Efficacy of fenugreek oil and black seed oil as feed additives for broiler starter chicks

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Abstract

This study investigated the efficacy of fenugreek oil and black seed oil as feed additives for broiler starter chicks. For four weeks, 240 day-old broiler chicks without sexes were divided into five treatments, each with four repetitions, using a randomized design. Each replicate contains 12 birds. The dietary group had diet 1 (control, without oil additive), diet 2 (vaccinated control without oil additive), diets 3, 4, and 5 were supplemented with Fenugreek and Black seed oils at a ratio of 10:10, 10:20, and 20:10 mL per kilogram diet. Data were collected on growth indices, digestibility of nutrients, blood profile, and primal cuts. There was no significant ($P > 0.05$) change in any of the growth metrics. Ether extract and ash digestibility differ notably ($P < 0.05$). Significant differences ($p < 0.05$) were recorded on PCV, hemoglobin, RBC, lymphocytes, heterocytes, and eosinophil counts. Values obtained for albumin, globulin, aspartate transaminase, alanine transaminase, alkaline phosphatase, cholesterol, high-density lipoprotein, glucose, creatinine, and urea were significantly ($P < 0.05$) affected. The pancreas was significantly influenced ($p < 0.05$). The values of dressing percentage, head, breast, drumstick, and wings showed substantial variations ($P < 0.05$) in the. From this study, the supplementation of broiler starter chicken diets with fenugreek seed oil and black seed oil at (1:1) 10 mL to 10 mL of diets is recommended for better oxygen transport, overall health, and dressing percentage. The use of fenugreek oil and black seed oil at the finished phase and layer production can also be investigated.

Keywords: *Trigonella foenum-graecum*, *Nigella sativa*, growth, blood, organ weight, carcass

Eficácia do óleo de feno-grego e do óleo de semente preta como aditivos alimentares para frangos de corte na fase inicial

Resumo

Este estudo investigou a eficácia dos óleos de feno-grego e de semente preta como aditivos alimentares para frangos de corte na fase inicial. Durante quatro semanas, 240 pintos de corte com um dia de idade, sem distinção de sexo, foram divididos em cinco tratamentos, cada um com quatro repetições, utilizando um delineamento inteiramente casualizado. Cada repetição continha 12 aves. O grupo alimentar foi composto por: dieta 1 (controle, sem aditivo de óleo), dieta 2 (controle vacinado, sem aditivo de óleo) e dietas 3, 4 e 5 suplementadas com óleos de feno-grego e de semente preta nas proporções de 10:10, 10:20 e 20:10 mL por quilograma de dieta, respectivamente. Foram coletados dados sobre índices de crescimento, digestibilidade de nutrientes, perfil sanguíneo e cortes primários da carcaça. Não houve diferença significativa ($P > 0,05$) em nenhuma das variáveis de crescimento. A digestibilidade do extrato etéreo e das cinzas diferiu significativamente ($P < 0,05$). Diferenças significativas ($P < 0,05$) foram registradas para o volume globular (VG), hemoglobina, eritrócitos (RBC), linfócitos, heterófilos e eosinófilos. Os valores obtidos para albumina, globulina, aspartato transaminase, alanina transaminase, fosfatase alcalina, colesterol, lipoproteína de alta densidade, glicose, creatinina e ureia foram significativamente ($P < 0,05$) afetados. O pâncreas foi significativamente influenciado ($p < 0,05$). Os valores de rendimento de carcaça, cabeça, peito, coxa e asas apresentaram variações significativas ($p < 0,05$). Com base neste estudo, recomenda-se a suplementação das dietas de frangos de corte na fase inicial com óleos de feno-grego e de semente preta na proporção de 10 mL para 10 mL (1:1) por quilograma de dieta, visando melhorar o transporte de oxigênio, a saúde geral e o rendimento de carcaça. O uso dos óleos de feno-grego e de

semente preta nas fases de terminação e postura também pode ser investigado.

