

Summary

Hunting activity is an environmental factor that can affect game animals' welfare. Cervids are susceptible to negative environmental stimuli due to the behavioral peculiarities characteristic of ruminants. A good method to assess the intensity of the endocrine response is to determine the levels of cortisol or its metabolites. The study was conducted to evaluate plasma cortisol levels in European roe deer and red deer during the seasons of the most intensive stalking hunts in Poland concerning sex, age and carcass mass of the studied animals. In addition, the health status of the animals was assessed on the basis of selected biochemical indicators of blood, which were also analyzed for correlation with cortisol levels. Another analyzed factor was cortisol levels in the hair of male European roe deer harvested at the beginning and end of the hunting season in eastern Poland in order to identify potential chronic stress induced by hunting activity.

The results showed that for European roe deer, average cortisol levels were 58,066 ng/mL in the male group (summer) and 27,694 ng/mL in the female group (late autumn). Higher cortisol levels were associated with significantly lower levels of total cholesterol, lactate dehydrogenase and uric acid ($p < 0,05$). In addition, mean uric acid concentration was negatively correlated with cortisol levels in males and females ($p < 0,05$). As the mean cortisol concentration increased, an increase in HDL cholesterol was observed in all animals tested ($p < 0,05$). Cortisol levels increased with the age of the animals. It was shown that uric acid and age are determinants of plasma cortisol concentrations in roe deer.

In red deer, mean cortisol concentrations in stags and does were at similar levels (20,2 and 21,5 ng/mL, respectively). Higher HDL cholesterol values were found in females plasma ($p < 0,05$). Similarly, mean levels of LDL cholesterol, lactate dehydrogenase and alanine aminotransferase were higher, respectively by 21%, 16% and 42% in the plasma of swans. In contrast, the amounts of alkaline phosphatase, bilirubin and aspartate aminotransferase were higher in stags (by 30%, 49% and 36%). There was a negative correlation between cortisol levels and urea and bilirubin, and a positive correlation between cortisol and aspartate aminotransferase in males ($p < 0,05$). In hinds, on the other hand, there was a negative correlation between cortisol and urea levels ($p < 0,05$).

The results obtained for cortisol concentrations in the hair of male European roe deer were significantly higher in samples collected in September compared to those collected in May ($\text{Pr.} > |t| = 0,0017$). Animal age and carcass mass had no significant effect on the concentration of the hormone studied.

In conclusion, stalking hunting causes stress to deer, which is reflected in changes in plasma cortisol levels and selected blood biochemical parameters. It should be noted, however, that increased cortisol concentrations in cervids were influenced by the mating

season, which coincided with sampling and directly related arousal, as well as the animals' poorer diet. However, the hunting season, climatic or intrapopulation factors, as well as disturbance associated with hunting activity of hunters, are not without influence on the intensification of stress in selected cervids. An important aspect of the conducted research is to draw attention to the need to improve hunting methods in order to minimize stress in game animals, since increased cortisol concentrations can interact among other things, a decrease in carcass mass, which can lead to deterioration of the physical condition of animals and impoverishment of the population.

Key words: cervidae, hunting pressure, blood biochemical parameters, hair cortisol