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Performance and cost analysis of broiler chickens fed 1% diatary inclusion of four different medicinal plants

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Abstract

The study was conducted to evaluate the performance, health and cost benefits of broiler chickens fed 1% of different diets of four selected medicinal plants. An hundred and fifty pieces of day old broiler birds were purchased from CHI farm in Ibadan, Oyo State, Nigeria. These birds were randomly assigned to five treatment groups in a completely randomized design involving group A= birds on synthetic antibiotic, B= birds on Garlic meal, C= birds on Ginger meal, D= birds on mango leaf meal and E= birds on neem leaf meal. Each treatment group was replicated trice to obtain a total of 15 replicates of 10 birds each. The chickens were randomly assigned to experimental pens of 2m x 2m each and raised in a deep liter system of management. Feed and water were provided ad-libitum, proper routine management practices and medications was strictly adopted. The trial lasted for 8 weeks. The results of the performance of the experiment showed no significant difference (P> 0.05) was observed among all the treatments for average final weight and daily weight gain. However, daily feed intake and feed conversion ratio increased significantly (P< 0.05) for the birds on D and E. The cost analysis results showed no significant difference (P> 0.05) in the cost of total feed/ kg. However, the costs of feed consumed, vaccination and medication for the birds on group B, C, D and E were significantly higher than A (P< 0.05). It was further observed that the costs of feed/weight gain and average production were similar (P> 0.05) for the birds on group A, B and C but significantly lower than D and E (P< 0.05) . However, the average sales price of the birds on A, B and C were similar (P> 0.05) but significantly higher than D and E (P< 0.05). Moreover, treatments A and C were more profitable with similar values (P> 0.05) followed by B and D but the result of E showed a significant loss (P< 0.05). At the end of this study, it was concluded that 1% dietary inclusion of ginger in broiler production is encouraged since lesser quantity of feed is used to produce 1kg of weight.

Keywords: Performance; Broiler; Different; Medicinal; Plants

1. Introduction

The increasing concern for antibiotic resistance and consumer preferences for natural alternatives in livestock feed has led to a growing interest in the use of medicinal plants in broiler production. Medicinal plants have been traditionally used in various cultures for their therapeutic properties, and recent studies have begun to explore their potential to enhance broiler health and productivity. Medicinal plants have been reported to be rich in bioactive compounds like polyphenols, flavonoids, and alkaloids, which can improve nutrient absorption, digestibility, and overall health in broilers. For instance, Azadirachta indica (neem) has been found to enhance feed efficiency and promote growth due to its high nutritional profile (Ajayi and Ibe, 2019, Hossain et al., 2018). Similarly, Allium sativum (garlic) has demonstrated antimicrobial properties that can aid in gut health, potentially leading to better weight gain and feed conversion ratios (Khajali & Toghyani, 2017). Furthermore, Alagawany et al., 2019 confirmed the use of medicinal plants to improve the immune system in broilers; their Research indicates that herbal extracts such as Thymus vulgaris (thyme) can have

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immunomodulatory effects, improving the bird's ability to resist diseases. Additionally, Echinacea purpurea is noted for its ability to enhance humoral and cellular immunity, thus protecting broilers from common infectious diseases (Bhanja et al., 2018). This study is therefore focused to evaluate the effects of some selected medicinal plants on the performance of broiler chickens and their production cost

2. Materials and methods

The ginger and garlic used in this study were harvested from Agricultural Technology Departmental demonstration farm after which they were thoroughly washed and sundried for one week, these dried materials were milled into a powder form the mango and neem leaves were harvested within Akanu Ibiam Polytechnic compound, these leaves were air dried for three days, smashed and incorporated into formulated feed at 1% inclusion. The feeds were formulated and offered in mash form to the respective birds from day old until 56th day.

2.1. Experimental diets

The starter and finisher diets were formulated and fed to the experimental birds. The compositions of the diets are as shown in Table 1 and 2.

