WHAT ARE THE HEALTH BENEFITS OF EXERCISE?

Even Socrates, not remembered as an athlete, recognised that exercise led to good health, and bemoaned the lack of fitness among his students. Today, many people would like to be more active to improve their health. Before we look at the amount of exercise we should be aiming for, we need to understand exactly what it does to our bodies. It has taken a surprisingly long time to figure that out, but recent work is illuminating.

FIRST, the obvious benefits: exercise keeps our muscles and hearts strong, our blood vessels pliant and improves aerobic fitness. When we get our heart rate up, the stresses imposed by the blood rushing through our arteries promotes the production of nitric oxide, which helps repair blood vessels and keep them elastic. Maintaining strength and aerobic fitness is particularly important as we age. Older adults who can cover at least 365 metres in a standard 6-minute walking test have half the risk of dying in the subsequent decade as their peers who can't make 290 metres.

Additional robust evidence comes from the Exercise is Medicine initiative pioneered by the American College of Sports Medicine in Indianapolis, Indiana. Researchers there have collated studies over decades looking at people who follow the US government's advice on physical activity. What their findings show is that this weekly dose reduces the risk of premature death through heart disease by 40 per cent, approximately the same as taking statins.

Chi Pang Wen of the National Health Research Institute in Zhunan, Taiwan, offers some insights into precisely how physical activity prevents cardiovascular diseases. "Exercise can stimulate circulation, flush out fatty deposits in the walls of blood vessels and dilate small vessels that could otherwise be the cause of a heart attack or stroke," he says. He conducted a study of more than 430,000 Taiwanese men and women, showing that exercise reduced the risk of heart attacks by 30 to 50 per cent.

Exercise also keeps blood vessels clear by helping to destroy the most dangerous fats, because it alters the ›

structure of fatty triglyceride particles in the bloodstream, making it easier for enzymes to destroy them before they can gum up the works. Many risks to circulatory health come from such fatty particles, in the form of chylomicrons produced in the gut, or very low density lipoproteins (VLDLs) pumped out by the liver. The bigger the VLDL particles are, the easier they are for enzymes to break down, and the findings show exercise causes the particles to enlarge by about a quarter.

One of the most startling findings of the Exercise is Medicine initiative is that a modest weekly dose of exercise lowers the chances of developing type 2 diabetes by 58 per cent, twice the preventive power of the most widely prescribed anti-diabetes medication, metformin.

Type 2 diabetes affects adults when they stop responding efficiently to the hormone insulin, which orders muscle and fat cells to absorb surplus glucose from the bloodstream. When insulin loses its punch, glucose continues circulating and creates the potentially fatal sugar imbalances that are the hallmark of diabetes. It has now been shown that exercise significantly increases how responsive cells are to insulin.

As cells reawaken to insulin, it seems that surplus glucose gets sponged from the circulation. The post-exercise boost has been shown to last for up to two days in humans.

What's more, both insulin and muscle contractions during exercise activate a molecule in muscle and fat cells called AS160, which helps them absorb glucose. Once activated, AS160 orders the cell to send molecules to the cell's surface to collect glucose and bring it inside. Without these transporter molecules, glucose cannot get through the fatty cell membrane.

That's not the only way exercise helps cells burn off excess sugar. Muscle cells absorb glucose and fatty acids from the bloodstream to replenish adenosine triphosphate (ATP), the molecular fuel found in most living cells. As ATP is used up, it produces waste products that are sensed by another molecule, AMPK. AMPK then orders cells to recharge by absorbing and burning yet more fat and sugar. In the mid-1990s, Grahame Hardie at the University of Dundee, UK, found exercise accelerates this process because muscle contraction activates AMPK.

Hardie says exercise has the potential to reverse obesity and diabetes and prevent cancer. The findings of the Exercise is Medicine initiative show that taking the US government's recommended weekly dose of exercise halves the risk of breast cancer in women and lowers the risk of bowel cancer by around 60 per cent.

