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The effect of an herb mixture supplement on the performance of milking sheep during the winter feeding period

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An experiment was conducted on 75 coloured Polish Merino ewes, milked from February to April. The ewes were housed indoors and fed on dried or ensiled bulky feed and a concentrate feed mixture. Three feeding groups were formed: group I—the control, with no herbs added to the concentrate feed, and groups II and III, in which an herb mixture was added (in place of wheat bran) to the concentrate feed in the amount of 10 or 20 g/sheep/day. The study analysed the effect of the herb supplement on the level of feed consumption, the body weight and body condition of the sheep, their milk performance, and the chemical composition of the milk. Better intake of bulky feed was noted in the experimental groups. The herb mixture was not found to influence the body weight and condition of the sheep or the basic chemical composition of the milk. The sheep that received the herb mixture exhibited better lactation persistency and higher daily milk yield, which led to greater milk production over the entire milking period, by 10.9% in group II and 20.4% in group III. These results, however, were not confirmed statistically due to high variation within groups.

KEY WORDS: sheep, herbs, milk performance, winter feeding

Herbs are defined as wild or cultivated plants with prophylactic or medicinal effects [5]. Due to the ban on the use of antibiotics in animal diets, many studies have been conducted on the use of natural substitutes, i.e. herbs [15]. Previous research, mainly involving dairy cattle, has indicated that herbs improve milk yield as well as the quality and composition of milk [1, 6, 9, 10, 11, 17]. A similar effect should be expected in the case of dairy sheep. Improving milk yield in sheep is essential, as their numbers have fallen dramatically in recently years because it has not been profitable to raise them. It should be emphasized that only a small portion of the sheep population in Poland is used for dairy purposes. Annual milk production, as reported by Danków and Pikul [2], is estimated at only 1,000 tonnes, and sheep are milked mainly in southern Poland. Growing consumer interest in healthy food, including sheep cheeses, in combination with the low supply of these products on the market, had led some farmers to begin to use sheep for dairy purposes in lowland areas as

well, where currently only 75 tonnes of milk are produced a year. Sheep in lowland areas are mainly housed indoors, and their bulky feed comes from monocultures that are poor in herbs.

In view of the above it was postulated that adding a suitably formulated herb mixture to the diet of milking sheep in indoor housing conditions, particularly during the period of feeding with dried or ensiled bulky feed, could make it possible to increase milk production and improve its composition.

Material and methods

The study was carried out at the National Research Institute of Animal Production, Koluda Wielka Experimental Station. The material for the study consisted of 75 coloured Polish Merino ewes aged 2 to 8 years, milked from February to April after weaning lambs at the age of 8-9 weeks. The ewes were housed indoors and fed a diet of dried or ensiled bulky feed (haylage, sugar beet pulp silage and hay) and a concentrate feed mixture. The feeding level was established according to INRA-88 norms for milking sheep with a body weight of 70 kg and daily milk production of 0.5 kg of milk. Sheep were assigned to three feeding groups, which were analogous in terms of date of lambing, body weight of ewes, lambs' daily weight gain, and number of lambs reared. Group I (the control) was fed bulky feed and a mixture of concentrated feeds with no added herbs. The experimental groups received the same diet as group I, but an herb mixture was added to the concentrate feed in place of wheat bran, in the amount of 10 g/sheep/day in group II and 20 g/sheep/day in group III. The herb mixture used in the study was composed of nine herbs (common nettle, fennel, caraway, coriander, fenugreek, peppermint, English marigold, chamomile and milk thistle). The mixture was intended to have a beneficial effect on the animals, mainly by improving their digestion and metabolism, by acting as galactogogues, and through bacteriostatic and anti-inflammatory activity.

The amount of feed supplied was recorded daily, and the amount of uneaten food twice a week. Every two weeks feed samples were collected for laboratory testing. The basic chemical composition of the samples was determined: dry matter (oven-dry method), crude ash (combustion method), crude fat (Soxhlet method), crude protein (Kjeldahl method), and crude fibre (Weende method). The chemical composition of the feeds was analysed at the laboratory of the National Research Institute of Animal Production, Koluda Wielka Experimental Station. The content of ethereal oils and flavonoids was determined in the herb mixture and the concentrate feed mixtures according to procedures used at the Institute of Natural Fibres and Medicinal Plants in Poznań.

At the start and the completion of the experiment the sheep were weighed and their body condition was evaluated (on a 5-point scale according to INRA [3]).

