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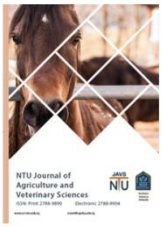

Impact of Germination or Heat treatment of fenugreek seeds on some growth and blood characteristics in Awassi lambs.

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A B S T R A C T

The research was conducted on the field site of the College of Agriculture and Forestry at the University of Mosul on 20 Awassi lambs to find the effect on the blood properties and growth characteristics of Awassi lambs when using roasted, sprouted, and regular fenugreek. The average weight of the experiment animals was 25.7 ± 3.3 kg during the winter season, and the average age was 4-5 months (90 day period), The animals were divided into four groups.1st group represent the control. 2nd group the animals, 30 grams of dried fenugreek were added. 3rd group the animals, 30 grams of fenugreek It was exposed to heat. 4th group the animals, 30 grams of fenugreek were cultured for 48 hours and added to the feed of the fourth treatment. The research results indicated that there was no significant effect on the final weight, the rate of daily and total weight gain, and the carcass weights of Awassi lambs exposed to all types of fenugreek compared to the control, while a significant effect was found ($P<0.05$). Roasted fenugreek reduces sugar and triglycerides, sprouted fenugreek reduces cholesterol and triglycerides and raises total protein in blood serum, and urea raises protein and urea, while regular fenugreek helps reduce fat and thus has a positive effect on animals.

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Introduction

Sheep are characterized by their tolerance to a harsh dry environment [1]. Sheep are ruminants that feed on cheap, coarse rations, and through anaerobic fermentation through rumen microscopic organisms, they are transformed into usable materials. Recently, there has been interest in introducing medicinal plants into the feed of ruminants. Because of its physiological effect on humans as well as animals [2]. Iraq has a distinct and diverse geographical location that helps in the growth of various medicinal and economic plants [3]. Including the Fenugreek, which is golden in color, small and solid. Researchers advise adding fenugreek to ruminant diets [4]. It is grown in Iran, India, and Pakistan [5]. And also in southern Europe [6]. There are 50 types of fenugreek [7]. Fenugreek is anti-inflammatory as well as anti-worm [8]. It is antimicrobial [9]. It contains linoleic and oleic acid [10].

It contains alkaloids [11]. In addition to phenolic substances [12]. It is antioxidants [8]. It reduces the effect of free radicals [13]. The effect of oxidative stress increases Glutathione (GSH) within the tissues of the organism [14]. as the plant makes it for itself for protection and uses it for cellular growth in very harsh growth conditions, and flavonoids have an aromatic ring that carries a hydroxyl group that gives electrons [15]. It reduces Malondialdehyde (MDA) and Aspartate transaminase(AST) [16]. It contains nutrients and immunochemical substances that are important for body balance [17]. It has a positive effect in improving the semen characteristics of Awassi ram [18]. Blood hemoglobin, agglutinin cell volume, and corpuscular volume were improved [19]. It increases the unsaturated fatty acids in the milk and increases its quality [20].

They are antioxidants due to a substance called naringenin, which contains 4-hydroxy isoleucine to reduce triglycerides [21]. It can restore the Lancer Hans Islands to normal after damage [22]. It has a positive effect on the immune system in particular [23].Tissue healing and anti-toxins [24]. Fenugreek reduces the release of AST and ALT enzymes into the bloodstream [25]. There is more lysine in fenugreek protein than in soybean meal protein [26]. Soaking, germinating and roasting fenugreek seeds can reduce bitterness [27]. In the case of germination, the percentage of gluten is low, and thus it acts as a very weak network through which Gases in Rumen can pass in large quantities [28]. [29] indicated that soaking causes an increase in the percentage of protein. It reaches 29% upon germination, increases the digestibility of the material, and increases iron and calcium [27]. Reducing the percentage of gluten, which is important in reducing gas retention [28]. The research was conducted to determine the effect of germination, roasting, and correct seeds on growth characteristics and blood components in Awassi lambs.

Materials and methods

Ethical approval

According to the approval of the Animal Welfare Committee Foundation No.: UM.VET.2023.070 on the date of 10/1/2023, the scientific committee approved the article that was conducted at the College of Agriculture and Forestry / University of Mosul.

