

Does calcium + vitamin D aid in weight loss & risks associated with metabolic syndrome?

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With a high incidence rate of 47 million Americans, almost one in every six have metabolic syndrome.¹ Due to increased portion sizes, food availability, high fat diets, and inactivity Americans are increasingly becoming overweight and obese. These risk factors can lead to metabolic syndrome. Typically, dietary patterns of overweight and obese individuals lack nutrients essential for weight maintenance such as calcium and vitamin D. Recent studies are finding that calcium + vitamin D supplementation may have further health benefits other than slowing bone loss. There is now greater emphasis on the relationship of calcium + vitamin D on weight loss and lowering one's risk of metabolic syndrome. Continuing research is suggesting that both supplementation and consumption of dairy products are beneficial for weight loss.

What is Metabolic Syndrome?

It is estimated that approximately 50 million Americans have metabolic syndrome.² This number is continuously growing due to an increase of energy dense foods in the diet and lack of physical activity. Researchers hypothesize that in the near future metabolic syndrome may overtake smoking as the leading risk factor for heart disease. Metabolic syndrome is an accumulation of risk factors in a person. For a person to have metabolic syndrome they must have three or more of the following risk factors:

- **Central adiposity:** excessive fat tissue in and around the abdomen
- **High triglyceride levels:** >200 mg/dL
- **Low HDL cholesterol levels:** HDL cholesterol is high density and is considered a good form of cholesterol. High HDL levels offer protection against heart disease.
- **High LDL cholesterol:** this form of cholesterol is low density and is considered a bad form of cholesterol. A high LDL cholesterol level can increase risk for heart disease and stroke.
- **Elevated blood pressure:** $\geq 135/85$ mm Hg
- **Insulin resistance or glucose intolerance:** body does not use insulin efficiently resulting in elevated blood sugar levels.



People who have metabolic syndrome are much more likely to develop coronary heart disease, stroke, or Type II Diabetes. Because metabolic syndrome is associated with overweight or obesity and lack of physical activity, weight loss may help prevent metabolic syndrome.

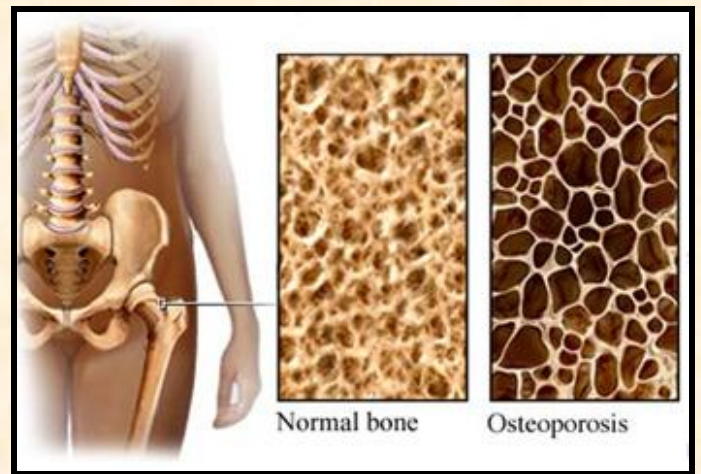


Importance of calcium and vitamin D?

Vitamin D is a fat soluble vitamin which is required for the body to absorb calcium. Vitamin D is not available in many foods but is produced from exposure to sunlight or by taking supplementation form. Vitamin D helps regulate serum calcium levels in order to maintain calcium homeostasis. When there is a decrease in serum calcium parathyroid hormone activates Vitamin D and enhances calcium absorption. The parathyroid hormone activity within the kidney generates vitamin D activity which facilitates absorption of calcium from the small intestine. In conjunction with parathyroid hormone, vitamin D enhances flux of calcium out of the bone. Vitamin D plays a role in calcium absorption as well. Calbindin, a vitamin D induced calcium binding protein, increases transcription of calcium binding proteins.³ In addition to vitamin D's role in maintaining calcium homeostasis, vitamin D may be linked

with treating hypertension; type I and type II diabetes, and glucose intolerance by stimulating insulin release and receptor expression.

Calcium is an essential mineral necessary for many bone, muscle, and blood vessel mechanisms in the body. Calcium is very important for bone health and protection from osteoporosis. In addition to bone health calcium may help with weight management, maintenance of blood pressure, and protection against digestive tract cancers such as colon cancer.⁴



How might calcium + vitamin D supplementation aid in weight loss and associated risks of metabolic syndrome?

