Growth Performance, Feed Utilization, and Productive Responses of Broiler (Ross 308) Chickens Fed Diets Supplemented with Fenugreek, Ginger, and Ashwagandha

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Abstract

This study was conducted of the poultry farm of the broiler house (Hall No. 2) at the College of Agriculture, Tikrit University, from March 17, 2025, to April 28, 2025. The study aimed to evaluate the effect of adding a mixture of natural medicinal plants, consisting of fenugreek seeds (*Trigonella foenum-graecum*), ginger (*Zingiber officinale*), and ashwagandha (*Withania somnifera*), referred to as FGA, in powder form to the diet of Rose 308 broiler chickens. This was done to enrich the diet with active ingredients to thereby improve growth rates and feed conversion ratio (FCR). The experiment used 160 unsexed, one-day-old Rose 308 chicks. The chicks were randomly distributed according to a completely randomized design (CRD) into four experimental treatments of 40 birds each, with four replicates per treatment (10 birds per replicate). The experiment lasted 42 days. The results showed a significant improvement in body weight, weight gain, and feed conversion efficiency for the fourth treatment (adding 3 g/kg of FGA feed). No significant differences in feed consumption were observed among all experimental treatments. We conclude that adding FGA at a rate of 3 g/kg of feed is an effective natural feed supplement for improving the productive performance and FCR of broiler chickens, thus promoting its potential use as a safe and natural feed additive in poultry diets.

Keywords: FAG, medicinal plants, poultry, nutrition

Introduction

The poultry industry has established itself as a cornerstone of the agricultural sector, providing essential high-quality animal protein for the world's growing population. In current poultry farming practices, improving growth, health, and disease resistance in broiler chickens is vital for achieving high productivity levels. For many years, synthetic antibiotics were used as growth promoters to enhance growth and feed efficiency in intensive poultry production systems. However, growing concerns about antibiotic resistance, the potential effects of antibiotic residues on consumers, and the increasing demand for safer, natural alternatives have led to a shift in focus towards using safe, natural herbal extracts as effective alternatives in poultry nutrition. This shift has been accelerated by EU restrictions on the use of antibiotics in animal feed as growth promoters in several member states. To reduce antibiotic use, strategies focusing on the use of natural growth promoters through nutritional interventions, using herbal formulations, have emerged as a promising and effective approach.

Medicinal plants and herbs have uses and benefits for both humans and animals. They enrich animal feed with natural and effective substances such as antioxidants with antimicrobial biological activity, which promotes the health and rapid growth of broiler chickens[1].

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Fenugreek, scientifically known as *Trigonella foenum-graecum*, has a high content of bioactive compounds, such as flavonoids, phenols, alkaloids, saponins, and other bioactive compounds[2] Specialized in its work fighting microbes, oxidation, fungi, and viruses, it improves the overall health of the digestive and intestinal system, such as digestion and absorption, thus indirectly boosting the birds' immunity [3]. In addition to what has been mentioned, fenugreek has been used in recent studies as an additive to broiler chicken feed and has been found to have an effective impact on cholesterol and blood sugar levels, immunity, and protein and globulin levels in blood plasma.[4].

Ginger, scientifically known as *Zingiber officinale*, contains many biologically active compounds such as gingerol, shogaol, and zingerone, which are anti-inflammatory, antimicrobial, and digestive stimulants [5]. It has uses in human medicine, and interest in it and its use as a natural growth promoter for poultry has increased in recent years [6]. These additives can modify intestinal structure, improve nutrient absorption, and enhance immune responses, thus contributing to improved growth and FCR in broiler chickens [7], [8]. Ashwagandha (*Withania somnifera L. Dunal*), also known as winter cherry [9], is a subtropical plant that grows to a height of 30–150 cm. It belongs to the nightshade family (Solanaceae) and grows naturally in large areas of Africa, Pakistan, India, and the eastern Mediterranean [10]. It is sometimes called Indian ginseng due to its medicinal properties, which are comparable to ginseng [11], and it functions as a natural herbal tonic for maintaining health [12]. It is an antioxidant, liver tonic, anti-inflammatory, aphrodisiac, astringent, antifungal, and antibacterial agent [13], [14], in addition to immune functions and raising hemoglobin, red blood cell, and white blood cell levels [15], [16] and enhancing the physiological and immune functions of birds exposed to stress [17].