Experimental animals and veterinary care

The study was conducted in the animal husbandry field of the Department of Animal Production/College of Agriculture and Forestry/University of Mosul (8/10/2023 – 8/1/2024) for 20 lambs of the Awassi breed in the city of Mosul, with an average live animal weight of 25.7 ± 3.3 kg, purchased from the market on the left side of the city of Mosul during the winter season, with an average age of 4-5 months. The experimental animals were distributed into four groups that were very close in age and weight, Each group has five lambs for each experimental group. They were placed in special places for raising experimental animals with dimensions of 4 x 5 m^2 for each experimental group. It contains feeders and troughs for sheep, and the animals were numbered with plastic numbers. The lambs were subjected to the veterinary program followed in the field of animal husbandry by vaccinating them against parasitic diseases inside and outside the animal's body, as well as against intestinal poisoning, after the process of isolating them and ensuring that the purchased experimental animals were not infected with infectious diseases when purchased.

Animal feeding

The experimental animals of the four experimental groups were exposed to the food acclimatization system for a period of 15 days in order for the microorganisms in the rumen of these animals to adapt to the new feed that will be provided to them during the experimental period. Table 1 indicates the components of the diets of the four experimental groups.

The first is a control group.

The second group was provided with 30 grams of fenugreek seeds/animal/day for the duration of the experiment.

The third group was given 30 grams of fenugreek seeds/animal/day, and for the duration of the experiment they were soaked in water for three hours and exposed to a temperature of 100 degrees Celsius for two hours .

The fourth group gave the animals 30 grams of fenugreek seeds/animal/day. Throughout the experiment, they were germinated in warm water for 12 hours, then washed with water and placed for 48 hours in special plastic containers for the experiment. The animals were fed at two times: the first in the morning at seven o'clock and the second in the evening at four o'clock, and the diet was provided on the basis of 2.5% of the animal's live weight. The animals were weighed once every 15 days during the duration of the experiment, which lasted 90 days, on a sheep scale of English origin.

The components of the feed, regular, roasted and sprouted fenugreek were measured in the animal nutrition laboratory, following the instructions of [30].

Table 1. The composition of the feed and its chemical composition.

Components of the feed	Basal diet %	Chemical dry matter composition%	
Soybean meal	7.5	Dry matter	90.95
White crushed barley	70	Ash	5.6
Wheat bran	15	Crud fiber	8.02
Urea	0.5	Crud protein	13.79
straw	4	Ether extract	1.44
Calcium carbonate	1	Energy Mj/kg	10.13
Sodium bicarbonate	1	Nitrogen free	54.63
Sodium chloride	1	extract	

The ingredients were measured in the Nutrition Laboratory/Animal Production Department and according to A.O.A.C).

Collect blood samples and weigh the carcass

Blood samples for the experimental animals for the four groups were collected from the jugular vein at the beginning, middle, and finally at the end of the experiment in an amount of 7 ml and placed in special plastic tubes (in a 10 ml glass tube free of EDTA for the purpose of separating the blood serum). The tube was left at an angle several times. Minutes until coagulation occurred, then it was placed in a centrifuge at a speed of 3000 rpm for 15 minutes to obtain the blood serum. The urea concentration in the blood serum was estimated according to [31] using a ready-made analysis kit (Kit) prepared by the Spanish company Biosystems. Measurement of total protein concentration using the Biuret method, and measurement of total cholesterol and triglyceride concentrations in blood serum by the enzymatic method, according to [32]. Glucose was estimated, all using a ready-made kit manufactured by the French company Biolel, and according to the instructions of the producing company, all using a spectrophotometer with different wavelengths.

Estimation of vitamin C

Vitamin C has been estimated only in fenugreek seeds [33].

Weight of animals after slaughter

The experimental lambs for the four groups were slaughtered and the weight was taken immediately.

Statistical analysis

All the data collected were analyzed to Complete Random Design (CRD),It was analyzed using the statistical [34], and the following mathematical model equation was used:

$Y = \mu + Ti + eij$

Where:

μ= The general average of the community

Ti= The effect of transaction (i) which represents 1,2,3,4

eij= The value of the experimental error for the experimental unit affected by treatment (i)

The significance of the differences between the means was also tested using the [35]. multiple range test at a significance level ($P<0.05$) and finding the standard error of the means.