To evaluate milk performance, individual monitoring of the amount of milk produced was carried out by means of control milking performed twice in one day at two-week intervals (6 control milkings). The sheep were milked mechanically in the morning from 5^{00} to 7^{00} and in the evening from 17^{00} to 19^{00}. Sheep which produced less than 100 g of milk in the morning and evening milking combined were eliminated from milking and considered dry. For each group of ewes lactation persistence was calculated as the ratio of

the number of ewes that were milked for the entire period of the experiment to the number of ewes at the start of the experiment, expressed as a percentage. The data obtained during control milking were used to calculate milk yield for individual ewes by Fleischmann's method [8].

The chemical composition of the milk, i.e. dry matter, protein, fat and lactose, was determined. Three series of analyses were performed on milk samples from 20 ewes in each group, from morning control milking in the first, second and third month of the experiment. The analyses were performed in a MilcoScan apparatus in the laboratory of the District Dairy Cooperative in Inowrocław (180 samples).

The results were analysed statistically in the STATISTICA 6 PL software package, using one-way analysis of variance (ANOVA). Statistical differences between groups were verified by Duncan's test.

Results and discussion

Consumption of feed and nutrients by the ewes. Analysis of the content of bioactive substances in the concentrate feed mixtures supplemented with herbs (MD1 and MD2) revealed higher content of ethereal oils (by 13.6% and 45.4%, respectively) and higher content of flavonoids (by 30.0% and 105.0%, respectively) in comparison with the control (MK) – Table 1.

The higher content of bioactive substances, which were meant to improve the appetite of the sheep, probably led to better intake of haylage in the experimental groups than in the control, by 5.2 p.p., and better intake of hay, by 7.6 p.p. in group II, and 9.4 p.p. in group III (Tab. 2). In all groups 100% of the sugar beet pulp silage and concentrate feed was eaten. The 100% intake of concentrate feed suggests that the herbs used and the size of the supplement suited the taste preferences of the sheep, despite the high percentage (55%) of herbs containing substantial amounts of ethereal oils considered to be unacceptable to sheep. Simitzis et al. [16], who studied the behavioural responses of adult and young ewes to supplementation of concentrate feed with ethereal oils, found that the adult sheep were less tolerant of the oils (particularly peppermint and oregano) than the young sheep. The results of our study on adult ewes did not confirm these observations, as greater intake of

Table 1
Content of bioactive substances in the herb mixture and concentrate mixtures

Specification	Herb mixture	Concentrate mixture		
		MK	MD1	MD2
Ethereal oils (ml/kg)	10.06	0.22	0.25	0.32
Flavonoids (% of dry matter)	0.470	0.020	0.026	0.041

MK – control mixture without herbs
MD1 – experimental mixture with 10 g herbs/sheep/day
MD2 – experimental mixture with 20 g herbs/sheep/day

Table 2
Daily consumption of feeds and their nutritive value

Specification	Group I		Group II		Group III	
	kg	% of ration	kg	% of ration	kg	% of ration
Daily consumption of feeds (kg/head):						
concentrate feed	0.65	100.0	0.65	100.0	0.65	100.0
grass haylage	1.50	85.7	1.59	90.9	1.59	90.9
sugar beet pulp silage	1.70	100.0	1.70	100.0	1.70	100.0
grass hay	0.45	84.9	0.49	92.5	0.50	94.3
Nutritive value of consumed feeds*:						
JPM	1.44		1.48		1.48	
BTJN (g)	145		149		149	
BTJE (g)	147		152		152	
Daily consumption of components* (g):						
dry matter	1890		1960		1960	
protein	174		189		193	
fat	62		60		68	
fibre	463		482		486	

*Per day and per sheep
JPM – feed unit for lactation
BTJN – protein digested in the intestine when rumen fermentable nitrogen is limiting
BTJE – protein digested in the intestine when rumen fermentable energy is limiting

haylage and grass hay was noted in the experimental groups receiving concentrate feed supplemented with herbs than in the control.

The better feed intake in the experimental groups translated to slightly higher nutritional value of feed consumed (by about 3%) and generally higher daily consumption of nutrients (by 4-10%), with the exception of fat consumption in group II. No substantial or characteristic differences were noted in this respect between the experimental groups receiving different amounts of herbs in the concentrate mixture (Tab. 2).

Body weight and body condition of the ewes. The herb supplement was not found to significantly affect the body weight of the sheep (Tab. 3).

At the start of the experiment the ewes in all groups had a similar mean body weight (66.4-66.6 kg) and there was less variation in this trait within groups. The body weight of the sheep at the end of the experiment was similar in all groups and not markedly different from their initial weight, with little variation within groups. Moreover, no pronounced or statistically confirmed differences were noted in the body condition of the sheep at the start and end of the experiment. At both the start and end of the experiment the ewes in group II had somewhat higher mean body condition scores. In all groups, however, a slight (1.8%) decrease was noted in mean final body condition scores with respect to the initial scores, with high variation in the groups at the start of the experiment (V in a 30-39% range) and intermediate variation at the end (19-22%).

