

Discover your inner strength

There's an underrated aspect of fitness that boosts health and brainpower and extends your lifespan – no steps needed. **Helen Thomson** lifts the lid

I AM lying on my living room floor, my whole body shaking, along with 30 strangers, who I can just about glimpse on little squares on my laptop screen. If you would have told me a month ago this would be my new workout routine, I would have laughed you out of the room. Until now, fitness for me meant getting out and about, religiously racking up steps on my pedometer. Then London went into lockdown, and for the past few weeks I have barely left the house. But here's the thing – in terms of health benefits, my new exercise regime is through the roof.

Unwittingly, these strange times have forced my habits in line with the latest thinking in exercise science. Aerobic exercise was once seen as the holy grail of fitness, but another kind of workout is just as important – if not more so. Something we can all do from the comfort of our homes without any equipment: strength training.

Our muscle strength peaks in our 30s, then slowly declines. Eventually, it can drop so much that we are unable to get out of chairs or climb stairs. It isn't just older people who would benefit from improving their strength, though. We are discovering unexpected health boosts from building muscle for all adults that go way beyond simply being strong.

Strength training could add years of life and protect you from some major killers. Having stronger muscles seems to decrease the chance of getting cardiovascular disease, type 2 diabetes and cancer. There is even evidence that it can improve your memory

and prevent cognitive decline.

Its importance is so great that the UK government's latest physical activity guidelines emphasise muscle strengthening over aerobic workouts. "It's an urgent message that needs to get through," says Stuart Gray, who studies metabolic diseases at the University of Glasgow, UK. "People need to know that strength training is important at any age."

When it comes to fitness, muscle power has long played second fiddle to aerobic exercise, perhaps because of the misguided idea that weight training is simply for bulking up. On the other hand, the health boost that comes with aerobic exercise is much touted, so most people focus on getting the recommended 150 minutes of aerobic activities a week – running, brisk walking, swimming or anything that gets your heart pumping and you breathing faster.

That began to change more than a decade ago, and in 2011, UK exercise guidelines stated for the first time that all adults should perform muscle strengthening activities two days a week. Yet while getting physically strong became much more mainstream among regular gym goers, nobody else took much notice. "People just remembered the first line about aerobic activities," says Jason Gill, also at the University of Glasgow. "The second line was forgotten."

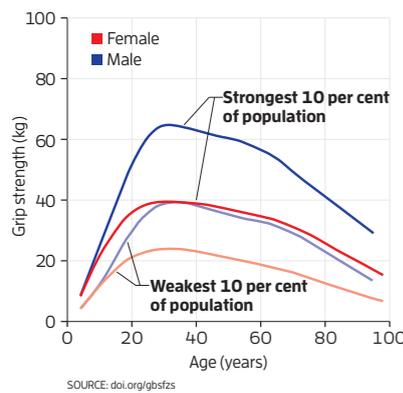
It is a big oversight. About 50 per cent of the UK population fail to get enough aerobic exercise and only 25 per cent get enough strength exercise. It is a similar story in the

“When it comes to fitness, muscle power has long played second fiddle to aerobic exercise”



Strength vs age

Muscle strength peaks in early adulthood, then declines. There are big differences between men and women, and between the strongest individuals and the weakest. Overall muscle strength can be assessed by measuring grip strength



SOURCE: doi.org/gbsfzs



DEEPOOL BY PLAINPICTURE/USA WIKISTRAND

Mightier and healthier

The weaker your muscles are, the greater your risk of certain illnesses and of dying prematurely. For every 5 kilogram loss in grip strength, the risk of death over around seven years goes up considerably

Increased risk of death

Any cause

▲ **20%** women
▲ **16%** men

Cardiovascular disease

▲ **19%** women
▲ **24%** men

Cancer

▲ **17%** women
▲ **10%** men

SOURCE: BMJ, DOI: 10.1136/bmj.k1651

US, despite physical activity guidelines from both the US government and the World Health Organization also recommending a least two sessions of strengthening activities per week.

At least some benefits of strong muscles have been appreciated for centuries (even Socrates told his disciples that it was a disgrace to grow old without developing their physical strength to the highest limit), but it is only recently that we have come to appreciate just what our muscles can do for our health.

Age-related muscle loss happens to everyone. Around the age of 30, we start to lose up to 5 per cent of our muscle mass each decade, and this accelerates at 70 (see “Strength vs age”, top left). This effect was first brought under the spotlight by Irwin Rosenberg of Tufts University in Massachusetts back in 1988 after he attended a meeting on ageing. In his notes on the meeting, he wrote that “no decline with age is more dramatic or potentially more functionally significant than the decline in lean body mass. Why have we not given it more attention?”