How exercise does this is not yet clear – not least because so many factors are involved in cancer's appearance and progression, including sex hormone imbalances, the ability of the immune system to clear cancer cells, and damage to genes and DNA.

However, some clues are beginning to emerge.

IS EXERCISE WORTH IT?

Runners and other active people tend to live longer. But if these bonus years are equivalent to all the time spent working up a sweat throughout life, then is it all a waste of time? It is a pertinent question for those who find exercise a penance.

Duck-chul Lee of Iowa State University and his colleagues dug into the data to find out. They calculate that between the ages of 44 and 80, someone who runs 2 hours per week will spend a total of 0.43 years running. This would still provide an average "bonus" of 2.8 additional years of life on top of the time spent running. In other words, 1 hour of running typically adds an extra 7 hours to lifespan. "It is controversial whether progressively more running provides further mortality benefits, but running certainly provides cost-effective longevity benefits," they concluded.

Exercise can help to reduce body weight, which is a known risk factor for some cancers.

It could also be that reducing fat deposits in the body results in less exposure to circulating hormones, growth factors and inflammatory substances.

Another potential protection against cancer might come back to the ability of exercise to stimulate AMPK. Exercise stimulates cells craving extra energy to burn unwanted rubbish, including faulty or mutated DNA that could trigger cancer if it hangs around.

Some research hints that the same processes could be at play in brain cells, suggesting that exercise might play a role in staving off dementias and neurodegeneration.

Exercise strengthens our hearts and muscles, then, and can help the body regulate sugar and fats, keep our weight in check – with being overweight a high risk factor for many diseases – and can help to keep cancer at bay.

One way to think about these beneficial effects of exercise isn't what it dials up in the body, but what it dials down. That's because exercise triggers helpful suppressive effects all over the body. It reduces chronic inflammation, moderates levels of the reproductive hormones testosterone, oestrogen and progesterone, and blunts our physiological response to stress. This suppression has big health impacts. Chronic inflammation and stress are indiscriminate killers, increasing the risks for heart disease, cancer, diabetes, mental illness and other maladies.

Research is revealing how exercise keeps our brains fit too. Aerobic activity increases blood flow to the brain and causes the release of molecules that stimulate the generation of new brain cells and keep old ones healthy.

→ See chapter 5 for more on how exercise impacts the brain

Running, cycling and walking also challenge the brain to coordinate myriad signals involved in balance, navigation and movement, helping to maintain our cognitive reserve – a kind of mental padding that is thought to help ward off dementia and other forms of cognitive decline.

Counter-intuitively, one thing that exercise doesn't do very well is increase our daily energy expenditure. Research done by Herman Pontzer at Duke University, along with David Raichlen at the University of Southern California and others, reveals that Hadza hunter-gatherers in Tanzania burn the same number of calories a day as adults in the US and Europe, despite being five to 10 times as active.

It isn't that exercise is less energetically expensive for the Hadza. Instead, their bodies have somehow adjusted to their physically active lifestyle by spending less energy on other tasks, which keeps their total daily calorie expenditure in check.

The same seems to be true for people everywhere: being physically active doesn't change the number of calories your body spends each day, it changes how you spend them.

→ For more on the work of Herman Pontzer on metabolism, turn to chapter 4

This may be bad news for people relying on exercise to lose weight, but it does help us understand why activity is so important in the modern world. It may well be that this "metabolic management" underpins the suppressive effects of regular exercise.

For those of us who live mostly sedentary lives, the body has an abundance of calories at its disposal. As a result, physiological activities such as inflammation and the fight-or-flight response, which are normally short-lived and sporadic, are always on, raging in the background.

Similarly, our reproductive systems produce an overabundance of sex hormones – twice the levels we see in populations like the Hadza.

As we have already seen, exercise can have a suppressive effect. In other words, exercise helps us regulate these and other overzealous activities. By forcing our bodies to economise, it helps prevent many of the diseases that haunt the developed world. ▮