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The BASES Expert Statement on Eligibility for Sex Categories in Sport: Trans Athletes

Introduction

Physiological differences between men and women have led to the segregation of sport according to biological sex. Without this segregation, women would disappear from most elite and matched levels of sport, as greater physical capacity in men, developed particularly in response to androgens during and after puberty, confers insurmountable advantages in speed, strength, endurance and other variables. Thus, to ensure fair competition, and safety of combat and collision sports, a protected female category in sport exists.

In most individuals, biological sex aligns to gender identity (cis men/women), whereas in trans people, biological sex differs from gender identity. Thus, if permitted to compete in the sporting category aligned to their gender identity, trans women (assigned male sex at birth; no relevant genetic difference from most cis men) may retain a performance advantage and create safety considerations for other athletes in certain sports, while trans men (assigned female sex at birth; no relevant genetic difference from most cis women) may be at increased risk of injury.

In an attempt to facilitate inclusion while balancing fairness of competition and athlete safety, several sport governing bodies have developed guidelines for the inclusion of trans athletes. Both World Athletics and the International Olympic Committee (IOC) permit trans men to compete without restriction in the male category. Trans women may compete in the female category, if they maintain serum testosterone <5 or 10 nmol/L (depending on sport and/or governing body) for 12 months before competition. Contrastingly, World Rugby exclude trans women from competing with elite women, and require trans men to confirm physical ability before competing against elite men for safety reasons – a policy based on current evidence in non-athletic trans women and men.

Through this expert statement, we provide recommendations for practitioners providing support to trans athletes competing in elite sport. We also provide research recommendations to enhance the evidence base from which sports governing bodies can draw when developing eligibility regulations.

Background and evidence

Sexual dimorphism-linked performance differences

Sexual dimorphism is the development of divergent secondary sex characteristics between males and females during puberty due to androgenisation and a resulting ~ 15 -fold higher serum testosterone in most cis men. As testosterone is primarily responsible for initiating positive changes in many anthropometric and physiological variables (Table 1), there is a corresponding divergence in athletic performance between biological males and females following puberty. Indeed, cis male performance advantages in elite sport range from $\sim 12\%$ in swimming, rowing and running, irrespective of distance, to $\sim 20\%$ in sports more reliant on upper body strength (Hilton & Lundberg, 2020) and $\sim 30\%$ in combat sports (Busko et al., 2016). Comparable differences also exist between untrained cis men and women. Accordingly, concerns have been raised regarding how well eligibility regulations introduced by sports' governing bodies balance fairness and safety of competition with inclusion of trans athletes, particularly trans women, in categories aligned to their gender identity. While research on the physiological effects of hormones on trans athletes is lacking, evidence emerging since the IOC and World Athletics regulations were introduced suggests 12 months of testosterone suppression is not sufficient to remove the physiological advantage of untrained trans women, so the regulations should be reviewed (Wilk et al., 2020; Hilton & Lundberg, 2020; Harper et al., 2021).

Table 1. Extent of male advantage in selected physiological characteristics relevant for athletic performance. Adapted from Hilton & Lundberg (2020).

Physiological characteristic	Approximate male advantage
Limb bone length	$\sim 12\%$
Muscle mass	$>37\%$

Cardiovascular function	~27%
Muscle strength	~56%

Effect of hormone therapy

As part of transitioning, trans people often undergo hormone therapy, which for trans women typically involves administration of oestrogen, and testosterone suppression via androgen blockers. A recent systematic review (Hilton & Lundberg, 2020), revealed that although muscle mass (~5%) and strength (~4%) reduced in trans women following 12 months of testosterone suppression below 5 nmol/L, these reductions are much less than typical advantages in muscle mass (~37%) and strength (~55%) of cis men. Extending testosterone suppression >12 months produced no further substantial reductions, which appear to plateau within 2 years.

