

EFFECT OF FENUGREEK SEEDS (*Trigonella foenum-graecum L.*) AS FEED ADDITIVE ON SHEEP PERFORMANCE IN THE NORTH WESTERN COAST OF EGYPT

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SUMMARY

The current trend in the world is to impose a ban on the use of chemicals in any human-related products. Some of these chemicals are used in animal feeding. The use of natural substances (herbal plants) instead is adopted.

This study was conducted to evaluate the effect of natural herbal seeds, fenugreek, as a feed additive on the performance of sheep in the northwestern coast of Egypt.

Sixty growing Barki lambs were randomly divided equally into three groups. Each group was, then, subdivided into two subgroups of ten animals each on basis of body weight [light (LW) versus heavy (HW) body weight]. Main groups were randomly assigned to experimental rations in 180 days feeding trial. Diets consisted of 60% concentrates and 40% roughage. The first group was supplemented with ten g fenugreek seeds/h/d, while the second had 30g seeds /h/d and the third group served as a control.

Total dry matter (TDM), total digestible nutrients (TDN) and Digestible crude protein (DCP) intakes were significantly ($P<0.05$) in favor of fenugreek seeds supplemented groups. The second group had higher ($P<0.05$) TDM and DCP intakes than first group. However, HW animals had higher TDM intakes than LW animal in all groups. They also surpassed LW animals in TDN intakes in almost all groups. The group fed 30 g seeds /h/d showed higher ($P<0.05$) average daily gain (ADG) (96.22 g) followed by control (83.52 g). Again, HW animals had higher ADG than LW animals and this could be due to higher feed intakes. Efficiency of feed utilization as weight gain was in the side of 30 g fenugreek seeds fed group. It had the highest feed conversion rates (11.4, 6.89 and 0.91 Kg DM, TDN, and DCP/Kg gain, respectively). Lightweight animals showed low feed efficiency.

It might be concluded that supplementing rations with fenugreek seeds at low levels (10 g or less) might have beneficiary effect on animal performance.

Keywords: Sheep, supplement, herbal plant, fenugreek, performance

INTRODUCTION

The current trend in the world nowadays is to impose a ban on the use of chemicals in the production of any human-related products. Some of these chemicals are used in animal feeding. The Food and Drug Administration (FDA) of America has classified these chemicals as those which have the least potential for unsafe residues (Church, 1991).

Natural herbal plants are well known in the field of drug industry. However, the medicinal use of herbs is deeply rooted in human history. Some plant seeds were used as tonics and restoratives such as fenugreek (Hoda *et al.*, 1992). Aflatoxin production by a toxinogenic strain (*Aspergillus flavours*) was inhibited by about 85 – 90% (El-Shayeb and Mabrouk, 1984) when a 10% of an extract of a mixture of herbal plants (powdered liquorice root, lupin seeds, fenugreek seeds, *Artemesia herba-alba* flower heads and *Nigella sativa*) was used. Bhat *et al.* (1985) found that 200 mg fenugreek extract stimulated the conversion of cholesterol to bile salts. This was a direct result of increased bile secretion. Madar (1984) indicated that fenugreek extract decreased blood glucose of diabetic rats because it inhibited glucose transport in everted sacs of jejunum.

In a previous study (Attia-Ismail, 2000), it was found that whole fenugreek seeds did not exert a significant effect on DM or CP digestibility over that of control. On the other hand, DM digestibility increased ($P<0.05$) by about 5% over that of control (55.56%) when ground fenugreek seeds were incorporated into a mixture of herbal plants (garlic cloves, *Nigella sativa* seeds, chamomile flower and fenugreek seeds). Crude protein digestibility coefficient increased from 68.32% for the control group to 75.64% for the herbal plant mixture group (Zeid, 1998).

However, this investigation is the second of a planned series of studies. The first study (Attia-Ismail, 2000) aimed at casting light at fenugreek seeds as fed to sheep in a short-term experiment. The present study was planned to investigate the long-term effects of feeding fenugreek seeds on sheep performance.

