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NUTRITIONAL EVALUATION OF RATIONS AND BLOOD PARAMETERS AS AFFECTED BY FENUGREEK SEEDS (*Trigonella foenum graecum* L.) FOR SHEEP UNDER DESERT CONDITIONS

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ABSTRACT

Eighteen mature Barki rams were divided into three main groups; first group had 10 g seeds, second had 30 g seeds and third group served as a control. Each group was divided according to body weight into light and heavy weight subgroups. The basal diet consisted of 60% concentrates and 40% roughage.

High protein content (24.52%) and ether extract (6.62%) characterize fenugreek seeds. Animals fed 30 g seeds had the lowest (P<0.05) DM, CP and ADF digestibility coefficients. Animals fed 10 g seeds had similar digestion coefficients to those of control. Heavy weight animals had lower digestion coefficients than light weight ones for 10 g seeds fed group and control. Nitrogen balance was higher (P<0.05) for the 30 g fed group. The HW animals showed higher NB than LW except for control. TDM (g/Kg0.75) intakes were similar among groups while TDNI was lower for 30g seeds fed group and so was DCPI and TDN%. Blood parameters (TP, albumin and globulin) were not significantly different. It is concluded that the addition of fenugreek seeds might be beneficial to animals at low levels, yet further studies, however, are evident.

Keywords: fenugreek, sheep, digestion, supplement.

INTRODUCTION

As early as late 1940's, the use of different growth promoters in animal feeding was recognized. These compounds were later classified as non-nutritive dietary additives or implants (Maynard et al, 1979). Antibiotics, hormones, and hormone-like compounds are either biologically produced or artificially synthesized. Because of the adverse effects of such growth promoting agents, most countries have imposed certain regulations to control the use of them. For instance, the safest animal drugs used in medicated feeds, as categorized by FDA, are those which have the LEAST potential for unsafe residue (Church, 1991). In addition, environmental pollution may also be evoked through feces and probably other routes.

The use of chemicals in animal nutrition (especially as feed additives) for different purposes has many drawbacks. It has been started to be banned out and replaced by natural resources. Fenugreek seeds is a potential natural growth activator. Investigating the effects of fenugreek seeds (Trigonella foenum graecum L.) is worthwhile.

The current trend in the world nowadays is inclined towards the concept of getting back to mother nature. Nature has got a lot of resources that help mankind to live healthy. Herbal plants are one of these sources. Their use gets back to several centuries. The rediscovery of herbal plants may help in the recovery of the destructive symptoms of modern civilization.

Fenugreek (Trigonella foenum graecum L.) is one of the well-known herbal plants in the life of mankind. It has several medicinal effects. Fenugreek is believed to be appetite enhancing agent, in addition to its use in childbirth (Ghazanfer, 1994) and the believe that it increases milk production. It also decreases serum cholesterol significantly (Rao et al, 1996). Fenugreek, as such, may act as a growth activator.

The current investigation aims at studying the nutritional value of diets as affected by the inclusion of fenugreek seeds.

MATERIALS AND METHODS

Animals and management

This study was conducted during spring period at Maryout experimental station belonging to DRC. This station lies 35 Km south west of Alexandria. Eighteen mature Barki rams were selected on basis of body weight. Animals were divided into heavy and light weight groups in order to have the effect of weight differences into account. Heavy weight animals (HW) and light weight animals (LW) were randomly divided into three groups of three animals each. Experimental rations were randomly assigned to animal groups so as to have the same diet assigned to HW animals and LW animals. Animals were weighed before and after the experiment. A period of fifteen days was left for animals before the experiment to get conditioned with the experimental diets. During that period feed intakes were recorder. Animals were, thereafter, kept in separate metabolic cages fitted with stainless steel separators. A three-week preliminary period was allowed for adaptation followed by a 7-d collection period. Therefore, six digestibility trials were conducted.