Palavras-chave: *Trigonella foenum-graecum*, *Nigella sativa*, crescimento, sangue, peso de órgãos, carcaça

1. Introduction

Feed additives are products used in animal nutrition to improve the feed quality, utilization, performance, health, and quality of animal products (Arsenos; Vouraki, 2023). Most feed additives are synthetic products (Mwale, 2023). Of major concern is the antibiotic class of additives. Some regions of the world have banned the use of some antibiotics due to the possibility that bacteria could develop resistance to them through ongoing subtherapeutic use as growth stimulants in animal feed (European Commission Regulation, 2003). Researchers are looking into alternative materials and methods for promoting animal growth and preventing sickness. Among them, phytogenic and herbal medicines have drawn more interest as customers have come to accept them as natural additives (Ojediran et al., 2024).

These phyto-additives range from plant leaves, seeds, roots, barks, flowers, seeds, and spices. They have many uses in folk medicine because of their medicinal properties derived from their bioactive constituents, metabolites, and oils (Alagbe, 2019; Ojediran; Ojediran, 2024). Some additives, like activated charcoal, are non-nutritive adsorptive materials (Olayeni et al., 2023b, 2024b,c)

Fenugreek (*Trigonella foenum–graecum*) is a legume natural plant cultivated all over the world, especially in semi-arid regions. Fenugreek seed is one of the medicinal plants that possess antibacterial, antidiabetic, anticancer, hypocholesterolemic, galactogogue, hepatoprotective, gastric stimulant, and anorexic effects (Bash; Ulbricht, 2003; Chen et al., 2003; Khorshidian et al., 2016). Meghwal & Goswami (2012) observed that fenugreek's protein is more soluble at alkaline pH. Fenugreek has roughly 25% dietary fiber, 6–7% fat, 58% carbs, and 23–26% protein (USDA, 2012; Ahmad et al., 2016). Minerals, including iron, copper, selenium, zinc, calcium, potassium, magnesium, and manganese, are all abundant in fenugreek seed. It is also a great source of many essential vitamins, including riboflavin, thiamine, pyridoxine, vitamin A, vitamin C, and volatile oil (Michael; Kumawat, 2003). The seeds of fenugreek also include biotin, neurin, and trimethylamine, which work on the neurological system to increase the bird's hunger (Al Habori; Raman, 2002). Additionally, lecithin and choline, which are found in fenugreek seeds, aid in the dissolution of fats and cholesterol (Dixit et al., 2005). It contains polyphenols, antioxidants (Dixit et al., 2005; Naidu et al., 2010), saponins, flavonoids, diosgenin, steroidal sapogenins, diosgenin, alkaloids, and mucilage (Khare, 2004; Yadav et al., 2011).

Black seed or black cumin (*Nigella sativa*), an annual plant native to the Mediterranean region, Asia, and currently grown in Eastern Europe, is a member of the Ranunculaceae family. Thymoquinone, thymohydroquinone, dithymoquinone, thymol, and carvacol are the primary active ingredients in black seeds and are significant pharmacologically active compounds (Al Saleh et al., 2006; Nasir et al., 2005). According to Arslan et al. (2005), thymoquinone, which makes up 18.4–24% of black seed essential oil, has antibacterial, antioxidant, antihistaminic, and anti-inflammatory properties.

Diuretic, antihypertensive, hypoglycemic, hepatoprotective, and immunopotentiating properties had been reported (Zaoui et al., 2000; Abdel-Fattah et al., 2000; Enomoto et al., 2001). The seed has amino acids, carbohydrates, unsaturated fatty acids, and volatile oils. It also contains alkaloids and terpenoids. Oil from both seeds has a promising nutraceutical value. This study determines the effectiveness of fenugreek and black seed oils as supplements on the response of broiler starter chicks.

