

Abstract

Assessing the Potential of a Freeze-Dried Apple Residue Extract to Protect Intestinal Epithelial Cells against Cellular Damage Induced by *Escherichia coli* Lipopolysaccharide [†]

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Abstract: Apples are a fruit rich in active biomolecules, and are one of the most important fruits for human food. Apple waste also started to gain importance as potential feedstuff for farm animals after the ban on in-feed antibiotics. Large quantities of apples are consumed as such (~200 g/capita/day), but also as juice, and they are also used as a base for other juices. A large amount of residue containing active nutrients beneficial for health remains available, which could be added as pomace or meals to the feed of farm animals (e.g., pigs). The present study analyzed and compared the composition of three apple cultivars (Granny Smith, Golden, and Red Delicious) and investigated the capacity of the apple meal extract to counteract the membrane damage and pro-inflammatory effect induced by LPS on an in vitro cellular model of pig intestinal epithelial IPEC-1 cells, considering that the epithelium represents the first barrier for nutrient absorption, as well as against toxins and pathogens. The intestine is the first organ affected by inflammation in piglets during the weaning period, in which animals are frequently exposed to infections with pathogens such as *E. coli*, *Salmonella*, *Rotavirus*, etc. Cells were seeded in Transwell inserts in 24 well plates and treated with apple extract for 48 h. After 2 h of incubation, they were challenged with LPS until 48 h. The capacity of apple extract to protect cellular membrane permeability was evaluated by measuring the trans-epithelial electrical resistance (TEER) at 6, 24, and 48 h, and its potential to diminish the pro-inflammatory effect induced by LPS was also assessed by measuring the pro-inflammatory cytokines synthesis (ELISA). Red Delicious apple extract was used for the in vitro studies due to its higher level of micronutrients than the other two. Our results showed that LPS significantly reduced the TEER at all three measured times in a time-dependent manner, suggesting that the endotoxin disrupted the tight junctions' proteins and as a consequence the epithelial integrity. But apple extract was efficient to defend the cells against the increased membrane permeability caused by LPS. It was also able to prevent the over-production of pro-inflammatory markers triggered by LPS.

Keywords: apple residue extract; intestinal cells; LPS

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