Battling obesity with better mathematical models

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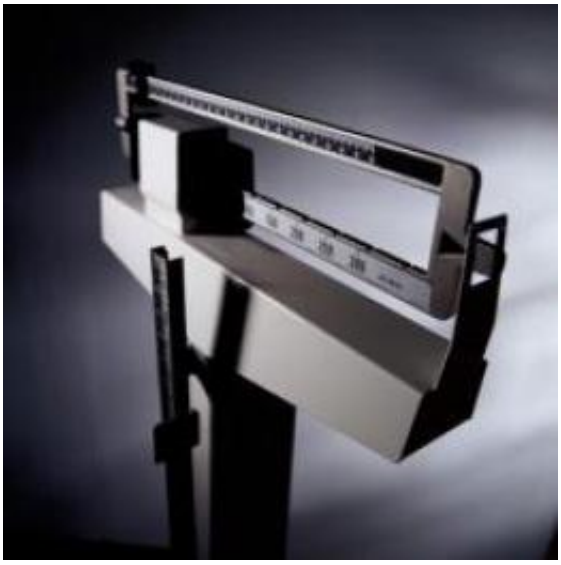

Credit: NIH

In the war to lose weight it may be something other than willpower or junk food that's preventing victory: it could be faulty use of mathematics.

Traditionally, nutritionists and researchers have assumed that all you need to do to lose weight is cut calories -- about 500 calories per day to lose a pound per week for most dieters, from the assumption that each pound of weight lost represented 3,500 calories in reduced calorie intake or increased exercise.

"People have used this rule of thumb for decades, and it turns out to be completely wrong," Kevin Hall, a scientist with the National Institutes of Health, said at the American Association for the Advancement of Science annual meeting in Vancouver.

Hall said the reality is that losing weight slows a person's metabolism -- and the mathematical model typically used doesn't take this slowing into account. When dieters report a "yo-yo" sequence, of weight loss, reaching a plateau in weight and then slowly regaining previously lost pounds, this is part of the reason.

New models may have some of the answers. The science of weight loss isn't new; scientists have been struggling to understand it for almost 40 years, said Carson Chow, a senior investigator at the National Institutes of Health in Bethesda, Md. Chow said that what's different now is that scientists are compiling many data sets into a single model.

Hall and Chow are part of a team that has created a new model, and an online weight simulation tool that shows what happens when people of varying weights, diets and exercise habits try to change their weight. Their model was first published last fall in the journal *The Lancet*.

"Instead of using that old rule of thumb, people input their goal weight in a certain period, and the model shows them what you have to do in [the] short term to get to goal weight and then what they'd have to do permanently," explained Hall. The model takes into account differences in sex and body-fat content.

At the moment, the online tool is not very user-friendly, say the researchers, so it's primarily intended for physicians and researchers who help guide people toward better health. Obesity is on the rise: two-thirds of the adult U.S. population is classified as overweight or obese, and around the globe, obesity rates have doubled in the past 30 years.

Outdated calculations predicted that people could lose weight forever, if they stuck to the calorie-reduction rules. The new model predicts slower weight loss.

"If I want to lose 10 pounds of weight eventually, I have to cut 100 calories per day out of my diet," Hall explained. "You'll get halfway there in about a year, and then you will eventually plateau, [reaching the goal] after about three years."

Math can also help to drive policy decisions, said Boyd Swinburn of the World Health Organization Collaborating Centre for Obesity Prevention in Australia. He explained that many of the "best buy" policies that tend to have a real impact, such as restricting marketing to kids, taxing sugary substances, and increasing labeling, also tend to be the policies that governments do not want to undertake.

The less cost-ineffective interventions, like after-school programs, tend to be the ones that governments are more interested in undertaking, said Swinburn.

"You get a huge spread in the relative effectiveness of these programs," said Swinburn, adding that mathematical perspectives that parse out health improvements per dollar help shed light on policy interventions.

Questions remain about the science of weight loss. For example, is a calorie of butter burned the same way in the body as a calorie of fruit? Like many other parts of the equation, said Hall, it may vary from person to person.

The same is true of exercise. "For small changes, exercise is more potent than cutting calories -- it speeds up weight loss," said Hall. But at some point, a person will reach a tipping point, where cutting calories will have a larger impact.

That's because someone who is 200 pounds will lose more calories doing the same exercise than someone who is 150 pounds.

"The heavier you are, unlike the popular notion, the more calories you're burning," said Hall.

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