Why does red meat increase the risk for cardiovascular disease? Blame our gut bacteria

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An uncooked rib roast. Credit: Michael C. Berch/Wikipedia

New research provides details on how gut bacteria turn a nutrient found in red meat into metabolites that increase the risk of developing heart disease. Publishing in the November 4th issue of the journal *Cell Metabolism*, the findings may lead to new strategies for safeguarding individuals' cardiovascular health.

Previous research led by Dr. Stanley Hazen, of Lerner Research Institute and the Miller Family Heart and Vascular Institute at Cleveland Clinic, revealed a pathway by which red meat can promote atherosclerosis, or hardening of the arteries. Essentially, bacteria in the gut convert L-

carnitine, a nutrient abundant in red meat, into a compound called trimethylamine, which in turn changes to a metabolite named trimethylamine-N-oxide (TMAO), which promotes atherosclerosis. Now Dr. Hazen and his team extend their earlier research and identify another metabolite, called gamma-butyrobetaine, that is generated to an even greater extent by gut bacteria after L-carnitine is ingested, and it too contributes to atherosclerosis.

The researchers found that gamma-butyrobetaine is produced as an intermediary metabolite by microbes at a rate that is 1,000-fold higher than the formation of trimethylamine in the gut, making it the most abundant metabolite generated from dietary L-carnitine by microbes in the mouse models examined. Moreover, gamma-butyrobetaine can itself be converted into trimethylamine and TMAO. Interestingly, however, the bacteria that produce gamma-butyrobetaine from L-carnitine are different from the bacterial species that produce trimethylamine from L-carnitine.

The discovery that metabolism of L-carnitine involves two different gut microbial pathways, as well as different types of bacteria, suggests new targets for preventing atherosclerosis—for example, by inhibiting various bacterial enzymes or shifting gut bacterial composition with probiotics and other treatments.

"The findings identify the pathways and participants involved more clearly, and help identify targets for therapies for interventions to block or prevent heart disease development," says Dr. Hazen. "While this is into the future, the present studies may help us to develop an intervention that allows one to 'have their steak and eat it too' with less concern for developing heart disease."

More information: *Cell Metabolism*, www.cell.com/cell-metabolism/a… 1550-4131(14)00453-7

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