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The New Policy on Hyperandrogenism in Elite Female Athletes is not about “Sex Testing”

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Abstract

In April 2011, the International Olympic Committee (IOC) and the International Association of Athletic Federations (IAAF) updated their regulations regarding female elite athletes with hyperandrogenism: Females whose testosterone levels crossed into the male range could not compete with other females unless it is shown that they are resistant to the effects of testosterone. Although the new rule is a marked improvement over past attempts to ensure that males were not trying to compete as women in elite competition, there have been several criticisms leveled against the new regulations. Here we offer our reactions to claims that the new regulation promotes a sex-verification test, claims that intersex athletes will automatically be disqualified from competition, and proposals to either divide athletes based on variables beyond sex or completely eliminate sex groupings. Although elite sports can never achieve a perfect, level playing-field, there should be parameters within which athletes must adhere for a given sport. Yet, elite athletes themselves should play a decisive role in what is best for their sport.

The relationship between elite female athletes and elite sports organizations has been a strained one. While some policies have been used to advance girls and women's athletics, other policies have been outright offensive (e.g., requiring athletes to undergo direct physical examination). Unfortunately the endeavor to make elite sports a “level playing field” has victimized many women—including the second author of this commentary (Ljungqvist et al., 2006).

Martínez-Patiño was a rising star within women's track and field, with dreams of competing in the Olympic Games. In 1985, her dreams were derailed because it was discovered that she had a Y chromosome, which disqualified her from competing with women. Even though she identified as female throughout her whole life, her sense of self was called into question because of the results of a cytogenetic test. After being subjected to intense medical and media scrutiny, it was determined that she had a condition that rendered her incapable of benefiting from the presence of the Y chromosome and she was once again reinstated in athletics. Nevertheless, her life and her athletic career were forever scarred by the incident (see Martínez-Patiño, 2005).

Consequently, it makes sense that most people who believe in equality between the sexes and the dignity of female athletes should be leery about any new policy that is released and

that is directly related to the lives of elite female athletes. Such is the case when in April 2011, both the International Olympic Committee (IOC) and the International Association of Athletic Federations (IAAF) updated their regulations regarding androgen levels among female athletes. The new regulation declared that females would be disqualified from competing against other women if their androgen levels crossed the lower limit for males.

Although established endocrinology textbooks reported the lower limit for males at 6.9 nmol/l (Strauss & Barbieri, 1999), the IAAF specified a more liberal and markedly higher threshold of 10 nmol/l (IAAF, 2011)—or over 10 standard deviations above the mean for females, making this a highly improbable threshold to cross. Although some females will cross the threshold, this will not result in an automatic disqualification, which we discuss below. Regardless, the new rule is a marked improvement over past attempts to ensure that males were not trying to compete as women in the elite competition.

This is by no means a perfect solution, and some have levied criticisms against the new policy (e.g., Dreger, 2011; Karkazis, Jordan-Young, Davis, & Camporesi, 2012). Likewise, Cooky and Dworkin (2013, this issue) raise concerns about the possible meaning and misuse of the new policy. We agree with some of the notions developed in their article including that sports can never be a truly “level playing-field” (Vilain & Sánchez, 2012) so we will not rehash those ideas in this commentary. Instead, we offer our reactions to their claims that the new regulation promotes a sex-verification test and that intersex athletes have an advantage over other athletes. In addition, we discuss proposals by other scholars to either further divide athletes based on variables beyond sex or to completely eliminate sex groupings.

The New Policy is not about Proving Sex

Although a few elite sports allow males and females to compete against each other (e.g., equestrian and race-car driving), athletics have largely been divided based on biological sex. In large part, this was a sociopolitical division created to “recognize [athletes'] specific aptitude and performance” (IAAF, 2011, p. 1). And at the international level there has been greater concern that countries may use males in female events in order to boost their medal count. Consequently, the history of elite sports has been riddled with methods to ensure that female athletes are in fact female (Ljungqvist et al., 2006).

Given this history, it seems reasonable that many would suspect that the new policy continues the problematic tradition of sex or gender verification. Yet, the new policy does not aim to confirm a person's sex or gender. Rather, the aim was to establish parameters that elite athletes must adhere to in order to compete with females. Of course finding such parameters is a difficult endeavor.

