The Gut Flora

A Synopsis of the Original Article [1]

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Editor's Note: *The gut flora are now recognized as such a vital influence on multiple organ systems, that despite space limitations, I felt it essential for this special issue to include at least a synopsis of the full review article from the Winter 2013 issue. The original article with all the references is available online.*

It is now established that the gut flora can profoundly affect everything from irritable bowel syndrome and inflammatory bowel disease to mental health, obesity, and Clostridioides difficile infection (CDI).

Colonization of the newborn's sterile gut occurs shortly after birth, and within a few days, bacterial colonies reach numbers in the billions, populated by Bifidobacterium, Bacteroides, Clostridioides, and Ruminococcus species.

The gut flora serve many important functions, including:

- digesting unutilized energy substrates,
- stimulating the immune system and cell growth,
- synthesizing vitamins,
- repressing overgrowth of harmful microorganisms.

The gut flora have an important role in immunity. Children with severe allergies have different bacterial compositions than children without allergies. In vitro studies have demonstrated that the gut flora are critical to the proper development of the immune system at a molecular level and are important in the expression of "pattern-recognition receptor" proteins, which allow the gut to distinguish between commensal, helpful organisms and pathogenic, harmful organisms. These proteins are strong familial risk factors for inflammatory bowel disease, which is relatively common in developed countries, but is virtually unreported in third-world nations. Excessive hygiene and relative lack of exposure to microorganisms may lead to faulty immune systems, and to autoimmune responses that result in inflammation. Further, certain bacterial strains have even been associated with accelerated tumor growth, while others have been shown to suppress it.

HARMFUL AND BENEFICIAL ALTERATIONS IN GUT FLORA

Antibiotics, by altering the gut flora, can cause diarrhea in a number of ways, independent of C. difficile infection (CDI). The presumed mechanism, an imbalance between beneficial and harmful bacteria, may also be a factor in other conditions, including irritable bowel syndrome (IBS). Probiotics are thought to restore a healthy balance, and they have clear benefit in disorders such as irritable bowel syndrome, inflammatory bowel disease, and superinfections with C. difficile. The latter has become increasingly troublesome recently because of the development of resistant and hypervirulent strains. When probiotics are not effective, fecal microbiota transplantation (FMT) is now commonly used. [2]

IMPLICATIONS FOR OTHER ORGAN SYSTEMS

The fact that bacteriotherapy has potential in neurological disorders underscores the critical relevance of the brain-gut axis. Certainly our minds profoundly influence gut function, but recent evidence suggests this is not a one-way street, as the composition of our gut flora can affect our mental health, well-being, and appetite.

When mice without their own native flora were fed bacteria from an obese twin, they got fat. When they were fed bacteria from a non-obese twin, they stayed slim. Furthermore, the flora from lean mice could "outcompete" the flora from obese mice: when the mice were mixed and ate each other's feces, the obese mice became leaner. Additionally, mice fed a high-fat diet retained their obese flora, but when they were switched to a leaner diet of fruits and vegetables, the lean gut flora took over. We have long known that antibiotics promote weight gain in farm animals, perhaps by altering their gut flora.

Gut bacteria have been implicated in psychiatric disorders like anxiety and obsessive-compulsive disorder. One recent study demonstrated that levels of HPHPA, the chemical byproduct of Clostridioides species, were higher in patients with autism and schizophrenia.

REFERENCES

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