Dear Sir:

We welcome the insightful comments received from Hall and Chow in response to our recent articles (1, 2). In our previous regression analyses (2, 3), we log-transformed body weight and energy flux (EnFlux = total energy expenditure = total energy intake) to reduce the skewness and heteroskedasticity of the data and increase the linearity of the relation. We believe that this is justifiable, and it gives a zero intercept (ie, zero body weight means zero EnFlux), which is more plausible than the positive intercept given by the untransformed data. EnFlux and body weight are interdependent, and we elected to place EnFlux as the independent variable on the x axis because we were trying to predict weight from EnFlux and covariates such as height, age, and sex. Hall and Chow argue, with some justification, that EnFlux should be considered the dependent variable on the y axis, which would give the equation for adults as follows:

\[
\ln \text{EnFlux} = 0.521(\ln \text{Weight}) + 0.003(\text{Height}) - 0.005(\text{Age}) - 0.126(\text{Sex}) + 6.845
\]  

(1)

Where \(\ln\) = natural logarithm for EnFlux in kJ/d and weight in kg, height is in cm, age is in y, and sex corresponds to males = 0 and females = 1.

The slope of this log relation without covariates is 0.668, which approximates the slope of the linear equation (94 kJ \cdot kg\(^{-1}\) \cdot d\(^{-1}\)) over the range of 60 to 100 kg (as shown in Figure 1) and closely matches the slope estimated by Hall et al (4, 5) in their analyses. There is an urgent need to test the validity of these and other equations [eg, Christiansen and Garby (6), Wang et al (7)] against longitudinal studies (eg, Christiansen and Garby (6), Wang et al (7)) against longitudinal measures of energy expenditure and body weight in adults. Ideally, these would be adults exposed to normal secular and age-related changes in weight as opposed to adults involved in weight-gain or weight-loss studies (which can trigger metabolic responses to counter weight change). When we tested the validity of our equations for children (which were derived with EnFlux on the x axis), our equations predicted the mean weight change in children from 3 longitudinal studies (\(n = 212\); mean follow-up: 3.4 y) to \(<0.5\%\) (3).

We note that our previous conclusion (1), that the increase in food energy supply is more than sufficient to explain the US epidemic of obesity, remains the same regardless of the regression equation used to predict population body weight on the basis of estimated energy intakes. The use of the new equation presented above, with body weight as the independent variable, would indicate a higher expected weight change than previously reported. This result, along with that of Hall et al (4), appears to indicate an increase in food waste in the United States that has not been fully accounted for by the US Department of Agriculture (USDA) in their estimates of food availability adjusted for wastage. We believe that it would be valuable for the USDA to update its estimates of food waste so that the food energy supply data more closely parallel food energy intake.

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REFERENCES


Exercise and ambient temperature may influence energy balance via satiation processes

Dear Sir:

We read with interest the report by Shorten et al (1) and were excited by their results. However, had they focused on the proximal...
effects of exercise on body hydration, subsequent food intake, and satiation processes as contributors to energy balance rather than exclusively on energy balance per se, they might have proposed a more parsimonious explanation for their results. A focus on satiation would have put the spotlight on exercise-induced body dehydration and its effect on preference for water- and fiber-rich foods, especially fruit and vegetables. In their crossover design experiment, Shorten et al found that their subjects consumed more fluids (juices and water) after exercising in the heat than at rest; they also lost more body water (as reflected by change in body weight) when exercising than when spending the same amount of time at rest, which is consistent with past literature (2). The authors also noted that subjects after exercising were found to have lower relative energy intake during a subsequent ad libitum meal than after the nonexercise condition, as has been previously shown (2).

What Shorten et al (1) failed to report, however, was whether the subjects who exercised in the heat consumed not only more fluids via drinks and juices but consumed more water- and fiber-containing solid foods as compared with the nonexercise condition. The energy density of the solid food consumed ad libitum by the subjects after they had completed exercising in the heat was 10.8 kJ/g food, whereas the energy density of the solid food consumed in the nonexercise condition was 11.9 kJ/g food, a 10% greater energy density. Passive overconsumption of energy is more likely with foods that are high in energy density (3). The authors might consider further analysis of their ad libitum food consumption data. They may find that the total water content of the foods consumed by the subjects who exercised in the heat significantly exceeded the water content of the foods consumed by the same subjects at rest.

Of the various food components contributing to satiety, water content is easily the most important, followed by dietary fiber (4, 5). An increase in the intake of minimally processed fruit and vegetables, the foods that are consistently highest in water content and rich in fiber, is becoming recognized as a sustainable way of increasing satiety with fewer calories, contributing to long-term weight loss with less hunger (6, 7).

Americans have been told repeatedly by their government since the 1974 publication of the nation’s first dietary goals by the Senate Select Committee on Nutrition to consume more fruit and vegetables but have had difficulty meeting even half the minimum recommendation (8, 9). Shorten et al (1) may now have an answer to the question of how to motivate individuals to consume more water-rich, fiber-rich, minimally processed foods. Intervention trials are needed to titrate how much exercise-induced dehydration and glycogen depletion are needed to motivate optimally satiating food choices. The results reported by Shorten et al may make a more important contribution to the literature on obesity treatment and prevention than they recognized.

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REFERENCES


Reply to WJ McCarthy et al

Dear Sir:

Thank you for the opportunity to respond to the letter of McCarthy et al. These authors suggested that our finding of lower relative energy intake after exercise in the heat (36°C; HEAT) compared with a resting control trial (CON) may be explained, at least in part, by the effect of exercise-induced body dehydration on preferences for foods rich in water and fiber, which in turn may encourage satiety with fewer kilojoules. Consequently, we reexamined our results to determine the effect of exercise in the HEAT on the consumption of water- and fiber-containing solid foods compared with the nonexercise condition (Table 1).

It was found that total ad libitum water intake (in g) from the combination of both solid foods and drinks was higher after exercise in the HEAT compared with the resting control trial (P = 0.045). Similarly, total water intake (in g) from the combination of both solid foods and drinks was higher after exercise in a more neutral temperature (NEUT; 25°C) compared with the resting control trial (P = 0.026). These observations were not surprising given that our original report revealed a greater consumption of water as a beverage after both exercise trials (1). However, contrary to the hypothesis of McCarthy et al, the absolute water content (in g) of the solid food alone was not different between HEAT and CON trials (P = 1.000), but was higher in NEUT compared with CON (P = 0.041). The latter observation of greater absolute water intake from solid foods in the NEUT compared with the CON trial is likely accounted for by the greater absolute intake (in g) of solid foods in general after NEUT compared with CON [401 ± 174 g compared with 238 ± 107 g as originally reported (1)]. Accordingly, when water intake (in g) was expressed as a percentage of the absolute amount

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