One approach taken in the past was to determine a person's sex via sex-chromosome complement and sex-specific genes (e.g., *SRY* or the Sex-Determining gene on the Y-chromosome). The assumption was that the development of *sexually dimorphic traits* or characteristics that markedly differ between men and women—many relevant to athletic performance, including height and red blood cell content—was determined by the sex-specific genotype. Yet, assessing these traits by themselves is problematic; and it is a tricky endeavor to decide if an athlete can compete with females based on genotypes that supposedly predict phenotypic traits.

First, the distribution for many sexually dimorphic traits show significant “overlap.” For instance, the average height for men (69.4 inches, $SD = 4.69$) in the United States is significantly higher than the average height for women (63.8 inches, $SD = 4.18$): $Mean_{Difference} = 5.60$ inches [$CI_{0.99} = 5.36–5.84$], Cohen's $d = 1.26$. Yet, the normal range for women (or the range for 95% of the population) is 59.3–68.2 inches, and it shows

marked overlap with the normal range for men (64.4–74.3 inches), whereby approximately 44% of women are taller than 64.4 inches (McDowell, Fryar, Ogden, & Flegal, 2008).

Second, a basic evaluation of genotypes that are known to be sexually dimorphic will not always result in an accurate determination of a person's sex. For instance, if a zygote inherits an X and a Y chromosome, it is possible that the fetus will develop as female and not as a male. In rare cases, the accidental deletion of the *SRY* gene off the Y chromosome will result in the person developing as female (Arboleda & Vilain, 2009; Sánchez & Vilain, 2010).

Third, simply because a phenotype significantly differs between groups, it may be unclear to what degree this is meaningful. For instance, women show greater gray matter concentration and more gyrification of the brain compared to men (Luders & Toga, 2010). Yet, we do not know to what degree these differences influence their abilities, if at all.

However, there is a trait that is known to influence one's athletic performance and which happens to be sexually dimorphic: Androgens. Although females produce androgens—mainly secreted by their adrenal glands—their androgen levels are markedly lower than the levels in males. Furthermore, androgens are known to influence one's athletic capabilities, especially by increasing muscular development and strength (Wood & Stanton, 2012).

Does this mean that males will always outcompete females? No. As with all abilities there is variability (cf. Sparling, O'Donnell, & Snow, 1998; Whipp & Ward, 1992). For example, Cooky and Dworkin mentioned Hermann (Dora) Ratjen, who was a man and who competed on behalf of Germany in the Women's High Jump during the 1936 Berlin Summer Games. Ratjen finished fourth with a height of 1.58 meters—just 0.02 meters from contending for a medal. Interestingly, Ratjen would have probably failed to even qualify to compete in the 1936 Olympics Games as a man, as the lowest performance of the 40 men in the Men's High Jump was 1.70 meters (Kubatko, 2012).

Thus, under the new policy, athletes may compete as female if they are women with androgen levels below the male range (IOC, 2011). If an athlete's androgen level falls within the male range, then it must be shown that she is resistant to the effects of androgen in order to compete in the female category, which has been described among women with specific conditions. We now turn to this topic.

The New Policy Does Not Aim to Disqualify Athletes with “Intersex” Conditions

There are numerous conditions under the nomenclature of “intersex” conditions, now formally known as Disorders of Sex Development (DSD; Houk et al., 2006). DSDs may be due to a variety of issues during fetal development, including atypical sex hormone levels (e.g., Congenital Adrenal Hyperplasia and Hypospadias), the presence or absence of specific genes (e.g., the *WNT4* gene, which is necessary for the Müllerian ducts [the future uterus and Fallopian tubes] to develop in females) and sex chromosome complement (e.g., Klinefelter's Syndrome [XXY] and Turner's Syndrome [XO]; Arboleda & Vilain, 2009). Most DSDs are detected at birth, though some conditions may not be discovered until adolescence or adulthood (e.g., 5 α -reductase Deficiency; Maimoun et al., 2011).

Although it is possible that a DSD will be discovered in an elite athlete under the new policy, merely having a DSD does not automatically give the athlete an “unfair advantage,” as suggested by Cooky and Dworkin. In fact, many features associated with specific DSDs may inhibit one's athletic ability, including stunting growth, muscular atrophy, heart defects,

and skeletal malformations (Arboleda & Vilain, 2009). The eight female athletes mentioned by Cooky and Dworkin who were discovered to have a Y chromosome via PCR testing during the 1996 Summer Olympics were cleared because they were found to be resistant to the effects of androgens (Buzuvis, 2010).

