

CARCASS CHARACTERISTICS AND CAECAL MICROBIOLOGY OF BROILER CHICKENS FED NEEM LEAF POWDER AS FEED ADDITIVE

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ABSTRACT

*This study was conducted for eight weeks to evaluate the effect of Neem leaf powder (NLP) as feed additive on carcass characteristics and caecal microbiology of broiler chickens. One hundred and twenty (120) day old broiler chicks were randomly assigned to four dietary treatments replicated thrice with (10) birds per replicate in a completely randomized design. Four diets were formulated to contain neem leaf powder at 0, 2, 4, and 6g/kg of the diet designated as T_1 (control), T_2 , T_3 and T_4 respectively. Data was generated for carcass parameters and caecal microbiology. Compared with the control, the result for carcass characteristics showed that, NLP causes significant decrease ($P<0.05$) in the weights of Crop, Liver, Abdominal fat and intestinal length. Similarly, the weight of head, shank and gizzard showed significant ($P<0.05$) increase with increase in NLP supplementation. The result for caecal microbiology showed no significant ($P>0.05$) difference among the treatment group for total bacteria count and individual species except for *E. coli* which tended to decrease with increase in NLP. It is concluded that NLP supplementation had no adverse effect on carcass characteristics of broiler chickens. It however, caused a reduction in the weight of some internal organs.*

Key Words: Broiler Chickens, Carcass characteristics, Cecal Microbiology, Neem Leaf.

INTRODUCTION

Feed additives such as enzymes, antibiotics, coccidiostats, prebiotics, organic acids, probiotics, etc are being used to improve growth rate, feed efficiency and control diseases. The use of anti-biotics for growth promotion, has received criticism over years. It has been blamed as a factor compromising the effectiveness of antibiotics for treating human infections and posing a serious threat to public health (Wegener, 2003). The situation has put tremendous pressure on the poultry industry to find alternatives. Products of plant origin like spices, herbs and many

plant extract have been recently considered (Windisch et al., 2008). Neem (*Azadirachta indica*) is an indigenous tropical plant, which predominates in Nigeria. It contains several biologically active constituents such as azadirachtin, meliacin, gedunin, salanin, nimbin, valassin and many other derivatives of these principles. (NRC, 1992). The Objective of this study was to evaluate the effect of Neem leaf powder as feed additive on carcass indices and cecal microbiology of broiler chickens.

Materials and Methods

Experimental Site

The study was conducted at the poultry unit of the Teaching and Research Farm, Department of Animal Science, University of Maiduguri. The area, falls between Latitude 11° 05' and 12° North and Longitude 13° 05' and 14° East. It is characterized by short rain fall (3-4 months) which varies from 50 mm to 500 mm, with long dry cold season (8-9 months). The ambient temperature ranges from 20- 42°C (Raji et al., 2009).

Experimental Diets and Processing of Neem Leaves Powder

Neem leaves used for the experiment were obtained within the University of Maiduguri environment. They were air-dried in a ventilated room for one week. The leaves were there after reduced to small particles with mortar and pestle to produce Neem leaf powder (NLP). Four experimental starter (24% CP) and finisher (20% CP) diets were formulated. The NLP was added as additive to the diets at 0, 2, 4, and 6g/kg designated as T₁ as control, T₂ (2g/kg feed), T₃ (4g/kg feed) and T₄ (6g/kg feed). Composition and calculated analysis of the experimental starter and finisher diets are presented in table 1.

Table 1. Composition and Calculated Analysis of Broiler Starter and Finisher Diets

Ingredients (%)	Starter				Finisher			
	Inclusion Level of Neem							
	T ₁ (Control)	T ₂ (2g/kg)	T ₃ (4g/kg)	T ₄ (6g/kg)	T ₁ (Control)	T ₂ (2g/kg)	T ₃ (4g/kg)	T ₄ (6g/kg)
Yellow Maize	46.00	46.00	46.00	46.00	56.00	56.00	56.00	56.00
Groundnut cake	15.50	15.50	15.50	15.50	12.50	12.50	12.50	12.50
Soyabean meal	15.50	15.50	15.50	15.50	12.50	12.50	12.50	12.50
Wheat offal	12.00	12.00	12.00	12.00	10.00	10.00	10.00	10.00
Fish meal	7.00	7.00	7.00	7.00	5.00	5.00	5.00	5.00
Bonemeal	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Limestone	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Salt	0.25	0.25	0.25	0.25	0.20	0.20	0.20	0.20
Premix *	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.15	0.15	0.15	0.15
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated analysis								
Crude protein	23.34	23.34	23.34	23.34	20.46	20.46	20.46	20.46
Crude fibre	3.99	3.99	3.99	3.99	4.50	4.50	4.50	4.50
Calcium	1.57	1.57	1.57	1.57	1.68	1.68	1.68	1.68

