

Majority of weight loss occurs 'via breathing'

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Although it is often pushed to the side during the festive rush, during the post-Christmas fallout, weight loss will once more be at the top of many of our agendas. But where does excess weight go when we lose it? The answer provided by a new paper may be a surprise.

According to researchers from the University of New South Wales in Australia, when weight is lost, the majority of it is breathed out as carbon dioxide. Their paper is published in the Christmas issue of The BMJ.

Prof. Andrew Brown and Ruben Meerman reported widespread misconception regarding how weight is lost, finding physicians, dietitians and personal trainers all equally guilty of not knowing. Most believed that fat is converted to energy or heat, "which violates the law of conservation of mass," they write.

Others believed that fat could be excreted within feces or converted to muscle. These responses may well have provoked gasps from Brown and Meerman, who have now formulated a calculation to illustrate how we actually "lose weight."

Excess dietary [carbohydrates](#) and protein are converted to a type of fat called triglyceride. When people attempt to lose weight, they are attempting to metabolize these triglycerides while keeping their fat-free mass intact, explain the authors.

Triglycerides are comprised of three types of atom: carbon, hydrogen and oxygen. Triglyceride molecules can be broken down only by unlocking these atoms, through a process known as oxidation.

Tracking the atoms

The researchers chose to follow the path of these atoms when leaving the body. They found that when 10 kg of fat were oxidized, 8.4 kg were converted and excreted as carbon dioxide (CO₂) via the lungs, and 1.6 kg became water (H₂O).



The lungs are the primary excretory organ in weight loss, according to the researchers.

In order for 10 kg of human fat to be oxidized, the researchers calculated that 29 kg of oxygen must be inhaled. Oxidation then produces a total of 28 kg of CO₂ and 11 kg of H₂O.

"None of this biochemistry is new," say the authors, "but for unknown reasons it seems nobody has thought of performing these calculations before. The quantities make perfect sense but we were surprised by the numbers that popped out."

The results suggest that the lungs are the main excretory organ for weight loss, with the H₂O produced by oxidation departing the body in urine, feces, breath and other bodily fluids.

On average, a person weighing 70 kg will exhale around 200 ml of CO₂ in 12 breaths each minute. The authors calculate that each breath contains 33 mg of CO₂, with 8.9 mg comprised of carbon. A total of 17,280 breaths during the day will get rid of at least 200 g of carbon, with roughly a third of this weight loss occurring during 8 hours of sleep.

The carbon that is lost through exhalation is only replaced through the consumption of food and beverages such as fruit juice, milk and soft drinks. "Keeping the weight off simply requires that you put less back in by eating than you've exhaled by breathing," state the authors.

'Eat less, move more'

The amount of carbon that is lost can be increased with exercise. By substituting 1 hour of rest for 1 hour of moderate exercise such as jogging, the metabolic rate is increased sevenfold, removing an additional 40 g of carbon from the body, increasing the daily total by around 20% to 240 g.

However, this can easily be offset with unhealthy eating. A single 100 g muffin, for example, provides around 20% of an average person's total daily energy requirement. "Physical activity as a weight loss strategy is, therefore, easily foiled by relatively small quantities of excess food," write the authors. The solution is a traditional one - "eat less, move more."

"We recommend these concepts be included in secondary school science curriculums and university biochemistry courses to correct widespread misconceptions about weight loss," they conclude.

Although the findings of the paper may alter how weight loss is understood, strategies for losing weight should remain unchanged. Eating less and moving more is a surefire way to combat the overindulgences of the festive season.

Earlier this month, a new study in The Journal of Pediatrics reported that two sleep disorders - chronic lack of sleep and sleep-related breathing problems - [double the risk of childhood obesity](#).

Written by [James McIntosh](#)

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When somebody loses weight, where does the fat go?, Ruben Meerman and Andrew J. Brown, The BMJ, doi: 10.1136/bmj.g7257, published online 16 December 2014, [abstract](#).

The BMJ news release, accessed 16 December 2014.

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