Samples of feeds, orts, feces, and urine were taken daily at 0700h. Blood samples (through Jugular vein) were withdrawn pre feeding and at three and six hrs post feeding.

Experimental diets

Rations consisted of 60% concentrates and 40% roughage (Kearl, 1982). Concentrate portion consisted of concentrate feed mix (CFM) and barley (70:30) whereas the roughage was Berseem hay. Fenugreek seeds were mixed with concentrate portion before being presented to animals. First animal sub-groups (both HW and LW) had 10 g/h/d of fenugreek seeds while second animal sub-groups (HW & LW) had 30 g/h/d of fenugreek seeds. Third animal sub-groups (HW & LW) served as control for other groups. Chemical composition of feed ingredients is presented in Table (1).

Analytical methods

Samples of feeds, orts, feces, and urine were analyzed according to A.O.A.C. (1990). Blood plasma total protein were analyzed according to Patters,. (1968), and Albumin (Drupt, 1974). Data was statistically analyzed using GLM procedures of SAS (1985).

RESULTS AND DISCUSSION

Fenugreek seeds have been rarely used in the field of animal nutrition. It is believed that it is an appetite enhancing agent- such as many other medicinal plants. It, therefore, may play a role in activating body growth of animals. Yet, its effects on diets fed to animals should be investigated beforehand. Table (1) shows the chemical composition of fenugreek seeds. Notably, it has high protein contents (24.52%). Some literature (Hidvegi et al, 1984) reported even higher protein contents (26.4%). Osman and Simon (1991) reported the same findings also. Mansour and El-Adawy (1994) concluded that fenugreek seeds were a good source of essential amino acids and they are rich in certain minerals (Na, Cu, and Fe). However, protein content of fenugreek seeds seems to be of high solubility. The major components of fenugreek seeds protein are albumin, globulin, glutein, and prolamin in order (El-Aal and Rahma, 1986). The first largest two proteins are soluble. Osman and Simon (1991) prepared protein extracts from the seeds by dH2O, salt solution, and alkaline solution. They found that alkaline solution had the highest extract (82%). Fenugreek seeds also have high crude fat contents (6.62%), relative to conventional feedstuffs as shown in Table (1).

Supplementing diets (Table 2) with 30 g fenugreek seeds did not affect average digestion coefficients positively. All the parameters measured (DM, CP, EE, NFE, and ADF digestion coefficients) were lower than control. When 10 g fenugreek seeds were added to diets, average digestion coefficients of different nutrients were not significantly affected. No much difference was detected from control diets. The level of 10 g fenugreek seeds showed higher digestion coefficients of nutrients than that of the 30 g seeds. On the other hand, at the 10 g seeds level LW animals exhibited better ($P<0.05$) nutrient apparent digestion coefficients for DM, CP, EE, NFE, and NDF than HW (Table 2). This might be due to that light weight animals utilized nutrients more efficiently than heavy weight animals. At 30 g fenugreek seeds, no significant differences were detected between the two subgroups (LW and HW). Control subgroups (LW & HW) had similar results for almost all nutrient digestion coefficients. Abo-Donia et al (2003) found that in vitro DM and OM disappearances were not significant when different levels of fenugreek seeds (1,2,3,4, and 5%) were added to the rumen culture media. Also, they found that in vivo nutrient (DM, OM, CP and CF) digestibility coefficients were not affected significantly by treatments.

Table 1: Chemical composition of diet ingredients as fed to sheep.

