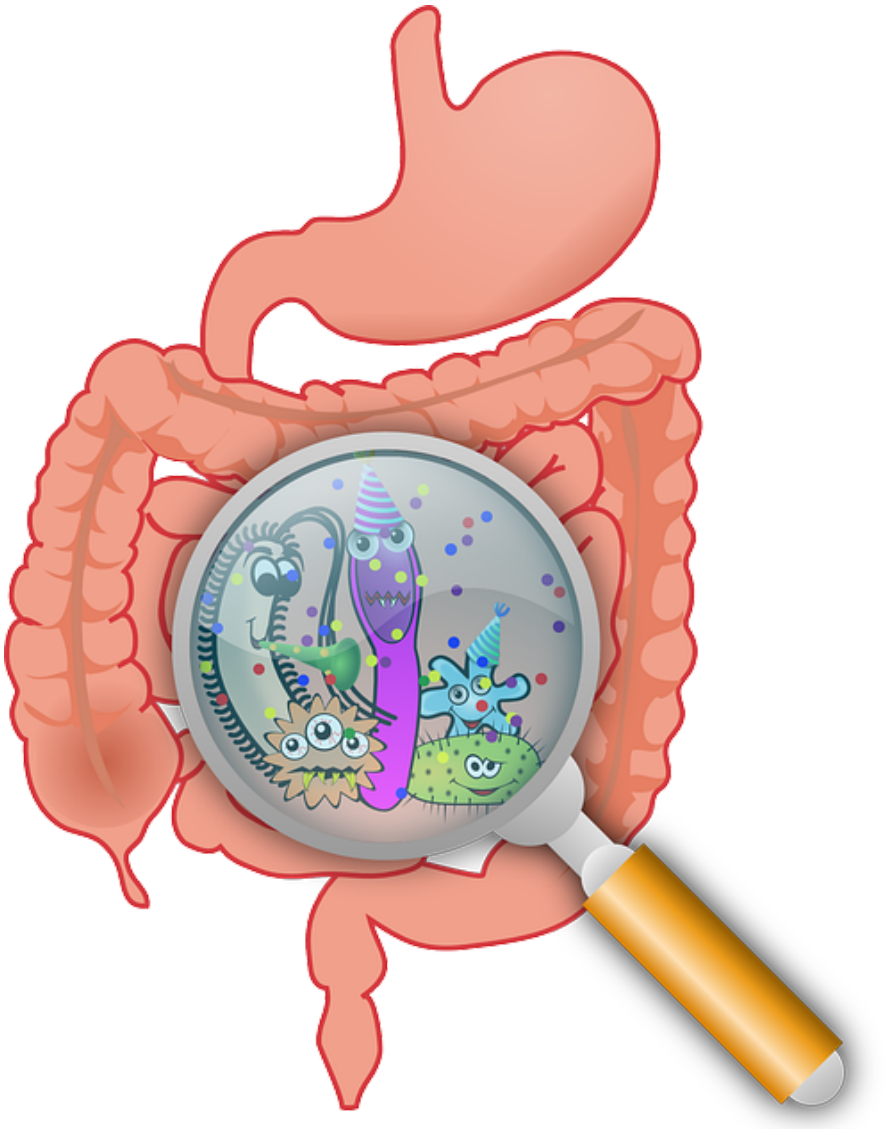
Microbiota manipulation: the key to treating chronic conditions?



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Microbes have had a bad reputation in the past as being responsible for a number of serious diseases and infections, which has resulted in our affinity for antibiotics and antibacterial products. But we are now starting to understand that the health of our gut microbiota can have a profound effect on our overall health, with evidence of connections to obesity, mental illness, autoimmune and gut conditions, as well as autism and Alzheimer's disease. Individual differences in abundance and diversity

of gut microbe species have been discovered, which can be altered both positively or negatively by a number of factors. Recent studies trialling manipulation of gut microbiota in patients with autism and gut conditions have shown promising results.

