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Effect of Fenugreek seeds on nutrient digestibility and some blood parameters in Awassi rams

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ABSTRACT

This study was investigate the effect of fenugreek seeds on digestibility and some blood parameters. Fifteen Awassi rams 18-20 months of age average body weight 32-38 kg , they were used alternately as complete randomized design seven rations used different levels of ground fenugreek seeds which (0, 3, 6, 9, 12, 15 and 18%) Each group was fed for 10 day at period and 5 days for feces collection to determine the nutrient digestibility.

Results a significant decrease in dry matter (72.62%) and organic matter (72.76) digestibility in the 2nd treatment as compared with the other treatments, for organic matter respectively . Results also showed that fenugreek seeds had significant effect on ether extract but no effect on organic matter digestibility. It was noted significantly decrease in group fed on ration contained 6% on fenugreek seeds as compared with other treatments. moreover significant in fiber digestibility in group fed ration contained 6, 12 and 15% of fenugreek seeds as compared with other groups.

Significant ($P<0.05$) increase in blood glucose as fenugreek seeds levels increased in the rations accept the group fed on ration contained 3, 9% of fenugreek seeds. Triglyceride levels was significantly increase while cholesterol for decreased in the 4th, 5th and 6th treatments as compared with the other treatments. It was noted significant increase in total protein in control group and the 1st, 4th and 6th as compared with the other group . However there was no significant differences there is no albumin treatment. Blood urea was significantly ($P<0.05$) increase in 2nd, 3th, 4th, 5th, and 6th group as compared with 1st group.

1. Introduction

Medicinal plants have a long history in peoples' life, including the Fenugreek plant, its scientific name is (*Trigonella foenum-graecum L.*), which is a herbal plant of the Leguminous or legume family [1]. Fenugreek have many names in Arabic language, including Nafla Hallab, Halab, Fariqa, and in some Arab countries it is called Basbsa [2]. Its habitat in North Africa and the countries eastern Mediterranean. This plant is grown in large areas especially in India [3]. Fenugreek seeds contain good levels of protein, about 12-45% according to it sources [4], in addition to energy that reaches more than 3000 kcal\kg of seeds [5], it also contain carbohydrates, fats and some vitamins. Few studies have been conducted about the effect of fenugreek seeds on the digestion of food compounds. [6] showed that there were no significant differences between the experimental groups in the digestibility coefficient of dry and organic matter and protein, while it found a decrease in the digestibility coefficient of ether extract with an increase in the percentage of fenugreek seeds in sheep's diet when fenugreek seeds were used at rates of 0 , 5 , 10 , and 15% within the diets dealt with. In a study on goats conducted by [7] in which experimental groups were fed diets containing fenugreek seeds at rates of 5 ,10, and 15%, it was noted that the digestibility of dry matter digestion for animals that consumed the diets increased by 10 and 15%, significantly (P≦0.05). It reached 88.72and 89.13%, respectively, compared to animals that ate diet and 5%, which amounted to 79.51%. Also, the protein digestion coefficient for animals that ate the two diets increased by 10and 15%, significantly (P≦0.05), reaching 86.43 and 86.68% according to respectively, compared with animals that ate diet and 5%, which amounted to 73.97%. [8] indicated in a study on buffaloes that the digestibility coefficient of each of the ether and fiber extracts increased significantly (P ≦0.01) in the group added to their diets 200 gm/day per head, reaching 76.11 and 74% compared to the control group, which was It reached 70.06 and 63.5%, respectively. Therefore, the aim of this study is to know the effect of different proportions of fenugreek seeds on the coefficient digestion of food compounds and some blood biochemical parameters.

2. Material and Methods:

This study was conducted in animal Fields \ College of Agriculture and Forestry\ University of Mosul, to study the effect of different proportion of fenugreek seeds on rams' diets on the digestibility of food compounds. 15 Awassi rams were used in the study aged between (18-20 months), and weights (32-38 kg). The animals were placed in individual cages (1.5 x 1.5 m^2) were equipped with feeders and drinkers . Digestion cages were used, whose dimensions were (1.2 x 0.6 m^2), which were designed for the purpose of collecting waste and urine individually for each of them, and were equipped with a feeder and a drinker of water. In this experiment, 7 diets were used, whose chemical composition and components are shown in (Table 1).

