

Are you what you eat? New study of body weight change says maybe not

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If identical twins eat and exercise equally, must they have the same body weight? By analyzing the fundamental equations of body weight change, NIH investigators Carson Chow and Kevin Hall find that identical twins with identical lifestyles can have different body weights and different amounts of body fat.

The study, published March 28th in the open-access journal *PLoS Computational Biology*, uses a branch of mathematics called dynamical systems theory to demonstrate that a class of model equations has an infinite number of body weight solutions, even if the food intake and energy expenditure rates are identical.

However, the work also shows that another class of models directly refutes this, predicting that food intake and energy expenditure rates uniquely determine body weight. Existing data are insufficient to tell which is closer to reality, since both models can make the same predictions for a given alteration of food intake or energy expenditure.

Given the ongoing obesity epidemic, Drs. Chow and Hall are interested in what factors determine human body weight and its stability. Of particular importance is whether a treatment for obesity would have to be administered repeatedly over a lifetime or could be given only until a target body weight is reached. As a particular example, the study considers whether weight lost from a liposuction procedure is permanent. For the class of equations with an infinite number of body weight solutions, fat removal through liposuction could lead to

permanent results. However, the opposing models predict that the body would eventually return to its original weight.

Chow and Hall note that neither class of models accounts for the many variables affecting how much a person tends to eat, an important factor determining bodyweight. Nevertheless, for any food intake rate this latest research suggests that an individual may have an infinite number of possible body weights. The study outlines the mathematical conditions underlying this possibility and suggests how future experiments could determine if it is true.

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