This study aimed to evaluate the addition of different levels (1, 2, 3 g/kg feed) of a mixture of medicinal plants (FGA) to the feed and its potential effects on productive performance such as body weight, weight gain, feed consumption and FCR.

Materials and Methods

Study Design

This study was conducted at the poultry farm of the Animal Production Department, College of Agriculture, Tikrit University, from 17/3/2025 to 28/4/2025 to determine the effect of adding equal amounts of a natural herbal mixture consisting of fenugreek seeds, ginger powder, and ashwagandha powder at (0, 1, 2, 3) g/kg of feed. The treatments were as follows: Treatment 1: Control (no additives); Treatment 2: Addition of the herbal mixture at a rate of 1 g/kg of feed; Treatment 3: Addition of the herbal mixture at a rate of 2 g/kg of feed; Treatment 4: Addition of the herbal mixture at a rate of 3 g/kg of feed.

Feed formulation and poultry nutrition

The feed was formulated in the feed mill at the animal field in the College of Agriculture, Tikrit University. Yellow corn, soybean meal, sunflower oil, limestone, Dicalcium phosphate, lysine, methionine, and table salt were used in formulating the feed. The feed was formulated based on the broiler breeding guide of [18], Table 1.

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Table 1. Proportions of nutrients included in the composition of the rations and their chemical analysis.

ıgredient (%)	tartar 0-10 days	Grower 1 11-20	Grower 2 21-42
orn	50	60	60
oybean meal (CP 44%)	35.85	30.53	27.53
remix (minerals & vitamins)	2.5	2.5	2.5
unflower oil	4.52	3.07	4.16
imestone	4.58	2	4.12
icalcium phosphate	2	1.15	1
alt (NaCl)	0.25	0.25	0.25
-lysine HCl	0.15	0.25	0.19
L-Methionine	0.15	0.25	0.25
otal	100	100	100
***Calculated Nutrients**			
Ietabolizable energy (Kcal/kg)	2975	3050	3075
rude protein (%)	22.00	20.50	19.00
rude fiber (%)	3.71	3.53	3.31
alcium (%)	2.75	1.32	2.07
vailable phosphorus (%)	0.44	0.27	0.26
ysine (%)	1.28	1.26	1.12
Iethionine (%)	0.61	0.69	0.67
Iethionine + Cysteine (%)	0.79	0.75	0.71

Premix (minerals and vitamins): Use a Wafi product in a 25 kg bag containing ɔecific proportions of vitamins and minerals.
*Based on chemical analysis as per [19]

Statistical Analysis

The Statistical Analysis Program (SAS) version 9.1 [20] was used to analyze the data according to the completely randomized design (CRD), and Duncan's [21] method was applied to find the significant differences between the means of the treatments at a significance level of 5%.

Results

The birds were weighed weekly and for each replicate separately throughout the study period (42 days). Table 2 shows the significant differences between the mean treatments. In the first three weeks of chick life, there are no significant differences in bird weights between the experimental treatments. However, a significant increase in live body weight is observed in the fourth treatment (treatment adding 3 g/kg of feed from FGA) in the fourth, fifth, and sixth weeks compared to the other experimental treatments

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Table 2. Effect of adding FGA to the diet on the live body weight of broiler chickens at 42 days of age (mean± standard error)

ges in ays	Treatments				evel of gnificance
	1: Without any ldditions	2: 1 g/kg FGA	3: 2 g/kg FGA	4: 3 g/kg GA	
	170.00±4.50[a]	158.75±1.25[a]	164.00±4.26[a]	163.00±3.67[a]	N.S
4	311.50±5.66[a]	320.00±6.86[a]	312.25±5.15[a]	318.25±3.01[a]	N.S
1	501.75±21.01[a]	513.50±23.52[a]	486.75±7.48[a]	488.50±4.40[a]	N.S
3	539.00±39.58[b]	574.50±19.94[ab]	620.75±19.96[ab]	640.75±23.47[a]	*
5	617.25±34.75[ab]	544.25±35.28[b]	545.75±4.58[b]	657.25±16.72[a]	*
2	718.50±47.57[a]	719.75±30.60[a]	756.75±43.01[a]	807.50±8.88[a]	N.S
-42	2858.00±14.52[b]	2830.75±43.37[b]	2886.25±39.92[b]	3075.25±5.48[a]	*

Different letters within the same row indicate significant differences between the mean values at a gnificance level of 5%.

