

PRODUCTIVE PERFORMANCE THAT INFLUENCED BY DIETARY FENUGREEK, ALFA-ALFA AND THEIR MIXTURE IN BROILERS AND SENSORY CHARACTERISTIC

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Abstract

The aim of the study was to compare the productive performance of broiler chickens when fed a traditional standard feed and the same feed supplemented with Fenugreek or/and alfalfa. One hundred and twenty one day old unsexed broiler chicks of the strain Ross 308, that were divided into four groups each included 30 birds with three replicated 10 birds in each replicated which reared for 35 days, the first group (control group G1): chicks were fed on a basic diet without any addition, the second group fed on a basic diet with 2.5 gm fenugreek (G2)/ Kg diet, the third group fed on a basic diet with 2.5 gm alfalfa (G3)/Kg diet, the fourth group was fed on a basic diet with 2.5 gm fenugreek and 2.5 gm alfalfa /Kg diet(G4). The productive parameters were calculated weekly throughout the experimental period. The mixture of fenugreek and alfalfa significantly affected and improve weekly body weight, weight gain, feed intake and feed conversion ratio in treated groups compared with control group. Mortality was zero in all groups. The results of sensory test showed that flavor, taste, juiciness, and color in breast and thigh muscles were higher in addition groups as compared with control, except that moderate juiciness and tenderness in fenugreek group as compared with control.

Keywords: *Broiler chickens, Fenugreek, alfalfa and Productive performance*

Introduction

The latest ban on the use of antibiotics as feed additives is due to drug resistance in animals and the concern about the effect of drug residues in animals and consumable food products by human. As this may negatively affect the productivity of the poultry, feed industries will have to search for new alternatives. At present, there is an increasing interest to find alternative substances to improve the health status of the farm animals for human consumption (Wang *et al.*, 2015). Herbal agents could work as safer alternative growth promoters due to their suitability, availability, favorite, lesser cost of production, reduced risks of toxicity and minimum health hazards (Khadr and Abdel-Fattah, 2007).

Fenugreek (*Trigonella foenum - graecum L.*) is a medicinal plant with a broad aspect of therapeutic and antimicrobial and growth-promoting effects (Purushothaman *et al.*, 2015), it is a good source of dietary protein for consumption by human and animals, and of fatty acids which are chiefly linoleic, linolenic, oleic and palmitic (Schryver, 2002). Beside that it contains many carbohydrates, minerals and vitamins (Michael and Kumawat, 2003). Fenugreek contains neurin,

biotin, tri-methylamine which have a tendency to stimulate the appetite by their direct action on the nervous system (Ahmadiani *et al.*, 2001). A moderate level of anti-proteolytic activity in fenugreek and it contains coumarins and other active components that might affect platelet aggregation. It also contains different alkaloids, flavonoids and saponins but out of all these, saponins are found to be in maximum concentration in the fenugreek (Tariq *et al.*, 2016). Elmahdi-Elbushra, (2012) showed that the fenugreek seeds powder improved broiler metabolism and the improvement in body weight gain may be due to antibacterial related to the flavonoids in fenugreek that led to maintaining the normal intestine microflora population.

Alfalfa (*Medicago sativa L.*) is one of the most common perennial legume forage occupying around 324.53 million tones worldwide in 2013 (Tufarelli *et al.*, 2018). Ddehydrated alfalfa is usually used at very low levels in poultry nutrition, especially due to its high fiber and low energy contents, previously it has been shown that alfalfa slows the passage rates in the avian gastrointestinal tract (Sibbald,1980), that could be beneficial because dietary fiber sources may be fermented at a greater extent by microorganisms (Ricke *et al.*,1982). Furthermore, this fermentation could retain microflora that may function, in part, as a barrier to pathogenic bacteria (Vispo and Karasov,1997) .Actually , preliminary studies by Kwon and Kubena, (2001) have shown that alfalfa limited the colonization and infection with Salmonella enteritidis in laying hens.

In latest years, some studies have reported that alfalfa contained flavonoids, saponins, dietary fiber, vitamins, minerals, organic acids and polysaccharide(Dal Bosco *et al.*,2015), the above-mentioned bioactive substances have possessed a wide range of bioactivities such as antioxidant, anti-inflammation, anticancer, and enhancing immunity function (Al-Dosari, 2012). Hence, alfalfa flavonoids have been usually used as an additive added to animal feed to promote the antioxidant activity of serum and liver, meat quality, growth, and production performance.

