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Complementary Effect of Black Seed and Fenugreek Seeds on Growth Performance, Carcass and Blood Profile of Broiler Chickens at Stater Phase

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ABSTRACT

A total of (160) unsexed day-old broiler chicks (Abor-acre) was used to determine the effect of fenugreek seed and black seed on growth performance, carcass, organ, haematology and serum biochemistry at stater phase. The chicks were divided into four dietary groups of T_1- 0g, T_2- 20g/kg in ratio 1:1 of FS/BPS, T_3-30g/kg in ratio 1:2 of FS/BPS and T_4- 30g/kg in a ratio of 2:1 of FS/BPS inclusion. The birds were randomly allotted into four (4) dietary treatments of 40 birds per treatment and 4 replicate of 10 birds and was arranged in a completely randomized design. Data were collected on growth performance, carcass characteristics and were analysed using ANOVA. The results revealed significant difference on ($P<0.05$) on some of the parameters measured at starter. Highest ($p<0.05$) final weight (1464.00g) and total weight gain, (51.15g) were recorded with broiler bird fed diet containing 1:1 of fenugreek seed and black seed (T2) while broiler fed control diets T1 had the least (1,271.50g), (44.06) at starter phase respectively. Higher ($p<0.05$) carcass weight (1046.75g) was recorded with broiler bird fed diet containing 1:1 of fenugreek seed and black seed (T2) while broiler fed control diets T1 had the least (929.00g). Broiler chicken fed control diet recorded the highest value (30.25%) of pack cell volume while those fed diet with T3 (1:2) had the least (26.25%). Higher ($p<0.05$) eosinophil (4.25%) was recorded with broiler bird fed control diet while broiler chickens fed diet T1 (1:1) had the least (2.75%). Total protein level was significantly ($p<0.05$) reduced in chicks fed diet 2, 3 and 4 respectively, glucose level was significantly increase in birds fed diet 3 while lowest value was obtained in birds fed diet 4. ALP were significant similar across the treatments except for the treatment 4 which had highest value. Chicks fed diets 3 and 4 had significantly ($p<0.05$) higher value for Aspartate transaminase when compared to other treatments. In conclusion the use of 10g of fenugreek seed and 10g black seed at ratio 1:1 had positive effect on growth performance, feed conversion ratio, carcass yield and health status of broiler chickens.

Keywords: *Fenugreek seeds, Black seed, Broiler chicken, Performance, Haematology and Serum*

INTRODUCTION

The use of feed additives has been an important part of achieving this success in animal production. Natural medicinal products originating from herbs and spices have also been used as feed additives for poultry (Guo *et al.,* 2004). Compared with synthetic antibiotics or inorganic chemicals, these plant-derived products have proven to be natural, less toxic, residue free and are thought to be ideal feed additives in food animal production. The excessive use of synthetic additives in poultry production has driven the exploration of natural alternatives, such as black seeds (*Nigella sativa*) and fenugreek seeds (*Trigonella* foenu*m-graecum*), both known for their potential to enhance broiler performance and health (Khan *et al.,* 2012; Nasra *et al.,* 2014).

While the individual effects of these seeds on growth, immunity, and blood parameters have been studied (Al-Beitawi *et al.,* 2008; El-Sheikh *et al.,* 2017), the synergistic impact of their combination remains under-researched. The bioactive compounds in these seeds may interact to produce complementary or additive effects, improving feed efficiency, growth, and physiological status. However, the mechanisms through which these seeds act synergistically, particularly in improving performance characteristics and blood profiles, have not been adequately explored. Addressing this gap is crucial for determining their combined efficacy as a natural alternative in broiler diets (Hashemi and Davoodi, 2011).

Additionally, black seeds (*Nigella sativa*) and

fenugreek seeds (*Trigonella* foenu*m-graecum*) contains various bioactive compounds, such as saponins, alkaloids, and flavonoids, which possess health-promoting effects. These compounds may modulate the immune system, provide antioxidant activity, and regulate hormones, potentially contributing to improved health and performance in poultry. This study aims to fill a critical gap by determining whether the combination of the test ingredient will provide better outcomes in terms of growth performance and general health status of broiler chickens.

MATERIALS AND METHODS

EXPERIEMENTAL SITE

The experiment was carried out at the Poultry Unit of Teaching and Research Farm, Ladoke Akintola University of Technology Ogbomoso, Oyo State Nigeria. The area is in derived savannah zone of Nigeria. It lies on longitude 4.5^0 east of greenish meridian and latitude 8.5^0 North-East towards Ibadan the capital of Oyo State. (Google Earth Map, 2024).

