

EDITORIAL

Trans and cis women in sport: *Citius, altius, fortius, sed aequitas*



Mujeres trans y cis en el deporte: *citius, altius, fortius, sed aequitas*

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The debate surrounding the participation of transgender women (TW) in high-performance sports has gained significant relevance in recent years, particularly in disciplines where strength, endurance, and speed play a key role.¹ This issue has generated intense debate in sports, scientific, and legislative communities, due to the potential physical advantages of transgender athletes who have initiated gender-affirming hormone therapy (GAHT), such as greater wingspan/height, lung capacity, cardiovascular function, muscle mass, and strength.² However, the participation of transgender men is not perceived as a challenge to the integrity of male competitions. As research advances on the effects of GAHT, it will be imperative to evaluate the available scientific evidence and its influence on current sports regulations, to maintain fairness in competition, while valuing the inclusion of transgender athletes in the category that aligns with their gender identity. With this priority objective, and very rightly, Cuadrado Clemente et al.³ from the Gonad, Identity, and Sexual Differentiation Working Group of the Spanish Society of Endocrinology and Nutrition –GIDSEEN–, conducted a systematic review

of the available cross-sectional and longitudinal studies, in which they highlight the impact of GAHT after 12 mo of use on key variables, such as hematocrit, strength, and muscle mass. Additionally, they also demonstrate greater grip strength and long-term sports performance in sports involving the upper body. The authors conclude that scientific evidence is insufficient and long-term studies, with morphofunctional considerations and validated biomarkers, are needed to evaluate the differences in physical performance between TW and cisgender women (CW) in each discipline.

To understand the complexity of the issue at hand, the multidimensional conception of biological sex—chromosomal, genetic, hormonal, anatomical sex—is fundamental. There are some biological differences between sexes, probably of genetic and chromosomal origin, that affect performance even before puberty. However, we lack evidence in this regard. *A priori* and with a simplifying intention, it seems that the physical advantages acquired in male puberty notably influence sports performance, while the other factors would have a residual role. In the absence of new data, it seems reasonable to focus the debate on TW with post-pubertal GAHT initiation, focusing on the modifiable and non-modifiable factors associated with performance (Fig. 1).

GAHT is the standard of care in gender transition, and its impact on testosterone-derived physical characteristics

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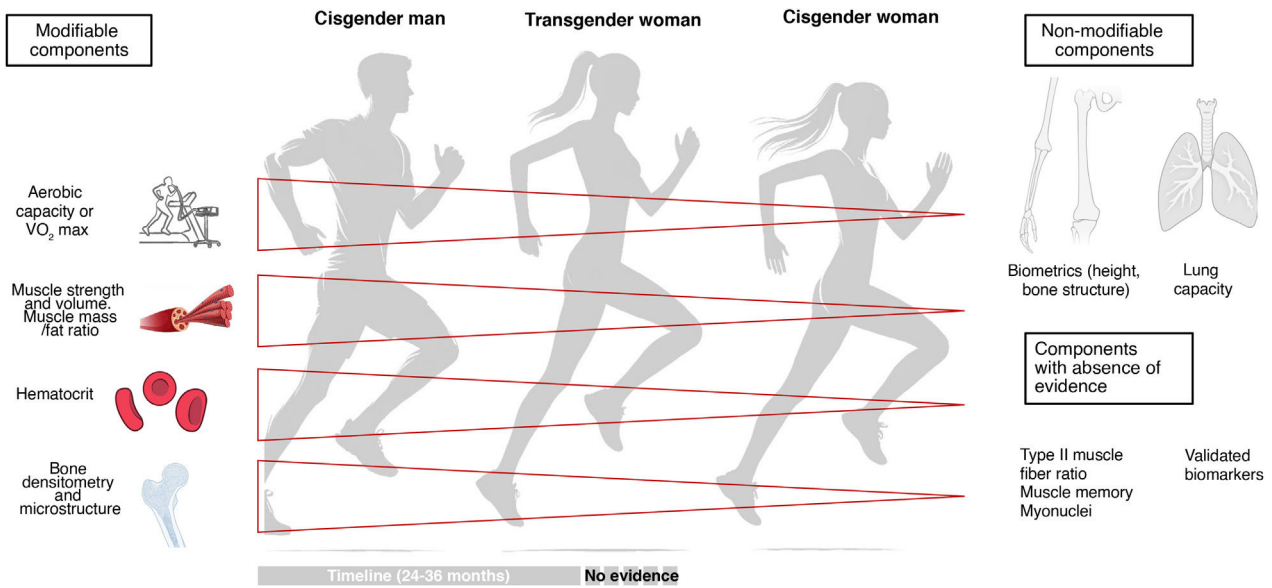


Figure 1 Multidimensionality of biological sex and impact on sports performance in response to gender-affirming hormone therapy after puberty.

is the cornerstone. In TW, GAHT involves the administration of estrogens and antiandrogens to suppress testosterone levels to reach levels observed in CW.⁴ However, the extent to which this treatment mitigates the biological differences acquired during male puberty and its influence on sports performance is largely unknown. Most of the available scientific evidence is of low quality, as it is based on uncontrolled studies, with a small number of people, often compared to cisgender men (CM) and not CW, and includes athletes who are not high-performance.

