Effect of *Senna alata* Leaf as an Alternative Anti-coccidian on Growth Performance, Oocyst Counts and Carcass Characteristics of Broiler Chickens

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Abstract

A sixty-three (63) days experiment was conducted to assess the effects of *Senna alata* leaf meal as an alternative anti-coccidian in the water of broiler chickens using one hundred and fifty, a day old Abor acre broiler chickens raised in a deep litter system in five treatments with three replicates each. Treatment one was the control which had only water, treatment two had 0.25ml of Diclosol (Diclazuril 10mg) per litre of water. Treatment three had 1.5g of *Senna alata* leaf meal per litre of water, treatment four had 1g of Embaccoc (Sulfametrazole 200mg + Trimethoprim 40gm + Vit K 20gm) per litre of water while treatment five had 1g of Prococc (Amprolium 200mg + Sulfaquinoxaline 200mg + Vit K 2mg) per 3 litres of water. Data on the growth performance, oocyst count of *Eimeria* spp and carcass characteristics were collected. Results obtained showed 1.5g of *Senna alata* leaf per litre of drinking water significantly reduced ($P<0.05$) the oocyst count of caecum in the third week from (483.30o/g) to (233.00o/g), and in the sixth week, from (1686.70o/g) to (166.67o/g) after administration. There was a significant difference ($p<0.05$) in the breast, wings, shank, proventriculus and liver with variations in the values obtained for the various treatments. It was concluded that *Senna alata* inclusion as an alternative anti-coccidian reduced the oocyst count of *Eimeria* species in the ileum and caecum of the broiler chickens.

Keywords: Intestinal content, Ceacum, Oocyst count, Carcass characteristics, *Senna alata* leaf meal

Introduction

Coccidiosis is a parasitic disease of the intestinal tract of animals caused by coccidian protozoa. It is one major parasitic disease of poultry with substantial economic losses due to malabsorption, bad feed conversion rate, reduced weight gain and increased mortality (Hafeez, 2008). Avian intestinal coccidiosis is a ubiquitous protozoa gastrointestinal parasite that is a microscopic, single-celled organism that primarily affects young chickens. The disease is typically seen in birds from 3-6 weeks of age before they acquire immunity (Maurice, 2012).

The emergence and spread of drug-resistant pathogens that have acquired new resistance mechanisms, leading to antimicrobial resistance, continue to threaten our ability to treat common infections (WHO 2021). Furthermore, the development of drug resistance and potential toxic effects of some antibiotics in poultry birds has led to the use of naturally occurring medicinal plants in the treatment of various bacteria causing infections in poultry. Coccidiosis is one of the

most common and economically important diseases of chicken worldwide, and that has a major economic impact on the global poultry industry (Williams, 1996). Ethno-medicine using plant extracts and leaves provides health coverage for most developing countries, particularly among rural dwellers. This is because medicinal plants are known to contain certain biological compounds that are potent for medicinal utilities (Ekpo & Etim, 2009).

The scientific appraisal of the pharmacological activities of herbal plants revealed about 200,000 phytochemicals and these compounds contribute to the apparent medicinal activities displayed by plants and invariably justify the involvement of natural products in the development of novel drugs (Svahn, 2015). Despite these achievements, the use of herbal drugs was not universally accepted in contemporary medicine due to lack of scientific evidence and proper documentation. However, the significance of herbs in pharmacology has necessitated the provision of scientific facts on bioactive compounds and pharmacological assays of plants (Balunas & Kinghorn 2005, Singh *et al*., 2012). Traditional medicine using plant extracts continues to provide health coverage for over 80% of the world's population, especially in the developing world. Medicinal plants are known to owe their curative potentials to certain biologically active substances that are referred to as active principles or phytochemical substances that exist in parts of the plants (Ekpo & Etim, 2009). The emergence of resistance build-up by pathogens over continuous usage of conventional drugs and antibiotics has become a global concern.

Senna alata locally known as gungoroko (Nupe- Northern Nigeria), asunwon oyinbo (yoruba - Western Nigeria), nelkhi (Igbo - Eastern Nigerian) is a pantropical ornamental shrub, belonging to the family Fabaceae. It is commonly known as a ringworm plant and is widely distributed from tropical America to India. Ibrahim & Osman (1995). The leaves of *Senna alata* possess analgesic, antimicrobial, antitumor, and antidiabetic properties (Somchit *et al.*, 2003). The leaves have been locally used in Nigeria in the treatment of several infections such as ringworm and parasitic skin diseases (Abdulwaliyu, 2013).

