Discovering new compounds against bad bacteria

Bacteria can be either harmful or beneficial to us. In recent years, specific lactic acid bacterium strains have shown to contribute to good health in humans, and several such bacterial strains are being used in food products today. A positive property of lactic acid bacteria is their production of organic acids that keep fermented foods free of spoilage and protect against contamination of pathogenic bacteria. Another beneficial property of lactic acid bacteria is that some can produce compounds that are often called as bacteriocins. Bacteriocins are a kind of natural weapons of bacteria, which may kill related harmful bacteria. An EU-funded project, PROPATH, has the objective to document the mechanism(s) by which some of the beneficial lactic acid bacteria, so-called probiotics, can produce compounds that can kill harmful bacteria such as *Helicobacter pylori*, *Escherichia coli*, and *Salmonella*, and identify such compounds chemically.

To identify such beneficial strains the PROPATH project started with collecting more than 850 strains of lactobacilli and bifidobacteria from food products and from healthy humans. Of these, fifteen strains, which showed clear inhibiting effects against pathogenic bacteria were studied further. Bifidobacteria produce organic acids that can kill *Escherichia coli* and *Salmonella*, bacteria that cause infectious diarrhoea. Lactobacilli produce, in addition to organic acids, substances that contribute to the killing of pathogenic bacteria. Some of these *Lactobacillus* strains produced compounds that could eliminate *H. pylori*. *Helicobacter pylori* is a spiral bacterium that infects the stomach of 50 % of the human population, and can cause gastritis, gastric ulcers, and eventually gastric cancer (about 1 % of the infected people) in humans. *H. pylori* are difficult to eliminate from the stomach as the bacteria has become increasingly resistant to currently administered antibiotics. PROPATH has discovered that some lactobacilli produce specific compounds that can kill harmful *H. pylori*.

Some strains could influence a wide range of harmful bacteria in an undefined way, whereas other strains produced bacteriocins that provided protection against specific harmful strains. These beneficial compounds seemed to be stable in a wide range of acidity and can thus survive both in food products and in the human body, even through the whole gastrointestinal tract. They were also tolerant against heat treatments, but proteolytic enzymes could destroy the antimicrobial activity produced by some strains. When the most effective lactobacilli were administered to *H. pylori* infected mice, a reduction in the numbers of *H. pylori* infecting bacteria in the stomach and an improvement in the associated gastritis was observed.

The results suggest that by using cautiously selected strains of lactic acid bacteria we may be able to improve the protection of humans against pathogenic bacteria. The research in the PROPATH project will continue by analysing the chemical composition of the beneficial antimicrobial compounds and by testing the effect of the most promising probiotic lactic acid bacterium strains in clinical trials. By identification of the effective compounds produced by some lactobacilli against the harmful bacteria, the PROPATH project can contribute to find new ways to prevent the development of such common infectious diseases.

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