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LONGEVITY OF DAIRY COWS — ENERGY PROFILE

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In the study we compared parameters of energy profile in relation to number of lactation of dairy cows. We analysed blod serum to glucose, non-esterified fatty acids, β-hydroxybutyrate, total cholesterol, triacylglycerols and total lipids of Slovak Pied dairy cows with number of lactation (I L — 6 cows, II L — 5 cows, III L — 6 cows, IV L — 5 cows). Blood samples were collected 20 days a.p. and 20, 40, 60, 80 days p.p.

There were observed lower concentrations of glucose and BHB in groups of cows I L and II L compared with cows of groups of III L and IV L. The highest concentrations of glucose was recorded in cows IV L 20 days a.p. (4.32±0.09; P<0.01). NEFA and TL were increased with a.p. period. TCH values in groups III L and IV L, were lower than in groups of cows I L and II L (P<0.01; P<0.05). In the assessment of concentration of TG was found the highest concentrations in group of cows I L during ante-partum (0.22±0,03; P<0.05). Cows during a.p. had significantly higher TG concentrations compared to cows in postpartal period (P<0.05). These results showed dynamic changes in the energy profile during a.p. and p.p. which reflect the physiological response of the organism to the variation of metabolic functions occuring from gestational to a lactating state in dairy cows. Our results indicate that older cows have higher levels of blood GL, BHB and NEFA levels, which proves that dairy cows with higher number of lactations have a better adaptation to the metabolic challenge, for example to milk production, in terms of maintenance of glycemia.

Keywords: ENERGY PROFILE, DAIRY COWS, NUMBER OF LACTATION, LONGEVITY

Transition period and the early lactation phase, are characterized by sudden episodes of metabolic and hormonal changes, such as the parturition and the onset of lactation, which include alterations in the energy balance that lead to increased lipomobilization with consequent elevation of plasma concentration of nonesterified fatty acids. This period is considered the most critical period in the lactation cycle because 50 % of transition cows may be affected by disease.

Materials and methods

Glucose (GL), β-hydroxybutyrate (BHB), non-esterified fatty acids (NEFA), total cholesterol (TCH), triacylglycerols (TG) and total lipids (TL) were evaluated in dairy cows of Slovak Pied Cattle. The dairy cows (n=22) were classified into 4 groups based on the number of lactation: dairy cows at 1st lactation (I L) (n=6), dairy cows at 2nd lactation (II L) (n=5), dairy cows at 3rd lactation (III L) (n=6), dairy cows at 4th lactation (IV L) (n=5). The blood samples were collected by direct puncture of *v. jugularis* during *ante-partum* (20 days *ante-partum*) and *post-partum* (20, 40, 60 and 80 days *post-partum*).

Mean production age was 3.45 lactation. Total mixed rations (TMR) with different levels of ME were offered to dairy cows twice daily, nutrient composition of the TMR varied with the stage of pregnancy and lactation. Meals for the cows were based on meadow hay, lucerne silage, haylage, green fodder and concentrate. Chemical components of meals meet the needs of cows in dry period and different period of lactation. Diet was suited to the energy requirements of late pregnancy, early and mid-lactation cows. The dairy cows had free access to drinking water. Before sample collection, the animals were clinically examined by standard clinical examination procedures. No treatments were administered before the start of the experiment. The concentrations of glucose, TCH, TG, and BHB were determined using commercial diagnostic kits (*Randox*) on automatic biochemical analyser ALIZE (*Lisabio*, France). Total lipids were analyzed using commercial diagnostic kits (*Ecomed*) by spectrophotometric method. The concentrations of NEFA were by spectrophotometric method. Evaluation of the obtained results was performed by the assessment of mean values (x) and standard errors (SE) in each monitored group of dairy cows. Significance of differences in the mean values in relation to the several monitored periods was evaluated by one way analysis of variance (ANOVA). Significance of differences in the mean values between groups was evaluated by Tukey's multiple comparisons test. Statistical analyses were done with the *GraphPad Prism 3.0*.

