

Feeding the Microbiota: The State of Prebiotic and Probiotic Research

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Since approximately 2000 BC, some form of medicine has been practiced for the treatment of maladies. Beginning with the use of roots, then progressing to using prayer and potions, and, ultimately, in the 1940s, to the discovery and use of medicinal drugs, specifically antibiotic drugs, the use of external concoctions to aid the body in regaining and maintaining a state of health has been pursued by both the lay man and the health professional. Recently, much debate has risen as to whether the side effects of these medicinal drugs are worth the alleviation of the conditions they are meant to treat. This concern is particularly strong for the excessive reliance on antibiotics, which has now created superbugs resistant to medication. Often times these superbugs become deadlier than their original forms as they are able to mutate faster than scientists are able to develop new treatments. As a response, science is turning back to nature for an answer; enter probiotics.

The study of probiotics, prebiotics and their food forms is fast growing. Probiotics are living microorganisms that, when consumed, have the potential to confer a beneficial health effect. Most scientists today will agree that the microbiome plays an important physiological role for the host when it comes to bacterial interaction. Thus, dietary modifications to manipulate said interaction are being explored. In principle, there are two major strategies for influencing the microbiota: one is the use of living bacteria added to the food, which must survive the gastrointestinal tract to be active in the colon (probiotics). The second strategy is the use of dietary ingredients that are non-digestible, reach the colon, and can be used by health-promoting colonic bacteria (prebiotics).

Most people today suffer from some form of diet-related health condition, including obesity, various types of cancer, food hypersensitivity and allergies, cardiovascular diseases and degenerative ailments. The use of prebiotics as a functional food component in the diet seems to be a feasible option to improve the quality of life of people presenting the previously mentioned health conditions. This possibility is being explored by several clinical trials, the food industry, and large-scale research projects such as the Human Microbiome Project. All of these efforts are expected to revolutionize the prebiotic and probiotic world by developing specific functional properties.

Health claims related to pre and probiotics include the prevention of weight gain in adolescents and as a way to strengthen the immune systems of population groups at risk, including newborns and the elderly. Beyond food and pharma, these functional ingredients are also expected to penetrate the wellness sector on a larger scale, including cosmetics and skin care as a large potential market. Prebiotics are also likely to replace the antibiotics used in animal-related activities destined for human consumption. Nevertheless, all claims and working mechanisms of these applications remain under scrutiny by expert watchdog groups and continue in the need for rigorous scientific evidence. With the potential role of prophylaxis and amelioration, the study of the prebiotic and probiotic fields continues to develop.

Derived from the Greek meaning 'for life', the word 'probiotic' been used in various different ways, evolving over the years in accordance to its application and scientific development. Having been initially used by Lilly and Stillwell in 1965 [1], it was implemented to describe a compound secreted by one microorganism which in turn provided the stimulation for the growth of another. In this sense, the meaning was contradictory to an antibiotic. The term was later used by Sperti [2] to describe tissue extracts that stimulated microbial growth. The meaning in which it is more commonly used today came around in 1974 with the work of Parker [3]. His definition was 'Or-

ganisms and substances which contribute to intestinal microbial balance.' Fuller [4] redefined probiotics as 'a live microbial feed supplement which beneficially affects the host animal by improving its intestinal microbial balance.' With this definition, Fuller attempted to highlight the importance of viability for the use of probiotic substances.

Probiotics and prebiotics work on the premises of manipulating the microbiota. A healthy microbiota for humans then translates into a more efficient immune response, avoidance of gastrointestinal-related conditions such as leaky gut syndrome, faster recovery from intestinal infections when these are present, less severe allergic responses, as well as improved digestion. Research has shown that probiotics and prebiotics may be useful in achieving these and other positive effects, provided that proper strain, product selection, and dosing guidelines of commercial products are followed.

Conclusion

There is a need to consolidate the basic and applied research on probiotics and prebiotics into useful tools for food and nutrition professionals. Information on probiotic species, applications for specific strains, dosages and forms, safety, and shelf life is not sufficiently summarized to allow practical and consistent recommendations to be made by most food and nutrition professionals. In addition, prebiotic fibers-although providing nutraceutical and nutritional value-are a group of diverse carbohydrate ingredients that are poorly understood in regard to their origin, fermentation profiles, and dosages required for health effects. The science and practice-based guidelines under development will enhance clinician and client understanding of probiotics and prebiotics, with the aim of improving appropriate recommendations and informed use of these emerging dietary ingredients and the products containing them.

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