Lesson 2
The Key Principles of Energy Balance

Part 2
Calories Out
THE SURPRISING PROBLEM WITH CALORIE COUNTING

Part 2: ‘Calories Out’

By John Berardi Ph.D. and Helen Kollias Ph.D.

Think meticulous calorie counting means knowing exactly how much breakfast you’re burning during exercise? Unfortunately, it’s more complicated than that. Here, 4 reasons why daily activity tracking and exercise counts can be problematic.
In Part 1: ‘Calories In’, we revealed some of the hidden imperfections of calorie math.

Of course, when I say “hidden”, I mean “unknown to most”. Because scientists — at least those specializing in nutrition — have known about calorie math’s quirks for a long time.

The calorie certainly has its uses, and knowing how to apply calorie counts properly is a crucial skill for health and fitness pros (that’s why we devote a whole chapter to it in the Precision Nutrition Level 1 Certification).

However, despite what most people think, meticulous calorie counting simply isn’t a “must” when it comes to weight management — and that goes for ‘calories in’ and ‘calories out’.

In this infographic, we present 4 reasons why depending on calorie burn estimates for weight management can be really problematic.

It’ll change your understanding of how nutrition and exercise work together to achieve (or maintain) a fit, healthy body. If you’re a fitness pro, it might change how you coach and communicate with clients.
THE SURPRISING PROBLEM WITH CALORIE COUNTING

PART 2: ‘CALORIES OUT’

Most people who count calories for weight management assume it’s an exact science. Here, 4 reasons why tracking the calories you burn can be problematic.

1. CALORIE BURN ESTIMATES ARE IMPRECISE.

The calorie expenditure figures you see in lifestyle publications, online calculators, and fitness trackers are based on laboratory averages with large margins of error.

**DIRECT CALORIMETRY**

Scientists use a hermetically sealed isolation chamber to measure energy burned. It’s the most expensive method, so it’s rarely used.

**DOUBLY LABELLED WATER METHOD**

Study subjects drink water containing medical isotopes, which scientists measure in body fluids over time to estimate average daily metabolic rate.

**INDIRECT CALORIMETRY**

Gas exchange measurements are taken to estimate energy expenditure. This is the method behind 99% of the calorie burn estimates you see.
Consumer fitness trackers are off by about 30% for total daily calorie expenditure. And for aerobic exercise, the devices show errors between 9% and 23%. Here’s what that looks like for a 300-calorie workout.
2. **INDIVIDUALS BURN CALORIES UNIQUELY AND VARIABLY.**

Many factors affect the true number of calories you’ll burn during exercise and at rest.

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**GENES**

A single variation in the FTO gene can cause you to **burn 160 fewer calories per day**.

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**BROWN FAT**

In cold environments, people with brown fat (fat tissue containing more mitochondria) **burn up to 400 calories more per day** than people without it. Diet is also a factor: In one study, people who ate capsaicin burned 120 more calories per day via brown fat activation.

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**EPIGENETICS**

External factors affect how genes are expressed. In mice, when a mother eats more of a specific nutrient (methyl donors) during pregnancy, her offspring **burn 5% more calories per day** than others. Human studies indicate the potential for similar findings.

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**SLEEP**

Sleep deprivation for a single night may **decrease calories burned by 5-20%**.
Overall, it's not unusual for an individual’s metabolic rate to vary by 100 calories from day to day.

**ERROR: UP TO 20%**
Importantly, you’ll burn more energy digesting some macronutrients than others.

**PERCENTAGE OF A MACRONUTRIENT’S CALORIES YOU’LL BURN VIA DIGESTION**

- **PROTEIN**: 20-30%
- **CARBOHYDRATES**: 5-10%
- **FATS**: 0-3%

**ERROR: UP TO 20%**

Without adaptive metabolism, each person would have gained 16 pounds.

For example, in response to overeating, metabolism increases. However, some people’s metabolism will adapt more than others’.
YOUR WEIGHT HISTORY INFLUENCES HOW MANY CALORIES YOU’LL BURN.

