

# How The Gut Microbiome Can Influence Weight

Information brought to you by Eve Kalinik



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**On a fundamental level the food we eat depends on physical hunger and appetite signals. Our food choices are driven largely by taste, preference, cultural and perhaps ethical reasons – as well as influenced by images and the latest diet fads we are continually bombarded with through our daily newsfeed or social media channels. It also depends on where we live, availability and cost. This complex mix of factors will also influence weight. Another very important factor to consider is the role of our gut microbiota.**

## **Inflammation and appetite**

Firstly, it is important to consider the specific hormones that drive and diminish our hunger. These act on the hypothalamus, which oversees our daily intake of food and eating behaviour. The hypothalamus has been finely tuned by evolution to govern the appropriate amount of energy we need to take in through our food. It constantly assesses our requirements and regulates our metabolism using the extensive input it receives from hormones.

When the stomach is empty, cells located in its lining secrete ghrelin, which is sent to the hypothalamus to signal that it is time to eat. At the end of a meal, when we are satiated, our gut releases appetite-suppressing hormones such as leptin and peptide YY (PYY). This switches off the need to eat so that we know when enough is enough.

However, in more recent years it seems as though there might be some 'glitches' in this appetite system. One reason that has been suggested for this is due to low-grade chronic inflammation (from stress or illness perhaps for example), which can disrupt the microbiota–gut–brain communication. This can be a result of the release of inflammatory substances such as cytokines that can damage the lining of the gut and lead to a more permeable gut barrier. As the gut barrier becomes breached inflammatory substances activate a pro-inflammatory immune response, resulting in an overall state of inflammation in the body. This has the ability to interfere with an appropriate response to leptin so that the brain doesn't receive cues that we have had enough to eat, hence we don't receive the appropriate signal to stop.

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Another crucial part of this inflammatory picture relates to SCFAs (short-chain fatty acids) that are principally produced by gut microbiota. Studies with mice who were fed a high energy diet alongside supplementation of one SCFA, butyrate, gained much less weight than those that were not. In addition, similar studies indicate that butyrate helps to regulate the hormone GLP-1 which has a role in appetite as well as storage and usage of fat reserves. Other studies on the SCFAs propionate and acetate have also indicated that these can influence the level of leptin as well as suppress appetite.

Therefore, from both an inflammation and a weight management perspective it is important to nourish the gut microbiota appropriately with foods that can encourage the production of SCFAs.

## 'Feel good' food and gut microbiota cravings

Another angle to consider is food cravings. Part of this could be due to the muddled communication between the gut and brain outlined above, but it also relates to the dopamine reward system. Dopamine is one of the so-called 'feel-good' neurotransmitters, and is associated with a sense of pleasure - it is this that is activated in addictive behaviours.

The dopamine reward system is also hooked up to our appetite regulation hormones, so it can be switched on or off on the command of some of the same hormones that work on the hypothalamus. This makes sense in terms of evolution: when calorie-dense, high-fat and high-sugar foods were scarce our hormones motivated us to find these foods and rewarded us with a feeling of pleasure when we ate them. However, in our modern society, where these foods are available at any time, it is all too easy to end up overconsuming, with a constant 'reward' feedback to encourage us to seek out these 'feel-good' foods. Chuck in the barrage of advertising to compound the problem and it's easy to see how temptation can get the better of us. We essentially become conditioned to keep eating high-sugar, high-fat foods.

Furthermore, because our gut microbes produce and influence dopamine, it has been suggested they may have some ability to sway our dopamine reward system towards specific foods they have a preference for eating. This makes sense for their own survival and to give them a superior position in the gut over other microbes. This then raises the question of how much of an influence we really have over our food choices? Could we be harbouring 'greedy' microbes? Of course that's not strictly the case as then we could use our 'weight loss' microbes (!) but the gut microbiota can certainly have an indirect way on influencing weight.

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## 'Lean' gut microbiota...is there such a thing?

It would be entirely misleading to label microbes as having the ability to influence a leaner physique. However, studies on the composition of the gut microbiota have demonstrated that a higher proportion of the Firmicutes group of bacteria is associated with increased inflammation and a higher propensity for obesity. This has born the tongue-in-cheek comment 'Firmicutes make you fat' but the reality is that certain groups of gut microbes, like Firmicutes, are particularly adept at extracting energy (calories) from food. In our modern culture of constantly available food, this may lead to increased caloric absorption and risk of weight gain. In contrast, studies found that gut microbiota profiles with a higher proportion of Bacteroidetes bacteria and a generally more diverse population of microbes were associated with a naturally leaner physique.

Two other gut bacteria identified in gut microbiota analysis that have also been linked with a leaner body weight include Akkermansia muciniphila and Christensenella minuta. Akkermansia helps to promote mucus production that strengthens the gut barrier which is important to consider when a compromised or 'leaky' gut barrier can correlate with obesity. In addition, Akkermansia produce acetate, which has a role to play in appetite and regulating storing of body fat. It may be increased through prebiotics. Christensenella, however, seems to be largely down to a genetic lottery, meaning that it is more likely that this bacterium will reside in the gut if they have been inherited. You win some, you lose some!

Given all this, it doesn't seem unrealistic to speculate that weight management is not just to do with willpower alone, and it certainly questions the basic 'calories in versus calories out' theory. In fact, it is worth considering that our weight and perhaps our penchant for specific foods might have some very significant correlations with the bugs in our gut? These are cutting-edge and somewhat controversial opinions but it does certainly provide food for thought!