65	3.67±1.53

Means with different superscript on the same row differ significantly ($p < 0.05$).

from 7.51 to 9.61%. The drumstick values ranged from 8.40 to 9.57%. All organ weights were statistically similar ($P>0.05$) across the treatment groups.

Discussion

The proximate composition of the NLM obtained in this study is at variance to that reported by Esonu *et al.* (2006) who reported 7.58% moisture; 20.68% crude protein; 16.60% crude fibre; 4.13% ether extract; 7.10% ash and 43.91% Nitrogen Free extract. The difference in the values obtained could be traced to the ages of the leaves used. The moisture content of the neem leaf meal in the present study exceeds that reported by Olabode and Onyimonyi

(2009) which yielded 3.5% but lower than the 7.58% and 13% reported by Esonu *et al.* (2006) and Bonsu *et al.* (2012) respectively. The variation in the moisture content could be due to the method of drying and storage employed. The samples used by Olabode and Onyimonyi (2009) were sun dried which is different from the air drying method used in the present study. Also, climatic factors at the time of harvest of the leaves have great influence on the moisture content which could be the reason for the high moisture content reported by Esonu *et al.* (2006). Likewise, the values obtained for the ash content in the report of Esonu *et al.* (2006) is higher than the value obtained in the present study which could be

Table 6: Carcass yield of broiler birds fed varying dietary levels of Neem (*Azadirachta indica*) leaf meal

Parameters	Inclusion level of NLM (%)			
	0	0.1	0.2	0.3
Live weight (Kg)	1.78 ± 0.029 ^a	1.67 ± 0.153 ^{ab}	1.5 ± 0.100 ^b	1.62 ± 0.202 ^{ab}
Eviscerated weight (Kg)	1.04 ± 0.064	1.02 ± 0.029	0.92 ± 0.104	0.93 ± 0.058
Dressed weight (Kg)	0.92 ± 0.061	0.90 ± 0.040	0.80 ± 0.098	0.82 ± 0.044
Dressed percentage (%)	51.76 ± 2.994	54.40 ± 3.727	53.28 ± 4.845	51.01 ± 3.465
Cut up parts (% of live weight)				
Head	2.32 ± 0.079	2.70 ± 2.628	2.88 ± 2.817	2.70 ± 0.353
Shank	4.20 ± 0.295	4.28 ± 0.770	4.72 ± 0.222	4.34 ± 0.012
Neck	4.26 ± 0.409 ^{ab}	4.52 ± 1.223 ^{ab}	5.52 ± 0.202 ^a	3.82 ± 0.073 ^b
Thigh	9.01 ± 1.066	7.79 ± 1.841	9.99 ± 1.524	7.67 ± 0.378
Breast	13.60 ± 0.590	13.29 ± 3.653	14.70 ± 1.163	13.78 ± 0.344
Back	9.95 ± 0.400	9.82 ± 2.386	10.69 ± 1.386	9.97 ± 0.691
Wings	7.51 ± 0.400	7.96 ± 1.919	9.61 ± 0.618	7.67 ± 0.378
Drumstick	8.29 ± 0.200	8.40 ± 1.258	9.57 ± 0.756	8.50 ± 0.078
Organ weight (% of live weight)				
Heart	0.52 ± 0.072	0.42 ± 0.100	0.40 ± 0.078	0.52 ± 0.108
Kidney	0.14 ± 0.043	0.15 ± 0.045	0.22 ± 0.118	0.32 ± 0.121
Liver	2.44 ± 0.201	2.06 ± 0.404	2.83 ± 0.851	2.45 ± 0.554
Lungs	0.54 ± 0.033	0.54 ± 0.222	0.58 ± 0.101	0.60 ± 0.173
Gizzard	2.08 ± 0.277	1.85 ± 0.532	2.13 ± 0.274	1.99 ± 0.242
Spleen	0.13 ± 0.026	0.14 ± 0.020	0.12 ± 0.044	0.12 ± 0.003

Means with different superscript on the same row differ significantly ($p<0.05$)

attributed to variation in soil chemical properties as influenced by seasonal variations and the ages of the leaves at harvest. Crude protein value of 17.10% obtained in this study is lower than the crude protein value of 18.90% reported by Sokunbi *et al.* (2003) but higher than 16.6% reported by Esonu *et al.* (2006) while crude fibre of 13.69% obtained in the present study is higher than 12.00% reported by Sokunbi *et al.* (2003). These differences in the crude protein and crude fibre level may be related to several factors affecting plant composition. NRC (1992) identifies soil condition as one of the factors affecting nutrient content of most trees among other factors such as plant age, specie, season, and ecological zones. The ether extract value of 0.91% in this study is lower than the ether extract of 6.0% reported by Onyimonyi *et al.* (2009) and Ogbuwu *et al.* (2009). These differences in the value of ether extract may be related to the condition of the soil in the ecological zone.

Similar feed intake across the treatment groups noted in this study is in harmony with the report by Bonsu *et al.*, (2012) at chick and finisher phase.

This study revealed that NLM at 0.3% level of inclusion significantly improved the weight gain at the starter phase of growth of the birds despite the similar values in their feed intake. This can be as a result of *Azadirachta indica* constituents and its role in the proper utilization of feed. However, the daily weight gain per bird at finisher phase study is similar to work of Bonsu *et al.* (2012) who reported similar weight gain per day in finished broilers NLM. Ikani *et al.* (2008) also obtained similar weight in broiler birds fed sesame seed meal. Generally, the effect of *Azadirachta indica* was not seen at finisher phase. This may be attributed to the low inclusion levels adopted. Perhaps, if the level is increased,

the effect might have been significant. However, the final weight at the finisher phase is similar to the findings of Obun and Ayanwale (2008) who reported similar values in the weight of broiler birds fed raw and roasted dehulled *Azalia Africana* seed meal.

According to Esonu *et al.* (2005) and Bonsu *et al.*, (2012), dressing percentage of the birds fed neem (*Azadirachta indica*) leaf showed no significant difference from those of the control which is similar to the results of this experiment. Non-significant ($p > 0.05$) difference in dressing percentage contradicts results obtained by Esonu *et al.* (2006). This could be attributed to the lower crude protein content in the NLM used by the author compared to crude protein content in the present study. No differences were seen in carcass yield due to the use of NLM, and these results were similar to findings reported by Maiorka *et al.* (2001), Moreira *et al.* (2001) and Vargas *et al.* (2002).

Similar values for head, wings and organs (lung, kidney, heart, spleen, liver and gizzard) across the treatments were similar to results obtained by Odunsi *et al.* (2009). Landy *et al.* (2011) reported that carcass traits and internal organ weight of broilers fed diets supplemented with neem (*Melia azadirachta*) or antibiotic were not affected by dietary treatments. Bonsu *et al.*, (2012) also reported that the overall carcass characteristics (dressing percentage and organ weights) were not influenced by the NLM in the diets of the broilers.

Conclusion

Based on the result obtained in this study, dietary inclusion of *Azadirachta indica* meal in broiler chicken diet at chick phase can improve weight gain. Carcass

characteristics were not significantly influenced by the dietary inclusion of NLM. Trials on higher inclusion levels can be conducted to determine if growth can as well be promoted at the finishing phase and perhaps carcass yield.

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