EFFECT OF ANISE AND FENUGREEK SUPPLEMENTATION ON PERFORMANCE OF RABBIT DOES

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ABSTRACT

The study investigated the effects of diet supplementation with aniseed (*Pimpinella anisum*) and fenugreek seeds (*Trigonellae foenum-graecum*) on the performance of does and kits. Thirthy eight NZW does were randomly divided into two groups (n=19) considering live weight, parity, number of born alive and litter weight after equalisation to 8 kits at first day of lactation. Three days before expected time of parturition until 17 days of lactation, control group was fed *ad libitum* a commercial diet (C), while the treated group (AF) received the same feed supplemented with aniseed (6 g/kg) and fenugreek seeds (6 g/kg). After 17th day of lactation, groups were fed the C diet and nursed freely till weaning at 35 days of age. Milk yield was daily measured until day 17 with separation of kits and weighing the doe immediately before and after controlled suckling. Between 1 and 17 days of lactation, the supplementation tended (P=0.058) to reduce the doe's feed intake (325 vs 348 g/day). Mortality of AF kits tended to be higher (3.9 *vs.* 0.6% P=0.056) causing a relatively smaller 17d litter size (7.68 vs 7.95 P=0.075) and lower 1-17 days milk yield (3468 vs 3561 g). The daily milk intake of AF kits (26.7 g) was equivalent to that of C rabbits (26.4 g). Also, the 17 days body weight did not differ significantly between AF and C kits (334 and 341 g). However, milk conversion of AF kits was lower (P=0.011) compared to C rabbits (1.73 vs 1.64 g/g). At 35 days of lactation, the differences between AF and C groups were not significant in litter size (7.65 and 7.89), litter weight (6837 and 7168 g), kit weight (900 and 909 g) and 1-35d weight gain (23.8 and 24.1 g/day). In conclusion, further studies are needed to investigate the palatability and optimal level of these spices in the feed of lactating rabbits.

Key words: rabbit, anise, fenugreek, milk yield, nursing.

INTRODUCTION

Growth of sucklings depends on the nursing capacity of their mothers. With impoving doe's milk yield an appropriate milk supply of the kits can be ensured.

Several herbs and spices are assumed to have beneficial effects on milk secretion. Aniseed (*Anisi fructus*) contains essential and fatty oils, protein, choline and sugar. The main component of the essential oil is anethole. It also consists of anisaldehyde, anisic acid and estragol. The biological properties of anise oil are inhibiting bacterial (SAĞDIÇ and ÖZCAN, 2003) and fungal (SOLIMAN and BADEAA, 2002) growth, stimulating the secretion of digestive enzymes and appetizing. Beside efficacious digestion, the estrogenic agents of anise can also contribute to better milk secretion (ALBERT-BUELO, 1980).

The active substances in fenugreek seed (*Trigonellae foeni-graeci semen*) are trigonelline, galactomannan, choline, vitamine C, steroid saponins and flavonoids. This bitterish and coumarin-scented condiment is used in a traditional Indian dish (methipak) for pregnant and lactating women to stimulate appetite and boost milk production (PETIT *et al*., 1995). Another properties of fenugreek seed are its hypoglycemic and hypocholesterolemic (RAO *et al*., 1996), anti-inflammatoric and antipyretic effects (AHMADIANI *et al*., 2001), antioxidant potential (CHOUDHARY *et al*., 2001, MCCARTHY *et al*., 2001, SUJA *et al*., 2002), stimulation of the activities of pancreatic digestive enzymes and stimulation of the liver to produce and secrete bile rich in bile acids (PLATEL *et al*., 2001).

In the previous study of RASHWAN (1998), the inclusion of anise or fenugreek seeds in a level of 12 g/kg diet improved ($P<0.05$) the 1-21 days litter weight gain and reduced the pre-weaning mortality in NZW rabbits. Anise additition increased ($P<0.05$) even the milk yield. However, fenugreek inclusion impaired some traits in his experiment.