MATERIALS AND METHODS

1) Animals and management

Sixty growing Barki lambs were randomly selected for the experiment. Animals were, then, weighed, and divided into three main groups with similar average body weights (28.87, 28.75, and 28.96 Kg \pm 1.101 for 1st, 2nd, and 3rd groups in order). Each group was, thereafter, subdivided into two subgroups on basis of differential body weight (lightweight versus heavy weight). Number of animals in each subgroup was ten.

Animal groups were kept in large pens. Pens were divided from the inside into two partitions using wood bars before allocating animals. Each main group was randomly allocated in a pen where each subgroup was allocated randomly to a partition. Animal groups were randomly assigned to the experimental rations for 180 days in a feeding and performance monitoring trial. Animals were treated for external and internal parasites.

2) Experimental rations

Requirements of animals (both maintenance and gain of 100 g/h/d) were provided according to Kearn, 1982 in a group feeding system. Refusals of 10% were allowed to animals. Rations were formulated so that 60% of the diet was concentrates and 40% was roughage. Concentrate portion consisted of concentrate feed mix (CFM) and whole barley grains in a 3:1 ratio. Roughage portion of diets was Berseem hay. Whole fenugreek seeds were mixed well with concentrate portion (i.e. whole barley grains) before being presented to animals. Third animal group served as a control for first group (offered 10 gm/h/d fenugreek seeds) and second group (offered 30 gm/h/d fenugreek seeds). All animals were allowed 15 days as a conditioning period before recording any data. Chemical composition of ration ingredients is shown in Table 1. Rumen samples were withdrawn from three randomly selected animals from each subgroup through a stomach tube at 0, 3, and 6 hrs post feeding.

Table 1. Chemical composition of ration ingredients as fed to growing lambs

Feed Ingredients	DM, %	CP	ADF	NDF	EE	NFE	Ash
		DM basis, %					
Berseem hay	88.21	13.11	49.05	65.01	2.44	43.41	13.93
CFM*	89.13	13.41	27.96	69.85	3.41	58.77	11.19
Barley grains	89.40	8.28	13.99	34.78	2.79	77.54	3.00
Fenugreek seeds	92.11	27.01	22.16	50.91	6.49	53.02	4.12

*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%

3) Analytical methods

Samples of feeds and orts were analyzed according to A.O.A.C. (1990). Ruminant TVFA's were assayed by steam distillation according to Warner (1964). Ammonia- nitrogen of rumen fluid was measured according to Abou-Akkada and Osman (1967). Data was statistically analyzed using GLM procedures of SAS (1985).

RESULTS AND DISCUSSION

The average total dry matter intake (TDMI) of 30 g fenugreek seeds fed group (Table 2) was significantly the highest (1082 g/h/d) whereas the control group had the lowest ($P < 0.05$). Heavy weight animals (HW) in each group had higher TDMI than light weight animals (LW). The HW and LW animals fed 30 g seeds had similar TDMI. Zeid (1998) fed 500 mg of fenugreek seeds powder for growing Zaraibi kids and found that TDMI reached 735 g/h/d compared to control (567 g/h/d). He incorporated 125 mg fenugreek seeds powder into a mixture of a herbal plants (15 mg garlic cloves powder, 25 mg *Nigella sativa* seeds powder and 15 mg chamomile flower powder) and obtained lesser TDMI (666 g/h/d) than the fenugreek seeds powder only but higher than control. He had no comment on that effect. Yet, it seems that there were no associative effects of the herbal mixture over that of fenugreek seeds alone. However, the results obtained in the present study concerning both TDMI and total digestible nutrients intake (TDNI) are greater than those obtained by Zeid (1998) for the same period (180 days). These positive differences might due, in part, to species differences and, to the greater part, to the physical form of seeds (powder) as well as the level of seeds fed to animals. Conversely to TDMI, average TDNI (g/h/d) of 10 g fenugreek seeds fed group showed higher value

than that of 30 g seeds fed group. Control group was the least. In harmony with that contrast, LW subgroup had higher TDNI (698 g/h/d) than HW subgroup.