That time has finally come, and we now have a good picture of what happens to muscles as we age. Over time, the kinds of fibres in our muscles change, with “type two” fibres, which help us bear heavy loads for short spells, slowly being replaced with more “type one” fibres that are more efficient over long periods but less able to carry weight. Our muscles also

“Strength training uses up calories even after the exercise is over”

RESISTANCE ISN'T FUTILE

Strength training might be synonymous with lifting dumb-bells in a gym, but any form of resistance training – exercises that cause muscles to contract against an external force – helps build strength. This external resistance can be in the form of weights, but also elastic bands, special resistance training machines or just your own body weight.

stop using protein as efficiently and so are less able to repair themselves. These age-related changes have many causes, including alteration in the levels of hormones such as testosterone, and a reorganisation of brain cells that control movement.

In the past, efforts to tackle muscle loss were focused on people in their later years, but now a mountain of evidence points to the benefits of fighting muscle wastage throughout life.

The best evidence comes from studies of the exercise habits of large numbers of people. One showed that lifting weights for less than an hour a week reduces the risk of heart attack and stroke by up to 70 per cent – independent of any aerobic training. Another study of 100,000 women found that those who did at least an hour a week of strength training significantly lowered their risk of type 2 diabetes. And people with better grip strength – a proxy for overall muscle strength – have a lower risk of cardiovascular disease and cancer and are at reduced risk of premature death by any cause.

One reason stronger muscles keep us healthier is that they help prevent the debilitating effects of wobbles, falls and problems moving, increasing well-being in the process. For instance, when residents at a nursing home performed one set of six resistance machine exercises (see “Resistance isn’t futile”, left), twice a week for 14 weeks, they not only increased their overall strength by 60 per cent, but also improved their ability to live independently by having the power to cope with everyday activities like getting to the bathroom.

Muscle also plays an important role in regulating the body’s glucose levels. With the help of insulin, it soaks up glucose from the blood and stores it in the form of glycogen. Bigger muscles mean a bigger sink for glucose and a higher number of cells that transport and clear glucose from the body, which all helps ward off type 2 diabetes, in which blood glucose levels become too high.

And while you don’t have to look like a bodybuilder to reap the benefits, having bigger muscles is also linked with better survival rates for people with cancer, probably because the disease decreases muscle mass, so it is helpful to have a bigger resource to start with to keep the body going for longer.

Another surprising benefit of strength training is how it burns calories, even after the exercise is over. Weight training increases your basal metabolic rate – the amount of energy your body consumes when at rest – in two ways. First, bigger muscles require more

energy to fuel their tissue maintenance. So simply having more muscle mass uses more calories. Second, in the short term, lifting weights causes tiny tears in your tissue that require a relatively large amount of energy to remodel. This increase in energy demand can last three days after a workout.

Let’s say I fit in two 20-minute resistance training workouts a week. Each online session requires about 200 extra calories to perform, but over the next three days, I will use another 100 extra calories a day to help repair my muscles. Over the month, my two workouts a week have consumed a whopping 5000 extra calories – without even leaving the house.

All of this helps if you want to decrease body fat, a factor associated with lower cholesterol, lower blood pressure and improved insulin sensitivity and glucose control, all of which contribute to a decreased risk of type 2 diabetes and cardiovascular disease. This is one of the reasons why getting stronger protects you from heart attacks.

But strength training really trumps aerobic exercise with its effect on bone. Our bones start to degrade as we age, losing mass and making us more prone to fractures. Aerobic



PLAINPICTURE/BUSETIKLARA G

Little things in your daily routine can make a big difference, including carrying shopping bags

exercise is beneficial to a lot of systems in the body, but there is little evidence that it protects us from bone loss.

Our bones are in a constant flux of being broken down by cells called osteoclasts and being built up again with osteoblasts. Strength training places stress on the bones, triggering the activity of osteoblasts and inhibiting osteoclasts, helping us to maintain, and even build, denser bones. This significantly lowers the risk of osteoporosis, which causes around 1.66 million hip fractures globally every year.

Mind gym

If that weren’t enough to convert you to boot-camp classes over going running, building muscle can also boost your brain. Several studies show that people with a better grip strength – hence better overall body strength – score higher on tests of memory and reaction time, as well as on assessments of verbal and spatial abilities. This means that grip strength can be used as a marker of cognitive decline.

It seems there is something special about muscle training specifically, rather than exercise in general. For instance, older women who lifted weights once a week for a year had significant improvements in cognitive tests of attention, compared with women who performed balance and toning classes. The underlying mechanisms aren’t fully understood, but strength training seems to trigger the release of several brain chemicals, including one called BDNF, that support the health of neurons, helping them to communicate, grow and resist age-related decline, all contributing to a healthier brain.