Collection of Test Ingredient

The test ingredient fenugreek seed and black seed" were purchased from a local market at Ogbomosho, Oyo State. The fenugreek seed and black seed were used in the diets directly without any further processing.

Experimental birds and Management

One hundred and sixty (160) unsexed day-old Abor acre chicks were purchased from a reputable hatchery. The birds were randomly allotted into five (4) dietary treatments of 40 birds per treatment and 4 replicates of 10 birds per replicate in a completely randomized design. Four experimental diets were formulated in different ratio of inclusion of black seeds and fenugreek seed blend in which the treatment groups include T1- 0g, T2- 20g/kg in ratio 1:1 of 10g of fenugreek seed and 10g of black seed, T3- 30g/kg in ratio 1:2 of 10g fenugreek seed and 20g of black seed, T4- 30g/kg in a ratio of 2:1 of 20g fenugreek seed and 10g of black seed inclusion of the blend. The birds at 0-4 weeks were fed on a starter diet which had 23% crude protein and 2800Kcal metabolisable energy/kg. Feeding and drinking troughs were adequately provided. Feed and water were given *ad libitum* throughout the period of the trial which lasted 4 weeks.

Data Collection

Growth performance

Weight gain (g) = Final weight gain (g) – Initial weight (g)

Feed intake (g)= (feed given – Leftover)

Feed Conversion Ratio (FCR) = $\frac{\text{Average feed intake (g)}}{\text{Average weight gain(g)}}$

Carcass characteristics and relative organ weights

At the end of stater phase four birds were randomly selected and starved of feed for 12 hours with the presence of abundant water and slaughtered by severing the jugular veins. The birds were bled; defeathered after which the visceral organs such as liver, intestine, pancreas, spleen, kidney, proventriculus, and hearts were removed. The bled, defearthered and eviscerated weights were evaluated accordingly. The head and shanks were removed to determine the carcass weight.

The carcass was cut into various parts (thigh, breast, back, shank, drumstick, wings and head) and their weights were expressed in percentage relative to the carcass weight. The weights of the organs were also expressed in relative values. The following calculations were evaluated:

Relative cut parts weight = $\frac{\text{Weight of the cut}}{\text{Carcass weight}} \times 100$

Blood Analysis

Four birds were randomly selected from each treatment. About 2.5 ml of blood were collected in tubes containing EDTA anticoagulant to determine the values of haemoglobin concentration, packed cell volume, red blood cells count, total white blood cells count, differential white blood cell count, platelets count, and red cell indices as describe by (Iranloye *et al.,* 2002 and Venkatesan *et al.,* 2006). The blood was slowly expressed into EDTA tubes to reduce the risk of haemolysis after removing the needles from syringes (Haen, 1995).

Serum parameters include, total protein was obtained by biuret method in the assay as described by Kohn and Allen (1995). The globulin concentration was obtained by subtracting albumin from the total protein. Albumin was determined using Bromocresol Green (BCG) method as described by Peter *et al.,* (1982). Aspartate transferase (AST) activities were determined using spectrophotometric methods as described by Rej and Hoder (1983). Alanine transferase (ALT) activities were determined using spectrophotometric methods as

described by Rej and Hoder (1983). Serum urea was determined using a kit (Quinica clinical spam) having a linear measurement of about 566.6 ml per liter of urea concentration. The serum urea will determine calorimetrically. The serum cholesterol was determined using enzymatic endpoint method as described by Roeschlau *et al.* (1974).

Statistical Analysis

Data collected were analysed using ANOVA as contained in SAS (2002). Significant means were separated using Duncan Multiple Range Test (Duncan, 1955) as contained in SAS (2002).

RESULTS

Table 1 shows the effect of Fenugreek seed (*Trigonella foenum - graecum*) and black seed (*Nigella sativa*) blend on growth performance of broiler chickens at starter phase. Significantly ($p<0.05$) difference were recorded on weight gain at starter phase. Highest ($p<0.05$) final weight and total weight gain (1464.00g), (51.15g) was recorded with broiler bird fed diet T2 (containing 1:1 of fenugreek seed and black seed while broiler fed control diets T1 had the least (1271.50g), (44.06) at starter phase respectively. Result of present study showed that addition of fenugreek and black seed blend at different levels had significant improvement on weight gain at starter phase. However, moderately inclusion of fenugreek and black seed level had the highest value regarding final live weight and weight gain respectively, compared to the control.