Table 2. Components of germination and heat treated Fenugreek seeds.

Composition	Fenugreek seeds		
	Germination	Heat treated	Raw
Crud protein %	36.75	33.58	32.46
Crud fiber %	35	29	31
Vitamin C mg/100 g	5.1	3.9	4.5
Dry matter	23.68	92.55	90.3
Energy Mj/kg	10.2	11.00	10.6

The ingredients were measured in the central laboratory of the College of Agriculture and Forestry.

Results and Discussion

Table 3 indicates that the final weight of the lambs of the Awassi experiment did not have any significant differences compared to the control group, and the average weights reached 47.25, 45.75, 45.62, and 43.37 kg for the groups of control, untreated fenugreek, roasted fenugreek, and sprouted fenugreek, respectively, and the result agreed with [36]. when giving Awassi lambs fenugreek seeds 7.5 grams/head daily, which did not affect the weight gain of the experimental animals, their final weight, or the efficiency of food conversion. It did not increase rumen fermentation,

and there was no effect of fenugreek on the amount of dry matter intake of Saanen goats [20]. It can be observed that the total weight decreases mathematically in the normal and treated fenugreek groups compared to the control, as fenugreek reduces the total fat and thus reduces the fat in the animal's body and finally has a negative effect on the final weight of the animal [37]. Saponins constitute 6.2% of the components of fenugreek seeds and work to inhibit fat accumulation [38]. While the result was different from [39] who found that giving 6% fenugreek seeds to Arabian lambs led to an increase in weight gain at the age of 1-8 weeks for the lambs. Fenugreek seeds helped raise birth weights at the ages of 30, 60, and 90 days for newborns of Shami goats [40]. The overall average average total weight gain did not vary significantly with the treatments compared to the control group, and the total weight increases amounted to 21.50, 19.25, 20.12 and 18.37 kg for the control groups, the untreated fenugreek, the roasted fenugreek, and the sprouted fenugreek, respectively.

The general average daily weight gain was not significantly affected by the treatments compared to the control group, and the daily weight increases amounted to 0.23, 0.21, 0.22 and 0.21 kg for the control, untreated fenugreek, roasted fenugreek, and sprouted fenugreek groups, respectively.

It agreed with the result of giving Awassi lambs fenugreek seeds at an amount of 7.5 grams/head per day, which did not affect the rate of daily weight gain, which amounted to 131.4 grams per day throughout the days of the experiment compared to the control, which amounted to 135.7 grams per day [36]. Likewise, [41] did not find Any significant effect when giving 2.5 grams of fenugreek seeds per day of feed intake to Sudanese ewes on daily weight increases.

The general average carcass weight of the Awassi lambs under the experiment for the four groups did not differ significantly with the treatments compared to the control group, and the general average carcass weight reached 23.26, 22.43, 22.72 and 22.77 kg for the control groups, the untreated.

Table 3. Effect of germination and heat treatment fenugreek on some growth traits and carcass traits (means ± standard error).

Traits	T1 (control)	T2 (Raw fenugreek seeds)	T3 (Heat fenugreek seeds)	T4 (Germinated Fenugreek seed)
Final weight kg (7-8 months)	47.25±3.32 a	45.75±2.86 a	45.62±2.15 a	43.37±1.72 a
Total increase kg (8/10/2023-8/1/2024)	21.50±1.19 a	19.25±0.62 a	20.12±0.65 a	18.37±0.62 a
Daily gain kg	0.23±0.01 a	0.21±0.01 a	0.22±0.01 a	0.21±0.01 a
Carcass weight kg	23.26±1.51 a	22.43±1.32 a	22.72±1.55 a	22.77±1.0 a

Difference of letters horizontally evidence of significant effect ($P<0.05$).

