

Research Document on Sex, Gender and Elite Sport

1. Context

This Research Document will map the current debate and present the most actual research findings on the correlation between sex, gender and sport, to facilitate scientifically validated, consistently elaborated policy in Dutch elite sport competition. Although each Olympic & Paralympic sport's federation will have to make their own choices, this Research Document aims to install a balanced framework to guide all.

On Sex and Gender in general

It is commonly acknowledged that sex is a biological, immutable thing and gender a socio-cultural identity. While a growing amount of people accept that gender is a spectrum, the vast majority of people still sees sex as binary, that you are either man or woman, and nothing in-between. However, science has so far has not been able to agree on any single or objective way to define sex.¹ There are at least six markers of sex: chromosomes, gonads (testes and ovaries), hormones, secondary sex characteristics (body hair, square jaw, Adam's apple, body shape etc.), external genitalia and internal genitalia (uterus, prostate, etc.). None of these characteristics are binary, all of them can vary within individuals, resulting in various combinations.²

Chromosomes can be more than XX and XY, there can also be XXY, XXXY, XYY and other varieties. The chromosomes are not the whole story though. Each chromosome is full of different genes. On the top of the Y chromosome for instance, there is a gene that functions as an on/off switch. If that switch doesn't turn on, a person with XY chromosomes will, to a large extent, present as a person with XX chromosomes. All the other genes on the X and Y chromosomes can also either not kick in or mutate, and thus create variety in how they work. These kinds of variations are usually called intersex or difference of sex development (DSD).³ In fact, few people know their genetic sex as it is rarely tested. It is estimated that 600.000 Americans have chromosome formations other than XX and XY and four million more Americans have an anatomical sex that doesn't correspond to their genetic sex.⁴

Hormones such as testosterone, oestrogen and progesterone are not sex-specific, everyone has them. The supposedly male hormone testosterone is not only produced in testes but also in healthy ovaries and adrenal glands, and by conversion from peripheral tissues.⁵ While on average men have higher testosterone levels than women, there is a lot of variation and a considerable overlap. This does not mean that women and men have the same testosterone levels. It means that on average men have higher levels of testosterone than women, but that there are some women who have really high levels of testosterone and a number of men who have low levels of testosterone, as shown in the graph below, borrowed from Sönksen 2020.⁶ Hence, women and men can have testosterone levels that are far from the average levels, and as such, focusing on levels of testosterone renders a false sense of understanding someone's body. Small quantities of testosterone can have big effect on a body, and big amounts can have small effects, as will be explained further down in this research overview.

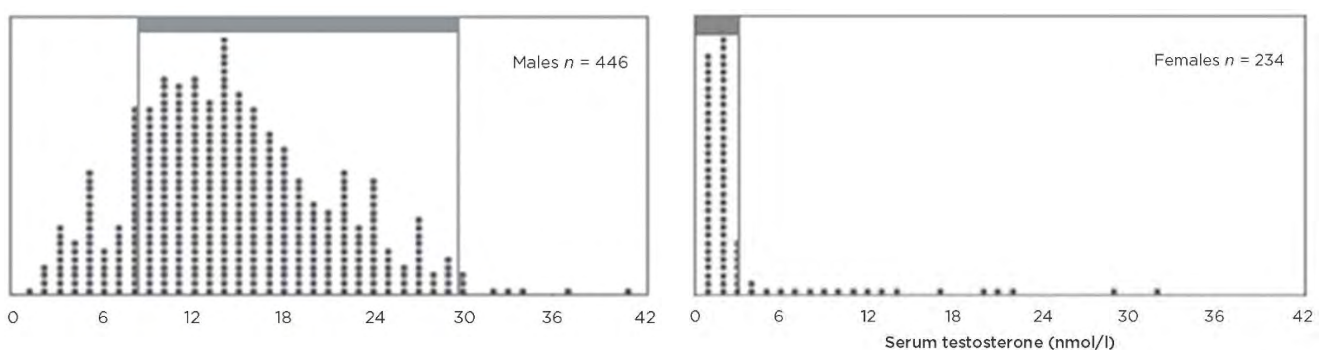


Figure. Dot plots of testosterone levels in volunteer elite athletes. ©P Sönksen

In fact, testosterone is often mislabelled, being considered 'only' a sex hormone, while in reality it is vital for many bodily functions, including the liver function and bone density.⁷ Gonads and internal reproductive organs can also vary. Women may have undescended testes and/or an absence of an uterus and ovaries, due to intersex variation and hysterectomies.⁸ External genitalia look different on every individual, and secondary sex characteristics vary enormously between individuals as well, with for instance some women having a lot of body hair and some men having almost none.