Table 3. Effect of adding FGA to the diet on weight gain of broiler chickens at 42 days of age (m

ges in ays	Treatments				evel of gnificance
	1: Without any ldditions	2: 1 g/kg FGA	3: 2 g/kg FGA	4: 3 g/kg GA	
	211.00±4.50[a]	199.75±1.25[a]	205.00±4.26[a]	204.00±3.67[a]	N.S
4	522.50±7.17[a]	519.75±6.56[a]	517.25±2.01[a]	522.25±5.52[a]	N.S
1	1024.25±25.90[a]	1033.25±23.57[a]	1004.00±8.05[a]	1010.75±8.08[a]	N.S
3	1563.25±27.99[b]	1607.75±20.09[ab]	1624.75±15.99[ab]	1651.50±17.59[a]	*
5	2180.50±33.73[b]	2152.00±16.14[b]	2170.50±14.38[b]	2308.75±5.25[a]	*
2	2899.00±14.52[b]	2871.75±43.37[b]	2927.25±39.92[b]	3116.25±5.48[a]	*

Different letters within the same row indicate significant differences between the mean values at a gnificance level of 5%.

Table 3 shows the effect of adding levels of FGA to the diets on the weight gain of broiler chicks for 42 days. We note that there were no significant differences in the first three weeks between all experimental treatments, and the fourth treatment was significantly superior in

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the weight gain for the fourth and fifth weeks. There were no significant differences in the sixth week between all experimental treatments, and in the overall rate of weight gain (0-42 days), the fourth treatment was superior to all experimental treatments in the weight gain.

Table 4 shows the effect of FGA addition on the weekly feed consumption of broiler chicks at 42 days of age. There were no significant differences between all experimental treatments at 42 days of age.

Table 4. Effect of adding FGA to rations on feed consumption of broiler chickens at 42 days of age (mean ± standard error)

ges in ays	Treatments				evel of gnificance
	1: Without any ldditions	2: 1 g/kg FGA	3: 2 g/kg FGA	4: 3 g/kg GA	
	0.95±0.02[a]	0.97±0.02 [a]	0.98±0.03 [a]	0.98±0.02 [a]	N.S
4	1.17±0.02 [a]	1.10±0.02 [a]	1.14±0.03 [a]	1.11±0.01 [a]	N.S
1	1.29.0.05 [a]	1.18±0.08 [a]	1.15±0.05 [a]	1.14±0.03 [a]	N.S
3	1.68±0.08 [a]	1.60±0.05[ab]	1.48±0.05[b]	1.43±0.02[b]	*
5	1.81±0.05[b]	2.13±0.15[a]	1.88±0.03[ab]	1.72±0.02[b]	*
2	2.08±0.02[a]	2.00±0.05[a]	1.97±0.03[a]	1.79±0.03[b]	*
-42	1.62±0.01[a]	1.61±0.02[a]	1.54±0.01[b]	1.46±0.004[c]	*

Different letters within the same row indicate significant differences between the mean values at a gnificance level of 5%.

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Table 5 shows the effect of adding FGA to the diets on the FCR of broiler chicks at 42 days of age. There were no significant differences between the experimental treatments in the first three weeks of the experiment, and the fourth treatment showed a significant improvement in the fourth, fifth and sixth weeks, as well as in the overall average (0-42) days compared to the control treatment.

Table 5. Effect of adding FGA to diets on FCR of broiler chicks at 42 days of age (mean ± standard

ges in ays	Treatments 1: Without any ldditions	2: 1 g/kg FGA	3: 2 g/kg FGA	4: 3 g/kg GA	evel of gnificance
	162.50±1.55[a]	154.50±3.20[a]	160.25±2.56[a]	161.00±3.62[a]	N.S
4	366.00±6.09[a]	351.00±5.80[a]	357.50±6.98[a]	352.50±4.33[a]	N.S
1	648.50±24.59[a]	606.75±36.86[a]	561.50±28.31[a]	558.25±23.88[a]	N.S
3	897.75±43.17[a]	919.75±18.46[a]	920.50±27.08[a]	917.00±25.09[a]	N.S
5	1118.75±78.60[a]	1150.25±42.66[a]	1029.50±22.25[a]	1129.00±12.81[a]	N.S
2	1494.50±85.37[a]	1440.25±27.36[a]	1495.00±71.35[a]	1446.50±36.50[a]	N.S
-42	4688.00±48.13[a]	4622.50±37.72[a]	4524.25±75.76[a]	4564.25±24.89[a]	N.S

Similar letters within the same row indicate that there are no significant differences between the mean :ores at a significance level of 5%.