2. Materials and Methods

2.1 Experimental management

The trial took place in the derived savannah zone of Nigeria in the Poultry Farm Research Unit of the institution at Ogbomosho. The Fenugreek and Black seed oils were sourced from a wholesale store in Ogbomosho. The Fenugreek and Black seed oils were added to the diets. Finished starter feed (Adva feeds®) gave rise to five trial diets (Table 1) such that diet 1 served as the control diet with no Fenugreek and Black seed oils supplementation, while diet 2 also had no supplementation, but the experimental animals were vaccinated. Diets 3,4,5 were supplemented with Fenugreek and Black seed oils at a ratio of 10:10, 10:20, and 20:10 mL per kilogram diet, respectively (Table 2).

Table 1. Gross nutrients of the trial diet.

Nutrient (%)	Quantity
Metabolizable Energy (kcal/kg^{-1})	3000.00
Protein	22.00
Fat	5.00
Crude Fibre	5.00
Calcium	0.85
Available Phosphorus	0.40
Lysine	1.10
Methionine	0.50

Source: Authors, 2025.

Table 2. Level of supplementation in the trial diet.

Diet	1 (0:0)	2 (0:0; vaccinated)	3 (10:10)	4 (10:20)	5 (20:10)
Fenugreek oil (ml/kg diet)	0.00	0.00	10.00	10.00	20.00
Black oil (ml/kg diet)	0.00	0.00	10.00	20.00	10.00

Source: Authos, 2025.

240 unsexed day-old broiler chicks (Ross 308) strain sourced from a reliable hatchery were used. The birds were housed in a deep litter partitioned pen. They were weighed on arrival and randomised to five sets of four (4) replications containing 12 chicks each in CRD. Each replicate contains twelve (12) birds.

2.2 Data collection

The following data were collected

2.2.1 Growth indices

The distinction between the feed offered daily and the feed left was the feed consumed (FI). The birds were weighed on a weekly basis. The difference of the final and the initial weights was the weight gain (WG). The ratio of the summation of the FI to WG was the feed conversion ratio.

2.2.2 Nutrient digestibility

On the 28th day of the phase, two birds randomly picked per replicate were moved to metabolic cages. They had three days of acclimatization before the faecal samples were collected, measured, oven dried, ground, bulked, and analysed for proximate analysis according to AOAC (2000) methods. The digestibility coefficient was calculated as described by Dialoke et al. (2020).

2.2.3 Blood profile

On the same day, blood samples were taken from two birds per replicate from the jugular veins into EDTA-free bottles for serum analysis and EDTA tubes for haematological analysis. Haematological components were analyzed using an auto-analyzer. Decanted serum fluid was centrifuged for metabolites such as proteins, aminotransferases, urea, creatinine, triglycerides, and lipids, as mentioned by Ojediran & Emiola (2018).

2.4.4 Carcass features

Also, two birds of mean weight randomly picked per replicate were denied feed for 12 h, jugularly slaughtered, and bled completely. They were defeathered and eviscerated. The carcasses obtained were cut into head, neck,

breast, wings, back, thigh, drumstick, and shanks. These were expressed relative to the live weight.

2.6 Statistics

Following the experimental design, using DMR and SAS (2010), the one-way ANOVA technique was applied to all obtained data. The separation was done using the same statistical package's test.

3. Results

3.1 Growth performance

The growth metrics of broiler chicks offered feeds with fenugreek oil and black seed oil are presented in (Table 3). There was no significant (P > 0.05) change in any of the parameters.

Table 3. Growth metrics of broiler chicks offered feeds with fenugreek oil and black seed oil.

Parameters	1	2	3	4	5	SEM
Initial weight (g)	32.00	32.00	32.00	32.00	32.00	0.00
Final live weight (g)	1320.50	1352.00	1366.00	1371.50	1334.50	23.90
Weight gain (g/b/d)	46.02	47.14	47.65	47.84	46.52	0.85
Feed intake (g/b/d)	67.90	69.18	69.50	68.84	69.40	0.24
Feed conversion ratio	1.49	1.48	1.48	1.44	1.50	0.03

Note: SEM: Standard error of means. Sourcer: Authors, 2025.