While assessments of muscle mass and strength are useful and often used within sport for selection and to monitor training, these may not necessarily reflect sport-specific actions, which will ultimately determine whether trans women competing in female sport is fair and safe. Indeed, comparisons between cis men and women suggest differences in sport-specific actions are larger than differences observed for the individual phenotypes that combine to determine them. The force generated during maximal arm cranking, for example, was 162% greater in cis men than cis women despite typical sex differences in muscle mass, strength and speed each not exceeding 60% (Morris *et al.*, 2020; Hilton & Lundberg, 2020). Thus, for sports where muscle mass and strength are important determinants, data suggest including trans women in the female category, even after 12 months testosterone suppression, would be unfair and (in some circumstances) unsafe, though research on sport-specific actions using athletic participants would clarify the extent of these differences.

Similarly, while testosterone suppression partly reverses some effects of pubertal androgenisation in soft tissue, it has no effect on skeletal anatomy in post-pubertal adults. Trans women who experienced androgenisation, therefore, are likely to be taller, with ~12% longer limbs and a ~6% narrower pelvis than cis women (Hilton & Lundberg, 2020) regardless of any hormone therapy. All else being equal, longer limbs produce greater torque, which is advantageous in jumping, throwing or other sports requiring explosive actions and/or reach. Thus, based on current evidence that trans women retain all/some advantages in skeletal anatomy, muscle mass and strength compared to cis women, fair and safe competition in female sports where these phenotypes are particularly important is not ensured under current World Athletics and IOC eligibility regulations.

In comparison to strength/speed sports, sex differences in endurance performance are notably smaller ($\leq 13\%$; Hilton & Lundberg, 2020), although no controlled investigations on the long-term effects of testosterone suppression on elite endurance performance exist. In trans women soldiers, 2.4 km run performance after 2.5 years of hormone therapy was ~8% slower than pre-therapy and ~5% slower than cis men, but remained ~11% faster than cis women (Roberts *et al.*, 2020). Reductions in serum haemoglobin following testosterone suppression (~14%; Gooren & Bunck, 2004) are similar to the difference between cis men and women (~12%; Murphy, 2014), and probably contribute to the impaired running performance. Endurance performance is multifactorial, however, and effects of testosterone suppression on factors such as blood volume, cardiac output and lactate metabolism require further investigation. Ultimately, fair regulation of trans women's eligibility in female sport cannot be all-encompassing, and organisations governing multiple sports/events should assess conditions for eligibility for each sport separately.

For trans men, gender-affirming hormone therapy typically involves administration of testosterone, so a therapeutic use exemption is required to avoid an anti-doping violation. Many governing bodies require a signed declaration of an athlete's gender identity, and some require additional confirmation of performance capability (World Rugby), or annual verification of gender-affirming hormone therapy and serum testosterone (British Judo). In general, these requirements will not restrict trans men from participating in male sport but practitioners working with trans men should assess whether they are physically able to compete against cis men, particularly in contact or collision sports, and are aware of

potential injury risks. Testosterone administration in trans men improves strength and endurance, with evidence in soldiers of trans men outperforming cis men in 2.4 km run, and push-ups and sit-ups completed in 1 min, following 2.5 years of hormone therapy (Roberts *et al.*, 2020). The shorter limbs and wider pelvis of trans men (disadvantages in many sports) are, however, unaffected by post-pubertal testosterone administration. Thus, the magnitude of any retained disadvantage or risk of injury will differ between sports/events, particularly contact vs non-contact, but requires more research involving athletes and sport-specific actions.

Conclusions and recommendations

- Recent data suggest testosterone suppression probably cannot negate the effects of prior androgenisation sufficiently to enable fair and safe participation of trans women in the female category of those sports heavily influenced by physiological capacity, so current regulations for such participation (e.g. IOC and World Athletics) should be reviewed and updated.
- Further research investigating the impact of hormone therapy on performance of sport-specific actions in trans athletes is required.
- Practitioners supporting trans men athletes should assess whether they are physically able to compete against cis men, particularly in contact or collision sports that present significant injury risks.
- Awareness of current trans athlete eligibility regulations and the likely extent of physiological adaptations following transition should be raised among athletes and practitioners, to develop broader scientific and ethical understanding.

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