

Effects of functional foods, nutraceuticals, and herbal products on pancreas

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To the Editor: Today functional foods, nutraceuticals, and herbal products are becoming a part of human daily diet. The patient's interest and demand for them are rising. Globally, healthcare systems and people have shown an increased desire to prevent some diseases and to improve their performances. Published data about the properties and side effects of these products on the pancreas are still lacking, and more studies are required to provide a definitive opinion on their clinical benefits and safeties. The industry of functional foods, nutraceuticals, and herbal products is gaining popularity. Functional food is food with chemical or biological additives that can modify human physiological systems such as digestive, endocrine, nervous, immune, and cardiovascular. The term first appeared in Japanese literature in 1984.^[1] Nutraceutical supplements are food or ingredients with medical or health benefits for the prevention and treatment of diseases. This term was introduced by Stephen L. De Felice in 1989. Nutritional supplements are not essential to the human diet but are considered safe and able to prevent and manage some human diseases.^[1] Finally, herbal products consist of whole plants or fragmented plants, algae, fungi, and lichens containing vitamins or minerals with well-documented evidence for safety.^[2] Diet plays a key role in pancreatic health and diseases. The pancreas, in fact, is involved in nutrition, digestion, and absorption of the ingested food. Published data about functional foods' effects on the pancreas are often contradictory. Specifically, probiotics and prebiotics are much prescribed today for their potential health effects on humans.^[3] Probiotics are living microorganisms, non-pathogenic bacteria, or yeasts, such as *Lactobacillus*, *Streptococcus*, *Saccharomyces*, *Bifidobacterium*, etc. Prebiotics are constituents of food and dietary supplements, which are not absorbed during digestion, but used selectively by the microorganisms of the human gut

"microbiota." They are oligosaccharides such as inulin, fructo-oligosaccharides galacto-oligosaccharides, non-digestible carbohydrates, etc, or other substances such as lactulose. Probiotics and prebiotics can modulate the compositions, the activities, and the balance of the intestinal microbiota with a "believed" positive impact on other systems. As regards the pancreas, a multicenter and double-blind trial on patients with acute necrotizing pancreatitis, registered a high mortality in the group treated with probiotics (24 of 152 patients died *vs.* nine of 144 controls).^[3] This was explained with an inappropriate combination of probiotics and an incorrect timing of their administration (probiotics were not administered at the beginning of the symptoms).^[3] On the other hand, another study on rats with acute pancreatitis (AP) has had positive outcomes after treatment with probiotics (*Lactobacilli* strains).^[4] Probiotics were administered 4 days before the induction of pancreatitis.^[4] Other functional foods, such as curcumin, resveratrol, Ginkgo biloba, garcinol, and biochanin A, have been studied for their beneficial and protective effects against AP and in the prevention of pancreatic cancer (PC).^[5] These nutraceuticals can regulate inflammation, showing potent antioxidant properties against hydrogen peroxide/free radicals and oxidative damages derived by lipid oxidations, and downregulate pro-inflammatory cytokines. They have inhibitory activity against the nuclear factor kappa-light-chain-enhancer of activated B cells and Janus kinase/signal transducers and activators of transcription pathways, upregulating pro-inflammatory cytokines as the interleukin (IL)-6 and IL-17, and promoting the attenuation of the immune cell migrations, lowering chemokines levels.^[4,5] Moreover, published data underlined that they can modify cell apoptosis processes, stop calcium overload, reduce pancreatic and extra-pancreatic inflammation, and inhibit the development and progression of PC acting on different

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DOI:

10.1097/CM9.0000000000002396

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Chinese Medical Journal 2023;136(5)

Received: 29-05-2022; Online: 13-02-2023 Edited by: Yuanyuan Ji

signaling pathways, such as NF- κ B, COX-2, and EGFR, that are aberrant in case of malignancy.^[5] Furthermore, nutraceuticals also modulate epigenetic processes through the down-regulation of coding genes and microRNAs, influencing pancreatic stellate cells and tumor microenvironment.^[5] They are considered promising agents for the prevention of PC. More importantly, nutraceuticals could also be used as an adjuvant therapy to enhance the effect of standard chemotherapy for better patients' outcomes. However, more clinical trials and *in vivo* and *in vitro* studies are warranted to explore this field.^[5]

In conclusion, diet is considered one of the most important elements to maintain and promote good health and to prevent chronic diseases. Nutrition is a major modifiable determinant. Daily diet can have an influence (positive or negative, based on ingested foods and nutrients) on pancreatic health and on overall health. The global use of functional foods as nutraceutical supplements, probiotics, prebiotics, and herbal products has been rising, sometimes out of medical control. These products attract patients' interest and healthcare systems to manage both acute and chronic disorders. But today the market is still very huge and more studies are required to provide a definitive opinion on the clinical benefits and safety of regular consumption of these products for the pancreas.

Conflicts of interest

None.

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How to cite this article: Saviano A, Zanza C, Longhitano Y, Nista EC, Franceschi F, Ojetti V. Effects of functional foods, nutraceuticals, and herbal products on pancreas. *Chin Med J* 2023;136:619–620. doi: 10.1097/CM9.00000000000002396