Besides this, sex and gender are interconnected and influence each other. According to gender theorist Judith Butler, even our presupposed convictions on sex are socially constructed, just like the ones on gender, as the understanding we have of our bodies is shaped by a certain kind of socialization. Butler argues that it is gender, meaning our understanding of what it means to be feminine or masculine, that creates the cultural significance of the sexed body, meaning that we consider certain bodies more feminine or masculine than others according to our cultural ideals of what a man and a woman should look like. This is why sex is gendered, it is seen and understood by our social and cultural understanding of gender. Because of this interconnection sex and gender cannot be seen as distinct from each other.⁹ Many indigenous scholars have pointed out that the very idea of a binary species, so the idea that there are only men and women, is a typical Western concept. Social identities, such as the two-spirit people in native communities in the USA and Canada¹⁰, Samoan fa'afafine,¹¹ hakawahine among Maori people in Aotearoa/New Zealand,¹² or hijras in India and Bangladesh¹³ for instance all refer to genders beyond the Western binary concept of male and female polarities.

To conclude for now, policymaking is increasingly recognized as a key practice from which sex emerges.¹⁴ It means that in order to be able to use sex as a base for policy, policymakers have to both decide what constitutes sex, out of all possible variables and combinations, thus creating a narrow definition of sex, and then disentangle it from the effects of gender by actively imposing a natural/social divide. Yet this attempted disentanglement is near impossible to realize, as no one is completely free of ideas and opinions about gender and sex.¹⁵

Ambitions NOC*NSF | TeamNL

The NOC*NSF Sports Agenda inspires and indicates our strategic long term plan, annual plans, (multi) annual budget, and the path Dutch sport wants to take in the future. It is our mission to create ideal circumstances for everyone who aspires to take part in sport and physical activities, from youth and grass roots sports to elite athletes, and from people with an impairment to volunteers and fans. It is our ambition to keep sport an essential part of the Dutch society with high sports participation numbers and excellent performances of our elite athletes.

As sport is a crucial and integral part of society, we aim to adapt the system that facilitates (elite) sport to decisive societal developments. The rising fluidity in gender differences is one of those. A practice like sport, strongly rooted in binary gender categories, faces many challenges to reformulate its current mode of existence. NOC*NSF aims to improve gender inclusion up unto the highest levels of performance. However, the Netherlands is part of a global (sports) community; different policies about gender diversity, both in- and outside sport, seem to restrain our ambition. Global differences in culture, religion and economic alignment affect the acceptance of gender fluidity as a fact. At best, we open up to a new reality facing sport, and try to maximize opportunities for all types of gender identities to perform at the highest levels. Gender should not be a variable breaking down elite sport careers, nor should it be a threshold to participate in grass roots sport. The challenge is to reconsider, and maybe even reform, sport's dominating presuppositions and features to foster gender inclusion. In doing so, we evolve sport to a future form, resilient and adaptive to upcoming societal developments.

International context

In 2022, both the International Olympic Committee (IOC), and several international sport's federations (like World Rugby and FINA), sent out frameworks and policy documents to guide the changes in gender for their international member organizations. Whereas the IOC guidelines are quite generically defined, as their objective is to encourage National Olympic Committees and international sports federations, both World Rugby and FINA came out with explicit criteria to decide if transgender female athletes should be allowed to compete in the women's elite category. This line of thought raised quite a lot of questions in the public debate, and in the Dutch sports federations more specifically. In particular the Rugby and Swimming Federation struggle with the internationally restrictive criteria, and try to find a third way to include transgender women. This Research Document aims to support and inspire this so-called 'Dutch Approach'.

2. Research Overview

Why separating men and women in sport?

