Assessment of antioxidant capacity in pigs and broiler chickens, after administration of feed, with polyphenolic additives from olive mill wastewaters.

Abstract

The oxidative stress reflects an imbalance between the systemic expression of reactive oxygen species and the ability of a biological system to detoxify reactive oxidative intermediates and repair the resulting damage. Free radicals are reactive compounds that are naturally produced in the living organisms They can exert positive effects (e.g. on the immune system) or negative effects (e.g. lipids, proteins or DNA oxidation). To limit these harmful effects, an organism requires complex protection – the antioxidant system. This system consists of antioxidant enzymes (CAT, GPx, and SOD) and non-enzymatic antioxidants (e.g. vitamin E, vitamin A, vitamin C, GSH and uric acid). An imbalance between free radical production and antioxidant defense leads to oxidative stress, which may be involved in aging processes and even in some pathology (e.g. cancer and Parkinson's disease). Oxidative stress can also be increased under physiological conditions such as fatigue.

In recent years, in an effort to increase the antioxidant defense and protection of the body from the harmful effects of oxidative stress, there is an increased interest in finding natural sources of antioxidants. The present study is the first one where polyphenolic additives from processed olive mill waste waters (OMWW) were added to livestock feed. Oxidative stress markers in blood and tissues were assessed, so as to investigate whether there would be enhancement of the antioxidant mechanisms. Thus, at the beginning, thirty (36) broilers were fed for fifty (50) days with the feed supplemented with polyphenols from OMWW. Moreover, it was created a feed for piglts. In particular, thirty (30) pigs at the age of weaning were fed with feed supplemeted with polyhpenols from OMWW in order to examine if their antioxidant capacity would be enhanced. Finally, the distribution of fatty acids was assessed in plasma and tissues of piglets aged fifty days with interesting results, such as, the presence of a greater percentage of omega-3 fatty acids in the polyphenolic group that consumed feed contained byproducts from processed OMWW.

The results showed that broilers given feed supplemented with OMWW retentate or permeate had significantly lower protein oxidation and lipid peroxidation levels and higher total antioxidant capacity in plasma and tissues compared to control group. In both OMWW groups, catalase activity in erythrocytes and tissues was significantly increased compared to control group. OMWW retentate administration increased significantly GSH in erythrocytes in broilers with low GSH, although both OMWW products significantly reduced GSH in broilers with high GSH.

In addition, the piglets fed with diet supplemented with OMWW polyphenols had significantly increased antioxidant mechanisms in blood and in the most of the tested tissues as shown by increases in TAC, CAT and GSH compared to control group. Moreover, piglets fed with the experimental feed exhibited decreased oxidative stress-induced damage to lipids and proteins as shown by decreases in TBARS and CARB respectively.

Conclusively, based on the results of the present study, the byproducts from processing of OMWW (retentate or permeate) may be used as supplements in feeds for livestock animals in order to enhance their antioxidant capacity and in turn their welfare and to improve the quality of the produced meat. Moreover, the use of these by-products is a solution of the environmental problems caused by OMWW, while on the other hand, biofunctional products of high added value are created.