Milk performance results. No statistically significant differences were noted between feeding groups for any of the milk performance parameters analysed in the sheep,

Table 3
Body weight and condition of the ewes during the experiment

Specification		Group			SEM
		I	II	III	
Number of ewes	n	25	25	25	
Body weight (kg):					
start of experiment	$\overline{x}$	66.38	66.40	66.55	0.810
	V%	11.4	10.4	10.4	
end of experiment	$\overline{x}$	65.96	66.80	66.84	0.821
	V%	11.8	10.3	10.4	
Body condition (1-5 pts):					
start of experiment	$\overline{x}$	3.04	3.17	3.00	0.114
	V%	32.9	30.0	38.8	
end of experiment	$\overline{x}$	2.98	3.10	2.96	0.071
	V%	22.4	18.6	18.8	

while the results were generally better in both experimental groups than in the control (Tab. 4).

Sheep from the experimental groups attained better lactation persistency (by 5.8 p.p.) than the control. This was confirmed by the longer milking period for the sheep in groups II and III as compared to group I, by 4.7 days (5.8%) and 5.3 days (6.6%), respectively. A tendency was also observed for greater daily milk yield in group II (by 20 g, i.e. 4.8%) and group III (o 54 g, i.e. 13.0%) as compared to the control. Owing to higher lactation persistency and higher daily milk yield, more milk was obtained per ewe during the three--month milking period in the experimental groups, by 3.66 kg (10.9%) in group II and by 6.83 kg (20.4%) in group III, in comparison with group I (NS). The lack of significant differences in these traits between feeding groups may have been due to the high variation within groups. However, it should be noted that there was less variation in the experimental groups than in the control for all parameters analysed (V for milk production during the milking period was 37.0% in groups II and III and 52.2% in group I).

Analysis of the lactation curves of the ewes in the feeding groups indicates a marked beneficial effect of the herb supplement on maintenance of the level of milk production (Fig.). In the groups receiving the herb supplement the decline in the lactation curves was somewhat more gradual than in the control. The highest, statistically confirmed differences in daily milk production between groups were noted in the final milking period (on day 136 of lactation). During this period the sheep in groups II and III produced more milk than in group I, by 39.2% and 54.6% ($P \leq 0.05$).

The available literature contains no studies on the effect of the use of herbs on milk performance in sheep. Relatively few studies deal with aspects of milk performance in sheep in relation to various determinants. Comparison of the results of our own study with results obtained by Pakulski [13] regarding sheep of the same breed receiving a winter diet indicates that in our study milk yield was higher in all groups. In the study cited, despite

Table 4
Milk production characteristics

Specification		Group			SEM
		I	II	III	
Number of sheep	n	25	25	25	
Lactation persistency	%	89.5	95.3	95.3	
Milking period (days)	$\overline{x}$	80.5	85.2	85.8	1.751
	V%	21.4	16.8	16.0	
Daily milk yield (kg/ewe)	$\overline{x}$	0.416	0.436	0.470	0.018
	V%	42.4	33.0	34.3	
Milk production in milking period* (kg/ewe)	$\overline{x}$	33.50	37.16	40.33	1.816
	V%	52.2	37.0	37.0	

*Estimated on the basis of control milking according to the Fleischmann method

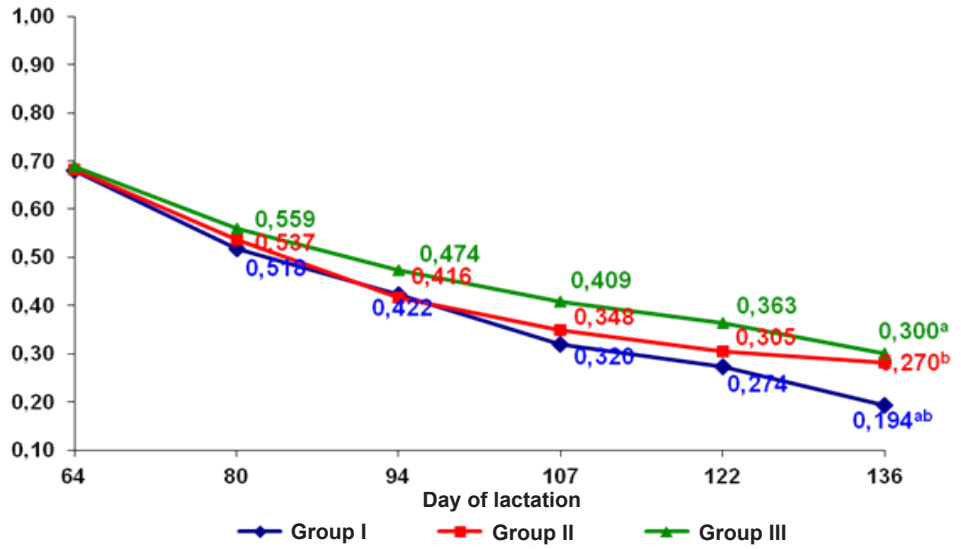

Fig. Mean daily milk production during milking period (kg/ewe)

the much higher feeding level (1.58-1.93 kg dry matter and 226-269 g protein) and the fact that the sheep were milked during a period of higher productivity (from days 50 to 108 of lactation), considerably lower milk yield was obtained (from 279 to 380 g/sheep/day). This indicates a relatively high level of milk productivity in the coloured Merino sheep in the present study.