Table 1: Effect of Fenugreek seed *(Trigonella foenum - graecum* and black seed *blend* on growth performance of broiler chicken at starter and finisher phase

Parameters	T_1(control)	T_2(1:1)	T_3(1:2)	T_4(2:1)	SEM
Initial weight (g)	33.12	32.10	33.04	32.78	0.01
Final weight (g)	1271.50^{c}	1464.00^{a}	1327.00^{b}	1327.00^{b}	25.53
Weight gain(g)	44.06^{b}	51.15^{a}	44.84^{b}	44.84^{b}	2.02
Feed intake (g)	70.13	69.63	69.88	69.88	0.63
FCR	1.61	1.38	1.57	1.57	0.35

^{ab} = Means on the same row bearing different superscript differed significantly ($p<0.05$)

Table 2 shows the effect of Fenugreek seed *(Trigonella foenum - graecum)* and black seed (*Nigella sativa*) on carcass and relative cut-up parts of broiler chickens at starter phase. Significant ($P<0.05$) differences were observed on live weight, eviscerated, defeathered weight, carcass weight and back. Higher ($p<0.05$) live weight, bled weight, defeathered weight, eviscerated weight and carcass weight (1464.00g), (1416.00g), (1364.00g), (1074.50g), and (1046.75g) were recorded with broiler bird fed diet containing T2 (1:1) of fenugreek seed and black seed while broiler fed control diets T1 had the least (1271.50g), (1224.50g), (1177.50g), (1010.25g) and (929.00g) respectively. Higher ($p<0.05$) back weight (16.51%) was recorded with broiler birds fed diet containing T4 (2:1) of fenugreek seed and black seed while broiler fed diet T2 had the least (15.80%).

Table2: Effect of Fenugreek seed (Trigonella foenum - graecum) and Black seed (Nigella sativa) on carcass and relative cut-up parts of broiler chickens at starter

Parameters	T_1(control)	T_2(1:1)	T_3(1:2)	T_4(2:1)	SEM
Live weight (g)	1271.50^{a}	1464.00^{a}	1329.50^{ab}	1287.50^{b}	25.53
Bled weight (g)	1224.50^{b}	1416.00^{a}	1288.00^{ab}	1248.50^{b}	24.84
Defeathered weight (g)	1177.50^{b}	1364.00^{a}	1241.50^{ab}	1199.50^{b}	24.41
Eviscerated weight (g)	1010.25^{b}	1187.50^{a}	1074.50^{ab}	1037.75^{b}	22.56
Carcass weight (g)	929.00^{b}	1046.75^{a}	987.00^{ab}	956.00^{ab}	43.06
Dressing Percentage (%)	73.05	71.82	74.24	74.25	0.52
Head (%)					0.08
Neck (%)	3.49	3.39	3.25	3.36	0.16
Back (%)	6.87	7.66	7.36^{ab}	7.32^{a}	0.36
Breast (%)	16.07^{bc}	15.80^{c}	16.21^{b}	16.51^{a}	0.69
Thigh (%)	35.60	40.15	37.02	37.20	0.22
Drumstick(%)	16.09	15.88	15.70	14.64	0.19
Wing (%)	13.49	13.28	12.97	12.66	0.16
Shanks (%)	10.63	10.35	10.38	10.75	0.11
	5.25	5.27	5.60	5.27	

^{ab} = Means on the same row bearing different superscript differed significantly ($p<0.05$)

^{ab} = Means on the same row bearing different superscript differed significantly ($p<0.05$)

Table 3 shows the results of hematological characteristics of broiler starter chickens fed varying levels of fenugreek seed and black seed at starter phase. Significant ($P<0.05$) differences were observed on pack cell volume and eosinophils. Broiler chickens on control diet recorded the highest value (30.25%) of pack cell volume while those fed diet with T3 (1:2) had the least (26.25%). Higher ($p<0.05$) eosinophil (4.25%) was recorded with broiler birds fed control diet while broiler chickens fed diet T1 (1:1) had the least (2.75%).

Table 3: Effect of Fenugreek seed (Trigonella foenum - graecum) and Black seed (Nigella sativa) on haematological parameters of broiler chickens at starter phase.

