Forget the idea that you can just burn off the holiday gluttony – exercise isn't the route to weight loss you thought it was, finds Teal Burrell

Calories in crisis

A SIMPLE calculation lies at the heart of a lot of mainstream weight loss advice. If calories out exceed calories in, you will lose weight. It is why both exercise and diet are said to be key to staying trim, and why many of us feel we can make amends for overindulging by joining the gym or dusting off our running shoes.

But if you have ever increased how much exercise you do and found it did little to shed the pounds, you have probably had an inkling that the sums don't add up. Despite tipping the balance in favour of calories out, the scales don't budge. This is the so-called exercise paradox. Until recently, it has been explained away by the logic that exercise leaves people hungry so they eat more.

It now turns out something weirder is going on. Working out a lot doesn't appear to burn more calories than doing a little. In fact, going mad in the gym doesn't seem to burn any more calories than moderate activity a few days a week and taking the stairs, for instance.

Researchers are scratching their heads as to how to reconcile this. And while it might be bad news for those who had hoped to run off those festive dinners, there is a flip side. Those who exercise intensively through a sense of guilt or obligation might be happier, and possibly wealthier, taking it easier.

Some of the biggest clues that something was up with the exercise and weight loss equation lie far from the gym, on the plains of Tanzania. Here, the Hadza people live as we all once did, as hunter-gatherers. The men walk about 10 kilometres each day, stalking game with bows and arrows, while women spend hours on the move, digging for wild tubers and picking berries.

A few years ago, Herman Pontzer headed to Tanzania to study the Hadza and their metabolism. He wasn't expecting to reveal any big mysteries around exercise. "It started off that we wanted to just ask a basic question: 'How many calories do you need to burn to live as a hunter-gatherer?'" he says.

To find out, Pontzer, an evolutionary anthropologist at Hunter College in New York, and his colleagues turned to the gold standard test for measuring daily energy expenditure, known as the doubly labelled water method. This involved the Hadza drinking water laced with slightly different forms of oxygen and hydrogen, called isotopes. How much of these isotopes are left in their urine accurately reveals how much energy they have used.

Far from burning through huge amounts of calories on their daily expeditions, the Hadza got through only slightly more than Westerners who drive to a job to sit all day, with the men using up about 2600 calories and the women 1900. "I couldn't believe it," says Pontzer.

The findings caused a stir. They called into question the widely accepted idea that sedentary lifestyles in many societies are responsible for the obesity epidemic. Instead, Pontzer and his team began to wonder whether our daily energy expenditure could have evolved to be fixed at these levels, regardless of whether we sit at a desk all day or search the plains looking for our next meal.

To back up the idea, what's needed is to study other ways of living too, including populations with Western lifestyles. That's where Lara Dugas of Loyola University Chicago comes into the story. Her team kitted out nearly 2000 people from the US, Ghana, ›

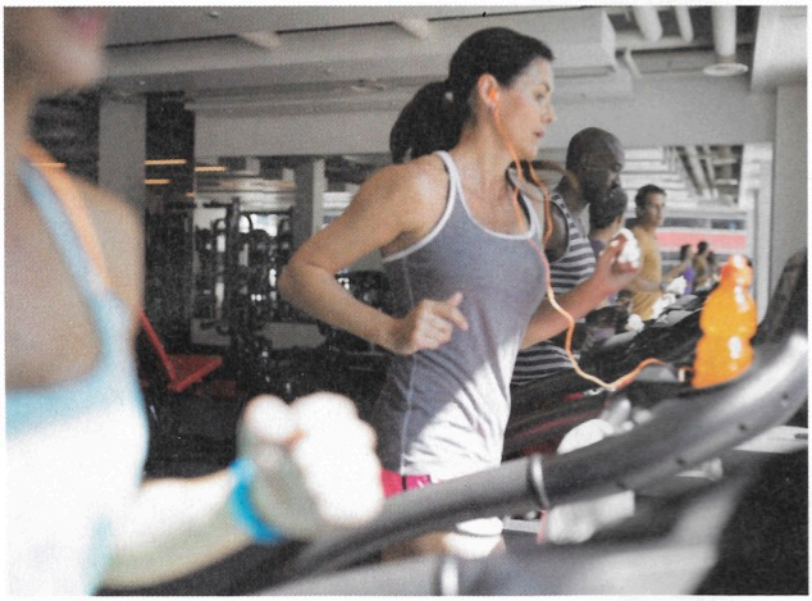
Jamaica, South Africa and the Seychelles with activity monitors for eight days to gauge their basic pattern of physical activity. She then tracked their weight over several years. The upshot? Activity levels didn't predict weight two years later. In fact, those who met the US guideline of 150 minutes of moderate-intensity exercise per week, according to the monitor data, tended to have put on more weight than those that did less. A paradox indeed.

