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Beneficial propionibacteria: from traditional cheeses to next generation probiotics

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Swiss cheeses have been produced for centuries in a traditional way and their typical opening indicates the presence of propionibacteria. These last are indeed present in raw milk, their growth is favored by the specific technology of Swiss-type cheeses, and their high population in the ripened cheese is responsible for its characteristic sensory properties, including the opening and the aroma. In addition to this long history of safe use and consumption, they constitute a source of nutraceuticals. The specific propionic fermentation leads to the production of short chain fatty acids as main final obligatory products. These exert beneficial effects including nourishment of digestive epithelial cells, as well as promotion of differentiation and of apoptotic depletion of colon cancer cells. Propionibacteria also produce vitamins of the B group, which enhances the nutritional value of the food products they ferment. Some selected strains were moreover shown to produce immunomodulins, proteins able to modify the secretion of cytokines in human immune cells. These last were identified as proteinaceous components of propionibacteria surface layer. They also produce extracellular vesicles which modulate in vitro inflammation and the NFκB pathway in human intestinal epithelial cells. Accordingly, such strains modulate the immune response and mitigate inflammation. In mice, they prevent both mucositis and colitis, via such immunomodulins limiting acute inflammatory response and protecting the gut epithelial barrier. In pigs, their consumption also modulates the inflammatory response and the lymphocyte populations. Finally, clinical studies dealing with consumption of propionibacteria whey cultures suggest a beneficial role in the context of IBD. Propionibacteria strains were recently identified in the gut microbiota of healthy newborns, yet not in that of children with necrotizing enterocolitis. Indeed, propionibacteria were detected in human fecal samples, which means that propionibacteria may be traditional cheese starters or next generation probiotics. The growing knowledge of these peculiar actinobacteria, including their great strain-diversity, opens new avenues for the development of functional foods and of food supplements, in a general context of increasing incidence of ailments that include an inflammatory component. Moreover, their ability to ferment both dairy and vegetable matrices is presently investigated and the first promising advances open new perspectives for the development of functional fermented vegetable products.