Abstract of the doctoral dissertation of Anna Steg, M.Sc., entitled:

Effect of vitamin D_3 supplementation of pigs diet on transcriptome and proteome in selected tissues.

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Date of abstract preparation: 26.08.2025

Doctoral dissertation conducted at National Research Institute of Animal Production in Balice.

Vitamin D plays a key role in regulating calcium-phosphate homeostasis and maintaining metabolic balance in various tissues. An increasing body of evidence highlights its pleiotropic effects beyond the skeletal system, including modulation of the immune, nervous, muscular, and reproductive systems. In recent years, there has been growing interest in the use of high doses of vitamin D, both in therapeutic and preventive contexts, as well as in the biofortification of animal-derived food products. However, data on the safety and molecular consequences of long-term high-dose vitamin D supplementation in healthy individuals without baseline deficiency remain limited.

The aim of this study was to evaluate the effects of long-term dietary supplementation with high doses of vitamin D_3 (5000 and 10,000 IU/kg feed) in healthy pigs, focusing on: production and biochemical parameters, vitamin D content in tissues, gene expression in liver, muscle, and adipose tissue, and liver protein levels using omics technologies.

Supplementation did not significantly affect body weight gain of animals or feed intake but led to an increase in kidney calcium levels and changes in selected biochemical markers (ALT, LDH, glucose). A dose-dependent increase in vitamin D content was observed in muscle and fat; however, the final concentrations were too low to consider the meat a meaningful dietary source of vitamin D. Molecular analyses revealed pronounced changes in the hepatic transcriptome and proteome, including repression of the β-oxidation pathway, alterations in amino acid and lipid metabolism, and reduced levels of antioxidant proteins. In contrast, the response in muscle and adipose tissue was minimal.

These findings suggest that high doses of vitamin D_3 can affect hepatic metabolism in healthy individuals and that, in the absence of deficiency, high-dose supplementation may induce subtle adverse metabolic changes not associated with classical toxicity manifestations

such as hypercalcemia. This study underscores the need for cautious use of high-dose supplementation and highlights the importance of further research, including functional tissue assessment and oxidative stress marker analysis.