

# Will female long distance runners ever catch up to males?

There are few aspects of life in which women cannot compete with men. Since bursting onto the scene of athletics, women have certainly made their mark.

# CATCH ME IF YOU CAN!

The gender gap between male and female runners has been a hotly contested topic amongst sports scientists as well as the public for many years. **INGELISE JONES** brings you up to speed.



**T**HE biological differences between men and women have long suggested that men are stronger, faster and hence more dominant in sports. Elite men appear to maintain an advantage over elite women in most sports. From rowing to cycling, sprinting to long distance running, men hold faster world records.

Much hype has surrounded the 'gender gap', particularly given the rapid improvements in world record times in women's running events from the 100m sprint through to the marathon during the last half century. Women have, of course, only been competing in world class running events more recently and women's world records have only been kept since the 1950s.

Highlighting the gender differences in sport may have previously fuelled sexist thinking that women are the 'weaker sex'. While there are several biological differences between men and women, you can't ignore the social constraints, misconceptions and lack of opportunity that has plagued women throughout history.

### A short history

In ancient times, women were not even allowed to attend the Olympics, let alone compete in them! While women were

first invited to the Olympics in 1912, women's running has only been taken seriously more recently thanks to the women's liberation movement of the 1960s and 1970s, and through the efforts of pioneering female long distance runners such as Kathrine Switzer. Switzer was the first woman to compete in the Boston Marathon in 1967 and helped put women's running on the world stage through the creation of the Avon Running Program, which involved a women's racing circuit across 16 countries. She was also largely responsible for the inclusion of the women's marathon in the 1984 Olympic Games.

Attitudes towards women in sport have significantly improved. Women are now given more opportunities to train and compete, from junior

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girls' competition through to all the top races around the world. If the increase in participation in fun runs here in Australia is anything to go by, women of all ages and abilities are hitting the pavement! Women are also given the unique opportunity to compete in women only fun run events.

### Don't believe the hype

In 1992, Nature published a letter from Brian L. Whipp and Susan Ward from the University of California, titled "Will women soon outrun men?" The letter received a great deal of attention. Whipp and Ward compared the world records of five Olympic running events from the 1920s to 1990. Results from the 200m through to the marathon suggested that women have been narrowing the gap and were improving their times at double the rate of men, and even faster in the marathon.<sup>(4)</sup>

Could this prediction be true? At the time, theorists were divided. Was the significant improvement simply due to a relatively new and emerging field of female athletes? Or could their success be attributed to illegal doping?

Over the last 15 years or so world records in women's events have plateaued. Why? The most likely reason is the introduction of random drug testing in 1989 which has undoubtedly reinforced the gender gap. Performance enhancing drugs such as anabolic steroids (e.g. testosterone) may have significantly helped female athletes close the gender gap in the 1970s and 1980s.<sup>(5)</sup>

Drug use continues to be an issue in athletics for both genders. Interestingly though, the introduction of drug testing does not appear to have greatly affected top male athletes who have continued to improve world record times since 1989.<sup>(6)</sup>

### Gender testing

There has also been controversy surrounding gender identification in racing. The call for gender testing came in the 1960s after the revelation that



Hermann Ratjen, a German male athlete, admitted to competing as "Dora" in the 1936 Olympics. Gender testing has evolved from parading in front of officials, to gynaecological examinations, to the development and use of a sex chromatin test known as the Barr Body Test (buccal smear testing).

The IOC introduced the sex chromatin test at the 1968 Olympics in Mexico. The test took a sample of cells from inside a person's cheek to determine an athlete's chromosome count. The accuracy of this test, however, remains in question. Perhaps more importantly though, there are ethical concerns as to what defines gender.

The highly controversial issue centres on the potential discrimination against women who may have sex differentiation and sexual development disorders. Current genetic research is placing doubt over how gender is medically defined. Males and females may not simply be defined by their X's and Y's. For example, there are some 40,000 Australians whose chromosomes don't match the standard XX for girls and XY for boys.

The sex chromatin test was used at the Olympics up until 1991, but on-site use of the test has consequently ceased. At present, the IOC's policy gives medical delegates the authority to arrange for gender testing if they deem it desirable. It certainly doesn't seem a fair or openly regulated system. As genetic research into gender identification continues, international sporting regulators will need to change their policies and testing methods to take these issues into consideration. At the present time, it is therefore difficult to know just how this issue is impacting on the gender gap.

### What is the gap?

The gender gap between male and female performances is fairly prominent. If you compare the current world record times across running events from the 100m sprint to the marathon, you will see the difference is between 7 and 14 percent, with an average of approximately 10-11 percent. (Table 1)

Paula Radcliffe's inspirational win in the 2003 London Marathon reignited the rumors that women would soon catch up to men. Radcliffe shaved almost two minutes off the world record with a time of 2:15.25. If you compare this with the current male record of 2:04.55 (2003) there is actually only 8.4 percent difference. This seems to be the standout case at the moment, however.