Bacteria aren't all bad

Microbes inhabit several sites in and on our bodies; however, the gut is home to the largest and most diverse collection of around 100 trillion microbes. Gut microbiota composition is dynamic and changes throughout life due to diet, environment, illness, stress, antibiotic use and genetic factors. The importance of gut microbiota is indicated by the fact that an infant's gut becomes populated with the mother's vaginal microbiota during a natural birth; however, infants delivered by caesarean section miss out on these microbes, which has been linked to higher risk of inflammatory conditions later in life.[1]

Previously regarded as bad guys, we now know that some microbes are beneficial: the gut microbiota in particular has a number of important functions including carbohydrate digestion, as well as producing B vitamins, vitamin K, amino acids, short-chain fatty acids and neurotransmitters. Gut microbes also play a vital role in immune defence, producing anti-inflammatory and antimicrobial compounds and competing with pathogens for nutrients and receptor sites. Consequently, an imbalance in gut microbiota (dysbiosis) can be detrimental to metabolism and immune function and could have consequences for obesity, diabetes and non-alcoholic fatty liver disease. More recent evidence indicates that dysbiosis may also play a role in autism, anxiety, depression and gut conditions such as IBS and IBD, with possible links to Alzheimer's disease as well.[1][2]

Researchers have also discovered an association between weight and microbiota composition: obese individuals tend to have a reduced ratio of Bacteroidetes to Firmicutes bacteria. It has also been suggested that more abundant microbes may be able to influence appetite or food choices.[3][4]

Differences in microbiota could also explain weight variation between siblings: transplanting gut microbiota from obese and lean twins into mice has been found to increase weight gain in those mice receiving the obese microbiota.[5] The unfavourable microbiota ratio present in obese individuals reverses with weight loss including after bariatric surgery; a study found that even transplanting post-surgery microbiota to mice resulted in reduced fat storage.[6]

Could we eat our way to a healthier microbiota?

Although still a fairly new though quickly developing area, research on gut microbiota has already found that different diets can manipulate microbiota composition, changing the abundance of microbes involved in metabolising

particular nutrients.[7] Harvard researchers have found that dietary shifts to either a wholly plant-based or animal-based diet can alter the microbiota in a matter of days.[8] The typical high-sugar, low-fibre Western diet may also be responsible for loss of diversity of gut microbiota: another study showed positive modifications when African-American participants consumed a typical rural South African diet, with the reverse effect in rural South African participants when they consumed the usual diet of the African-American participants.[9]

Faecal transplant, diet or both?

Faecal microbiota transplant (FMT), which involves transplanting faeces (and therefore microbiota) from a healthy donor, is already being used to successfully treat patients with severe recurring Clostridium difficile infection – a contagious condition caused by toxins from a spore-forming bacterium with symptoms ranging from mild diarrhoea to severe colonic ulceration and systemic toxicity. Small studies have also indicated positive results for use of FMT as a treatment for Crohn's disease in children[10] and produced improvements in reported behavioural and gastrointestinal symptoms in children with autism.[11] A study is also currently underway in the US to research the outcomes of FMT in obese participants.

FMT alone may not be the only solution however: studies have also found links between probiotic use and weight loss, while a Danish study published earlier this year has found that the New Nordic Diet (NND), which includes traditional Nordic foods such as rye bread, berries, nuts, herbs and fish, produced double the amount of weight loss compared to participants consuming a standard Danish diet. Most interestingly, however, when participants were stratified according to microbiota composition, participants in the NND group with a higher ratio of Prevotella to Bacteroides bacteria had lost 3.5kg more compared to other participants.[12]

These results suggest that establishing a healthy microbiota in combination with dietary intervention may be the most effective treatment for some conditions. It has also been recommended that biomarkers such as blood and stool samples play a more prominent role in nutrition, offering an opportunity to tailor nutrition guidance or treatment to an individual based upon their gut microbiota. Danish researchers have noted this would be more effective than the current one-size-fits-all approach currently promoted by many dietary guidelines, which could provide positive outcomes for many suffering from chronic conditions.

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About the Author

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Originally from New Zealand, Sandra has been living in Oslo, where she recently completed a Bachelor in Public Health Nutrition. She has a passion for nutrition and fitness, with a particular interest in nutrition psychology and digestive health. She is now based in Brisbane, where you can generally find her at the local farmers market, trying out new cafés or enjoying a riverside run.