

ANALYSIS

Sex, health, and athletes

Recent policy introduced by the International Olympic Committee to regulate hyperandrogenism in female athletes could lead to unnecessary treatment and may be unethical, argue **Rebecca Jordan-Young, Peter Sönksen, and Katrina Karkazis**

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The International Olympic Committee (IOC) and international sports federations have recently introduced policies requiring medical investigation of women athletes known or suspected to have hyperandrogenism. Women who are found to have naturally high testosterone levels and tissue sensitivity are banned from competition unless they have surgical or pharmaceutical interventions to lower their testosterone levels.^{1,2} Sports authorities have argued that women with naturally high testosterone have an unfair advantage over women with lower levels, and thus the primary aim of the policies is to address this perceived advantage. However, sports bodies have also claimed that the investigations are for the medical benefit of athletes with hyperandrogenism.^{3,4,5} We consider this claim in the light of a new study of four young athletes (aged 18-21) from developing countries who had gonadectomy and “partial clitoridectomy” after being identified as hyperandrogenic under these policies.⁶ The report notes that these procedures were not required for health reasons. These interventions are invasive and irreversible, and given the potential number of female athletes affected the report prompts an important question: do the new policies undermine ethical care?

Why were policies on hyperandrogenism introduced?

The new rules were made in response to international outrage over the investigation of Caster Semenya, a South African middle distance runner, after fellow athletes questioned her sex at the 2009 Berlin world championships. After undergoing intensive medical and psychological examinations, Semenya said, “I have been subjected to unwarranted and invasive scrutiny of the most intimate and private details of my being.”⁷ Intended to improve the handling of such cases, these policies have nevertheless generated controversy.^{3,8,9,10} Most of the debate, however, has focused on questions of fairness, such as the logic of using testosterone levels as grounds for exclusion

while allowing all other natural variations among athletes that affect performance, rather than the medical justification.

How many athletes are affected?

The hyperandrogenism policies now extend beyond elite athletes (international level competitors). The IOC mandates that national Olympic committees “actively investigate any perceived deviation in sex characteristics” before registering athletes,² and at least one government, India, has already complied, creating a policy that applies to women athletes at every level.¹¹ Some international federations governing particular sports (such as track and field, rowing, and football) have adopted similar rules, and these affect athletes competing below international level.

The number of women affected will depend, in part, on the threshold for testosterone that is set. Some policies, including those of the IOC and Fédération Internationale de Football Association (FIFA), set no specific limit for testosterone,^{2,12} and those that do set a threshold use different values. For example, the International Association of Athletics Federations (IAAF) sets the threshold at 10 nmol/L,¹ whereas the Indian policy sets it at 6.9 nmol/L.¹¹ Although few women in the general population will have testosterone levels this high, elite female athletes have been shown to have significantly higher testosterone levels than either non-elite athletes (as measured by saliva¹³) or non-athletes.¹⁴ The only large scale study of testosterone in elite athletes showed that 11 of 234 (5%) of elite female athletes sampled immediately after competition had testosterone values >10 nmol/L, and 32 (14%) had a testosterone level >2.7 nmol/L, the upper limit of the normal reference range.¹⁴ Using these data, up to 14% of women athletes could be investigated for “hyperandrogenism.”

Defining and detecting hyperandrogenism

Medically, the question of when raised androgen levels become a problem is complex and is not simply answered by laboratory

measurement of testosterone or other androgens. Most cases of hyperandrogenism are linked to polycystic ovary syndrome (affecting 5-10% of women), and medical management in these and other cases is focused on dealing with patients' symptoms and identifying any underlying health risks. Although hyperandrogenism may precipitate disease in various organ systems,¹⁵ it does not invariably cause morbidity.^{16 17} Authoritative guidelines such as those of the American Association of Clinical Endocrinologists do not set specific testosterone levels that indicate disease and warrant intervention.¹⁵

By contrast, the definition and detection of hyperandrogenism in the sports setting considers only high testosterone and tissue sensitivity.^{1 2 11 12} Cases seem to be mainly identified through systematic hormonal screening as part of the "athlete biological passport" (an anti-doping programme),^{1 6} though current protocols distinguish between "doping" and endogenous testosterone. Not all international bodies have specified the full testing process, but the IAAF procedure, for example, begins with a clinical examination and an endocrine assessment to determine if there "are grounds to indicate an athlete with hyperandrogenism"; if so, a full examination and diagnostic process ensues, consisting at minimum of full physical and gynaecological examinations, endocrine assessments of blood and urine, medical and family histories, and psychological assessment.¹ The four athletes with hyperandrogenism described in the recent report also had karyotyping and genetic analysis, abdominal-pelvic magnetic resonance imaging, and radiography to determine bone mineral density and composition.⁶

The sport policies are likely to disproportionately affect women with intersex conditions in which testosterone is especially high, such as congenital adrenal hyperplasia, androgen insensitivity syndrome, and 5 α reductase deficiencies. These women may have no health complaints stemming from the androgen excess itself. Women with intersex conditions may also be investigated if they have not had genital "feminisation" surgery: doping officers observe athletes during urination, and they may report a woman perceived to have an enlarged clitoris.⁶ Thus, under these policies, women without symptoms or health complaints may have medically unnecessary intervention with long term consequences in order to continue their careers.

