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A Bacterial Role in High Blood Pressure - the Microbiome Speaks

By Chuck Dinerstein — December 12, 2017

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“You are what you eat” – that phrase often forms the basis for dietary advice. And in some instances, that information can be helpful. In particular, I am thinking about the role of salt and high blood pressure or hypertension. Leaving aside the argument about whether we eat too much salt, there is a reasonable physiologic basis for the belief that salt raises blood pressure. But what about fiber? There the evidence is not as clear, although you will hear many nutritional advocates, including our Food and Drug Administration, extol the virtues of increasing fiber in our diets.

But we do not digest fiber so how can fiber exert any effect other than on bulking up our stool and reducing constipation? The answer to that question lies in another adage applied to pregnant women, they are “eating for two.” And with fiber, the injunction applies to us all, because while fiber is not food for us, it is for some of the bacteria living within our microbiome. Fiber is food for our gut’s microbes, digested (fermented) and forming acetate, propionate and butyrate, short chain fatty acids (SCFA) that subsequently enter our bloodstream. We know that we do not make SCFAs on our own, they are a product of bacteria.

One of the reasons fiber is recommended in our diet, besides that constipation issue, is that some studies have demonstrated a beneficial effect on high blood pressure and cardiovascular disease. But again, why? It turns out that a plausible physiologic linkage between fiber and high blood pressure does exist. Those SCFAs produced by our microbiome can impact our blood pressure through two receptors found in the walls of our smaller arteries, the arterioles.

There are basically two physiologic pathways that determine our blood pressure. The kidney senses our blood pressure, and acting like a thermostat, releases a chemical messenger, renin,

that causes us to retain fluid and constrict our arterioles, raising our blood pressure. The arterioles are essential because they can not only contract to raise our blood pressure, but also dilate to lower it.

The two receptors that respond to bacterial SCFAs play a role in blood pressure too. The first receptor is Olf78 found in the small blood vessels of the kidney as well as the smooth muscle of the arterioles. When stimulated by SCFAs, Olf78 constricts the blood vessels and raises our blood pressure. But if this were the only effect, fiber would be “bad” for us. But there is another receptor, Gpr41 found in the arteriole’s inner wall that when exposed to SCFAs causes them to dilate, lowering our blood pressure. The effects of Gpr41 predominate, and so SCFA stimulation results in vasodilation and lower blood pressure.

Now while the response of blood pressure to fiber/microbiome produced SCFAs is real, it is not as great as our response to renin or even acute stress. So, there is no reason to throw away your blood pressure medications for a heaping bowl of fiber, at least not yet. It is challenging to isolate the interactions of our microbiome and our physiology especially when you also must factor in a possible genetic proclivity to high blood pressure. What is clear is that fiber and the SCFAs produced in our microbiome have a plausible physiologic basis for influencing the phenotypic expression of hypertension. And that is a seductive belief because at least at this juncture, changing our diet is easier than changing our environment or genes.

Sources How Bacteria Help Regulate Blood Pressure [2]

Report of the National Heart, Lung, and Blood Institute Working Group on the Role of Microbiota in Blood Pressure Regulation: Current Status and Future Directions [3]