Hence the objective of this study was to assess the effect of *Senna alata* leaf as an alternative anti-coccidian on the growth performance, Oocyst counts of *Eimeria* species and carcass characteristics of broiler chickens.

Materials and methods

Animals and experimental designs

Approximately 150 a-day-old broiler chicks were randomly allotted into five treatments of 30 birds each and replicated thrice with 10 birds per replicate in a completely randomized design. The Experimental treatment (prophylactic coccidian treatment) was given at an interval of three weeks at the third week (Starter phase), sixth week (Grower phase), and ninth week (Finisher phase) of the experiment for a period of 3days, rest for two days and administered again for another two days.

The five treatments are as follows:

T_1 (control) - Water only

T_2- 0.25ml of Diclosol (Diclazuril 10mg) per litre of water.

T_3- 1.5g of *Senna alata* leaf meal per litre of water.

T_4- 1g of Embaccoc (Sulfametrazole 200mg + Trimethoprim 40gm + Vit K 20gm) per litre of water.

T_5- 1g of Prococc (Amprolium 200mg + Sulfaquinoxaline 200mg + Vit K 2mg) per 3 litres of water.

Intestinal content was collected from the birds before the administration of the treatments and collected again after the administration of the treatments. The synthetic anti-coccidian used was mixed according to the manufacturer's instructions. The administration was done following the growth cycle of the *Eimeria* species.

Senna alata leaf preparation

Senna alata leaves were collected from Ijebu Ode in Ogun state, Nigeria. The leaves were authenticated at the Forestry Research Institute of Nigeria (FRIN) and air dried till completely dried, ground using a hammer mill, sieved using a 2mm sieve and kept in airtight containers.

Parasitology examination

Poultry beddings suspected to be infected with coccidiosis were sourced from a farm that had the disease outbreak. Samples of bedding from the farm were taken to the laboratory to confirm the presence of *Eimeria* which was confirmed positive. After brooding, the old litters of the experimental birds were packed and the infected litters were mixed with new litter and evenly spread across the treatments.

Data collection

Data was collected on the following parameters:

Growth Performance

The growth performance was determined by taking the feed intake daily and also the weight changes weekly and recorded. The feed conversion ratio was recorded at the end of the experiment.

Feed intake = Amount of feed served - Leftovers.

Weight gain = Final weight – initial weight

The feed conversion ratio (FCR) was determined at the end of the feeding trial using the formula below:

$$FCR = \frac{Feed\ intake\ (g)}{Body\ Weight\ gain\ (g)}$$

Oocyst counts

Intestinal content from different parts of the small intestine was collected and put into sample bottles and this was stored in ice and taken to the laboratory where the Oocysts were counted using the McMaster counting technique (Long & Rowell, 1958)

Carcass characteristics of broiler chicken.

At the end of the ninth week of the experiment, two birds per replicate were fasted for 8 hours and the body weights were taken and recorded. The birds were slaughtered by cutting through the jugular vein after which they were allowed to bleed and the weights were once again taken and recorded. Other procedures such as de-feathering, evisceration and cutting into primal cuts were carried out and weights were taken and recorded accordingly. Weights of some organs such as the liver, lungs, heart, gizzard and bile were also taken and recorded accordingly.

Statistical analysis

All data collected were subjected to analysis of variance (ANOVA) using SAS, (2005) and significant means were separated using Duncan's multiple range test of the same statistical package.

Results

The effects of *Senna alata* leaf as an alternative anti-coccidian on the growth performance of broiler chickens at the starter, grower and finisher phases are presented in Table 1. There were no significant ($p>0.05$) differences among all the parameters

measured at all the phases. All the results collected for the final weight, average daily weight gain, total feed intake, average daily feed intake and the feed conversion ratio were not significantly different (P>0.05).

