Cold Exposure Increases Insulin Sensitivity

Type 2 diabetes, which is reaching epidemic proportions, is characterized by increased insulin resistance. The hormone insulin doesn’t work as well as normally, and so the beta cells in the pancreas must make increasing amounts of it.

Dietary carbohydrate restriction, exercise — especially strength training — and intermittent fasting all promote good insulin sensitivity (low insulin resistance).

Cold temperatures increase insulin sensitivity

It looks like we can add cold exposure to the list of interventions that increase insulin sensitivity.[1. Speakman, John R., and Sahar Heidari-Bakavoli. “Type 2 diabetes, but not obesity, prevalence is positively associated with ambient temperature.” Scientific Reports 6 (2016).]

Type 2 diabetes is positively associated with ambient temperature. The warmer the weather, the more diabetes. Up to about 30% of the variation in diabetes can be explained by temperature.

Curiously, no effect of temperature was seen on obesity, although other studies have found that there is one.

The authors believe that activation of brown adipose tissue (BAT) may contribute to this effect. BAT is a type of fat tissue that increases its metabolism for the sole purpose of generating body heat.

Cold thermogenesis has many health benefits, although helping you to lose weight probably isn’t one of them, for the same reason that aerobic exercise is not very effective for weight loss.

The connection between cold exposure and insulin sensitivity isn’t just an association either: acclimation to the cold causes a substantial increase in insulin sensitivity.[2. Hanssen, Mark JW, et al. “Short-term cold acclimation...
improves insulin sensitivity in patients with type 2 diabetes mellitus.”

Eight people with type 2 diabetes were exposed to cold temperatures, 14 to 15 C (57 to 59 F) for 6 hours a day for 10 days. Insulin sensitivity increased 43%.

BAT activation was minor. But there was a large increase in the GLUT4 receptor, the proteins in skeletal muscle that take up glucose from the bloodstream. These same GLUT4 receptors are activated by exercise – again, especially by strength training.

Cold showers and other cold exposure should be quite effective in increasing GLUT4 receptors and improving insulin sensitivity. Since water conducts heat far more than air, you wouldn’t need to spend 6 hours in the shower to achieve this effect. The heat conductivity of water is about 24 times as great as for air. (0.58 vs 0.024).

If the relation were linear, then 15 minutes in a cold shower of ~58 F would give the same effect. But I’m guessing that actual time would be much shorter since the body reaches a lower temperature faster.

I take a cold shower every morning. I’ve measured the water temperature as about 56 F in the winter, at about 66 in summer.

**Iron metabolism is also associated with insulin resistance**

A recent study found that the more iron in a person’s body, the greater the insulin resistance they had.[2. Wlazlo, Nick, et al. “Iron Metabolism Is Associated With Adipocyte Insulin Resistance and Plasma Adiponectin The Cohort on Diabetes and Atherosclerosis Maastricht (CODAM) study.” *Diabetes care* 36.2 (2013): 309-315.]

These findings suggest that body iron stores and/or iron metabolism-related factors may contribute to the induction of IR early in the pathogenesis of T2DM. Of note, body iron stores can easily be influenced by low-cost interventions such as phlebotomies or dietary interventions. Therefore, iron metabolism, and particularly effects of iron on adipose tissue, represents an interesting feature of the metabolic syndrome that deserves further investigation.

In rats that are bred to have type 2 diabetes, restricting iron in the diet, or lowering their iron via phlebotomy, improves all indicators of diabetes, including insulin, triglycerides, glucose, cholesterol, and free fatty acids.[3. Minamiyama, Yukiko, et al. “Iron restriction improves type 2 diabetes mellitus in Otsuka Long-Evans Tokushima fatty rats.” *American Journal of Physiology-Endocrinology and Metabolism* 298.6 (2010): E1140-E1149.]
Conclusion

Both cold exposure and lowering iron levels can increase insulin sensitivity. Since insulin sensitivity is a key marker of health and decreases in aging, keeping it high (low insulin resistance) can markedly improve health.

To use cold exposure, take 5 to 15 minute cold showers; alternatively, being outside in colder weather with light clothing would work too.

To lower iron, see my book, Dumping Iron.

PS: Check out my Supplements Buying Guide for Men.

Could Cold Showers Cut Muscle Growth?

Cold water immersion has its drawbacks

Reader Rob pointed me to a study on how cold water immersion after a workout affects muscle growth: Post-exercise cold water immersion attenuates acute anabolic signalling and long-term adaptations in muscle to strength training. (1) This study has to do with full immersion, but could cold showers cut muscle growth?

First, here’s the layman’s summary of the article:

- Cold water immersion is a popular strategy to recover from exercise. However, whether regular cold water immersion influences muscle adaptations to strength training is not well understood.
- We compared the effects of cold water immersion and active recovery on changes in muscle mass and strength after 12 weeks of strength training.
We also examined the effects of these two treatments on hypertrophy signalling pathways and satellite cell activity in skeletal muscle after acute strength exercise.

- Cold water immersion attenuated long term gains in muscle mass and strength. It also blunted the activation of key proteins and satellite cells in skeletal muscle up to 2 days after strength exercise.
- Individuals who use strength training to improve athletic performance, recover from injury or maintain their health should therefore reconsider whether to use cold water immersion as an adjuvant to their training.

Awhile back I wrote about cold thermogenesis, and what parts of it were hype and what were reality. In short, exposure to cold water does have health benefits, but weight loss is probably not one of them.

**Are cold showers the same as cold water immersion?**

I also mentioned my habit of taking cold showers, and that the water temperature at the time (November 1) was about 66 degrees F. These day – end of December – the temperature of my showers is more like 56 degrees F.

When I first read the above study, I dismissed it as being of any relevance to my own practices. The study concerns *immersion* in cold water for 10 minutes. I don’t do immersion and my exposure is much less than 10 minutes, maybe 2 minutes this time of year.

The study doesn’t say how cold the water was. (At least not in the abstract, and they want money for me to read the whole paper.)

But the gains of those who immersed in cold water were cut dramatically. In the group that did not immerse themselves in cold water, “Isokinetic work (19%), type II muscle fibre cross-sectional area (17%) and the number of myonuclei per fibre (26%) increased in the ACT group (all P < 0.05)”. The cold water group saw no gains in these measures.

In part of the study, they looked at the consequences of a single exercise bout followed by cold water immersion or not, and activation of satellite cells and muscle synthetic proteins was greater in the group that did not immerse. The study authors conclude:

These data suggest that CWI [cold water immersion] attenuates the acute changes in satellite cell numbers and activity of kinases that regulate muscle hypertrophy, which may translate to smaller long-term training gains in muscle strength and hypertrophy. The use of CWI as a regular post-exercise recovery strategy should be reconsidered.
I’ve stopped cold showers post-workout

I’m now ready to reconsider taking a cold shower after a session of weightlifting, and in fact I’ve stopped doing so.

This time of year the water is likely cold enough to cut my gains, and besides, why take the chance?

The cuts in gains in the study were far larger than I would have expected.

How does all this work? Athletes who do cold water immersion say that their exercise recovery is better. The better recovery probably comes about because the cold dampens inflammation.

The problem is, inflammation is necessary for muscle hypertrophy. Applying weights to muscles causes signals to be sent telling the muscles to grow, and inflammation is a part of these signals.

Cold showers have benefits, among them activation of the hypothalamic-pituitary axis, better immune function, and an antidepressant effect. But done post-workout, they may very well decrease muscle growth. I continue to take them daily, but not after a gym session.

PS: Check out my latest book, Best Supplements for Men.

PPS: Check out my Supplements Buying Guide for Men.