Results and disscusion

In our study, prepartum serum NEFA concentrations for cows with 1st lactation exceeded the threshold of 0.4 mmol/l proposed by [9] as indicating prepartum negatively altered metabolic status and the serum concentration (0.7 mmol/l) — in cows with 4th lactation 40 days p.p. proposed to indicate postpartum negatively altered metabolic status. NEFA concentrations increased at calving, reached peak concentrations on day 20 p.p. for primiparous and multiparous cows and started to decrease thereafter (fig. 1). This increase is a result of a decrease in dry matter intake prior to parturition and of hormonal changes before and at parturition that stimulate mobilization of NEFA from adipose tissue to provide energy for parturition and lactogenesis. The high postpartum levels of NEFA would indicate that primiparous cows were mobilizing more long chain fatty acids from adipose tissue than multiparous cows [12], which would agree with the results of [4].

[3] found higher concentrations of β-hydroxybutyrate in the postpartum period compared to prepartum period. Our results comply with these findings. BHB concentrations were low at calving, rose sharply up to 20 days *post-partum* and slowly decreased thereafter (fig. 2), but they remained higher than the *ante-partum* levels, reflecting the negative energy balance and the consequently mobilization of body reserves [5] associated with the onset of lactation. High serum concentrations of BHB have been associated with reduced immune system functionality [6], disease risk (displaced abomasum, retaired placenta etc.), and less milk production [7], and many other transition and early lactation cow disorders [9].

The blood glucose level is regarded as one of the indicators of energy status in the cow. Glucose was significantly lower in I L, II L and IV L after calving, but in III L were observed significantly lower values than before calving. Overall glucose was higher in older cows (IV L) than in younger cows (I L) (fig. 3.). Similar result was found by other researcher, demonstrating that older cows had higher overall glucose than younger cows [12]. Our results comply with these finding, as after parturition we found decreasing mean values of glucose compared with cows in the prepartum

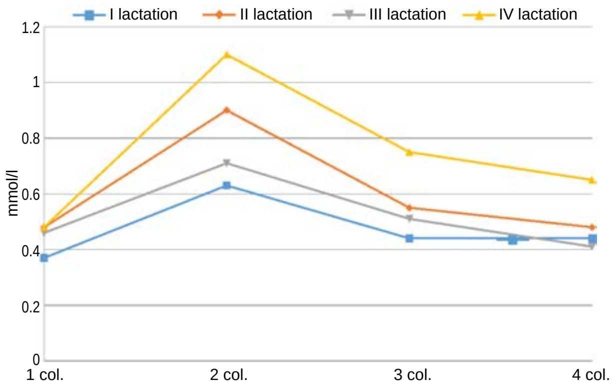

Fig. 1. Non-esterified fatty acids concentration

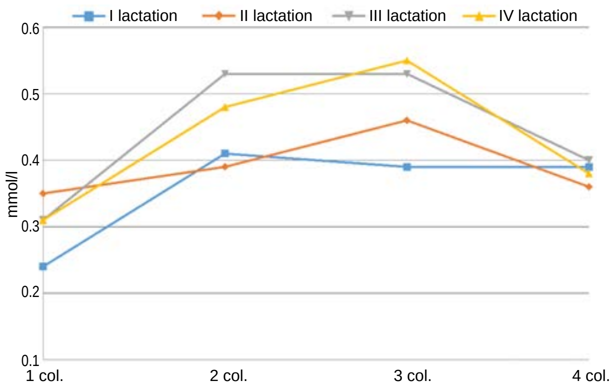

Fig. 2. β-hydroxybutyrate concentration

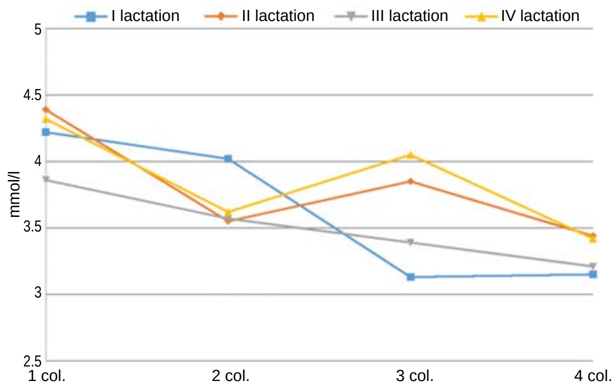

Fig. 3. Glucose concentration

period. [1] observed cows from 4 days before until 36 days after calving, and recorded lower glucose concentrations in the early postparturient period, with a significant increase on the 27th day *post-partum*. The blood glucose level was higher in lactating cows this may be due to high energy diet feeding during lactation period and also for taking the extra amount of feed than the requirement of animal for milk production and maintenances.