Table 1. Effect of *Senna alata* leaf meal as alternative anti-coccidian on growth performance of Broiler Chickens

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Starter						
Initial weight(g/b)	48.10	49.77	50.26	48.10	45.43	0.45
Final weight(g/b)	675.00	654.00	679.17	613.66	660.65	12.74
Total weight(g/b)	626.90	604.39	628.91	565.56	615.21	12.71
Av. Daily weight(g/b/d)	31.46	30.46	31.62	28.56	30.83	0.60
Total feed intake(g/b)	834.77	813.84	843.64	814.32	814.71	9.27
Av. Feed intake(g/b/d)	40.18	38.75	40.17	38.78	38.79	0.44
FCR	1.35	1.35	1.34	1.46	1.33	0.03
Grower						
Initial weight(g/b)	675.00	654.17	679.17	613.66	660.65	12.75
Final weight(g/b)	1752.78	1745.24	1886.11	1706.75	1718.65	26.77
Total weight(g/b)	1077.78	1091.07	1206.94	1093.09	1058.00	29.92
Av. Daily weight(g/b/d)	153.97	155.87	172.42	156.16	151.14	4.27
Total feed intake(g/b)	3386.31	3216.87	3377.56	3244.49	3238.10	33.12
Av. Feed intake(g/b/d)	1128.77	1072.29	1125.79	1081.50	1079.37	11.04
FCR	3.16	2.98	2.80	2.98	3.11	0.08
Finisher						
Initial weight(g/b)	1752.78	1745.24	1886.11	1706.75	1718.65	26.77
Final weight(g/b)	2968.10	2966.70	3304.20	3146.70	3116.10	52.96
Total weight(g/b)	1215.30	1221.40	1418.10	1439.90	1397.50	52.75
Av. Daily weight(g/b/d)	173.61	174.49	202.50	205.70	199.64	7.54
Total feed intake(g/b/d)	2011.30	1925.00	1959.30	1908.20	1870.40	57.32
Av. feed intake(g/b/d)	287.33	275.00	279.90	272.60	267.20	8.19
FCR	1.69	1.59	1.39	1.36	1.34	0.07

T_1 (control) - Water throughout the experimental period, T_2- 0.25ml 0f Diclosol (Diclazuril 10mg) per litre of water, T_3- 1.5g of *Senna alata* leaf meal per litre of water., T_4- 1g of Embaccoc (Sulfamethoxazole 200mg + Trimethoprim 40gm + Vit K 20gm) per litre of water: T_5- 1g of Prococc (Amprolium 200mg + Sulfaquinoxaline 200mg + Vit K 2mg) per 3 litres of water. SEM=Standard error of means; FCR=Feed conversion ratio; g/b/d= gram per bird per day Av. =Average

Oocyst count of Eimeria species in the ileum and caecum before and after administration of Senna alata leaf meal as an alternative anti-coccidian

Eimeria species causing coccidiosis majorly affects the small intestine and different species of this parasite affect different parts of the small intestine. The result obtained for the Oocyst count of *Eimeria* species in the ileum is presented in Table 2. It showed that there was no significant (P>0.05) difference in the oocyst count of *Eimeria* species found in the ileum of the birds before and after administration of anti-coccidian treatments at the third and sixth week. However, at the ninth (9^{th}) week there was significant difference before administration of anti-coccidian treatment, and birds administered *Senna alata* leaf had significantly (P<0.05) lower oocyst count (50o/g) which compared favourably with control (50.00), Diclosol (83.33o/g) and Prococc (0.00o/g), while birds in Embacoc group had the highest oocyst count(250o/g) however, there were no significant differences (P>0.05) observed after administration of the anti-coccidian treatments.

Table 2. Effect of *Senna alata* leaf meal *on the* oocyst count of *Eimeria* species in the ileum of broiler chicken

Weeks/ Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Third week						
Before(oocyst/g)	1116.70	1266.70	1533.30	1433.30	2083.30	242.87
After (oocyst/g)	566.70	533.30	450.00	466.70	650.00	55.77
Sixth week						
Before (oocyst/g)	550.0	1000.00	1000.00	1466.70	1083.30	214.24
After (oocyst/g)	116.67	150.00	216.67	233.33	233.33	21.93
Ninth week						
Before (oocyst/g)	50.00^{b}	83.33^{b}	50.00^{b}	250.00^{a}	0.00^{b}	27.37
After (oocyst/g)	75.00	100.00	125.00	100.00	125.00	9.51

^{a,b,c} Means along the same row with different superscripts are significantly different (p<0.05): SEM=Standard error of means: T_1 (control) - Ordinary water throughout the experimental period; T_2- 0.25ml of Diclosol (Diclazuril 10mg) per litre of water.; T_3- 1.5g of *Senna alata* leaf meal per litre of water. T_4- 1g of Embaccoc (Sulfamethoxazole 200mg + Trimethoprim 40gm + Vit K 20gm) per litre of water.T_5- 1g of Prococc (Amprolium 200mg + Sulfaquinoxaline 200mg + Vit K 2mg) per 3 litres of water.

