

Original article

The Effect of Adding Fenugreek Seed Powder to Rabbit Diet on Weight Gain and Some Hematological Parameters

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Abstract

Fenugreek (*Trigonella foenum-graecum*) intake in animal feed has been investigated for potential benefits on growth performance and health. However, studies on its effects on rabbits have yielded mixed results regarding weight gain and feed conversion. This study aimed to evaluate the effects of different levels of fenugreek seed powder supplementation (2g, 4g, and 8g) in rabbit feed on feed consumption, weight gain, blood characteristics, and internal organ weights compared to a control group. The rabbits were divided into four groups, with the control group receiving no fenugreek supplementation. Feed consumption, total weight gain, and feed conversion ratio (FCR) were measured. Blood parameters, including red blood cell count (RBC), white blood cell count (WBC), packed cell volume (PCV), hemoglobin (Hb), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), and platelets were analyzed. The weights of internal organs (stomach, intestines, lungs, spleen, kidneys, heart, and liver) were recorded post-mortem. The results were analyzed using the statistical program SAS. The findings indicated no significant difference in total weight gain or FCR between the different levels of fenugreek supplementation compared to the control group. However, feed consumption was significantly higher in groups receiving fenugreek, potentially due to its fiber content. In contrast, significant increases ($P < 0.01$) were observed in all blood parameters with fenugreek supplementation. The addition of fenugreek positively influenced the weights of internal organs, with the highest weights recorded at the 4g and 8g supplementation levels. We Concluded that, the intake of fenugreek seed powder in rabbit feed enhances feed consumption and positively affects blood characteristics and internal organ weights. Although no significant improvement in weight gain or FCR was noted, the positive effects on blood parameters and organ weights suggest potential health benefits.

Keywords. Fenugreek, *Trigonella foenum-graecum*, FCR, Feed Intake, Rabbit Weight Gain, Internal Organ.

Introduction

Rabbit production plays a significant role in meeting the global demand for animal protein, particularly in regions where other livestock production faces challenges due to limited resources or cultural preferences [1]. Optimizing rabbit growth and health is crucial for ensuring efficient and sustainable production. Nutritional strategies, including the incorporation of functional feed additives, are continuously explored to enhance growth performance and overall health status. This thesis investigates the potential of fenugreek seed powder (FSP) as a dietary supplement for rabbits, focusing on its effects on weight gain and hematological parameters [2].

Fenugreek (*Trigonella foenum-graecum* L.) is an annual legume widely cultivated for its seeds, which are rich in various bioactive compounds. These include saponins, flavonoids, alkaloids, polyphenols, and dietary fiber [3]. Traditionally, fenugreek has been used in various cultures for its medicinal properties, including anti-diabetic, anti-inflammatory, and antioxidant effects. Increasingly, research is focusing on its potential applications in animal nutrition [4].

Several studies have demonstrated the beneficial effects of fenugreek supplementation in different animal species. For instance, in poultry, the addition of fenugreek seeds or its ex-

tracts has been shown to improve growth performance, feed efficiency, and carcass characteristics [5]. These positive effects are attributed to various mechanisms, including enhanced nutrient digestibility, improved gut health, and modulation of the immune system. The saponins present in fenugreek are believed to play a key role in reducing serum cholesterol levels and improving lipid metabolism [6].

In ruminants, fenugreek supplementation has been reported to increase milk production and improve milk quality [7]. Furthermore, studies have shown that fenugreek can enhance rumen fermentation and reduce methane production, contributing to more sustainable livestock practices. The fiber content in fenugreek seeds can promote the growth of beneficial gut microbiota, leading to improved nutrient utilization and overall gut health [8].

Hematological parameters are valuable indicators of animal health and physiological status. Changes in these parameters can reflect the impact of dietary interventions and provide insights into the overall well-being of the animal. While some studies have investigated the effects of fenugreek on hematological parameters in other species, there is a need for more research specifically in rabbits. Understanding the impact of fenugreek supplementation on blood parameters such as red blood cell count, white blood cell count, hemoglobin concentration, and other hematological indices is crucial for assessing its overall safety and potential benefits [9].

While the effects of fenugreek have been studied in various animal species, research on its application in rabbit nutrition is relatively limited. Existing studies suggest that fenugreek supplementation can positively influence growth performance and digestive function in rabbits.