Parameters	T_1(control)	T_2(1:1)	T_3(1:2)	T_4(2:1)	SEM
PCV(%)	30.25^{a}	29.50^{ab}	26.25^{b}	27.25^{ab}	0.21
HB(g/dl)	8.98	3.21	13637.50	170125.00	1.10
RBC($\times10^{6}$	3.07				
UL)		14500.00	146625.00	66.50	1.08
WBC	14937.50				
($\times10^{3}$ UL)		130000.00	60.50	29.75	0.22
Platelet	119225.00				
($\times10^{9}$UL)		68.00	32.50	2.50	0.33
Lymphocytes	66.75				
(%)		27.75	3.50	2.78^{b}	
Heterophils	28.00			0.21	
(%)		3.75	4.00a^{b}	0.10	
Monocytes	2.50		8.50		
(%)		2.75^{b}	2.53	204.11	
Eosinophils	4.25^{a}	8.20			
(%)	9.25	2.78	14350.00	9304.99	

^{ab}Means on the same row bearing different superscript differed significantly ($p<0.05$)
HB: Haemoglobin, PCV: Pack Cell Volume, RBC: Red Blood Cell, WBC: White blood cell

Table 4: shows the results of serum biochemistry of broiler starter chickens fed diets supplemented with fenugreek seed and black seed. Significant differences (P<0.05) in the values of Glucose, Albumin, Aspartate transaminase, Alanine transaminase, Alkaline phosphatase, Total protein, Cholesterol. Total protein level was significantly (p<0.05) reduced in chicks fed diet 2, 3 and 4 respectively, glucose level was significantly increase in birds fed diet 3 while lowest value was obtained in birds fed diet 4. ALP were significant similar across the treatments except for the treatment 4 which had highest value. Chicks fed diets 3 and 4 had significantly (p<0.05) higher value for Aspartate transaminase when compared to other treatments. Alanine transaminase was significantly (p<0.05) higher in birds fed diet 3. Cholesterol level was significantly (p<0.05) higher in birds fed diet 2 while the value of birds fed with diet 4 has the lowest value. Urea level was significantly (p<0.05) higher in birds fed diets 3. Birds fed diets 4 had the lowest values of urea at starter phase.

Table 4 Effect of Fenugreek seed (Trigonella foenum - graecum) and Black seed (Nigella sativa) on serum biochemistry of broiler chicken at starter.

Parameters	T_1(control)	T_2(1:1)	T_3(1:2)	T_4(2:1)	SEM
T.P (g/dL)	2.76^{c}	2.57^{ab}	2.35^{b}	2.55^{ab}	0.05
Globulin (g/dL)	1.47	1.21	1.17	1.42	0.05
Glucose (g/dl)	201.04^{ab}	208.65^{ab}	218.16^{a}	188.21^{b}	3.87
Albumin (g/dl)	1.29^{b}	1.36^{a}	1.18^{bc}	1.13^{c}	0.05
ALP (µ/l))	75.06^{b}	74.44^{b}	73.57^{b}	79.58^{a}	0.84
AST ((µ/l))	19.78^{bc}	16.49^{c}	26.25^{ab}	31.56^{a}	1.69
ALT (µ/l))	12.31^{bc}	15.69^{b}	20.66^{a}	14.94^{bc}	0.85
UREA (mg/dL)	3.35^{a}	2.47^{b}	3.57^{a}	2.06^{c}	0.15
CRT (mg/dL)	0.85^{ab}	0.95^{a}	0.86^{ab}	0.75^{b}	0.02
CHO(mg/dL)	136.99^{ab}	141.50^{a}	127.33^{c}	121.30^{b}	2.87
HDL (mg/dL)	72.54	70.72	67.06	68.05	1.27

^{abcd}: Means with different superscripts are significantly (p<0.5) different.

^{abcd}: Means with different superscripts are significantly (p<0.5) different.
SEM: Standard Error of Mean, HDL - High Density Lipoprotein, AST - Aspartate Aminotransferase, ALT - Alamine Aminotransferase TP - Total Protein, CRT – Creatinine, CHO-Cholesterol

DISCUSSION

These results are in agreement with those obtained by Essien and Josiah, (2024) who found that addition of Fenugreek seed in broiler diets improved the weight gain, final live weight and feed conversion ratio. Also, Olayeni *et al,* (2024) observed that, the use of fenugreek seed powder in the diets significantly enhanced weight gain at 1g/kg when compared to other treatment group. Result of Khadr and Abdel-Fattah, (2007) showed that addition of black seed at 1% and 2% improved the final body gain at the end of the experimental period when compared with the control group. The observable improvement in the growth parameters in this present study may be linked to the beneficial effect of fenugreek and black seed as spice. Spices are known to stimulate appetite and enhance the secretion of digestive enzymes that boost the digestion of protein, carbohydrates and absorption of these digestive products thus, resulting in better growth performance (Ingweye *et al.,* (2020). The increase surface area of intestinal mucosa of the birds supplemented with the black cumin may be the reason for better utilization of nutrients and therefore lower feed gain ratio.