Table 1 Percentage composition of the starter diets

Ingredient (%)	**T1**	**T2**	**T3**	**T4**	**T5**
Maize	45.57	44.57	44.57	44.57	44.57
Wheat offal	5.05	5.05	5.05	5.05	5.05
PKC	4.51	4.51	4.51	4.51	4.51
GNC	18.05	18.05	18.05	18.05	18.05
Soya bean meal	20.30	20.30	20.30	20.30	20.30
Fish meal	2.26	2.26	2.26	2.26	2.26
Galic meal	0.00	1.00	0.00	0.00	0.00
Mango leaf meal	0.00	0.00	1.00	0.00	0.00
Neem leaf meal	0.00	0.00	0.00	1.00	0.00
Ginger meal	0.00	0.00	0.00	0.00	1.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Salt	0.50	0.50	0.50	0.50	0.50
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Total(kg)	100	100	100	100	100
Calculated analysis;					
Crude Protein (%)	22	22	22	22	22
Crude Fibre(%)	5	5	5	5	5
Energy Kcal/kg	2800	2800	2800	2800	2800

Table 2 Percentage composition of the finisher diets

Ingredient	T1(kg)	T2(kg)	T3(kg)	T4(kg)	T5(kg)
Galic meal	0.00	1.00	0.00	0.00	0.00
Ginger meal	0.00	0.00	1.00	0.00	0.00
Mango leaf meal	0.00	0.00	0.00	1.00	0.00
Neem leaf meal	0.00	0.00	0.00	0.00	1.00
Maize	48.97	51.66	53.13	50.52	53.14
Wheat offal	5.44	1.84	1.46	2.71	1.00
PKC	4.03	4.03	4.02	4.05	3.96
GNC	16.14	16.09	16.06	16.21	15.84
Soya bean meal	20.17	20.13	20.08	20.26	19.81
Bone meal	4.00	4.00	4.00	4.00	4.00
Salt	0.50	0.50	0.50	0.50	0.50
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Total Calculated analysis	100	100	100	100	100
Crude Protein (%)	21	21	21	21	21
Crude Fibre (%) Crude fat (%)	5.94 4.82	4.99 4.48	4.75 4.15	5.17 3.81	4.64 3.51
Energy Kcal/kg	2990	2899	2895	2994	2896

** To provide the following per kilogram of feed; vit A 10,000IU; vit. D3 1,500 IU; vit. E 2 mg; riboflavin 3 mg; pantothenic acid 10 mg; nicotinic acid, 2.5 mg; choline 3.5 mg; folic acid 1mg; magnesium 56 mg; lysine 1mg; iron 20 mg; zinc 50 mg; cobalt 1.25 mg.*The metabolizable energy of the test ingredient was calculated using prediction equation as reported by Pauzenga, 1985 with the formula M.E = 37 X %CP + 81.8 X %EE + 35.5 X%NFE

Note: GNC =ground nut cake. PKC=Palm Kernel Cake. CP=crude Protein.CF=Crude Fibre.T1= control diet 0% medicinal plant. T2= 1% garlic meal. T3= 1% ginger meal. T4= 1% mango leaf meal. T5= 1% neem leaf meal.

2.2. Experimental birds and management

A total of one hundred and fifty (150) Abor ecre strains of a day old broilers with an average weight of 0.40kg were used for the experiment. The broilers were randomly assigned to five treatment groups in a completely randomized design involving 1% dietary inclusion of four different medicinal plants, garlic meal, ginger meal mango leaf meal and neem leaf meal. Each treatment group was replicated in triplicate to obtain a total of 15 groups of 10 birds each. The chickens were randomly assigned to an experimental unit of 2m by 2m each partitioning and raised in a deep liter system of management. Feed and water were given *ad-libitum* and proper routine management practices and medications strictly adopted. The feeding trial lasted for 56 days.

2.3. Data collection and measurements

Data were collected on the growth performance and the cost implication of using the 1% dietary inclusion of these medicinal plants in broiler production. The day old chicks were weighed on arrival at the beginning of the experiment to ascertain their initial body weight and subsequently on weekly basis until the 56th day the experiment lasted to determine their weekly weight gain, daily weight gain and average final weight .The birds were brooded separately in their replicates; Feed intake was recorded daily and was determined by the weigh back technique which involved obtaining the difference between quantity of feed offered and the left over the following morning. Feed conversion ratio (FCR) was calculated from the data of feed intake and weight gain as the quantity of feed taken daily per kilogram of weight gain over daily weight gain. Data collected were analyzed in a completely randomized design ANOVA. Differences

among means were determined with Duncan's multiple-range test with 5% level of significance as described by Steel and Torrie (1980). The data were computed with IBM SPSS statistical 16 of 2013 software. Feed samples were assayed for their proximate composition by the method of AOAC (1990).