In a study in Sudan, twelve rabbits were used to examine the effect of dietary saponin of fenugreek (*Trigonella foenum-graecum*) seeds on voluntary feed intake, digestibility, N-retention and some blood metabolites. Animals were randomly assigned to three different treatments (0, 0.5 and 1 gram of saponins extract per day) with four animals per treatment. Before feeding, the different levels of fenugreek saponins extract were fed at 9:00 am, mixed with small quantities of carrot and bananas daily for a period of six weeks. Voluntary feed intake, dry matter digestibility, and live body weight gain significantly ($P < 0.05$) increased in rabbits fed 0.5- and 1-gram fenugreek saponins extract. The N-retention improved in rabbits consumed 0.5- and 1-gram fenugreek saponins extract compared with the control. In contrast, cholesterol and triglyceride showed a significant reduction in rabbits ($p < 0.05$) consumed the fenugreek saponins extract (0.5 and 1 gram) compared to the control. Hemoglobin concentration and red blood cell count significantly ($p < 0.05$) increased in rabbits fed fenugreek saponins extract compared to the control. Inclusion of fenugreek saponins extract to the diet concluded positive effects on production, hematological parameters and blood Metabolites of rabbits. [10]

Methods

This study conducted in a barn of the Al-Sawani area, south of Tripoli, between September 2022 and October 2022. We used 60 local male rabbits, ages 4-5 weeks, with an average weight between 400 and 450 grams. They were divided randomly (using a completely randomized design) into 4 treatments groups, each containing 15 rabbits and 3 replicates (5 rabbits). The rabbits were housed in iron cages, and the barn had a thermometer and electric lighting for 16 hours a day.

The feed was prepared and processed according to its treatment, as the Fenugreek seeds were provided to three groups as follows: control group (T0) diet without additive, (T1) diet with 2 g of Fenugreek powder/kg of diet, (T2) diet with 4 g of Fenugreek powder/kg of diet, and the third group (T3) diet with 8 g of Fenugreek powder/kg of forage, at fixed times daily. Considering free drinking water within the specified period, the control group T0 was provided only basic feed without adding Fenugreek seeds.

The waste from each treatment was collected weekly, dried, and ground to calculate the digestibility coefficient of the dry matter. At the end of the study, blood samples of approximately 5 ml were drawn from the marginal ear vein. Tubes were used to collect blood containing an anticoagulant, EDTA, to conduct a blood test, which included red blood cell count (RBC), white blood cell count (WBC), packed cell volume (PCV), hemoglobin (Hb), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), and platelets. Random samples of rabbits were selected from each treatment to be slaughtered, and about 5 hours before the slaughtering process, the rabbits were not provided with feed and were weighed before slaughtering (final weight). Their internal viscera, including the liver, heart, kidneys, spleen, lungs, intestines, and stomach, were also weighed. The rabbits were frozen. on the second day, rabbit was sacrificed

by using -20oC freezing for 24 hours. after the entrails were kept for about an hour at the temperature of the barn, they were dried and their weights were calculated again.

Table 1. Analysis of feed components. Al-Salam feed Factory

Item	Percentage %
Earn yellow corn	40
Soybean gain	28
Barley gain	22
Wheat bran	5
Fishmeal	1
Vegetable oil	1
Diphosphorus	0.9
salt	0.38
Lime powder	1.1
The fathers	0.13
Premix mixture	0.5
the total	100.01
Protein	17.66
Metabolic energy (kcal)	2147.46

Results

The results in table 2 showed that there was no significant difference between the different levels of adding Fenugreek seed powder to the feed compared to the control group. Through the statistical analysis, the F value did not appear at a significant level of difference at probability ($P < 0.01$) and ($P < 0.05$) Regarding total weight gain or feed conversion ratio (FCR), while analyses showed that feed consumption, there are significant differences between all treatments containing Fenugreek powder compared to the control treatment.