Discussion

Adding medicinal plants such as FGA to poultry feed, especially for broiler chickens, is beneficial. Broiler chickens are fast-growing and require careful attention to their nutrition and supplements that support and enhance their nutritional needs. They also have lower immunity, requiring special care and attention. Therefore, natural supplements like herbs, which contain highly effective compounds, are used to boost their immunity. FGA has three common mechanisms of action as antioxidants, working synergistically. It stimulates the secretion of digestive enzymes from the pancreas and intestines, which digest proteins and fats, and increases the length of intestinal villi, thereby increasing the surface area for absorption. This leads to greater utilization of digested nutrients and less loss. In addition, these antioxidants act as natural antioxidants with a strong effect on oxidative stress within living cells, thus preserving the bird's energy and utilizing it for growth.

The increased body weight in fenugreek may be attributed to its high content of bioactive compounds such as polysaccharides and mucilage, which act as prebiotics, nourishing beneficial gut bacteria and reducing harmful bacteria like E. coli, thus improving digestive health and function. Additionally, the saponins present in its seeds may act as an appetite stimulant and facilitate nutrient absorption

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through the intestinal wall, increasing feed utilization efficiency. Linoleic acid, also present in fenugreek seeds, contributes to increased body weight in birds [22], [23].

Ginger is a top-tier digestive stimulant thanks to its gingerols and shogaols content, which stimulate digestive secretions [24]. It does this by stimulating the liver to secrete bile and the pancreas to secrete essential enzymes (lipase, protease, and amylase) that break down and digest nutrients in feed [25]. Ginger also reduces intestinal inflammation, thus maintaining intestinal health and efficient absorption of digested nutrients. Furthermore, ginger enhances the taste of feed for birds, increasing feed consumption and consequently body weight [24], [26].

Ashwagandha works through a different mechanism by reducing stress caused by heat and density farming. It reduces cortisol secretion, and when cortisol levels decrease, protein breakdown in muscles is reduced, and energy is directed towards building muscle and tissue instead of being wasted in resisting stress [27]. Ashwagandha has an anabolic effect due to its content of compounds called withanolides, which have an effect similar to natural anabolic hormones, thus promoting the synthesis of proteins necessary for muscle building [27], [28]. In addition, ashwagandha enhances immunity and improves the efficiency of the immune system, which reduces mortality and emaciation rates [29].

The positive results obtained in our study, in which we used the addition of levels of a mixture of medicinal plants, namely FGA (1, 2, 3) g/kg of feed to the diets of Rose 308 broiler chicks from one day to 42 days old, indicated a significant improvement for the fourth treatment, the addition of 3 g/kg of FGA, in live body weight, weight gain, and FCR, while maintaining the same rate of feed consumption among all experimental treatments. The reason for this improvement may be due to this herbal mixture containing multiple active components that worked synergistically and gave a stronger effect on digestive health, absorption, and general health, as these herbs AFG have the potential to increase the length of the villi and the depth of the crypts of the intestines, which improves the digestion and absorption of nutrients and improves the optimal utilization of feed, thus raising growth rates and weight gain. The FCR of the feed improves because the bird digests the feed completely and more efficiently and does not excrete undigested feed with the droppings. This reduces the need for smaller quantities of feed to produce a kilogram of meat.

Conclusions

Our study concludes that adding the herbal mixture of FGA medicinal plants had a synergistic effect, with each plant complementing the others. Fenugreek and ginger benefit the digestive system by improving digestion and absorption efficiency, while ashwagandha reduces stress and directs energy towards muscle growth. The most significant improvement in growth performance and FCR was observed in treatment four (adding 3 g/kg of FGA to feed).

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Conflict of Interest

We declare that there is no conflict of interest.

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