Biotransformation of zearalenone administered at low doses and its effect on selected endocrinological parameters and metabolic profile of gilts

Abstract

Zearalenone (ZEN) is produced by fungi of the genus *Fusarium*. These fungi are often identified as contaminants of cereal grain and products, particularly in the temperate zone. The effects exerted by high ZEN doses on humans and animals have been thoroughly investigated and are well documented. However, the effects of low monotonic doses of this mycotoxin have not been fully elucidated to date. The aim of this study was to determine whether low monotonic doses of ZEN administered to pre-pubertal gilts for six weeks may induce changes in the effects of ZEN biotransformation in the blood serum and cause changes in selected endocrinological parameters, metabolic profile and body weight (BW) gains. The experiment was performed on gilts with initial BW of 14.5±2 kg. The gilts were randomly divided into three experimental groups and one control group, with 15 animals per group. In group ZEN5 (MABEL), ZEN was administered *per os* at 5 µg/kg BW, in group ZEN10 (NOAEL) ZEN was administered *per os* at 10 µg/kg BW, and in group ZEN15 (LOAEL) ZEN was administered *per os* at 15 µg/kg BW. Control group (C) animals received placebo *per os*. During the experiment, blood for analyses of metabolic profile was collected ten times from gilts. Minor, but statistically significant changes in selected parameters of the blood metabolic profile of gilts (ALT, AST, ALP, cholesterol, bilirubin, glucose, total protein, iron, BUN and urea) were observed in the analyzed animals. The results of the study indicate that maintaining homeostasis and the biotransformation processes of ZEN require considerable energy expenditures. Starting from the fourth weighing date, BW gains continued to be higher in the experimental groups than in the control group. A decrease in glucose and total protein levels, which was also observed, could be attributed to higher BW gains and the ongoing biotransformation processes of ZEN in enterocytes and in the liver. Five gilts from each group were euthanized on day 7. (D1), 21. (D2) and 42. (D3) of the experiment. Samples for analyses of steroid hormone concentrations, ZEN and its metabolites were collected three times, immediately before euthanasia. Quantitative and qualitative changes in the biotransformation of low ZEN doses were noted. This process was least pronounced in group ZEN5 where ZEN metabolites were not identified on analytical date D1, and β-ZEL was the predominant metabolite on the second (D2) and third (D3) sampling dates. The above phenomenon was accompanied by an increase in estrogen concentration, which – probably together with “free ZEN” - led to a decrease in the plasma levels of progesterone and testosterone. The so called "free ZEN" can also compete with endogenous estrogen or co-determine its supply, which is confirmed by the fact that even MABEL, NOAEL and very low LOAEL doses lead to a significant increase in the concentrations inducing hyperestrogenism.

Key words: zearalenone, low doses, blood biochemistry, body weight, steroid hormones, biotransformation, prepubertal gilts