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MEDICINAL PLANT SEEDS SUPPLEMENTATION TO LACTATING GOATS DIETS AND THEIR EFFECTS ON MILK YIELD AND MILK COMPOSITION

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SUMMARY

Nine lactating Baladi goats, in early lactation, were divided into 3 groups, using 3 × 3 Latin square design with 30 d periods. The control diet used consisted of berseem clover (B), as a source of roughage, and concentrates (50 : 50, dry matter basis) (I). The two experimental diets used were: Control diet plus 10 g/d of fenugreek seeds (*Trigonella foenum*) (II) and control diet plus 5 g/d of Nigella sativa seeds (III). Individual milk samples were collected at the last 3 days of each period for analysis. Fenugreek increased milk yield ($P<0.05$) than control. *Nigella sativa* increased milk yield and milk lactose ($P<0.05$) and C_{15} in milk fat than control. However, it decreased pH of milk ($P<0.05$). Data indicates that the 2nd group; which fed fenugreek seeds; was better economically than the other two groups (control or Nigella sativa-supplement group).

Keywords: Fenugreek, Nigella sativa, goats, milk composition, fatty acids

INTRODUCTION

To cope up with the problem of reduced milk production, many workers applied various drugs, chemical supplements, hormones, minerals, vitamins and feed–additives to enhance milk yield for providing significant economic income. However, these preparations have some side effects, which may lead to health hazards. The use of medicinal herbs and plants with human is well known since the old civilizations times of ancient Egyptians, Chinese and Greek. Using medicinal herbs and seeds as feed additives to ruminants seems to be a recent trend globally (Singh *et al*., 1993). Many efforts have been done to obtain detailed references concerning this work but the yield was not sufficient to be comparable with results obtained from these studies. The use of herbal galactagogues is known to have beneficial effect on milk production (Singh *et al*., 1991 and Tiwari *et al*., 1993). In Egyptian Folkloric medicine, it is well known that fenugreek seeds is used by ancient as well as modern Egyptian women to increase milk secretion (Basha *et al*., 1987). Vihan and Panwar (1987) reported that Nigella sativa seeds might be a useful galactagogue for lactating goats. Therefore, this experiment was conducted to evaluate the effects of supplementing lactating goat's diets with fenugreek or Nigella sativa seeds galactagogue on the yield and composition of their milk.

MATERIALS AND METHODS

1. Animals and diets

Nine lactating Baladi goats, in early lactation, were divided into 3 groups using 3 × 3 Latin square design with 30 d periods. The control diet used consisted of berseem clover (B), as a source of roughage, and concentrates feed mixture (CFM) (50 : 50, dry matter basis) (I). The two experimental diets used were: Control diet plus 10 grams/day of fenugreek seeds (Trigonella foenum), (II) and control diet plus 5 grams/day of Nigella sativa seeds (III). The CFM, consisting of 23% crushed faba bean seed by-products, 23% wheat bran, 50% crushed corn, 1% urea, 2% dolomite and 1% salt (NaCl). The chemical composition of ingredients are shown in Table 1. Animals were fed twice daily at 7.00 and 15.00 h. The offered feeds were assessed to cover the requirements for each animal (A. R. C., 1965). Water was offered 2 times daily.

2. Analysis of feed samples

Samples of ingredients and rations were analyzed for DM, ash, CP, CF, organic matter, ether extract (EE) and nitrogen-free extract (NFE) (A. O. A. C., 1995).

3. Sampling and analysis of milk

At the last 3 d of each period, the animals were hand milked (twice/day), milk yield was recorded, pH of milk was determined (Ling, 1963). Milk samples were, also, analyzed for fat, total solids (TS), solids-not-fat (SNF), total protein (TP) ash (Ling, 1963) lactose (Barnett and Abd El-Tawab,1957) and

individual fatty acids were measured (Farag *et al.*, 1978) as mentioned in Kholif *et al.* (1999); using Konik HRGC 3000 (Konik Instruments Inc, Miami - Florida 33015, USA).