Closer to home, current top Australian long distance athletes also share a gender gap of approximately 10-13 percent. If you compare Craig Mottram's PB for the 1500m with Sarah Jamieson's PB, you will see a difference of 13.19 percent. The marathon shows a similar gap, with Lee Troop holding a PB that is 12.45 percent faster than Kerryn McCann's PB. (Table 2)

### A body of evidence

Body size is an obvious factor for the difference in performance between men and women in most sports. If we compare some of our top Australian

Table 1: Current World Record Times

Event	Women	Year	Men	Year	Difference
100m	10.49	1998	9.77	2005	7.37%
200m	21.34	1988	19.32	1996	10.46%
400m	47.60	1985	43.18	1999	10.24%
800m	1:53.28	1983	1:41.11	1997	12.07%
1500m	3:50.46	1993	3:26.00	1998	11.89%
5,000m	14:24.53	2006	12:37.35	2004	14.14%
10,000m	29:31.28	1993	26:17.53	2005	12.29%
Half Marathon	1:06.44	1999	58:55.00	2006	13.15%
Marathon	2:15.25	2003	2:04.55	2003	8.41%

Data obtained from IAAF website, 21 July 2006. [www.iaaf.org](http://www.iaaf.org)

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>> athletes again, Craig Mottram (188cm, 71kg) is distinctly taller and heavier than Sarah Jamieson (176cm, 56kg). In the marathon however, there is usually little difference in the height and weight between runners of both genders. For example, the difference between Andrew Letherby (165cm, 52kg) and Kerryn McCann (162cm, 47kg) is far less obvious. Body size alone cannot therefore explain these differences in performance. Perhaps of more pertinence is body composition, hormones, aerobic

and anaerobic capacity.

### Your bones

Firstly, men and women have different skeletal structures. This suggests that the two genders also run differently. A female pelvis is generally wider than a man's with a different angle to their leg bones. Men also generally have a smaller, tighter gluteus maximus.<sup>(6)</sup>

These differences help us to understand why

Table 2: Top Australians - Personal Best Times

Athlete	Event	Time	Year	Difference
Craig Mottram Sarah Jamieson	1500m	3:33.97 4:00.93	2005 2006	13.19%
Lee Troop Kerryn McCann	Marathon	2:09.49 2:25.59	2003 2000	12.45%

Data obtained from Athletics Australia website, 21 July 2006. [www.athletics.org.au](http://www.athletics.org.au)



the incidence of injuries can also differ. There is a higher incidence of lower back pain, hip strains and knee injuries among female athletes. All professionals involved in the running industry, from scientists to coaches and shoe manufacturers, are addressing these differences to help understand and support female performance.

### Oxygen capacity

Aerobic capacity is of course extremely important in running. Your performance is affected by how well your muscles use oxygen to burn glycogen. Glycogen is the carbohydrate stored in your muscles that is used for energy during exercise. The maximum amount of oxygen your muscles can consume is defined as your maximum oxygen capacity (VO2max). The difference in VO2max between the genders is well documented. On average, men have 10-11 percent greater VO2max levels than women. Is the significance of this figure an interesting coincidence?

This difference can be explained not simply by body size, but also by the size of our hearts and hemoglobin levels in the blood. Women on average have slightly smaller hearts than men. Smaller hearts will in most cases result in a decreased stroke volume, i.e. the amount of blood expelled from the heart on each contraction. Women also have about 10 percent less hemoglobin, the oxygen-carrying protein in red blood cells.<sup>(8)</sup>

In a novel study by the University of Georgia, Kirk Cureton studied the hemoglobin levels in a group of 10 male athletes and 11 female athletes. They removed just under one litre of blood from each male so that both genders would have the same level of hemoglobin in their blood. All athletes were then tested for VO2max and endurance a few days later. The study revealed that after the removal of

blood from the males, both the VO2max values and the hemoglobin levels in the blood were generally equivalent between the sexes. The males, however, still achieved better results in the endurance test.<sup>(2)</sup>

Cureton and Sparling also believe that testosterone, the main male sex hormone, is largely responsible for the male advantage. However, estrogen, the main female sex hormone, offers little advantage to women.<sup>(2)</sup>

### The testosterone advantage

Men produce about 14 times more testosterone than women. Testosterone increases the number of red cells in the blood and stimulates the production of hemoglobin; Men are therefore better able to process oxygen because they have a higher concentration of red blood cells which carry hemoglobin.

Testosterone also increases metabolic rate, decreases body fat, maintains muscle and spurs muscle growth. It is no wonder that if you give women a little testosterone they might just see some significant improvements in their performance!

### The estrogen factor

The female anatomy is unique and clearly different to males. Women require unique attention and care, from sports bras to specific running shoes. Women actually have shorter muscle fibres than men and their muscle tendons are also softer. Women also have a higher concentration of estrogen which is responsible for reproduction, as well as playing an important role in the brain, behaviour, fat and bone.

The menstrual cycle imposes a hormonal rollercoaster on women, impacting them both physiologically and psychologically. This cycle can have a huge impact on running performance. Many female athletes manage and manipulate their own cycle to suit their particular preferences for races through use of the contraceptive pill.