The aim of this study was to investigate the effects of aniseed plus fenugreek seeds dietary supplementation with lower doses (6 g/kg diet) on performance of does.

MATERIAL AND METHODS

The study was performed in the rabbit farm in Gödöllő. Thirthy eight New Zealand white mothers were randomly divided into two groups (n=19) considering live weight (4.2 to 4.4 kg), parity (2^{nd} or 3^{rd}), number of born alive (8.8-9.1) and after egalisation to 8 kits, litter weight (518-532 g) and kit weight (65-66 g) at first day of lactation. The does were housed in wire-mesh breeding cages (60x60x30 cm) under controlled conditions (15-20°C, 16L:8D photoperiod).

In the control group a commercial rabbit feed (C) containing 17.5% crude protein, 3.1% crude fat, 13.9% crude fibre and 10.3 MJ/kg DE was fed *ad lib.* In the treated group (AF) rabbits received the C diet supplemented with 6 g/kg of whole aniseed (*Pimpinella anisum*) plus 6 g/kg fenugreek seeds (*Trigonellae foenum-graecum*) three days before expected day of parturition until 17 days of lactation. After 17^{th} day, groups received the C diet and nursed freely till weaning at 35 days of age. The spices were purchased from Egypt.

Milk yield was daily measured until day 17 with separation of kits and weighing the doe just before and after controlled suckling. Kit mortality was recorded daily until 17 days

and weekly until weaning. Died kits were not replaced. Doe's live weight and feed intake and litter weight were weekly measured until weaning. Feed and milk conversion, weight gain of kits and suckling mortality were calculated from the data.

Statistically, analysis of variance was used to estimate the effect of treatment on feed and milk intake, milk yield, body weight, and daily weight gain with STATGRAPHICS ver. 6.0 (1992). The following model was used for each trait: $Y_{ij} = \mu + t_i + e_{ij}$ where Y_{ij} = an observation, μ = overall mean, t_i = effect of i^{th} treatment (i = 1 and 2) and e_{ij} = random error. Chi-squared test was used for evaluating mortality.

RESULTS AND DISCUSSION

The supplementation tended to reduce (P=0.058) the feed intake of AF does by 7% (Table 1). Also, RASHWAN (1998) reported a 9 or 11% decrease in feed consumption with higher dose of anise (219 g/day) or fenugreek addition (215 g/day) compared to the control group (240 g/day).

Table 1. Effect of feeding on doe's feed intake, milk yield and feed conversion

	Age (days)	Control	AF	P value
Does (n)		19	19	
Feed intake, g/day	1-7	262±11	247±11	0.314
	8-14	398±13	373±13	0.180
	1-17	348±9	325±9	0.058
Milk yield, g	1-7	1063±44	1006±45	0.379
	8-14	1665±54	1622±54	0.583
	1-17	3561±109	3468±120	0.578
Feed conversion+	1-7	1.75±0.09	1.74±0.09	0.922
	8-14	1.68±0.05	1.63±0.05	0.465
	1-17	1.66±0.04	1.59±0.04	0.195

+Feed conversion: daily feed intake/daily milk yield

In AF group the 1-17 days milk yield did not increase. Its amount can be related to a reduced (P=0.058) feed intake and smaller (P=0.075) 17d litter size caused by somewhat higher (P=0.056) mortality of AF kits (Table 1 and 3). The feed conversion of AF does seemed better (P=0.195) due to the slightly lower feed intake. Similarly, RASHWAN (1998) did not find differences in 1-14d milk yield but in the 3rd week of lactation it was higher in anise (1427 g) and relatively better in fenugreek (1187 g), than in the control group (1015 g). However, he reported relatively larger 21d litter sizes in the treated groups (5.90 and 5.80 vs 4.95).

Poorer (P=0.011) milk conversion was observed in AF kits (Table 2) during 1-17 days of lactation. Despite the relatively higher 1-17d milk intake of AF kits (26.7 vs 26.4 g), the body weight of AF young tended (P=0.640) to be smaller at 17 days of age (334 g), than in C sucklings (341 g).

