The Role of Vitamin K and Bone Cells in Metabolism

A new study is making headlines and revealing new information about the important function of the skeleton in how the body regulates sugar, energy and fat.

Previous studies have shown that fat cells secrete leptin, a hormone that influences osteoblasts, which are the cells involved with bone formation (1). Recently, a team of researchers led by Gerald Karsenty of Columbia University made the discovery that in turn, osteoblasts play a role in controlling fat tissue metabolism by producing osteocalcin.

Osteocalcin is a vitamin K-dependent protein produced by osteoblasts. As the name implies, osteocalcin is involved in the mineralization of bone. Osteocalcin is needed to effectively bind calcium to the bone matrix and for the support of bone health (2). Karsenty's team also found that osteocalcin has hormonal metabolic benefits (3).

According to the study, osteocalcin improves insulin synthesis by pancreatic beta cells while directing fat cells to store less fat. Osteocalcin also induces fat cells to release adiponectin, a hormone that improves sensitivity to insulin and reduces insulin resistance (3). According to Karsenty, "[Osteocalcin] has been the flagship molecule of the [bone-research] field for 30 years, but nobody knew what it was doing," until now.

Karsenty's team fed a normal diet to mice lacking the gene for osteocalcin. These mice became obese and had low blood concentrations of insulin, a hormone important for controlling blood glucose. These mice also had poor sensitivity to insulin. Another group of mice, engineered to have extra osteocalcin, were fed a high-calorie diet. Despite high calorie intake, these mice stayed thin and maintained higher insulin concentrations and better sensitivity to insulin (3).

This study expands not only the understanding of the skeleton and its role in energy metabolism, but also the vital role that vitamin K-dependent osteocalcin plays in the regulation of fat cells and glucose metabolism. According to Leon Schurgers, PhD., a vitamin K expert from the University of Maastricht, the discoveries made by this study may pave the way for potential therapeutic applications, including a new method to help regulate glucose.

In showing that osteocalcin has an influence on the regulation of fat cells and pancreatic cells, this study also demonstrates that the function of vitamin K extends beyond blood clotting. Vitamin K is a generic name given to a collective group of substances that include vitamin K1, also known as phylloquinone, and vitamin K2, or menaquinone. Until recently, the main focus of vitamin K research has been on its function in the synthesis of liver proteins that control blood clotting. However, with the increased awareness of osteocalcin's role in metabolism and glucose balance, the health benefits attributed to vitamin K expand to include potential benefits for obesity and diabetes.

Although vitamin K1 provides many of the benefits attributed to vitamin K, for optimal benefits, vitamin K2 may be a better choice. In addition to helping reduce aortic calcification and coronary heart disease, vitamin K2 is also more bioavailable and more effective in supporting osteocalcin activity (4). NSP has added vitamin K2 to our recently improved Cardio Assurance, a product formulated to bring you all of the benefits of this versatile and important nutrient.

References:

1. Thomas T, et al. Leptin acts on human marrow stromal cells to enhance differentiation to osteoblasts and to inhibit differentiation to adipocytes. *Endocrinology*. 1999;140:1630–1638.

2. Veremeer C, et al. Vitamin K supplementation: a simple way to improve bone and vascular health. *AgroFood Industry High-Tech*. 2003 Nov/Dec.

3. Lee NK, Sowa H, Hinoi E, Ferron M, Ahn JD, Confavreux C, Dacquin R, Mee PJ, McKee MD, Jung DY, Zhang Z, Kim JK, Mauvais-Jarvis F, Ducy P, Karsenty G. Endocrine regulation of energy metabolism by the skeleton. *Cell*. 2007 Aug 10;130(3):456-69.

4. Schurgers LJ, Teunissen KJF, Hamulyak K, Knapen MHJ, Vik H, and Vermeer C. Vitamin K-containing dietary supplements: comparison of synthetic vitamin K1 and natto-derived menaquinone-7. *Blood*. 2006.

Created by:
Larisa Wright
09/07