Sport, and especially elite sport, was seen as something for men only far into the twentieth century. The right of women athletes to participate in elite sport was based on the assumption of biological difference between men and women, with women's bodies actively constructed as physically able, yet inferior to men's bodies. A large part of the fight to include women athletes in Olympic sport focused on the age-old assumption that rigorous physical activity is inappropriate for women and dangerous for their reproductive capabilities. Still in the late 1960s some medical professionals posited that "...sport is dangerous to the health of women . . . because of her inferior physique, [which means] a woman is not suited to intense physical activity . . . [and because] intense sporting activity

leads to the deterioration of women's reproductive organs". As late as in 1981 an IOC member and chair of the Programme Commission stated during the Olympic Congress: "We shall further encourage women's participation... provided that it is recommended from a medical point of view to do so." In sum, women athletes are seen as weaker than men and in need of protection. This protection involves, besides separating women athletes from male athletes in almost all competitions, preventing trans women and women with an intersex condition to compete with them unless they accept certain treatments, mainly to lower their testosterone levels, and other procedures which can cause irreversible harm to their health.

For instance, the 2018 IAAF regulations, as well as the 2011 ones, are based on the claim that regulation of higher natural testosterone in women is necessary to 'ensure fair and meaningful competition'. The IAAF links several claims to make this assertion. It argues that sport is divided into sex categories because 'of the significant advantages in size, strength and power enjoyed (on average) by men over women from puberty onwards, due in large part to men's much higher levels of circulating testosterone'. The IAAF claims that there is a medical and scientific consensus that female athletes with naturally high testosterone have an advantage over their peers, not unlike the advantage men typically have over women. They contend that this advantage is unfair. Whether this claim is substantiated or not, will be presented below. This position implies that the IAAF Medical Manager has an unchecked authority to investigate any women it deems suspicious. And while the regulations state that 'no athlete will be forced to undergo any assessment and/or treatment under these regulations' it also says that those who fail to comply are non-eligible for competition in the female classification. It seems that the limit between consent and coercion gets rather blurred.

In general, much of the scholarship on gender segregation seeks to explain why women and men perform different activities or develop different preferences, in the same places, for instance the division of household and caregiving labour or in educational and career choices. Generally, it is assumed that this gender segregation at home, in education, or at work is neither natural nor desirable. In the field of sport this is exactly the opposite: sport is gender-segregated, despite male and female athletes doing the same activities. While some sports activities are not gender segregated, including Olympic sports like the equestrian ones, in most Western countries sport still is one of the more explicit cases of gender segregation. And yet, the crucial assumption that sport should be gender segregated because of the average differences in athletic performances of women and men, has almost not been questioned. Even in practice, this assumption is challenged; men don't always outperform women in elite sport. And women sometimes outperform men at ultra-endurance races by several hours. The latter has been attributed to both a greater distribution of slow twitch muscle fibres, different ways of coping with fatigue and sleep deprivation, as well as the fact that the greater maximal capacities exhibited by men, aren't as important in an ultra-endurance event as in shorter ones.

What evidence-based research is there on transgender/intersex persons and athletic performance?

The first study on transgender women and sport was done by Gorean and Bunck in 2004. Their findings were that it was reasonable to let trans women compete after they had undergone one year of hormone replacement therapy. After one year of said therapy, they found that the subjects' testosterone levels had gone down below those of cisgender women (cis-women – meaning that they are assigned female at birth and identify as such as well), and the haemoglobin levels were

equal to those of cis-women. Their muscle mass had furthermore been divided by two. However, this study was not undertaken on athletes, nor did the researchers directly measure any physical component of athleticism, such as strength, speed, explosiveness, or endurance. And yet, the Stockholm Consensus enacted by IOC in 2004, allowing trans women to compete in women's sport, was largely based on this study, as it was the only study on the topic at the time.

It was not until 2015 that specific research was done, using trans women athletes (albeit not elite athletes) as subjects. Harper studied eight long-distance runner and found that seven of the eight experienced a substantial reduction in running speed upon transition. The eight-runner started to train much more seriously after transition and also lost a lot of weight, which would explain why she improved her speed after transition, compared to before. The transition made the subjects lose muscle mass and gain fat mass. Harper concluded that the study made a powerful statement in favour of letting trans women compete with cis-women. Harper then conducted another study with other scholars in 2018, acquiring performance data from several trans women athletes, a sprinter, a rower, a cyclist and three long-distance runners. They all performed at a significantly lower level after transition. A study of 46 trans women in the U.S. Air Force compared their fitness tests before and after transition, and found that 31% advantage in push up performance and 15% advantage in sit-up performance, that these trans women had over cis-women at the baseline, disappeared after 24 months of hormonal treatment. T'Sjoen et al. (2009), studied 50 individuals who made the transition from MTF ('male to female') and reported a loss of muscle mass, an increase in fat mass, and a decrease in bone mineral density. Meanwhile other studies have found limited or no loss in muscle mass (albeit without studying athletes). Thus, we should conclude that there is little relevant research been done, and that the research often referred to, is questionable and ambiguous.