fenugreek, the roasted fenugreek, and the sprouted fenugreek, respectively Figure (1) shows that treatment with regular fenugreek and roasted and sprouted fenugreek did not significantly affect the blood serum glucose concentration of the Awassi experiment lambs 45 days after the start of the experiment compared to the control group, where it reached 66.8 and 74.9, 59.9 and 63.3 mg/100 ml for the control groups and normal fenugreek. And roasted and sprouted respectively. It agreed with giving 1.2 grams of fenugreek seeds/kg of live animal weight, which did not affect the glucose concentration in the blood serum of Al-Hamdani ewes [42]. Figure (1) shows that treatment with roasted fenugreek led to a significant increase in the concentration of triglycerides in the blood serum of the experimental lambs 45 days after the start of the experiment, and it reached 44.1 mg/100 ml compared to the control group (37.1 mg/100 ml), while it reached 40 and 40.2 mg/100 ml in the regular and sprouted fenugreek groups, respectively, and there was no significant effect between them and the control group. It agreed with [43]. when 15% fenugreek seeds were given compared to the control in Awassi lambs aged 18-20 months. Figure 2 indicate the effect of treatment with regular, roasted and sprouted fenugreek on the concentration of urea in the blood serum of the experimental animals, which was not significantly affected in the two groups of regular and roasted fenugreek, amounting to (32.9 and 35.1 mg/100 ml) compared to the control group (39.5 mg/100 ml) in While it increased in the sprouted fenugreek group and reached 53.3 mg/100 ml compared to the control after 45 days of the experiment. It was found that the serum urea concentration in the blood of Awassi rams at the age of 2-3 years increased when given crushed fenugreek at a feed rate of 5% and 10% compared to Control group animals may be due to poor protein representation within the rumen of experimental animals due to the presence of microorganisms, causing an increase in absorbed nitrogen [23]. The effect of treatment with regular, roasted and sprouted fenugreek on the concentration of cholesterol in the blood serum of the experimental animals, which was low in the regular and roasted fenugreek groups and amounted to 55 and 75 mg/100 ml, and the lowest was in the sprouted fenugreek group and amounted to (40.4 mg/100 ml) compared to the group. Control (75.7 mg/100 ml) after 45 days of the experiment. Sprouted fenugreek contains fiber, thus reducing absorbed cholesterol. It also contains vitamins and minerals [28]. The protein concentration in the blood serum of the experimental group animals was not affected compared to the control after 45 days of the experiment

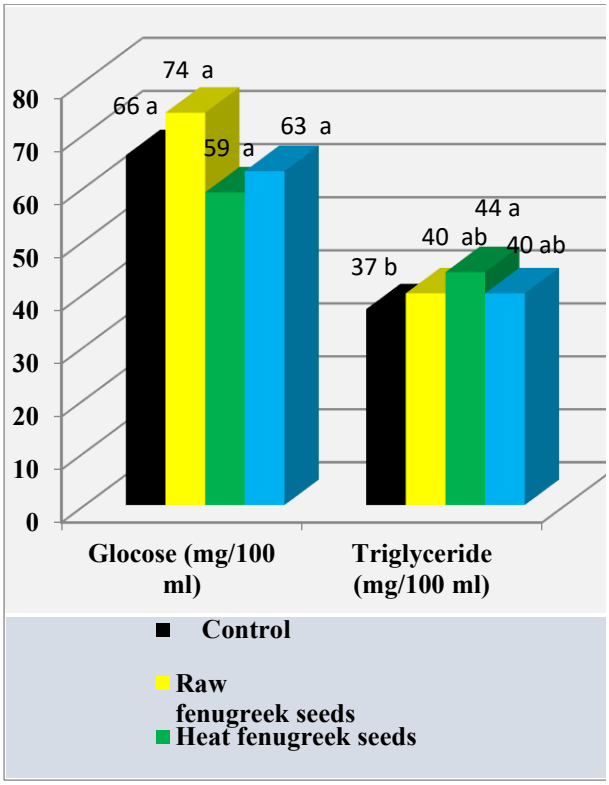

Figure 1. Effect of germination and heat treatment fenugreek on glucose and blood serum triglycerides after 45 days of the experiment.