Phosphorus	1.01	1.01	1.01	1.01	1.07	1.07	1.07	1.07
Lysine	1.15	1.15	1.15	1.15	1.03	1.03	1.03	1.03
Methionine	0.49	0.49	0.49	0.49	0.46	0.46	0.46	0.46
ME (kcal/kg)	2840.36	2840.36	2840.36	2840.36	2920.94	2920.94	2920.94	2920.94

*Starter premix supplied per kg of feed: Vitamin A =12,000 IU, Vitamins D₃ =2500 IU, Vitamin E =15000mg, Panthotenic acid 15000mg, Vitamin B₁₂ =15000mg, Vitamin B₆ =2500mg, Vitamin K=2000mg, Chlorine = 5000mg, Manganase = 10000mg, Nicotinic acid = 40000mg, Vitamin B₁= 2000mg, Vitamin B₂ =6000mg, Biotin = 6000mg, Vitamin C = 3000mg, Copper = 15000mg, Colbalt = 250mg and Selenium =1000mg.

*Premix finisher supplied per kg of feed: Vitamin A =12,000 IU, Vitamins D₃ =2500 IU, Vitamin E =15000mg, Panthotenic acid 15000mg, Vitamin B₁₂ =15000mg, Vitamin B₆ =2500mg, Vitamin K=2000mg, Chlorine = 5000mg, Manganase = 10000mg, Nicotinic acid = 40000mg, Vitamin B₁= 2000mg, Vitamin B₂ =6000mg, Biotin = 6000mg, Vitamin C = 3000mg, Copper = 15000mg, Colbalt = 250mg and Selenium =1000mg.

*ME=Metabolisable energy= 432 + 27.91 (CP + EE x 2.25 + NFE) (Ichaponami, 1980).

Experimental Stock and Design

One hundred and twenty mixed-sex broiler chicks were randomly allocated into four treatment groups T₁, T₂, T₃ and T₄. Each treatment consists of 30 birds with 10 birds per replicate in a complete randomized design. Feed and water were given ad- libitum, the experiment lasted eight weeks.

Data Collection and Analysis

Carcass Measurement

At eight (8) weeks of age, two birds were randomly selected from each replication and fasted overnight. They were weighed the next morning to obtain the final live weight. They were then, slaughtered scalded in hot water for 60 seconds plucked and then eviscerated. Slaughter weight, plucked weight, dressed weight, weights of cut-up parts and internal organs were determined using a sensitive electronic scale and their proportion expressed as percent of slaughter weight. The length of intestine was measured using a measuring tape.

Cecal Microbial Analysis

At the end of the experiment, caecal content from two birds per replicate was obtained after slaughter for microbial count and identification. The samples were immediately taken to the laboratory. Total and individual bacterial counts were conducted according to standard laboratory procedure and expressed as colony forming unit (cfu/g).

Statistical Analysis

All data collected were subjected to analysis of variance (ANOVA) using a Complete Randomized Design (CRD). Significant differences between treatments were compared using least Significant Differences (LSD).

RESULTS AND DISCUSSIONS

Carcass Characteristics

The effect of including different level of neem leaf powder (NLP) as feed additive on carcass and organs' weights of broiler chickens are presented in Table 2. With the exception of head and shanks and some visceral organs (Gizzard, Liver, Abdominal fat, Crop), NLP supplementation had no significant effect

($P>0.05$) on carcass characteristics of broiler chickens.

The weights of head and shank showed significant ($P<0.05$) increase with NLP supplementation. Chickens on T₂(2g/kg feed) had the highest (5.170%) weights while those on T₄(6g/kg of feed) had the least value of 4.143%. Gizzard weight also, showed significant ($P<0.05$) increase with increase in neem leaf inclusion. Birds on T₂ (2g/kg feed)

recorded heaviest weight (3.903) followed by T₄(6g/kg) and the control (0g/kg feed). The weights of liver showed significant decrease ($P<0.05$) with increase in neem leaf meal (NLM) supplementation. The control had the heaviest weight of liver (2.62%) while chickens on NLM groups recorded lower values (2.07- 2.38%) that were statistically similar.