With higher dose of fenugreek addition, RASHWAN (1998) recorded a relatively lower 21d body weight (309 g) despite the similar milk intake (21.2 g/day) compared to the control group (318 g and 21.1 g/day). In contrast, milk intake improved (24.7 g) and subsequently the 21d kit weight increased (341 g) in response to a higher level of anise inclusion.

Table 2. Effect of feeding on the performance of suckling rabbits

	Age (days)	Control	AF	P value
Litters (n)		19	19	
Milk intake, g/day	1-7	19.1±0.8	18.6±0.8	0.628
	8-14	29.9±1.1	30.3±1.1	0.795
	1-17	26.4±0.8	26.7±0.9	0.794
Milk conversion+	1-7	1.47±0.04	1.51±0.04	0.449
	8-14	1.68±0.03	1.73±0.03	0.297
	1-17	1.64±0.02	1.73±0.02	0.011
Mortality rate, % (n)	1-17	0.6 (1/152)	3.9 (6/152)	0.056
	1-35	1.3 (2/152)	4.6 (7/152)	0.091

+Milk conversion (litter): daily milk intake/daily weight gain

In AF and C groups the body weight at 35 days of age (900 and 909 g) and the 1-35 days weight gain (23.8 and 24.1 g/day) were similar (Table 3). However, the 21d litter size tended (P=0.064) to decrease in AF group.

PETIT *et al*. (1995) found that subchronic dietary addition of steroid saponins extracted from fenugreek seed motivated the rats to eat. In contrast, RAO *et al*. (1996) detected a reduced feed intake and a 9% lower gain in male rats fed 20% fenugreek diet, whereas females with 10 and 20% fenugreek had higher weight of liver when compared with 0 and 5% fenugreek groups. CHOUDHARY *et al*. (2001) studied the dose-dependent effect of fenugreek in mice and found that some traits (body weight, antioxidant function, glutathione level and glutathione S-transferase activity in the liver, activities of catalase and superoxide dismutase enzymes) were improved up to 1-2% of fenugreek inclusion, but they were impaired at level of 10%.

In this study, no difference was detected in milk output and nursing performance between AF and C groups.

RASHWAN (1998) reported that the 1.2% fenugreek diet resulted in a relatively higher 0-28d milk yield (3295 vs 2785 g) with slightly larger 28d litter size (5.35 vs 4.62). In line with our result, the 28d body weight in fenugreek group (418 g) was lower (P<0.01), than in the control group (459 g), in spite of the relatively higher milk intake (22.0 vs 21.5 g/day). He obtained the best (P<0.05) result in anise group, where the 0-28d milk yield was 3795 g, the milk intake 25.6 g/day and with 5.30 rabbits per litter, the 28d body weight was the largest, 480 g at weaning.

Table 3. Effect of feeding on the performance of does and their litters

	Age (days)	Control	AF	P value
Does or litters (n)		19	19	
Litter weight, g+	1++	518±13	532±13	0.452
	7	1259±32	1203±32	0.224
	14	2262±60	2146±60	0.183
	17	2705±68	2557±68	0.131
	21	3016±69	2860±71	0.123
	28	5035±112	4842±118	0.245
	35	7168±149	6837±155	0.135
Litter size	7	7.95±0.08	7.74±0.08	0.079
	14	7.95±0.10	7.68±0.10	0.075
	17	7.95±0.10	7.68±0.10	0.075
	21	7.95±0.10	7.67±0.10	0.064
	28	7.89±0.12	7.65±0.12	0.173
	35	7.89±0.12	7.65±0.12	0.173
Kit weight, g	1	65±2	66±2	0.452
	7	158±4	156±4	0.690
	14	285±8	281±8	0.723
	17	341±9	334±9	0.640
	21	380±9	372±10	0.570
	28	639±14	635±15	0.876
	35	909±22	900±23	0.761
Weight gain, g/day	1-7	13.4±0.5	12.8±0.5	0.444
	8-14	18.0±0.7	17.8±0.7	0.815
	15-21	13.6±0.3	13.5±0.4	0.894
	22-28	37.0±1.1	37.6±1.2	0.695
	29-35	38.7±1.8	37.7±1.9	0.731
	1-17	16.2±0.5	15.8±0.5	0.533
	1-35	24.1±0.6	23.8±0.6	0.730

