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Understanding the Importance of the Gut Microbiome for Overall Health and the Role of Probiotics

The gut microbiota, all the microorganisms (bacteria, fungi, viruses, and archaea) that colonize the gut, plays a key role in metabolism, nutrition, physiology, and, subsequently, health. Variations attributed to the gut microbiota, such as the diversity and abundance of microorganisms in the gastrointestinal (GI) tract, contribute to the millions of unique genes that make up the gut microbiome.[1-4]

GUT MICROBIOTA

The gut microbiota is an area of emerging research that has become a ubiquitous topic of scientific and popular interest. It plays a role in the maturation and maintenance of the GI tract, nutritional contributions to the host, and protection from pathogenic microbes.[2,3] Although humans are thought to be exposed to microbes in utero, major colonization of the human microbiota, including the GI tract, begins during birth.[1] From birth through adulthood, factors that may influence normal gut microbiota include gestational age, mode of delivery, diet during infancy, and exposure to antibiotics, either through direct use or from the environment (ie, the presence of antibiotics in food).[3] The microbiota established in a newborn infant comprises mostly *Lactobacilli* and *Bifidobacteria.* After 1 year of age, the microbiota begins to stabilize, resembling that of a young adult by age 3, colonized predominantly with 2 major phyla, Firmicutes and Bacteroidetes.[1,3,4,9]

GLOSSARY[1,2,4-10]

Term	Definition
Colony-forming units	The number of viable bacteria or fungal cells in a sample; the appropriate unit of measurement for probiotics
Fermented foods	Foods or beverages made through controlled microbial growth and enzymatic conversions of major and minor food components (fermentation), such as carbohydrates, producing interesting flavors, textures, and smells
Gut microbiome	The microorganisms in the intestines of the human gastrointestinal tract and the most densely concentrated region of microbes in the human body
Microbial abundance	The relative representation of a particular microbe in a microbial ecosystem
Microbial diversity	The spectrum of variability among all types of microorganisms in the human microbiome
Microbiome	The organisms of the microbiota and their collective genomes
Microbiota	All the microorganisms that live inside and on the human body
Probiotics	Live microorganisms that, when administered in adequate amounts, confer a health benefit on the host
Probiotic strain	The key designation of a probiotic that can be tied to clinically demonstrated health benefits, usually listed as the third and final component of a probiotic name, eg, *Lactobacillus rhamnosus* GG

THE RELATIONSHIP BETWEEN GUT MICROBIOTA AND OVERALL HEALTH

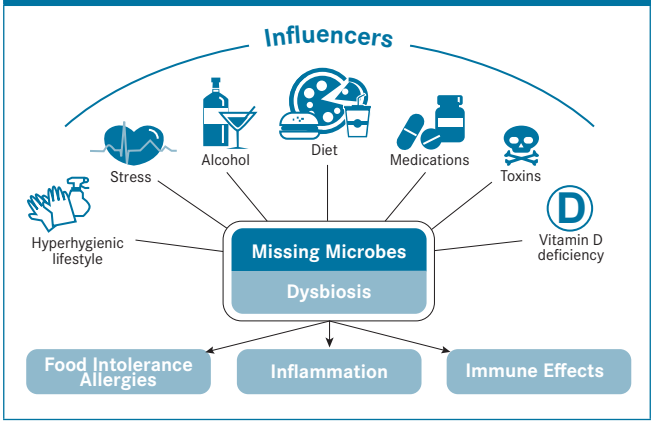
The symbiotic relationship between the microbiota and the host influences overall health and the risk of disease as well as behavioral and cognitive functions.[10] In addition to assisting with gut barrier protection, nutrient production, neuroendocrine communication, and digestion and absorption, the gut microbiota supports immune function.[3,10]

Adverse changes in the gut microbiota, known as dysbiosis, are associated with a variety of influencers (FIGURE[11]).[12] Low microbial diversity or abnormal gut microbiota may be associated with disease, including antibiotic-associated diarrhea, *Clostridioides difficile* infections, diabetes, irritable bowel syndrome, allergies, depression, and anxiety.[3,13] Furthermore, the loss of diversity of the gut microbiota, which is typically observed in elderly adults, has been associated with increased frailty and reduced cognitive performance in this vulnerable population.[11]

