Substitution and Compensation Erode the Energy Deficit from Exercise Interventions

Dear Editor-in-Chief:

In their recent review, Melanson et al. (3) neatly illustrated how compensatory changes in diet or physical activity may explain why the weight loss achieved through an exercise program is less than predicted and highly variable between people. We would like to highlight a further consideration that could be just as important.

Physical activity energy expenditure can vary enormously from a sedentary physical activity level (total energy expenditure/basal metabolic rate) of <1.39 through to a highly active PAL of >2.00 (1). It is noteworthy that even a person with a very low PAL (e.g., 1.30) will expend several hundred kilocalories per day through physical activity. Therefore, when an exercise or physical activity intervention is prescribed for weight loss, we should bear in mind that the baseline is not zero and the prescription will be superimposed against the background of existing (variable) physical activity. Thus, an exercise prescription will rarely replace absolute rest. Indeed, it is quite conceivable that in some circumstances, the prescribed exercise (e.g., walking) simply replaces nonprescribed (existing) physical activity of a similar intensity for a negligible or nonexistent energy deficit.

We have briefly referred to this concept as "substitution" (4), although it has been very poorly characterized in the literature. The substitution of nonprescribed physical activity with prescribed physical activity has the capacity to substantially erode the potential energy deficit from an exercise or physical activity intervention. Such substitution may help explain why prescribed exercise interventions do not always lead to an increase in overall daily energy expenditure (2).

Many of the studies discussed in the review by Melanson et al. (3) simply subtracted measures of "prescribed" exercise energy expenditure from measures of total physical activity energy expenditure to derive nonprescribed physical activity. This approach does not take into account the loss of the physical activity that existed before the "new" prescribed exercise was introduced. This may erroneously give the impression of behavioral compensation when, instead, the apparent reduction in nonprescribed physical activity is actually the product of substitution. Of course, variability in habitual physical activity, the duration and intensity of the intervention, and the precise timing of newly prescribed exercise (relative to habitual physical activity) will all affect the degree of substitution. Our own 6-month exercise training study shows strong evidence for dietary compensation (i.e., an increase in energy intake to offset the increase in energy expenditure) but no evidence for a compensatory reduction in nonprescribed physical activity (5).

Thus, we share the views of Melanson et al. (3) that behavioral compensation is a critically important consideration that helps explain why weight loss is less than predicted with exercise and also variable between people. We also share their excitement about the potential development of strategies to help susceptible individuals. This letter is intended to highlight that we also need to recognize the role of substitution if we hope to understand the true impact of behavioral compensation.

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