Estrogen helps to maintain the body's balance of fat in both men and women. Some female athletes may not actually have enough body fat to maintain a menstrual cycle which can seriously impact on not only their reproductive function, but can also alter bone mineral density (BMD), increasing the risk of fractures as well as potentially leading to osteoporosis.

### Body fat

Body fat is often seen as adding a 'dead weight' to long distance runners. Extra weight can affect speed and performance. The average man has about 10-20 percent body fat, while a male athlete typically has 6-13 percent. The average woman, however, has about 20-30 percent body fat, while a female athlete typically has 14-20 percent.

Sparling and Cureton conducted an interesting study in 1980 which involved 10 male subjects running with weight-bearing harnesses to even out the 'dead weight' ratio with their 10 female subjects. Additional weight was given to the men in proportion to their leanness. These men and women were then put to a 12 minute test in which they had to run as far as possible. With no extra weight, men ran an

average of 569m further than the women. When wearing the weight bearing harnesses, however, the men ran an average of only 395m further.<sup>(1)</sup>

You might assume that a higher percentage of body fat gives women a distinct disadvantage. This may well be the case in most events, however, it is important to point out that fat can also provide fuel for your muscles. Some sports scientists argue that fat can actually be useful in endurance events.

### Anaerobic capacity

The process of using glycogen for energy during exercise is called your anaerobic metabolism. It allows your muscles to use energy quickly, without oxygen. Because men have bigger muscles they have larger stores of glycogen.

When you run out of glycogen stores, your body must slow down. If however, your muscles use fat for energy, you are able to conserve glycogen. If women have more fat to use for fuel, do they have an advantage over men in endurance events?

### Ultra endurance

Some theorists believe that women's bodies are more suited to endurance events, such as the ultramarathon, because they carry more fat and are better at metabolising fat after they have depleted their glycogen supplies, indicating that they can last longer than men.<sup>(5)</sup> The proof of this theory remains debatable. The elite male ultramarathon runners are still faster than elite female ultramarathon runners. It is of course, a relatively new sport for women, so perhaps the female field will continue to improve.

Dr Tim Noakes, a physician and sports research scientist at the University of Cape Town in South Africa and author of *Lore of Running*, believes that two studies conducted in South Africa in the early 1990s indicate that women may have more endurance than men.<sup>(7)</sup>

While men might have more muscle, women have more muscle elasticity. According to Dr Noakes women have more "fatigue resistant" muscles which enable them to maintain their form even after an ultramarathon. On studying the form of women and men during the 56 mile (88km) Comrades Marathon in South Africa, the women were still able to maintain a running pattern of even strides at the end of the event, while many of the men were not.<sup>(7)</sup> Again, the proof as to whether women are actually better at endurance events still remains questionable.

### Psychology of the genders

Perhaps another factor suggesting that women might be more suited to endurance events is that they are better at handling pain and stress. While men might be physically stronger than women, perhaps women have a higher threshold for pain and hence are constitutionally stronger than men. Scientifically, this idea does hold merit. Women live longer and are more resilient against illness, famine and fatigue, not to mention the childbirth experience!<sup>(3)</sup>

Attitudes towards running may also vary

between the genders. Men are stereotypically believed to have a more impulsive nature and a tendency to rush (starting a race too fast!). Women may be seen to be a little more rational in their approach.

The paradigm of gender differences is certainly changing. It is difficult to escape varying social barriers and expectations as well as cultural and political divides that face many athletes around the world, particularly women. As women continue to receive more opportunities to train and compete, they continue to attract the attention and the accolades previously only enjoyed by men.

### Comparing the field

Though the arguments above suggest that men really do have the advantage over women in long distance running, it is important to remember that the 10-11 percent difference in performance has been identified among elite athletes, not the general population.

Importantly though, the best female runners generally beat the majority of male runners. Of course many women are quite capable of beating many men, depending on several of the above mentioned factors as well as age, ability and training. You only have to observe the field of athletes in a fun run to know that many women can beat men to the finish line!

### Will women catch up?

Will world records continue to be broken? Will humans reach a maximum speed? Are the limits of human performance just around the corner? It would seem that the cost of breaking these records will be extremely high for elite athletes in the future.

Seiler and Sailer actually believe that men will continue to get faster and that the gender gap is widening. They also suggest however, that it would be naïve to think drug use has been abolished by random drug testing in either gender field.<sup>(8)</sup> We can only hope that drug testing continues to be enforced to ensure fair and clean competition in athletics for both men and women.

The precise difference in world record times as shown in Table 1 suggests that elite male runners are approximately 10-11 percent faster than elite female runners. Clearly though, these comparisons are not representative of all men and all women, but only of the world's very best athletes.

The gender gap amongst elite athletes may be explained by the fact that men generally have larger hearts in relation to body size, higher aerobic and anaerobic capacity, more testosterone, higher levels of hemoglobin in their blood, plus more muscle and less fat.

The rapid increase in women's world record times during the last half century may have misled some people to believe that the gender gap is closing.



However, since the introduction of random drug testing, and with the clear biological advantages that men have over women, the gap is unlikely to close.

As Grete Waitz, a Norwegian marathon runner in the 1970s and 1980s said, "As long as women are women, I don't think they will surpass men."<sup>(4)</sup>

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