Written by David Bishop, Research Leader, Sport, Institute of Sport, Exercise and Active Living, Victoria University

Just a normal person, from a different planet, a planet from a different galaxy.

This is how Russian swimmer Alexander Sukhorukov used to describe the legendary US swimmer Michael Phelps. The same words could be used to describe most successful marathon runners: they're very different from most people on the planet.

Body and physiology

For a start, they look different.

Have a look at the photos of Michael Phelps and the current world record holder for the marathon (Dennis Kimetto; 2:02:57). Michael Phelps (6'4") is nearly 20cm taller than Dennis Kimetto (5'9"), but their leg lengths are similar and they could probably trade tracksuit pants at the Rio Olympics.

It's common for successful marathon runners to have very long legs relative to their height. They're not very heavy – Kimetto reportedly weighs 55kg – and have a low percentage of body fat. They also have extraordinary physiology.

Maximal oxygen uptake (VO2max) refers to an individual's ability to take large amounts oxygen from the air, transport it to their muscles, and then utilise that oxygen to produce energy in the working muscles. Successful marathon runners have a VO2max most of us can only dream of; they use this extra oxygen to support the high-energy production needed to run the marathon as fast as possible.

Successful marathon runners will typically have a VO2max more than double that of the average man or woman.

Efficiency dividends

Just like an efficient car on a long trip, the best marathon runners also use less energy to run at a given speed. Scientists call this excellent running economy, and it can be determined by measuring how much oxygen a runner uses when running at a standard speed.

In the years leading up to her world record in the women's marathon (2:15:25), it was reported that Paula Radcliffe’s running economy improved by 15% (that is, there was a 15% reduction in the amount of oxygen she consumed per kilometre at a standard pace).

Having a high percentage of slow-twitch muscle fibres (better suited to endurance) compared to fast-twitch muscle fibres (better suited to speed and power) is also associated with better running economy.

In the lead up to her marathon world record, Paula Radcliffe also had a large increase in her lactate threshold. The lactate threshold relates to the ability to produce energy without accumulating high levels of lactate (a cause of that burning sensation you feel in your legs after a fast run, like after running to catch a train or bus).

An individual's lactate threshold is determined by the point at which the blood lactate begins to rise above resting values, and is generally considered to be an important determinant of marathon pace. You can think of the lactate threshold as helping to set a maximum speed at which one can run a marathon, and a high lactate threshold as being critical to be a successful marathon runner.

Still, the right body, and the right physiology, are only a start. The hard work is another matter completely.

The real work

Without an incredible training ethic, it's fair to say it is impossible to be a successful marathon runner (or successful in most sports). It is commonly reported that the longest training session, training intensity, and training volume all correlate with endurance performance. And anyone who has seen elite marathon runners train reports that they train hard, very hard.

The flip side of training hard is quickly recovering from the physiological stresses an intense or long run places on the body. Successful marathon runners probably recover quickly, which means they can train more often and arrive at the next session ready to gain the most benefit from the planned training session.

Successful marathon runners pay as much attention to recovery, and getting a good night's sleep, as they do training.

It's impossible to quantify all of the factors required to be a successful marathon runner. But it probably requires the rare combination of the perfect set of genes, the right body, exceptional physiology, and the correct training. The right psychological make-up is also critical, and a key component of that is being highly motivated.

David Bishop does not work for, consult, own shares in or receive funding from any company or organisation that would benefit from this article, and has disclosed no relevant affiliations beyond the academic appointment above.

Authors: David Bishop, Research Leader, Sport, Institute of Sport, Exercise and Active Living, Victoria University

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