Several investigators reported that using medicinal plants in broiler diets improved body weight gain and feed conversion efficiency and reduced the cost of feed (Farman Ullah *et al.*, 2009). Thus, the objective of the present study was to investigate the impact of Fenugreek seeds as natural feed additives on the performance of broiler chicks.

Material and method

This study was carried out in a private breeding hall, from 22 Jan. to 26 Feb. / 2022.A total of 120 day old broiler chicks were taken and randomly allocated into 4 groups with 3 replicates per group, ten chicks per replicate. G1 was used as a control and fed basal diet while the chicks of G2 fed basal diet with 2.5 gm/kg diet of dry fenugreek leaves , G3 fed basal diet with 2.5 gm/gm diet dry alfalfa leaves , G4 fed basal diet with 2.5 gm/kg dry fenugreek leaves and 2.5 gm/kg diet dry alfalfa leaves .

Standard broiler diets for starter (0-21 day) and finisher (21-35 day) show table (1) .The broiler chicks were housed in a deep litter system and provided *ad libitum* feed and water throughout the

trial period. The temperatures were 33°C, 30 °C, 28°C, 24°C and 22°C during the 1st , 2nd , 3rd , 4th and 5th weeks of age respectively . The lighting regime was 23:1 light-dark cycle.

The chicks were weighted every week of age. Body weight (BW) and weight gain(WG) of the birds were determined at the end of each week of herbs supplementation, to determination of feed consumption, weekly feed intake of the birds was determined by weighing the amount of feed given for each group and subtract the weight of the remaining feed from the original weight to determine the quantity of feed intake. The feed conversion ratio was determined at weekly by dividing the feed intake by the body weight gained in every week.

At the end of the trial, Two chicks of each replicate were selected at random and shot., after bleeding, slaughtered chicks were cleaned and feathers pulled automatically, then washed and drained after eviscerating, sawn in two halves. One side divided into commercial cuts (thigh and breast). The carcasses were chilled to 4 °C for 24 hours intended for characteristics of the carcass for the taste of the team.

Data obtained from present study were analyzed as one-way analysis of variance(ANOVA) using general linear model (GLM) procedure to SPSS 22.0 software (Corp, 2011). Four treatment means were separated by using a Duncan`s analysis in level (0.05).

Table (1). Ingredients, and nutrient composition of experimental diets.

Ingredient %	Starter (1-21 day)	Finisher (22-35 day)
Corn%	30	30
Soya bean meal (44% protein)	28	20
Wheat%	27.5	35.5
Animal Protean (50%)	3	10
Oil%	3	3
Salt%	0.3	0.3
Limestone%	1	1.2
Total	100	10

Chemical Analysis*of basal diet

Gross energy	3078	3125.2
Crude protein %	22.74	20.16
Energy/protein ratio	135.35	155,07
Calcium %	0.97	1.0
Available Phosphate %	0.41	0.48
Methionine +cysteine%	0.83	0.75
Lysine%	1.02	0.95

Methionine%	0.78	0.51
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chemical analysis according to NRC.(1994)

Result

Means of live body weight and weight gain of broiler chicks were listed in table (2) and (3) in respect, there were a significant increase ($P \leq 0.05$) in live body weight and weight gain during 3-5 weeks of age of addition groups as compared with control, It has been observed that G4 recorded the highest weight as compared with all experimental groups, there were no significant differences between G2 and G3 groups at the same weeks of age. The result in table (4) showed a significant difference ($P \leq 0.05$) in feed intake between the additive groups and control during 2-5 weeks of age, the current study showed a significant increase ($P \leq 0.05$) at the G4 as compared with other groups, while the G2 recorded a significant increase ($P \leq 0.05$) as compared with G3 and control group, The result of accumulative feed consumption showed a significant increase ($P \leq 0.05$) in additive groups as compared to control, The result of feed conversion ratio were recorded in table (5), that showed a significant decrease ($P \leq 0.05$) in G2, G3 and G4 groups as compared to control during 4-5 week of age, the G4 showed better FCR as compared to other groups of study.

Table(6)and(7) recorded the influence of fenugreek or /and alfalfa as a dietary addition in broiler meat of thigh and breast muscles in respect, the results showed that significant improvement ($P \leq 0.05$) was found in tenderness, juiciness, color, flavor and Palatability in additive groups as compared with control.

Table (2) Effect of fenugreek, alfalfa and their mixture on weekly live body weight (gm/bird) of broilers. (Mean±SE).

