

# Gut bacteria imbalance increases diabetes risk

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Currently, scientists think the major contributors to insulin resistance are excess weight and physical inactivity, yet ground-breaking new research by an EU funded European-Chinese team of investigators called MetaHit have discovered that specific imbalances in the gut bacteria can cause insulin resistance, which confers an increased risk of health disorders like type 2 diabetes.

"We show that specific imbalances in the [gut microbiota](#) are essential contributors to [insulin resistance](#), a forerunner state of widespread disorders like type 2 diabetes, hypertension and atherosclerotic cardiovascular diseases, which are in epidemic growth," says Professor Oluf Pedersen, Metabolism Center, University of Copenhagen, and senior lead author of the paper.

In the Danish study of 277 non-diabetic individuals and 75 type 2 diabetic patients, there was close collaboration between the University of Copenhagen and the Technical University of Denmark with extensive international participation from a team of investigators, who performed analyses of the action of the insulin hormone. They

monitored the concentrations of more than 1200 metabolites in blood and did advanced DNA-based studies of hundreds of bacteria in the human intestinal tract to explore if certain imbalances in gut microbiota are involved in the causation of common metabolic and cardiovascular disorders.

The researchers observed that people who had a decreased capacity of [insulin action](#), and therefore were insulin resistant, had elevated blood levels of a subgroup of amino acids called branched-chain amino acids (BCAAs). Importantly, the rise of BCAAs levels in blood was related to specific changes in the gut microbiota composition and function.

The main drivers behind the gut bacterial biosynthesis of BCAAs turned out to be the two bacteria *Prevotella copri* and *Bacteroides vulgatus*. To test mechanistically if [gut bacteria](#) were a true cause of insulin resistance, the researchers fed mice with the *Prevotella copri* bacteria for 3 weeks. Compared with sham fed mice the *Prevotella copri* fed mice developed increased blood levels of BCAAs, insulin resistance and intolerance to glucose.

"This study represents very significant medical and technical advances, and it is the first study to integrate serum metabolomics, microbiome and clinical data in a single analysis. Importantly, the analysis weight the importance of the different bacterial species in relation to the disease, and thus it enabled us to identify a specific microbe that caused insulin resistance when it was transferred to mice," says Henrik Bjorn Nielsen, lead author from the Technical University of Denmark.

"Most people with insulin resistance do not know that they have it. However, it is known that the majority of overweight and obese individuals are insulin resistant and it is well known that dietary shifts to less calorie-dense eating and increased daily intake of any kind of vegetables and less

intake of food rich in animal fat tend to normalize imbalances of [gut microbiota](#) and simultaneously improve [insulin sensitivity](#) of the host," adds Pedersen.

**More information:** Human gut microbes impact host serum metabolome and insulin sensitivity, *Nature*, DOI: [10.1038/nature18646](https://doi.org/10.1038/nature18646)

Provided by University of Copenhagen

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