

## Role of the Microbiota in Health and Disease

The health information of the National Health Association (NHA) is grounded in the principles and requisites of hygienic living that strongly emphasize our important relationship with the natural world and the organisms that live in our inner and outer environments. Therefore, the NHA recognizes and respects the interdependence of all species. This is especially important when you consider that living within each of us is a vast, teeming world of microorganisms that are essential to life and health. This population of organisms (approximately 50-100 trillion) is referred to as the microbiota and is significantly greater than the entire number of body cells (approximately 10 trillion). Several pounds of these organisms live in our large intestine as the gut microbiota (GM). This remarkable arrangement begs the questions, “Why do we have this universe within, and what are these creatures doing among us?”

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As scientific research continues to shed light on this remarkable relationship, it has become apparent that the diversity, activity, and biochemistry of the GM plays an important role in health and disease and affects a variety of the body's functions, including nutrition, mood/mental health, cardiovascular health, regulation of inflammation, function of the immune system, satiety/eating behavior, and even cancer.

Many of these effects are mediated by a network of 100 million nerve cells buried in the walls of the digestive system, from mouth to anus, which controls every aspect of the digestive process from swallowing to enzymatic digestion, food transport/motility, and ultimately fecal elimination. This enteric nervous

system (ENS) has been referred to as the “little brain,” and it communicates directly with the big brain. The incredible communication between the GM, the ENS, and the brain has been popularized as the gut-brain connection.

### **Foundation of the Gut Microbiota**

Diet shapes the gut microbiota from birth to adulthood. The foundation of a healthy GM is established by the birthing process as well as the manner in which we are fed in the early months and years of our lives. The NHA has always promoted the importance of natural childbirth and breastfeeding for the optimal health of mothers and their

children. Interestingly, consistent with the recommendations of the NHA, babies that are born vaginally and breastfed have healthier and more diverse species of GM. Breastfed babies have more Bifidobacteria (including *Bifidobacterium infantis*) and other varieties of microorganisms that establish a healthy immune system, including the highest concentration of the immunoglobulin secretory IgA, which is concentrated in breast milk and is the most prevalent, protective antibody of the immune system. Bottle-fed babies have significantly fewer protective bacteria and immune-enhancing antibodies while having more cytokines like IL-6 that work as targets for and promoters of inflammation throughout the gut and body. The integrity of our immune system is established in the earliest moments of our lives by our gut microbiota, and disturbances of the GM in infancy can lay the foundation for allergies, asthma, and irritable, inflammatory bowel conditions later in life.

## Diet shapes the gut microbiota from birth to adulthood.

### Nutrition and Diversity of the GM

While there are a number of organizations that promote plant-based eating, the NHA is the oldest established health organization in the world promoting plant-exclusive nutrition without added salt, oil, and sugar (SOS-free). This eating plan has profound effects on human health and the GM. It is important to realize that the gut microbiota of children and adults who eat a varied, high-fiber, plant-based diet have a diversity and number of GM species that are significantly more health-promoting than people eating diets loaded with low-fiber, refined carbohydrates and animal products. This is the case regardless of whether they live in an industrialized Western nation or in more-primitive tribal cultures in the Amazon.

For example, plant-exclusive diets that are high in fruits and vegetables with less saturated fat support a microbiota containing the genera *Prevotella* and *Ruminococcus* that reduce inflammation,

arterial stiffness, and cardiovascular disease. They also include Bifidobacteria and other lactic acid bacteria that promote a local acidic environment in the intestine that protects cells of the colon from cancer. Consuming a diet high in animal protein, saturated fat, and processed foods decreases healthy bacteria and increases pathogenic versions of Bacteroides, Firmicutes, and Bilophila that significantly increase inflammation. While there is no absolutely “normal” GM, it is the diversity of the gut microbiota that is promoted by high-fiber plant foods that determines a healthy, well-functioning GM.

When you eat, the macro- and micronutrients of the diet are absorbed in the small intestine. But the fiber content of food is not digested and absorbed. Diverse high-fiber plant foods (including oats, bananas, whole grains, legumes, potatoes, onions, nuts, and seeds) provide the prebiotic nutrients fiber (soluble and insoluble) and resistant starch. These are transported to the large intestine (colon) where they are fermented by the GM to produce short-chain fatty acids (SCFA) including propionate and butyrate, while also promoting the postbiotic production of vitamins, amino acids, neurotransmitters, and phytonutrients.

