

Fat or thin—can the bacteria in our gut affect our eating habits and weight?

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Credit: AI-generated image ([disclaimer](#))

When we can't lose weight, we tend to want to blame something outside our control. Could it be related to the microbiota – the bacteria and other organisms – that colonise your gut?

You are what you eat

Our gut harbours some trillion microorganisms. These are key in harvesting energy from our food, regulating our immune function, and keeping the lining of our gut healthy.

The composition of our [gut microbiota](#) is partly determined by our genes but can also be influenced by lifestyle factors such as our diet, alcohol intake and exercise, as well as medications.

The bacteria in the gut obtain energy for growth when we metabolise nutrients from food. So our diet is a crucial factor in regulating the type of bacteria that colonise our gut.

One key role of the gut microbiota is degrading the carbohydrates we can't digest into short-chain fatty acids. These help regulate our metabolism and are also important for keeping our colon cells healthy.

Changes in our diet [can rapidly change](#) the gut microbiota. Generally, a high-fibre diet which is low in saturated fat and sugar is associated with a healthier gut microbiome, characterised by a greater diversity of organisms.

On the other hand, diets high in saturated fat and refined sugars with low fibre content reduce the microbial diversity, which is bad for our health.

Our animal studies have shown that consuming an unhealthy diet for only three days a week has detrimental effects on the gut microbiota, even when a healthy diet is eaten for the other four days.

This may be because the gut microbiota are under selective pressure to manipulate the hosts' eating behaviour to increase their own fitness. This [may lead to cravings](#), akin to your system being "hijacked" by your microbiota.

Can gut microbiota changes lead to obesity?

Bacteria in humans fall into two major classifications: bacteroidetes and firmicutes. Obesity is associated with a reduction in the ratio of bacteroidetes to firmicutes but weight loss [can reverse this shift](#).

Many studies have found that the gut of an obese person is more likely to contain bacteria that inflame the gastrointestinal tract and damage its lining. This allows the bacteria in the gut to escape.

We still don't know definitively if changes in the gut microbiota from an unhealthy diet can contribute to obesity. Most evidence supporting this hypothesis comes from [animal studies](#); for instance, the transfer of faecal material from an obese human can lead to weight gain in a recipient mouse.

One possibility is that the obese microbiota may be more efficient in harvesting energy, in part, by influencing the host to eat foods which favour its growth. This could ultimately contribute to weight gain.

Gut changes after weight-loss surgery

Bariatric surgeries such as gastric bypass, are one of the most effective treatments for obesity because they reduce the size of the stomach. This limits how much food can be eaten and has also been shown to promote the release of [hormones](#) which make us feel full.

But other factors may be involved. Intriguingly, some patients report a shift in [food preference](#) away from energy-dense foods after surgery. This may contribute to the success of the procedure.

[Gastric bypass-induced weight loss](#) has also been associated with

increased diversity of the gut microbiota. But how much this contributes to the success of the procedure remains to be determined.

One possibility is that the changes in food preferences reported in bariatric patients may relate to changes in the composition of their gut microbiota.

How gut microbiota affect our behaviour

Apart from regulating gut health, there is compelling experimental evidence that gut microbiota play a role in regulating mood.

Several studies have shown that depression is associated with changes in the gut microbiome of humans.

[Depressed patients](#) showed changes in their abundance of firmicutes, actinobacteria and bacteroidetes. When these patients' gut microbiota was transferred to mice, the mice showed more depressive behaviour than mice that received biota from healthy people.



Credit: AI-generated image ([disclaimer](#))

More work still needs to be done as it is unclear whether this may indicate a causal relationship, or be related to other factors associated with depressive disorders such as a poor diet, changed sleep patterns and drug treatment.

Emerging evidence suggests that gut microbiota can influence other behaviours through the "microbiota-gut-brain axis". Put simply, the gut and the brain communicate in part via the microbiota, which links the emotional and cognitive centres of the brain with our intestinal functions.

[Recent work](#) from our lab showed that rats consuming diets high in saturated fat or sugar, for just two weeks, had impaired spatial memory. These rats consumed the same amount of energy as the control rats

(those on a regular diet) and were also a similar body weight.

We found that the memory deficits were associated with changes in the gut microbiota composition and genes related to inflammation in the hippocampus, which is a key brain region for memory and learning.

Similar memory deficits [have also been reported](#) when healthy mice were transplanted with microbiota from overweight mice who had been fed a high-fat diet.

Together, studies such as these suggest the gut microbiota could play a causal role in regulating behaviour. This may, in part, be due to the different microbiota profiles influencing the production of key transmitters such as serotonin.

What can you do now?

Further research is needed into the relationship between poor diet, the gut microbiota and behavioural changes. In the long term, such knowledge may be harnessed to develop targeted therapeutic interventions to replace relevant microbiota diminished by an unhealthy lifestyle.

Meanwhile, the good news is that the gut microbiota can change relatively quickly and we have the capacity to promote the growth of beneficial bacteria which may ultimately improve a range of health outcomes. Eating a healthy [diet](#) of unprocessed foods, including adequate fibre, avoiding excess alcohol and getting enough exercise are key.

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