BENEFITS OF PROBIOTICS TO THE MICROBIOTA

Probiotics are live microorganisms that supplement the microbiota to confer a health benefit if administered in adequate amounts.[8] The health benefits of probiotics in clinically verified amounts include promoting the balance of intestinal microbiota, aiding digestion, and supporting the immune system through mechanisms similar to endogenous microbiota.[2,14] Because the fermentation process uses microorganisms to transform food products, patients may consider fermented foods to be a source of probiotics, and, importantly, clinicians should educate patients on the distinction between probiotics and fermented foods. Fermented foods, such as yogurt, use beneficial microorganisms to achieve a desired flavor and texture; however, fermented foods typically do not contain a clinically proven probiotic strain or provide microorganisms in adequate amounts to result in health benefits. In addition, some fermented foods require additional processing, such as heat treatment, filtration, or pasteurization, which can inactivate or remove any live microorganisms. Therefore, to achieve the desired health benefit, it is important that patients choose a clinically proven probiotic supplement (*see Considerations for the Selection of a Probiotic section*).[6]

FIGURE. THE EFFECT OF INFLUENCERS ON THE MICROBIOME[11]



The Importance of Probiotic Strains

A probiotic is classified by the genus, species, and subspecies (if applicable) and an alphanumeric identifier for specific strain designation. Nomenclature and strain designations for probiotics are important, as certain benefits are based on clinical evidence for specific strains or combinations of strains. Potential probiotic health benefits can be attributed to only the strain(s) tested and not to a species or a whole group of lactic acid bacteria. Each strain will have unique properties that may result in certain metabolic, neurological, immunological, and antimicrobial effects. Furthermore, different organisms will have varying abilities to survive in the GI tract, as well as strain-specific features that enable them to compete with pathogens and exert an effect on mucosal immune mechanisms that may lead to an overall health benefit.[8,15]

Select probiotic strains reduce the incidence and duration of antibiotic-associated diarrhea, reduce colic symptoms and eczema, and decrease the incidence or duration of common infections.[16]

Commonly available probiotic strains include *Lactobacillus rhamnosus* GG, *Bifidobacterium infantis* 35624, *Lactobacillus acidophilus* La-14, *Lactobacillus acidophilus* NCFM, and *Lactobacillus rhamnosus* HN001.[14]

TABLE. FACTORS TO CONSIDER WHEN CHOOSING A PROBIOTIC

Resists the harsh upper gastrointestinal tract conditions
Adheres to human intestinal cells
Colonizes the human intestinal tract
Inhibits illness-causing bacteria
Balances immune responses
Is clinically supported and safe

CONSIDERATIONS FOR THE SELECTION OF A PROBIOTIC

When selecting a probiotic, patients should look for key elements on the label, such as the genus, species, and strain of every microbe in the product; the colony-forming units (CFUs) per dose at time of expiration; the suggested dose; the proper storage conditions; and contact information for the manufacturer.

Selection of a probiotic should be based on clinical evidence that supports the desired health benefits associated with a specific strain at a certain dose. Increasing the number of microorganisms, as noted by the CFUs contained within a probiotic supplement, does not necessarily result in increased benefits. Clinical trials determine the effective dose for each probiotic strain or formula, which could be as low as 100 million CFUs per dose depending on the strain and the desired benefit.[5,8]

The TABLE includes factors to consider when choosing a probiotic.

THE ROLE OF THE PHARMACIST

With ready access to patients and their prescription drug information, pharmacists are uniquely positioned to educate patients about the human microbiome, factors that may affect the gut microbiota, and the role of probiotics. Patients with certain disease states and specific populations, including elderly adults and children, provide pharmacists with an opportunity to discuss the clinical benefits of probiotics and explain the differences between different strains and products.

Pharmacists play a critical role in antibiotic stewardship and ensure that patients are educated on the appropriate use of antibiotics. They are also primed to inform patients on how the use of probiotics in adequate amounts may ameliorate adverse effects that result from antibiotic use and may stabilize the gut microbiota. As children under 2 years receive the most prescriptions for antibiotics, this population of patients presents an opportunity for pharmacists to educate patients on the benefits of probiotics for supporting a healthy microbiota to reduce and prevent antibiotic-associated diarrhea and improve immune response.[8,17]

In addition, because some medications that are available over the counter may disrupt the microbiome, such as nonsteroidal anti-inflammatory drugs and proton pump inhibitors, pharmacists have an opportunity to identify patients seeking recommendations regarding these medications and to be proactive in educating them about the potential role of probiotics, if appropriate. Importantly, pharmacists can increase awareness of the characteristics of an ideal probiotic. As health benefits are strain specific, knowledge of clinical data will aid in the recommendation of probiotics to each patient. Pharmacists can educate their patients about the available probiotic options, especially those that are high-quality supplements that have clinically demonstrated a specific or desired health benefit.

References are available at PharmacyTimes.com.