This study of carcass yield is in agreement with the findings of (Khadr *et al.,* 2007 and Olayeni *et al.,* 2024) who reported that Fenugreek Seed and black seed had significant influence on carcass characteristics of broiler chickens and the variation in the result by the combination and the inclusion level of the test ingredient in the diet use in this study. The overall might be due to appropriate utilization of protein which are made available in the feeds of the chickens which is in agreement with the study of El Bushra, (2012). Also, the phytochemicals (phenols, quinones, flavones, tannins, terpenoids, and alkaloids) found in both fenugreek seed and black seed used in this study act as natural growth promoter and boosters which enhance both growth and carcass yield. Durrani *et al.* (2007) also observed, incorporating 4 % black cumin into broiler diets increased the weight percentage of thigh and breast.

The results on hematological parameters agrees with the study of Gaikwad *et al.* (2019) who observed significant effect on all haematological parameters measured after feeding of varying levels of fenugreek powder. Similar results were obtained by Abdul-Rahman (2012) who suggested that higher values of blood parameters such as Hb and PCV in treatment groups over control group. Also, black seed and fenugreek contain some phytochemical like phenol and alkaloid as reported by Shaimaa *et al.* (2023) which function is to build the immune system in order to fight disease causing agent in the body and also as an active oxygen scavenger, competing with haemoglobin (Hb) in red blood cells (RBCs) for oxygen, which induces hypoxia. This hypoxic condition stimulates the synthesis of haemoglobin and production of RBCs, consequently increasing the concentration of RBCs in the blood. The Black seed (*Nigella sativa*) is one of the medicinal seeds, black seeds contain oils containing Thymoquinone and Nigellone, these compounds play an important role in alleviating the severity of some disease conditions because these compounds are antioxidants as reported by Guler, *et al.* (2007).

But despite the increase in the haematological parameters in this study they still falls within the normal range as reported by Merck (2012). The increasing in immunoglobulin levels in blood may be attributed to through the additivity of their antioxidant properties that resulted in the enhancement of the immune systems of birds (Abd El-Hack *et al.,* 2021). The antioxidant activity of black seed has a modulating effect on blood indices. Furthermore, studies evidenced that some constituents of black cumin exert stimulatory roles toward T-cell-mediated immune responses, whereas other constituents suppress B-cell mediated immune responses (Islam *et al.,* 2004) and improved the immune response of chicks and marked an increase in the weight of lymphoid organs (Toghyani *et al.*, 2010; Khan *et al.,* 2012).

In the present study, the fenugreek seed and black seed supplementation has appeared to have significant influence on hepatic activity as evidenced from the serum activity, serum albumin and the values of all the biochemical parameters found in the present study were within normal ranges for healthy boiler chickens according to Merck (2012) and this implied that the use of fenugreek seed in broiler production with the present levels is safe and healthy. The serum glucose concentrations in broiler demonstrated no significant variation among the different treatments ($P<0.05$). All treatment groups demonstrated serum glucose concentrations within the normal range as outlined by Khan *et al*. (2012) and Shokrollahi *et al*. (2018) noted no significant variance in serum glucose levels in broilers diets fed black cumin seed supplementation. Decreased in total cholesterol in serum observed in the results agree with those obtained by Khan *et al*. (2012), Hassan *et al*. (2018) and El-kashef, (2020), who recorded that *Nigella sativa* significantly decreased the levels of total cholesterol since it contained saponin which help to reduce cholesterol content in the body. Furthermore, black cumin contains high content of unsaturated fatty acids which may stimulate the cholesterol excretions into the intestine and the oxidation.

CONCLUSION AND RECOMMENDATION

The study concluded that the use of fenugreek seed and black seed had positive impact on growth performance, feed conversion ratio, carcass yield, haematology and serum biochemistry of broiler chickens. It therefore recommended that the inclusion of 10g/kg of fenugreek seed and 10g/kg of black seed blend at ratio 1:1 in the diet will help to improve overall performance and health status of boiler chickens at stater phase.

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