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Sitting target: How long periods of inactivity slash years off your life

New research suggests that even if you spend an hour at the gym every day, long periods of inactivity - be it at your desk or in front of a television screen - can significantly shorten your life span, writes Richard Lovett

BY **NEW SCIENTIST**
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Michael Jensen is talking to me on the phone, but his voice is drowned out by what sounds like a vacuum cleaner. Or maybe it's a lawnmower. I'm used to bad connections, but Jensen isn't using Bluetooth on a busy motorway. He's in his office at one of the United States' top medical-research facilities.

Illustration: Yam Lee

"I'm sorry," he says, when I ask about the noise. "I'm on a treadmill."

I'd had a similar experience with David Dunstan, an Australian researcher who talked to me on his speakerphone as he walked around his office at the Baker IDI Heart and Diabetes Institute, in Melbourne.

It's not that Jensen and Dunstan are hyperactive. Rather, both are exercise researchers looking into the link between sitting down and premature death. What they have found is clearly disturbing enough for them both to make sure they spend most of the day on their feet.

Jensen explains that he and his colleagues at the Mayo Clinic in Rochester, in the American state of Minnesota, were studying weight control when they discovered that some people "spontaneously start moving round and don't gain weight" when they have overeaten. These people don't dash to the gym - they just walk more, hop up from the couch to run errands or find other excuses to get on their feet. "This really got us thinking about this urge to move," Jensen says, "and how important that might be for maintaining good health."

That led them to a field known as "inactivity research", which reveals that inactivity, particularly in the form of sitting, is really bad for your health. It might sound like an obvious statement, but the killer point is this: inactivity is bad for you even if you exercise as well. Going to the gym is not a licence to spend the rest of the day on your backside.

In 2010, a team led by Alpa Patel of the American Cancer Society in Atlanta, in the US, analysed the data from a 14-year study of 123,000 middle-aged adults. When they compared mortality rates between those who spent six hours a day or more sitting and those who reported three hours or less - and taking into account other factors such as diet - they found something surprising. Extra time on the couch was associated with a 37 per cent higher mortality rate for women and 17 per cent higher for men. It is not clear why there is such a big gender difference.

In another study, a team at the University of Queensland, Brisbane, analysed data on the television viewing habits of 8,800 Australians. They calculated that each hour of television slices 22 minutes off the average life expectancy of an adult aged over 25. In other words, people who watch six hours of television a day can expect to die, on average, about five years younger than those who don't watch any.

There are many other studies reaching similar conclusions. In a review of all the evidence, Dunstan's team concluded that there was a "persuasive case" that excessive sitting "should now be considered an important standalone component of the physical activity and health equation".

The message is clear. Sitting still for hours at a time is a health risk regardless of what you do with the rest of your day. Just as you cannot compensate for smoking 20 a day by running 10 kilometres at the weekend, a bout of high-intensity exercise does not cancel out the effect of watching TV for hours on end. Patel's study found that people who spent hours sitting had a higher mortality rate even if they worked out for 45 to 60 minutes a day. The researchers call these people "active couch potatoes".

But it is not just the couch that worries them. If the harm comes primarily through the inactivity itself - discounting sleep, which brings its own health benefits - the researchers suspect that other kinds of inactivity may be just as harmful as watching TV, be it reading a novel or sitting at an office desk.

To find out just how sedentary people are, Dunstan equipped hundreds of research subjects with accelerometers and inclinometers to monitor their daily activities. The accelerometers measured how energetic their movements were, and the inclinometers revealed how much time they spent sitting.

"The sobering reality," Dunstan says, "is that across a 14- or 15-hour waking day, we're getting 55 to 75 per cent sedentary time. Moderate-to-vigorous activity - what people like to call 'exercise' - occupies just 5 per cent or less of people's days."

Intrigued by our conversation, I began to wonder about my own lifestyle. I have always considered myself to be active, although arthritis has ended my marathon-running days. But maybe I've been kidding myself. To find out the reality, I bought an armband with a mix of accelerometers, skin-conductivity sensors and heat-flow detectors to determine my minute-by-minute exertion level.

What I learned was disturbing. On a typical working day, I am inactive for eight hours in total. Although I run up to 25 kilometres a week and take long walks, there are periods when I sit for more than two hours at a time writing.

I also gave an armband to a friend, who is a physical therapist. Her activity pattern is totally different. On a typical working day she gets up, drives to work, walks into her office, spends a few minutes at the computer, and then it's move, move, move as she meets patients and demonstrates exercises. She spends much of the day on her feet. After work she goes for a run or rides her horse. Television? If she watches it, I'm not sure when. She has sedentary moments, but they only add up to five hours 30 minutes. Not only is that lower than my total, but the pattern is different. She sits frequently, but rarely for more than a few minutes at a time. Other than her workouts, her activities are never very intense, but there's nothing close to my extended writing sessions.

When I describe my friend's lifestyle to Dunstan, he gives the telephonic equivalent of a shrug. He points out that many professions, such as hairdressers and restaurant workers, probably fall into the same group. But such jobs are becoming less common. Once, file clerks actually carried files to the places where they were needed. Not any more. "The modern office worker is engaged with a computer screen while seated at a desk," says Dunstan.

