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REGULAR ARTICLE

RELATIONS BETWEEN SELECTED INDICATORS OF BLOOD AND MILK OF DAIRY COWS WITH METABOLIC DISORDERS

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ABSTRACT

The aim of this work was to monitor the relations between selected indicators of technological properties of milk and blood biochemical parameters of dairy cows with metabolic disorders. Thirty-two cows were chosen, which were divided into 3 groups: first group - cows with metabolic problems of acidosis, second group - cows with metabolic problems of alkalosis, third group - healthy cows. Blood, urine and milk samples were collected. Urea, total lipids, total proteins, glucose and calcium was determined in the blood serum. Pure acidobasic forms, pH and density of urine were determined. Proteins, lactose, non-fat-solids, somatic cells count, calcium, urea, titratable acidity, fermentability, rennetability and thermostability were determined in samples of milk. Significant negative dependences were observed in the group of cows with metabolic problems of acidosis between urea in blood and in milk ($r = -0.694$, $P < 0.05$), between calcium in blood and in milk ($r = -0.653$, $P < 0, 05$), and between calcium in milk and glucose in blood ($r = -0.648$, $P < 0.05$). In the group of cows with alkalosis, statistically significant correlation between total lipids in blood and fat in milk was found ($r = -0.879$, $P < 0.05$).

Keywords: dairy cattle, metabolic disorders, ketosis, acidosis, alkalosis.

INTRODUCTION

The quality of milk and its composition is influenced by several factors. One of the key factors is the nutrition of dairy cows. According to many authors **(Kirst and Jakobi, 2002; Kirchnerová *et al.,* 2002; Kováčik, 2006)** nutrition of dairy cows can affect the production and quality of milk. High-producing dairy cows, bred for high milk production are nutrition demanding and possible nutritional deficiencies are strongly reflected in a reduction of milk production, but also in a decrease of its technological properties (**Kirchnerová *et al.,* 2002; Hanuš *et al.,* 2002)**.

Economically most important diseases of high-producing dairy cattle include metabolic disorders - ketosis, acidosis, and others. E.g. metabolic alkalosis causes a reduction in cattle tissue oxygen consumption, energy deficit, acid-base and water-electrolyte balance disturbances **(Nicpoń and Hejłasz, 2005)**.

Metabolic disturbances wage initially in a hidden form and their formation is associated with problems of food and fermentation processes in the rumen **(Willige, 2002; Hanuš *et al.,* 2002; Demeterová and Vajda, 2000)**. Nutrient conversion and creating precursors of milk depends on rumen fermentation **(Vajda *et al.*, 2003 Hofírek et al. 2002)**.

The functional ability of the mammary gland is in direct correlation with health status of dairy cows and milk ingredients reflect the level of total metabolism **(Kirst and Jakobi, 2002)**. The values of various biochemical indicators in milk reflect the metabolic status of dairy cows **(Hamann and Krömker, 2005)**.

Metabolic disorders associated with damaged balance between nutrients and metabolites intake and output cause changes in the composition of milk, which consequently leads to decrease of its technological properties **(Buchberger *et al.,* 2002, Gajdůšek, 2000)**.

Kološta (2004) indicates decrease of total protein, casein and calcium if there is deficiency of energy in the diet. Decrease in titratable acidity was also recorded, lactose content was not influenced by the energy level of nutrition. Energy deficit, according to the author, was reflected in indicators of milk technological quality. Casein content and proportion of its fractions, balance of calcium-caseinate and calcium-phosphate complex, the size and degree of casein micelles hydration, composition of other minerals and even more factors affect not only the fermentability but also other technological features as rennetability and thermostability.

The aim of this work was to monitor the relations between selected indicators of technological properties of milk and blood biochemical parameters of dairy cows with metabolic disorders.

MATERIAL AND METHODS

Based on the results of metabolic tests, 32 Holstein cows were chosen, which were divided into 3 groups:

First group - cows with metabolic problems of acidosis,

Second group - cows with metabolic problems of alkalosis,

Third group - healthy cows.

