

## Changes in Blood Values of Glucose, Insulin and Inorganic Phosphorus in Healthy and Ketotic Dairy Cows after Intravenous Infusion of Propionate Solution

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### Abstract

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The aim of the present study was to determine the degree of blood glucose utilization by peripheral tissue on the basis of changes in blood concentrations of glucose, insulin and inorganic phosphorus in healthy (n = 10) and ketotic cows (n = 10) after intravenous infusion of propionate solution.

Blood samples were taken in both groups of examined cows at the following time intervals: just before (time 0) and 8, 30, 60, 120, 180, 240 and 480 min after the intravenous infusion of 1.84 mol·l<sup>-1</sup> solution of propionate in the amount of 1 ml·kg<sup>-1</sup> of body weight. Glucose and insulin blood serum values in both groups of cows increased significantly within 120 min of the experiment ( $p < 0.05$ ). Significantly lower values ( $p < 0.05$ ) of glucose in blood of ketotic cows, compared to the blood value of glucose in healthy cows were established within 30, 60, 120 and 240 min of the experiment, as a consequence of the decreased gluconeogenic ability of the liver in the ketotic cows. Significantly lower values ( $p < 0.05$ ) of insulin in blood of ketotic cows in comparison with healthy ones were established within 240 and 480 min of the test. That indicates that the ability of beta cells of the endocrine pancreas to release insulin is reduced in cows suffering from ketosis. After intravenous administration of propionate, it was established that values of inorganic phosphorus were reduced in blood in both groups of cows after 8, 30, 60, 120, 240 and 480 min. Within 480 min of the test there was a significant decrease ( $p < 0.05$ ) in blood value of inorganic phosphorus in ketotic cows in comparison with healthy ones. This is linked with the active entry of glucose into glycolytic pathway of peripheral tissues. It can thus be concluded that there is a higher degree of blood glucose utilization by peripheral tissues in ketotic cows.

*Gluconeogenesis, ketosis, glucose utilization, peripheral tissue*

The optimal supply of liver and extrahepatic tissues with glucose has an important role in preserving the health of dairy cows in the early stage of lactation. Glucose concentration in blood of dairy cows in early lactation completely depends on the process of gluconeogenesis in the liver. If the degree of gluconeogenesis does not satisfy increased needs of glucose in dairy cows, the state of hypoglycaemia, ketonemia and ketonuria occurs (Young 1977).

The first metabolic change in primary ketosis in dairy cows in early lactation is hypoglycaemia. It causes serious metabolic changes in the cow's body, which are manifested through lipid mobilisation from body reserves and ketogenesis and lipogenesis in the liver (Bruss et al. 1986; Veenhuizen et al. 1991).

Propionate loading test in ruminants is used for estimating the intensity of gluconeogenesis in the liver, such as the ability of endocrine pancreas for synthesis and secretion of insulin (Gröhn 1985; Sano et al. 1993; Šamanc et al. 1996; Constable 2000). The ability of endocrine pancreas for insulin release after intravenous infusion of glucose is well known. The insulin concentration in blood is reduced in ketotic cows, compared to healthy animals

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