The oocyst count of *Eimeria* species in the caecum is represented in Table 3. The administration of 1.5g of *Senna alata* leaf per litre of drinking water significantly reduced oocyst count in the (3) third week from (483.30o/g) to (233.00o/g). In the sixth week, a significant difference (P<0.05) was noticed before administration of the anti-coccidian treatments with birds on *Senna alata* leaf treatment having the highest oocyst count(1686.70o/g) which was reduced to (166.67o/g) after administration. No significant difference (P>0.05) was recorded for the oocyst counts during the ninth week of administration.

Table 3. Effect of *Senna alata* leaf meal on the oocysts count of *Eimeria* species in the caecum of broiler chicken

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Third week						
Before	1200.00^{b}	583.30^{c}	483.30^{c}	283.30^{c}	1883.30^{a}	162.02
After	583.30^{ab}	280.00^{b}	233.00^{b}	650.00^{ab}	750.00^{a}	75.82
Sixth week						
Before(oocyst/g)	975.00^{ab}	620.00^{ab}	1686.70^{a}	1416.70^{a}	200.00^{b}	187.74
After (oocyst/g)	200.00	250.00	166.67	100.00	216.67	23.13
Ninth week						
Before(oocyst/g)	216.70	453.30	81.70	50.00	58.30	62.96
After (oocyst/g)	100.00	100.00	225.00	175.00	100.00	19.79

^{a,b,c} Means along the same row with different superscripts are significantly different ($p<0.05$); SEM=Standard error of means; T_1 (control) - Ordinary water throughout the experimental period; T_2 (0.25ml) 0f Diclosol (Diclazuril 10mg) per litre of water.; T_3(1.5g) of *Senna alata* leaf meal per litre of water.; T_4(1g) of Embaccoc (Sulfamethoxazole 200mg + Trimethoprim 40gm + Vit K 20gm) per litre of water.; T_5- (1g) of Prococc (Amprolium 200mg + Sulfaquinoxaline 200mg + Vit K 2mg) per 3 litres of water.

Carcass characteristics of broiler chickens administered Senna alata leaf meal as an alternative anti-coccidian

The results of the carcass analysis of broiler chicken served with *Senna alata* leaf meal as an alternative anti-coccidian treatment are presented in Table 4. There were significant differences in the breast, wings, shank, proventiculus and liver. All other parameters did not show a significant difference ($P>0.05$). The birds administered Diclosol as an anti-coccidian had the least breast weight (22.22%), while the birds in the control treatment without any anti-coccidian treatment had the highest breast weight (27.66%). Weights obtained for the wings were not significantly different ($P<0.05$) but the birds on the control diet and birds administered *Senna alata* treatment had the highest weights (8.23 and 7.99%) respectively. The birds administered Diclosol and *Senna alata* as anti-coccidian treatment had the lowest values for the shank, proventriculus. (2.48 and 2.34%) and (0.32 and 0.31%) respectively. The control birds which had water alone throughout the experimental period without any form of anti-coccidian treatment had the least weight for the liver (1.41%). Birds administered Embacoc and Prococ had the highest values for the liver weights (1.96 and 1.95%) respectively while the value obtained for the birds administered was comparable to the control value.

Discussion

The effect of administration of *Senna alata* leaf meal as an alternative anti-coccidian did not show any effect on the growth performance of broiler chickens but numerically, birds administered water containing *Senna alata* leaf meal as an alternative anti-coccidian had the best total weight gained at the starter and the finisher phase. The reports obtained in this study contradicts the reports of Alabi *et al.* (2017) who reported a significant difference in all the parameters measured for broiler chickens served water containing *Moringa oleifera* leaf extracts, and Kwari *et al.* (2019) reported poor growth performance for broiler chickens fed

Table 4. Effect of *Senna alata* Leaf Meal as an alternative anti-coccidian on carcass characteristics of broiler chickens

