

# Fair play at the Olympics—testosterone and female athletes

June 22 2016, by Peter Sonksen And Daryl Adair

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There are performance differences between the sexes in elite sport. It has long been assumed that contrasting [levels of testosterone](#) in [men and women](#) can largely account for that gap, but [new scientific studies](#) are [bringing that into question](#).

This emerging research is also important for a practical reason: until recently, [women](#) with higher-than-expected [testosterone levels](#) were declared ineligible to take part in track and field athletics. Sporting authorities were under the impression these [female athletes](#) had an unacceptable performance advantage.

## Androgens, women and sport

Androgens are a sex hormone. Among these is testosterone.

Typically, men and women have a different range of testosterone levels, but some women present with much higher than the norm. This is [known medically as hyperandrogenism](#).

A key cause of hyperandrogenism is androgen insensitivity syndrome (AIS). It occurs when an embryo is born XY (male) but resistant to male hormones, subsequently developing with some or all of the conventional physical traits of a woman. Babies with this presentation are routinely raised as girls and develop into women according to prevailing social norms.

However, in developed countries there typically comes a point at which they are diagnosed as having AIS, such as by an investigation for the absence of menstruation, or infertility.

Those with AIS may have different gender identities; should they choose, hormonal treatments can be used to better reflect that disposition. Some may also consider surgery in scenarios where health and psychological outcomes are beneficial.

Women who have AIS are not "obvious" by way of physical appearance. Many are tall and slim, just as women without the syndrome. Most – like Spanish hurdler [Maria Jose Martinez-Patino](#), who failed a [chromosome test](#) in 1986 – had no idea their status as an adult woman was anything but conventional.

Women with severe AIS are resistant to androgens such as testosterone. Thus, it cannot confer any athletic "advantage".

## The 'hyperandrogenism' rule

In 2009, South African runner Caster Semenya was [withdrawn from competition](#) on the basis of claims that – as a woman – she had a higher-than-normal testosterone level that conferred a performance advantage.

Two years later, the International Association of Athletics Federations (IAAF) announced a "hyperandrogenism" rule that was intended to counter concerns about female athletes with [excessive production of testosterone](#).

The rule had serious consequences for [women with AIS](#), which typically results in very high serum testosterone levels. In order to be classified as "women" in a sport contest, medical intervention was deemed necessary. Reportedly, [four elite athletes](#) were persuaded to undergo surgery on

genitalia or sex organs and to accept estrogen-replacement therapy.

Even though these procedures involved informed consent, the need for such significant interventions raised [serious ethical issues](#) for women who wished to continue with sport but were persuaded that their bodies needed alteration in order to do so.

In 2015, however, the Court of Arbitration for Sport (CAS) upheld Indian sprinter Dutee Chand's appeal against the ["hyperandrogenism" rule](#). It concluded there was no convincing [scientific evidence](#) that women with elevated testosterone levels had a performance advantage over others.

The path was now clear for those who had previously been declared ineligible to compete in the 2016 Olympic Games.

The CAS decision has generated much debate, but [these discussions](#) have ignored the significant scientific evidence that supported the rule being struck out.

## **Why was the rule flawed?**

After the Semenya case in 2009, the IAAF had convened a working group to advise on how to manage female athletes with elevated testosterone levels.

Among that group was Liz Ferris, a medical doctor and former Olympian, who was advocating on behalf of athletes. She sought the advice of Peter Sonksen, the lead author of this article. Coincidentally, he was part of a research team that was investigating the hormone profiles of female and male athletes.

This study [measured hormone profiles](#), including testosterone, from a

sample of 693 elite athletes across 15 sporting categories. There were many unexpected findings.

For example, 16.5% of men had a testosterone level below 8.4 nanomole per litre (the lower limit of the normal male reference range). Some were unmeasurably low. And 13.7% of the elite female athletes had a level higher than 2.7nmol/l, the upper limit of the normal reference range for women. Some were in the high male range.

Thus, there was a complete overlap of testosterone levels between male and female [elite athletes](#). This challenged existing knowledge, which had assumed there was no such overlap.

Frustratingly for Ferris, the IAAF working group ignored this research. Instead, it proceeded to introduce its flawed – but now suspended – "hyperandrogenism" rule.

CAS has given the IAAF two years to present scientific evidence to justify its position. If it cannot do so the rule will be declared void.

## **An unfair advantage?**

It appears likely that women with AIS are more commonly Olympic athletes than one would expect by chance alone. They often have an "athletic" body configuration. This has recently been attributed to a number of [genes on the Y chromosome](#), but not the presence of the high serum testosterone level – to which they are physiologically unable to respond.

Sonksen's research team [found](#) the gaps in world records between [men and women](#) for various track and field events are in keeping with the differences in their lean body mass. The study showed men to have approximately 10kg greater lean body mass than women.

The researchers concluded this contrast was:

*... sufficient to account for ... differences in strength and aerobic performance seen between the sexes without the need to hypothesise that [elite sport] performance is ... determined by ... testosterone levels.*

Chand just missed out on the qualifying time for [Olympic selection](#), but Semenya will be at Rio, as is her right. The scientific evidence outlined here should be borne in mind by those watching Semenya or competing against her at the Olympics.

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