That's not the lifestyle to which the human body is adapted.

"From an evolutionary point of view, we are built to be active," says Audrey Bergouignan, a human physiologist at the University of Colorado, in the US. "Your grandparents were not going to the fitness centre. They were active all day."

Much of Bergouignan's research involves bed-rest studies funded by space agencies. They are primarily concerned with the effects of low gravity on astronauts but the results also apply to earthbound inactivity. In a typical study, healthy and previously active volunteers are confined to bed for anything from a day to three months.

"They develop metabolic features very close to what we observe in obese people and people with type 2 diabetes," Bergouignan says.

The studies reveal that inactivity produces a complex cascade of metabolic changes. For example, unused muscles not only atrophy, but shift from endurance-type muscle fibres which can burn fat to fast-twitch fibres that rely more strongly on glucose. Inactive muscles also lose mitochondria, the cells' power packs, which can also burn fat. With the muscles relying more on carbohydrates for what little work they are doing, unburned lipids accumulate.

Says Bergouignan: "Your blood is going to become very fatty," which could be why sitting has been linked to heart disease. Fat also gathers in muscles, the liver and the colon - places where it is not supposed to be stored.

Other changes involve insulin resistance, a diabetes-like condition in which glucose accumulates in the bloodstream even when the body produces insulin to sequester it. All of this happens very quickly.

"In three days we have insulin resistance," Bergouignan says.

Similar effects, she adds, occurred in a study in which normally active people were asked to curtail their exercise, in essence spending a few weeks imitating their sedentary friends.

So what can people do to avoid this - other than quitting their desk jobs and taking up nursing, hairdressing or waiting tables? First of all it is important to note that exercise still has benefits - an hour's workout cannot undo hours of sitting, but it is still good for your health. Patel's gym-bunnies fared better than people who sat a lot and did not go to the gym. That's a message exercise advocates don't want to get lost in the gloom.

"We know that if you exercise 40 to 60 minutes a day, you're going to have a health benefit," says Iñigo San Millán, director of the Human Performance Laboratory at the University of Colorado Hospital's Sports Medicine Clinic.

Dunstan agrees. "We shouldn't throw out the well-documented benefits of vigorous physical activity," he says. Rather, we should think of extensive sitting as a risk factor that should be addressed separately.

But how? One of the things I tried was fidgeting: tapping my feet while sitting at my desk or squirming on my seat. But when I looked at the data from my armband, I could barely discern the effect. Sitting still, I burn 1.3 calories per minute. Fidgeting raises it to 1.4.

"Fidgeting isn't the same as standing up and walking around," Jensen says. "Contrast that with puttering around your home or even going for a very gentle walk. There really is no comparison." My armband concurs. The moment I stand up and move around, it starts fluctuating between 3.0 and 5.0 calories per minute. That is hardly vigorous. I easily burn 12 calories a minute while running, but low-intensity activity is sufficient. It all depends on how long you do it for, says Marc Hamilton, an inactivity researcher at Louisiana State University, in the US.

Anything that raises your metabolic rate above 1.5 times the resting rate is considered light activity. For me, that means burning two calories a minute (my resting metabolic rate is 1.3 calories per minute), which is about half the energy I expend putting clothes in a washing machine.

In his latest experiments, Dunstan has been bringing people into his lab so that he and his team can find out precisely what works. In a study published last year, volunteers visited on three separate days. The first visit, they simply sat watching TV. On the other two, they watched TV but stood up three times an hour to spend two minutes on a treadmill. On one of the days they went at an easy pace, on the other they walked more briskly. On each visit they were given lunch with a sugary drink.

The scientists discovered that short activity breaks reduced the volunteers' blood sugar and insulin spikes after the drink by roughly 25 per cent.

"That is a good thing," Dunstan says. "We want to avoid those big spikes." Even more interestingly, ambling on the treadmill was just as effective as more energetic walking.

Jensen thinks that what makes these short bouts of activity effective is that they're enough to burn off some of the glucose that's accumulated in your bloodstream.

"Your bloodstream isn't that big," he says. "In the whole body it's only five litres." For non-diabetics, that translates to less than 10 grams of glucose in the bloodstream. "If you just burn off four grams - 16 calories - that's a lot of glucose you've taken out of the bloodstream."

It's easy to burn 16 calories. According to my armband, I can do it within five minutes simply by pacing around the room. That's also a really good way to clear the mind. "People who get up and move around for five minutes every hour are every bit as productive as people who sit there for hours at a time," Jensen says.

The next step, adds Dunstan, is to determine the best ways to build activity breaks into the day. Is it best to have frequent short breaks? Or less frequent, longer ones? Are treadmill desks and adjustable-height workstations even better, allowing workers to switch from sitting to standing or walking as they work? At home, the questions are similar. If you are working on the computer, Dunstan suggests, "take a break and do the dishes". If you are watching TV, get up and move around every 20 minutes, or whenever there's a break.

Patel adds that this may actually come as good news to the millions of people who have not been able to get close to recommended daily exercise levels.

"The nice take-home message," she says, "is that anything is better than nothing. Just getting up and moving at all is taking a big step in the right direction."

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