

When you lose weight, where does the fat go?

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This is an image of a weight scale. Credit: CDC/Debora Cartagena

Despite a worldwide obsession with diets and fitness regimes, many health professionals cannot correctly answer the question of where body fat goes when people lose weight, a UNSW Australia study shows.

The most common misconception among doctors, dieticians and personal trainers is that the missing mass has been converted into energy or heat.

"There is surprising ignorance and confusion about the metabolic process of [weight loss](#)," says Professor Andrew Brown, head of the UNSW School of Biotechnology and Biomolecular Sciences.

"The correct answer is that most of the mass is breathed out as [carbon dioxide](#). It goes into thin air," says the study's lead author, Ruben Meerman, a physicist and Australian TV science presenter.

In their paper, published in the *British Medical Journal* today, the authors show that losing 10 kilograms of fat requires 29 kilograms of oxygen to be inhaled and that this [metabolic process](#) produces 28 kilograms of carbon dioxide and 11 kilograms of water.

Mr Meerman became interested in the biochemistry of weight loss through personal experience.

"I lost 15 kilograms in 2013 and simply wanted to know where those kilograms were going. After a self-directed, crash course in biochemistry, I stumbled onto this amazing result," he says.

"With a worldwide obesity crisis occurring, we should all know the answer to the simple question of where the fat goes. The fact that almost nobody could answer it took me by surprise, but it was only when I showed Andrew my calculations that we both realised how poorly this topic is being taught."

The authors met when Mr Meerman interviewed Professor Brown in a story about the science of weight loss for the Catalyst science program on ABC TV in March this year.

"Ruben's novel approach to the biochemistry of weight loss was to trace every atom in the fat being lost and, as far as I am aware, his results are completely new to the field," says Professor Brown.

"He has also exposed a completely unexpected black hole in the understanding of weight loss amongst the general public and [health professionals](#) alike."

If you follow the atoms in 10 kilograms of fat as they are 'lost', 8.4 of those kilograms are exhaled as carbon dioxide through the lungs. The remaining 1.6 kilograms becomes water, which may be excreted in urine, faeces, sweat, breath, tears and other bodily fluids, the authors report.

"None of this is obvious to people because the [carbon dioxide gas](#) we exhale is invisible," says Mr Meerman.

More than 50 per cent of the 150 doctors, dieticians and personal trainers who were surveyed thought the fat was converted to energy or heat.

"This violates the Law of Conservation of Mass. We suspect this misconception is caused by the energy in/energy out mantra surrounding weight loss," says Mr Meerman.

Some respondents thought the metabolites of fat were excreted in faeces or converted to muscle.

"The misconceptions we have encountered reveal surprising unfamiliarity about basic aspects of how the human body works," the authors say.

One of the most frequently asked questions the authors have encountered is whether simply breathing more can cause weight loss. The answer is no. Breathing more than required by a person's metabolic rate leads to hyperventilation, which can result in dizziness, palpitations and loss of consciousness.

The second most frequently asked question is whether weight loss can cause global warming.

"This reveals troubling misconceptions about global warming which is caused by unlocking the ancient carbon atoms trapped underground in fossilised organisms. The carbon atoms human beings exhale are returning to the atmosphere after just a few months or years trapped in food that was made by a plant," says Mr Meerman, who also presents the science of climate change in high schools around Australia.

Mr Meerman and Professor Brown recommend that these basic concepts be included in secondary school curricula and university biochemistry courses to correct widespread misconceptions about weight loss among lay people and health professionals.

Provided by University of New South Wales

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