There has been a lot of debate over the years whether calcium can help with weight loss or reduce weight gain. Some research has shown a negative relationship between body fat levels and calcium intake; in other words, people with higher calcium intakes tend to have less body fat. However, these are observational studies, and correlation does not equal causation. It may simply be that people with higher calcium intakes tend to have healthier diets and are more active. The true way to know whether calcium can affect body composition is through controlled research. But even there, the data is not consistent. Some animal studies indicate calcium can reduce fat gain when rodents are fed high fat diets, but other studies do not support this. When you look at humans, the majority of studies fail to support an effect of calcium supplementation on body weight or body fat. However, many of these studies are limited by small numbers of subjects, and the fact that the studies did not last very long. The Women's Health Initiative study, which involved over 36,000 postmenopausal women over a period of 7 years, did show calcium and vitamin D supplementation to reduce weight gain. The effect was small; women who took supplemental calcium and vitamin D gained 0.3 pounds less than women who received a placebo. Thus, it is possible that calcium does impact weight in humans but the impact is negligible and difficult to detect in research studies. The Women's Health Initiative study also cannot tell us what happened to body composition. The effect was also primarily observed in women who had inadequate calcium intake in the first place.

Vitamin D has become a hot topic over the past decade, and research has shown that obese people have lower levels of vitamin D than people who are not obese. But again, correlation does not equal causation; this data does not necessarily indicate that low vitamin D causes obesity, or that vitamin D supplementation will help with weight or fat loss.

To get a better handle on the whether calcium or vitamin D can help reduce fat gain, a group of researchers looked at data from a 4-year study that was designed to look at the effects of calcium and/or vitamin D supplementation on fractures from osteoporosis. As a secondary analysis, they looked at the effects of supplementation on weight and fat gain.

The Madness in the Methods

This study originally consisted of 1,179 postmenopausal white women of 55 years or older who were randomly selected from a Midwest population. The subjects were randomly assigned to one of three groups:

- 1400 – 1500 milligrams per day of supplemental calcium, along with a vitamin D placebo
- 1400 – 1500 milligrams per day of supplemental calcium, and 1,100 IU of vitamin D
- Calcium and vitamin D placebos

Of the original group, 1,024 completed the four-year study. Most withdrawals occurred in the first year (92 subjects). Subjects with cancer and metal prostheses/implants were excluded from the analysis (as cancer can affect body weight, and metal prostheses can interfere with body composition estimates). Subjects who did not complete the 4-year study were also excluded; overall, 870 subjects were included in the final analysis. Compliance with the supplements/placebos were determined by bottle weight at 6-month intervals. Compliance rate (defined as taking at least 80% of doses) was 76% for calcium and 86.9% for vitamin D. Body mass index (BMI) and body composition estimates were determined annually. Body composition was estimated using dual-energy X-ray absorptiometry (DEXA), and included estimates of trunk fat, trunk leas mass, and percentage of trunk fat. Blood levels of vitamin D were also measured annually. The researchers estimated subjects' total calcium intake from the calcium in their diet, any calcium that they habitually took as a supplement (outside of the study), and the calcium supplement given to them. The researchers did not state how they determined dietary calcium. Total vitamin vitamin D intake was determined as the combination of the vitamin D supplement and any habitual vitamin D supplementation outside of the study.

Calcium Consequences

There were no significant differences between groups for changes in BMI. There were also no significant changes between groups in regards to trunk composition measurements over the first 2 years. However, at years 3 and 4, subjects on the placebo gained significantly more trunk fat mass, and lost more trunk lean mass, than subjects on calcium. At years 3 and 4 , trunk fat had increased by 6% in the

placebo group, but only 2-3% in the calcium groups. Trunk lean mass had decreased by 1-2% in the placebo group but decreased only 1% in the calcium groups. Vitamin D supplementation had no effects.

Cautious Conclusions

The results of this study support the idea that calcium supplementation can help reduce fat gain, at least around the trunk area. However, this study has a number of limitations that you need to consider:

- The effect of calcium was very weak, and did not appear until years 3 and 4. To give you an idea of the magnitude of the effect, the 2-3% increase in trunk fat mass in the calcium groups translates to about 0.6 to 1 pound of fat, while the 6% increase translates to about 2 pounds. This is only around 5% of overall trunk fat mass. So, while statistically significant, the question is whether this is biologically significant in regards to health. It certainly is not biologically significant when talking about overall obesity; calcium supplementation will obviously do little to help you lose significant amounts of fat (or prevent significant amounts of fat gain).
- The researchers expressed the changes as a percentage change, which always makes the differences look bigger than they really are.
- The statistical analysis used surprised me. Without going heavily into statistics here, it would have been better for the researchers to use what is called a *mixed model for repeated measures*, rather than the analysis that they did use. Judging by the data, however, I doubt this would have affected the outcome much.
- Another limitation to the statistics is that the researchers did not report whether their data was normally distributed. Whenever you use parametric statistics, you need to make sure your data fits the assumptions of parametric statistics (one of which is that your data is normally distributed). If your data doesn't meet these assumptions, then you may see significant results when you shouldn't.
- The researchers did not measure dietary intake over the 4-year study. While randomization should help equalize the groups in terms of diet, it can never hurt to have this extra information just to make sure there are no systematic

differences in diet between groups.

- When the researchers excluded subjects with low compliance, the results on trunk fat and lean mass were still significant, but the magnitude of the difference was not reported.
- The researchers never propose a mechanism behind how calcium supplementation may have exerted the impact on trunk fat and lean mass. Some research suggests that calcium may increase the amount of fat lost in the feces (you crap more fat out rather than absorb it), but this research was on dairy products and not calcium supplementation. Other research suggests that calcium supplementation may cause people who are calcium deficient to spontaneously eat less fat and calories. This is why estimates of dietary intake would have been helpful.
- The researchers speculated in the introduction that calcium supplementation may be beneficial specifically in people who are calcium deficient, yet the participants in this study averaged over 1,000 milligrams of calcium intake coming into the study and thus were not calcium deficient.
- This study was a secondary analysis of a data that was originally intended to look at the effects of calcium and vitamin D on fracture risk. One should always be more cautious when using a study to answer questions that the study was not originally designed to answer.

Given the results of animal studies, along with the results of this trial and the women's Health Initiative, calcium supplementation may help prevent fat gain, but the effect is extremely small, takes many years to be apparent, and thus is nothing to get excited about. It is also clear that vitamin D supplementation has no benefit in regards to helping with fat loss or preventing fat gain. This is not to say that calcium and vitamin D supplementation do not have any health benefits at all; there is certainly evidence that they do have health benefits, particularly in women. Just don't expect any magical effects in the body fat department.

REFERENCE: Zhou, J., et al. The effect of calcium and vitamin D supplementation on obesity in postmenopausal women: secondary analysis for a large-scale, placebo controlled, double-blind, 4-year longitudinal clinical trial. *Nutrition and Metabolism*. 7:62, 2010.