Live body weight gm/bird				
Group	G1	G2	G3	G4
AGE				
WK1	217.3 ± 1.01 a	218.5 ± 0.66 a	218.0 ± 0.72 a	218.5 ± 0.71 a
WK2	564.0 ± 0.63 a	565.8 ± 3.65 a	564.8 ± 2.59 a	565.8 ± 2.90 a
WK3	1064.0 ± 3.16 c	1090.0 ± 2.98 b	1104.2 ± 7.88 a	1118.0 ± 2.50 a
WK4	1668.0 ± 7.18 c	1802.0 ± 11.78 b	1804.0 ± 6.36 b	1860.2 ± 1.28 a
WK5	2289.2 ± 3.79 c	2579.2 ± 8.68 b	2578.0 ± 5.15 b	2689.4 ± 2.58 a

Different letters in the same row showed a significant difference at ($P \leq 0.05$)

G1(Control):basal diet only,G2:2.5gm/kg diet Fenugreek ,G3:2.5 gm/kg diet alfalfa ,
G4:2.5gm/kg diet Fenugreek +2.5 gm/kg diet alfalfa , wk1,2,3,4,5:weeks of experiment.

Table (3) Effect of fenugreek , alfalfa and their mixture on weight gain(gm/bird) of broilers. (Mean±SE).

Body weight gain (gm/bird)				
Group AGE	G1	G2	G3	G4
WK1	176.8 ±0.80 a	177.3 ±1.15 a	177.2 ±1.50 a	177.1 ±1.15 a
WK2	346.7 ±0.96 a	347.3 ±3.20 a	346.8 ±2.93 a	347.3 ±3.20 a
WK3	500.0 ±3.35 c	524.2 ±5.95 b	539.4 ±8.27 ab	552.2 ±2.73 a
WK4	604.00 ±5.23 c	712.0 ±14.45 b	699.8 ±8.33 b	742.2 ±3.18 a
WK5	621.2 ±10.87 c	777.2 ±17.57 b	774.0 ±9.84 b	829.2 ± 3.37 a
Cumulative (gm)	2248.8 ±3.76 c	2538.0 ±8.40 b	2537.2 ±2.10 b	2648.0 ± 2.09 a

-Different letters in the same row showed a significant difference at ($p < 0.05$)

G1(Control):basal diet only,G2:2.5gm/kg diet Fenugreek ,G3:2.5 gm/kg diet alfalfa ,
G4:2.5gm/kg diet Fenugreek + 2.5 gm/kg diet alfalfa , wk1,2,3,4,5:weeks of experiment.

Feed intake (gm/bird)				
Group AGE	G1	G2	G3	G4
WK1	200 ± 2.09 a	197 ± 1.14 a	200 ± 2.90 a	200 ± 1.41 a
WK2	447 ± 2.49 ab	445 ± 2.19 ab	448 ± 2.30 a	440 ± 2.77 b
WK3	670 ± 1.41 d	698 ± 5.15 c	710 ± 2.77 b	720 ± 1.79 a
WK4	1051 ± 8.99 b	1035 ± 2.77 bc	1025 ± 3.22 c	1067.6 ± 4.64 a

WK5	1106 ± 2.00 d	1292 ± 1.79 b	1268 ± 2.61 c	1327 ± 2.19 a
Cumulative	3474 ± 11.13 c	3667 ± 6.66 b	3651 ± 7.40 b	3754.6 ± 8.52 a

Table (4) Effect of fenugreek , alfalfa and their mixture on weekly feed intake (gm)/bird of broilers (Mean±SE).

Different letters in the same row showed a significant difference at (p<0.05)

G1(Control):basal diet only,G2:2.5gm/kg diet Fenugreek ,G3:2.5 gm/kg diet alfalfa , G4:2.5gm/kg diet Fenugreek +2.5 gm/kg diet alfalfa , wk1,2,3,4,5:weeks of experiment.

Table (5) Effect of fenugreek , alfalfa and their mixture on weekly feed conversion ratio of broilers (Mean±SE).

Feed conversion ratio (%)				
Group	G1	G2	G3	G4
WK1	1.13 ±0.03 a	1.11 ±0.01 a	1.13 ±0.19 a	1.12 ±0.01 a
WK2	1.29 ±0.01 a	1.28 ±0.13 a	1.29 ±0.01 a	1.27 ±0.01 a
WK3	1.34 ±0.01 a	1.33 ±0.01 a	1.32 ±0.02 a	1.30 ±0.004 a
WK4	1.74 ±0.02 a	1.46 ±0.03 b	1.47 ±0.02 b	1.44 ±0.005 b
WK5	1.78 ±0.03 a	1.67 ±0.04 b	1.64 ±0.02 b	1.60 ±0.01 b
FCR mean	1.46 ±0.004 a	1.37 ±0.005 b	1.37 ±0.002 b	1.35 ±0.003 c

-Different letters in the same row showed a significant difference at (p<0.05)

G1(Control):basal diet only,G2:2.5gm/kg diet Fenugreek ,G3:2.5 gm/kg diet alfalfa , G4:2.5gm/kg diet Fenugreek +2.5 gm/kg diet alfalfa , wk1,2,3,4,5:weeks of experiment,FCR: feed conversion ratio.

