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Effect of a diet supplemented with nettle (*Urtica dioica* L.) or fenugreek (*Trigonella foenum-graecum* L.) on the litter size and milk yield of rabbits

Sylwia Pałka#, Michał Kmiecik, Łukasz Migdał

Department of Genetics, Animal Breeding and Ethology, University of Agriculture in Krakow, Al. Mickiewicza 24/28, 30-059 Krakow, Poland

ABSTRACT

The purpose of the experiment was to investigate the effect of the addition of nettle (*Urtica dioica* L.) leaves or fenugreek (*Trigonella foenum-graecum* L.) seeds to rabbit feed on their breeding and lactation performance. The research material was female Blanc de Termonde rabbits (n = 22) and their offspring – four consecutive litters. The does were divided into three feeding groups, and each group was fed *ad libitum* a commercial pelleted complete feed with min. 17,5% crude protein, max. 15% crude fibre, and 2-3% crude fat. The diet for does in the control group (n = 6) contained wheat bran, dried alfalfa, extracted soybeans, barley, beet pulp, sunflower meal, and a vitamin and mineral supplement. The does in experimental group I (n = 8) were fed a diet enriched with 2% dried nettle leaves, while the diet for experimental group II (n = 8) contained fenugreek seeds (2%). The rabbits were mated between 10 and 14 days after kindling. To examine the effect of the herbal supplements on the does' reproductive and lactation performance, the following information was collected: number of rabbits born per litter, litter weight at 24 h after birth and at 21 days of age, and milk yield. Statistical analysis was performed using the SAS statistical package. The results show positive effects of the use of nettle leaves and fenugreek seeds in the diet of female rabbits, but this should be confirmed in further research.

KEY WORDS: rabbit, nettle, fenugreek, litter size, milk yield

INTRODUCTION

The high fertility and short pregnancy (31-33 days) of rabbits allows for a rapid increase in the number of individuals in the herd. By exploiting postpartum oestrus occurring 2-3 days after parturition, the breeder can obtain up to 70 young rabbits per doe per year. However, achieving such results entails a high rotation of females in the herd (130-150% per annum), and the diet must be of very good quality and balanced so as to fully cover the doe's needs for the overlapping periods of pregnancy and lactation (Kowalska, 2006).

#Corresponding author e-mail: sylwia.palka@urk.edu.pl
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Lactation is a sensitive period for rabbit does, affecting their subsequent use and the proper development of the young. For this reason, some researchers have given mineral supplements to does (Kowalska et al., 2009) or experimented with the amount of fibre in their diet (Fraga et al., 1989). Bingal and Farnsworth (1991) recommend that the diet of females of various species should include herbal supplements that increase milk yield and improve the chemical composition, physicochemical parameters, and nutritional value of milk, as well as its suitability for processing. The literature on rabbit nutrition contains relatively few studies on improving milk yield by adding herbs to the feed. These have included studies on the effect of goat's rue, fennel, star anise, purple coneflower, turmeric and cinnamon (Eiben et al., 2004; El-Kholy et al., 2012; Földešiová et al., 2015; Pałka et al., 2019).

The literature on herbal supplements for rabbit feed offers little information on the use of nettle and fenugreek. Both of these herbs are valuable sources of vitamins (e.g. A, C, and E) and minerals (e.g. calcium, magnesium, and iron). They regulate the digestive system, stimulate the appetite, have a positive effect on the functioning of the immune system, and exhibit antibacterial activity (Al-Asadi, 2014; Upton, 2013).

The purpose of the experiment was to investigate the effect of feeding rabbit does nettle (*Urtica dioica* L.) leaves or fenugreek (*Trigonella foenum-graecum* L.) seeds to increase their litter size and milk yield.