Diet Ingredients	DM, %	OM	CP	CF	ADF	NDF	EE	NFE	Ash	AIAa
		DM basis, %								
Berseem hay	87.79	86.14	12.89	28.62	49.57	64.62	2.59	42.09	13.81	5.91
CFM*	89.64	88.71	13.29	13.10	28.14	70.11	3.31	59.01	11.29	--
Barley	89.21	97.08	8 33	8.33	14.47	35.00	2.61	77.72	2.92	0.74
Fenugreek seeds	91.99	95.67	24.52	24.52	21.95	51.10	6.62	55.42	4.33	0.88

a AIA = Acid insoluble ash

*CFM = concentrate feed mix consisted of yellow corn 10%, undecorticated cotton seed meal 10%, wheat bran 22%, rice bran 38%, extruded sun flower meal 10.5%, venasses 5%, and vitamins and minerals 4.5%

Table 2: Digestion coefficients (%) of diets offered to sheep as affected by the addition of fenugreek seeds

Treatment	10 g seeds		30 g seeds		Control	
Subgroup	LW*	HW*	LW	HW	LW	HW
DM	69.39a	63.64b	60.50b	64.31a	66.81a	65.72a
Ave.	67.13c		62.94d		67 12c	
CP	72.15a	65.52b	63.72a	66 95a	68.00a	68.21a
Ave.	68.84c		65.34d		68.11c	
EE	79 78a	75 48b	75.19a	77.33a	78.11a	78 06a
Ave.	77.63c		76.26c		78.09c	
NFE	77.44a	70.39b	68.72a	72 73a	74 64a	73.16a
Ave.	73 92c		70.73c		73.90c	
ADF	51 97a	54.78a	45.29b	51.43a	55.44b	58.83a
Ave.	53.38c		4836d		57 14c	
NDF	63.59a	60.09a	66.56a	60.54b	62.92a	63.26a
Ave.	61.84c		63.55c		63.09c	

a,b values in the same row under the same treatments bearing different superscripts differ significantly (P<0.05)

c,d values in the same row bearing different superscripts differ significantly (P<0.05)

*LW = light weight animals, HW = Heavy weight animals

Average total dry matter intake (TDMI) expressed on basis of metabolic body size of groups fed fenugreek seeds (Table 3) were not significantly different from that of control. Rao et al, (1996) supplemented fenugreek seeds to weanling rats at 5, 10, and 20% levels of DM intake for 90 days to study the nutritional and toxicological properties of seeds. They found a negative correlation between fenugreek content of diets and DM digestibility as well as CP digestibility. They concluded that fenugreek seeds are not toxic. On the other hand, El-Mahdy and El-Sebaiy (1982) found that germination of fenugreek seeds increased the trypsin inhibitor activity by 66%. Animal subgroups supplemented with 30 g seeds (either LW or HW) had much variation within group. The same trend applies to TDNI. Almost similar values of TDN% were obtained for all groups and subgroups. Digestible CPI was the highest (P<0.05) for control. Within the fenugreek fed groups, the 10 g seeds level was higher than 30 g level. Yet DCPI/TDNI ratio was similar among all groups.

This discrepancy maybe attributed, in part, to that the HW animals could have utilized digested nutrients inefficiently. In additions, fenugreek seeds have some anti-nutritional factors such as phytic acid, tannic acid and trypsin inhibitor (Mansour and El-Adawy, 1994), saponins (Bedour et al, 1964), and alkaloids trigonilline and choline (Chopra, 1958). It appears that the physical form of seeds had an influencing effect on digestion coefficients. Zeid (1998) fed 500 mg of fenugreek seed powder to kids. He found that DM digestibility of diet supplemented with fenugreek powder to be significantly higher than control. When 125 mg of fenugreek seed powder was included in a mixture of some other medicinal plants (15 mg of garlic powder, 25 mg of Nigella sativa seed powder, and 15 mg of chamomile flower powder), DM digestion coefficient was even higher. Yet, this might due to the associative effects of the herbal mix.

