HHS Public Access

Author manuscript

Obesity (Silver Spring). Author manuscript; available in PMC 2019 November 01.

Published in final edited form as:

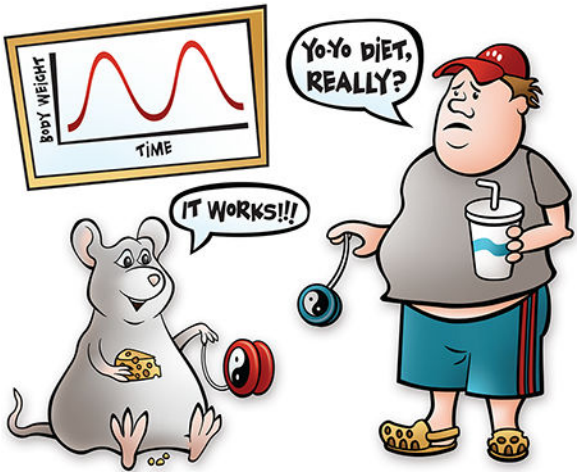
Obesity (Silver Spring). 2018 November ; 26(11): 1673. doi:10.1002/oby.22335.

Yo-yo dieting is better than none

Clara Di Germanio, **Andrea Di Francesco**, **Michel Bernier**, and **Rafael de Cabo***

Experimental Gerontology Section, Translational Gerontology Branch, National Institute on Aging, National Institutes of Health, Baltimore, Maryland 21224, USA

Graphical Abstract



The prevalence of obesity in the US has reached epidemic proportions, with roughly 70% of the population being overweight, and among those 40% have obesity [Health, United States, 2016, CDC]. The most effective and prescribed intervention to prevent or control obesity is modification of daily habits, such as a decrease in calorie intake and increase in physical activity. The difficulty of people to adhere to this recommendation leads often to lifelong periodic energy restriction cycles associated with repeated loss and regain of body weight and changes in body mass index (BMI). These periodic up-and-down weight cycles are referred to as yo-yo diets. For most of us, this strategy has negative connotations. In fact, there are several controversial reports on the harmful effects of such dieting cycles, some of which concluded that weight cycling is linked to a net increase in weight gain and body fat and heightened cardiovascular and metabolic risk, while other reports found no adverse metabolic effects in humans [1]. In animal studies, most of the inconsistencies can be attributed to differences in the experimental designs, such as the amount and type of diet used, strain, age, and sex of the animals, length of study and husbandry conditions. Genetic heterogeneity plays an additional and cardinal role when assessing the effects of yo-yo weight cycling in humans. While most studies have focused on short-term outcomes after a

*Correspondance: deCaboRa@grc.nia.nih.gov.

few weeks/months of weight cycling, very little is known about the long-term consequences on employing this experimental design over the adult life.

One of the strengths of animal experimentation is the ability to perform a well-controlled study that enables careful analysis of the lifelong impact of a given treatment on all aspects of health and survival. In this issue of Obesity, Smith and colleagues [2] performed an elegantly designed animal study reporting on the beneficial effects of weight cycling on survival in mice. The authors used a randomized, controlled design testing the consequences in terms of health and survival of sustained weight loss *vs* weight cycling over the lifetime of obese adult male and female mice. While sustained reduction of calorie intake led to an improvement in lifespan when compared to mice that remained obese (no surprises here!), those animals that weight cycled (three times over their adult life) also lived significantly longer than the obese controls. This is probably the best-crafted and controlled animal study on weight cycling that has been done to date. The authors carefully designed and executed a strict clinical experimental design using both sexes and a diet with a nutritional composition that resembles a typical Western diet. These fascinating and intriguing results lead us to conclude that weight cycling, or yo-yo, dieting is better than no dieting at all, at least in mice!

On the other hand, animal studies have several shortcomings when translating findings into clinical practice. One is that chronic or short cycles of calorie restriction in rodents typically entail daily meal feeding that mice tend to consume in a short period of time, leading to long periods of fasting [3]. This is typically not the case in humans on a diet, where most regimens involve multiple meals during the day. This is clearly an important variable to consider when translating these findings into humans. However, and in tune with this report, there is also an emergent body of literature suggesting the beneficial effects of periodic fasting cycles in humans [4, 5, 6]. This extensive daily fasting period leads to a metabolic switch from carbohydrate to fat utilization [7], promoting the activation of degradation and turnover pathways that promote repair and removal of damaged macromolecules. Perhaps inducing a daily alternation of substrate utilization cycles may explain some of the long-term beneficial effects observed in this study and may facilitate the translation into the clinic.

Acknowledgments

This work was supported by the Intramural Research Program of the NIA/NIH

References

1. Mehta T, Smith DL, Jr, Muhammad J, Casazza K. Impact of weight cycling on risk of morbidity and mortality. Obes Rev. 2014;15(11):870–881. [PubMed: 25263568]
2. Smith DL, Jr, Yang Y, Nagy TR, et al. Weight cycling increases longevity compared with sustained obesity in mice. Obesity (Silver Spring) 2018 doi:10.1002/oby.22290
3. Mitchell SJ, Bernier M, Mattison JA, et al. Daily Fasting Improves Health and Survival in Male Mice Independent of Diet Composition and Calories. Cell Metab. 2018; 10.1016/j.cmet. 2018.08.011.
4. Mattson MP, Allison DB, Fontana L, et al. Meal frequency and timing in health and disease. Proc Natl Acad Sci 2014;111(47):16647–16653. [PubMed: 25404320]

5. Longo VD, Panda S. Fasting, Circadian Rhythms, and Time-Restricted Feeding in Healthy Lifespan. Cell Metab. 2016;23(6):1048–1059. [PubMed: 27304506]
6. Sutton EF, Beyl R, Early KS, Cefalu WT, Ravussin E, Peterson CM. Early Time-Restricted Feeding Improves Insulin Sensitivity, Blood Pressure, and Oxidative Stress Even without Weight Loss in Men with Prediabetes. Cell Metab. 2018 6 5;27(6):1212–1221 [PubMed: 29754952]
7. Anton SD, Moehl K, Donahoo WT, et al. Flipping the Metabolic Switch: Understanding and Applying the Health Benefits of Fasting. Obesity 2018;26(2):254–268. [PubMed: 29086496]