If you’ve ever been overweight / obese, your metabolic rate may be lower than equations predict due to something called adaptive thermogenesis.

Consider a 40-year-old man who weighs 200 pounds. Equations predict he’ll require 2,759 calories / day to maintain his weight.

He starts to eat less in an effort to lose weight.

Over time, he loses 20 lb., or 10% of his previous body weight. Since a smaller body needs to process fewer calories to live, his total caloric output goes down.
Because the man has been living on a calorie deficit and lost significant weight, his brain thinks he’s in danger of starving to death. His fat cells release less leptin, a hormone that influences hunger and activity cues.

This sends the body into calorie conservation mode, causing the man to subconsciously move less (via a drop in non-exercise activity thermogenesis, or NEAT) and making his muscles more efficient so he burns fewer calories even when he exercises.

Because of this adaptive thermogenesis, research shows the man may always require up to 300 fewer calories per day than equations predict to maintain his new weight.

Whereas most equations would predict the man requires 2,623 calories per day to maintain 180 lb., he might actually need as few as 2,323 daily.

ERROR: UP TO 10%
PUTTING IT ALL TOGETHER

Because...

Calorie burn estimates are imprecise;
Individuals burn calories uniquely and variably;
What and how much you eat influences the calories you’ll burn; and
Your weight history influences how many calories you’ll burn...

...counting ‘calories out’ may be less reliable than you think.

TOTAL ERROR WHEN COUNTING ‘CALORIES OUT’:
UP TO 25%

WHERE DO WE GO FROM HERE?

Tracking calorie intake and calorie output is imprecise and variable. Until science comes up with a better way, we like to keep things simple:

Commit to a daily movement practice and ballpark food portions using a hand measurement system.
Some important notes

Lowercase ‘c’

For the scientists among our readership: Throughout the introduction and infographic, ‘calories’ — lowercase ‘c’, refers to kilocalories — or ‘Calories’. Over time, popular language has lost the big C/little c distinction.

Section 1: “Calorie burn estimates are imprecise.”

Direct calorimetry measures the heat you give off in a sealed metabolic chamber. It’s similar to a bomb calorimeter, which measures the caloric value of a food by burning the food, measuring the heat given off, and extrapolating the caloric value.

Doubly labeled water uses two isotopes, tritium ($^{3}$H) and $^{18}$O in the form of water ($^{3}$H$_{2}^{18}$O). After drinking the doubly labeled water scientists sample water lost through urine, feces, and sweat, and the CO$_{2}$ lost when breathing.

Using the proportions of “labeled” hydrogen and oxygen, scientists can estimate energy used based on some physiological assumptions. However, some of these assumptions only hold true above a certain threshold of carbohydrate intake, so when individuals are on low-carbohydrate diets the calorie estimates are very inaccurate.

Indirect calorimetry estimates the calories you burn based on the amount of oxygen you use and carbon dioxide you produce. These values are related to overall metabolism because oxygen is consumed (and carbon dioxide given off) in proportion to metabolic activity. However, many variables affect this relationship. For example, as you consume less carbohydrate it becomes less accurate (because of
basic assumptions it uses to calculate energy burned). These basic assumptions don’t hold up on a low carb diet.

**Section 2: “A single variation in the FTO gene can cause you to burn 160 fewer calories per day.”**

The FTO gene polymorphism has been associated with obesity. In fact, it has the most evidence supporting it and is the most compelling polymorphism for linking obesity risk to a single gene.

**Section 2: “External factors affect how genes are expressed.”**

Epigenetic changes result in modifications to DNA that don’t change the DNA sequence. The two main types of epigenetic modifications are DNA methylation and histone modification.

In the case of the mice referenced in this infographic, mothers ate more of the methyl donors: folic acid, B12, choline chloride, and anhydrous betaine. And their offspring were more metabolically active.