Blood samples collection for biochemical analysis was performed 2 hours after the morning feeding by *vena jugularis* puncture. Blood was captured directly into centrifuge tubes and centrifuged. Urea, total lipids, total proteins, glucose and calcium was determined in the blood serum. Analyses were provided in biochemical and hematological laboratory at the Department of Animal Physiology of SUA through commercial sets DiaSys (Diagnostic Systems GmbH, Germany) on the device Microlab 300 (villa Scientific, Dieren, The Netherlands). Samples of milk were collected from each cow from the evening milking, where it was determined: proteins, lactose, non-fat-solids, somatic cells count, calcium, urea, titratable acidity, fermentability, rennetability and thermostability.

The results were evaluated by MS Excel and Statgraphic Plus 1.5

RESULTS AND DISCUSSION

The average values of indicators in blood profile of the internal milieu of monitored cows were in the physiological normal range, except a lower level of urea in dairy cows with metabolic problems of acidosis and elevated levels of glucose in the blood of dairy cows of all three groups.

By evaluation of the basic milk indicators between different groups of cows, no statistically significant differences were detected. In both groups of cows with metabolic disorders was a decrease of technological properties of milk pointing to its processing unsuitability. In the group of cows with metabolic disorders of alkalosis, did not show lower lactose content and non-fat-solids and increased urea concentration in milk. In both groups of

cows with metabolic disorders were found significantly impaired technological properties of milk as follows: fermentability in both groups, and rennetability in the second group.

Krömker and Hamann (2005) suggested that biochemical indicators in milk may reflect the metabolic status of dairy cows. Therefore, they observed relationships between selected biochemical indicators of internal milieu - the blood - and milk ingredients of dairy cows in their work. In contrast to the results reported by **Kološta (2004)**, most of the correlations were not statistically significant. Significant negative dependences were observed in the group of cows with metabolic problems of acidosis between urea in blood and in milk ($r = -0.694$, $P < 0.05$, Figure 1), between calcium in blood and in milk ($r = -0.653$, $P < 0, 05$ figure 2), and between calcium in milk and glucose in blood ($r = -0.648$, $P < 0.05$, Figure 3). In the group of cows with alkalosis, statistically significant correlation between total lipids in blood and fat in milk was found ($r = -0.879$, $P < 0.05$, Figure 4).

Negative relationship ($r = -0.318$, $P > 0.05$) was found between fermentability of milk and concentration of urea in blood, only in the group of healthy cows. In both groups of cows with metabolic disorders, this dependence was positive and cows with metabolic alkalosis and problems of statistically significant ($r = 0.747$, $P < 0.05$). A high positive correlation was also found between milk fermentability and blood glucose levels ($r = 0.909$, $P < 0.05$) in the group of healthy cows (Figure 5).