Table (4) indicates that there was an effect of treating the fenugreek with roasting in reducing the blood serum sugar concentration, which amounted to 56.6 mg/100 ml compared to the control (76.6 mg/100 ml), while the sugar concentration in the germination group and the normal fenugreek group reached 67.01 and 75.8 mg/100. ml, respectively. There was no significant difference between it and the groups of regular fenugreek and the control, despite the presence of a severe arithmetic decrease. The result of the regular fenugreek and the control agreed with the result of [23] when given the crushed fenugreek at a feed rate of 5% and 10%, and it did not affect the blood serum glucose of the rams. Awass is 2-3 years old. With the result of giving Osimi lambs ground fenugreek seeds at an amount of 3% of the feed intake/head daily, which did not affect glucose [44].Roasted fenugreek may have increased the secretion of insulin from the Lancer Hans islets [45]. It is characterized by its positive biophysical effect on Awassi ewes [46]. The result differed with glucose rising to 77.9 mg/100 ml when 15% fenugreek seeds were given compared to the control, 53.2 mg/100 ml in Awassi lambs [43].

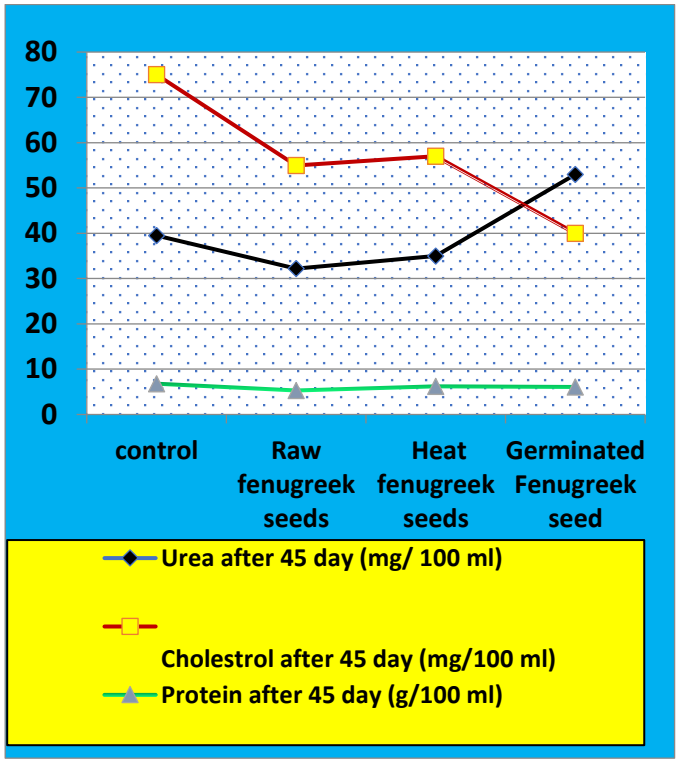

Figure 2. Effect of germination and heat treatment fenugreek on some biochemical characteristics of blood serum after 45 days of the experiment.

The data in Table (4) shows a decrease in the concentration of blood serum cholesterol of Awassi lambs in the regular and sprouted fenugreek groups, which amounted to 54.7 and 51.7 mg/100 ml, compared with the control, 76.3 mg/100 ml, while the concentration did not differ in the roasted fenugreek group, which amounted to 56.1 mg/ 100 ml compared to control.

The data were consistent with the results of giving Sudanese ewes regular fenugreek seeds at a concentration of 2.5 grams per kg of live weight and reducing cholesterol [47]. It was also found that cows' blood serum cholesterol decreased when fenugreek was given [48]. [49] did not find any effect of fenugreek at 5, 10, and 15% on cholesterol concentration in Kurdish ewes. High blood cholesterol raises free radicals and reduces antioxidant defenses [50]. Cholesterol is reduced when consumed with fenugreek due to the combination of saponins with bile salts and cholesterol, thus preventing absorption in the intestines, in addition to fibers that pass quickly through the intestinal area. It contains substances that inhibit the HMG-CoA reductase (3-hydroxy-3-methyl-glutaryl-coenzyme A reductase), thus reducing cholesterol [51]. Fenugreek also contains calactomannan, which is gelatinous in structure and prevents the absorption of both fats in the small intestine [7]. Table 4 shows a higher concentration of blood serum protein in the sprouted fenugreek group (6.2 g/100 ml) compared to the control (6.1 g/100 ml), while the concentrations did not differ in

the roasted and regular fenugreek groups (6.1 and 5.2 g/100 ml) when compared with the control.

