

Manipulating gut microbiome to treat obesity

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ABSTRACT: *Obesity has been a serious problem nowadays. People have tried a large number of ways to deal with it but there's little effective. This passage talks about why obesity has a high prevalence and how to use gut microbiome to treat this disease.*

KEYWORDS: *Obesity, microbiota, treatment, gut microbiome, therapeutic*

1. Introduction

Obesity is defined by an abnormal accumulation of body fat, often twenty percent or more over an individual's ideal body weight. However, it is difficult to measure the amount of fat in our fat. So people developed a new concept to called body mass index, which is shortened to BMI. This index equals to body weight divided by height. If a person's BMI is larger than or equals to thirty, he or she is obese.

Obesity is a problem caused by complex reasons, including genetics, age, diet, lack of exercise, poor sleep quality, environment etc. Researchers found that if both parents are obese, the rate of their children being obese is at seventy to eighty percent, which is extremely high. Studies also show that people are more likely to be obese after thirty-five years old. Unhealthy diet and lack of exercise lead to excessive intake of calorie. If the person doesn't sleep well, his fat cells in the stomach will respond to insulin less actively, which means fat accumulate faster. Last but not least, we are living in an environment where obesity is likely to occur. Contrary to the past, when technology is not advanced and people have to do a lot of manual labor, now most of us sit in the office all day and stay sedentary. These issues all contribute to the increase of obesity rate.

Nowadays, the prevalence of obesity is 10.8% in men and 14.9% in women. It seems that data is not large, but remember before 4 decades, it was 3.2 % in man and 6.4% in women. The rate is increasing at a surprisingly high rate. What makes the problem worse it that obesity can also cause a lot of disease, including diabetes,

osteoporosis cardiovascular disease, fatty liver disease, cancer, etc. Obesity has become a severe problem in today's society.

2. Ordinary Treatment

Since obesity is that harmful, there should be several treatments. Current treatments can be split into three kinds. The first category is called lifestyle intervention. People change what they eat and how they live to get rid of obesity. They will have to eat more vegetable instead of meat and sugar. They should also exercise more. Nevertheless, this intervention is hard to insist and a kind of painful. When your friends eat cake and ice-cream, you can only have salad! In hot summer days, when all the other people are staying under air conditioners playing video games, you have to go out and run around the house! What's more, it takes a long time to get rid of obesity through this way. If you stop eating vegetable and stop exercising right after you become in good shape, your weight will rebound quickly and your effort leads to no need. It can be seen that lifestyle intervention is an ineffective way to deal with obesity.

This second category is called anti-obesity drugs. Although these medicines are effective, most of them has serious side effects. Some anti-obesity drugs work by blocking absorption, such as melbine, which works by reducing the absorption of glucose in the gut. As a result, patients will absorb less and lose weight. But this leads to oily spotting bowel movements stomach pain, because the bowel is not working correctly. Another type of drugs suppress appetite. After taking this, patients no longer want to eat anymore. But this kind of medicine also leads to serious side effects. Take SAXENDA as an example. It mimics a hormone in the intestines called GLP-1 that tells the brain the stomach is full. Not only physical side effects like increasing heart rate is caused by this drug, it also contributes to mental side effects such as suicidal thoughts. From these experiences, it can be shown that anti-obesity drugs are also not a treatment of obesity.

The third category is surgery. But these surgeries are often along with high risks. The examples of gastric bypass and lap sleeve are good cases in point. Gastric bypass refers to reconnecting the intestine to make the small intestine shorter. Hence, the food will pass the body faster and less fat is absorbed. However, there is a high risk of interface inflammation. The food may leak from the connection points of intestines. Serious inflammation even causes the death of patients. Due to the high risk, only patients whose BMI is larger than forty, which means extreme obesity are allowed to take this surgery. Lap sleeve means reducing the size of the stomach. Therefore, patients cannot eat too much. However, this surgery has high risks of deep vein thrombosis (DVT), hemorrhage, irregular heartbeat and gastric bleed. Just like gastric bypass, people who take this surgery must be morbidly obese. It is clear that surgery is also not a good choice to get rid of obesity.

3. Microbiome treatment

When we look through current treatment of obesity, we found almost all of them are ineffective, which emphasize the need of looking at something else to find ways to deal with this disease. After long term study, research finally turned their eyes to microbiology. So here comes the question, could microbiome be a solution to obesity? To test this possibility, scientists tried to find answers in microbiota transplantation studies. They found that conventionally raised mice (mice that harbored gut microbiota at birth) have more body fat than germ-free mice (mice without microbiota). What is more, after transmitting microbiota from CONV-R mice to GF mice, body fat in GF mice significantly increase. These findings all point to the conclusion that manipulating gut microbiome is a possible treatment of obesity.

In fact, gut microbiome influences host metabolism using the metabolites such as short-chain fatty acids (SCFAs) produced during the fermentation of indigestible dietary. This substance inhibits fat accumulation, increases energy expenditure and enhance the production of hormones that reduces weight. SCFAs can also bind to G-protein coupled receptors (GPCR) to stimulate the secretion of anorexigenic gut hormones. Experiments have shown that after eating food that contain SCFAs, high-fat mice's weight gain is suppressed.

What is more, obesity is regarded as a kind of chronic low-grade inflammation that is mediated by gut microbiota. The gut microbiota-derived endotoxin, lipopolysaccharide, can be able to stimulate increase inflammation grade and insulin resistance. Obese individuals were found to have elevated lipopolysaccharide (LPS) levels. Also, obesity and inflammation in mice can be induced with LPS infusion. These evidence all indicate that gut microbiota is mediating the low-grade inflammation associated with obesity.

The finding of mechanisms linking gut microbiome and obesity leads to microbiome-based therapies in the treatment of obesity. One of them is via using probiotics, which means live microorganisms that, when administered inadequate amount, confer a health benefit on the host. They can inhibit adhesion to mucosal surface of bad bacteria and enhance gut epithelial barrier. Hence, they can modulate the immune system without harming the host.

Engineered microbes can also be used to regulate gut microbiomes. They are able to deliver by-products that reduce weight. N-acyl-phosphatidylethanolamines (NAPEs) are the precursors of N-acylethanolamines (NAEs) that are anorexigenic. They can reduce food intake and decrease the absorption of fat safely.

All in all, obesity is a severe problem nowadays, and controlling microbiome is an effective way to deal with it.

References

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