Table 2. The effect of adding Fenugreek powder on the growth performance of rabbits at different levels

Treatment	FI (g)	GW (g)	FCR
	Mean \pm SE	Mean \pm SE	Mean \pm SE
T0	4342.17 \pm 21.35	1177.93 \pm 1.61	3.67 \pm 0.02
T1	4448.10 \pm 1.13	1190.40 \pm 3.24	3.74 \pm 0.01
T2	4457.30 \pm 3.58	1214.66 \pm 5.57	3.67 \pm 0.02
T3	4474.87 \pm 2.59	1198.47 \pm 4.32	3.74 \pm 0.02
LSD \pm	70.62	28.26	0.103

T0: diet without additives; T1: a diet and 2 g of Fenugreek powder/kg of diet; T2: a diet and 4 g of Fenugreek powder/kg of diet; T3: diet and 8 g of Fenugreek powder/kg of diet; FI: Feed intake; GW: Gain weight; FCR: Feed conversion ratio; LSD: Least significant difference.

Table 3 shows the effect of adding Fenugreek on some blood characteristics, which included red blood cell count (RBC), white blood cell count (WBC), packed cell volume (PCV), hemoglobin (Hb), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), and platelets. It was found that adding Fenugreek at all addition rates had a significant positive effect ($P < 0.01$). As it increases at a proportional rate with increased rates of addition of Fenugreek (2g, 4g, and 8g), in general, the groups treated with Fenugreek powder showed a significant increase in all blood parameters studied.

Table 3. Distribution of hematological test results at the end of the experiment.

Treatments	T0	T1(2g)	T2(4g)	T3(8g)	LSD ±
WBC (103 cells/ μ L)	5.5 ± 0.01	5.9 ± 0.02	6.7 ± 0.12	7.4 ± 0.09	0.55
Platelets (103 cells/ μ L)	290 ± 0.72	305 ± 0.74	467 ± 1.60	535 ± 1.18	5.86
MCHC (g/dL)	30 ± 0.47	33 ± 0.27	40.5 ± 0.05	49.5 ± 0.45	1.53
MCH (pg)	17.5 0.05	18.7 ± 0.03	20.4 ± 0.05	22.7 ± 0.23	0.71
MCV (μ m3)	50.5 ± 0.07	58.5 ± 0.03	60.5 ± 0.08	66 ± 0.54	1.67
Hb (g/dL)	9.5 ± 0.05	10.4 ± 0.02	11 ± 0.16	14 ± 0.01	0.59
PCV%	35 ± 0.27	40 ± 0.27	48 ± 0.27	50 ± 0.47	1.76
RBC (106/ μ L)	4.43 ± 0.01	5.46 ± 0.01	6.89 ± 0.01	6.95 ± 0.01	0.04

WBCs: white blood cells; RBCs: red blood cells; HGB: hemoglobin; HCT: hematocrit; MCV: Mean corpuscular volume; MCH: Mean corpuscular hemoglobin; PLT: Platelet count. SE: Standard error of the mean. Means in the same column with superscript letters are significantly different ($p < 0.01$).

Table 4 shows the effect of adding Fenugreek seed powder on some characteristics of the carcass organs, such as the stomach, intestines, lungs, spleen, kidneys, heart, and liver. According to the statistical analysis, the results showed that adding Fenugreek in all three levels of 2g, 4g, and 8g in rabbit feed has positive advantages on the weights of the internal organs of rabbits, as it has increased significantly and significantly ($P < 0.01$) compared with the control treatment without the addition of Fenugreek. The study indicated that the highest weights were with high levels of Fenugreek addition, 4 g, and 8 g.

Table 4. The effect of adding different levels of Fenugreek on the weights of some characteristics of the rabbit's internal organs

Treatments	T 0	T1 (2g)	T2 (4g)	T3 (8g)	LSD
Stomach (g)	15.30±0.03	17.40±0.07	17.90±0.14	18.50±0.05	0.362
Intestine (g)	49.50±0.12	59.30±0.07	60.40±0.10	65.40±0.11	0.05
Lungs (g)	9.87±0.02	10.76±0.02	10.96±0.02	11.50±0.09	0.237
Spleen (g)	0.47±0.01	0.60±0.03	0.69±0.02	0.78±0.01	0.120
Kidneys (g)	9.80±0.18	11.66±0.02	11.89±0.02	12.40±0.03	0.580
Heart (g)	4.03±0.01	5.040±0.01	5.09±0.02	6.070±0.01	0.058
Liver (g)	45.40±0.09	59.10±0.55	59.90±0.11	60.70±0.15	1.96

T0: diet without additives, T1: a diet and 2 g of Fenugreek powder/kg of diet, T2: a diet and 4 g of Fenugreek powder/kg of diet, T3: diet and 8 g of Fenugreek powder/kg of diet.

