The Role of Nuts in Modulating Gut Microbiota and Health

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Nuts act as a vital fuel for our gut microbiota thanks to their prebiotic properties, which support the growth of beneficial bacteria in our digestive system, promoting overall digestive health and well-being.

The gut microbiota is labeled by many as a "supporting organ" as it plays many key roles in promoting the smooth daily operations of the human body, including immunological education of the immune system, energy harvest from foods that are otherwise indigestible to humans and the production of short-chain fatty acids, the main energy source of intestinal epithelial cells.[1] Dietary interventions that target the gut microbiota have valuable implications for the maintenance of gastrointestinal health in the general population.[1] Nuts are nutrient-dense foods and a component of numerous dietary patterns, such as the Mediterranean, vegetarian and Portfolio dietary patterns. Nuts consist of a complex nutritional matrix rich in compounds that synergistically have been proven to have beneficial effects on major health problems, including cardiovascular diseases, diabetes, obesity and other chronic diseases.

It has been suggested that nuts have a prebiotic effect on the gut microbiota.[2] Prebiotics are described as "selectively fermented ingredients that result in specific changes, in the composition and/or activity of the gastrointestinal microbiota, thus conferring benefit(s) upon host health."[3] The potential mechanisms behind the observed prebiotic effect of nuts relate to their nutrient composition and physical structure. Nuts are rich in fiber and polyphenols, both of which are used as substrates by the gut microbiota. The fermentation of fiber by the gut microbiota produces short-chain fatty acids such as butyrate, which promote contractility and mucus secretion in intestinal epithelial cells, in part explaining the beneficial effect of the microbiota on gut function,[4] and decrease the level of cholesterol by inhibiting a critical enzyme for the synthesis of this molecule. Polyphenols have a bidirectional relationship with the host microbiota, in which the bacteria process polyphenols into absorbable products, and these products modulate the composition of the microbiota.[5] Nuts are also rich in lipids, which have low bioaccessibility as a consequence of intact cell walls providing a physical barrier to digestion in the upper gastrointestinal tract; as a result, the lipids might therefore reach the colon, where they are potentially used by the microbiota.[6] The food matrix of nuts might therefore represent a unique method of delivering a rich supply of fermentable nutrients such as fiber, polyphenols and lipids to the gut microbiota.[7]

According to various studies, nut consumption significantly changes the gut bacteria composition at a genus level.[8-10] The regular consumption of walnuts significantly increases the abundance of *Clostridium* and a consumption of over 45 grams of nuts a day for a period longer than four weeks significantly increases the abundance of *Dialister, Lachnospira* and *Roseburia* while decreasing the abundance of *Parabacteroides*. Interestingly, *Roseburia* appears to be affected by dose and duration of intervention, whereby a larger dose of nuts and a longer intervention lead to a loss of significance, indicating a potential adaptation of the microbiota over time.[7] The increase of *Clostridium*, *Lachnospira* and *Roseburia* due to nut consumption supports the hypothesis of the prebiotic effect of nuts. All three genera are known producers of butyrate, a four-carbon short-chain fatty acid produced through microbial fermentation of dietary fibers that is vital for gastrointestinal health, both as an energy source for intestinal colonocytes and in the maintenance of the intestinal epithelium. By promoting the growth of beneficial bacteria and increasing short-chain fatty acid production, these foods may reduce the risk of gastrointestinal disorders, such as inflammatory bowel disease and colorectal cancer.[7] Additionally, a diverse and balanced gut microbiota is associated with improved metabolic health and reduced risk of obesity and type 2 diabetes.[1,11,12] Therefore, incorporating nuts into the diet could contribute to weight management and metabolic stability. Regarding other aspects related to human health, such as cognition, a recent clinical trial showed that consumption of mixed tree nuts for a period of four weeks led to significant improvements in accuracy and speed of response in a picture recognition task while slightly changing the gut microbiota composition,[13] although further exploration is required to significatively assess the relationship between nuts and the gut–brain axis.

> *"Nut consumption shows a favorable prebiotic effect on the gut microbiota."*

In summary, the consumption of nuts shows favorable effects on the microbial community within the gastrointestinal tract. The significant fiber content, prebiotic attributes and polyphenolic composition of nuts supply nutrients to beneficial bacteria, stimulating short-chain fatty acid production and promoting a diverse and harmonious gut microbiota. The modulation of gut microbiota resulting from the dietary inclusion of nuts holds promising potential for enhancing gastrointestinal well-being, metabolic functionality and overall health. Further comprehensive investigation is needed to fully understand the precise mechanisms underlying the influence of nuts on gut microbiota and their enduring impact on human health. Nevertheless, incorporating nuts into a well-balanced dietary regimen offers an enjoyable and nutrient-rich approach to promoting gut microbiota wellness.

References

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