MATERIAL AND METHODS

The research material was female Blanc de Termonde rabbits (n = 22) and their offspring, i.e. four consecutive litters. All does included in the experiment were five months old and were sisters or half-sisters. Data were collected from the first four litters of each doe. Does were mated between 10 and 14 days after kindling, so that the periods of lactation and subsequent pregnancy overlapped. The does were kept individually in metal cages in a building equipped with a water supply (nipple drinkers), lighting (14L:10D), and forced ventilation. The cage floor was 60 cm x 40 cm and the height was 41 cm. The cages contained nesting boxes with a 23 cm x 40 cm floor and a height of 36 cm. The does were divided into three feeding groups, each of which received *ad libitum* a commercial pelleted complete feed with min. 17,5% crude protein, max. 15% crude fibre, and 2-3% crude fat. The diet for does in the control group (n = 6) contained wheat bran, dried alfalfa, extracted soybeans, barley, beet pulp, sunflower meal, and a vitamin and mineral supplement. Females in experimental group I (n = 8) were fed a diet enriched with 2% dried nettle leaves, while the feed for experimental group II (n = 8) contained fenugreek seeds (2%). Feeding with the experimental diet was begun one week before the first planned mating.

To examine the effect of the herbal supplements in the feed ration on the reproductive and lactation performance of does, the following information was collected: number of rabbits born per litter, litter weight at 24 h after birth and at 21 days of age, and the milk yield coefficient calculated according to the formula proposed by Niedźwiadek (1982):

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

where:

M - milk yield coefficient,
C_1 - litter weight (g) 24 h after birth,
C_2 - litter weight (g) on the 21st day after birth.

A statistical analysis was performed using the SAS statistical package (SAS, 2014), 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 $P \leq 0,05$.

Table 1

Average rabbit weight (g) at 24 h after birth

Experimental group	Litter number			
	1	2	3	4
C	60,44	70,89	60,50	70,22
I	60,21	70,74	69,06	67,12
II	59,42	61,78	58,93	62,18

C – control group, I – diet with nettle, II – diet with fenugreek

Table 2

The effect of diet on litter size and number of rabbits dead by 21 days of age (%)

Litter number	Experimental diet					
	C		I		II	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
	Litter size					
1	8,83[a]	2,32	4,75[b]	1,71	8,22[a]	1,92
2	8,40[a]	3,65	7,13[b]	3,36	7,50[b]	2,12
3	9,83[a]	1,72	8,13[b]	2,13	9,86[a]	2,03
4	9,20[a]	1,79	9,57[ab]	1,72	9,88[b]	2,03
	Number of rabbits dead by 21 days of age (%)					
1	0		0		0	
2	0		0		0	
3	0		0		2,53	
4	0		2,94		2,63	

C – control group, I – diet with nettle, II – diet with fenugreek
a, b - means in rows with different letters are significantly different ($P \leq 0,05$)

RESULTS AND DISCUSSION

The herbal additives had no clear positive influence on litter size. The analysis showed that the size of the first littler was smallest (4,74) in does whose feed contained nettle (group I). The size of the first litter was similar in does from the control group and those fed fenugreek (group II) (8,83 and 8,22, respectively). The does from the control group had the largest second litter size (8,40). In does from groups I and II, the average litter size was similar (7,13 and 7,50, respectively). The size of the third litter was similar for the control and group II (9,83 and 9,86, respectively). A significantly smaller third litter size was noted for females from group I (8,13). The size of the fourth litter was largest in the does fed fenugreek (9,88), and smallest (9,20) among females from the control group (Table 2).

The herbal additives had no clear effect on the does' milk yield. There were no significant differences between groups in the milk yield coefficient in the first lactation. The milk yield coefficient was highest for group II, which received a diet containing fenugreek seeds (4,30), and lowest in the control group. There were no significant differences in the milk yield coefficient for the third and fourth lactation between groups (Table 3).

Table 3

The effect of diet on the milk yield of rabbits

Lactation number	Experimental diet					
	C		I		II	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
1	3,76	0,20	3,99	0,24	4,06	0,25
2	3,52[a]	0,13	3,97[b]	0,12	4,30[c]	0,03
3	4,18	0,13	3,95	0,23	4,01	0,14
4	4,09	0,09	3,90	0,12	4,04	0,14

C – control group, I – diet with nettle, II – diet with fenugreek
a, b - means in rows with different letters are significantly different ($P \leq 0,05$)

The results of our research, which are not entirely positive, are consistent with those reported by other authors.