3.2 Nutrient digestibility

Table 4: The nutrient digestibility of broiler starters offered diets supplemented with fenugreek seed oil and black seed oil (the ether extract and ash differ significantly (P < 0.05), while the crude protein, crude fiber, Nitrogen nitrogen-free extract were not significantly affected (p > 0.05). Birds given diet 2 (75.62%) had the highest ether extract digestibility, those offered diet 2 (62.05%) had the least (P < 0.05), while those fed diets 1, 3, and 5 (64.66-69.46%) compared favourably. Ash digestibility was lowest in broilers fed diets 2 (49.02%) and 3 (49.20%), those offered diet 4 (57.63%) had the highest, while those offered diets 1 and 5 (52.78-53.93%) were comparable.

Table 4. Digestibility of nutrients of broiler starter chicks offered diets with fenugreek seed oil and black seed oil.

Parameters (%)	1	2	3	4	5	SEM
Crude protein	60.37	65.18	57.04	56.29	756.44	2.35
Crude fibre	62.06	58.50	54.90	54.96	53.23	1.30
Ether extract	69.46^{ab}	75.62^{a}	64.66^{ab}	62.05^{b}	69.71^{ab}	1.84
Ash	52.78^{ab}	49.02^{b}	49.20^{b}	57.63^{a}	53.93^{ab}	1.21
Nitrogen-free extract	73.31	68.92	66.68	75.98	66.52	2.03

Note: ^{ab} Significant variations occurred across means in the same row with different superscripts (P < 0.05). SEM: Standard error of means. Source: Authors, 2025.

3.3 Haematological responses

Effects of Blackseed oil and Fenugreek oil on heamatological parameters of broiler starter chicks (Table 5). Significant differences (p < 0.05) were recorded in PCV, Hemoglobin, RBC, Lymphocytes, Heterocytes, and Eosinophils. Birds fed diet 3 had higher values for PCV, Hb, and RBC (p < 0.05). The highest (p < 0.05) Packed Cell Volume (PCV) (29.50) was recorded in broiler chicken given diet 3, with the lowest value recorded in diet 5. The highest (p < 0.05) Hemoglobin value was observed in diet 3. The lowest value was recorded in diet 5. Red

Blood Cell (RBC) was different in treatment 3 in that it had the highest value (3.32) and diet 5 (2.70) had the lowest.

Lymphocyte count reduced in birds fed diet 1 (71.75%) to diet 5 (58.75%). Heterocytes count was higher in birds fed diets 3-5, while those fed diets 1-2 were significantly lower ($p < 0.05$). Eosinophils varied significantly with diet 5 having the highest value (3.00%), and diets 1, 3, and 4 showed lower values, while diet 2 was comparable.

Table 5. Haematological response of broiler starters offered diets with fenugreek oil and black seed oil**.**

Parameters	1	2	3	4	5	SEM
PCV (%)	28.75^{ab}	29.50^{a}	29.50^{a}	28.50^{ab}	26.25^{b}	0.46
HB (g/dL)	9.35^{ab}	8.95^{ab}	9.70^{a}	8.68^{ab}	8.40^{b}	0.17
RBC ($x10^{6}uL$)	2.90^{ab}	3.16^{ab}	3.32^{a}	3.03^{ab}	2.70^{b}	0.08
WBC ($x10^{3}uL$)	14837.50	15175.00	15400.00	15000.00	13987.50	204.50
Platelet ($x10^{3}uL$)	166.25	180.00	143.38	162.75	174.50	74.93
Lymphocytes (%)	71.75^{a}	67.00^{ab}	64.25^{abc}	60.00^{bc}	58.75^{c}	1.45
Heterocytes (%)	24.50^{b}	26.50^{b}	32.25^{a}	36.75^{a}	35.50^{a}	1.34
Monocytes (%)	3.00	3.00	2.50	2.50	2.75	0.22
Eosinophils (%)	1.25^{b}	2.25^{ab}	1.50^{b}	1.00^{b}	3.00^{a}	0.25

Note: ^{abc} = Significant variations occurred across means in the same row with different superscripts ($p < 0.05$). SEM: Standard error of mean. PCV: Packed cell volume, HB: Haemoglobin, RBC: Red blood cell, WBC: White blood cell. Source: Authors, 2025.