Table 2. Feed and nutrient intakes of growing sheep fed rations containing fenugreek seeds

Treatment	10 g seeds		30 g seeds		Control	
Subgroup	LW*	HW*	LW	HW	LW	HW
No. of animals	10	10	10	10	10	10
Initial BW, Kg	25	32.75	26.75	32.75	25.32	32.75
Ave.		28.87		28.75		28.96
TDMI, g/h/d	1036 ^b	1083 ^a	1092 ^a	1072 ^a	916 ^b	1080 ^a
Ave.		1059 ^b		1082 ^a		998 ^a
TDNI [†] , g/h/d	698 ^a	648 ^b	641 ^b	670 ^a	592 ^b	681 ^a
Ave.		673 ^a		655.5 ^b		636.5 ^a
DCPI, g/h/d	91.17 ^a	86.75 ^a	85.18 ^a	88.44 ^a	74.65 ^b	89.53 ^a
Ave.		88.96 ^a		86.81 ^{ab}		82.09 ^b
DADF [‡] intake	175.49 ^b	309.44 ^a	209.21 ^b	245.92 ^a	280.68 ^b	329.54 ^a
Ave.		245.47 ^b		227.57 ^c		305.11 ^a
DNDF [‡] intake	422.03 ^b	561.55 ^a	565.35 ^a	498.97 ^b	543.11 ^b	586.38 ^a
Ave.		491.97 ^c		532.16 ^b		564.75 ^a

^{a,b} values in the same row under the same treatment 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

† Digestion coefficients used in calculating digestible nutrients are those of Attia-Ismail, 2000

‡ DADF = digestible acid detergent fiber, DNDF = Digestible neutral detergent fiber.

The higher but not significant digestible crude protein intake (DCPI) of fenugreek seeds fed groups than control may not be attributed to the addition of fenugreek seeds to their rations. This is because of the low amounts of seeds compared to other ingredients of the rations. This explanation is supported by the finding that 10 g seeds fed group had higher but not significant DCPI than 30 g seeds fed group. However, this increase in DCPI of fenugreek fed groups might be due to the higher solubility of fenugreek seeds, which affected protein apparent digestibility positively (Attia-Ismail, 2000) and thus increased intake of DCPI.

Digestible ADF and NDF intakes were higher for control than for fenugreek fed groups (Table 2). Heavy weight animals had higher intakes of ADF and NDF than LW animals except for NDF at 30 g seeds levels.

Average daily gain of 30 g fenugreek fed animal group (Table 3) was the highest (96.22 g/h/d) followed by control group (83.52 g/h/d) and least was the 10 g fenugreek fed animals. Al-Aghbari (1988) fed 5 g fenugreek seeds to growing sheep and obtained ADG of 33.1 g/h/d. The results of ADG of his study were low (31.5, 33.1, 34.1, and 34.7 g/h/d for control, fenugreek seeds, herbal mixture and lepidium seeds respectively). On the other hand, Zeid (1998) found that fenugreek seed powder fed kids to have the highest ADG (70 g/h/d). The results of the present study were higher than those obtained by Zeid (1998). This might be due to the very low level (500 mg) and the physical form of fenugreek seeds (whole seeds in the present study versus seed powder for Zeid, 1998). Species differences could be attributable.

Feed efficiency of different groups reflects both intake and daily gain (Table 3). The best feed efficiency as Kg DM, TDN, or DCP/Kg gain was in the side of heavy animal subgroup, which was fed 30 g fenugreek seeds. However, feed efficiency was generally in the side of 30 g seeds group (either LW or HW) resulting in better ratios than control and 10 g seeds fed groups (either LW or HW). Therefore, economic efficiency was in the same trend.