A systematic review of literature about transgender people and sport by Jones et al. (2017) found that rather than trans women being a threat to the cis-women around them, it was the other way around. Many transgender people do not exercise because of the lack of inclusive and comfortable environments, as well as the restrictive policies for competition. Another major finding in the review was that the majority of transgender competitive sport policies were not evidence based. Another, more actual review was done by Canada based E-alliance. They concluded, just like the Jones review, that there is no direct or consistent research at this moment, affirming that trans women have an athletic advantage at any stage of their transition (e.g. cross-sex hormones, gender-confirming surgery) and, therefore, competitive sport policies that place restrictions on transgender people need to be considered and revised.

On testosterone

Testosterone is mostly known as the 'male' sex hormone, produced by the testes. And while it has this function it does much more. Without testosterone all humans would have problems with their liver functions, kidneys, bone density and more. So women also need testosterone and produce it in their ovaries. Both men and women also produce testosterone in their adrenal glands and by conversion from peripheral tissues. While most men (but not all) produce more testosterone than women, and some women produce more testosterone than other women, it is deceptive to focus on quantity, as it suggests that small amounts of testosterone have small effects and vice versa. However, the levels of testosterone don't predict how the human body uses them, nor how much of it is used. We have different types of receptors that the testosterone can bind to. These receptors vary in number and efficiency between individuals. Someone may have low testosterone levels but highly efficient and numerous receptors, and someone else may have high levels of testosterone but very inefficient receptors, leading to the same amount being used in both bodies. And besides, levels of testosterone in women and men overlap very often.

The effect testosterone has on the body also varies between individuals; for instance, some develop more facial and body hair than others and some develop muscles more easily than others. Testosterone can also be found all over the body; in the blood, saliva, urine, the brain, muscles, skin and the internal organs. Sometimes it connects to receptor cells, sometimes it is free-flowing and sometimes it transforms into other hormones, such as oestrogen (!) and dihydrotestosterone. Despite the fact that testosterone levels don't tell us how much of the amount the body actually uses, and how it uses it, it is still very common to want to measure testosterone levels in (female) athletes that are either transgender or suspected of having an intersex condition. But what type of testosterone should one test; the one that is bound in receptors, the free-flowing level or a combination? And in what medium? It turns out that testosterone in saliva has a different relationship with for instance fat distribution than testosterone in blood has. Timing also has an influence on the measures as levels of testosterone fluctuate during the day, during the week, during the menstrual cycle and can be influenced by a number of factors such as sleep-deprivation, sexual intercourse, competing, being single or not (single men have on average higher testosterone than married men) or partaking in the nurturing care of an infant (which lowers the levels of testosterone considerably, also in men). A single or a few measures taken on an individual are thus not likely to show an accurate global picture. Of course there are differences between sports, whether is strength or endurance that is required, but it still not a clearcut measure.

As many trans women's athletic performances and strength levels decreases to levels more common for cis-women after hormone-replacement therapy, it is considered a proof that testosterone levels are linked to performance and strength. This in turn makes a case for excluding women with very high testosterone levels from women's competitions, as this is considered as an unfair advantage. However, reality seems more complicated than this. Jordan-Young and Karkazis (2019) interviewed several clinical endocrinologists, and learned that there are signs that the body produces exactly the amount of testosterone that it needs (meaning: if it has bad receptors it needs to produce more, if the receptors are very efficient it can produce very little), thus creating an optimal level for the body in question. If this optimal level is changed by hormone replacement therapy, it would lead to malfunction. It would thus not be the lower level of testosterone in itself that made Harper's runners (see above) run slower after their transition, but the fact that their testosterone levels dramatically dropped from these runners' natural, optimal level. This also implies that the high levels of testosterone of some women, especially those with an intersex condition, would not constitute an unfair advantage, as the testosterone level itself is not what influences performance. Also, as described above, testosterone levels alone don't tell us how the body uses them. Moreover, artificially lowering testosterone levels in an individual comes with serious health risks, risks that trans women have chosen to accept. Forcing women with an intersex condition to undergo such procedures that have potentially irreversible effects on their health, to allow them to join competition, can only be considered as un-ethical, as will be discussed below in the Human Rights section.