Table 2: Effect of Neem Leaf Powder Supplementation on Carcass Characteristics of Broiler Chickens

Parameters	Units	Treatment (Diets)				SEM
		T ₁ (Control)	T ₂ (2g/kg)	T ₃ (4g/kg)	T ₄ (6g/kg)	
Live weight	g	1744.7	1148.0	1445.0	1711.0	208.90
Slaughtered weight	g	1671.7	1113.3	1411.7	1641.0	184.59
Plucked weight	g	1580.0	1060.7	1337.0	1540.7	176.47
Carcass weight	g	1103.3	776.7	1009.0	1146.7	124.59
Dressing percentage	%	65.913	67.947	62.530	68.853	2.0184
Cut-up parts						
Shanks	%	4.2400 ^{ab}	5.1700 ^a	4.8867 ^{ab}	4.1433 ^b	0.2983 [*]
Neck	%	4.9400	4.6700	4.5000	4.5133	0.1510
Breast	%	15.147	13.247	15.513	16.390	1.0472
Drumsticks	%	8.6967	8.8233	8.7000	8.6000	0.2684
Thighs	%	9.4400	9.1970	10.293	9.1470	0.7115
Back	%	12.397	12.520	13.253	13.170	0.5557
Wings	%	6.8900	7.4333	7.4967	6.9033	0.3108
Head	%	2.4500 ^b	3.6033 ^a	2.8267 ^{ab}	2.4700 ^b	0.3046 [*]
Organs						
Gizzard	%	2.940 ^b	3.9033 ^a	2.8200 ^b	3.0800 ^{ab}	0.2687 [*]
Liver	%	2.620 ^a	2.0767 ^b	2.1433 ^{ab}	2.3800 ^{ab}	0.1495 [*]
Abdominal fat	%	1.140 ^a	0.2667 ^b	0.9467 ^{ab}	0.5233 ^{ab}	0.2376 [*]
Crop	%	0.690 ^a	0.5267 ^{ab}	0.6533 ^a	0.2633 ^b	0.0924 [*]
Heart	%	0.460	0.5000	0.3900	0.4033	0.0564
Intestines	%	7.870	5.7733	7.0633	6.5200	0.9578
Kidneys	%	0.123	0.1933	0.1200	0.1967	0.0376
Intestinal Length	cm	237.0 ^a	198.67 ^{ab}	178.67 ^{ab}	170.67 ^b	19.812 [*]

Means on the same row with different superscripts letters (a,b) are significantly different ($p<0.05$). *=Significant difference ($p<0.05$), SEM=Standard error of mean.

The abdominal fat weights also showed significant decrease ($P < 0.05$) with increase in neem leaf meal (NLM) supplementation. Birds on T2 (2g/kg) recorded the least weight (0.26), while the control recorded the highest weight (1.14%). Similarly, weight of crop showed significant ($P < 0.05$) effect with tendency to decrease with increasing level of NLP inclusion. Chickens on the control and group on 4g/kg NLP recorded the highest (0.690 and 0.653%) weight while the least (0.260%) value was recorded for birds on T4 (6g/kg). The length of the intestine also showed significant ($P < 0.05$) reduction with increasing level of neem leaf powder. Chickens on the control group recorded the longest (237.00 cm) length followed by those on 2g/kg (198.67cm) and 4g/kg NLP (178.67cm) while the shortest (170.67cm) length was recorded for T4 (6g/kg).

Cecal Microbiology

The result for total bacteria count and individual bacteria count is presented in Table 3. With the exception of *E. coli*, the result in this study showed no significant ($P > 0.05$) difference among the treatment group for total bacteria count and individual species. The result for *Escherichia coli* showed significant ($P < 0.05$) difference among the treatment group. The control (T₁) recorded the highest (22.33cpu) concentration while T₄ (6g/kg) had the lowest (11.67 cpu/g) concentration of the bacterium. The trend showed a decreasing effect with increase in NLP inclusion.

Discussion

Carcass Characteristics

Lack of significant effect of NLP supplementation on major carcass characteristics of broiler chickens is in

agreement with findings of Ubua et al. (2019) Obun et al. (2013), Obikaonu et al. (2013), Obikaonu et al. (2012), Bonsu et al (2012), Ogbuewu et al. (2011), Ogbuewu et al. (2010) and Esonu et al (2006) who observed a similar trend in birds fed $\leq 5\%$ neem leaf meal.