The result of regular fenugreek and the control agreed with the result of [23], who found no change in the protein concentration of the blood serum of Awassi rams aged 2-3 years when given crushed fenugreek at a feed rate of 5% and 10%. It differed when giving Ousimi lambs ground regular fenugreek seeds at 3% of the feed intake/head per day, as the serum protein concentration was raised and this is due to the increase in digested crude protein [44]. The high concentration of blood serum protein in the sprouted fenugreek group can be attributed to the significant role of vitamin C, which amounted to 5.1 mg/100 ml, which represents an antioxidant. Sprouted fenugreek is also a very rich source of natural antioxidants, which are biologically important. It raises the percentage of protein from 27.1% to 32.6% and fiber from 10.11% to 15.4%. It raises GSH and SOD and reduces MDA and urea. Giving 10% reduces toxicity in the animal's liver [23]. It reduces ammonia [44]. Finally, it reduces protein breakdown in the rumen [54]. It contains the highly beneficial substance Furosap [55].

The concentration of triglycerides in the regular, roasted, and sprouted fenugreek groups, which amounted to (61, 56.1, and 54.7 mg/100 ml) when compared to the increase in the control (76.3 mg/100 ml).

It agreed with the result of giving 5% and 10% fenugreek seeds to feed female Damascene goats aged 2-3 years, which led to a decrease in triglycerides in the blood serum [56]. It differed with giving 1.2 grams of regular fenugreek seeds/kg of live animal weight, which did not affect the concentration of triglycerides in the blood serum of Al-Hamdaniya ewes [42]. Giving Osimi lambs ground regular fenugreek seeds at 3% of the feed intake/head per day did not affect the concentration of triglycerides in the serum compared to the control [44]. Fenugreek is characterized by antioxidants due to a substance called naringenin and contains 4-hydroxy isoleucine to reduce triglycerides [21].

The data in Table 4 show that there was a highly significant increase in the concentration of urea in the blood serum of the lambs of the sprouted fenugreek group, which amounted to 50.6 mg/100 ml when compared with the control (42.1 mg/100 ml), while the concentrations in the regular and roasted fenugreek groups were 36.9 and 41.1 mg/100. ml respectively, and it was not significantly different from Control group. It agreed with [36] when giving Awassi lambs regular fenugreek seeds at a concentration of 7.5 grams/head daily, which did not affect the blood serum urea concentration. It disagreed with giving Sudanese ewes fenugreek seeds at a concentration of 2.5 grams per kg of live animal weight, leading to a reduction in Blood serum urea percentage [46].

As the sprouted seeds of the leguminous fenugreek plant, the protein increases to 40.13% compared to the unsprouted ones, and they contain biologically stimulating substances and raise immune globulins [57]. Urea is the last stage of protein metabolism and is eliminated by the kidneys, which is evidence of its work [58].

We conclude from the above research data that sprouted and roasted fenugreek raises protein and urea and reduces glucose, cholesterol, and triglycerides, and thus its positive effect on animals.

Table 4. The effect of treated and untreated fenugreek on some blood serum biochemical characteristics (means ± standard error).

Traits	T1 (control)	T2 (Raw fenugreek seeds)	T3 (Heat fenugreek seeds)	T4 (Germinated Fenugreek seed)
Glucose 100 ml/mg	76.62±3.39 a	75.85±3.14 a	56.69±3.32 b	67.01±4.42 ab
Cholesterol 100 ml/mg	76.37±3.72 a	51.75±11.64 b	56.10±3.61 ab	54.70±1.98 b
Protein 100 ml/gm	6.18±0.48 b	5.82±0.30 b	6.13±0.18 b	6.27±0.38 a
Triglycerides 100 ml/mg	76.37±3.72 a	61.00±3.46 b	56.10±3.61 b	54.70±1.98 b
Urea 100 ml/mg	42.12±1.72 b	36.93±2.80 b	41.42±2.74 b	50.56±2.59 a

Difference of letters horizontally evidence of significant effect ($P<0.05$).

Conclusion:

The following study showed that roasted fenugreek seeds helped reduce blood glucose, and that sprouted fenugreek seeds worked to reduce fats such as cholesterol and triglycerides in blood serum, and this enhances their use in reducing fat levels compared to other plants in Awassi lambs.

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