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Short communication

Factors affecting acetone concentration in blood of dairy cows at the first stage of lactation

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Abstract

The aim of this paper was to determine effects of selected genetic and environmental factors on the concentration of acetone in blood of cows in the first trimester of lactation. The study included 124 Polish Holstein-Friesian primiparous cows born, reared and managed on the same farm. The samples of blood were collected on day 2, 5, 30, 60 and 90 after calving.

The highest serum acetone concentration in the animals examined was observed on day 5 after calving. The level of this compound was inversely related to the contribution of the original Holstein-Friesian breed in gene pool. Significantly higher serum acetone level was observed in cows calved in January-March period when compared to other months of the year. Besides, the level of acetone determined on day 5 after calving was associated positively with body weight determined at the same day and negatively with body weight changes between days 5 and 60 after calving.

Key words: cows, blood acetone, genotype, environment

Introduction

Acetone is numbered among ketone bodies, which include also acetoacetic acid and beta-hydroxybutyric acid. Since acetone is transferred from blood to milk in a definitely easiest way, it is a very attractive diagnostic material used in lactating dairy cows. The aim of this study was to determine an effect of selected factors on the concentration of acetone in blood of primiparous cows during the first trimester of lactation.

Materials and Methods

The study was conducted on 124 Polish Holstein-Friesian primiparous cows born, reared and managed on the same farm. They were maintained in a litter tied system, and fed with rations calculated according to the current Polish recommendations. The blood samples were collected after morning milking, from *vena jugularis externa* on day 2, 5, 30 (±3), 60 (±3) and 90 (±3) after calving. On day 5 and 60 after calving, concurrently with blood samples collection,

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Table 1. Factors affecting serum acetone concentration in primiparous dairy cows.

Item		N	Days after calving				
			2	5	30	60	90
HF gene pool, %	<62.6	31	0.43^{A}	0.48	0.46^{A}	0.38^{A}	0.36
	62.6-87.5	63	0.34^{B}	0.46	0.41^{a}	0.38^{A}	0.37
	>87.5	30	0.30^{B}	0.44	0.32^{Bb}	0.28^{B}	0.29
Season at calving	I-III	19	0.37	0.69^{A}	0.62^{A}	0.42^{A}	0.34
	IV-VI	45	0.37	0.45^{Ba}	0.38^{B}	0.38^{a}	0.36
	VII-IX	32	9.33	0.38^{Bb}	0.32^{B}	0.32^{Bb}	0.35
	X-XII	28	0.34	0.42^{B}	0.39^{B}	0.31^{Bb}	0.33
Age at first calving, d	<720	31	0.38	0.45	0.43	0.36	0.36
	720-870	62	0.36	0.46	0.40	0.37	0.37
	>870	31	0.32	0.46	0.36	0.32	0.29
Body weight at 5 d after calving, kg	<486	31	0.40	0.43^{A}	0.45	0.40	0.37
	486-540	62	0.37	0.39^{A}	0.43	0.39	0.38
	>540	31	0.36	0.71^{B}	0.35	0.34	0.35
Body weight at 60 d after calving, kg	<456	30	0.40	0.43	0.47	0.38	0.37
	456-532	64	0.36	0.51	0.42	0.40	0.35
	>532	30	0.34	0.46	0.45	0.34	0.39
Body weight change between 5-60 d after calving, g/d	1 to 1161	31	0.36	0.38^{a}	0.43	0.37	0.39
	-999 to 0	64	0.37	0.46^{b}	0.42	0.38	0.38
	-2353 to -1000	29	0.33	0.49^{b}	0.38	0.33	0.31
Total/ average		124	0.36	0.46	0.40	0.35	0.35
Coefficient of variation, %			36.1	65.2	60.0	40.0	48.6

A,B,a,b – Least squares means with different superscripts differ significantly: capital letters – $P \leq 0.01$, small letters – $P \leq 0.05$.

the cows were weighed. The data were analyzed statistically with analysis of variance according to the model containing the compared groups of animals and random residual effect.

Results and Discussion

Table 1 demonstrates that the highest acetone level was noted on day 5 after calving. Similar effect of lactation stage on the level of this compound in blood was observed by van Knegsel et al. (2010). The concentration of acetone in blood decreased with an increase of gene pool of the original Holstein-Friesian breed. Skrzypek (2003) has also reported about the genetic background of the acetone level in the blood of cattle. The cows that calved in January-March period were characterised by the higher level of acetone in blood when compared to cows calved in other months, what is consistent with the results of Heuer et al. (2001). The age at first calving was not significantly associated with the level of acetone in cows, while Nyman et al. (2008) found a significant positive relationship. This inconsistency may be explained by different genotype and nutrition of the animals examined in the present paper. The level of acetone determined on day 5 after calving was associated positively with body weight determined at the same day ($P \leq 0.05$) and negatively with body weight changes between days 5 and 60 after calving ($P \leq 0.01$). Thus, the effects of body weight and its changes, and the age at first calving were independent, what suggests that the animals growing quickly in the pre-production period of life and at the same time usually maturing earlier, are more prone to the elevated level of acetone at the first stage of lactation when compared to the slower growing animals. In the study by Heuer et al. (2001) also a positive correlation was found between the body weight at the first stage of lactation and acetone concentration in an organism.

Concluding, the highest level of acetone in blood of Polish Holstein-Friesian primiparous cows was found on day 5 after calving. Besides the lactation stage, the level of blood acetone was associated with

the proportion of the gene pool of the original Holstein-Friesian breed, season at calving, body weight on day 5 after calving and body weight changes between days 5 and 60 after calving.

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