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ANTIOXIDANT EFFECT OF APPLE POMACE DIET IN INTESTINAL LYMPH NODES OF WEANED PIGLETS CHALLENGED WITH *ESCHERICHIA COLI* ENDOTOXIN

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Abstract: Apple pomace, a major by-product of the fruit processing industry, is a rich source of dietary fiber and bioactive compounds, particularly polyphenols, with potential applications in animal nutrition. This study aimed to evaluate the effects of dietary apple pomace inclusion on oxidative stress in weaned piglets challenged with bacterial lipopolysaccharides (LPS). A total of 26 weaned piglets were assigned to four experimental groups: control, LPS-challenged, apple pomace and LPS + apple pomace. After 21 days, oxidative stress markers were assessed in intestinal lymph nodes, including antioxidant enzyme activities (catalase, glutathione peroxidase, superoxide dismutase), total antioxidant capacity (TAC) and biomarkers of lipid, protein, and DNA oxidation. LPS challenge significantly impaired antioxidant defense by decreasing enzyme activities and TAC, while increasing oxidative damage to lipids, proteins, and DNA. Dietary inclusion of apple pomace improved antioxidant enzyme activities and partially restored TAC. Moreover, it significantly reduced LPS-induced oxidative damage, as evidenced by decreased levels of protein carbonyls, TBARS, and 8-oxo-2′-deoxyguanosine. In conclusion, apple pomace inclusion in the diet mitigates oxidative stress and enhances antioxidant status in weaned piglets under inflammatory challenge. These findings support the potential use of apple pomace as a functional feed ingredient in animal nutrition.

• Introduction

Apple pomace is a by-product generated from fruit juice industry produced in large quantities in countries with strong fruit-processing sectors, as for example Romania (Kauser et al., 2024). These components make apple pomace a product with nutritional and functional potential. Due to its valuable composition, the apple pomace was used in bakery and dairy production, biotehnology or generation of renewable energy (Sudha et al., 2007 Dhillon et al., 2013). Animal nutrition is a promising field for the use of apple pomace, as due to its content in bioactive compounds and fibers, it can be included in the diets of ruminants, pigs, and poultry. Literature data have shown that incorporation of apple pomace into the diet of farm animals improve gut health and can influence digestive processes (Gasa et al., 1992; Wenk, 2001). Several studies have shown that apple pomace has a significant potential to enhance immune response, antioxidant capacity and gut health (Hoseinifar et al., 2021). The present paper investigates the capacity of a diet containing apple pomace to lower the oxidative stress induced by the exposure to bacteria of weaned piglets.

• Material & Methods

Experimental design. The feding trial was carried out in the National Research and Development for Biology and Animal Nutrition IBNA Balotești experimental farm on 26 weaned TOPIG hybrid piglets (6-7 piglets/lot) divided into four batches and received the following treatments: Control group fed with complete control feed based on corn and soybean meal); LPS group stimulated with E.coli-LPS and fed with complete control feed); Apple pomace group fed with a diet with 5% apple pomace) LPS + Apple pomace group stimulated with E.coli-LPS and fed a diet with 5% apple pomace. After 21 days the animals were euthanized and intestinal lymph nodes were collected and stored at -80^{o}C until analysed for the activity of antioxidant enzymes, lipid peroxidation, protein oxidation and DNA oxidation. Differences among groups were tested using one way ANOVA analysis of the GraphPad Prism 9 software followed by Fisher PSLD test

• Results and discussions

In the present paper we have investigated the capacity of a diet containing apple pomace to reduce the oxidative stress in intestinal lymph nodes of weaned piglets challenged with LPS bacterial endotoxin.

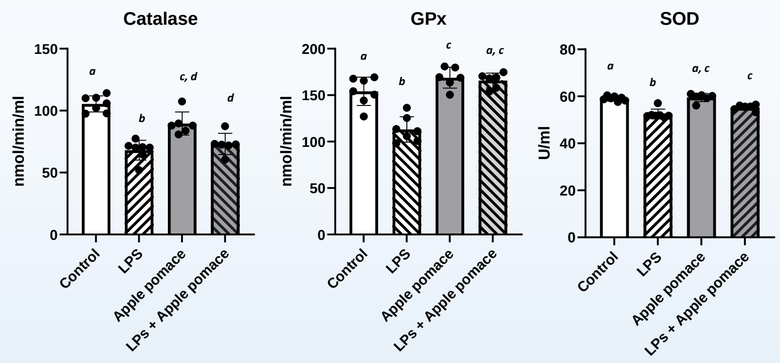

Figure 1. Effect of apple pomace diet on antioxidant enzimes activity

The activities of antioxidant enzymes were significantly reduced in the LPS group (catalase by 31.9%, GPX by 10.1%, SOD by 11.19%) compared with the control group, confirming that LPS challenge induces oxidative stress and disrupts enzymatic antioxidant defense mechanisms. Apple pomace diet partially alleviated this effect, as the LPS + apple pomace group showed significantly higher antioxidant enzyme activity - an increase of 46.5% for GPx, 7.3% for CAT and 5.34% for SOD – as compared with LPS group.

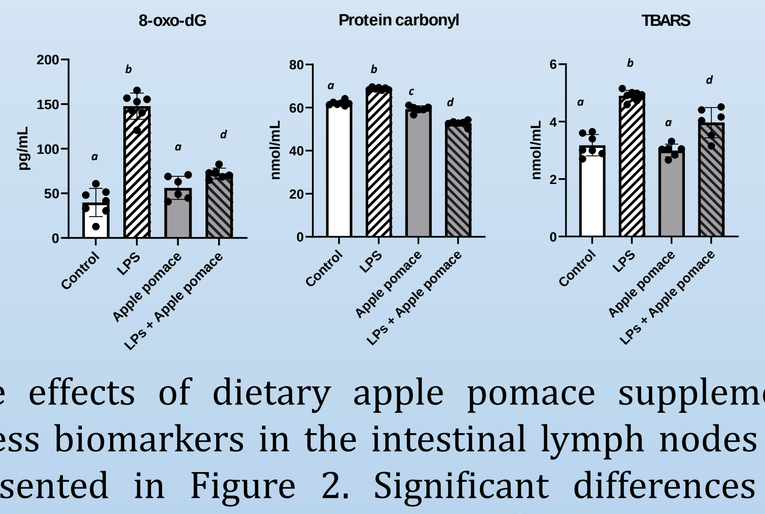

Figure 2. Effect of apple pomace diet on the oxidation of DNA, proteins and lipids.

The effects of dietary apple pomace supplementation on oxidative stress biomarkers in the intestinal lymph nodes of weaned piglets are presented in Figure 2. Significant differences among experimental groups were observed for 8-oxo-2′-deoxyguanosine (8-oxo-dG), protein carbonyl, and TBARS concentrations ($p < 0.05$), indicating that both LPS challenge and dietary treatment influenced oxidative damage of DNA, proteins and lipids. By contrast dietary poliphenols from apple pomace protect the body against oxidation of DNA, proteins and lipids.

• Conclusion

Our results showed that LPS induce an increase of oxidative damage and a decrease of the antioxidant capacity in intestinal lymph nodes of weaned piglets. On the other side apple pomace due to the high content in polyphenols improve antioxidant status and attenuate the oxidative damage induced by LPS. In conclusion, these results support the potential use of apple pomace as a functional feed ingredient capable of improving antioxidant status in animals exposed to inflammatory or oxidative challenges.

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