Table (1): Experimental diets and its chemical analysis

Feed	R1%	R2%	R3%	R4%	R5%	R6%	R7%
Crushed barley	50	50	50	50	50	49	48
Bran	35.5	34.5	33.3	31.4	28.5	26.5	24.6
Soybean meal	5	3	1	--	--	--	--
Crushed fenugreek	--	3	6	9	12	15	18
Hay	8	8	8	8	8	8	8
Salt	0.5	0.5	0.5	0.5	0.5	0.5	0.3
Urea	0.5	0.5	0.7	0.6	0.5	0.5	0.4
Limestone	0.5	0.5	0.5	0.5	0.5	0.5	0.45
Chemical composition							
Dry matter%	92.55	92.50	92.60	92.75	92.75	92.80	92.40
Organic matter%	88.80	87.58	88.19	88.03	87.22	88.39	88.10
Ether Extract	4.28	4.25	5.07	4.65	4.21	5.05	4.77
Crude protein%	14.17	13.85	13.90	13.86	13.84	13.94	14.14
Crude fiber%	11.08	10.84	10.57	10.28	10.79	10.66	10.61
Metabolism Energy Mcal/kg))	2.41	2.41	2.44	2.43	2.45	2.46	2.48

Rams were divided into three groups, each containing 5 animals. Because the number of animals is limited, they were used alternately and as shown in (Table 2). At the beginning of the experiment, the first group was introduced and included 5 animals as they were introduced into individual wooden cages and fed on the first ration (R1) for a period of 10 days as an introductory period. The animals took at a rate of 1.5 kg \ day in two periods in the morning and evening, then transferred to the digestion cages on the tenth day of each trial period for the purpose of collecting waste for a period of 5 consecutive days. Waste is collected every morning and before feeding the fodder for the morning meal. It is weighed and a sample of 25% of the weight is taken. It is placed in polyethylene bags and kept in the refrigerator until the collection process is completed. The samples were collected on the last day of the collection process and mixed well, then a sample representing 25% of sample weight was taken. of the total weight, then dried at 60 °C until the weight is stable and kept until chemical analyzes are performed. Blood samples were taken from the jugular vein [9]. 5 days after introducing the first group, the second group was introduced to the individual cages and fed on the second diet (R2).

Table (2): Plan of using animals in the digestible experiment

Groups	Times								
	5 Days	10 Days	15 Days	20 Days	25 Days	35 Days	40 Days	45 Days	50 Days
T1	Wooden cages		Digestive cages						
T2		Wooden cages		Digestive cages					
T3			Wooden cages		Digestive cages				
T4				Wooden cages		Digestive cages			
T5					Wooden cages		Digestive cages		
T6						Wooden cages		Digestive cages	
T7							Wooden cages		Digestive cages

3. Results and Discussions

The results in Table 3 that the dry matter digestibility of the experimental rations did not differ significantly between the treatments except for the second treatment (6% fenugreek seeds), as a significant decrease (P≤0.05) was observed in the dry matter digestibility compared with the rest of the rations. The percentages of the digestibility of the dry matter for the experimental diets were 75.78 , 76.99 , 72.62 , 76.61 , 74.02 , 73.54 and 75.36% for each of the control group and the rest of the treatments. So it is with regard to the digestion coefficient of organic matter, as the values of the digestibility were 76.71 , 77.64 , 72.76 , 77.34 , 75.24 , 74.79 , and 77.04%, respectively.

The digestion of the dry and organic matter for any diet may varies in any group depending on factors such as type of animal, type of diet in terms of its components, and the ability of microorganisms to decompose and digest them . As for the decrease in the digestibility of dry and organic matter in the second diet (6% fenugreek seeds), its cause is not clear. In this field, and in a study conducted by [6] on sheep, in which fenugreek seeds were used at rates of 0 , 5 , 10 , and 15% in experimental diets, results similar to the results of this study were obtained, as no significant effect was observed for the different levels of fenugreek seeds in dry and organic matter digestibility . Similar results obtained by [8] in their study on buffaloes showed that the addition of fenugreek seeds to the rations led to a significant decrease (P≤0.05) in the digestibility of dry matter digestibility of the ration to which fenugreek seeds were added compared to

the control ration. In a previous study by [8], they showed that adding 200 gm of fenugreek seeds to buffalo diets led to an improvement in the coefficient of dry matter digestibility . In studies on goats, an improvement was observed in the coefficient of digestion of both dry and organic matter in goat groups whose diets contained a proportion 5 , 10 , and 15% as fenugreek seeds, a result that contradicts what was found in [7] .