Table(6) Effect of fenugreek, alfalfa and their mixture on broiler thigh muscles sensory (Mean±SE).

breast muscles sensory				
Group	G1	G2	G3	G4
SC				
Tenderness	3.6 ±0.24 a	2.6 ±0.24 b	3.8 ±0.2 a	4.2 ±0.2 a
Juicy	3.2 ±0.2 b	2.8 ±0.2 b	4.0 ±0.32 a	4.4 ±0.25 a
Color	1.0 ± 0.0 c	1.8 ±0.2 b	3.0 ±0.32 a	3.6 ±0.25 a
Flavor	2.6 ±0.25 c	4.4 ±0.25 a	3.4 ±0.25 b	4.4 ±0.25 a
Palatability	3.0 ±0.32 b	4.2 ±0.2 a	3.8 ±0.2 a	4.4 ±0.25 a

thigh muscles sensory				
Group	G1	G2	G3	G4
SC				
Tenderness	3.2 ± 0.4 b	3.2 ± 0.2 b	4.4 ± 0.2 a	4.6 ± 0.2 a
Juicy	3.4 ± 0.2 b	3.4 ± 0.2 b	4.6 ± 0.2 a	4.4 ± 0.2 a
Color	1.4 ± 0.2 c	3.2 ± 0.2 b	3.6 ± 0.2 b	4.6 ± 0.2 a
Flavor	2.6 ± 0.2 c	4.6 ± 0.2 a	3.6 ± 0.2 b	4.4 ± 0.2 a
Palatability	3.2 ± 0.2 b	4.4 ± 0.2 a	4.4 ± 0.2 a	4.8 ± 0.2 a

-Different letters in the same row showed a significant difference at (p<0.05)

G1(Control):basal diet only,G2:2.5gm/kg diet Fenugreek ,G3:2.5 gm/kg diet alfalfa ,
G4:2.5gm/kg diet Fenugreek +2.5 gm/kg diet alfalfa ,SC(Sensory characteristics).

Table (7)Effect of fenugreek, alfalfa and their mixture on broiler breast muscles sensory (Mean±SE).

Different letters in the same row showed a significant difference at (p<0.05)

. G1(Control):basal diet only,G2:2.5gm/kg diet Fenugreek ,G3:2.5 gm/kg diet alfalfa ,
G4:2.5gm/kg diet Fenugreek +2.5 gm/kg diet alfalfa ,SC(Sensory characteristic)

Discussion

The results of the current study were illustrated that a significant increase of BW, WG as compared with control, Improved body weight may be due to antimicrobial activity of fenugreek because of flavonoids, saponins and phenols present in it (Schryver., 2002), which have strong antioxidant and anti-microbial properties, reported to inhibit bacteria growth, such as *Salmonella typhi*, *Escherichia coli*, and *Staphylococcus aureus* in the poultry gut. Thus, these compounds enhance performance and health by modulating the gut ecosystem of poultry birds (Iqbal,2020), Where the stabilization of the gut microbiota ecosystem and the stimulation of digestive enzymes secretion are the two well-accepted mechanisms that play a leading role in improving feed utilization and inhibiting the growth-depressing elements related to metabolism and digestion (Bento,2013),these results agree with Murlidhar and Goswami,(2012)who found that the broiler chicks fed diets added with Fenugreek seeds, had elevated live body weight , improved body weight may It can be attributed to high-quality proteins present in fenugreek or because it has a high availability of nutrients . In contrast to several studies that report that the inclusion of fenugreek did not significantly improve the live weight of the chickens (belaid *et al.*, 2021).

current study showed that the dietary alfalfa resulted in a significant improvement in the growth performance of chickens, the addition of alfalfa leaves may also cause a significant increase in the average weight body and the cumulative weight gain , which can be attributed to the natural nutritional content of this plant. The alfalfa, especially in its leafy part, is a distinguished source of many vitamins, minerals and other important compounds. It also contains estrogen , which plays a role in increasing body weight and depositing proteins and fats in tissues,farther more it have high protein content of the leaves of the alfalfa, as it comes in the second grade after soybeans (Edminster *et al.*,2001), The result of the present study, which is an agreement with the results of Tkáčová *et al.*, (2011), who revealed that the addition of 2% alfalfa increased body weight gain of broilers as compared to control bird.