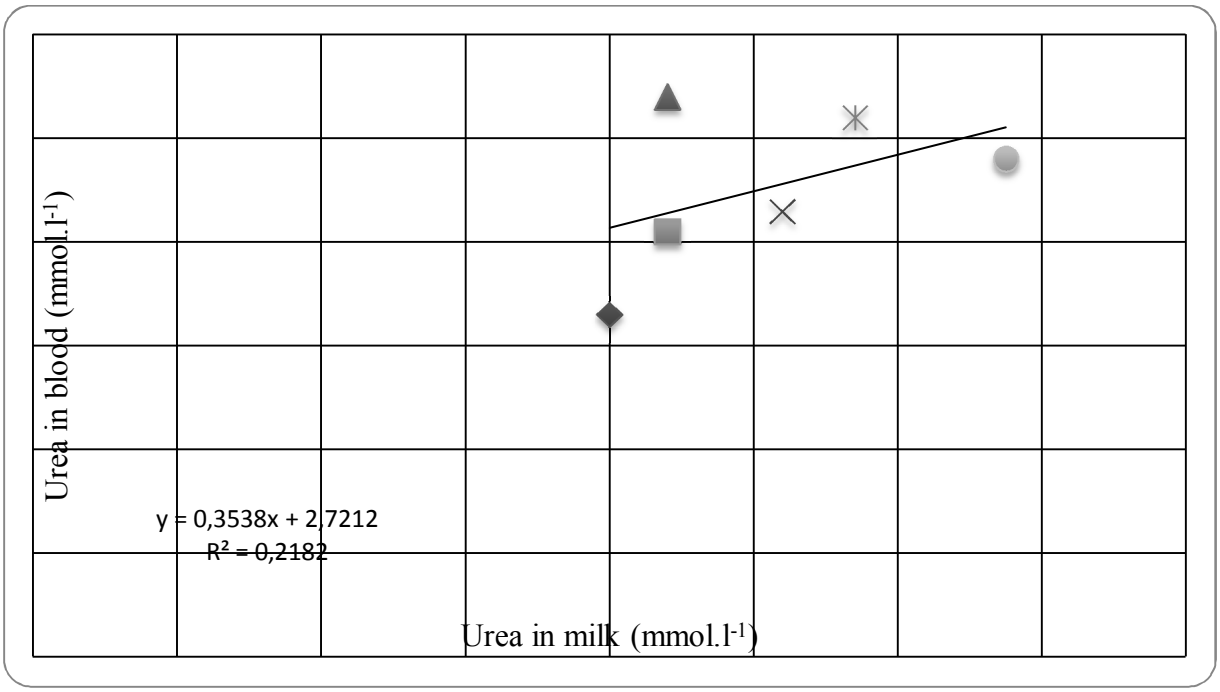

Figure 1 Relation between urea in blood and urea in milk of cows with acidosis

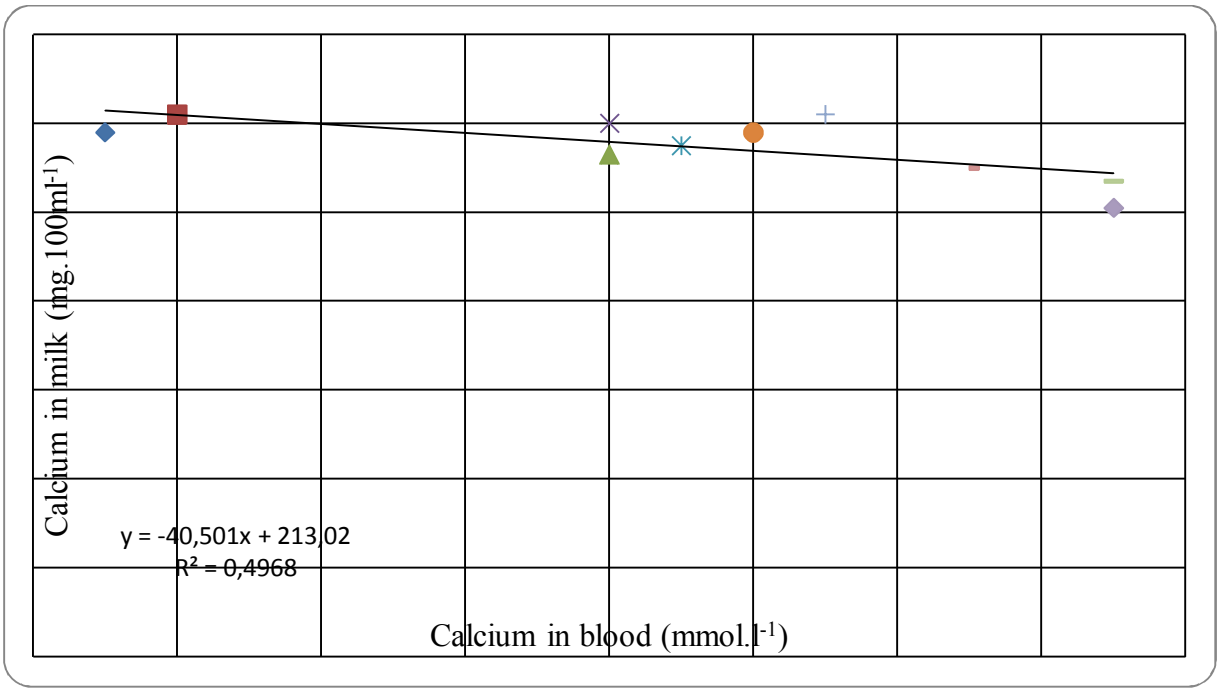

Figure 2 Relation between calcium in blood and calcium in milk of cows with acidosis