Numerous literature reports show that enrichment of the feed ration of females of various species of farm animals can increase their milk yield and improve the chemical composition and physicochemical properties of their milk (Al-Shaikh et al., 1999; Kraszewski et al., 2004; Kraszewski et al., 2008; Paschma, 2004). Numerous studies on breeding have attempted to determine the effect of various herbal supplements in the diet of rabbits, such as goat's rue, fennel, star anise, purple coneflower, turmeric and cinnamon, on the size of their litters and their milk yield (Eiben et al., 2004; El-Kholy et al., 2012; Földešiová et al., 2015; Pałka et al., 2019).

Positive effects of fenugreek (*Trigonella foenum-graecum*) and star anise (*Pimpinella anisum*) were not confirmed by Eiben et al. (2004). The authors found no significant effect of the addition of these herbs (6 g/kg of feed) on the litter size of New Zealand White does or on their milk yield coefficient. These supplements also had no effect on the uptake of milk by the young, their daily weight gains, or their growth rate (Eiben et al., 2004). Rashwan (1998) also showed no effect of these herbs on the milk yield of does from 1 to 14 days of lactation, but noted that during the third week of lactation it was higher in groups receiving anise and fenugreek compared to the control group. In addition, the author observed that the litters of females from the experimental groups were larger on the 21st day of rearing compared to the control group (Rashwan, 1998). El-Hammady and Abdel-Kareem (2015) observed that the addition of a mixture of fenugreek, fennel and caraway to the feed of rabbits resulted in an increase in litter size at birth and at weaning. It also significantly improved their milk yield in the 2nd, 3rd and 4th weeks of lactation (El-Hammady et al., 2015). The lactogenic effect of fenugreek has been confirmed in studies conducted in rats. The authors showed that adding an aqueous extract of fenugreek seeds increases milk production in females and accelerates the growth of young rats. Furthermore, the addition of fenugreek had a positive effect on feed uptake by females (Sevrin et al., 2019). Studies in goats showed that a 25% addition of fenugreek seeds to the

feed ration significantly improved milk yield and milk fat content. At the same time, the addition of 50% fenugreek seeds to the diet was found to reduce milk yield and milk fat content compared to the control group (Al.-Shaikh et al., 1999). Alamar and Basiouni (2005) showed that milk production in goats whose feed was enriched with fenugreek seeds increased by 13% compared to the control group (Alamar et al., 2005).

A study on Jersey cows showed that enriching their feed with nettle (*Urtica dioica*) had a positive effect on their production traits. The authors demonstrated that the addition of 20 g/day and 40 g/day of powdered young nettle leaves to the diet increased milk production by 8,08% and 10,19%, respectively, compared to the control group. It also had a positive effect on the fat content of milk and the overall condition of the cows (Khanal et al., 2005). Kraszewski et al. (2008) found that enriching the feed of dairy cows with a mixture of herbs consisting of nettle (*Urtica dioica*), chamomile (*Marticaria chamomilla*), yarrow (*Achillea millefolium*), agrimony (*Agrimonia eupatoria*), plantain (*Plantago lanceolata*), St John's-wort (*Hipericum perforatum*) and *Alchemilla pastoralis* increased milk production during lactation and improved the somatic cell count and microbial count in the milk (Kraszewski et al., 2008). Borys and Jarzynowska (2016) observed that a mixture of nine herbs (nettle, fenugreek, peppermint, fennel, cumin, coriander, marigold, chamomile, and milk thistle) had a positive effect on lactation persistence in sheep, increasing their daily milk production and thus market milk production. However, the use of herbs in winter feeding was much more beneficial than in summer. In the winter feeding period, the milk yield of ewes fed a diet containing 10 g of herbs was 12,2% higher, while the corresponding increase in the summer feeding period was only 4,1% (Borys et al., 2016).

The results show positive effects of the use of nettle (*Urtica dioica* L.) leaves and fenugreek (*Trigonella foenum-graecum* L.) seeds in the diet of rabbit does, but this requires confirmation in further research.

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