



Probiotics: Trend of Recent Publications

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Paying attention to food has always been an important issue in human societies. History of science shows that with the first signs of civilization and the development of science, Aristotle and other frontiers have recommended eating food with medicinal and functional properties. In the last century, and especially with the concern of antibiotic resistance, the use of functional food has been more and more noticed by modern humans. Undoubtedly, probiotics are one of the most important functional foods. Immediately after the introduction of the subject in the late 1900s, a flood of researches and articles were reported in this field by microbiologists, biotechnologists, food researchers, and pharmacists. The specific objective of the letter is to focus on research papers published in the last few years within the "Applied Biotechnology Reports", "Iranian Journal of Microbiology", and "Applied Food Biotechnology" journals (as sample journals) with a clear goal of categorizing reports in probiotic science and technology in all aspects: from screening and technological aspects to health beneficial, medical and bio-decontamination properties.

One of the most promising aspects of probiotics was their native concept and familiarity with the human body and life. Practically, nothing was supposed to enter where it was not or shouldn't. Immediately after the introduction of the subject in the late 1900s, a flood of researches and articles were presented in several aspects, including general, functional, and technological characteristics.¹⁻³⁹ Researchers started screening of probiotics, from food, humans, and the environment. *In vitro* and *in vivo* usage of probiotics were reported one by one. Application of probiotics to inhibit growth of other microorganisms,⁴⁰ as well as prevent and treatment of somatic disorders have published.⁴¹⁻⁵⁵ A new trend in this context is postbiotics impacts of their culture.⁵⁶ Anyway one main branch in probiotic research is increasing of their survival during shelf life of foodstuffs and in

gastrointestinal tract via optimizing process condition and encapsulation techniques.⁵⁷⁻⁶⁴

Anyway, reports showed that *in vivo* impact following application of probiotics is a controversial concept due dependence of health-beneficial properties to various factors including organism (survival, age, physiology, health condition, and gut microbiota), environment, and consumption instruction (microbial dose, treatment duration, type and shelf life of medicine or food, as well as packaging and process condition). Review of researches indicate that despite controversial reports about clinical impact of probiotics, most articles confirm each other in one issue, ability of probiotics to decontaminate of food and feed. These bio-decontaminators are able to entrap pollution by adsorption to the cell surface of the cell in the live or inactive form.⁶⁵⁻⁷⁰ This view is killing two birds with one stone, even if their health-beneficial effects are denied, at least their decontamination effects are undeniable. I believe that the main two trends in the future regarding the probiotic aspect would be new approaches for enhancing the performance of probiotics (e.g. encapsulation, co-culture, prebiotic application, etc.), as well as the application of probiotics as bio-decontaminator. With the activity of human industrial life, pollution is increasing. These pollutants slowly accumulate in soil and water and as a result food, and there are reports about the possibility of accumulation in the human body. There are various ways of decontamination, but biological methods are friendly and efficient bio-detoxification is the main scope of new research and a green method to overcome contamination in the human environment. The effect of probiotics in dysbiosis,⁷¹ oxidative stress,⁷² colon cancer,⁷³ even in poultry health.⁷⁴

Probiotics are already known for providing health-beneficial properties in food and feed. In any case, what will be the future trend? What are the unsolved problems in understanding the correlation between the load of microorganisms

in food and gut microbiota? A step towards another era of probiotics' role in human wellbeing is the concept of the ability to colonize each probiotics in gastrointestinal tract, which widely depends on genetics, nutritional habits, food characteristics, and many various factors in life style of the host. Also, another new trend for probiotic research would be interaction with "exotic microbial species/strains" and postbiotics. Investigating team works from Iran and other Asian nations created a large part of the reports pointed out in this brief article. Researches are coming from distinctive nations all over the world and dissemination of 21st century communications instruments encourages access to data and the sharing of our most recent research findings.

Conflict of Interest Disclosures

The authors declare that they have no conflicts of interest.

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