



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.” *Nature medicine* 21.8 (2015): 863-865.]

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 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](#).