COMMENTARY

Biological detoxification of food chemical contamination using probiotics

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ABSTRACT

People are now exposed to a variety of chemical and environmental toxins that are produced by industry and agriculture. Food contamination from mycotoxins, heavy metals, and Persistent Organic Pollutants (POPs) is a severe issue for global food safety with repercussions for the economy and for public health, particularly in the newly industrialised nations (NIC). A growing body of research shows that xenobiotics, or food pollutants, have a detrimental impact on human health. These effects include inflammation, oxidative stress, and intestinal problems associated to changes in the composition and metabolic profile of the gut microbiota. Although physicochemical methods for food decontamination are frequently used, they frequently cannot be used in many industrial sectors due to the necessary circumstances. At the moment, a biological detoxification process carried out by probiotic strains and their enzymes is one promising method to lower the risk associated with the presence of xenobiotics in foods. Probiotics are an efficient, practical, and affordable strategy for preventing xenobiotic-induced dysbiosis and reducing its toxicity, according to numerous research. This article seeks to provide an overview of the direct mechanisms that probiotics can use to affect xenobiotic detoxification. Additionally, host response and probiotic-xenobiotic interactions with the gut microbiota were examined.

Key Words: *Environmental toxins; Organic pollutants; Food contamination; Xenobiotics*

INTRODUCTION

Food contamination by chemicals brought on by industrialization and rising environmental pollution has been a significant issue for worldwide food safety during the past ten years, with substantial economic and public health consequences. The main causes of human exposure to numerous harmful compounds known as xenobiotics are contaminated water and food. Chemical chemicals that are not typically found in the surroundings of living things are referred to as "xenobiotics." These include endobiotics when they are present at concentrations above their usual levels, as well as manmade environmental contaminants and naturally occurring toxins that serve as other organisms' defensive mechanisms. These substances, which include pesticides, heavy metals, mycotoxins, bacterial and herbal toxins, and Persistent Organic Pollutants (POPs), Polyaromatic Hydrocarbons (PAH), Polychlorinated Biphenyls (PCBs), bisphenols, have a detrimental effect on human health. Intestinal problems, oxidative stress, and inflammation are all caused by them. Intestinal dysbiosis can occur in both humans and animals as a result of prolonged exposure to dietary xenobiotics, according to a number of in vitro and in vivo investigations. For instance, mice exposed to a mixture of Polychlorinated Biphenyls (PCBs) such as PCB153, PCB138, and PCB180 significantly reduced the composition of their gut microflora, as evidenced by a decline in the Proteobacteria phylum count, whereas exposure to Arsenic (As) reduced the abundance of the Firmicutes community. t has been established through in vitro and in vivo research that dysbiosis of the gut microflora is linked to the development of metabolic diseases including diabetes and obesity, as well as cardiovascular illnesses, allergies, inflammatory bowel disease, and liver cancer. Additionally, a number of studies have documented how xenobiotics affect the gut microflora's metabolome. For instance, the rabbits exposed to bisphenol A (BPA) had lower levels of Short-Chain Fatty Acid (SCFA) production and higher levels of Lipopolysaccharide (LPS). Recently, there has been a rise in interest in the use of probiotics that have a high ability to bind xenobiotics and could be used to guard against dietary pollutants, such as to reduce the acute and chronic toxicity of heavy metals by Lactobacillus strains. Probiotic bacteria have been shown in *in vitro* and *in vivo* experiments to bind and/or metabolise a variety of chemical contaminants, including heavy metals, mycotoxins, and organophosphorus insecticides. It has been proven that oral probiotic supplementation can lessen the harmful health effects of exposure to food contaminants by altering the gut

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microflora's composition, reducing oxidative stress, enhancing the function of the intestinal barrier, altering the host's gene expression, and ultimately affecting the host's ability to metabolise xenobiotics. Certain xenobiotics can be directly bound to the cell wall by probiotics, which lowers their bioavailability and toxicity. In contaminated areas of the world, oral supplementation with xenobiotic-binding probiotic strains can be a quick and efficient strategy to lessen the quantity of contaminants ingested through food. Human exposure to xenobiotics will rise as industrialisation continues, thus understanding the interactions between xenobiotics and probiotics and how they affect the gut microbiome and metabolic pathways is essential for determining the true health risk posed by exposure to these substances. Probiotics are defined as "live bacteria that, when provided in suitable proportions, impart a health benefit on the host" by the World Health Organization (WHO). Lactic Acid Bacteria (LAB) like Lactobacillus and Bifidobacterium, which are effective in the treatment of several gastrointestinal problems, are currently present in standard probiotic strains that are marketed. But in addition to these bacteria, probiotic strains of Lactococcus, Streptococcus, and Enterococcus, as well as several species of Bacillus and Saccharomyces yeast, are also used. Probiotics' role in boosting health has been thoroughly investigated in recent years. Inhibiting pathogen adhesion to the intestinal epithelium by probiotic bacteria and yeast results in a decrease in bacterial toxins and the production of antibacterial compounds (bacteriocins, antibiotics), as well as vitamins. Additionally, the same probiotic metabolites are crucial for preserving intestinal homeostasis and advancing gut health. Studies have shown, for instance, that metabolically active SCFAs from Lactobacillus acidophilus CRL 1014, such as acetic, butyric, and propionic acids, are involved in a variety of biological activities that serve as sources of energy for human colonic epithelial cells. Probiotic strains are also known to be crucial in the control of the host immune system. These microorganisms are necessary for maintaining immunological tolerance to environmental antigens in the intestines, as well as for preventing allergies and auto-aggressive reactions. The probiotic stimulation of particular intracellular signaling pathways in the epithelial cells is the cause of many of these reactions.