Table 3: Average daily feed intake and value of diets fed to sheep as affected by the inclusion of fenugreek seeds

Treatment	10 g seeds		30 g seeds		Control	
Subgroup	LW*	HW*	LW	HW	LW	HW
Body weight, Kg	31.5	49.5	35.75	49.75	40.1	47.0
Ave.	40.5		42.75		43.5	
TDMI, g/BW$^{0.75}$	77.77a	73.16a	86.53a	64.91b	76.63a	76.47a
Ave.	75.47c		75.72c		76.55c	
TDNI, g/BW$^{0.75}$	56.53a	47.76b	54.55a	43.66b	55.41a	51.34a
Ave.	52.15c		49.11d		53.37c	
DCPI, g/BW$^{0.75}$	7.70a	6.61b	7.61a	6.04b	7.64a	7.35a
Ave.	7.16d		6.83c		7.50e	
DCPI, % TDNI	13.64	13.92	13.94	13.82	13.79	13.75
Ave.	13.78		13.88		13.48	
TDN, %	64.51a	57.55b	55.97a	59.71a	61.57a	60.27a
Ave.	61.03c		57.84d		60.92c	

a,b values in the same row under the same treatments bearing different superscripts differ significantly (P<0.05)
c,d, e values in the same row bearing different superscripts differ significantly (P<0.05)
*LW = light weight animals, HW = Heavy weight animals

On the other hand, neither CP, CF, EE nor NFE digestion coefficients were different from control ration (Berseem hay, rice straw and concentrate feed mix). He concluded that fenugreek seed powder was the least in nutrient digestion coefficients compared with other medicinal plants he used. Physical form of fenugreek did not affect DCP% (Zeid, 1998) as the values he obtained agree with those in the present study. It appears that fenugreek does not exert significant effects on digestion coefficients of different nutrients as supppрted by the present findings and those of Abo-Donia et al. (2003).

Average nitrogen intake (g/BW0.75) did not differ significantly among animal groups (Table 4).

Table 4. Nitrogen metabolism by sheep fed diets included fenugreek seeds

Treatment	10 g seeds		30 g seeds		Control	
Subgroup	LW*	HW*	LW	HW	LW	HW
N. intake, g/BW$^{0.75}$	1.71a	1.62b	1.91a	1.44b	1.85a	1.86a
Ave.	1.67c		1.68c		1.86b	
Digested N., g/BW$^{0.75}$	1.23a	1.06b	1.22a	0.97b	1.12a	1.13a
Ave.	1.15c		1.01d		1.13b	
Urine N., g/BW$^{0.75}$	1.06a	0.75b	0.87a	0.62b	1.35a	1.92a
Ave.	0.91c		0.75d		1.64b	
NB., g/BW$^{0.75}$	0.17b	0.31a	0.35b	0.35a	1.26a	1.21a
Ave.	0.24d		0.35c		1.24b	
NB., % N. intake	9.94	19.14	18.32	24.31	15.74	12.85
Ave.	14.37		21.32		14.29	

a,b values in the same row under the same treatments bearing different superscripts differ significantly (P<0.05)
c,d values in the same row bearing different superscripts differ significantly (P<0.05)
*LW = light weight animals, HW = Heavy weight animals

However, HW animals fed fenugreek seeds (both 10 and 30 g) showed lower nitrogen intake and digested nitrogen than LW animals. Average urine nitrogen was higher ($P<0.05$) for the 10 g seeds fed animals. Digested nitrogen was lower for HW animals than for LW animals suggesting increased nitrogen excreted in feces for these animals. Average digested nitrogen showed that 30 g fed animals had the lowest digested nitrogen. The variations within groups in regard to nitrogen intake and digested nitrogen had its reflection on average digested nitrogen where the 30 g fenugreek seeds fed group had lower digested nitrogen than both 10 g seeds fed group as well as control. Average nitrogen excreted in urine was the highest for 10 g fed animals. Within this group the HW animals excreted less nitrogen in urine than LW ones. However, the results obtained for DCPI (Table 3) are proportional to those of nitrogen intake and digested nitrogen (Table 4). The nitrogen balance was, therefore, higher for the 30 g fed animals, whereas, 10 g fed animals had a typical value of NB as did control. The differences in both urine and fecal nitrogen excreted were reflexed in the NB/N intake. The 30 g fed animals had higher values than both 10 g fed animals and control.