3.4 Serum characteristics

Serum characteristics of broiler starters offered diets with fenugreek oil and black seed oil are introduced in (Table 6). The albumin, globulin, Aspartate Transaminase, Alanine Transaminase, Alkaline phosphatase, Cholesterol, High-density lipoprotein, Glucose, Creatinine, and Urea differ ($P < 0.05$) noticeably, except total protein and triglyceride ($P > 0.05$). Broiler starter chicken fed diet 1 (negative control) had a higher ($P < 0.05$) value for albumin, although the value is similar to those on diets 2, 3, and 5. Globulin value was higher (P<005) in chicks given diet 4. Aspartate Transaminase showed high values ($P < 0.05$) in chicks given diets 1 and 4, while others were lower.

Alanine Transaminase value was detectably ($P < 0.05$) reduced in chicks offered control diets. Alkaline Phosphatase was high in birds fed diet 4, although similar ($P < 0.05$) to others on diets 1 and 5. Chicks presented with diet 3 showed the lowest value (70-58 u/L). High-Density Lipoprotein was conspicuously ($P < 0.05$) higher in chicks offered diet 3 (18:01 mg/dL) while the lowest values were obtained in birds fed diets 1 and 4 (67.15 and 67.57 mg/dL), respectively. Broiler starter chicken fed diet 2 showed significantly ($P < 0.05$) high value for Glucose, while the lowest value was obtained in diet 3. Urea concentration was significantly ($P < 0.05$) high in birds fed diets 4 and 5 (5.17 and 4.47 mg/dL, respectively), unlike diets 1-3.

Table 6. Serum characteristics of broiler starters offered diets with fenugreek oil and blackseed oil.

Parameters	1	2	3	4	5	SEM
Albumin (g/dL)	1.21^{a}	1.15^{ab}	1.09^{ab}	1.05^{b}	1.11^{ab}	0.02
Globulin (g/dL)	1.31^{b}	1.45^{ab}	1.50^{ab}	1.72^{a}	1.39^{ab}	0.06
Total protein (g/dL)	2.52	2.60	2.58	2.77	2.50	0.04
AST (IU/L)	28.75^{a}	21.74^{b}	20.89^{b}	31.46^{a}	16.58^{b}	1.48
ALT (I.U/L)	16.73^{b}	24.49^{a}	20.31^{ab}	20.73^{ab}	20.97^{ab}	0.81
ALP (I.U/L)	77.97^{ab}	73.66^{bc}	70.58^{c}	79.30^{a}	75.93^{ab}	0.90
Cholesterol (mg/dL)	125.49	115.84	115.35	110.28	130.99	7.14
HDL (mg/dL)	67.15^{c}	71.22^{b}	78.01^{a}	67.57^{c}	70.92^{b}	0.98
Triglycerides (mg/dL)	70.30	73.42	67.02	67.82	63.51	1.45
Glucose (mg/dL)	230.79^{b}	247.50^{a}	205.00^{c}	236.58^{b}	235.50^{b}	3.38
Creatinine	1.05^{b}	1.01^{b}	0.95^{b}	1.56^{a}	1.04^{b}	0.06
Urea (mg/dL)	3.04^{b}	3.14^{b}	3.13^{b}	5.17^{a}	4.47^{a}	0.24

Note: ^{abc} Significant variations occurred across means in the same row with different superscripts ($p < 0.05$). SEM: Standard error of mean. ALT: Alanine transaminase, ALP: Alkaline phosphatase, HDL: High density lipoprotein, AST: Aspartate Aminotransferase. Source: Authors, 2025.