If we consider non-modifiable biological characteristics, height and bone structure cannot change after puberty. From a biomechanical point of view, TW presents an average height and weight 12 cm and 11 kg higher than that of CW, respectively.⁵ Regarding body composition, overall, in response to hormone therapy there is a decrease in lean mass and an increase in fat mass, reaching intermediate values between CM and CW, with persistence of greater absolute lean mass than in CW.^{5,6} The change in the proportion of type II muscle fibers, which are found in greater proportion in CM vs CW and are especially relevant in sports that require explosive strength and power, is unknown.⁵ At bone level, GAHT entails a decrease in densitometric values and microstructure vs CM.^{7,8} Differences persist in muscle volume-mass and bone density-structure—such as pelvic size and axial skeleton—vs CW, which could confer a residual advantage, especially in disciplines that depend on physical size.

From a functional point of view, strength, muscle memory, and aerobic capacity deserve special attention. There is confirmed evidence of muscle strength loss associated with decreased muscle volume after 12 mo of GAHT.⁵ These results are more consistent in grip strength and upper body, and more heterogeneous in squats, jumps, and running, where these differences progressively decrease as the duration of hormone treatment increases. However, this reduction does not seem to fully equate strength levels

with those of CW and there is little data > 36 mo.⁹ Finally, it has not been studied whether the phenomenon of muscle memory could confer an advantage in TW athletes. Anabolic steroids, such as testosterone, increase myonuclei, and these do not decrease during detraining phases, which provides a basis for rapid muscle recovery when activity is resumed. Therefore, the loss of muscle mass induced by GAHT in TW could be compensated by continuous strength training.²

Aerobic capacity or VO_2 max is key in endurance sports and those that demand high levels of oxygenation. Although it decreases with GAHT, it does not reach the parameters observed in CW. Slightly modifiable factors, such as greater lung capacity—thoracic structure and airway diameter—heart size, and cardiac mass, which in turn influence stroke volume, would be responsible. With the aim of ruling out a persistent advantage in TW, some authors propose using VO_2 adjusted to fat-free mass, as it could better represent the aerobic performance of active muscles. In fact, the absence of significant differences between TW after, at least, 24 mo of GAHT and CW has been found in studies with a very small number of people.^{5,9}

Faced with the growing demand for fairness in sports competition, several international federations and the International Olympic Committee have issued guidelines for the participation of transgender athletes. These regulations vary depending on the discipline and, in some cases, have been recently revised due to new scientific evidence and social demands. Until November 2021, the International Olympic Committee allowed TW to compete in the female category if their testosterone levels were maintained <10 nmol/L (2.88 ng/mL) for, at least, 12 mo prior to the competition. This arbitrary cut-off point lacked any scientific basis and did not consider the plausibility of a competitive advantage for TW with testosterone concentrations above the high limit of normality of a

CW (<3.5 nmol/L; <1 ng/mL). Furthermore, this simplistic regulation did not contemplate the possible performance advantage of MT who had initiated GAHT after puberty, which generated great uncertainty and disagreement among CW athletes, and diversity in the implementation of these policies. Subsequently, the International Olympic Committee adopted a more flexible stance, prioritizing inclusion and non-discrimination based on gender identity^{10,11} and delegating responsibility to individual sports federations to establish specific criteria based on the evidence of each sport.¹²

In recent years, some international federations, such as swimming¹³ and athletics,¹⁴ have established stricter regulations that prohibit the participation of TW in female categories if they have gone through male puberty. In Spain, Article 26 of Law 4/2023, of February 28th¹⁵ promotes equality in sports for transgender people but does not detail specific criteria for the participation of TW in female categories in high-performance sports, but rather focuses on eradicating discrimination and promoting inclusion.

Clinical positions by expert groups and the development of equitable legislation are always extremely complex when they affect the needs and rights—inclusion vs fairness—of groups of people with different sensitivities. From a sports ethics point of view, it seems fully justified to avoid any competitive advantage in high-performance female athletes, whether they are trans or cis. Since this controversy affects 50% of high-performance athletes, international sports organizations should promote and fund the generation of new high-quality knowledge that supports decision-making, considering expert committees including specialists in endocrinology, metabolism, and nutrition. Pending the ability to elucidate in the future whether there are competitive advantages of TW, given the biological plausibility and taking into account a fundamental principle of scientific reasoning in highly complex scenarios —“the absence of evidence is not evidence of absence” (Carl Sagan, *The Demon-Haunted World*, 1995)—, from the perspective of endocrinology, and even being cautious, it seems reasonable to conclude that some of the physical and functional attributes associated with the tandem pubertal development prior to the start of GAHT/inappropriate plasma concentrations of testosterone would not completely eliminate the advantages related to strength, endurance, and cardiopulmonary capacity, especially in sports where these characteristics are decisive.

Although international legislation is in a process of adaptation, it must ensure the principles of the Olympic movement. Its motto, *Citius, altius, fortius*, urges athletes to strive for personal excellence in everything they do, but without equal opportunities its meaning is completely distorted. The scientific community must continue to contribute to improving the evidence to be able to make decisions based on solid data. Until then, it is worth highlighting the fundamental work of working groups such as GIDSEEN, which promote multidisciplinary dialogue and underscore the need for solutions based on scientific evidence and social sensitivity.

Declaration of competing interest

None declared.

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