The IAAF approach

Despite the research on testosterone, the 2011 IAAF Regulations defined endogenous (naturally occurring) testosterone in female athletes' bodies as the key factor determining their athletic abilities and compromising the 'fairness and integrity' of women's competition. The IAAF stated that while women with naturally elevated testosterone are technically not cheating, they still gain an unfair advantage from having a more masculine physiology. There have been no equivalent regulations specifying 'fair' levels of naturally occurring testosterone in men. Under the Regulations, the limit to the amount of functional endogenous testosterone in female athletes was arbitrarily defined as the start of the 'normal male range' or 10 nmol/L. Also, the 2011 Regulations did not mandate the testing of all female athletes and allowed considerable room for interpretation with respect to how a 'suspect' athlete may be identified. With time, it appears that these regulations mainly have been applied in ways, that disproportionately target women of colour from the Global South, suggesting that the geopolitics of race and nation also shape the normative, social and cultural constructions of femininity (white and Western) that are privileged in international sport. IAAF further claimed that male and female bodies have different and non-overlapping levels of testosterone once 'pathological' outliers were excluded from the analysis. The problem is that the number of 'pathological' outliers in their study of 2,127 elite athletes competing across the 2011 / 2013 IAAF World Championships, is rather high. In fact, 198 men had testosterone levels below the so-called normal male range, including four whose levels were considered to fall within the female range, and 13 women had testosterone levels were above the nominated normal limit for female athletes. This means that around 10% of the athletes studied, had a testosterone level outside what the IAAF had decided was normal. Calling such a large group 'pathological' outliers and then take them out of the study clearly influences the results.

Bermon et al. (2014) wrote that 'the lack of definitive research linking female hyperandrogenism and sporting performance is problematic' and that 'there is no clear scientific evidence proving that a high level of T is a significant determinant of performance in female sports.' Many others have stated the same thing. So why does this belief in testosterone as the determining factor in (men's) athletic success persist, in the absence of clear evidence? One reason might be the conflation of endogenous androgens with doping or exogenously altered androgens, which reflect pharmacological manipulations that affect testosterone production. This matters because exogenously altered androgens affect muscle mass and are banned to prevent cheating. But no evidence shows that endogenous androgens act on the body in the same way as exogenous androgens do, and some evidence shows that they act differently.

To legitimate their standpoint the IAAF had Bermon and Garnier (2017) conduct a study on testosterone and athletic performance. Jordan-Young and Karkazis (2019), among many others in the scientific community, criticised this study on many levels and the study finally required formal correction. Jordan-Young and Karkazis stressed that in three of the eleven running events, totalling 2127 observations in male and female athletes, cited in the Bermon and Garnier study, it was the group with the lowest testosterone levels who performed best, and there was a strong negative association between testosterone levels and 100m race time. The jury is thus still out on the question on if and how testosterone has an impact on athletic performance. Maybe there is another explanation to why some perform better than others, apart from the obvious factors like access to sport at an early age, training facilities, financial security allowing to spend time exercising and more. Perhaps some other genetic differences, which have not yet been identified, are important.

Prevalence

Intersex conditions are more common than most people think. The umbrella term intersex, also referred to as 'differences of sex development' (DSD) in medical milieus, includes more than 40 variations where approximately 1,7 % of individuals (or one in 60) are born with one. It means that the chromosome configuration, hormonal make-up, internal and / or external genitalia (combination or independently) are 'atypical' to those of 'standard' male and female anatomy. They also take shape in 'physical differences in secondary sexual characteristics such as muscle mass, hair distribution, breast development and stature'. Given this diversity, it is not surprising that intersex is a contested term, variously described in terms of 'disorders of sex development' in medical milieus, and erroneously still referred to as 'hermaphroditism' within the general public. That is, it is still pathologized and understood in relation to traditional female/male sexual binaries. During the 2011 World Athletics Championships, research on behalf of IAAF and WADA on the normative values of serum androgen levels of elite track and field athletes was conducted in order to inform the blood steroidal module of the Athlete Biological Passport for doping control. Based on these findings it was calculated that, within the elite athlete population, hyperandrogenism in relation to XY DSD was 140 times more common than in the general population. Still, as will be discussed below, we tend to only check those who do not correspond to Western, white, standards of femininity.