In 2016, Pontzer and Dugas joined forces. They looked in more detail at over 300 of the people in Dugas's original study. It turned out that those who were moderately active used up about 200 more calories per day than sedentary people, but after that, calorie burning plateaued. Those who exercised every day didn't burn any more than those who worked out a few times a week. "Only at the very, very low end did we see anything like a trend of lower activity being paired with lower energy expenditure," says Pontzer.

This view tallies with calculations of how much people exercise when viewed over longer time spans, says Glenn Gaesser at Arizona State University. "If you add up the amount of calories individuals would expend doing 150 minutes [of exercise] a week, times 52 weeks of the year, you come up into the literally tens of thousands of calories that are expended." And yet exercisers only weigh around 2 kilograms less on average, he says. As the evidence piles up, says Pontzer, the idea that activity dictates how many calories you burn looks "pretty naive".

It seems time to put the calories in, calories out equation to rest. But how can it be that people do more exercise without seeming to expend extra energy?

The assumption has been that they eat more to make up for it, whether because they are hungrier or feel like they have earned it. "You can consume a doughnut in less than a minute," says Gaesser. "But that minute of consuming the doughnut might take an hour or more of walking to match in terms of calories."



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METABOLIC MINEFIELD

For those trying to lose weight, the body plays a cruel trick. As the excess comes off, your metabolism slows down, which can trigger that all-too-common phenomenon of gaining the weight right back. That was evident in the outcomes of 14 contestants on *The Biggest Loser*. Six years after losing nearly 60 kilograms on average on the TV weight-loss show, all but one regained some of it. Five were back to their original weight or more.

That's not all. While heavier people normally burn more energy just going about their day, when contestants put the weight back on, their resting metabolism remained sluggish, as if they still weighed less.

Similar signs emerge when comparing groups of three people matched by gender and weight: one at their usual weight, one having lost weight a few weeks ago and one having done so a year earlier. Those who lost weight, whether recently or a year prior, had slower metabolisms than those at their usual weights, raising the risk of putting the pounds back on. It is as if the body is trying to return the dial to the heavier, pre-weight-loss state (see main story).

There is a good reason for this, says evolutionary anthropologist Herman Pontzer at Hunter College in New York. The body evolved to make sure we store enough energy to find food and survive lean times. So if food intake drops in dieting, metabolism slows to try to preserve resources, and that effect seems to linger, even after your weight goes up again. "Evolution isn't trying to give you a summer beach body," says Pontzer. "Your body's trying very hard to match your expenditure to what you bring in every day."

Buffet blindness

It also doesn't help that people grossly overestimate their energy use during exercise. In one study, people were assigned a treadmill workout and then told to estimate how many calories they burned and eat an equivalent amount from a buffet. They guessed they used up 800 calories and ate about 550. In reality, they had burned just 200.

That might help explain why Dugas found that those meeting US exercise guidelines tended to have put on more weight. But it wouldn't explain why the Hadza's prolific activity doesn't add up to much more energy consumption over the course of a day than a sedentary lifestyle.

So another suggestion for the exercise paradox is that our bodies compensate for a hard workout by moving less the rest of the day. Some clues have come from mice. When given running wheels to prompt exercise, they were found to move around less than usual in between bouts of activity. The number of calories saved from moving less the rest of the day almost exactly negated the calories burned from running.

It seems people make similar sorts of adjustments when they embark on a new exercise regime, even if they don't realise it. For example, after a hard morning workout, obese adolescents have been found to reduce energy expenditure in the afternoon, resulting in similar total calorie burn on days with and without exercise. Another study of obese teens found a dialling down of activity for six days after a workout.

Rather than think of people as active or sedentary, an increasing number of us are both active, playing sports or working out regularly, and sedentary, spending the rest of the day sitting, says James Betts, who studies nutrition and exercise at the University of Bath, UK. So it is a mistake to just count the calories burned on a treadmill and not consider the rest of the day, he says. "All these other parts of exercise, just moving around more, can be the biggest component of energy expenditure and can dictate which person might be lean and which person might be obese," he says.

But Dugas doesn't buy the idea that an afternoon's sloth negates a morning workout. "That doesn't mean you lose that 500-calorie run because you're sedentary for the rest of the day," she says. "That doesn't make sense." Furthermore, she was surprised to see activity monitors continuing to buzz late into the night for many of her US participants. The people were working three jobs, on their feet packing groceries and boxes all day. "This notion that people are just sitting down and not doing anything is just not true," at least not for everyone, she says.

Which takes us to a third explanation for the paradox. We are starting to discover just how much the body adapts and slows down calorie burning when you exercise above a certain level.