2.4. Proximate composition of experimental materials

Table 3 The proximate composition of Garlic,Ginger, mango leaves and Neem leaves

Accessions	MC(g/100 g)	CP (g/100 g)	CA (g/100 g)	CF(g/100 g)	F(g/100 g)	CHO(g/100 g)
Garlic	4.55	15.33	4.08	2.10	0.70	73.22
Ginger	6.37	8.53	6.30	3.25	5.35	68.15
Mango leaves	48.85	10.50	12.00	19.5	5.98	52.02
Neem leaves	0.18	18.20	5.31	15.56	2.51	58.24

MC=moisture content. CP= crude protein. CA= crude ash. CF=crude fiber= fat. CHO= carbohydrate

2.5. Growth performance of broiler chickens fed 1% dietary inclusion of four different medicinal plants meals

Data on performance of finisher broiler chickens fed 1% dietary inclusion of four different medicinal meals is presented in table 4.

Table 4 Performance of finisher broiler chickens fed 1% dietary inclusion of four different medicinal plants meals

PARAMETER	T1	T2	T3	T4	T5
Initial weight	0.40	0.40	0.40	0.40	0.40
Final weight	2.57 ± 1.68^{ab}	2.47 ± 3.03^{ab}	2.63 ± 3.00^{b}	2.46 ± 3.21^{ab}	2.18 ± 1.69^{a}
Average daily weight gain	0.21 ± 0.02^{ab}	0.20 ± 0.03^{ab}	0.24 ± 0.03^{b}	0.20 ± 0.03^{ab}	0.17 ± 0.02^{a}
Daily feed intake	0.09 ± 0.36^{a}	0.10 ± 0.28^{a}	0.10 ± 0.13^{a}	0.12 ± 0.36^{b}	0.14 ± 0.17^{c}
Feed conversion ratio	0.43 ± 0.03^{a}	0.50 ± 0.05^{ab}	0.42 ± 0.04^{a}	0.60 ± 0.05^{b}	0.82 ± 0.05^{c}

a,b,c Different superscripts within each row indicate significant differences ($p < 0.05$) (n =3). Without superscript = not significant; T1= control diet 0% medicinal plant. T2= 1% garlic meal. T3= 1% ginger meal. T4= 1% mango

2.6. Cost analysis of broiler chickens fed 1% dietary inclusion of four different medicinal plant meals

Data on cost analysis of broiler chickens fed 1% dietary inclusion of four different medicinal plant meals is presented in table 5.

Table 5 Cost Analysis of finisher broiler chickens fed 1% dietary inclusion of four different medicinal plants meals

PARAMETER	T1	T2	T3	T4	T5
Cost of feed/kg(#)	1000	1,030	1,030	1,030	1,030
Cost of feed consumed/bird(#)	$5,400^{a}$	$5,700^{b}$	$5,700^{b}$	$6,700^{c}$	$7,800^{d}$
Cost of medication(#)	120.00^{a}	0.00^{b}	0.00^{b}	0.00^{b}	0.00^{b}
Cost of vaccination(#)	53.00^{a}	0.00^{b}	0.00^{b}	0.00^{b}	0.00^{b}
Cost of feed/weight gain(#)	428.57^{a}	515.00^{a}	429.17^{a}	600.00^{b}	823.53^{c}
Cost of Day old chicks(#)	1,500.00	1,500.00	1,500.00	1,500.00	1,500.00
Average cost of production(#)	$7,073.00^{a}$	$7,200.00^{a}$	$7,200.00^{a}$	$8,200.00^{b}$	$9,300.00^{c}$
Sales price/kg weight(#)	3500.00	3500.00	3500.00	3500.00	3500.00
Average sales price(#)	$8,998.50^{a}$	$8,645.00^{ab}$	$9,205.00^{a}$	8610.00^{b}	$7,630.00^{c}$
Profit(#)	$1,925.50^{a}$	$1,445.00^{b}$	$2,005.00^{a}$	410.00^{c}	$-1,670.00^{d}$

a,b,c,d Different superscripts within each row indicate significant differences ($p < 0.05$) (n =3). Without superscript = not significant; T1= control diet 0% medicinal plant. T2= 1% garlic meal. T3= 1% ginger meal. T4= 1% mango

3. Results and Discussion

The results of the proximate analysis, performance and cost analysis of broilers fed 1% dietary inclusion of four different medicinal plants as presented in tables 3,4 and 5 showed the results of the proximate analysis of garlic, ginger, mango leaves and neem leaves that they have appreciable quantity of nutrients higher than what is found in some conventional feed ingredients such as maize, rice bran to mention but a few. These results are evidences that these experimented materials can help to improve the quality of chickens feed if incorporated at graded levels. The proximate results are similar to the reports of Diksha and Anshu 2022 who worked on the phytochemical and proximate analysis of mango leaves and yellow mustard seed.

