

Energy Balance

THE KEY TO A UNIFIED MESSAGE ON DIET AND PHYSICAL ACTIVITY

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The aim of this commentary is to highlight the advantages of an energy-balance framework to unify diet and physical activity messages. Despite an array of pharmacotherapies, lifestyle modification remains the first-line approach for preventing obesity, cardiometabolic diseases, and cancer. Yet, patients, let alone professionals, often perceive recommendations on diet to be separate from, or even competitive with, those on physical activity. They perceive these as 2 sets of unrelated guidelines. This is a mistaken and unfortunate view. Nutrition and physical activity are highly interrelated, complementary, and synergistic. As exemplified by findings from the National Weight Control Registry, the power of combining a wise diet and a physically active lifestyle is compelling. Accordingly, the American Cancer Society and the American Heart Association have integrated their respective diet/physical activity/body weight recommendations into single documents. Corresponding follow-through at the clinical level is overdue. The diet versus physical activity question is *passé*. Let us move forward by teaching our patients about energy balance, the inclusive concept that captures the synergy between diet and physical activity. Adopting an energy-balance framework can improve the relevancy and potency of lifestyle messages to patients and better enable them to develop and apply effective behavior-change skills.

KEY WORDS

diet

energy balance

physical activity

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The authors declare no conflict of interest.

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DOI: 10.1097/HCR.0b013e3182721568

Adam and Eve, salt and pepper, rod and reel—all are recognized pairs where one is not thought of without the other. This is the way we need to visualize diet and physical activity—together. Trying to elevate the importance of one over the other is futile. Diet and physical activity are a package deal, inextricably tied together by the principle of energy balance. But most Americans have only a vague notion about what is meant by energy balance. We believe that it is time to rethink how we counsel patients on these fundamental behaviors and to see the importance of unifying healthy lifestyle messages around the principle of energy balance.

Sadly, many patients receive no guidance about improving eating and physical activity behaviors from their physicians. For those patients who do, the

advice they get may be mixed and vary depending on the health care professional (eg, physician, nurse, dietitian, and exercise specialist). Patients often perceive nutrition and physical activity messages as being separate, for example: “I need to improve my diet” or “I should exercise more.” Without an appreciation of the interplay between what they eat and their activity levels, patients are easily confused or conflicted. Some see lifestyle recommendations as being competitive (diet vs exercise). Mass media reports often increase bewilderment.

The current situation is understandable. As exemplified by the dietary guidelines for Americans and the surgeon general’s report on physical activity and health, recommendations in nutrition and exercise

science have been developed and refined over decades.¹⁻⁵ Each discipline acknowledges the value of the other, but a full partnership to integrate health messaging for patients and consumers is yet to occur. The time is overdue to unify what most adults see as distinct directives. Separate guidelines no longer make sense. The overarching message should be on energy balance and the potent health-enhancing interactions between dietary choices and physical activity.

ENERGY BALANCE: A UNIFYING FRAMEWORK

Energy balance is an essential principle of weight regulation and, along with the avoidance of cigarette smoking, is critical to the prevention and treatment of obesity, cardiovascular diseases, diabetes, and cancer. Maintaining body weight is fundamentally a balance between energy consumed through the food we eat and energy we expend throughout the day (which is dependent on body size and physical activity). If we eat fewer calories than we expend, *negative energy balance*, then we lose weight. If our energy intake is consistently higher than our energy expenditure, *positive energy balance*, then we gain weight.

This is not to say that innate biological variability in *energy efficiency* (the ability to derive energy from food and use it to fuel body processes) does not exist from person to person. Individual differences due to genetics and physiology are present. But in the vast majority of cases, such differences amount to only negligible differences in a person's overall energy balance. Occasionally, medical disorders have been shown to cause obesity; these cases are the exception, not the rule.

The synergy between a prudent diet and an active lifestyle is often overlooked or unrecognized. The body's complex internal workings modulate energy intake and expenditure (the Figure). Healthy habits of intake and expenditure lead to energy

balance via the synergistic activation and signaling among tissues and organs, particularly those of the cardiopulmonary, endocrine, gastrointestinal, immune, metabolic, musculoskeletal, and nervous systems. Over time, healthy energy-balance behaviors improve physiological capacities and efficiencies, which, in turn, yield positive health outcomes and enhanced well-being.

