UC San Diego
UC San Diego News Center

November 30, 2020 | By Heather Buschman, PhD

Study Reveals Connection Between Gut Bacteria and Vitamin D Levels

Our gut microbiomes — the many bacteria, viruses and other microbes living in our digestive tracts — play important roles in our health and risk for disease in ways that are only beginning to be recognized.

University of California San Diego researchers and collaborators recently demonstrated in older men that the makeup of a person's gut microbiome is linked to their levels of active vitamin D, a hormone important for bone health and immunity.

The study, published November 26, 2020 in Nature Communications, also revealed a new understanding of vitamin D and how it's typically measured.

Vitamin D can take several different forms, but standard blood tests detect only one, an inactive precursor that can be stored by the body. To use vitamin D, the body must metabolize the precursor into an active form.

"We were surprised to find that microbiome diversity — the variety of bacteria types in a person's gut — was closely associated with active vitamin D, but not the precursor form," said senior author Deborah Kado, MD, director of the Osteoporosis Clinic at UC San Diego Health. "Greater gut microbiome diversity is thought to be associated with better health in general."

Kado led the study for the National Institute on Aging-funded Osteoporotic Fractures in Men (MrOS) Study Research Group, a large, multi-site effort that started in 2000. She teamed up with Rob Knight, PhD, professor and director of the Center for Microbiome Innovation at UC San Diego, and co-first authors Robert L. Thomas, MD, PhD, fellow in the Division of Endocrinology at UC San Diego School of Medicine, and Serene Lingjing Jiang, graduate student in the Biostatistics Program at Herbert Wertheim School of Public Health and Human Longevity Sciences.

Multiple studies have suggested that people with low vitamin D levels are at higher risk for cancer, heart disease, worse COVID-19 infections and other diseases. Yet the largest randomized clinical trial to date, with more than 25,000 adults, concluded that taking vitamin D supplements has no effect on health outcomes, including heart disease, cancer or even bone health.

“Our study suggests that might be because these studies measured only the precursor form of vitamin D, rather than active hormone,” said Kado, who is also professor at UC San Diego School of Medicine and Herbert Wertheim School of Public Health. “Measures of vitamin D formation and breakdown may be better indicators of underlying health issues, and who might best respond to vitamin D supplementation.”

The team analyzed stool and blood samples contributed by 567 men participating in MrOS. The participants live in six cities around the United States, their mean age was 84 and most reported being in good or excellent health. The researchers used a technique called 16s rRNA sequencing to identify and quantify the types of bacteria in each stool sample based on unique genetic identifiers. They used a method known as LC-MSMS to quantify vitamin D metabolites (the precursor, active hormone and the breakdown product) in each participant’s blood serum.

In addition to discovering a link between active vitamin D and overall microbiome diversity, the researchers also noted that 12 particular types of bacteria appeared more often in the gut microbiomes of men with lots of active vitamin D. Most of those 12 bacteria produce butyrate, a beneficial fatty acid that helps maintain gut lining health.

“Gut microbiomes are really complex and vary a lot from person to person,” Jiang said. “When we do find associations, they aren’t usually as distinct as we found here.”

Because they live in different regions of the U.S., the men in the study are exposed to differing amounts of sunlight, a source of vitamin D. As expected, men who lived in San Diego, California got the most sun, and they also had the most precursor form of vitamin D.

But the team unexpectedly found no correlations between where men lived and their levels of *active* vitamin D hormone.

“It seems like it doesn’t matter how much vitamin D you get through sunlight or supplementation, nor how much your body can store,” Kado said. “It matters how well your body is able to metabolize that into active vitamin D, and maybe that’s what clinical trials need to measure in order to get a more accurate picture of the vitamin’s role in health.”

“We often find in medicine that more is not necessarily better,” Thomas added. “So in this case, maybe it’s not how much vitamin D you supplement with, but how you encourage your body to use it.”

Kado pointed out that the study relied on a single snapshot in time of the microbes and vitamin D found in participants’ blood and stool, and those factors can fluctuate over time depending on a person’s environment, diet, sleep habits, medications and more. According to the team, more studies are needed to better understand the part bacteria play in vitamin D metabolism, and to determine whether intervening at the microbiome level could be used to augment current treatments to improve bone and possibly other health outcomes.

Additional co-authors of the study include: John S. Adams, UCLA; Zhenjiang Zech Xu, Nanchang University; Jian Shen, Gail Ackermann, UC San Diego; Stefan Janssen, Justus-Liebig-University Gießen; Dirk Vanderschueren, KU Leuven and University Hospitals Leuven; Steven Pauwels, University Hospitals Leuven, KU Leuven, Jessa Hospital; and Eric S. Orwoll, Oregon Health & Sciences University.

Funding for this research came, in part, from the National Institutes of Health (U01AG027810, U01AG042124, U01AG042139, U01AG042140, U01AG042143, U01AG042145, U01AG042168, U01 AR066160 and UL1TR000128).

MEDIA CONTACT

Heather Buschman, 858-249-0456, hbuschman@ucsd.edu