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Live weight (g)	2916.70	2750.00	2766.70	3250.00	3183.30	102.62
Bled weight (%)	98.26	95.55	98,26	97.90	96.66	1.01
Defeathered weight (%)	95.49	88.14	93.31	94.31	93.19	1.22
Eviscerated weight (%)	83.94	74.17	82.31	80.03	80.93	1.66
Carcass weight (%)	74.86	64.19	75.06	70.31	71.35	1.70
Primal cut (% of live weight)						
Breast weight (%)	27.66^{a}	22.22^{b}	25.82^{ab}	24.19^{ab}	24.45^{ab}	0.75
Drum stick (%)	9.67	10.11	10.04	10.70	10.73	0.27
Thigh (%)	12.40	11.38	12.97	13.12	13.05	0.31
Back (%)	13.39	12.62	12.56	11.24	11.93	0.39
Wings (%)	8.23^{a}	7.07^{b}	7.99^{a}	7.54^{ab}	7.65^{ab}	0.15
Other cuts (% of live weight)						
Shank (%)	2.79^{ab}	2.48^{b}	2.34^{b}	3.62^{a}	3.05^{ab}	0.17
Head (%)	1.79	1.61	1.64	2.29	1.85	0.12
Neck (%)	3.82	3.77	4.24	4.42	4.14	0.18
Visceral organs (% of live weight)						
Proventiculus (%)	0.35^{ab}	0.32^{b}	0.31^{b}	0.49^{a}	0.38^{ab}	0.03
Gizzard (%)	1.25	1.28	1.29	1.41	1.19	0.04
Liver (%)	1.41^{b}	1.51^{ab}	1.46^{ab}	1.96^{a}	1.95^{a}	0.09
Heart (%)	0.33	0.29	0.34	0.37	0.37	0.16
Lungs (%)	0.39	0.41	0.32	0.42	0.41	0.03
Spleen (%)	0.07	0.06	0.05	0.09	0.04	0.01
Abd.fat (%)	1.17	1.06	1.04	1.63	1.26	0.13
Bile (%)	0.09	0.07	0.10	0.12	0.10	0.00

^{a,b,c}; means along the same row differ significantly at ($p<0.05$); T_1 (control) =Ordinary water throughout the experimental period, T_2=0.25ml of Diclosol (Diclazuril 10mg) per litre of water, T_3=1.5g of *Senna alata* leaf per liter of water, T_4=1g of Embaccoc (Sulfamethoxazole 200mg+Trimethoprim 40gm+VitK 20gm) per litre of water, T_5=1g of Prococc (Amprolium 200mg + Sulfaquinoxaline 200mg +VitK 2mg) per 3 litres of water, SEM=Standard error of mean

diets containing differently processed *Senna obtusifolia* seed meal.

The results are also not in agreement with the reports of Banjoko *et al.* (2019) who reported that the best feed intake, final weight and weight gained for the birds in the positive and negative control of broiler chickens fed diets containing Vernonia amygdalina leaf meal.

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diets containing *Vernonia amygdalina* leaf meal.

Chandrabhanu *et al*. (2013), identified flavonoid and phenolic compounds in the aerial parts of *Senna alata* that have antioxidant and anti-inflammatory effects. Indeed, the efficacy of *Senna alata* in the oocysts excretion and counts in the ileum and caecum reduction observed in the study might be ascribed to the beneficial action of antioxidants contained in the leaves. *Senna alata* leaf inclusion in the water of broiler chickens as an alternative antioxidant reduced the oocyst count of *Eimeria* species in the ileum at the starter and the grower phase but the count was increased at the finisher phase. There was also a significant reduction in the oocyst count of *Eimeria* species at the starter and grower phases in the caecum of the broiler chickens. The *Senna alata* leaf meal exhibited an inhibitory effect on the shedding of oocyst count in the faeces of broiler chickens. The report of this study is in agreement with the reports of Onyiche *et al.* (2021) who also reported an inhibitory effect on the shedding of oocyst count in the faeces of broiler chickens experimentally infected with *Eimeria* spp. And treated with leaves extract of *Azadirachta indica*.

There was significance in the breast, wings, proventriculus, shank and liver in the carcass characteristics of broiler chickens administered *Senna alata* leaf meal as an alternative anti-coccidian and other conventional drugs. According to the reports of Banjoko *et al*. 2018, this might be attributed to the anti-nutritional factors present in the leaf meal.

Conclusion

It can be concluded that the inclusion of *Senna alata* leaf meal as an alternative anti-coccidian without affecting the growth performance and carcass characteristics of broiler chicken

Recommendations

It is therefore recommended that *Senna alata* leaf meal be used as an alternative anti-coccidian in the water of broiler chicken.

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