Table 1. Chemical composition of CFM, berseem, fenugreek and Nigella sativa seeds (%DM basis)

Item	Ingredient			
	CFM*	Berseem clover	Fenugreek seeds	Nigella sativa seeds
Dry matter	89.9	18.0	96.18	95.25
Ash	7.56	12.1	4.07	4.36
Organic matter	92.44	87.9	95.93	95.64
Crude protein	15.29	12.8	24.13	21.15
Ether extract	3.28	2.5	10.69	35.00
Crude fiber	9.14	28.2	6.97	5.56
Nitrogen-free extract	64.73	44.4	54.14	33.93

*Concentrate feed mixture.

4. Statistical analysis

ANOVA Latin square design using the general linear model procedure $Y_{ijk} = U + R_i + C_j + T_k + e_{ijk}$. where Y_{ijk} : is the parameter under analysis of the ijk goat. U : overall mean, R_i : lactation period, C_j : animals, T_k : treatment, e_{ijk} : experimental error for the ijk*th* observation for milk (Snedecor and Cochran, 1982). The DMRT was used to test the significance between means.

RESULTS AND DISCUSSION

1. Milk production and composition:

Fenugreek and Nigella sativa seeds increased milk and 4% fat-corrected-milk (FCM) yield ($P<0.05$) than control (Table 2). These increases in milk yield might be attributed to the galactopoetic effect of fenugreek and Nigella sativa seeds supplemented diets. It was found that fenugreek seeds contains the steroidal saponin, diosgenin, trigofoenosides A-G, alkaloid and trigonelline (Ghazanfar, 1994). Saponin is the major constituent of these components which may be enhance appetite and discourage constipation. Fenugreek seeds, also, decreased blood urea (Sharma *et al.* 1996) and there was a negative relationship between blood urea and milk yield (Kholif,1999). Nigella sativa seeds contains thymoquinone; the main constituent of the volatile oil; (Badary *et al* 1998) and nigellimine N-oxide; an isoquinoline alkaloid; (Ghazanfar, 1994). El-Komy (1996) suggested that Nigella sative seeds increased mammary development in rat due to increased secretory epithelial cell number or increased total capacity of the mammae, which resulted in significantly increased milk yield at different stages of lactation. Mahmoud (1993) found that Nigella sativa and its oil extract showed antibacterial activity against 5 strains of Listeria monocytogenes, which may enhance the performance of the animal. Another conclusion which noted by Singh *et al.* (1993) that the positive effect of galactagogues on milk production due to decreasing the circulating biogenic amines (histamine, tryptamine and tyramine) in blood which cause excessive release of catecholamines in mobile pool leading to suspension of milk secretion as well as cause indigestion by inhibiting the ruminal mobility and absorption.

Table 2. Yield and composition of milk produced by lactating goats fed diets supplemented with fenugreek or *Nigella sativa* seeds

Items	Treatments			
	I	II	III	S.E.
Milk yield (g. /day)	907.1^b	1003.7^a	997.7^a	26.8*
4 % Fat-corrected-milk (g/d)	695^b	767^a	763^a	22.5*
Fat %	2.44	2.43	2.43	0.22^{ns}
Total solids %	10.35	10.31	10.53	0.38^{ns}
Solids-not-fat %	7.91	7.88	8.10	0.10^{ns}
Total protein %	2.75	2.71	2.62	0.09^{ns}
Lactose %	4.44^b	4.46^b	4.73^a	0.09*
Ash %	0.70	0.71	0.74	0.02^{ns}
pH	6.33^a	6.33^a	6.28^b	0.01*

Treatments: I = Control (consisted of CFM : Berseem; 1:1), II = Control + 10 g/d. fenugreek seeds , III = Control + 5 g/d. Nigella sativa seeds . Each value is a mean of 27 samples from 9 animals. S.E. = Standard error. *Significant differences ($P<0.05$) between means, at the same row, are indicated by dissimilar superscripts.ns = not significant.

