Do genes determine whether you can be an endurance athlete?

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Credit: AI-generated image (disclaimer)

For some of us, no matter how consistently we train, running never seems to get any easier—while others appear to be naturally gifted and can run for miles with ease. Part of this comes down to factors such as the kind of training you do or your diet, but our recent study has shown that genetics may also explain why some people are better at endurance

exercise than others.

We found that genetics contribute to how well someone's body responds to endurance-based exercises—things such as cycling, running and swimming. This may mean that some have a natural advantage over others when it comes to running long distances.

To conduct our research, we recruited 45 participants in the UK aged between 20 and 40. Just over half were male. All participants were then randomly split into two groups.

The first group were prescribed a strict, eight-week endurance-based running program. This consisted of a 20–30 minute outdoor run three times per week.

The other group acted as a control group and were instructed to continue with their normal daily routine. During this entire period all physical activity in both groups was monitored. Diet and other lifestyle habits were unchanged.

At the beginning of the study, all participants took a military fitness test called the 12-minute Cooper run test, which shows the maximum distance a person can run in 12 minutes. This was to measure their running ability and aerobic fitness. The test was repeated in the middle and at the end of the study to track changes in fitness.

Participants were also given a DNA test kit at the end of the training program to assess their genetic information from a sample of their saliva.

The training group significantly improved their Cooper test score by an average of 11.5% (0.24km). But even with this group performing the exact same amount of training, and making no changes to their diet or

lifestyle habits, people still improved at different rates.

By the end of the study, we found the top performers could run around 20% more (0.45km) within the 12 minutes compared to their baseline results. On the other hand, a few of the participants struggled to see any improvements within the eight weeks of training.

When we looked at the reasons why some showed large improvements while others showed little, we discovered it came down to a participant's specific genetic profile. We found 18 single nucleotide polymorphisms, or SNPs, which were directly associated with the endurance improvements.

SNPs explain how a genetic sequence or a single gene can vary from person to person or population to population. So while our base genetic make-up is the same, what differentiates us are the specific genetic variations we have.

We discovered that people were able to run longer distances when they had more of these 18 favorable SNPs. Those who did the endurance training program, but saw little to no improvement, had very few—and in some cases none—of these SNPs. This essentially means that some people have a greater potential when it comes to benefiting from endurance training than others.

It will now be important to conduct research on a larger scale to test if these results are repeatable to confirm our findings. More importantly we need to find out why exactly these SNPs are associated with better endurance performance—and what specific benefits they confer.

Genetics and exercise

Our study isn't the first one to show a link between genetics and fitness.

Other research suggests up to 44% of a person's response to endurance training may be influenced by genetics. This would equate to around an extra 5% improvement in aerobic fitness over those that do not have such favorable genetics.

This may explain why the participants in our study improved at different rates despite doing the same training program. Our previous research also showed that genetics play a role when it comes to other types of fitness, including strength training.

However, it's important to note that current research within this expanding area is overly simplified. A lot of the research to date has only viewed genes in isolation and made assumptions based on that, which may not be entirely accurate. Traits such as someone's aerobic ability are extremely complicated and likely influenced by multiple genes and the way they interact.

This would also explain why having one or two advantageous SNPs didn't equate to better endurance training performance, as supported by our study. This is why it is important for researchers to review a combination of these genes and how they interact with each other to understand the effect they may have on a person.

Our research reinforces the evidence base which shows genetics play a clear role in the way a person adapts to exercise, but this doesn't mean you should stop running just because you may not have favorable genetics. For the average person, these favorable genetics will probably only make a small difference in how easy (or difficult) they find it to improve their fitness.

But for competitive athletes, trying to push their limits, this could make a big difference in their performance and whether they could earn a gold medal or fail to place.

And while certain genes may make it a little easier for some to improve their endurance capacity compared to others, genetics are only part of the story. Other factors—such as diet, recovery and how hard you train—also play a big role in getting fit.

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