Some blood plasma parameters of sheep when fed fenugreek seeds are shown in Table (5). Fenugreek seeds at either levels (10 or 30 g seeds) did not affect total protein (g/100 ml) of sheep. They were not different from that of control. Both albumin and globulin concentrations in blood plasma were not different from control either. These results may suggest that fenugreek may not affect the animals negatively. Rao et al, (1996) concluded that fenugreek seeds are not toxic. This is in agreement with the results obtained in the present study.

Table 5: Some blood plasma parameters of sheep fed diets included fenugreek seeds

Treatment		10 g seeds		30 g seeds		Control	
Subgroup	Times (hr)	LW*	HW*	LW	HW	LW	HW
TP, g/100 ml	0	6.27	6.55	6.37	6 58	6.23	6.40
	3	6.47	6 72	6.56	6.80	6 43	6.54
	6	6.33	6.65	6.40	6.62	6.31	6.47
Albumin, g/100 ml	0	3.20	3.35	3.34	3.38	3.18	3 28
	3	3.33	3.52	3.37	3.58	3.26	3.35
	6	3.21	3.37	3.36	3.40	3.21	3.27
Globulin g/100 ml	0	3.07	3.20	3.03	3.20	3.05	3.12
	3	3.14	3.20	3.19	3.22	3.17	3.19
	6	3.12	3.28	3.04	3.22	3.09	3.20

*LW = light weight animals, HW = Heavy weight animals

CONCLUSION

The 10 g fenugreek seeds level seems to produce better results than the 30 g level. Therefore, it might be recommended to use fenugreek seeds at lower levels in order to enhance animal performance.

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تأثير بذور الحلبة على التقييم الغذائي للعلائق وبعض مكونات الدم في الأغنام

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استخدم في هذا البحث ١٨ كبش برقي ناضج تم تقسيمها إلى ثلاث مجموعات أساسية. أعطيت المجموعة الأولى ١٠جم بذور حلبة والمجموعة الثانية ٣٠ جم حلبة بينما كانت المجموعة الثالثة للمقارنه. تم تقسيم كل مجموعة إلى تحت مجموعات حسب وزن الجسم إلي تحت مجوعة ثقيلة الوزن وتحت مجموعة خفيفة الوزن وغذيت المجموعات كلها علي عليقه أساسية تكونت من ٦٠% علف مركز و٤٠% مادة خشنة وقد تميزت بذور الحلبة بارتفاع نسبة البروتين الخام (٢٤,٥٢%) و المستخلص الأثيري (٦,٦٢%).

وقد وجد أن معاملات هضم العناصر الغذائية اقل ما يمكن في الحيوانات التي غذيت على ٣٠ جم حلبة اقل من المعاملات الأخرى بينما كانت معاملات هضم العناصر الغذائية متشابهة بين المجموعة التي غذيت ١٠ جم حلبة ومجموعة المقارنة. الحيوانات الأثقل وزنا أظهرت معاملات هضم اقل من الأخف وزنا عند التغذية على ١٠جم بذور وكذلك في مجموعة المقارنة.

ميزان النيتروجين كان عاليا للمجموعة التي غذيت ٣٠ جم حلبة وكذلك كانت الحيوانات الأثقل وزنا عن تلك الأخف وزنا فيما عدا المقارنة وقد تشابه المأكول من المادة الجافة الكلية (جم / كجم ٠,٧٥)في كل المجاميع بينما كان المأكول الكلي من العناصر الغذائية المهضومة اقل في المجموعة التي غذيت ٣٠ جم حلبة وكذلك كان المأكول من البروتين الخام المهضوم ونسبة العناصر الغذائية المهضومة. وقد تشابهت قيم البروتين الكلي والالبيومين والجلوبيولين في كل المجاميع ولم تختلف معنويا.

ويستنتج من ذلك أن إضافة بذور الحلبة قد يكون مفيدا للحيوانات على المستوى الأقل من البذور.