

Role of Probiotics in Medical Practice

Hippocrates said that “Let food be the medicine and medicine be the food is certainly the tenet of today”.¹ The most common problem prevailing in the field of medicine is the development of resistance to a range of antibiotics by the important pathogens. The promiscuous and heavy use of antibiotics has led to the emergence of multi-resistant strains of bacteria. This unfortunate development has led scientists to shift the paradigm of treatment from specific bacteria elimination to altering bacterial ecology by use of probiotic.² Nobel laureate Élie Metchnikoff, postulated in 1907 that yogurt-consuming Bulgarian peasants lived longer lives because of this custom. He suggested that “the dependence of the intestinal microbes on the food makes it possible to adopt measures to modify the flora in our bodies and to replace the harmful microbes by useful microbes”.³ Metchnikoff proposed that consumption of fermented milk would “seed” the intestine with harmless lactic-acid bacteria and decrease the intestinal pH, and that this would suppress the growth of proteolytic bacteria. Different species of microorganisms such as lactic acid bacteria or yeasts have been proposed for human use.⁴ The concept of probiotics was thus born and a new field of microbiology was opened.

Probiotics are live microorganisms that provide health benefits to the host when ingested in adequate amounts. Probiotics are referred to ingested microorganisms associated with benefits for humans and animals. The term *probiotic* is derived from the Latin preposition pro (for) and the Greek adjective (biotic), the latter deriving from the noun (bios, life). A consensus definition of the term *probiotics*, based on available information and scientific evidence, was adopted after a joint Food and Agricultural Organization (FAO) of the United Nations and World Health Organization (WHO) expert consultation. In October 2001, this expert consultation defined probiotics as live micro-organisms that “when administered in adequate amounts, confer a health benefit on the host.” This definition necessitates that probiotics must be alive when administered (dead microbes cannot be called probiotic), must be the

subject of research documenting health benefits and must be microbiologically defined.^{5,6,7}

The microbes most often used as probiotics include species of the genera *Lactobacillus* and *Bifidobacterium*. Other probiotics include *Streptococcus thermophilus*, *Saccharomyces cerevisiae* (biovariant *boulardii*), and *Bacillus coagulans*. These microorganisms are different in their mechanism of action and indication.⁵ Major probiotic mechanisms of action include enhancement of the epithelial barrier, increased adhesion to intestinal mucosa, and concomitant inhibition of pathogen adhesion, competitive exclusion of pathogenic microorganisms, production of anti-microorganism substances and modulation of the immune system.⁸ Several factors are now leading physicians to examine probiotics and other alternatives to pharmaceutical remedies. These include the surging levels of multidrug resistance among pathogenic organisms, particularly in hospitals, the increasing demands of consumers for natural substitutes for drugs, and the emergence of scientific and clinical evidence showing the efficacy and effectiveness of some probiotic strains.

Probiotics could be used for several conditions such as diarrhea, necrotizing enterocolitis, candidal vaginitis, urinary tract infections, immune disorders, Irritable bowel syndrome, inflammatory bowel disease, recurrent abdominal pain, lactose intolerance, hypercholesterolemia, food allergy, to prevent and to treat post-surgical infections.⁹⁻¹⁵ Health care providers use probiotics in their practices, even though the quality of evidence varies and additional, well-controlled human trials would enable stronger conclusions on best probiotic use. The manipulation of the gut microbiota is complex and may cause bacteria-host interactions.¹⁶ Though probiotics are considered safe, some have concerns about their safety in certain cases.¹⁷ Clinical use of probiotics for vulnerable patients (such as premature infants or critical care patients) must be done with care. Probiotics for such uses should have demonstrated safety for the target patient population and should meet high quality standards.¹⁸ Some people, such as those with immuno-deficiency, short bowel

syndrome, central venous catheters, cardiac valve disease and premature infants, may be at higher risk for adverse events.¹⁹ In severely ill people with inflammatory bowel disease there is a risk of the passage of viable bacteria from the gastrointestinal tract to the internal organs (bacterial translocation) as a consequence of bacteremia, which can cause adverse health consequences.²⁰ Rarely, consumption of probiotics by children with lowered immune system function or who are already critically ill may result in bacteremia or fungemia, which can lead to sepsis, a potentially fatal disease. It has been suggested that *Lactobacillus* contributes to obesity in humans, but no evidence of this relationship has been found.²¹

There is no doubt that we will witness a significant increase in the role of probiotics in nutrition and medicine in the coming years. Their application in the prevention and treatment of various disorders should be considered by medical professionals as well as should be promoted by the food industry. The critical step in wider application will be to make products available that are safe and clinically proven in a specific formulation easily accessible to physicians and consumers. Efforts are needed to advance the scientific knowledge of probiotics and determine their mechanisms of action, as well as describe when and why they fail in certain situations. Various processing advances, such as microencapsulation and bacterial coating and addition of prebiotic compounds used as growth factors by probiotic organisms, will provide the means to optimize the delivery and survival of organisms at the site of action.¹⁴ While many invasive interventions will be necessary long into the future, many other aspects of medicine will change dramatically in the next decades.

The key to a long, healthy life likely does lie in our food and microbes - we just need to understand how best to align them, in some cases also taking into consideration our genetic endowment. Time will tell how quickly we embrace the future.

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