Results have been similar for milk yield and FCM yield by lactating animals in trials with buffaloes (Tomar *et al.*, 1996 and Abo El-Nor, 1999, using fenugreek), with goats (Malinowski *et al.*, 1996 and Zeid, 1998, using fenugreek), and with buffaloes and goats (Khurana *et al.*, 1996 and Zeid, 1998, using Nigella sativa). Nigella sativa increased also lactose content but decreased pH value of milk (P<0.05). The other milk constituents were not affected by treatment (P>0.05).

2. Individual fatty acids in milk

Data in Table 3 showed that percentages of individual fatty acids in goats milk were affected insignificantly (P>0.05) by including fenugreek or Nigella sativa seeds in the diet, except of total short-chain fatty acids ($<C_{12}$), C_6 and C_8; which decreased significantly (P<0.05) with Nigella sativa: however, C_{15} increased (P<0.01). Fenugreek seeds insignificantly (P>0.05) increased C_6-C_{14} and total short-chain fatty acids ($<C_{12}$), but decreased C_{16}, C_{18}, $C_{18:1}$ and total long-chain fatty acids than control or Nigella sativa treatment. On the other hand, calculated $C_{18:1}$ / C_{10} ratio was lower with fenugreek seeds and higher with Nigella sativa seeds than control. Decreasing $C_{18:1}$ / C_{10} ratio with presenting fenugreek in the diet possibly indicates the goats fed fenugreek were mobilizing lower body fat than those fed fenugreek seeds-free diets.

Table 3. Fatty acid composition of milk produced by lactating goats fed diets supplemented with fenugreek or *Nigella sativa* seeds

	Treatments			
Fatty acid	I	II	III	S.E.
C_6	2.63^{ab}	2.94^{a}	2.32^{b}	0.14*
C_8	3.22^{ab}	3.84^{a}	2.78^{b}	0.21*
C_{10}	10.25	12.17	9.79	0.66^{ns}
C_{12}	4.44	5.26	4.51	0.50^{ns}
C_{14}	10.43	12.17	10.79	0.47^{ns}
C_{15}	0.54^{B}	0.50^{B}	1.04^{A}	0.04**
C_{16}	29.40	27.82	28.11	0.98^{ns}
C_{18}	16.89	14.71	15.90	0.74^{ns}
$C_{18:1}$	22.20	20.59	24.76	1.33^{ns}
Short ($<C_{12}$)	16.10^{ab}	18.95^{a}	14.89^{b}	0.93*
Medium (C_{12-16})	44.82	45.75	44.45	1.69^{ns}
Long ($>C_{16}$)	39.08	35.30	40.66	2.04^{ns}
$C_{18:1}/C_{10}$	3.81	2.90	4.15	--

Treatments : I = Control (consisted of CFM : Berseem; 1:1), II = Control + fenugreek seeds., III = Control + Nigella sativa seeds. Each value is a mean of 3 pooled samples from 9 animals. S.E. = Standard error. *Significant differences {(P<0.05), small letters, (P<0.01), capital letters} between means, at the same row, are indicated by dissimilar superscripts. ns = not significant (P>0.05).

3. Economic efficiency

Table 4 represents the economical efficiency of milk produced from the three experimental groups. Based on the assumption that the prices of one kg of the CFM for treatments I, II and III was 0.52 L.E., 0.05 L.E. for berseem clover, 1.50 L.E. for fenugreek seeds and 5.00 L.E. for Nigella sativa seeds. Data indicates that the 2nd group: which fed fenugreek seeds: was better economically than the other two groups (control or Nigella sativa-supplement group).

Table 4. Economical efficiency of milk production from Baladi goats as affected by experimental diets

Item	Treatments		
	I	II	III
Intake as fed(g/d) :			
Concentrates	600	600	600
Berseem	3000	3000	3000
Fenugreek seeds	-	10	-
Nigella sativa seeds	-	-	5
4 % Fat-corrected-milk (g/d)	695	767	763
Cost of feed consumed* (P. T.)	0.462	0.4695	0.487
Price of 4% FCM yield (P. T.)	0.869	0.959	0.954
Cost of one kg of milk (P. T.)	0.66	0.61	0.67
Economical efficiency**	1.88	2.04	1.95

See footnote of Table 2

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