Effect of exercise on daily energy needs in older individuals

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Energy requirements decrease with advancing age (1). The reported declines in energy intake and daily energy expenditure are multifactorial and are due to a myriad of physiologic and behavioral changes in older men and women. Although both energy intake and energy expenditure are reported to decline with aging, a disproportionately greater decline in energy expenditure than in energy intake exists, resulting in positive energy balance. This energy dysregulation, or the inability to appropriately match energy intake with energy expenditure, results in increased total and central body fatness, a loss of muscle mass, and a greater predisposition to comorbidities associated with obesity and physical inactivity. Thus, clinical or lifestyle interventions that could restore energy balance and increase energy needs would have great therapeutic value to enhance the quality of life of older persons.

In this issue of the Journal, Bunyard et al (2) hypothesized that regular physical activity with and without weight loss would increase daily energy requirements in previously inactive lean and obese older persons. To investigate this hypothesis, the researchers asked 3 groups of older men to either participate in an exercise program if they were previously inactive, undergo exercise and weight loss if they were obese, or stop training for 3 mo if they were master athletes. This experimental approach is a significant strength of the study because it considers the effects of both increased and decreased physical activity on daily energy requirements. Daily energy needs in these men were established from standard resting metabolic rate equations and adjusted to achieve a stable body weight based on 7-d food records. Food was provided as preprepared diets calculated from food records to maintain weight stability. The scientific rigor of the study could have been enhanced by assessing daily energy needs with the doubly labeled water method, a more accurate measure of daily energy needs, but this does not detract from the major findings.

The major findings of the paper are that endurance exercise increased daily energy needs in previously inactive older men and that daily energy needs decreased in master athletes who interrupted their training for 3 mo. These findings underscore the powerful influence of regular physical activity on changes in daily energy needs in older men. Interestingly, daily energy needs were best predicted from a measure of maximal oxygen uptake, which is consistent with previous reports (3, 4). Collectively, these results suggest that the decrease in daily energy needs in older persons is primarily due to a decline in physical activity energy expenditure and not to the aging process per se. This is good news because it means that if regular physical activity is adopted by older persons and daily energy expenditure is increased, energy needs could be increased and energy balance reestablished. The reestablishment of energy balance in older persons would decrease the incidence of obesity and its associated comorbidities.

Note that the study was not designed to examine spontaneous adjustments in energy intake in response to increased or decreased physical activity. Food was prepared in a metabolic kitchen and provided to the volunteers to stabilize body weight. Thus, it is still unclear whether physiologic mechanisms are operative in older persons that serve to match energy intake with energy expenditure under a variety of physiologic perturbations. For example, there is much interest in adaptive changes in food intake in response to energy surplus and deficit conditions. Roberts et al (5) showed that older persons do not appropriately adjust (or match) their intake to brief periods of overfeeding and underfeeding. Episodic periods of over- and undernutrition caused by maladaptive responses to environmental perturbations may contribute to inappropriately high amounts of body fat and loss of skeletal muscle mass. On the other hand, healthy older persons have been reported to appropriately increase their daily energy intake with increasing levels of physical activity (6). Thus, on the basis of these results and those of the study by Bunyard et al (2), we advance the notion that the energy dysregulation associated with advancing age may be partially (if not totally) caused by declining physical activity, although the mechanisms remain to be established.

The study by Bunyard et al (2) was performed in older men. Thus, whether these findings are applicable to older women is unknown. Older women, particularly those of African American descent, have been shown to have lower rates of resting energy expenditure and physical activity than do older men (7). These results persist even when differences in body composition are taken into account. This difference may contribute to the higher rates of obesity and associated comorbidities in older women than in older men. Thus, for this reason, I encourage these investigators to extend their initial studies to examine the effects of increased physical activity on the daily energy needs of specific populations who have low rates of energy expenditure for their “metabolic size” (7). These are the populations in whom increased physical activity may yield significant metabolic and lifestyle benefits.

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It was encouraging to observe that older men increased their daily energy needs in response to endurance training. We reported that short-term endurance training caused a compensatory reduction in free-living physical activity in older men and women, as measured by the doubly labeled water method (8). We speculated that the short-term nature of the program (2 mo) and its high intensity may have fatigued our volunteers, which may have reduced their nonexercising physical activity. Bunyard et al report an average increase in daily energy needs of $\approx 770$ kJ/d (184 kcal/d) as a result of participation in the 6-mo training program. This energy expenditure is roughly equivalent to an increase of 2.8 km (1.75 mi) of walking per day. It is unclear, however, whether this increase is totally due to the direct energy cost of the exercise program or to some alteration in the components of daily energy expenditure (ie, increased physical activity outside of the exercise program). Unfortunately, the investigators did not assess the components of daily energy expenditure, which include resting metabolic rate and physical activity. Nonetheless, this carefully performed study provides encouraging news that increased physical activity augments daily energy needs in older persons. Moreover, the fact that daily energy needs tracked with increasing and decreasing levels of physical activity emphasizes the importance of regular physical activity and adequate energy intake in older persons to offset cardiovascular disease risk and diabetes. Overcoming “sloth and gluttony” with regular physical activity should be a high priority for all health care professionals concerned with improving the quality of life of older men and women.

REFERENCES