Cholesterol concentration increased during postpartum period in cows with I, II, III and IV

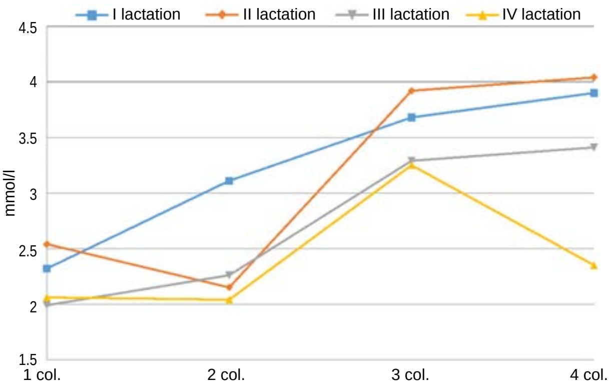

Fig. 4. Total cholesterol concentration

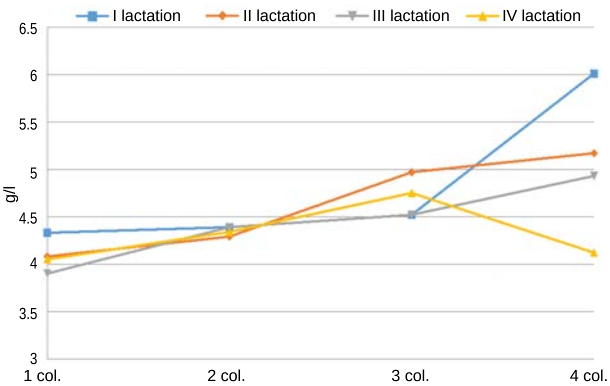

Fig. 5. Total lipids concentration

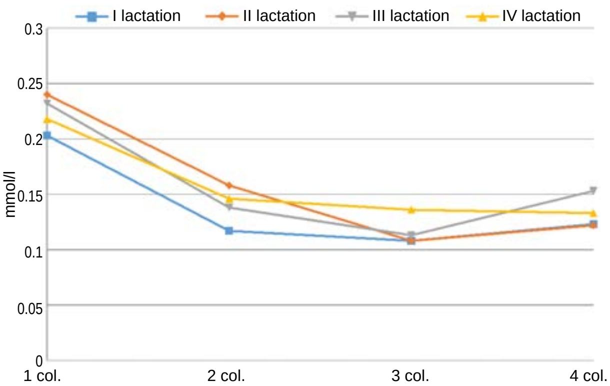

Fig. 6. Triacylglycerols concentration

lactation, although multiparous cows had higher cholesterol around day 60 p.p. than primiparous, reflecting an increased lipid uptake by the liver (fig. 4). Our results comply with findings by [2]. According to [8], hypercholesterolaemia can be considered physiological during lactation, either as a result of lipid mobilization caused by glucagon or to an increase in the synthesis of plasmatic lipoproteins. However, the increase in cholesterol concentrations may be due to a greater energy demand than that supplied by the offered diet. Rise in cholesterol is associated with an improvement in energy balance.

[10] reported that total lipids level increased significantly during the mild and late gestation, postpartum and early lactation compared to dioestrus, early gestation. Our results also show significantly higher values of TL before parturition than in cows after calving (fig. 5).

The same authors found that total cholesterol and triacylglycerols resulted significantly affected by the physiological status, in fact, both showed substantial increases during the mild lactation (fig. 6).

Probably because, during the puerperal period, there is an increase in the demands for regulatory mechanism, responsible for all the processes involved with milking. At this purpose, characteristic changes in lipid metabolism were found during pregnancy and lactation in most mammals. Endocrine profiles change and lipolysis and lipogenesis are regulated to increase lipid reserve during pregnancy, and, subsequently, these reserves are utilized following parturition and the initiation of lactation [11]. Similar results, however, were found by other researchers, demonstrating that concentrations of total lipids and triacylglycerols increased at parturition, despite the kind of fed administered.

Conclusion

During the study we found lower concentrations of glucose and BHB in groups of cows I L and II L compared with cows of groups of III L and IV L .The highest concentrations of glucose was recorded in cows IV L 20 days a.p. (4.32±0.09; P<0.01). NEFA and TL were increased with a.p. period. TCH values in groups III L and IV L, were lower than in groups of cows I L and II L (P<0.01;

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