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Hydrolytic enzyme activity in quails upon introduction of enzyme mixtures and various sulfur forms into their diet

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Introduction

Among the biologically active substances that positively impact digestion of substrates and nutrient availability in the feed are enzyme mixtures. Modern feed industry offers various enzyme supplements, yet their efficient use in the diet of poultry of different types, ages, and productivity requires additional research. A promising area of research encompasses the study of the efficiency of introducing nanoforms of micro- and macroelements into feed and feed supplements for poultry. Given the results obtained during the previous research, it appears feasible to look at the potential to include sulfur nanocitrate into the quail diet in place of sulfate, which is used to make up for sulfur-containing amino acids deficiency.

Material & Methods

The study was conducted on quails (14 days old) divided into five groups. All birds were fed balanced combined feed. Control and the 1st test group quails received additional sodium sulfate (0.2%) while the 2nd and the 4th test groups were given sulfur nanocitrate (produced by Nanomaterials and Nanotechnologies LLC, city of Kyiv) in the amount of 50, 24, and 10% of control group levels. In addition, all test group quails were given Natuzyme enzyme mixture, which contains three strains of microorganisms (*T. longibrachiatum*, *B. subtilis*, *A. Niger*) and phytase. At the end of the study, which covered a period of three months, birds were harvested, and liver and pancreatic tissues were sampled to identify proteolytic activity using the method of Kunitz (K. A. Kaluniants et al., 1973), amylolytic activity using the method of Caraway (N. Dovhan et al., 1998), and lipolytic activity using the method of Titz (B. D. Kalnitskiy, 1997).

Results

It has been established that proteolytic and lipolytic enzyme activity in pancreatic tissues of quails increased upon adding an enzyme mixture to the poultry diet. The addition of sulfur citrate in the amount of 25 and 10% of element levels in standard mineral premix resulted in 1.4 and 1.5 times protease activity increase ($P<0.05$) and 1.3 and 1.4 times lipase activity increase ($P<0.05$) respectively. At the same time, lipolytic activity in liver tissues decreased in all test group birds compared to the control group, which may be stipulated by the fact that pancreatic lipolytic enzymes are responsible for the hydrolysis of fats. Pancreatic lipase accelerates the hydrolysis of triglycerides, while the role of gastric lipase in hydrolysis is insignificant.

It has been established that the egg mass amount of the 4th test group birds received over test period was the highest (1.4% higher than the control group, $P<0.05$). At the same time, even the smallest amounts of biolement in its nanocitrate form (4th and 3rd study groups) increased shell strength by 35% ($P<0.01$) according to comparable data of control group quails. Eggshell thickness in the 2nd test group birds (additional 50% sulfur from its content in sodium sulfate inorganic salt) was by 25% higher. The introduction of enzyme mixture alone did not significantly impact the shell strength remaining at control group levels

Conclusions

Thus, the results obtained attest to the feasibility of replacing sulfur mineral supplements in the form of inorganic salt (Na_2SO_4) with nanocitrate of the element in the amount of 10% of its content in inorganic form and addition of Natuzyme multi-enzyme mixture in the amount of 0.03%.