The results in Table [3] indicated that there was an improvement in the digestibility of the ether extract in all treatments that contained fenugreek seeds compared to the control groups, but the differences were significant (P≤0.05) only between the second group (85.85%) and the fourth group (93.47%) compared to the control group (82.63%). And the sixth transaction (82.63%). In a similar study conducted by [6], a significant decrease was found in the digestibility of ether extract in groups of sheep that ate diets containing different fenugreek seeds proportion compared to the control group, which is a result contrary to what was found in this study. Whereas, [8] when adding 200 gm of fenugreek seeds to buffalo diets noticed a significant improvement in the digestibility coefficient of ether extract, a result similar to what was found in this study. The reason for this difference in the results of studies on the effect of fenugreek seeds on the digestibility of ether extract may be that the presence of these seeds is effective in affecting the absorption of fats from the small intestine [11].

Table (3) indicates that there are some significant effects of fenugreek seeds on the protein digestibility. It was observed a significant decrease (P<0.05) in the protein digestibility of the second diet (72.62%) compared to the control diet (75.96%), the first treatment (76.99%) and the sixth treatment (75.36%), while it did not differ significantly with the fourth and fifth treatments, which amounted to 74.02 and 73.54%, respectively. The degradability of protein within the rumen by microorganisms and the ability of these organisms to benefit from the degradable of nitrogen is one of the important factors that affect the coefficient of protein digestion. In this study, the proportion of protein in the experimental diets was different in the percentage of fenugreek seeds, as it appears from the results of this study that fenugreek seeds did not have a clear effect on the protein digestion coefficient, and this is what [6] indicated in his study on sheep. No significant effect was observed for the percentage of fenugreek seeds on the protein digestibility. However, in the study conducted by the researcher [10] when adding 200 gm/day of fenugreek seeds to the diets given to buffaloes, it caused a significant increase (P≤0.01) in the protein digestibility. This difference may be due to the different type of animal on the one hand and the environment of the rumen on the other hand. The results of the statistical analysis indicate that there is a significant decrease (P≤0.01) in the fiber digestibility in the second, fourth and fifth treatments, as the percentage of the fiber digestibility was 58.45 , 56.65 and 56.55 , respectively, compared to the control group and the first, third and sixth treatments, as the proportion of the digestibility reached 66.25 , 65.68 , 66.46 , and 63.68%, respectively. The reason for this difference is not completely clear, but

the pH of the rumen fluid may have a fundamental role in this difference, as it is known that when the pH of the rumen fluid decreases, the activity of fiber-decomposing bacteria decreases [12], and this is what was observed in this study. Although there is a variation in the effect of fenugreek seeds on the fiber digestibility coefficient, these results are in line with what was found by [8] in their study on buffaloes, where they indicated a significant increase (P ≤ 0.01) for the fiber digestibility coefficient of The group added to its diet was 200 gm/day per head, reaching 74% compared to the control group, which amounted to 63.5%. It was observed a significant decrease (P≤0.05) in the protein digestion coefficient of the second diet (72.62%) compared to the control diet (75.96%), the first treatment (76.99%) and the sixth treatment (75.36%), while it did not differ significantly with the fourth and fifth treatments, which amounted to 74.02. and 73.54%, respectively.

Table (3). Means ± S E for Digestibility in rams

Digestibility	Control	T1 3%	T2 6%	T3 12%	T4 15%	T5 15%	T6 18%
Dry matter%	75.78 ± 1.25 a	76.99 ± 0.54 a	72.62 ± 0.45 b	76.61 ± 1.13 a	74.02 ± 0.52 a	73.54 ± 1.28 a	75.36 ± 0.55 a
Organic matter%	76.71 ± 1.18 a	77.64 ± 0.57 a	72.76 ± 0.81 b	77.34 ± 1.16 a	75.24 ± 0.66 a	74.79 ± 1.34 a	77.04 ± 0.55 a
Ether Extract	81.50 ± 1.60 b	85.85 ± 0.74 a	83.71 ± 1.59 ab	85.18 ± 1.12 ab	93.47 ± 0.30 a	85.35 ± 1.39 ba	82.63 ± 1.71 b
Crude protein%	75.96 ± 1.24 a	76.99 ± 0.54 a	72.62 ± 0.45 b	76.61 ± 1.13 a	74.02 ± 0.52 ab	73.54 ± 1.28 ab	75.36 ± 0.55 a
Crude fiber%	66.25 ± 2.14 a	65.68 ± 1.36 a	58.45 ± 1.50 b	66.46 ± 2.41 a	56.65 ± 1.01 b	56.55 ± 1.77 b	63.68 ± 1.16 a

Note : Similar letters within the same row refer that there are no significant differences

3.1 Blood Parameters

Table (4) indicates that there is a significant effect (P≤0.05) of fenugreek seeds on the level of blood glucose, where a high level is observed with a significant increase in glucose values in the fifth treatment 75.47 and sixth 77.90 mg\100 ml compared to the rest of the treatments whose values ranged Between 45.42 to 56.24 mg\100 ml. A previous study by [13], there was a significant increase (P≤0.05) in the level of glucose for groups of Awassi lambs fed on diets containing different percentages of fenugreek seeds, which are similar results to what was found in this study. The researchers attributed the reason for the high level of glucose in the blood to a decrease in the decomposition of starch in rumen, and thus an increase in the amount of starch passing into the small intestine, which is decomposed by starch-digesting enzymes in the intestine, which results in glucose, which is absorbed and thus increases its concentration in the blood.