The SCFA butyrate that is produced by the GM helps produce the mucous bilayer that lines and protects the cells of the colon. This mucous lining produces mucus that promotes movement of food residue through the colon, and it also protects the colonic epithelial cells from toxin exposure in the gut that can promote irritation, damage, and even colon cancer.

### Dysbiosis and the Immune Response

A healthy gut microbiota and protective immune response are promoted by several important lifestyle factors that are strongly emphasized by the NHA, including a whole-plant diet, exercise, sleep, emotional poise, sun exposure, and the elimination of toxic chemicals in your food and environment. An excess of the adrenal hormone cortisol (which is released in chronic stress), alcohol, weed killers like the glyphosate that is heavily sprayed on GMO foods (including soy and corn), a low-fiber meat/dairy/refined-sugar diet, and antibiotic use all act as “gut disruptors” that can damage a healthy, balanced, probiotic GM creating a condition of dysbiosis.

This results in an overgrowth of potential toxic organisms as well as a breakdown in the normal protective mucous lining of the gut. This can cause a “leaky gut” lining that allows larger protein fragments and toxic by-products of digestion and bacterial endotoxins to seep out of the intestines and into cells and the circulating bloodstream. This leakage can irritate and infect cells of the colon and incite the immune system to promote inflammation, potential food sensitivities, and allergies, and, at its worst, autoimmune diseases like rheumatoid arthritis, lupus, and a form of low thyroid function known as Hashimoto’s thyroiditis.

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### Impact of the Gut Microbiota on Cardiovascular Disease

Typical animal-based diets high in animal protein and saturated fat that masquerade as quick-fix weight-loss plans (such as Paleo and Keto diets) promote remarkable cardiovascular risk that is mediated to some degree by the GM. Diets high in red meat, fish, and eggs are high in choline and L-carnitine, and there are more than nine different species of bacteria in the GM that convert these chemicals into the compound trimethylamine-N-oxide (TMAO). TMAO increases the risk of atherosclerosis<sup>1</sup> and the risk of all adverse cardiac events, including myocardial infarctions, stroke, and death.<sup>2</sup> Elevated levels of TMAO have been measured in people with heart failure<sup>3</sup> and are also associated with an increased risk of thrombosis (blood clots). Both TMAO production and the activity of the liver enzyme that catalyzes the final production of TMAO are significantly lower in people who consume plant-exclusive diets.

## Impact of the Gut Microbiota on Mental Health

There is evidence of communication between the GM and the brain via SCFA, bile acids, and the amino acid tryptophan. However, it is not completely clear if this is a direct connection between the GM and the nervous system via specific endocrine and chromaffin cells or if these chemicals are being transported via blood circulation. The GM produces neurotransmitters that affect mood and our pleasure-reward system similar to those created by the brain itself, including dopamine, serotonin, norepinephrine, and gamma-amino-butyric acid (GABA).

Irritation and inflammation in the gut can send signals to the brain that trigger mood change, which may be mediated by the gut microbiota. Dysbiosis of the GM can promote inflammation, the release and absorption of endotoxins from other infectious bacteria in the gut, and the release of cytokines, including TNF-alpha and MCP. These cytokines target and promote additional inflammation and chemical stress, which can damage the blood-brain barrier (the tight junction of small blood vessels that protect the brain from toxic chemicals circulating in the blood), resulting in increased brain toxicity and potentially anxiety, depression, and memory loss.

## Impact of the Gut Microbiota on Cancer

The NHA-sanctioned high-fiber, SOS-free, whole-plant-food diet promotes the production of GM metabolites that can positively affect gene expression and cancer risk in humans. Specifically, a diverse, plant-exclusive diet promotes the GM's production of enzymes that transform and activate healthy phytonutrients in plants, including isothiocyanates found in cruciferous veggies (broccoli, cauliflower, and brussels sprouts) and polyphenols (catechins, tannins, and isoflavones found in berries, pomegranates, walnuts, green tea, and soybeans). These phytonutrients epigenetically modify the structure and expression of gut cell genes to inhibit and kill cancer cells in the colon.<sup>4</sup>

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## In Conclusion

This information strongly suggests that optimal health relies on your support of the dynamic microbiota that lives within you. The NHA recommends routine food and lifestyle choices that are not only in your best interest but also in the best interest of your remarkable inner world. By avoiding animal products; refined/processed, low-fiber junk food; pesticides; antibiotics; and toxic food additives and adhering to a whole, SOS-free, plant-exclusive diet, you will provide the variety of vegetables, fruits, and fiber that your gut microbiota needs and loves to eat, thereby nourishing and nurturing a diverse GM that is essential for your optimal well-being and improved quality of life.

## REFERENCES

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