

The effect of a diet containing fennel (*Foeniculum vulgare* Mill.) and goat's-rue (*Galega officinalis* L.) on litter size and milk yield in rabbits

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The aim of the experiment was to investigate the effect of the addition of fennel (*Foeniculum vulgare* Mill.) extract and goat's rue extract (*Galega officinalis* L.) to rabbit feed on their breeding and milk performance. The research material was female Blanc de Termonde White rabbits (n = 15) and their offspring. The research was conducted on three consecutive litters of the does. The does were divided into three feeding groups, with 5 rabbits in each group. The rabbits in each feeding group were fed *ad libitum* with commercial pelleted complete feed. The control feed for the does contained wheat bran, dried alfalfa, extracted soybean seeds, barley, sugar beet pulp, sunflower extraction meal and a vitamin and mineral supplement. The rabbits in the first experimental group received feed containing 2% fennel extract, while the feed for the second group was enriched with a 2% addition of goat's rue. The rabbits were mated 10 to 14 days after kindling. To examine the effect of the herbal feed supplements on the reproductive and milk performance of the rabbits, the following information was collected: number of rabbits born per litter, litter weight at 24 hours after birth and on the 21st day of life, and milk yield. Statistical analysis was performed using the SAS statistical package. The analysis showed that the addition of fennel extract and goat's rue extract significantly affects litter size and milk yield.

KEY WORDS: rabbit, fennel, goat's rue, litter size, milk yield

Lactation is a sensitive period for female animals due to increased physiological demands and exhaustion. It also affects their subsequent use and the development of the young. There are a number of known factors that can have a positive effect on milk performance. Diets for this group should include herbal supplements that increase milk yield and improve the chemical composition and physicochemical parameters of milk, its nutritional

value, and its suitability for processing [6, 14, 15]. Kraszewski et al. [5, 7] have shown that feeding cows herbal mixtures can increase their milk yield and improve the chemical composition of the milk, its nutritional value, and its suitability for processing. Research conducted by Paschma [11] has shown that in sows given a herbal mixture containing nettle, chamomile, caraway and fennel from the 100th day of pregnancy to the 25th day of lactation parturition was much faster, while their litters were larger at birth and at weaning.

Herbs that improve milk yield include nettle (*Urtica dioica* L.), caraway (*Carum carvi* L.), corn spurry (*Spergula arvensis* L.), meadow salsify (*Tragopogon pratensis* L.), bristly hawkbit (*Leontodon hispidus* L.), fenugreek (*Trigonella foenum-graecum* L.) and goat's-rue (*Galega officinalis* L.).

An experiment was conducted to investigate the effect of feeding rabbit does extracts from fennel (*Foeniculum vulgare* Mill.) and goat's-rue (*Galega officinalis* L.) on their reproductive performance and milk yield.

Material and methods

The experiment was carried out at the Experimental Station of the Department of Animal Genetics, Breeding and Ethology at the University of Agriculture in Krakow. The research material was female Blanc de Termonde White rabbits (n = 15) and their offspring (n = 15). The research was conducted on three consecutive litters of the does. The rabbits were mated 10 to 14 days after kindling so that two periods overlapped: lactation and subsequent pregnancy.

The does were housed in a building equipped with a water supply (nipple drinkers), lighting (14L:10D) and forced ventilation, individually in metal cages (60 cm x 40 cm floor and a height of 41 cm). The cages contained nesting boxes with 23 cm x 40 cm floors and a height of 36 cm. The does were divided into three feeding groups, with 5 rabbits in each group. The rabbits in each feeding group were fed *ad libitum* with commercial pelleted complete feed containing min. 17.5% crude protein, max. 15% crude fibre, and 2-3% crude fat. The feed for does in the control group (K) contained wheat bran, dried alfalfa, extracted soybean seeds, barley, sugar beet pulp, sunflower extraction meal and a vitamin and mineral supplement. The rabbits in the first experimental group received feed containing 2% fennel extract, while the feed for the second group was enriched with a 2% addition of goat's rue. The plant materials used for the extracts were ground in an electric mill. Plant extracts were prepared as described by Kryża and Stodolnik [8].

To examine the effect of the herbal supplements in the feed ration on the reproductive and dairy performance of the does, the following information was collected: number of rabbits born per litter, litter weight at 24 hours after birth and on the 21st day of life, and

milk yield. Milk yield was calculated according to the formula proposed by Niedźwiadek [10]:

$$M = (C_2 - C_1) : (21 \times C_2) \times 100$$

where:

M – milk yield coefficient

C_1 – litter weight (g) 24 hours after birth

C_2 – litter weight (g) on the 21st day after birth

Statistical analysis was performed using the MIXED procedure in the SAS statistical package [12], taking into account the fixed effect in the model. The significance of differences between means was tested by the Tukey-Kramer test, at the significance level of $P \leq 0.05$.

