THE CONVERSATION
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Shivering unlocks new way of fighting fat

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Autor

Francesc Villarroya
Professor, Department of Biochemistry and Molecular Biology, Universitat de Barcelona

Shivering is not an activity many of us enjoy. We do it because we are cold and uncomfortable. But perhaps the news that it could have some of the same benefits as moderate bouts of exercise will stop us running in from the cold so quickly. Researchers have found that the act of shivering can stimulate the conversion of energy-storing “white fat” into energy-burning “brown fat”.

The findings, published in Cell Metabolism, show that when humans shiver their levels of hormones irisin (produced by muscle) and FGF21 (produced by brown fat) increase. Specifically, around 10-15 minutes of shivering by volunteers placed in temperatures of less than 15°C resulted in equivalent rises in irisin as an hour of moderate exercise.

Irisin, identified just two years ago in animals, converts white fat into brown fat. Unlike white fat, brown fat is designed to produce heat by burning calories. For example, around 50g of white fat retains more than 300 kilocalories of energy in the body. The same amount of brown fat could burn up to 300 kilocalories a day.

There has been a lot of excitement surrounding the discovery of irisin because the energy-burning nature of brown fat makes it a potential therapeutic tool for targeting obesity and diabetes. It appears to be a golden ticket to promoting a healthy metabolism: as well as burning calories, it drains the

blood of glucose (useful for preventing the onset of type II diabetes) as well as draining blood of unhealthy fat like triglycerides.

Also through studies in the laboratory on animals, FGF21 has been found to be a powerful activator of this brown fat, energy burning process. It is a molecule that originates in the liver and in brown fat itself. Since brown fat was discovered in humans, researchers have been bent on working out how to stimulate more of it, which makes this new research particularly exciting.

Unlocking our brown fat potential

The capacity of brown fat to burn calories in order to produce heat and maintain body temperature in cold environments has long been known in animals. We are all born with supplies of brown fat; it is nature's way of preventing hypothermia in babies. But until recently, it was thought to vanish in early infancy, getting replaced by "bad" white fat that sits on our waistlines.

We now know that brown fat is present in most, if not all, adults. Those with more brown fat are slimmer than those without. Glucose levels are also lower in humans with more brown fat. Efforts are therefore being made into understanding how brown fat is stimulated in humans. Previous studies have shown how irisin activates it in rodents; this research is an important step in understanding how it is stimulated in humans.

It was already known that cold temperatures stimulate brown fat, but a comprehensive knowledge on how the body signals that message to its cells was lacking. This latest study set out to better understand the mechanism underlying the activation of brown fat.

When we are cold, we first activate our brown fat because it burns energy and releases heat to protect us. When that energy is insufficient, our muscles contract mechanically, or shiver, thereby generating heat. But we did not know how muscle and fat communicate in this process. For the first time, this research shows the way that they communicate with each other through specific hormones – turning white fat cells into brown fat cells to protect us from the cold.

The identification of these two molecules, irisin and FGF21, as capable of promoting energy expenditure in humans, opens prospects for being used for potential drug developments. There is nothing better than promoting exercise as a healthy habit to enhance muscle production of irisin that will impair accumulation of calories as fat in our body. But, when exercising is difficult for clinical or personal conditions, knowing that enhancing certain hormones in the blood may promote energy expenditure could help develop more tools to combat obesity.

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