The details of epigenetics in people are less clear. However, recently, researchers found possible epigenetic causes for differences seen in body weights of identical twins. For example: A gene called *Trim28* controls a network of other genes (*Nnat, Peg3, Cdkn1c* and *Plagl1*) by epigenetic modifications (histone deacetylation). Lower levels of *Trim28* lead to one twin being obese while their sibling (who has higher levels of *Trim28*) is lean.

**Section 2: “Women’s menstrual cycle affects their resting metabolic rate.”**

Although scientists aren’t 100% sure of this, hormone-driven temperature changes during the menstrual cycle are likely the reason
behind the fluctuations in resting metabolic rate in women throughout menses.

**Section 3: “What and how much you eat influences how many calories you’ll burn.”**

The thermic effect of feeding (TEF, also called thermic effect of food, specific dynamic action, and/or dietary-induced thermogenesis) is the energetic cost of digesting, absorbing and assimilating food.

This includes the energy it takes to chew food; for enzymes to molecularly dismantle your food; and for transporters to shuttle the nutrients across your intestinal lining.

**Sections 3 and 4: Adaptive thermogenesis**

While adaptive thermogenesis doesn’t occur in everyone all the time, it’s a very important factor when trying to determine ‘calories out’.

In one study conducted at the Mayo Clinic, researchers overfed 16 normal-weight subjects by 1,000 calories per day for 8 weeks. That’s the equivalent of about 2 double cheeseburgers a day. And the participants were asked not to perform purposeful exercise.

Result: While this rate of overeating “should” have produced about a 16-pound weight gain in each subject, participants actually gained very different amounts of weight. The range was quite surprising: The individual with the highest adaptive metabolism gained only 0.79 pounds while the one with the lowest adaptive metabolism gained 9.3 pounds.

Why the difference? The subjects’ measured resting metabolic rate, thermic effect of food, and physical activity didn't change much.
(Although we know these measures can be somewhat error-prone.) However, there were huge differences in measured non-exercise activity thermogenesis, or NEAT.

On average, NEAT went up by 336 calories per day. But from person to person, changes in NEAT ranged from -98 to +692 calories per day. (Yes, that’s a minus sign on 98. As in one poor woman actually had less NEAT.)

The changes in their NEAT output directly predicted the amount of fat each individual gained:

More NEAT, less fat gained.
Less NEAT, more fat gained.

This study is supported by other research, which shows:

Some people find it easy to gain weight, and hard to lose it. Their energy expenditure (especially NEAT) doesn’t go up much when they over-eat, and they also expend much less energy when they eat less (as their NEAT drops more dramatically). They are also likely to be naturally more sedentary.

Other people find it hard to gain weight, and easy to lose it. Their bodies adapt to over-eating by firing up the metabolic furnace (cranking up their NEAT output), and don’t slow things down as much when eating less (NEAT doesn’t drop much). This is your classic “hardgainer” who struggles to gain mass. They are also likely to be natural fidgeters.

In many people, the body fights hard to defend against weight loss or gain. Overall, researchers calculate that changes in NEAT account for 85-90% of adaptive thermogenesis.
Want to learn more?

If you’d like to learn more about helping people find the best way of eating for them, check out our Precision Nutrition Level 1 Certification program; the next group kicks off soon.

The Precision Nutrition Level 1 Certification is the world’s most respected nutrition education program. It gives you the knowledge, systems, and tools you need to really understand how food influences a person’s health and fitness. Plus the ability to turn that knowledge into a thriving coaching practice.

Developed over 15 years, and proven with over 100,000 clients and patients, the Level 1 curriculum stands alone as the authority on the science of nutrition and the art of coaching.

Whether you’re already mid-career, or just starting out, the Level 1 Certification is your springboard to a deeper understanding of nutrition, the authority to coach it, and the ability to turn what you know into results.

Visit this link for more information:
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[Of course, if you’re already a student or graduate of the Level 1 Certification, check out our Level 2 Certification, an exclusive year long Master Class for elite professionals looking to take their nutrition knowledge and coaching techniques to the highest possible level.]