Correlation of Different Biochemical Parameters in Blood Sera of Healthy and Sick Cows

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ABSTRACT

Metabolic diseases of cows represent the leading internal pathology in Lithuania in terms of incidence and economic impact. This paper summarizes the mineral metabolic state of milk cows, and details the influence of feeding on serum levels of calcium, nonorganic phosphorus, magnesium, potassium, sodium, glucose, total protein, and urea quantity, and correlation among them, in healthy dry or post-calving cows as well as in cows with osteomalacia and milk fever after calving. There was less pronounced hypocalcaemia and there were only minor changes in phosphorus, magnesium, potassium and sodium in the serum of healthy dry and post-calving cows that had silage and mineral-vitamin supplements, compared to cows that did not have supplements and silage. There was a fall in calcium and phosphorus (to 1.89 ± 0.12 mmol/L and 0.71 ± 0.06 mmol/L, respectively) in the blood of cows sick with milk fever after calving, while levels of magnesium and potassium were increased. The correlation between calcium and phosphorus was r = 0.6993, p < 0.001 in the serum of sick cows. There was a fall in calcium, phosphorus and magnesium (to 1.86 ± 0.46 mmol/L, 0.75 ± 0.37 mmol/L, and 0.60 ± 0.19 mmol/L, respectively) and an increase in sodium level (to 158.90 ± 19.30 mmol/L) in the blood of cows with osteomalacia in comparison with healthy cows.

Keywords: cows, macroelements, milk fever, osteomalacia

Abbreviations: NEL, net energy for lactation

INTRODUCTION

Calcium, phosphorus and magnesium ions play very important role in the metabolism of animal body tissues. Animals are often affected by disorders of mineral metabolism when the balance between intake and excretion of macronutrients is disturbed. The requirements for normal levels of mineral elements for agricultural animals differ in different countries. These requirements depend not only on the breed of animal, climatic conditions, stocking intensity and mode of digestion, but also on unknown factors that might ameliorate and/or inhibit incorporation of these elements (Correa et al., 1993; Ebbesvik, 1993). The incidence and economic impact of metabolic diseases are a leading factor in internal pathology of cows in Lithuania. Approximately 19 000 cattle per year are affected by metabolic diseases in Lithuania.
Some authors report that up to 20% of herds of cows were identified having hypocalcaemia and hypomagnesaemia, which may manifest before calving, during calving or up to 48 h after calving (Coe, 1993; Fenwick, 1994; Kocabagli et al., 1995; Riond et al., 1995). Japanese researchers (Yamagishi et al., 1995) have reported that among cows that did not recover after calving, hypocalcaemia was observed during the dry period in the majority cases. Other authors (Ellison, 1994) have linked this non-recovering syndrome with hypomagnesaemia, which may also cause milk fever after calving. On the other hand, some authors (Chandler, 1997; Goff and Horst, 1998) claim that rather than calcium, phosphorus or magnesium, it is potassium and sodium levels in the ration that play the key role in the aetiology of milk fever. According to their data, a higher level of sodium in feedstuff increases the risk of milk fever, whereas the level of potassium in feedstuff is inversely proportional to the calcium level in serum. It has been experimentally established (Marten, 1995) that the levels of minerals in feedstuffs influence the levels of calcium, phosphorus, magnesium, sodium and potassium in serum. High levels of potassium and sodium in feedstuffs causes metabolic alkalosis and affects calcium homeostasis in dry cows, whereas calcium from feedstuffs cannot prevent milk fever. There is an opinion (Ewy and Lutz, 1997; Goff and Horst, 1997) that milk fever mostly affects cows whose diet includes 3.1% potassium and 0.5% calcium. It is seen that opinions differ significantly regarding the influence of the serum levels of macronutrients on the incidence of metabolic diseases of mineral nature in cows.

The aim of this work was to evaluate the levels of calcium, phosphorus, magnesium, potassium, sodium, glucose, urea and general proteins, and correlation between these parameters, in the serum of healthy dry cows, cows after calving, and cows suffering from osteomalacia and milk fever, in relation to different types of feedstuffs received.

MATERIALS AND METHODS

Experiments were carried out during the housing period using 5 to 12-year-old cows (dry and after calving) of Lithuanian black-and-white breed from holdings (group A) and farms (group B) with different feeding regimens. Cows in group A received a ration containing herbage 85.5%, mangel 4.7%, and barley flour 9.9%. Cows in group B received a ration containing herbage 70.8%, mangel 14.2%, and barley flour 15.0%. Based on analogue's principle and according to calving details, type of feeding and state of health, six trial groups of cows were formed (Table 1). Diagnoses of milk fever and osteomalacia were made on the basis of results of clinical examination of animals and biochemical blood analysis.

Blood samples from the cows in experimental groups I and III were taken 15 days before expected calving; in groups II and IV a week after calving; and in groups V and VI before treatment. Samples were taken from the jugular vein and placed into containers (Terumo Europe N.V., Leuven, Belgium) without anticoagulant. Separated serum was centrifuged. Biochemical blood indices were analysed by semiautomatic biochemical analyser (Clin Check Plus Hospitex Diagnostics, Firenze, Italy) using Hospitex diagnostic reagents. Indices of blood serum analysed were the levels of calcium, phosphorus, magnesium, potassium, sodium, glucose, urea and total proteins.