It was noted from Table (4) a decrease in the level of cholesterol in the blood of rams with an increase in the level of fenugreek seeds in a diets provided to the groups of rams, but a significant decrease

was observed (P≤0.05) and a clear decrease in the level of cholesterol in the blood of the fifth (61.64) and sixth treatment (59.02) mg/100 ml. This compared to its level in the rest groups, which amounted to 72.13, 69.51, 66.23, 64.26 and 65.25 mg/ml blood level for the control, first, second, third and fourth groups, respectively. The researchers ascribe the reason for possible association of fenugreek saponin with bile salts, and since saponin are indigestible in the rumen, this association hinders or reduces the re-absorption of cholesterol and bile salts from the lining of the intestine, and this is reflected in an increase in the conversion of Cholesterol in the liver turns into new bile salts, and leads to a decrease in the level of cholesterol returned to the hepatic circulation, and thus to a decrease in the level of cholesterol in the blood. Or that saponin have ability to stick with bile salts and neutral fats in the intestine and inhibits their absorption and then lower the level of cholesterol, and this stimulates the liver to convert cholesterol into bile acids and thus leads to a decrease in the level of cholesterol in the blood. Some researchers have explained the reason for the effect of fenugreek seeds in lowering blood cholesterol, because they contain fibers that affect the speed of passage of cholesterol and bile acids in the intestine, and then reduce their absorption rate, which leads to an increase in their excretion with waste [14], [16], [18]. As for the researcher [17], they explained the ability of fenugreek seeds to lower cholesterol through the association of bile salts with fiber and saponin, which reduces their re-absorption from the intestine, and this leads to an increase in the conversion of cholesterol in the liver into new bile salts, and thus its level decreases. Another reason for the decrease in the concentration of cholesterol in the blood plasma is that fenugreek seeds contain some compounds that reduce the synthesis of cholesterol by inhibiting the activity of (HMG Co A) Hydroxy Methyl Glutaral yeast, which raises the rate of excretion of cholesterol and bile acids with waste products [19]. The results of this study agreed with [18] in their study on sheep that ate diets containing fenugreek seeds in different proportions, while [6] did not find any effect of fenugreek seeds on the level of cholesterol in the blood of Kurdish ewes when they used fenugreek seeds at 0,5,10 and 15%.

As for the level of triglycerides in the blood, it began to rise with the increase in the proportion of fenugreek seeds in the diets, and the increases reached a significant level (P≤0.05) in the third, fourth, fifth and sixth treatments compared to the rest of the treatments. These levels reached 63.21, 61.55, 68.19, 80.83, 80.05, 75.85 and 75.65 mg/100 ml of blood for the seven treatments, respectively. The results of this study are different with those that indicated that adding fenugreek seeds to diets can lead to a decrease in the level of triglycerides in the blood because fenugreek seeds contain fiber and pectin that can reduce the level of absorption of this substance in the gastrointestinal tract [21]. In this study, there was a clear decrease in the control group and the first and second treatments. In other studies for sheep, the researcher [6] and [13] did not find any

significant effect of the proportion of fenugreek seeds on the concentration of serum triglycerides in sheep. A variation was observed in the effect of fenugreek seeds on the level of total protein in the blood. A significant decrease (P≤0.01) was observed for the second (6.13) , the third (6.17) and the fifth (6.51 mg/100 ml blood) treatments, compared to 7.62. , 7.27, 7.48 and 7.55 mg/100 ml blood for each of the control group and the first, fourth and sixth treatments, respectively. The reason for this difference is not clear, and it may be related to what happens to the protein inside the rumen on the one hand, and the availability of digested and absorbable protein on the other hand. Similar results were previously obtained by [13] and [20] in their study on sheep fed on diets containing different percentages of fenugreek seeds. In other studies, on sheep [6] and Shami goats [18] and [23], fenugreek seeds had no significant effect on the concentration of protein in the blood. The level of albumin in the blood was 3.48, 3.25, 2.94, 3.08, 3.25, 3.06 and 3.48 mg/100 ml blood for each of the control group and the first, second, third, fourth, fifth and sixth treatments, respectively, and the differences did not reach the level of significance. Similar results were reached by [18] and [6] when using fenugreek seeds in the diets in different proportions in sheep diets, as they did not notice any significant differences in the concentration of albumin. Other studies on goats, [22] and [23] also indicated that fenugreek seeds had no effect on albumin concentration. Fenugreek seeds had no clear effect on blood urea (Table 4), but a significant decrease (P≤0.05) was observed in the first group compared with the rest of the others , as its concentrations were 57.83, 51.65, 62.61, 61.57, 62.91, 63.46 and 60.94 mg/100ml blood. The results of this study were different with 24 in their study on Awassi ewes, and 5 in their study on cows, who found that the addition of fenugreek powder led to a significant decrease (P≤0.05) in blood urea.