The number of transgender individuals who attend transgender health services has increased considerably the last few decades in many European countries. The increase in people who openly identify as transgender is at least partly explained by the increase in acceptance of transgender people within Western society. There has also been an important increase in the number of people who self-identify as transgender and do not necessarily attend transgender health services. In 2014, Kuyper and Wijzen found that 4,6 % of people who were assigned male at birth and 3,2 % who were assigned female at birth in their Dutch population sample, reported an ambivalent gender identity (equal identification with the other gender as with the gender they were assigned at birth, also referred to as being non-binary). The authors reported that 1,1 % of the people who were assigned male at birth and 0,8 % of the people who were assigned female at birth identified as transgender. It remains unknown how many of these people will seek treatment via transgender health service. Despite the importance of a constant inflow of younger generations for the future of both sport in general and elite sport in particular, there is no known research on the (expected) prevalence of trans- and non-binary identities in youth sport, talent programs and elite sport.

What is fairness, and what is an unfair advantage in sport?

Most people agree with the statement, that on average, men perform better than women in most sport ; however, no empirical research has identified the specific reason(s) why. As seen above, a number of indirect studies with cisgender people, and very few with non-cisgender persons, constitute the basis for the belief that androgenic hormones (specifically high testosterone levels) confer an advantage in competitive sports (i.e. enhance endurance, increase muscle mass). This belief has informed most sport and competition related policies that are in use today by different sport's federations. However, we have seen above that the evidence that testosterone is the key ingredient in athletic success, is scarce at its best. Testosterone is only one part of a person's physiology and there are other important factors (both biological and environmental) that should be considered if fairness (the absence of advantage) is the aim in competitive sport. For instance, having large hands is key for manipulation in some sports (e.g. swimming or basketball), but this is not seen as an unfair advantage. In elite tennis being lefthanded appears to be an advantage, but it is not seen as unfair to those who are right-handed. Being tall is an advantage in basketball. Being petite is necessary to have success in gymnastics. Establishing what an athletic advantage is in each competitive sport would facilitate the inclusion of all athletes (regardless of their gender identity) on the premise of fairness.

Fairness, trans women and women with an intersex condition

Despite the IOC framework on fairness, inclusion and non-discrimination on the basis of gender identity and sex variations, there is no standard for the protection of trans-people and intersex people from discrimination. All sports federations are deciding on their own rules and policies, leaving trans- and intersex people at the mercy of different and arbitrary policies, more often than not relying on beliefs and emotions rather than science. Some scholars try to assist and/or influence the sport's federations. For instance, Hamilton et al. (2021) propose a sliding scale for sport's federations to use when considering the inclusion of trans women. Basically, it comes down to the perceived danger trans women pose to cis-women and inclusion is recommended in sports where there is no physical contact between opponents, like for instance in rugby. And yet: "If safety was a concern, and there was evidence to select certain bodily characteristics to base safety cut-offs on, then you would see, say, shorter men excluded from competing with taller men, or lighter women from competing with heavier women, across sports." We do see weight-class separation in boxing, rowing, and wrestling, yet it's far from the norm across all sports, and isn't typically seen as a method of integrating athletes of different sexes—though it could be.

The Women's Sports Foundation, founded by tennis legend Billie Jean King, offered guidance on how girls and boys can equitably compete with and against each other: "If the skill, size and strength of any participant, female or male, compared to others playing on the team creates the potential of a hazardous environment, participation may be limited on the basis of these factors, rather than the sex of the participant." In other words, if a girl in football needs to be assessed for her size and strength for safety reasons, so should all of the boys. When the entire population is considered, there are extensive differences in performance within each sex, and considerable overlap in performance between the sexes. Among the general population there is a significant overlap between men's and women's performances. Only on the very top is there a constant difference between male and female performances. The athletic advantage transgender female individuals are perceived to have (based on indirect and ambiguous evidence) may be no greater than widely accepted physiological (e.g. large hands, being tall or short or lefthanded) and financial (e.g. training opportunities) advantages that some cisgender people possess in competitive sport.