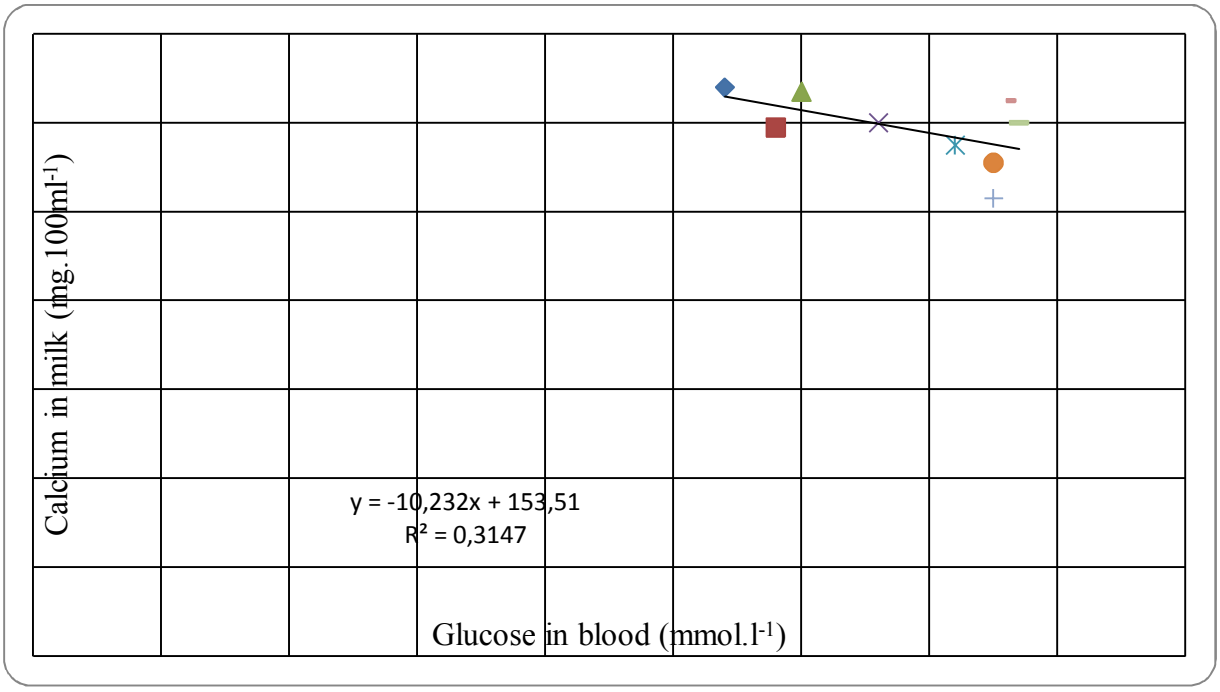

Figure 3 Relation between glucose in blood and calcium in milk

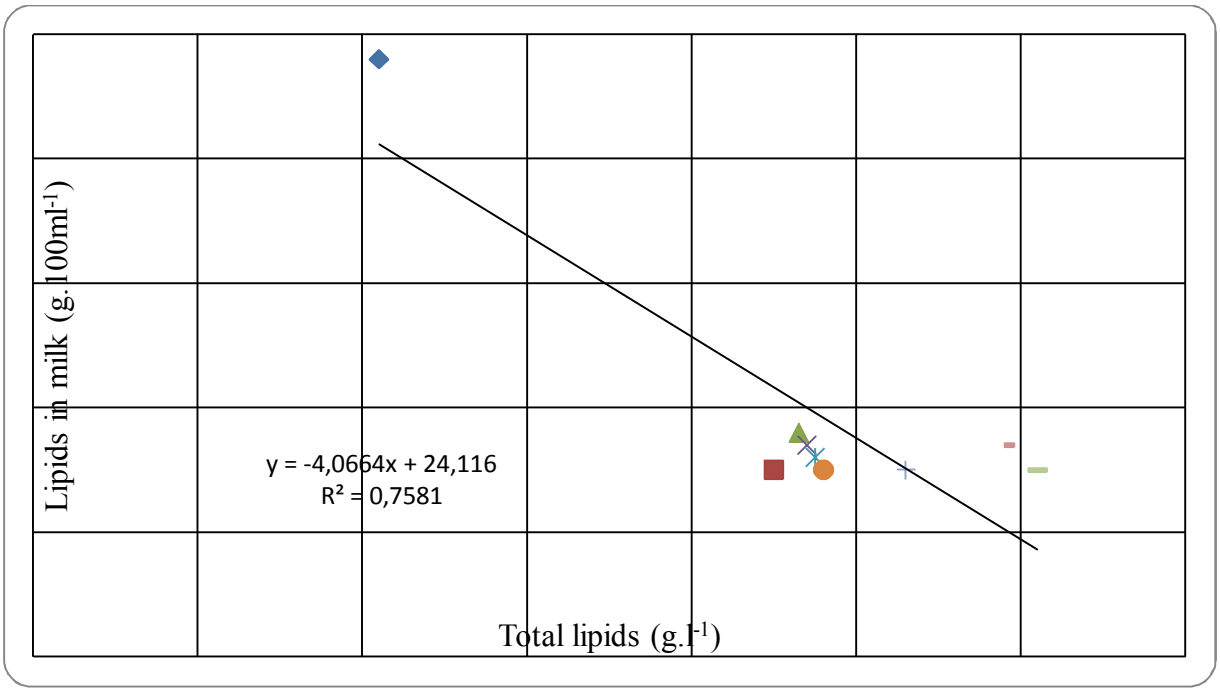

Figure 4 Relation between lipids in milk and total lipids in blood of cows with ketosis

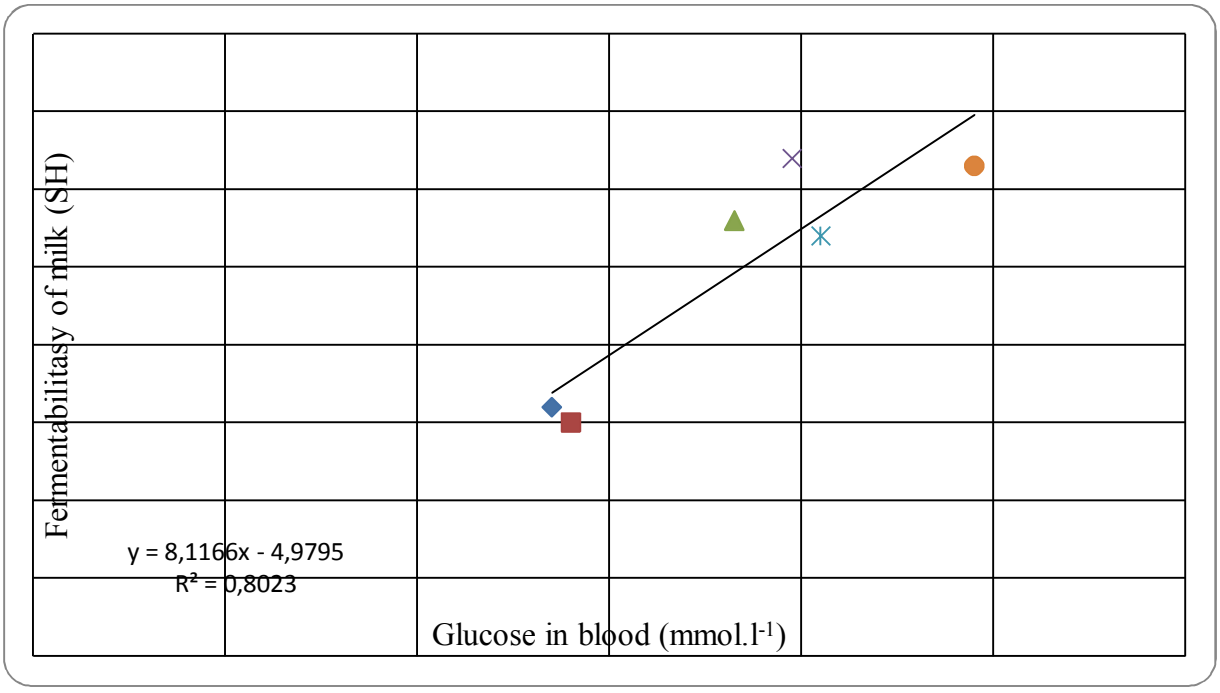

Figure 5 Relation between milk fermentability and glucose in blood

CONCLUSION

Our work has shown that changes in blood pH within the physiological range don´t affect technological quality of milk. Effect of acid-base situation of the organism on the acid-base balance of the milk manifests firstly after exhaustion of its buffering capacity. We also observed many significant dependences between urea or blood components and technological quality of milk.

Therefore, we can confirm, that nutrition of dairy cows can affect the quality of milk. But we also think, further research is needed.

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