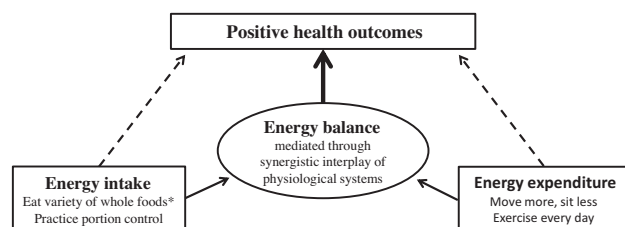
These complex interactions can be health-promoting or health-compromising. In older patients, a sort of negative synergism occurs where inadequate nutrition and minimal physical activity lead to loss of muscle mass, which reduces strength and walking speed, and thus overall activity and appetite.⁶ Years or decades earlier, unhealthy lifestyle behaviors may have initiated the process. With persistence of harmful habits, the responsiveness and integration of intake/expenditure systems are compromised and eventually produce clinical signs of dysregulation. Whether beneficial or harmful, the impact is more than the sum of the individual components.

Using an energy balance perspective, patients can appreciate the challenges of behavior change and how to identify social and environmental barriers better. In essence, modern lifestyle encourages consumption of excessive energy (food) and discourages energy expenditure (physical activity).⁷ For example, our built environment often interferes with healthy eating (eg, easy access to fast foods) and active recreation and active transport (eg, poor neighborhood walkability, limited access to green space and parks, and longer commutes by vehicle).⁸

UNDERSTANDING BOTH SIDES OF THE COIN

Years ago, when the airlines still served meals, a trim-looking woman ate her entire meal except the dessert, a small piece of apple pie. While clearing the trays, the flight attendant asked her if she wanted the pie. She replied, "Oh no, that's equal to a 3-mile run and not worth those calories." She understood the currency of calories (eg, small slice of pie = 250 kcal = 3 mile run), and applied the concept of energy balance to guide her eating and exercise practices.

Familiarity with the caloric content of foods/beverages and equivalent energy cost of routine physical activities is necessary. For instance, a medium piece of fruit (banana, apple, or orange) gives 50 to 100 kcal, a small soft drink (12 oz) 140 kcal, a small order of French fries about 250 kcal, and a standard fast-food burger (eg, Big Mac or Whopper) 500 to 700 kcal. A 120-pound woman needs about 2000 kcal



*emphasize plant-based foods (fruits,vegetables, whole grains) and limit saturated fat and added sugar

Figure. The potential for multiple health benefits (eg, attaining/maintaining healthy weight and reducing risk for chronic disease) is markedly increased using an energy-balance approach that combines prudent practices in both diet and physical activity.

per day to maintain her weight. One “value-pack” meal (drink, burger, and fries) will provide half the energy she needs for the day!

Then, again, how often does one opt to super-size because it is only another quarter? Or, how many soft drinks or snacks do we consume throughout the day? A slight but steady positive energy balance—the energy in a single soft drink, a candy bar, or a pack of crackers each day—can result in a significant weight gain in only a few months. Conversely, cutting back by the same amount can result in a significant loss of weight.

On the energy expenditure side, a person’s daily energy needs are determined by resting metabolic rate (function of body size), the thermic effect of food (energy cost of digestion), and the amount of physical activity. Together, the first two comprise about 75% of one’s daily energy needs. Physical activity is the lone factor under our control and thus key to achieving energy balance. Energy expenditure for 30 minutes of brisk walking or equivalent activity would be about 150 kcal for a 120-pound woman, a small amount indeed in contrast with the calories consumed during a 30-minute fast-food meal. This is why we must emphasize to our patients the importance of being physically active throughout the day.

It is now clear that habitual sedentary behavior (too much sitting) is an independent cardiometabolic risk factor distinct from that associated with a lack of moderate- to vigorous-intensity activity (too little exercise).⁹⁻¹² Over the past several decades, sedentary behavior (sitting and lying down; 1.0-1.5 metabolic equivalents [METs]) has largely replaced light-intensity physical activity (standing, self-care activities, and slow walking; 1.6-2.9 METs) during nonsleeping hours. Yet, periodic neuromuscular stimulation from standing and light activities appears to be necessary throughout the day to sustain components of musculoskeletal and metabolic health.