3.5 Organ characteristics

The organ characteristics of broiler starters offered diets with fenugreek oil and black seed oil are presented in (Table 7). The pancreas was significantly influenced ($p < 0.05$). The relative weight of the pancreas was conspicuously lower ($P < 0.05$) in birds given diet 1 in comparison to those offered diet 2, while others were comparable. All treatments had identical values ($P < 0.05$), except those on diet 2, which had the lowest value.

Table 7. Relative organ weight of broiler starters offered diets with fenugreek oil and black seed oil.

Parameters (%)	1	2	3	4	5	SEM
Proventriculus	0.47	0.44	0.55	0.52	0.55	0.03
Gizzard	3.37	2.74	2.60	3.13	3.31	0.19
Liver	2.17	1.86	2.28	2.50	2.53	0.13
Lungs	0.91	0.69	0.74	0.80	0.72	0.05
Pancrease	0.42^{b}	0.27^{a}	0.31^{ab}	0.35^{ab}	0.36^{ab}	0.02
Heart	0.56	0.46	0.60	0.58	0.57	0.03
Bursa of Fabricius	0.22	0.12	0.17	0.17	0.18	0.02

Note: ^{ab} Significant variations occurred across means in the same row with different superscripts. Source: Authors, 2025.

3.6 Carcass features

Table 8 shows the carcass cuts of broiler starters offered diets with fenugreek oil and Black seed oil. Significant differences ($P < 0.05$) were noticed in the values of dressing percentage, head, breast, drumstick, and wings. There was no significant ($P > 0.05$) difference in the final live weight, bled weight, defeathered weight, eviscerated weight, carcass weight, neck, back, thigh, and shank between the fenugreek oil and black seed oil supplementation levels. The dressing percentage was much greater ($P < 0.05$) in the chicks offered diet 3, although the values obtained showed similarity ($P > 0.05$) to ones given diets 1 and 4. Head values reduced significantly ($P < 0.05$) in chicks offered diet 3, similar ($P > 0.05$) to chicks on diets 1 and 2. Chicks given diet 3

had a higher ($P < 0.05$) value for breast, comparable with those fed diets 1, 4, and 5. Drumstick was notably ($P < 0.05$) higher in birds provided diets 1; those supplied diets 3 and 4 were lower, while those given diets 2 and 5 compared favourably. Wing values rose ($P < 0.05$) in chicks delivered diets 4 and 5, which were similar to birds supplied diets 1 and 2. Birds given diet 3 had the lowest values of wings.

Table 8. Carcass cuts of broiler were offered diets with fenugreek oil and black seed oil.

Parameters (%)	1	2	3	4	5	SEM
Final Weight (g)	1352.00	1366.00	1371.50	1334.50	1320.50	23.90
Bled weight (g)	1318.00	1305.00	1330.50	1291.99	1273.50	22.81
Defeathered weight (g)	1270.00	1262.00	1294.00	1249.00	1223.00	22.48
Eviscerated weight (g)	1108.75	1084.50	1132.75	1084.50	1060.25	20.53
Carcass percentage	1015.25	1000.00	1048.00	997.75	976.75	18.29
Dressing percentage	75.10^{ab}	73.24^{b}	76.41^{a}	74.75^{ab}	74.00^{b}	0.10
Head	3.26^{ab}	3.26^{ab}	3.05^{b}	3.47^{a}	3.41^{a}	0.05
Neck	6.62	6.64	5.27	6.07	5.47	0.21
Back	16.01	16.81	15.61	15.94	16.46	0.25
Breast	37.43^{ab}	34.09^{b}	38.74^{a}	38.44^{ab}	36.67^{ab}	0.67
Thigh	15.30	15.11	15.79	14.94	15.54	0.26
Drum stick	13.00^{a}	12.73^{ab}	11.96^{b}	11.89^{b}	12.19^{ab}	0.20
Shank	5.42	5.38	5.03	5.30	5.05	0.07
Wings	10.26^{ab}	10.55^{ab}	9.67^{b}	10.99^{a}	10.74^{a}	0.16

Note: ^{ab} Significant variations occurred across means in the same row with different superscripts. SEM: Standard error of mean. Source: Authors, 2025.

