The key moment for the health and productivity of dairy cattle is the period from the 3rd week before to the 3rd week after calving called transition period. Despite research on appropriate strategies for monitoring the cattle's health and welfare during this time, the incidence of negative consequences of negative energy balance and hyperketonaemia remains high.

The aim of the study was to evaluate changes in blood morphology and biochemistry, and to determine the degree of hepatic fatty infiltration as well as changes in the level of hepatic expression of selected genes (SOD1, SOD2, SOD3, GPX3) in Holstein-Friesian cows with elevated serum β-hydroxybutyrate (BHB) levels.

The study was conducted at the Bałdy Teaching and Research Centre - a Holstein-Friesian cattle farm of the University of Warmia and Mazury in Olsztyn. Twenty three cows after the second lactation, characterized by high milk yield in previous lactations (average 9500 kg of milk) were qualified to participate in the experiment. The selected cows were divided into two groups: control - CONT (n=11) - healthy animals, which did not show increase in serum BHB concentration from one week prepartum to three weeks postpartum, and experimental - EXP (n=12) - animals with BHB concentration in the range of 0,9 to 1,4 mmol/l at least once in this period, and the average concentration of this compound in three weeks after calving at over 0,8 mmol/l.

The research material was collected from the 1st week prepartum to the 9th week postpartum: whole blood (weekly) and whole blood serum (weekly), ultrasonograms of the liver (4th week postpartum, 7th week postpartum) and backfat thickness (weekly), and liver biopsy specimen obtained by ultrasound-guided core needle biopsy (4th week postpartum, 7th week postpartum).

There were no statistically significant differences in blood morphology between the groups one week prepartum, 4 and 7 weeks postpartum. However, a number of changes in blood biochemistry were found. Serum glucose concentration differed significantly between the groups during the time of the experiment ($P<0,05$). Ca concentration at 9 weeks postpartum differed significantly between the groups and was lower in the EXP animals ($P<0,05$), but remained within the reference range throughout the entire experiment. There was a decrease in triglycerides concentration in both groups after calving. Triglycerides level was significantly lower in EXP group ($P<0,05$) during the 2nd week postpartum and significantly higher in CONT animals 7 weeks postpartum ($P<0,05$). BHB concentration in EXP group remained significantly higher for 3 weeks postpartum ($P<0,05$). Moreover, changes in BHB levels over time were significantly different between the groups ($P<0,05$). NEFA levels showed significant

differences over time (P<0,05), but were not significantly different between the groups. ALT activity decreased in EXP animals after calving, while it increased in the CONT group. From 6th to 9th week postpartum these differences were statistically significant (P<0,05). AST activity in the EXP group was significantly lower than in the control group (P<0,05) during the 5th and 6th week postpartum. Superoxide dismutase activity was higher in the study group, from 6th and 7th week postpartum compared to the control group (P<0,05). ALP activity showed significant differences over time (P<0,05), but was not significantly different between groups. There were no significant differences in cholesterol level and CK, LDH and GSH-Px activity between groups.

There were no statistically significant differences in the backfat thickness between the groups throughout the experiment, while this parameter showed significant changes over time (P<0,05).

No ultrasonographic signs typical to the 2nd or 3rd degree of fatty infiltration of the liver were found in the CONT group, contrary to the EXP group. The percentage of cows with a normal hepatic ultrasonograms was higher in the CONT group in the 4th and 7th week after parturition, however those levels were similar.

Hepatic SOD2 expression differed significantly between groups at 4 weeks postpartum (P<0,05) and was significantly correlated with SOD3 expression (P<0,05). Expression levels of SOD 1, SOD 3 and GPX3 did not differ significantly between groups nor between 4 and 7 weeks postpartum.

The obtained results prove that cows with persistently higher BHB concentration after parturition (above 0,8 mmol/l) show a similar level of mobilization of fat reserves to cows not showing such changes. ALT activity may be a useful indicator differentiating cows that do not show an increase in BHB levels traditionally considered as SCK but are at risk of the negative effects of hyperketonaemia. In addition, the results of molecular analyses indicate the possibility of using the level of gene transcription, in particular SOD2, as a biomarker of the degree of ketosis. Gene expression analysis can also be helpful in determining the hepatic regenerative potential in cows after ketosis, in relation to impaired metabolism causing oxidative stress in particular.