A diet low in calcium may be linked to increased calcium in one's adipocyte (fat cell). When intracellular calcium is elevated it leads to additional energy storage and fat mass in the adipocyte. Adipocytes have vitamin D membrane receptors that cause calcium to rapidly respond to vitamin D inside of the cell. As a result the adipocyte continues to store more lipids due to

vitamin D's stimulation of lipogenesis (the generation of lipids) and its decrease of lipid oxidation (the breakdown of lipids).⁵ The extra production and accumulation of fat may eventually lead to overweight or obesity.

Vitamin D had also been found to inhibit the expression of uncoupling protein 2.⁵ The mechanism of an uncoupling protein is to undo the process of oxidative phosphorylation. The general oxidative phosphorylation process is to allow proteins to flow back into the matrix of the mitochondria to generate energy in the form of ATP. Uncoupling proteins disrupt this process which results in proteins leaking back in to the matrix. Proteins are not being coupled to generate energy but are rather used as heat. People who are leaner may burn more fuel as heat because they have more active uncoupling proteins, while overweight or obese individuals will store more energy reserves.

What Does the Research Say?

One study done by the *American Journal of Clinical Nutrition* showed that calcium + vitamin D supplementation had beneficial effects on weight loss and plasma lipid levels.⁶ The study design was a random, double blind study with 63 overweight or obese women at an average age of 42.6, who all currently had low dietary calcium intakes; BMIs of the participants were between 31-32. Participants were assigned to either a supplementation group or placebo group. Participants in the

supplementation group were given two calcium + D supplements composed of 600 mg of calcium and 200 IU vitamin D a day, one at breakfast and one at lunch. After meeting with a nutritionist at week 0, both groups were put on a weight loss intervention of a caloric restriction of 700 calories a day for fifteen weeks.

Before the intervention began and at the fifteen week mark, researchers collected a three day dietary record, anthropometric data, blood pressure levels, 75g oral-glucose-tolerance test results, and plasma lipid and lipoprotein levels from the participants. Participants continued to meet with the nutritionist every two weeks to assess their adherence to the weight loss intervention.

The results of the study showed that the participants in both groups experienced similar results in weight loss, body mass index, waist circumference, and fat mass from 0 to week 15. Both groups showed a decrease in HDL cholesterol, LDL cholesterol, LDL:HDL ratio and Total:HDL ratio levels. All groups showed a decrease in levels due to the length of the intervention, not the treatment itself. There was no change in total cholesterol or triacylglycerol levels.

The study concluded that calcium + vitamin D supplementation plus a weight loss intervention show beneficial effects on lipid and lipoprotein levels in overweight or obese women who usually have low calcium intake.

Another study published in Obesity Research looked at the effect of both dietary calcium and supplementation on weight loss in 32 obese adults. The participants included 27 women and 5 men, ranging in age from 46-49 years, with a BMI of 30-39.9.⁵ This randomized placebo control trial was 24 weeks long and also included a caloric deficit of 500 calories a day.

The subjects were placed into 3 different dietary regimen groups. The control diet, a low dairy diet, consisted of a 500 kcal/day deficit, with zero to one servings of dairy product a day, 400-500 mg of additional calcium via dairy products, and a placebo supplement. The second diet group had the same regimen as the first but their placebo was replaced with an additional 800 mg of a calcium supplement. The final diet group consisted of a high dairy diet with the 500 kcal/day deficit and 3 additional servings of dairy products totaling 1200-1300 mg of calcium a day. This group did not receive a calcium supplement but still received a placebo.

Researchers measured age, BMI, blood pressure, LDL & HDL cholesterol, percent body fat, and triglyceride levels at weeks 0, 12 and 24. The results showed that all participants lost body weight and body fat due to the caloric restriction. However, there was more weight and fat loss from participants on the high dairy and high calcium supplementation diet. The group on the high dairy diet showed improvement in glucose tolerance, as well as a

slight reduction in systolic blood pressure after the 24 week study.

Bottom Line

The research suggests that consumption of calcium supplementation or dairy products along with a daily caloric restriction may be beneficial in obese or overweight individuals. Combined results of the studies showed a correlation between calcium and weight loss, improved glucose tolerance, improved lipid and lipoprotein levels, and decrease in blood pressure. These are all risk factors associated with metabolic syndrome.

It can be concluded that a caloric restriction will have the greatest impact on weight loss in those who are obese or overweight; however it has been shown that an increase in calcium supplements or dairy are beneficial as well. Vitamin D intake is important in order to absorb calcium and receive its benefits. Supplementation alone is not a strong enough indicator for weight loss so it is important to remember to incorporate nutrient dense dairy products into your daily diet.



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