Higher values for the weights of head and shanks observed in this study is similar to the findings of Frimpong (2013) and Uchegbu et al, (2004) who reported higher values for the shanks weights of birds fed with neem kernel cake diets compared to the birds on the control diet. Similarly, significant increase in the weights of empty gizzard with increase in neem leaf inclusion concurs with the findings of Oloyede et al. (2010) and Edeh (2013) who reported an increase in the weight of the empty gizzard with increase in neem leaf meal inclusion. The higher percentage weight of gizzard observed on birds fed the neem leaf powder diet might be as a result of the muscular development of the gizzard in order to handle some extraneous component of the diet.

The effect of NLP on the weights of liver observed in this study agrees with the findings of Abdulazeez et al. (2014), Ozung et al. (2013) and Obun et al. (2013) who reported a reduction in the weight of the liver with increase in neem leaf meal inclusion. On the contrary, several authors (Beg et al 2019, Ogbuewu et al., 2015, Edeh 2013 and Uko and Kamalu, 2008) reported increase in the weight of liver with increasing levels of neem leaf and seed kernel. The variation with this study could be as result of discrepancies in inclusion level (0.4- 2.5%,)

Table 3: Effect of Neem Leaf Powder Supplementation on Caecal Microbiology of Broiler Chickens

Bacteria	Treatment				SEM
	T ₁ (control)	T ₂ (2g/kg)	T ₃ (4g/kg)	T ₃ (4g/kg)	
Total bacterial count	34.67	35.33	33.22	33.19	007.63
Escherichia coli	22.33 ^a	20.33 ^{ab}	13.67 ^{bc}	11.67 ^c	3.704*
Streptococcus faecalis	6.670	7.670	5.000	3.330	2.041
Staphylococcus aureus	1.670	1.330	0.670	1.670	1.374
Corynebacteria spp	3.000	3.670	2.332	2.000	0.882
Bacillus subtilis	2.332	2.000	0.671	1.001	1.130
Proteus mirabilis	0.000	0.333	0.000	0.333	0.333

The Observation in this study coupled with elevated liver enzymes earlier observed in this study could be an indication of residual bioactive components (Azidirachtins and linonoids) and to anti nutritional factors such as tannins, phenolic compounds and oxalates in the leaves powder which may have depressed this organ. Some authors related this effect to increase in activity of the liver in order to detoxify antinutritional substances in the neem leaf.

Significant decrease in abdominal fat weights with increase in neem leaf meal (NLM) supplementation is in consonance with the findings of Uko and Kamalu (2008), Edeh (2013), Obikaonu et al. (2013) and Ogbuewu et al. (2015) who reported reduced abdominal weight with increasing level neem leaf inclusion in diets. This shows that the increasing level of neem leaf powder significantly reduces abdominal fat deposition in the birds. This observation could also be indirectly related to the effect of liver on lipid metabolism where increased activity of the liver in detoxifying anti nutritional factors might have caused an increase in activity of enzymes involved in the conversion of

cholesterol to bilious acids, increase lipid utilization and subsequently decrease abdominal fat. Alternately, the fat reserve could have been used as energy source to sustain metabolic activities. Intestinal length reduction observed in this study contradicts the findings of Edeh (2013) who reported significant increase in the intestinal length of the birds with an increasing level of neem leaf extract inclusion. The author opined that the increased weight of segments of the gastrointestinal tract in chickens fed NLM could be as a result of increased muscular activity due to increased fibre in the diets. The differences with this study could be due to the differences in processing methods used in the preparation of the neem leaf (powder vs extract).

Cecal Microbiology

Significant effect of NLP supplementation on Escherichia coli count found in this study agreed with the report of Beg et al. (2019) who reported highest (163 x10⁴cfu/g) cecal bacteria count from the control group compared to (20 to 44x10⁴cfu/g) in broiler chickens fed NLM. It is also in agreement with the report of Das et al. (1999) who reported the antibacterial effect of neem leaves powder against E. coli infection in

fishes. Previous studies have shown that extracts of *A. indica* were effective against *E. coli* and *S. faecalis* (Koono and Budida, 2011). Antibacterial potential of leaf extract of neem has been proven against methicillin-resistant *S. aureus* (MRSA) by Sarmiento et al. (2011). This indicate that addition of neem leaf powder was effective in controlling this intestinal bacterium.

CONCLUSION

The findings of this study suggest that neem leaf supplementation in the diets of broiler chickens had no adverse effect on carcass characteristics of broiler chickens. It however, caused a reduction in the weight of some internal organs.

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