Table (4) Means ± S E for biochemical blood Parameters **for rams (mg/100 ml)**

Items	Control	T1 3%	T2 6%	T3 12%	T4 15%	T5 15%	T6 18%
Glucose	53.04 ± 2.71 bcd	45.44 ± 4.41 A d	56.24 ± 2.89A b	47.24 ± 2.36 cd	55.14 ± 3.03 bc	75.47 ± 1.89 A	77.90 ± 2.01 A
Cholesterol	72.13 ± 1.04 a	69.51 ± 6.34 ab	66.23 ± 2.41 abc	64.26 ± 3.68 abc	65.25 ± 1.31 abc	61.64 ± 1.91 Bc	59.02 ± 1.47 C
Triglycerides	63.21 ± 2.95 b b	61.55 ± 1.59b b	68.19 ± 2.73b b	80.83 ± 1.57a a	80.05 ± 2.46a a	75.85 ± 1.75a A	75.65 ± 3.468a A
Total protein	7.63 ± 0.16 a	7.27 ± 0.36 a	6.13 ± 0.05 b	6.17 ± 0.20 b	7.48 ± 0.204 a	6.51 ± 0.16 B	7.55 ± 0.28 A
Albumen	3.48 ± 0.15 a	3.25 ± 0.136 a	2.94 ± 0.25 a	3.08 ± 0.12 a	3.25 ± 0.23 a	3.06 ± 0.18 A	3.48 ± 0.11 A
Urea	57.83 ± 1.55 a	51.65 ± 2.77 b	62.61 ± 1.99 a	61.57 ± 1.88 a	62.91 ± 0.90 a	63.46 ± 1.48 A	60.94 ± 0.98 A

Note: Similar letters within the same row refer that there are no significant differences

Conclusion:

By reviewing the results of this study, the productive and medicinal importance of the fenugreek plant is evident. It can be used for improving some of digestibility traits and Blood Parameters for rams

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بذور نبات الحلبة وتأثيرها في معامل الهضم وبعض صفات الدم في كباش العواسي

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الملخص

استهدفت الدراسة تأثير بذور الحلبة في معاملات هضم المركبات الغذائية وبعض صفات الدم الكيموحيوية ، واستخدم فيها (15) كبش عواسي اعمارها (18–20 شهراً)، ومعدل اوزانها (35–كغم) ووزعت الى ثلاث مجاميع تجريبية واستخدمت بالتناوب وحسب التصميم العشوائي الكامل لاختبار مدى تأثير العلائق الحاوية على نسب مختلفة من بذور الحلبة المجروشة (0% ، 3% ، 6%، 9%، 12%، 15%،18%). غذيت كل مجموعة لمدة 10 أيام في كفترة تمهيدية ثم 5 ايام لجمع الفضلات. لغرض تقدير معامل هضم كل من المادة الجافة والعضوية ومستخلص الإيثر والبروتين والالياف. وفي نهاية كل فترة تجريبية يتم سحب عينات من الدم لقياس بعض الصفات الكيموحيوية للدم.

اوضحت النتائج انخفاضاً معنوياً ($0.05P\delta$) في معامل هضم المادة الجافة (72.62%) والعضوية (72.76%) للمعاملة الثانية مقارنة مع بقية المعاملات. كما اظهرت النتائج وجود تأثيرات معنويه لبذور الحلبة على معامل هضم مستخلص الإيثر. في حين لم يكن لها تأثيراً واضحا في معامل هضم البروتين اذ لوحظ انخفاض معنوي ($P<0.05$) في المجموعة التي تناولت العليقة الحاوية على 6% من بذور الحلبة مقارنة ببقية المعاملات. انخفاضا معنويا ($P<0.05$)لوحظ في معامل هضم الالياف في مجاميع الحيوانات التي تناولت العلائق الحاوية على 6 و 12 و15 %من بذور الحلبة مقارنة ببقية المجاميع.