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EFFECT OF HERBAL EXTRACTS ON SOME HAEMATOLOGICAL PARAMETERS OF CALVES DURING REARING

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Abstract

Clinically healthy Polish Holstein-Friesian calves were divided into two groups: a control group (12 individuals) and an experimental group (12 individuals). The experimental group calves received a mixture of 20% water herbal extracts prepared from *Urtica dioica, Hb.*, *Hypericum perforatum, Hb.*, *Melissa officinalis, Fol.*, *Chamomillae recutita Anth.*, *Calendula officinalis, Flos,* and *Plantago lanceolata, Fol*. The mixture was given from the 2nd to 14th week of their life. Control calves received no addition of herbal extracts to their diet. Red blood cell count, white blood cell count, haemoglobin concentration, haematocrit value, and mean corpuscular volume were determined in the 4th, 9th, and 14th week of the experiment. The beneficial effect of the herbal mixture on the level of the examined haematological parameters was demonstrated in all tested weeks. In the calves from experimental group, a significantly higher red blood cell count, haemoglobin concentration, and corpuscular volume, and lower white blood cell count were found. There were no statistically significant differences in the haematocrit values between both groups.

Key words: calves, herbal extracts, haematological parameters.

Natural herbal supplements are used in animal feeding to increase production effectiveness, protect the environment, and meet consumers' expectations in providing them with safe food. The supplements are used as alternatives to antibiotics. Specific properties of herbs have been known for centuries. The present-day phytotherapy is based on an extensive knowledge of herb properties and the influence of herbal active substances on animals. Over the last years, a renewed interest of feed producers and farmers in herbs usage has been observed due to a variety of their possible applications and complex activity. Apart from production effects, herbs regulate metabolism and activity of digestive tract, display anti-stress properties, and enhance the quality of animal-derived products (2, 6-8, 11, 13, 15, 21, 25). The most difficult period in cattle rearing extends up to the end of the 3rd month of age (20). Newborn calves do not have adaptive immunity and in early life they are particularly prone to diseases (16). Studies conducted so far have shown that mineral-herbal mixtures (offered as dry feed) have a positive influence on animals (1, 5, 12, 14, 18, 23). There is a paucity of works pertaining to an application of herbal extracts in calf nutrition (3, 4, 20). There is no published information on the effect of herbal extracts on calf basic haematological parameters, although they, to a great extent, reflect the animal health condition. Therefore, the objective of the present work was to evaluate the effect of a herbal mixture applied as a 20% water extract on the level of selected haematological indicators in calf rearing.

Material and Methods

Twenty-four Polish Holstein-Friesian calves were divided into two groups: control and experimental. The calves in experimental group were fed a mixture of 20% aqueous herbal extracts prepared from *Urtica dioica, Hb.*, *Hypericum perforatum, Hb.*, *Melissa officinalis, Fol.*, *Chamomillae recutita Anth.*, *Calendula officinalis, Flos,* and *Plantago lanceolata, Fol*. The other feeds (colostrum, whole milk, concentrate, and meadow hay) were the same in both groups and were offered as indicated in animal feeding standards (19). Composition of concentrate, herb mixtures, and feeding scheme of calves were presented by Stenzel *et al*. (20). Daily colostrum or milk intake per one calf was 4.0-4.5 l (days 1-3), 6 l (days 4-7), 7 l (weeks 2-6), 6 l (week 7), and 3 l (week 8). Milk feeding was terminated from the 9th week of age. The concentrate and meadow hay were available *ad libitum* in 4th-7th week of life and then they were rationed. Table 1 shows the composition of used concentrate and herbal mixture.

The herbal extract was prepared daily; the proportion was 200 g of herbal mixture per 1 l of water. The herbs were infused with boiling water for 10 min. Then the extract was cooled to 40°C, strained, and the daily ration mixed with milk was given to the calves from experimental group at each feeding twice daily. Daily ration of the herbal extract (2x50 ml/calf) was offered from the 2nd week of age and then it was gradually increased to 450 ml (1x200 and 1x250 ml/animal) in the 9th-14th week. The control calves received no addition of the herbal extract to their diet. Feeding scheme is presented in Table 2.