Silvia Camporesi (2016) points out two important problems in current policies. First, is that: '... setting a limit on hyperandrogenism and singling it out from other biological variations that may confer an advantage is – at best – an inconsistent policy'. As Camporesi outlines, there are more than 200 identified genetic variations that can provide an athletic advantage in elite sport. These can '... affect a variety of functions including blood flow to muscles, muscle structure, oxygen transport, lactate turnover, and energy production', yet are not consistently considered unfair for competition by IAAF or international governing bodies in other sports. The second problem is that current policies are only applied to women's events, which follows the previously outlined assumptions about

'normal' testosterone levels in women's and men's bodies. Men competing in the male classification are both assumed and allowed to have higher levels than women. Indeed, men who have been diagnosed with low testosterone (such as being diagnosed with the intersex variation Klinefelter's syndrome) are allowed to take synthetic testosterone for health reasons in line with the World Anti-Doping Agency's (WADA) Therapeutic Use Exemptions (TUE) Guidelines which raise noteworthy contradictions. More specifically this waiver seems to suggest that it is every man's right to compete in elite sports with healthy and high levels of testosterone, while athletes in the female classification with an intersex variation, generating high levels of functional testosterone, are subjected to penalties and exclusion, if not conforming to these restrictive binary norms.

To complete this overview, today it seems that many scholars, for instance the British sport ethicist Jon Pike, see fairness as intrinsically opposite to inclusion. Nowadays, inclusion is one of the main accepted sports values, together with fairness, equality and respect. The challenge is to let these values go hand in hand, and avoid to politically oppose them to each other. The classic Olympic values of excellence, respect and friendship also imply that there should be ways to organise sport so that everyone can participate.

Human Rights

In the famous CAS-case with Dute Chand vs. IAAF, bioethicist Katrina Karkazis witnessed for Chand. Karkazis argued that 'more than half of the indicators specified in the hyperandrogenism Regulations... are "entangled with deeply subjective and stereotypical Western definitions of femininity"'. These indicators included 'deep voice, breast atrophy ... increased muscle mass, [and] body hair of male type'. Additionally, Karkazis pointed to the multitude of social factors beyond physiology that influence the athletic success of elite athletes, such as access to training facilities, superior coaching, sports psychology, sports science, nutritious food and health supplements, each of which are more widely accessible to athletes in resource-rich countries. The panel's response was to describe these claims as a '... sociological opinion, which does not equate to scientific and clinical knowledge and evidence'. It is not difficult to argue that Chand was discriminated against by the CAS and the IAAF based on her gender - which in this case didn't conform to the stereotypical definitions of femininity.

In the 2018 IAAF Regulations, one of the three criteria for a 'relevant athlete' is androgen sensitivity that produces a 'material androgenising effect', thus conveying the same concerns of the 2011 Regulations and continuing surveillance of athlete's bodies for what may be perceived as signs of high testosterone. As stated in 2012 by Jordan-Young and Karakazis, '... relying on suspicion as a basis for investigation effectively legitimizes widespread surveillance of all women athletes by instructing national federations as well as doctors, doping officials, and other official personnel to scrutinize women athletes' perceived femininity'. This can include appearance, gender expression, and sexuality. Who is understood to be 'suspicious' is tied to subjective, cultural and politically ruled expectations regarding which bodies and modes of gender expression are 'appropriate' or even valorised by adherence to traditional or normative aesthetics of femininity. As such, the 'neutral' bodily fact of higher testosterone levels is mediated through culturally-coded ideas about gender expression and gender stereotypes. The 2011 regulations included a checklist detailing the numerous signs of these effects, many of which, such as body hair, breast size, muscularity, clitoral size, and voice, are deeply entangled with subjective gender assessments. While the 2018 regulations are less explicit, it is still safe to assume that these criteria are used unofficially.

The only option for a woman with high testosterone and androgen sensitivity to continue competing in the female category is to lower her testosterone. In this instance, she will undergo one or more medically unnecessary interventions to comply with the regulation. Testosterone can be lowered surgically or pharmacologically, though the 2018 IAAF Regulations state, '... surgical anatomical changes are not required in any circumstances.' While an IAAF Expert Medical Panel will review the cases, these new regulations note that: 'It is the athlete's responsibility, in close consultation with her medical team, to decide whether or not to proceed with any assessment and/or treatment'. Thus, it is entirely possible that gonadectomy and other interventions may be performed as part of a medical plan instigated and driven by compliance with these regulations. It will be presented as an offer that the athlete in question can't refuse.

