

practical diabetology

Meal Size, Not Body Size, Explains Food Intake Estimation Errors

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It is often assumed that obese people intentionally underestimate their food intake to improve their self-esteem (self-deception) or how they are viewed by others (self-presentation) (1–4). We argue, however, that biases in estimating calories have a perceptual, not motivational, origin and that meal size, not body size, explains the underestimation of calories (5). Thus, obese people are no more likely to underestimate the caloric content of their meals than are people of normal weight, and medical practitioners advising obese patients on lifestyle choices need to recognize this to help their patients better stave off or live healthily with diabetes (6).

To confirm this, we devised two studies wherein three hypotheses were made and tested: (1) everyone's estimation of calories follows a predictable pattern of diminishing sensitivity to increases in meal sizes; (2) once meal size is controlled for, there are no differences in the estimation biases of overweight and normal-weight individuals; and (3) the differences between overweight and normal-

weight individuals are simply a result of overweight individuals choosing, and thus estimating, larger meals.

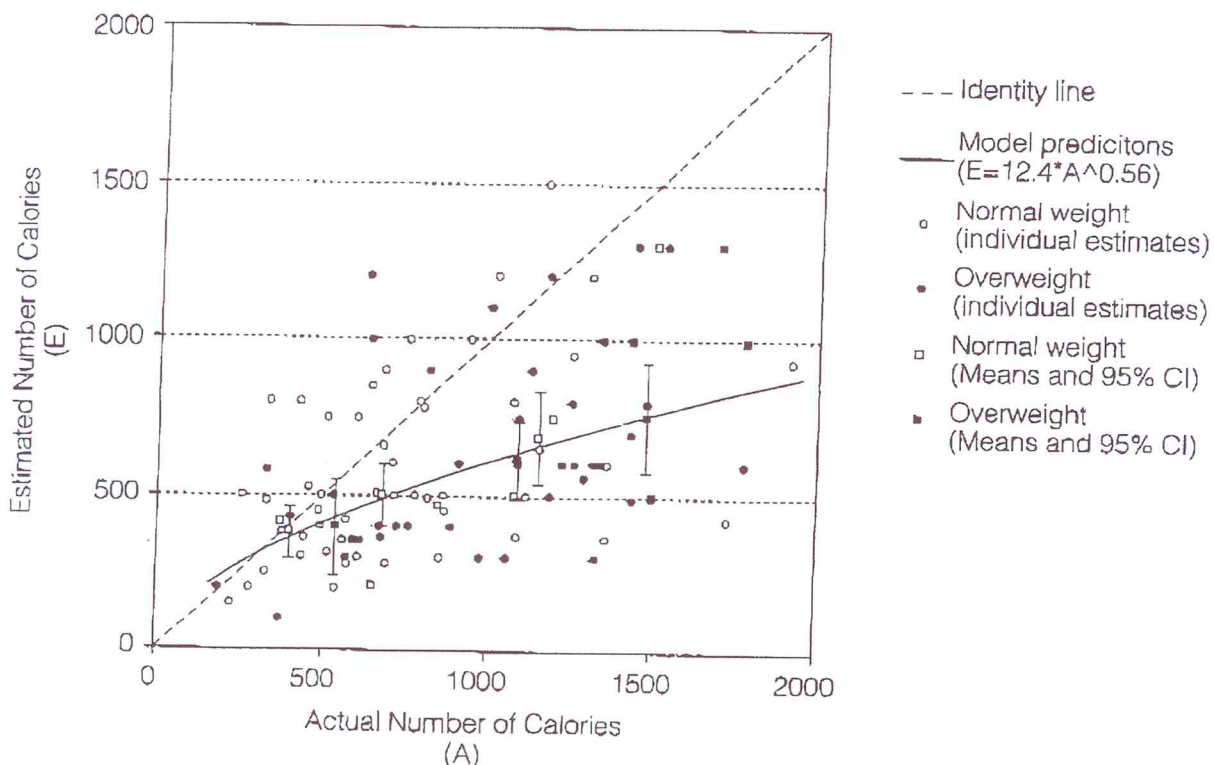
Calorie Estimation of Fast-Food Meals

This study was conducted in fast-food restaurants on nine weekdays in three medium-sized Midwestern U.S. cities over the noon hour. The targeted restaurants belonged to nationwide hamburger and sandwich chains and were located within 150 feet of each other. Trained interviewers approached every fourth person who was finishing a meal and asked them if they would answer some brief questions for a survey.