4. Discussion

4.1 Growth indices

This study showed that black seed oil and fenugreek oil additives did not have a synergistic effect on the growth performance of broiler beginning chickens. The result differs from the observation of Olayeni et al. (2023a, 2024a) when the meal of seeds was used singly. According to Sogut et al. (2012), broiler performance was found to be improved by low levels of fenugreek oil and black seed oil (3%) as opposed to high levels (7%). Supplementing the diets of laying hens increased the feed conversion ratio, as demonstrated by Aydin et al. (2008). Nevertheless, other research revealed that the chicken's body weight gain was much reduced when black seed oil was added to the meal (Akhar et al., 2003; Majeed et al., 2010).

This disagreement may be due to differences in the level of supplementation or the method of preparation in cultivated regions, variations in bioactive components of fenugreek oil and black seed oil, the environment, and the rearing conditions of broiler chickens. Along with their antibacterial and antioxidant properties, thymoquinone and its constituents (carvone, anethole, and carvacrol) also stimulate the pancreatic and intestinal mucosa's digestive enzymes. From reports by Guler et al. (2006), this enhances feed efficiency and dietary nutrient digestion, which raises growth metrics (Khan et al., 2012). Higher levels than those observed by Sogut et al. (2012), however, might have contributed to this study's findings.

4.2 Nutrient utilization

The oils' combined impact decreased the ether extract while increasing the digestibility of ash. This implies that the oils might have raised the ash and ether extract in the supplemental diets. Samarasinghe et al. (2003) found that supplementing broilers with turmeric increased their protein utilization. The current results are consistent with those of Issa & Omar (2012), who found that adding garlic powder to broiler feed increased the digestibility of ash and ether extract. Rajput et al. (2013) found that feeding broiler chicks curcumin as a phytobiotic

enhanced their ether extract usage considerably as well. Herbal actions in boosting the microbial population likely contributed to the improvement in total tract digestibility in broilers given varying concentrations of garlic powder as a phytobiotic (Issa; Omar, 2012). These results could be a combination of fenugreek seed oil and black seed oil in broiler starter chickens' diets.

4.3 Haematological parameters

The results of haematological parameters in this study showed that Blackseed oil and Fenugreek oil had positive effects on Packed Cell Volume (PCV), Hemoglobin (Hb), and Red Blood Cell (RBC), since the Blackseed oil and Fenugreek oil contained phytochemicals that help to improve the health status of broilers Olayeni et al. (2023a). As stated by Mitruka & Rawnsley (1977), the recorded values are still within the typical safe range for healthy broiler chicks, regardless of the significance level, and this implies that blackseed oil and fenugreek oil in the present inclusion level are safe and healthy. Also, the inclusion of this blend in the diet had shown the building of the immune systems of broiler chickens since they contains alkaloids and phenols which are known to serve as antibacterial and antifungal which fighting against foreign bodies in line with the reports of Ademola et al. (2009), Okanlawon et al. (2024), and Alagbe et al. (2024), which says phytobiotics help to build the immune system to maintain healthy systems in broilers.

