Testing a paleo diet hypothesis in the test tube

May 20 2014

By comparing how gut microbes from human vegetarians and grass-grazing baboons digest different diets, researchers have shown that ancestral human diets, so called "paleo" diets, did not necessarily result in better appetite suppression. The study, published in *mBio* the online open-access journal of the American Society for Microbiology, reveals surprising relationships between diet and the release of hormones that suppress eating.

While Western diets have changed dramatically in the last century to become high energy, low fiber, and high fat (think: cheeseburger), our digestive systems, including our gut bacterial colonies, adapted over millennia to process a low-energy, nutrient-poor, and presumably high fiber diet. One idea about the current obesity epidemic is that appetite suppression systems that evolved to work with a paleo diet are off-kilter today.

The appetite-suppressing gut hormones peptide YY (PYY) and glucagon-like-peptide-1 (GLP-1) can be triggered by the presence of short-chain fatty acids (SCFAs) in the colon. Fermentation of plant fiber in the colon by bacteria can produce these SCFAs, so it stands to reason that digestion of a diet high in plant fiber might lead to better appetite suppression.

Gary Frost and his colleagues at Imperial College London in the United Kingdom wanted to test that hypothesis in the laboratory using fecal bacterial samples from three human vegetarian volunteers and from

three gelada baboons, the only modern primate to eat mainly grasses.

"Getting to the bottom of how our gut bacteria and diets interact to control appetites is vitally important for tackling the problem of obesity," said Glenn Gibson, co-author on the study based at University of Reading. Frost added, "Understanding how a paleo-like diet impacts the colon's microbiota and the signals those bacteria produce to release hormones that reduce appetite may give us new insight that we can adapt in the modern world."

The team established gut bacteria cultures in flasks and then 'fed' them two different diets—either a predigested potato, high-starch diet or a predigested grass, high-fiber diet. Then they tracked changes in the numbers and types of bacteria and measured the metabolites produced by digestion.

Surprisingly, the human cultures on a potato diet produced the highest levels of SCFAs. Even the baboon cultures fed potato produced more SCFAs than the baboon cultures fed grass. When the researchers applied some of these cultures to mouse colon cells in the lab dish, the cells were stimulated to release PYY hormone. Those exposed to human cultures digesting a potato diet released the most PYY, followed by those exposed to baboon cultures on a potato diet.

This evidence argues that the previous view of paleo diets and appetite suppression is flawed and that high-fiber, plant-based diets likely do not lead to increased SCFAs and increased appetite suppression. Rather, the researchers propose, little to no appetite suppression might help baboons maintain grazing all day to consume enough nutrients.

A closer cataloguing of all the metabolites produced by the bacterial cultures digesting potato or grass diets showed that as the levels of the amino acids isoleucine and valine rose, so too did the amount of PYY

released. This relationship was even stronger than that with SCFAs.

"This hints that protein might play a greater role in appetite suppression than the breakdown of starch or fiber," said Timothy Barraclough, another co-author of the study. "More work will be needed to explore the effects of alternative breakdown products of various foods."

The researchers note that this study of digestion in the test tube is limited by not including the roles of gut cells, which absorb and secrete metabolites as well.

Provided by American Society for Microbiology