Table (4) presents some rumen parameters of sheep supplemented with fenugreek seeds as compared to control group. It does not appear that fenugreek seeds had apparent effects on pH values, TVFA's or $\text{NH}_3\text{-N}$ (Attia-Ismail, 2000). Values of measured rumen parameters obtained for fenugreek supplemented sheep were similar to those of control at different times (0 hrs, and 3 and 6 hrs post feeding). Although protein contents of fenugreek seeds (Table 1) were high (27.01%) and due to its high solubility (El-Aal and Rahma, 1986, Abdel-Naby and Damir, 1990 and Osman and Simon, 1991), the $\text{NH}_3\text{-N}$ concentrations were expected to be higher than control. This did not happen because of low amount of seeds offered to animals.

Table 3. Average daily gain, feed efficiency of growing sheep fed diets containing fenugreek seeds and economic efficiency of meat production

Treatment Subgroup	10 g seeds		30 g seeds		Control	
	LW*	HW*	LW	HW	LW	HW
ADG, g/h/d	65.88 ^b	88.78 ^a	84.96 ^b	107.48 ^a	67.79 ^b	99.24 ^a
Ave.	77.33 ^c		96.22 ^a		83.52 ^b	
Feed efficiency						
Kg DM/Kg gain	15.73 ^a	12.20 ^b	12.82 ^a	9.96 ^b	13.51 ^a	10.88 ^b
Ave.	13.97 ^a		11.40 ^b		12.20 ^b	
Kg TDN/Kg gain	10.60 ^a	7.29 ^b	7.54 ^a	6.23 ^a	8.73 ^a	6.86 ^b
Ave.	8.95 ^a		6.89 ^a		7.80 ^{ab}	
Kg DCP/Kg gain	1.38 ^a	0.98 ^b	1.00 ^a	0.82 ^a	1.10 ^a	0.90 ^a
Ave.	1.18 ^a		0.90 ^b		1.00 ^{ab}	
Economic efficiency [†]	1.10	1.42	1.28	1.62	1.23	1.65
Ave.	1.26		1.45		1.44	

^{ab} values in the same row under the same treatments bearing different superscripts differ significantly (P<0.05)

^{cd} values in the same row bearing different superscripts differ significantly (P<0.05)

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

[†] Economic efficiency = (price of selling one Kg of ADG¹) / (cost of production²) where: 1= market price and 2= 70% as feed cost and 30% as other costs.

Table 4. Some rumen parameters of growing sheep fed rations containing fenugreek seeds

Treatment Subgroup	time	10 g seeds		30 g seeds		Control	
		LW*	HW*	LW	HW	LW	HW
pH	0	6.83	6.82	6.79	6.76	6.75	6.85
	3	6.31	6.22	6.20	6.26	6.25	6.19
	6	6.50	6.52	6.39	6.45	6.40	6.44
TVFA's	0	3.71	3.80	3.55	3.76	3.54	3.62
	3	6.28	6.49	6.33	6.47	3.22	3.32
	6	4.62	4.62	4.88	4.76	4.72	4.71
NH ₃ -N	0	18.69	17.99	17.85	18.86	18.66	17.95
	3	28.73	28.83	27.59	29.86	30.00	26.94
	6	21.50	22.56	19.65	23.51	21.35	22.03

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

It is concluded that fenugreek seeds may have a beneficiary effect on animal performance on the long run and it may replace synthetic growth promoters. Fenugreek seeds are characterized by being natural edible promoter, which has no side effect on animals, and consequently the end user, the human being, will be safe of the dangers of synthetic chemicals. This study, however, raised several issues concerning the use of fenugreek seeds. These issues need further investigations which already taken into consideration for our future plan of studies. Generally, the use of herbal plants is a nice area of investigation in the field of ruminant nutrition.

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