To finish this review, let's focus some more on gonadectomy. Lowering testosterone can result in side effects that diminish well-being and are of medical concern. Gonadectomy can cause irreversible harm, including 'hypogonadism, compromising bone and muscle strength and risking chronic weakness, depression, sleep disturbance, poor libido, adverse effects on lipid profile, diabetes, and fatigue'. The procedure necessitates long-term hormone replacement and may also sterilize women. The partial clitoridectomies done to some women with intersex conditions from the Global South were unnecessary, unrelated to the regulation, and are part of a treatment paradigm that has long been challenged by intersex advocates and the human rights system. When pharmacologically lowering testosterone, '...side effects can be serious for an athlete, including diuretic effects that cause excessive thirst, urination, and electrolyte imbalances; disruption of carbohydrate metabolism (such as glucose intolerance or insulin resistance); headache; fatigue; nausea; hot flushes; and liver toxicity'. Sadly, the list of women with an intersex condition who were forced to undergo these harmful procedures is rather long, especially those from the Global South. This discrimination seems to be driven by the continued dominance of patriarchal structures in leadership and policy-making roles across sporting organisations, and their influence in actively leading research projects, 'producing' data to support IAAF's political agenda of policing women's sporting classifications, particular for intersex women. High executives in these organisations are allowed to make decisions about female and intersex athletes' bodies, while framing these decisions in terms of fairness and a claim that it is in order to protect cis-women. This is reflected by the fact that the majority of high executives and medical experts at sports federations still are Western men.

Ideology and beliefs

The debate about the inclusion of transgender women and intersex persons in (elite) sport is highly polarized, and filled with more ideology, values and beliefs, than with scientifically induced facts. Myths and cultural beliefs about testosterone's effect on athletic performance are so pervasive that Karkazis and Jordan-Young (2018) call it T talk, an entanglement of discourses about testosterone as both a molecular substance and a cultural emblem of masculinity. In their 'unauthorized biography' of testosterone, Jordan-Young and Karkazis (2019) show how sweeping claims about the effects of testosterone not only obscure significant variables that affect its functioning, but also result in crafting regulations that disproportionately target intersex women from the Global South.

While there are a few scholars participating in this rather inflamed debate, promoting the exclusion of trans women and women with an intersex condition from competitive sport (not using evidence-based research but rather unscientific sources and anecdotes), there are also many

feminist scholars who want to exclude trans women from women-only spaces and activities, claiming that they are unsafe for cis-women and that they are not, and never will be 'real' women. There are several organisations and campaign working to 'protect' cis-women from trans women. The ongoing debate in the field of elite sport is used as an example to legitimize their fight. There are also many organisations and scholars working for the rights of trans women and women with an intersex condition.

To finish this overview, we should also mention that religious and otherwise conservative organisations have started campaigning for the exclusion of trans women in women's sport (and other 'women only' places). This is often done embracing Christian perspectives on biological sex and a binary ideology on gender differences. In many non-Western cultures, for instance the Middle East, the debate on gender diversity is even forbidden.

Summary

- While most people think that sex is binary, the reality is much more complicated than that. All (six) markers of sex may vary within individuals, resulting in various combinations.
- Sex and gender are intertwined, as our understanding of what sex is, coloured by socialization, and cultural and societal beliefs around it.
- The tradition of separating women and men in sports is based on the presumption that women are weak and need protection. This is mainly based on beliefs and ideology around what it means to be a man or a woman and not on scientifically validated research.
- Approximately 1,7% of the global population, or 1 in 60, have some sort of intersex condition, more often women than men. Artificially lowering testosterone levels, chemically or through surgery can have serious and irreversible side effects to a person's health. Forcing women with an intersex condition to do so in order to let them compete is unethical.
- There is little research on trans women and athletic performance. The few studies we have, state there is no reason to exclude trans women who have undergone hormone replacement therapy from competing in the women's category.
- While on average men have higher testosterone levels than women there is an overlap, and testosterone levels don't say anything about how much the body is using. Measuring testosterone levels alone is thus not very useful.
- The IOC and many international sports federations, impose strict regulations on both trans women and women with an intersex condition, to allow them to compete in the women's category. These regulations are mostly not based on evidence-based research but on what people think they know about trans women and women with high testosterone levels.
- What fairness and unfair advantage is in elite sport, is an important discussion. Being tall is an advantage in many sports, being petite in others. There are over 200 genetic variations that have been identified as having an influence on athletic performance, for instance on oxygen uptake, muscle protein and a lot of other factors. Why do we focus so much on gender, sex and testosterone, when there are so many variables?

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