Pharmacologically lowering testosterone

The policies' requirement to lower testosterone regardless of the presence of symptoms raises multiple concerns. The process is not simple—it is not always possible to lower testosterone pharmacologically—and can take months. Long term maintenance of low levels may produce side effects that diminish quality of life and can be medically serious. Among a large cohort of women receiving suppressive therapies, roughly two thirds experienced important side effects.¹⁶ These 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.^{16 17 18} Liver function and blood chemistry must be carefully monitored during and after treatment because some anti-androgens have the potential to damage the liver, disrupt other necessary steroid production, and occasionally cause serious cortisol deficiency.¹⁹

Balancing side effects with efficacy in lowering testosterone can also be difficult. Medical care requires that physicians weigh patients' discomfort from symptoms and concern about metabolic indicators (such as insulin resistance and cholesterol

levels) against the presence and future risk of side effects. The sports regulatory approach, however, is to lower testosterone, irrespective of potential adverse effects. For example, clinicians and patients often prefer cyproterone acetate for managing the symptoms of hyperandrogenism because of its low side effect profile, but cyproterone acetate and other androgen blockers do not lower testosterone levels much, so they do not meet the sports bodies' mandate to "normalize androgen levels."⁴

Gonadectomy

Women with 46,XY karyotype are especially likely to be affected by the sports bodies' policies because they often have very high testosterone levels. Gonadectomy was until recently the standard care for these women because of the risk of a germ cell tumour of the gonads. However, because tumour risk varies with specific diagnoses, together with the serious health consequences of gonadectomy, a recent review in *BJU International* concluded that the tumour risk is low enough in most cases that gonadectomy is not warranted.²⁰

Gonadectomy will cause hypogonadism, compromising bone and muscle strength and risking chronic weakness, depression, sleep disturbance, poor libido, adverse effects on lipid profile, diabetes, and fatigue. It will necessitate lifetime hormonal replacement, which imposes a potential financial burden. Gonadectomy also makes women sterile and may exclude women (including those with testes) from the possibility of reproducing through new technologies.

The decision about whether, and when, to remove gonads has very high stakes, especially for young people. Notably, gonadectomy is not mentioned as a treatment option in the guidelines of the American Association of Clinical Endocrinologists.¹⁵ Nevertheless, this was the treatment used for the four athletes studied in the recent report despite the authors' acknowledgment that leaving the women's gonads in place posed "no health risk."⁶ All four have 5 α reductase deficiencies.

Do the new policies undermine ethical care?

Approaching hyperandrogenism as a sports problem raises ethical concerns about designating possibly benign physical variation as "unhealthy," resulting in potentially unnecessary medicosurgical intervention and possible neglect of the long term consequences of interventions.

The most striking and troubling illustration of these concerns is that all of the athletes in the recent report had "partial clitoridectomy."⁶ Clitoridectomy is not medically indicated, does not relate to real or perceived athletic "advantage," and is beyond the policies' mandate. Moreover, this technique is long eschewed because it has poor cosmetic outcomes and damages sexual sensation and function.²¹ Clitoral surgery should have no role in interventions undertaken for athletes' eligibility or health.

One of the least discussed aspects of these policies is how they may affect women differently depending on their ethnicity, race, class, and nationality. Poor and rural women from developing countries seem to be most affected,^{6 22} amplifying concerns about threats to autonomy and the possibility for coercion. When pharmacological intervention or gonadectomy is a precondition for eligibility to compete, an athlete has to make a profound life and health altering decision for non-medical reasons. These are not merely individual decisions: athletes are embedded in families, teams, organisations, and even nations that depend on

them to compete. Athletes can be “regarded as vulnerable to undue, even extreme situational pressures arising from the decision-making environment,”²³ especially when a competitive career is also a path to economic mobility and stability.

The lifelong burden of these interventions will sit especially heavily on poor women. Long term pharmaceutical management of testosterone levels is costly, and most drug combinations require multiple doses a day. Management of side effects and lifelong care by medical specialists add to the cost. None of the sport governing bodies indicates that they will pay for these interventions; the IAAF, for example, explicitly states that it will not pay. Finally, apart from the cost, specialist long term follow-up may be made necessary by the interventions. Such care may not be readily available in rural and remote regions.

Women athletes will continue to be identified as having high testosterone levels through universal anti-doping screening. When testosterone is high because of natural physiological variations, sports authorities should not require medical interventions to lower it. The interventions are too serious, especially given that sports officials have said, “Women with some DSDs [disorders of sex development] have no more competitive advantage than other elite athletes with favourable genetic characteristics.”²⁴ The testosterone based eligibility policies turn standard medical decision making about hyperandrogenism on its head. Rather than pegging treatment decisions to women’s overall wellbeing, symptoms, fertility goals, self image, physical functioning, and risks (if any) associated with a specific diagnosis, intervention is mandated when officials decide that naturally occurring testosterone confers unfair advantage. This seems to undermine ethical care.

Contributors and sources: RJ-Y is a sociomedical scientist with expertise in the design and interpretation of biological studies of sex differences. KK is a cultural and medical anthropologist as well as a bioethicist with 18 years of experience conducting qualitative research on intersex. PHS is a former member of the International Olympic Committee Medical Commission. He is also a fellow of the Faculty of Sports and Exercise Medicine and was recently awarded an OBE for his contribution to the fight against doping in sport. KK and RJ-Y conceived and wrote the initial manuscript; PHS reviewed and revised the manuscript and provided additional sources. RJ-Y is the guarantor.

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Key messages

New policies require women athletes known or suspected to have hyperandrogenism to lower testosterone in order to compete

The regulations' aim of lowering testosterone regardless of athletes' health, symptoms, and fertility goals conflicts with the medical approach to hyperandrogenism

Four young women athletes have had medically unnecessary gonadectomy to comply with the policies

Sports policies regulating hyperandrogenism in women athletes are not in keeping with best ethical practice