Discussion

Fenugreek is one of the oldest medicinal plants with exceptional medicinal and nutritional profile. Fenugreek seeds contain a substantial amount of fiber, phospholipids, glycolipids, oleic acid, linolenic acid, linoleic acid, choline, vitamins A, B1, B2, C, nicotinic acid, niacin, and many other functional elements.

In the current study found that the feed intake (FI) increases progressively with the addition of fenugreek in the diet. The highest FI is observed in the T3 group (4474.87 g), while the control group (T0) has the lowest (4342.17 g). This finding support that the intake of fenugreek powder in the diet may stimulate appetite or increase feed palatability, resulting in higher consumption. This was line with study done by Ahmad (2016) [11] supports these findings, stating that fenugreek seeds have bioactive components, which can enhance feed

palatability and nutrient utilization, contributing to improved feed intake. There was no significant difference between the different levels of adding Fenugreek seed powder to the feed compared to the control group, this finding disagrees with study El-Rawi (2012) [5], reported that the addition of powdered fenugreek seeds had a significant effect ($p \leq 0.05$) on most of the productivity traits in the diet of rabbits in the third group (T3) this group, which was supplemented with 8g/kg of fenugreek seed powder in their feed, showed higher values in the measured traits compared to the control group (T1) that received a diet with 2g of Fenugreek seed powder/Kg of diet. In the present study (GW) also shows an increase with the addition of fenugreek. The T2 group (medium fenugreek level) exhibits the highest GW (1214.66 g), while the control group (T0) shows the lowest (1177.93 g) that agrees with study by Ahmad et al. (2016) [11], another agreement with findings of Fadel Elseed 2013 [12] who demonstrated that fenugreek saponins enhance nitrogen retention in rabbits, leading to improved protein synthesis and tissue growth. Regarding to Hematological parameter in the present study found that differences ($P < 0.05$) in hemoglobin concentration (Hb), Red blood cells count (RBCs), (WBCs), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), and platelets. These findings were agreed with study done by Algridi, 2021[13] who reported that there was a significant increase in the levels of Hb, RBCs, and PCV after 7 days of fenugreek extract treatment. This finding consistent with study by Effraim, 2016 [14] who recorded significant findings of the hematological characteristic whose result indicated that group which received fenugreek, RBCs count remained elevated, due to the antioxidant activity of flavonoids. Another agreement with Rawi, (2012) [5] reported that adding Fenugreek seeds powder to fattening ration has significantly ($p \leq 0.05$) effect almost all production and blood traits. The total gain, total feed consumption, final weights, hot and cold carcass weights, dressing and abdominal fat percentages, red and white cell counts, hemoglobin, packed cell volume and cholesterol were increased significantly ($p \leq 0.05$). In the current study the results showed that adding Fenugreek in all three levels of 2g, 4g, and 8g in rabbit feed has positive advantages on the weights of the internal organs of rabbits, as it has increased significantly and significantly ($P < 0.01$) compared with the control treatment without the addition of Fenugreek. The study indicated that the highest weights were with high levels of Fenugreek addition, 4 g, and 8 g, this line with study by Ahmad, (2016) [11] found the Dietary supplementations greatly influenced the percentages of carcass yield, spleen and gut weight in group case compared to control.

Conclusion

The present study concluded that the intake of fenugreek seed powder in rabbit feed has more benefits in terms of feed intake (FI), growth performance, hematological parameters, and internal organ weights. Specifically, the study found that feed intake increased progressively with the addition of fenugreek, supporting the hypothesis that fenugreek enhances appetite and feed palatability. Also, the supplementation of fenugreek had a positive effect on the weights of internal organs, further supporting its role in promoting better overall physiological conditions in rabbits. Given fenugreek's positive effects on feed intake and nutrient utilization, further investigation into its role in enhancing nutrient absorption and digestion could provide valuable insights. Further studies could also explore the specific bioactive components, such as saponins and flavonoids, that contribute to the antioxidant and hematological effects of fenugreek.

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