The similar values observed in the performance of the birds on garlic, ginger, mango and neem leaves with the control on average final weight and daily weight gain among all the treatments is an indication that all the experimental materials are suitable for formulating diet for broiler. This is in line with the reports of Alagawany *et al*., 2019, Hossain *et al*., 2018 who argued that Azadirachta indica (neem) has been found to enhance feed efficiency and promote growth due to its high nutritional profile. (Khajali & Toghyani, 2017) similarly postulated that, Allium sativum (garlic) has demonstrated antimicrobial properties that can aid in gut health, potentially leading to better weight gain and feed conversion ratios. However, the significant increase observed for the daily feed intake on the birds on mango leaf meal and Neem leaf meal may be attributed to the palatability of the feeds. On the other hand, the significant increase recorded for feed conversion ratio is suggesting that the presence of anti-nutritional factors such as tanni in mango leaves and neem leaves could have prevented the experimental birds from properly converting the feeds to meat. The cost analysis results showed that the cost of total feed/ kg were similar among all the treatments. However, the costs of feed consumed for the birds on garlic, ginger, mango leaf meal and neem leaf meal were significantly higher than the birds on synthetic medications. This increase could be attributed to the increase in feed intake of the experimental diets which was linked with their palatability. The higher values observed for the cost of vaccinations and medications on the control birds could be attributed to the fact that drugs and vaccines used for the control birds were purchased meanwhile other treatments were not on any drugs or vaccines. Furthermore, the similar costs of feed/weight gain, average production cost and sales price of the control birds, birds on garlic and ginger is an indication that garlic and ginger contained feeds were maximally utilized with minimum cost and high sales price which was comparable to the control cost and sales price. This is in line with (Yunus et al., 2022) who reported in their work that the use of ginger (Zingiber officinale) in broiler diets resulted in better conversion rates and reduced mortality, ultimately contributing to improved profitability. However, the increased values observed for the cost of feed/weight gain, average production cost and decreased sales price of the birds on mango and neem leaves could be attributed to higher feed intake of the experimental diets and their poor utilization. Moreover, the birds on ginger meal were more profitable followed by the birds on garlic meal and mango leaf meal. However, the birds on neem leaf meal showed a significant loss. The scenario here support the argument of Ajayi and Ibe, 2019 who argued that an ideal broiler diet is the one that will maximize production at the least cost. Although a costly diet may produce phenomenal gains in live-stock, the cost per unit of production may make the diet economically infeasible. Likewise, the cheapest diets will not always be the best since it may not allow for maximum production. The superior influence of ginger contained diet in this study is in line with the report of Yunus, *et al*; 2022 who argued that ginger has high potential of improving broiler growth performances. The finding of this study concludes that 1% dietary inclusion of ginger in broiler production is encouraged since lesser quantity of feed is used to produce 1kg of weight without compromising the chicken's health and farmer's profit.

4. Conclusion and recommendation

The inclusion of medicinal plants in broiler diets not only addresses health and performance issues but also offers economic benefits. The integration of medicinal plants in broiler production presents a viable alternative to synthetic additives, contributing to enhanced health, immunity, and productivity. While challenges remain, ongoing research provides a pathway toward more sustainable poultry farming practices, this is because the promising benefits and implementation of medicinal plants in broiler production also faces challenges like Variability in phytochemical content, potential toxicity at high doses, and the need for standardized formulations can hinder widespread adoption. Future research should focus on establishing optimal dosages, conducting long-term studies, and investigating the synergistic effects of different plants to enhance their effectiveness further.

Compliance with ethical standards

Disclosure of conflict of interest

There is no conflict of interest in this work

Statement of ethical approval

Ethical approval for the conduct of this study was granted by the animal science option of the Department of Agricultural Technology, Akanu Ibiam Federal Polytechnic, Unwana.

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