Present study showed that there is a significant differences in feed intake among experimental groups start at the third week of age, addition groups with fenugreek and alfalfa showed a significant increase in feed intake as compared with control, this result in G2 and G4 can be attributed to the presence of steroid saponins (appetite-stimulating) in fenugreek leaves which increased feed consumption and motivation to eat (Khadr and Fathy, 2007)this result agree with Yassin *et al.*, (2020) who noted that fenugreek seeds might have an influence on the hypothalamus gland to stimulate appetite and expected intake, which in turn might lead to improved live body weight.

In a study by Guiwen *et al.*,(2021) who reported that the effects of different levels of alfalfa addition in broiler diets on feed intake, which can influence birds to consume more feed than the control, that may be attributable to the presence of fiber content in alfalfa. The fiber in diet affects the feed intake of poultry by stimulation of the gizzard with coarse fiber; commonly, it is assumed that coarse fiber reduces FI. Though, such effects were not observed when addition of finely ground and coarsely ground fiber (Itani and Svihus 2019).

Feed conversion ratio was significantly improved as fenugreek has a stimulatory influence on the secretion of digestive enzymes and gut mucous to stabilize microbial balance and digestion of feed which may improve FCR in broilers (Bin *et al.*, 2003). Similar results were recorded by Elbushra, (2012) who noted that supplementation about 0.5% or 1.5% fenugreek had a significant positive result on the FCR in broilers, on the other hand Al-Kerwi *et al.*, (2020) recorded that the value of the FCR with feeding fenugreek were no significant differences between the experimental groups.

Our study revealed that the group of chicks that were fed with alfalfa leaves had enhanced in FCR when compared to the control, the explanation for this result may be due to the increasing to the real advantage of the ingested feed and increasing of its metabolite, which was obvious by the increase in live body weight where the digestive enzymes were present in alfalfa (Nagy *et al.*, 1999), this result consistency with Zheng *et al.*, (2019), who noted that supplementation of different levels of alfalfa (5 %, 8 %, 10 %) decreased FCR compared to the control in chickens.

Tenderness, juiciness, color, flavor and Palatability of thigh and breast muscles in current study showed significant improvement in addition groups as compared with control, these positive effect might be due to fenugreek and alfalfa contain significant amounts of bioactive substances such as flavonoid that exhibit antioxidant properties, The role of antioxidants is to protect lipids against radical peroxidation (Lauro, 1991). Lipid peroxidation result in high levels of free radicals which can cause deterioration of the meat (Kim *et al.*, 2012) Besides, the lipid oxidation is closely related with meat color and accumulation of antioxidant substances can increase the color stability of the meat (Faustman and Cassens, 1990). Consequently, improving the antioxidant properties of the muscle is a great importance to improving meat quality and sensory trait (Wang *et al.*, 2017).

These results agree with Abdalla *et al.*, (2018) who recommended using 1% fenugreek seed in the feed to improve the quality of chicken meat, while Mukhtar *et al.*, (2013) found that inclusion of fenugreek in broiler diet produced moderate meat quality because of anti fat properties of the fenugreek.

In present study groups with alfalfa additive showed significant improved in color that may be due to the presence of saponins and pigments makes the alfalfa a unique feed component that improves meat quality (Liu *et al.*, 2013). The color improvement of the breast and thigh muscles was the most influenced characteristic due to the addition of alfalfa, it has been recorded to be a natural source of xanthophylls, which cause poultry carcasses have a desirable yellowish color (Ponte *et al.*, 2004).

Flavor is important factor that determines meat quality, in present study the results reported improvement in flavor in all addition groups compared with control, these results agree with, Zheng *et al.*, (2019) who suggesting that alfalfa could improve the flavor in chicken meat, and explained that the dietary supplementation of alfalfa significantly increased the inosine

monophosphate and delicious amino acids contents in breast muscle which represent the active flavor constituents in chicken meat as compared to the control.

Nevertheless, the results revealed that alfalfa consumption did not produce off-flavors in poultry meat, such as have been reported for meats from broilers fed on diets containing fish products (Lopez-Ferrer *et al.*, 1999).

Conclusion

The fore mentioned results confirm the beneficial use of alfalfa and fenugreek at 2.5 gm/kg in broiler chicken diets, as it increases production performance and improvement sensory trait of broiler meat also can be used as growth promoters and is highly recommended as a feed supplement.

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