4.4 Serum characteristics

Serum chemical markers are a useful tool for assessing an animal's overall health because they can reveal the body's metabolism and certain medical disorders (Abioye et al., 2017). The total protein shows the quality of feed (Ojediran et al., 2018, 2022). Increased values of globulin, AST, ALP, creatinine, and urea suggest that the liver and kidneys may be stressed due to the oil. It is possible to use the levels of triglycerides and total cholesterol in serum as markers of lipid metabolism. The dynamic balance of serum triglycerides is maintained under normal circumstances. The animal's body does not accumulate fat, as indicated by the measured levels of triglycerides and cholesterol in the serum (Toghyani et al., 2010). Lipoproteins are linked to the transport of cholesterol, including LDL-C and HDL-C (Pizzini et al., 2019). Both have a connection to cardiovascular disease and atherosclerosis. There is a negative correlation between the two variables and the incidence of the disease, while the former (LDL-C) has a positive correlation. The result of the glucose agreed with the study conducted by Pengfei et al. (2023), where the glucose level was significantly affected, unlike the values of cholesterol, globulin, albumin, HDL, AST, ALT, TP, Urea, and Creatinine.

4.5 Organ weight

Increased size of the pancreas in birds fed diets 2-5 suggests that the pancreas was producing more pancreatic juice. This observation conformed with Olayeni et al. (2024a), who observed pertinent differences in the pancreas of broilers fed different levels of fenugreek powder. Studies by Medina et al. (2020) and Yesuf et al. (2017) also reported a vital effect when broilers received fenugreek seed. On the contrary, fenugreek seed exhibited lipid-reducing properties attributed to the presence of lecithin and choline (Dixit et al., 2005). Similarly, Abbas (2010) found that the addition of fenugreek seed to the diet had no discernible effect on the relative weights of the gizzard, liver, spleen, and heart.

4.6 Carcass cuts

The observed result falls in line with the results of Al-Betawl and El-Ghousein (2008), Halle et al. (2004), and Toghyani et al. (2010) on dressing percentage, breast, drumstick, and wings. Guoet et al. (2004) found that incorporating fenugreek and black seed oils into broiler diets led to increased live weight. The observed negation could be due to environmental factors as well as level inclusion. Additionally, a notable improvement in dressing percentage was noted in the oil groups in contrast to those placed on negative and positive control diets. This improvement may be linked to increased feed consumption and the bioactive chemicals present in fenugreek seed oil and black seed oil, possessing antibacterial, antifungal, anti-inflammatory, carminative, and antioxidant properties.

These findings align with the research of Abou-EL-Wafa et al. (2003) and Hamdin et al. (2017). These outcomes further demonstrated that supplementation of fenugreek seed oil and black seed oil in broiler diets significantly enhanced feed consumption (Hamid et al., 2018). This positive influence of fenugreek seed oil and black seed oil

on feed consumption can be interpreted from various perspectives, such as the enhancement of diet palatability and the potential impact of carbohydrates, particularly galactomannan, in stimulating the appetite and digestive processes. This outcome is consistent with the findings of Michael and Kumawat et al. (2003) and Nadir Alloui et al. (2012). In contrast, Moustafa et al. (2006) reported that incorporating fenugreek seed oil and black seed oil at a 0.05% level did not result in a significant effect on feed consumption compared to the controls. This result is consistent with the studies conducted by Guo et al. (2004) and Alloui et al. (2012).

5. Conclusions

The inclusion of fenugreek seed oil and black seed oil in broiler starter diets positively influenced nutrient utilization, enhanced pancreatic activity, and improved immune cell performance. Birds fed with these oils showed better blood parameters and carcass quality, particularly in dressing yield and breast development. Therefore, supplementing broiler starter feeds with a balanced combination of fenugreek and black seed oils is recommended to promote efficient oxygen transport, improved physiological functions, and overall health status. Future studies should also explore the potential benefits of these oils during the finisher and layer production phases.

6. Authors' Contributions

Tunji Babatunde Olayeni: conceptualisation, designed the experiment, and analysed the data. *Taiwo Kayode Ojediran*: performed the experiment, interpreted the data, and wrote the first draft. *Samad Folagade Olayiwola*: contributed analysis tools and corrected the draft.

7. Conflicts of Interest

No conflicts of interest.

8. Ethics Approval

Yes. All procedures employed in this study were sanctioned by the Animal and Research Ethics Committee of the Ladoke Akintola University of Technology with approval number ANB/20/21-3/170087U.

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