+: after suckling
++: after adjusting to 8

The explanation for present results is that here the dose of anise (0.6%) was half of that level (1.2%) used in RASHWAN'S trial. Another reasons can be the dose-dependent effect, the bitter taste of fenugreek and higher productivity of our does. These hypotheses are confirmed by our results, e.g. the reduced feed intake of AF does causing loss of their initial advantage in body weight, the fail of better milk yield and the relatively poorer gain and higher mortality of AF kits in response to the treatment.

CONCLUSIONS

Anise and fenugreek seeds supplementation (level of 6 g/kg diet each) is not able to improve the milk production and nursing performance in high productive does. Further

studies are needed to investigate the palatability and optimal level of these spices in the feed of rabbits.

REFERENCES

ALBERT-BUELO M., 1980. Fennel and Anise estrogenic agents. *Ethnopharmacology*, **2**, 337-344.

AHMADIANI A., JAVAN M., SEMNANIAN S., BARAT E., KAMALINEJAD M., 2001. Anti-inflammatory and antipyretic effects of *Trigonella foenum-graecum* leaves extract in the rat. *Ethnopharmacology*, **75**, 283-286.

CHOUDHARY D., CHANDRA D., CHOUDHARY S., KALE R. K., 2001. Modulation of glyoxalase, glutathione S-transferase and antioxidant enzymes in the liver, spleen and erythrocytes of mice by dietary administration of fenugreek seeds. *Food and Toxicology*, **39**, 989-997.

MCCARTHY T. L., KERRY J. P., KERRY J. F., LYNCH P. B., BUCKLEY D. J., 2001. Evaluation of the antioxidant potential of natural food/plant extracts as compared with synthetic antioxidants and vitamin E in raw and cooked pork patties. *Meat Sci.*, **57**, 45-52.

PETIT P. R., SAUVAIRE Y. D., HILLAIRE-BUYS D. M., LECONTE O. M., BASSIAC Y. G., PONSIN G. R., RIBES G. R., 1995. Steroid saponins from fenugreek seeds: Extraction, purification and pharmacological investigation on feeding behavior and plasma cholesterol. *Steroids*, **60**, 674-680.

PLATEL K., SRINIVASAN K., 2001. Studies on the influence of dietary spices on food transit time in experimental rats. *Nutrition Research*, **21**, 1309-1314.

RAO P. U., SESIKERAN B., SRINIVASA P., NADAMUNI A., VIKAS V., RAMASCHANDRAN E. P., 1996. Short term nutritional and safety evaluation of fenugreek. *Nutrition Research*, **16**, No. 9. 1495-1505.

RASHWAN A. A., 1998. Effects of dietary additions of anise, fenugreek and caraway on reproductive and productive performance of new zealand white rabbit does. *Egyptian Rabbit Sci.*, **8** (2), 157-167.

SAĞDIÇ O., ÖZCAN M., 2003. Antibacterial activity of Turkish spice hydrosols. *Food Control*, **14**, 141-143.

SOLIMAN K. M., BADEAA R. I., 2002. Effect of oil extracted from some medicinal plants on different mycotoxigenic fungi. *Food and Chemical Toxicology*, **40**, 1669-1675.

STATGRAPHICS ® 1992. Reference Manual, Version 6.0, Manugistics Inc., Rockville, MD, USA

SUJA PANDIAN R., ANURADHA C. V., VISWANATHAN P., 2002. Gastroprotective effect of fenugreek seeds (*Trigonella foenum graecum*) on experimental gastric ulcer in rats. *Ethnopharmacology*, **81**, 393-397.