As cardiologist Alpert¹³ recently quipped, “You only have to exercise on the days that you eat.” That is, be physically active in multiple ways every day. Multiple lines of evidence indicate that our bodies favor stable energy balance with high energy flux (when both intake and expenditure are high).¹⁴ Let us counsel patients to embrace lifestyle physical activity, to engage in regular moderate- to vigorous-intensity activity, and to reduce prolonged sitting by increasing light-intensity activities. For example, disrupt prolonged sitting every hour by standing, stretching, or walking for several minutes or when on the phone stand or pace. Every minute of sedentary behavior replaced with light activity would expend 1 additional kilocalorie (calculated assuming 1.5 vs 2.3 METs for a person weighing 72 kg).

ENERGY BALANCE IN PRACTICE

The National Weight Control Registry, the largest prospective investigation of long-term successful weight-loss maintenance ($n \geq 10\,000$ adults), provides compelling real-world evidence on the value of an energy-balance approach.^{14,15} More than 90% of successful weight-loss maintainers made significant changes to their diet and exercise patterns. Most prominently, they follow a low-calorie diet and exercise an average of 1 hour per day. A large majority of them watch TV less than 1.5 hours per day, reflecting low sedentary behavior and weigh themselves at least once per week, indicating ongoing monitoring. These individuals understand energy balance, and their real-world results demonstrate that blended strategies (diet and physical activity) work.

Let us also make patients aware of the remarkable synergy between modest caloric restriction and increased physical activity in eliciting favorable cardiometabolic health outcomes. A recent study provides a case in point: despite similar reductions in body weight and fat stores, subjects who combined caloric restriction (12.5% decrease in energy intake) with regular exercise (12.5% increase in expenditure) improved cardiorespiratory fitness, insulin sensitivity, low-density lipoprotein-cholesterol, and diastolic blood pressure to a greater extent than those with more marked caloric restriction alone (25% decrease).¹⁶

Although weight loss followed by sustained maintenance is an important goal for many, countless others would benefit from an energy-balance approach to prevent excess weight gain (creeping obesity).^{7,14} Sometimes though, too much emphasis is put on what we weigh.¹⁷ The truth is that humans come in different shapes and sizes with strong genetic determination. Ideal weight is more a marketing myth than a scientific reality. What is most important is establishing healthy energy intake/expenditure behaviors.

MOVING FORWARD WITH AN ENERGY BALANCE PERSPECTIVE

Motivating and enabling salutary behavior change in patients, let alone in ourselves, is a complex and challenging process. Yet, despite an array of pharmacotherapies, lifestyle modification remains without doubt the first-line approach for preventing obesity, cardiometabolic diseases, and cancer. Unifying diet/physical activity recommendations by adopting an energy balance framework can improve the relevancy and potency of lifestyle messages to patients.

Steps in this direction are evident. Major universities, including Colorado State University, Florida State University, San Diego State University, and the University of Buffalo, now offer combined degrees/programs in nutrition and exercise science. The American Cancer Society and the American Heart Association have combined their respective diet/physical activity/body weight recommendations into single documents^{18,19}; both discuss the importance of energy balance. To reduce obesity rates population-wide, a joint task force and recognized experts propose strategies focused on helping people make small changes in diet *and* physical activity to prevent weight gain.^{20,21}

RECOMMENDATIONS AND CONCLUSIONS

Practical steps for integrating an energy balance approach into patient counseling will vary across health care teams. We offer a few recommendations:

1. Train dietitians on the fundamentals of caloric expenditure and physical activity so they can incorporate this information with their dietary counseling.
2. Increase opportunities for patients to meet with exercise specialists outside the formal rehabilitation setting.
3. Develop simple patient materials that focus on the importance of combining diet with physical activity to facilitate weight reduction and cardiometabolic health.

The diet versus physical activity question is *passé*. Let us move forward by teaching our patients about energy balance, the inclusive concept that captures the natural synergy between diet and physical activity. Like the stars and stripes, night and day, left and right, energy intake and energy expenditure comprise a fundamental duality. One is incomplete without the other. Our message to patients and consumers should be simple and clear: for better health, strive for energy balance by eating well and by being physical active.

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