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Probiotic fermented cereal-based functional foods

Food fermentation is regarded as one of the oldest ways of food processing and preservation. The products of fermentation depend on the microorganisms involved, substrates used, and also on the fermentation conditions. Lactic acid bacteria (LAB) are the most common and dominant microorganisms present in fermented foods and therefore, lactic acid fermentation is considered as the major contributor to the beneficial characteristics observed in those foods. Their importance is associated mainly with their safe metabolic activity thereby giving various functional attributes to the food. Probiotics are viewed currently as the world's biggest functional food products.

Cereal grains are claimed to be one of the most important sources of carbohydrates, proteins, dietary fibre (DF), vitamins, and minerals. However, their nutritional quality is inferior or poorer than other food matrices like milk and dairy products, due to 1) a lower content of proteins and biological value thereof, 2) deficiency of certain essential amino acids, such as lysine, and 3) presence of determined anti-nutrients (e.g., phytic acid, tannins, and polyphenols). Fermentation by LAB is indeed the processing technology of choice to improve the nutritional properties of cereals. Health-promoting components with antioxidant, anti-hypertensive, anti-diabetic and FODMAPs (which stands for fermentable oligosaccharides, disaccharides, monosaccharides, and polyols) -reducing activity may be found in fermented grain-based products either as a result of pre-treatment of raw materials by fermentation or by applying fermentation to the whole food system production.

Fermentation enables to increase total phenolic compound content thanks to the bioconversion of phenolic compounds from their conjugated forms to their free forms. The hydrolytic activity of enzymes produced by fermenting microorganisms promotes the structural breakdown of grain cell walls thus resulting in a greater bio-accessibility and bio-availability of bound and conjugated phenolic compounds (PC). An increase in total phenolic content has been observed in wheat, rye bran, germ, barley and buckwheat, and in whole grain barley and oat groats fermented by LAB. The increase in the PC content was promoted by enzymes produced by microorganisms which breakdown the cell wall matrix resulting in a greater accessibility of bound and conjugated PC. In particular, they observed that ferulic acid content in barley and oat was respectively 81.9 % and 49.9 % higher than in non-fermented substrates after fermentation.

Consumption of DF has been linked to a reduced risk of certain types of cancer, for example consumption of LAB fermented wheat bran which has been linked to a reduced risk of colon cancer. High-DF products (fermented

wheat and rye brans) with three times the DF of regular pasta and bread.

Cereal extracts (or milk) is a valuable and cheap source of protein and other nutritious and biologically active components, like lipids, vitamins, mineral elements, isoflavones, flavonoids, saponins etc. But the presence of indigestible oligosaccharides and a bean flavor limit the consumption of cereal "milk". In order to gain the greatest benefit from the health properties of cereals, several aspects have to be considered.