People who agreed to participate in the survey were then asked if they were 18 or older and if they ate in this fast-food restaurant at least once a month. If they answered positively to these two questions, they were then asked to estimate the total number of calories contained in their entire meal (not the number of calories that they had consumed). They were asked to provide their height (in feet and inches) and weight (in pounds). Dur-

FIGURE 1.

BOTH NORMAL WEIGHT AND OVERWEIGHT PEOPLE UNDERESTIMATE THE CALORIES OF LARGER MEALS MORE THAN SMALLER MEALS



This scatter plot shows that the larger a meal is, the more a person will underestimate the number of calories in the meal.

ing this process, the interviewers unobtrusively recorded the type and size of the food and drinks from the packages or wrappings left on the tray. In the few cases where identification was impossible (e.g., to determine if the drink was diet or regular), the information was obtained directly from the participants. Nutrition information available on the Web site of the fast-food restaurants was then used to compute the actual number of calories of each person's meal.

Is calorie underestimation caused by meal size? There were no statistical differences in calorie estimation between men and women. Participants underestimated the caloric content of their fast-food meal by an average of 23.1%. These average underestimations hide large differences depending on the size of the meal. A scatter plot shows that the larger

the meal, the more a person underestimates the calories in the meal (Figure 1).

Is calorie underestimation caused by body size? The mean percentage deviation was higher for overweight people than for people of a normal weight (-33.0% vs. -16.2%). This is because the calorie estimations of overweight consumers were not statistically different from those of normal-weight consumers (570 calories vs. 508 calories), even though their meal contained significantly more calories (957 vs. 683).

In a follow-up study, we experimentally manipulated meal size (independent of body size). We found that meal size did not matter. The overweight and normal-weight participants followed the same power curve. Once overweight and normal-weight people are asked to estimate the same meals, as op-

posed to the meals that they would have consumed, their estimations are undistinguishable (7).

Conclusion

This research was motivated by the oft-cited allegation that calorie underestimation, coupled with increasing portion sizes, is an important driver of obesity, which in turn drives up the rates of diabetes. In fact, there is considerable evidence that overweight individuals are more likely to underestimate their food intake than people with a normal weight.

The stronger underestimation by overweight people can be mathematically and empirically explained by two facts: (a) overweight people choose, and thus estimate, larger meals, and (b) both overweight and normal-weight people have a tendency to underestimate the calories in large meals. The results of earlier studies were confounded by the size of meal being estimated. People with very low body-mass indexes (BMIs) and those with very high BMIs would underestimate the size of a 2,000 calorie meal to the same extent. The big difference is that the overweight person is likely to eat a lot more of these meals than the thin person.

In summary, what drives the intake underestimation of overweight people is not intentional misreporting caused by denial or social desirability biases; it is a fundamental perceptual bias shared by all people.

For medical practitioners dealing with diabetic patients who may also be obese, these results underscore the fact that all people strongly underestimate the caloric content of large meals and large portions. Clinicians should realize that overweight patients are no less accurate in their basic estimation ability than are individuals of normal weight. Exhorting good-faith overweight patients to pay more attention or to stop lying to themselves and to their doctors is unfounded and most probably counter-productive.

Instead, one way to improve patient's calorie estimations might be to emphasize that the number of calories contained in a large meal is twice that of their best guess. A second option is to provide patients with portion-sized benchmarks that they can use in their everyday life. Our results suggest an innovative solution: ask patients to estimate calories item by item instead of in the aggregate.

When estimating the number of calories in small amounts of food, people are often very accurate. The effectiveness of food diaries as a weight-loss tool suggests that an item-by-item breakdown may even have the dual benefits of improving calorie estimations and reducing calorie intake.

This research can help offset the dangers of diabetes precisely by targeting the behaviors that lead to its onset. Trying to correct bad behaviors is infinitely more productive and cost-effective than dealing with their results. However, the idea that obese people are more inaccurate at calorie estimations than are normal-weight individuals is not true and does not pinpoint this "bad behavior" as an enabler of diabetes precisely because, as our research shows, it isn't. Obese patients are more likely to have diabetes than patients of normal weight because they tend to eat much more unhealthily, due to a variety of factors, but their supposed greater underestimation bias is not one of those factors. Once medical practitioners recognize this, they can focus on other negative habits and tendencies that may contribute to or exacerbate diabetes.

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