When we think about maintaining a health-conscious lifestyle, choices such as exercise and caloric intake come to mind. However, these are not the only factors that impact weight loss or health. In fact, something as simple as the levels of one vitamin in a person’s diet can have tremendous implications for their overall health. It is this theme that pervaded the fascinating talk given by Dr. Jeffrey D. Roizen at Duquesne University’s weekly Biological Sciences seminar on February 22, 2019. Dr. Roizen is an assistant professor within the Division of Endocrinology and Diabetes at the University of Pennsylvania. He also serves as a clinician at the Children’s Hospital of Philadelphia, having earned both MD and PhD degrees at the Washington University in St. Louis School of Medicine. His career and research has largely focused on the nutritional impact of vitamin D.

Created through exposure to sunlight as well ingested with food, vitamin D comes in unique forms. In this talk, he discussed $1,25(OH)_2D$ and $25(OH)D$. $1,25(OH)_2D$ is more active, but $25(OH)D$ lasts longer in the body – often being retained for several weeks – and may have greater implications for health. Binding between the different forms of vitamin D and their receptors leads to increased serum calcium, resulting in higher renal tubular calcium resorption, higher intestinal calcium absorption, and higher osteoclastic bone resorption.

Dr. Roizen then moved on to discuss current knowledge regarding energy balance within the body. Previously, the correlation between exercise and weight loss had been envisioned as linear, with weight loss increasing at the same rate as exercise increased. Using a more accurate “constrained” model, though, data indicates that weight loss actually plateaus once a certain level of activity is reached. Higher levels of exercise actually decrease energy expenditure during resting. Furthermore, weight loss can cause declines in muscle fiber activity and levels of the hunger-
inhibiting hormone leptin, leading to lower use of energy. Even individuals who are not overweight can suffer from symptoms of adiposity, or high body fat percentage. In patients with other medical conditions such as sickle-cell anemia or diabetes, a further decrease in health is experienced when levels of body fat are high.

Dr. Roizen studied the effects of vitamin D on adiposity, and reported decreases in percent fat mass after twelve weeks of vitamin D administration. This suggests a direct correlation where higher intake of vitamin D equates to lower adiposity. A proposed mechanism for this phenomenon is that vitamin D facilitates leptin responsiveness, thereby lowering levels of hunger. When less calories are consumed, fat storage is reduced.

The benefits of vitamin D intake are not simply limited to decreased adiposity, but also increased muscle strength. Approximately 40% of adults suffering from vitamin D deficiency simultaneously experience muscle loss and weakness, often referred to as sarcopenia. While current laboratory work is being done to explore how muscle strength is affected by calcium and phosphate abnormalities, Dr. Roizen was able to thoroughly investigate the relationship between vitamin D and muscles. Using mice with varying vitamin D intake, grip strength was assessed.

Mice who had been given high levels of vitamin D demonstrated a 30% increase in grip strength, as well as a 7% increase in lean muscle mass, relative those simply given a chow diet with fairly average vitamin D content. RNA sequencing then revealed that vitamin D modulates several minor cellular regulators, appearing to remove cellular “brakes” that would otherwise inhibit energy use. Coupled with cell culture screenings, these data led to the conclusion that vitamin D improves the specific process of oxidative phosphorylation in muscle. Most notably, the 25(OH)D form of vitamin D, which is found in especially high quantities in the summer, has a substantial impact on metabolism.

Dr. Roizen concluded his talk by presenting the question, “What is the most common disease I see?” and sharing that sarcopenia has attained this status. With this in mind, his research stands out as particularly helpful to the medical community, especially providers and patients who must confront either acute or chronic muscular dysfunction. The findings he presented show how helpful maintaining healthy vitamin D levels can be – and should motivate all of those who
had the chance to learn about his research to keep a close eye on this aspect of their diet and health!

Sources