The calves were fed individually. During the experiment, the animals were regularly attended by a veterinarian and animal care specialist. All calves were clinically healthy. Blood for analysis was sampled in the morning (prior to feeding) from the external jugular vein in the 4th, 9th, and 14th week of age. The samples were placed in test tubes with potassium salt of EDTA. Whole blood was used to determine the following parameters: red cell count, white blood count, haemoglobin concentration, haematocrit value, and mean corpuscular volume. The indicators were determined using the haematology analyser MS 4-5.

Arithmetic mean ($\bar{x}$) and coefficient of variation (V%) were given for each of the blood haematological indicators. Statistical calculations were made for the control and experimental groups depending on the date of blood sampling (age of calves).Significant differences for groups and blood sampling dates and interactive effects were checked with two-directional analysis of variance using to the following formula:

$$y_{ijl} = m + a_i + b_j + ab_{ij} + e_{ijl}$$

where:
y_{ijl} – value of the trait studied for the i-th group and j-th date and l-th animal;
m – mean for the population;
$a_{i,}$ b_j – main effects of the factors studied (groups: control and experimental; dates of blood sampling: 4th, 9th, and 14th week);
ab_{ij} – interactive effects;
e_{ijl} – random effect (of the error).

Significant sources of variation were compared between the means with Tukey's test and the least significant differences were determined at a significance level of 0.05. The methodology of statistical calculations was performed according to Trętowski and Wójcik (22).

Results

Table 3 demonstrates values of selected blood haematological parameters of calves in the control and experimental group. Statistically significant differences in the red blood cell count between the control group and the experimental group were found in the 9th and 14th week of calf life. A similar relationship was detected for haemoglobin concentration. A significantly higher mean haemoglobin concentration (for groups) was determined in the experimental group (7.05 mmol·l^{-1}). In the control group, the value was by 1.02 mmol·l^{-1} lower. Additionally, the concentration of haemoglobin in the experimental calves in the 9th and 14th week of life (7.44 and 7.62 mmol·l^{-1}, respectively) was significantly higher. The haematocrit value of experimental calves was higher compared with the controls although no significant differences were found. A similar association was found in blood samples collected in weeks 9 and 14. The mean (for groups) corpuscular volume in calves, which received the herbal extrac was significantly higher (by 1.6 μm^3) compared with the control group. Statistically significant differences in the values of this indicator were also confirmed between the control and experimental group in the 14th week of life. They amounted to 54.5 and 59.5 μm^3, respectively. The calves, which were offered the herbal extracts had significantly less white blood cells (7.70x10^9 l^{-1}) compared with the controls (8.17x10^9·l^{-1}) (means for groups). Moreover, in the successive blood sampling weeks (weeks 9 and 14), there was a significantly lower leukocyte count in the experimental group (7.59 and 8.10x10^9·l^{-1}, respectively) compared with the control group (8.28 and 8.90x10^9·l^{-1}, respectively).

Discussion

The results of this study showed that application of the 20% herbal mixture contributed to an increased level of selected haematological parameters. In successive weeks of calf rearing, the red blood cell count, haemoglobin content, haematocrit value, and mean corpuscular volume increased in both the control and experimental group, however, the observed increase was higher in the 9th and 14th week in calves fed the herbal extracts.

Table 1
Components of the concentrate mixture and herbal extract

Concentrate mixture		Herbal extract	
Components	%	Components	%
Ground barley	50.0	*Urtica dioica, Hb.*	25.0
Extracted soybean meal	22.0	*Hypericum perforatum, Hb.*	25.0
Ground wheat	16.5	*Melissa officinalis, Fol.*	20.0
Wheat bran	10.0	*Chamomillae recutita, Anth.*	10.0
Mineral mixture MMB	1.5	*Calendula officinalis, Flos.*	10.0
		Plantago lanceolata, Fol.	10.0

Table 2
Feeding scheme

Age of calves (weeks)	Daily ration				
	colostrum/milk (l)	herbal extracts (ml)		meadow hay (kg)	concentrate mixture (kg)
		morning	evening		
1	4.0 - 6.0	-	-	-	-
2	7.0	50	50	-	-
3	7.0	50	100	-	-
4	7.0	100	100	*ad libitum*	*ad libitum*
5-6	7.0	100	150	*ad libitum*	*ad libitum*
7	6.0	150	200	*ad libitum*	*ad libitum*
8	3.0	200	200	0.2	1.0
9	-	200	250	0.3	1.5
10	-	200	250	0.4	1.7
11-12	-	200	250	0.5	2.0
13-14	-	200	250	0.6	2.5

