

Second Brain in your Gut

Let Food Be Thy Medicine

—Hippocrates

The original Hippocratic Oath focused on dietetics and lifestyle measures to help the patients to the best of a physician's ability. Nutrition is one of the main tools the doctor can use on his patients. But in the modern adaptation of the oath the significance of diet is somehow hidden.

For millions of years human nutrition has had profound influence on both individual and community-based health. It has shaped human development, cultures, history, war, science, medicine and development. This is the reason that nutrition research stands at the center of medical, economic, cultural and social focus. A study in 2017 in 195 countries estimated 11 million deaths attributing to dietary factors, and therefore responsible for one of the most important risk factors for death in the world. This has considerable effect on mortality and morbidity of Noncommunicable diseases burden in the world.¹

Food – The Healing Force. Health experts have recognized that appropriate nutrition was capable of preventing disease. Food can rejuvenate, heal and restore health in a sick person. Many traditional foods have body healing chemicals, antioxidants, dietary fibers and probiotics. The functional components in food help in weight management, control of blood sugar levels, mood elevation and enhance immune system of the body.² We are entering the age of Genomics, and a new era of healing with food is center stage. According to researchers the impact on humans of genetics and single nucleotide polymorphism is the tip of the iceberg, while epigenetics is the bottom of the iceberg. Epigenetics may be one of the most important molecular mechanisms linking environmental stimulation, fetal programming, and adulthood phenotype. Epigenetics is emerging as an important factor in risk of diseases of global importance including obesity, cardiovascular disease and cancer. Since epigenetic processes can be modified by nutrition, it may be possible to modify inappropriate epigenetic marks by nutritional interventions to reduce disease risk. Unlike gene polymorphisms which have been the focus of understanding the role of inherited disease susceptibility for some time, epigenetic can be modified by environmental factors, in particular nutrition. Nutrition and chemical pollution are factors that may be responsible for pathogenesis of several diseases. This may contribute to a major worldwide health concern in even future generations and community by epigenetic transmission. In depth knowledge of their molecular basis and signaling mechanism will help in intervention to improve societal health.³

Food is a pivotal determinant of gut microbiota community structure and function. Gut microbiota is the ecosystem present in the gut. Introducing dietary signals into the nexus between the host and the microbiota, nutrition sustains homeostasis or contributes to disease susceptibility. There are health benefits and detrimental consequences that the interactions between dietary and microbial factors elicit in the host. Immune system is the gatekeeper of one's health. It protects a person against external pathogens, parasites, viruses and most of all diseases. When the immune system is attacked repeatedly by a host of bad microorganisms, one's innate and adaptive immune systems have to keep getting into gear, thereby overtaxing them. While fighting these invaders, antibodies are created by the immune system. To protect the body, the antibodies attack healthy cell tissue as well creating a state of chaos within the body.

Communication exists between our gut microbiota and the immune system in the intestines. These talks help in differentiating between harmful foods, and destructive microorganisms like salmonella which lead to gastrointestinal infections. The training to the immune system is given by the microbiota to make the differentiation. The intestinal immune cells are mobile and can travel to new sites throughout the body. The memory T cells can remember their experience with the microbes in the gut and they may migrate from intestines today to lung or spinal fluid tomorrow. The microbes in our gut can control the responsiveness of the entire immune system. The food that we eat may nourish our bodies or throw it topsy turvy. So it is important to provide good bacteria to our body, staying away from antibiotics and painkillers and maintain the inner ecosystem.

Brain in your Gut. Scientists call this little brain the *enteric nervous system* (ENS). It lies in the wall of the intestine spreading through the entire length from esophagus to the anus. The ENS has 100 million neurons, similar to the number in the spine. There are different types of neurotransmitters secreted by ENS – acetylcholine, nor epinephrine, adenosine triphosphate, serotonin, dopamine, cholecystokinin, substance P, vasoactive intestinal peptide, somatostatin, leu-enkephalin, met-enkephaline, bombesin.⁴ Of these 80–90% of serotonin also called the feel good hormone is made in the gastrointestinal tract, i.e. the gut. Concealed in the walls of the digestive system, this "brain in your gut" is transforming medicine's understanding of the links between digestion, mood, health and even the way we think. This novel interpretation of the ENS-CNS connection helps explain the credibility of treatment with antidepressants, cognitive behavior therapy (CBT) for irritable bowel syndrome and bowel-disorders. The two brains in our body – converse with each other. So treatments that provides balm to one may remedy the other. The research discoveries may lead to modernistic treatments for obesity, eating disorders, diabetes and even depression and autism—all of which have been associated to an impaired gut. The results of a study at Icahn School of Medicine at Mount Sinai also explain why, many times eating makes us feel good. In this paper researchers have mapped a gut – to- brain neural circuit linking sensory neurons in the upper gut to striatal release of neurotransmitter dopamine "Even though these neurons are outside the brain, they perfectly fit the definition of reward neurons that drive motivation and increase pleasure," according to Araujo IE.⁵ The findings established that vagal gut to brain axis is the integral component of the neural reward pathway.

The gut talks to the brain. Motivational and emotional states of the body are regulated majorly by the gut. Therefore what we eat influences the brain health and even our mood. The microbiota in our gut also plays a significant role in our overall health. We need to nurture our brain – we must give it good natural nutrition – both macro- and micronutrients are significant. Our diets should include vegetables, fruits, whole grains, dairy products, lean meat and fish. We need to take in diet high in fiber and omega 3 fatty acids. Probiotics

and probiotic food help to nurture healthy microbiota in the gut. What we eat and how we eat is significant. Healthy food not only saves us from chronic noncommunicable diseases but can also modify the response of our genes.

We are what we eat. We can literally reconstruct our bodies, rejig our mind and stir up our mood simply by choosing an inspiring diet – Eat Well – Eat Healthy.

Richa G Thaman

Editor and Professor

Department of Physiology

Sri Guru Ram Das Institute of Medical Sciences & Research

Amritsar, Punjab, India

References

1. GBD 2017 Diet Collaborators. Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2019; 393: 1958–72. doi: 10.1016/S0140-6736(19)30041-8.
2. Sarkar P, Kumar L, Dhumal C, Panigarhi SS, Choudhary R. Traditional and Ayurvedic foods of Indian Origin. *Journal of Ethnic Foods*. 2015; 2(3): 97-109.
3. Tiffon C. The impact of Nutrition and Environmental Epigenetic on Human Health and Disease. *International J of Molecular Science*. *Int. J. Mol. Sci.* 2018, 19, 3425; doi:10.3390/ijms19113425.
4. Guyton AC, Hall JE. Organisation of the gastrointestinal system. In Raj T. eds. *Guyton and Hall Textbook of Medical Physiology*. 2nd South Asian Edition. Delhi, India. Elsevier 2018 p 417-19.
5. Han W, Tellez LA, Perkins MH, Perez IO, Qu T, Ferreira J, Ferreira TL, Quinn D, Liu ZW, Gao XB, Kaelberer MM, Bohórquez DV, Shammah-Lagnado SJ, de Lartigue G, de Araujo IE. A Neural Circuit for Gut-Induced Reward. *Cell* 2018 10; 175(3).