

Genetics and dietary stress explain low calcium absorption

It is well understood that osteoporosis is influenced by a variety of environmental factors such as age, nutrition, and race. Calcium absorption is one of these important factors and low levels of calcium absorption have been associated with low bone mass and increased fracture risk. Recognizing the link between low calcium absorption and fracture risk, many studies have attempted to elucidate the factors that influence an individual's ability to absorb calcium. For example, it has been previously shown that calcium absorption is reduced during low calorie intake in older women. While these studies have identified dietary and hormonal factors that influence calcium absorption, a large portion of the variability in calcium absorption is still unexplained and may be due to genetic variability.

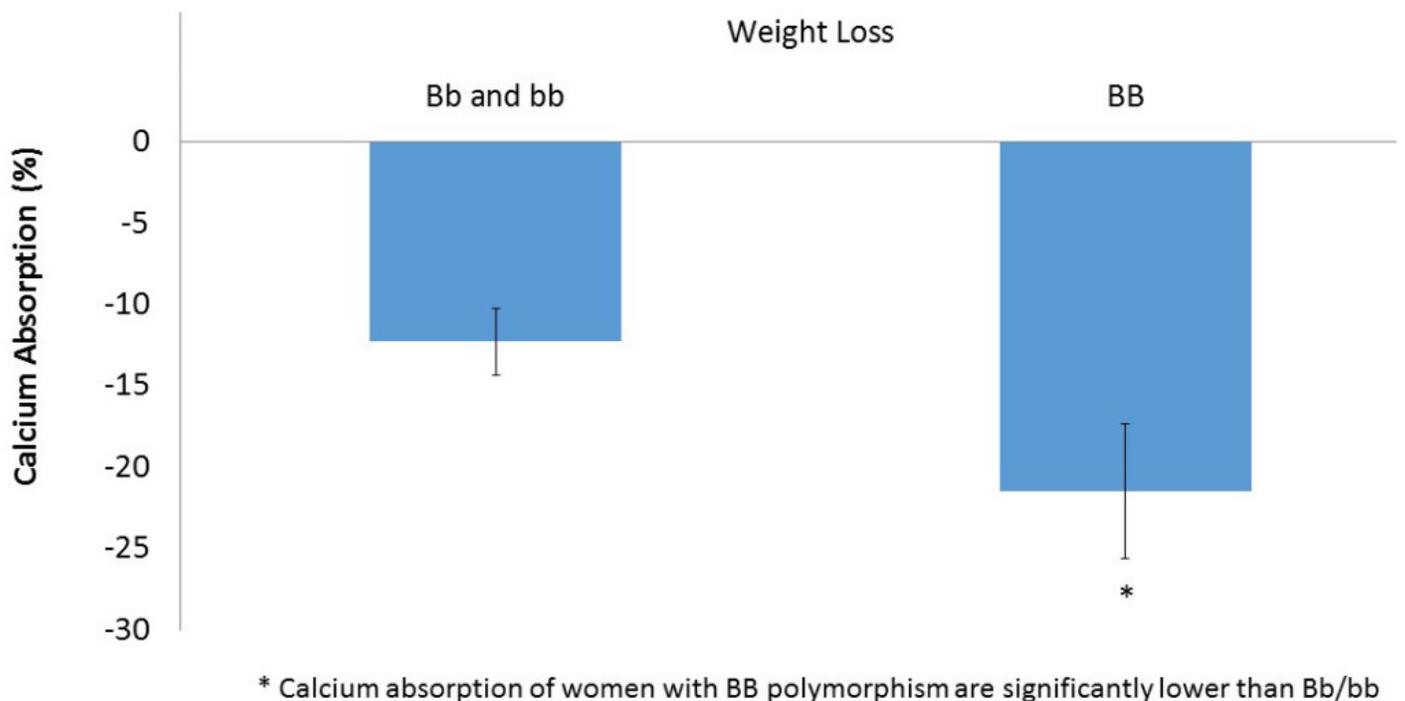


Fig. 1. Polymorphisms of the VDR genotype, Bsml.

Vitamin D is a major regulator of the calcium absorption in the small intestine and bone remodeling, and its effects are largely mediated by the vitamin D nuclear receptor (VDR). The VDR gene has been postulated to be a major candidate for the genetic effects on calcium absorption. The estrogen receptor (ESR1) gene is another strong candidate for the genetic regulation of calcium absorption because of the presence of the estrogen receptor in the intestine and the well-established role of estrogen in intestinal calcium absorption. However, the association between ESR1 and VDR polymorphisms and calcium absorption has not been extensively examined. The

goal in this investigation was to determine whether the known effects of caloric restriction to reduce calcium absorption are further influenced by several well-studied VDR and ESR1 polymorphisms.

In this study, we found no effect of the ESR1 polymorphisms on calcium absorption, but that a particular polymorphism “BB” of the VDR genotype (Bsm1) was associated with lower calcium absorption compared to the “Bb” and “bb” genotypes during weight loss. A previous study found that the same VDR genotype was associated with lower calcium absorption in individuals with low calcium intake, suggesting that the BB genotype may predispose individuals to low calcium absorption in the setting of dietary stress. In other words, if an individual consumes the recommended intake of calcium (i.e. ~1g/day), his/her VDR genotype will not influence his/her ability to absorb calcium. However, when one’s calcium intake is low or calories are restricted without adequate dietary calcium, his/her calcium balance will be compromised in the presence of the BB genotype. A solution is to recommend at least 1 g Ca/day, especially to those individuals who are dieting.

Overall, this work underscores the importance of using both a genetic and metabolic profile to define at-risk populations and improve disease prevention with personalized nutrition and medical care.

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Publication

[Influence of vitamin D and estrogen receptor gene polymorphisms on calcium absorption: Bsm1 predicts a greater decrease during energy restriction.](#)

Chang B, Schluskel Y, Sukumar D, Schneider SH, Shapses SA.

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