Results and discussion

Table 1 presents data on the effect of the does' diet on litter size. The analysis shows that the size of the first litter was similar in all groups. Does whose feed contained goat's-rue (group II) had the largest second litters (10.0), while the largest third litters were obtained from does from the control group (10.0). The average size of the third litter was similar in groups I and II (6.67 and 6.50, respectively).

Table 1
The effect of diet on females litter size

Litter number	Group					
	K		I		II	
	\bar{x}	SD	\bar{x}	SD	\bar{x}	SD
1.	8.33 ^a	2.72	7.25 ^a	2.55	8.50 ^a	2.12
2.	7.67 ^a	1.29	6.50 ^a	2.95	10.00 ^b	2.18
3.	10.00 ^a	1.69	6.67 ^b	0.98	6.50 ^b	0.53

K – control group, I – diet with fennel, II – diet with goat's-rue
a, b – means in rows with different letters are significantly different at $P \leq 0.05$

Table 2 presents the effect of diet on the milk yield of the does. There were no significant differences between groups in milk yield in the first lactation. The highest milk yield in the second lactation was obtained from does from group I fed with fennel (4.01). The milk yield coefficients in the second lactation were similar in the does of the control group and group II. In the third lactation, the control group of does had the lowest milk yield

(3.81). In group I and II the milk yield in the third lactation was similar (4.07 and 4.03, respectively).

Numerous literature reports indicate that feeding herbal mixtures to females of various livestock species can increase their milk yield and improve the chemical composition and physicochemical parameters of their milk [5, 7, 11]. Researchers studying rabbit breeding have also made numerous attempts to determine the effect of individual herbal additives in rabbit feed on litter size and milk yield. Eiben et al. [1] found no significant effect of the addition of anise (*Pimpinella anisum*) and fenugreek (*Trigonellae foenum-graecum*) to feed (6 g/kg of feed) on the litter size of New Zealand White does or on the milk intake, daily weight gain or growth rate of their offspring. In this manner the scientists confirmed findings by Rashwan [12], who also found no effect of these herbs on the milk yield of rabbits.

Table 2
Effect of diet on milk yield of rabbits

Lactation number	Group					
	K		I		II	
	\bar{x}	SD	\bar{x}	SD	\bar{x}	SD
1.	3.74 ^a	0.32	3.86 ^a	0.23	3.74 ^a	0.13
2.	3.78 ^a	0.09	4.01 ^b	0.15	3.71 ^a	0.27
3.	3.81 ^a	0.35	4.07 ^b	0.02	4.03 ^b	0.06

K – control group, I – diet with fennel, II – diet with goat's-rue
a, b – means in rows with different letters are significantly different at $P \leq 0.05$

Our research confirms that the addition of fennel significantly affects the milk yield of rabbits. Similar conclusions have been reported by El-Hammady and Abdel-Kareem [2], who enriched the feed of rabbit does producing small litters with a mixture of fennel, dill, fenugreek and caraway, and thereby improved litter size at birth and at weaning, as well as milk yield in the 2nd, 3rd and 4th week of lactation.

Our study showed a beneficial effect of the addition of goat's-rue to feed on the size of the second litter of rabbits and on milk yield in the third lactation. Our findings are supported by an experiment carried out by Hamed [4], in which supplementation of the diet of rabbit does of the synthetic V line with aqueous goat's-rue extract (150 and 300 mg/kg body weight) and shatavari (100 and 200 mg/kg body weight) increased secretion of ovarian hormones and increased litter size at birth and on days 21 and 28. Extracts from these herbs also improved milk yield on days 7, 14 and 21 of lactation. At the same time,

does that received lower concentrations of goat's-rue and shatavari (150 and 100 mg/kg body weight, respectively) were found to achieve better results for these parameters. The lactogenic effect of goat's rue has also been observed in studies on cows, sheep and rats. Latvietis et al. [9] have demonstrated that the addition of this herb to the daily diet of cows improves their milk yield. Gonzalez-Andres et al. [3] observed lactogenic properties of goat's-rue in ewes that received 2 g of the herb per kg of body weight every day. The milk yield of ewes from the experimental group increased by as much as 16.9% [3].

To sum up, the addition of extracts of fennel (*Foeniculum vulgare* Mill.) and goat's-rue (*Galega officinalis* L.) to the feed of rabbit does has a positive effect on their litter size and milk yield.

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