Milk yield in the sheep receiving the herb supplement in our study was markedly higher than in Polish Mountain Sheep (28.0 kg) or its crosses with Olkuska sheep (32.2 kg), but lower than in Olkuska sheep (48.6 kg) in a study by Molik et al. [12]. In the study cited the sheep were kept on pastures from April to August (on average 134 days in milk), which ensured free access to herbs, a natural component of pasture vegetation. In a study conducted on local breeds of sheep kept on Balkan mountain pastures [4], markedly higher milk production was noted (for a four-month milking period): Karakachan – 57.1 l, Staroplaninska – 62.4 l, and Tetevenska – 71.4 l. Hutton et al. [7] showed a positive effect of the use of fresh herbs (chicory, English plantain and red and white clover) to feed ewes suckling lambs [7]. Sheep whose diet included these plants produced more milk on the 7th, 14th and 21st day of lactation (by 20.0%, 32.1% and 33.3%, respectively) in comparison with sheep that only grazed in a pasture dominated by perennial ryegrass, and their lambs attained a higher body weight at 22 and 66 days of age (by 11.5% and 17.8%).

Basic chemical composition of milk. The experimental variable was not shown to significantly affect the chemical composition of the milk of individual sheep (Tab. 5).

The mean content of components in individual milk samples and the content of components in the dry weight of the milk were similar in all feeding groups. Similar milk composition was reported by Pakulski [13], who used winter feeds in the diet of coloured Polish Merino milking ewes. The milk of Polish Merino sheep [14] receiving summer feed had lower content of dry matter (19.20%), protein (5.89%) and fat (7.66%), and higher content of lactose (5.13%) than in the present study. The lower concentration of components noted in the study cited above was probably due to the use of green forage rather than dried or ensiled bulky feed in the diet of the sheep.

Table 5
Basic chemical composition of milk and production of milk components

Specification		Group			SEM
		I	II	III	
Number of ewes	n	20	20	20	
Content in 100 g of milk (g):					
dry matter	$\overline{x}$	20.58	20,28	20,19	0.149
	V%	5.9	7.1	6.1	
protein	$\overline{x}$	7.01	6.78	6.89	0.061
	V%	8.4	7.3	7.1	
fat	$\overline{x}$	8.33	8.29	8.07	0.098
	V%	10.4	11.1	9.5	
lactose	$\overline{x}$	4.55	4.52	4.52	0.044
	V%	5.2	7.2	11.9	
Protein/fat ratio	$\overline{x}$	0.842	0.818	0.853	0.010
	V%	9.1	8.9	8.5	
Production of milk components* (kg/ewe):					
dry matter	$\overline{x}$	7.11	7.43	8.25	0.359
	V%	50.8	36.2	35.8	
protein	$\overline{x}$	2.41	2.47	2.79	0.120
	V%	50.2	36.1	35.6	
fat	$\overline{x}$	2.84	3.01	3.27	0.139
	V%	49.6	34.7	34.9	
lactose	$\overline{x}$	1.61	1.68	1.90	0.089
	V%	55.2	39.8	39.0	

*Estimated on the basis of control milking results and the chemical composition of milk

No statistically confirmed differences were found in the production of milk components by the ewes of each group. However, there was a clear tendency of higher production of components in group III in comparison with groups I and II: dry matter by16.0% and 11.0%; protein by 15.8% and 13.0%; fat by 15.1% and 8.6%; and lactose by 18.0% and 13.1%, respectively. These differences were not confirmed statistically, probably due to high variation within groups (V 35-55%). The coloured Polish Merino ewes in the present study produced markedly higher levels of milk components than in the study by Pakulski [13], mainly because milk production was greater in our study.

In conclusion, the results of the study indicate that the herb mixture used to supplement concentrate feed during winter feeding of Merino milking sheep did not affect the body weight or condition of the sheep and had a generally beneficial effect on their milk performance, while having no effect on the basic chemical composition of the milk or production of its components. The beneficial tendencies were more pronounced when the larger portion of the herbs was used, i.e. 20 g/sheep/day.

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