Some DSDs are, however, associated with elevated androgen levels in females that may benefit them. For instance, females with Congenital Adrenal Hyperplasia produce an excessive amount of androgens, which may result in virilization or “masculinization” of the external genitalia. Such women also show more stereotypically masculine interests and higher rates of same-sex attraction compared to women who do not have the condition (Hines, Brook, & Conway, 2004; Meyer-Bahlburg, Dolezal, Baker, & New, 2008). In such cases, it is possible that the athlete's performance has benefitted from the elevated testosterone that was naturally produced by her body.

Nevertheless, it is uncommon for people with DSDs to have testosterone levels that cross into the male range, including women with Congenital Adrenal Hyperplasia. Even if a female athlete did happen to have “testosterone levels three times higher than the ‘average’ woman” (Cooky & Dworkin, 2013, p. xxx, this issue)—which would equal approximately 5.25 nmol/l—such a woman would still qualify for competing with women as her levels would be well below the lower limits for males. Anything above the female threshold but below the male threshold probably provides an advantage. Yet, athletes have many slight variations compared to their reference group—often due to their genetics (e.g., greater VO₂ capacity and longer toes; Ostrander, Huson, & Ostrander, 2009)—and these variations likely give them an advantage but they are all perfectly acceptable (Murray, 2010).

Again, the IOC's new policy is not a sex-verification test. Some women will fall above and below the typical androgen range, and this does not make them any more or less female. Rather, the test is a screening test that may eventually result in the exclusion of a person from competing against female athletes if her testosterone levels are within the male range and they are not found to have a condition that prevents them from utilizing androgens. Consequently, XY women who have an androgen insensitivity syndrome and who may or may not have intact testicles will be allowed to compete with females even though they developed some characteristics that are usually present in men but not in women.

The Problem with Grouping and Lumping

Some have offered alternative solutions to the variability we see among athletes (Jordan-Young & Karkazis, 2012). One idea is to create groups for those who do not fit within the “sex binary” or who have genetic advantages. For instance, perhaps all elite athletes with a DSD should be separated out from the existing male-female divide and grouped together for competition. If elite athletes and elite sports authorities are willing to do this, then that is their prerogative. However, we do not support such a move as it could further stigmatize athletes who have a private medical condition that may not even benefit their athletic ability. We also disagree with the proposal of grouping based on genotype as no study that we know of has demonstrated that specific genes associated with enhanced athletic abilities (e.g., *ACTN3* gene, which is associated with muscle hypertrophy; Ostrander et al., 2009) are sexually dimorphic.

Another idea is to eliminate the male-female divide and to allow all athletes to compete together (Rothblatt, 1995; Travers, 2008). The idea here is that if males and females directly compete against each other from a young age, then over time females will perform as good if not better than men across most sports. The premise is that by segregating sports based on sex, stereotypes are being reinforced that posit females are not going to perform as well as males or that they are the “weaker sex” (McDonagh & Pappano, 2008). Thus, just as men

and women are expected to perform differently on cognitive test or school subjects (Halpern et al., 2007), female athletes are not going to do as well as men because of some preconceived stereotype.

Would women as a group eventually “catch up” to men in elite sports if they competed together? Perhaps. This question has been the source of intense debates within scholarly journals; however, the data thus far do not decisively support this possibility (e.g., Sparling, O'Donnell, & Snow, 1998; Thibault et al., 2010; Whipp & Ward, 1992). Women directly competing with men would be an interesting—albeit risky—social experiment that would help tear down many sexist assumptions if successful.

Conclusion

Elite sports will continue to play a major role in our society. As part of the world of sports, elite athletes have rules within which to play the sport that they are in (Gooren, 2011). And, there is some agreement that sports should be fair. However, “fair sports competition does not require that athletes be equal in every imaginable respect” (Murray, 2010, p. 13). While it is easy for scientists and scholar to debate what is right and what is wrong with sports policy, ultimately it should be the elite athletes themselves who should play a decisive role in what is best for their sport.

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