Table 3
Mean values of haematological parameters in calves

Parameter	Age of calves (weeks)	Group			
		control		experimental	
		$\bar{x}$	V%	$\bar{x}$	V%
Red blood cells ($10^{12}\cdot l^{-1}$)	4th	5.63a	13.4	5.97a	9.1
	9th	5.92a	17.8	6.74b	11.5
	14th	6.19a	16.0	6.85b	12.2
	Means for groups	5.91a		6.52b	
Haemoglobin ($mmol\cdot l^{-1}$)	4th	5.70a	20.5	6.10a	14.7
	9th	5.98a	23.0	7.44b	15.4
	14th	6.40a	23.6	7.62b	10.8
	Means for groups	6.03a		7.05b	
Haematocrit ($l\cdot l^{-1}$)	4th	0.30a	19.2	0.28a	8.7
	9th	0.37a	27.6	0.39a	16.1
	14th	0.38a	24.0	0.40a	17.5
	Means for groups	0.35a		0.36a	
Mean corpuscular volume (μm^3)	4th	43.1a	15.0	42.1a	9.7
	9th	52.9a	29.4	53.8a	20.3
	14th	54.5a	28.5	59.5b	22.4
	Means for groups	50.2a		51.8b	
White blood cells ($10^{9}\cdot l^{-1}$)	4th	7.34a	27.0	7.41a	14.5
	9th	8.28b	26.7	7.59a	14.2
	14th	8.90b	19.3	8.10a	11.8
	Means for groups	8.17b		7.70a	

$\bar{x}$ - arithmetic mean; V% - coefficient of variation; a, b - means in rows marked with different letters differ significantly ($P \leq 0.05$).

A reverse association was observed for the white blood count, which decreased in the experimental group. Nevertheless, the haematological parameters values obtained in the study fell within the range of normal values (24). Similar changes in the levels of the aforementioned haematological indicators were observed in calves, which received the herbal mixture in the amount of 3.5% as a concentrate supplement (17).

Studies by Wawrzyńczak *et al*. (23) revealed that calves supplemented with 0.5% to 1.0% of herbal mixture consumed more feed, better utilised nutrients (per unit gain), and showed higher body weight gains. Higher values of these parameters were found in calves, which received a concentrate supplemented with 1% of herbs. The best production results were obtained following an application of the following herbs: *Urtica dioica, Hb.*, *Melissa officinalis, Fol*., *Hypericum perforatum, Hb*. and *Chamomillae recutita Anth*. (23). Studies by Stenzel *et al*. (20) revealed that good production effects can be obtained during the period of growth and development of calves (from the 2nd week of life) as a result of application of a reduced amount of herbs but in the form of aqueous extracts. The first daily

ration should not exceed 100 ml/animal, and then it can be increased up to 450 ml in the 9th-14th week of their age. Addition of herbal supplements, as a source of natural immunostimulants (in the amount of 1%-2% to the 3rd month of life, and of 2%-4% from the 4th month of life) in calf feeding (from 8th day of life) contributed to increased levels of immune cells. This was also confirmed by Krukowski *et al*. (12). Beneficial changes in the levels of biochemical indicators in blood were observed in the calves receiving 3% of mineral-herbal mixtures from the 3rd month of life (18). Application of 20% herbal extract from the 2nd week of life had a positive influence on biochemical parameters and minerals in the blood serum of calves (3, 4). Grela *et al*. (8) examined the effect of herbs on the growth and blood components in piglets and found that it was possible to apply appropriately composed herbal mixtures instead of antibiotic growth stimulants without negative consequences. The possibility of application of natural supplements, including herbs, in livestock feeding and their positive influence on animal health status has been confirmed in the studies by other authors (2, 5, 7, 10, 15, 21).

The results reported in this study on the effect of herbal extract on haematological parameters indicate that it is possible to apply herbs in calf rearing. The results should be confirmed by further studies, with a particular consideration of the kind and number of herb components, their reciprocal proportions, dose and length of application, as well as physical form of herbs.

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