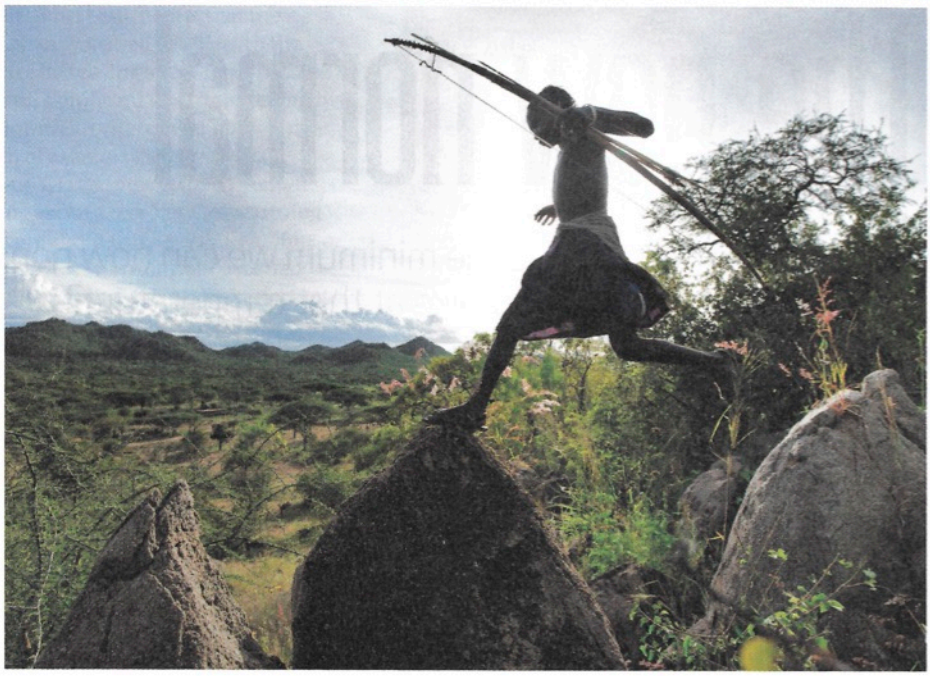
Evidence of this comes courtesy of runners in the Race Across USA, in which participants run a marathon on 140 consecutive days. Pontzer and Dugas teamed up once more to study them. During the first month, the metabolism of the runners skyrocketed, but after that it flattened out and eventually

"The idea that activity dictates how many calories you burn is now naive"

dropped in some of them. "This notion that we can keep increasing our calorie burning is not supported by the evidence," says Dugas.

What's more, calories out can vary even when two people are perfectly matched for body size, body fat and activity level. One might burn several hundred more calories per day than the other. "We really don't understand why that variability exists or what causes it, but it's not activity," says Pontzer.

He thinks the answer might lie in our resting metabolism – how many calories the body burns when not exercising – which



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Tanzania's Hadza are three times more active than Westerners, but use little more energy

contributes more to the variation between people and accounts for a bigger portion of daily calorie expenditure than exercise. "We talk about the energy that we spend running or walking or being active and those are important things to do, but you are ignoring what the biggest part of your budget is, which is all this internal stuff," says Pontzer. Rather than people compensating, knowingly or not, for exercise by moving less at other times, the body could be cutting down on its internal activity instead. "Your body has adjusted by shifting around all the internal stuff to make room for your active life," he says.

This fits with what we know about athletes with extreme training regimes. "If they train too hard for too long, their bodies wear down, because there's too many trade-offs, their bodies are spending too much on activity and they don't have enough calories left over for everything else," says Pontzer. As a consequence, they often suffer ill effects such as an injury that doesn't heal, a cold they can't shake or, in the case of women, disruption to their menstrual cycles.

Ultimately, it is hard to avoid the conclusion that, for many people, diet offers greater potential than exercise to get the calorie equation working more in your favour. But exercise does still have a place in the weight-loss journey: once you lose weight, it can help prevent the common problem of putting it back on (see "Metabolic minefield", opposite page). An analysis of contestants on *The Biggest Loser*, a TV weight-loss show, found that during the 30-week competition, weight loss and amount of exercise weren't correlated. However, six years later, those who increased physical activity the most regained the least weight or kept it off.

And there are plenty of other, excellent reasons to exercise. "The Hadza are about three times more physically active than any Western population," says Pontzer. "And, not a shocker, they also have excellent heart health, they never get diabetes, they're not overweight. They age extraordinarily well."

Being active improves overall health, mobility and brain function, and reduces the risk for many chronic conditions including Alzheimer's disease. "Exercise has health-promoting actions that far exceed its ability to regulate weight," says Gaesser, "so don't be disappointed if you don't lose a lot of weight."

And you can take comfort in knowing there is no need to run an ultramarathon to make up for the holiday weight gain. Diet is key though. "If you want to watch your weight, watch what you eat," says Pontzer. So if you do make it to the gym, maybe skip that doughnut afterwards. ■

Teal Burrell is a freelance writer based in Richmond, Virginia. For links to studies cited in this article, see the online version