All major muscles

What’s the best way to reap the benefits? There is no easy answer, says Gray. It is trickier than it is to tell people to get 150 minutes of aerobic exercise a week, because the type of strength exercises a person can do will differ wildly depending on their age and circumstances.

That said, advice from the American College of Sports Medicine couldn’t be simpler: it says that adults should perform strength exercises on all major muscle groups – legs, hips, back, abdomen, chest, shoulders and arms – at least twice a week.

That advice comes from evidence that your first workout of the week will give you the most benefit compared with nothing at all. Your second workout will give a bit more benefit, as will the third, but then the results plateau. ➤

BLUFF YOUR WAY TO BUFF

Want to get stronger but lack the time or motivation? There are some quick fixes.

Vitamin D3 supplementation appears to have an effect on muscle strength. In one study, for example, elite ballet dancers received D3 supplements over winter, resulting in a 19 per cent increase in quadriceps strength and fewer injuries compared with dancers who took a placebo. It isn't clear how this vitamin helps, but it is known to affect a complex process of events that control calcium levels, which are involved in the mechanisms that help muscles contract.

Or you might try a little vibration. Machines that vibrate your body while you work out became popular in the early noughties, but there were few studies to back their use. Now, though, evidence suggests that these machines, plus smaller devices that localise vibrations over particular muscles, can help you get stronger. In one study, participants used a device that sent high-frequency vibrations directly over their major arm and leg muscles, three times a week, for four weeks. They saw improvements in strength tests comparable with those of a control group that did resistance training with no vibration. These changes persisted for at least two months, and were probably due to a vibration-induced rise in growth hormone and other biochemicals that boost muscle performance, as well as increased muscle energy consumption.

And here is something for the real couch potatoes. A remarkable study by Brian Clark at Ohio University showed that you can build muscle just by using your imagination. His team used a surgical cast to immobilise the hand and wrist of 29 volunteers for four weeks. For 10 minutes a day, half the group sat still while imagining performing exercises with their immobilised hand. When the casts were removed, both groups had lost muscle strength in their wrists, but the group who had performed imaginary exercises lost 50 per cent less than the control group. The results suggest that mental workouts strengthen pathways in the brain that control muscle movements, which later translates into greater command over the target muscles, increasing their strength.



BENJAMIN LOWRY/GETTY IMAGES

You don't need to bulk up or even go to the gym to get the health benefits of strength training

But don't get carried away in the details of what you are doing in these sessions, Gill says: "If you exercise a particular group of muscles until it's tired, it doesn't really matter how heavy the weight is or how many times you lift it. The benefits for a non-athlete are broadly the same whether you lift a light weight 20 times, or a heavy weight five times."

Determined to make things even simpler, Gill's group is testing whether tiny amounts of exercise a day can make a difference to health. "The idea is, if you can do 1 minute of each exercise a day, press-ups Monday, squats Tuesday, then it's a way to build resistance exercise into your week very easily," he says. You could even boost your muscle strength without lifting a finger (see "Bluff your way to buff", left).

Like most things in life, a balance of activities is best. "Both aerobic and strength exercises seem to boost our health in slightly different ways, and most studies point to a bit of both being better than either alone," says Gill.

The heart, for instance, responds to both strength and aerobic training, but the two kinds of exercise cause it to adapt in a different way structurally, says Georgina Ellison-Hughes at King's College London, who specialises in regenerative muscle physiology. "If you ask

anybody who works in cardiovascular health, they'd say a balance between the two is a good place to be," she says. And remember that many aerobic activities, which get the heart rate up, are also good for muscle strength, such as circuit training and dancing.

Let's not overthink it, says Gray. Anything is better than nothing, and little things squeezed into your everyday routine can make a big difference, without the need for any equipment. "You can do press-ups on the floor at home, or against the kitchen worktop, or the wall if you're not able to do that," he says. "You can do squats and lunges to strengthen your legs in front of the TV, and lifting shopping bags or children certainly counts."

Whatever you do, just make sure it wears you out, he says. "If you just do whatever strength exercise gets you knackered in a reasonable amount of time, you'll probably get the same benefit to your health as if you were following a highly specific training routine." After a short boot-camp session online, I'm certainly feeling the burn. And the best bit about getting strong during lockdown? When your muscles are aching, it isn't far to hobble to bed. ■



Helen Thomson is a consultant for *New Scientist* and author of *Unthinkable: An extraordinary journey through the world's strangest brains*