

SCOPING REVIEW PAPER

Gender Identity and Differences in Sexual Development Controversies in Women's Boxing at the 2024 Paris Olympics: A Scoping Review of Policies and Challenges

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Abstract

In boxing, the 2024 Paris Olympics attracted major debate on gender identification issues in women's events. Particularly for those with differences in sexual development (DSD), the cases underlined the difficulty of categorizing gender identity in sports. This debate emphasizes the difficulties sports officials have in managing fairness, inclusion, and human rights. Moving away from considering testosterone levels as the exclusive eligibility criterion, the International Olympic Committee (IOC) has set policies to guarantee non-discrimination and justice. In the meantime, these rules have drawn criticism for potentially compromising the credibility of women's sports.

Keywords: *gender identity, Paris Olympics, testosterone levels, sexual development, sports fairness, International Olympic Committee (IOC)*

Introduction

Determining gender identity has grown to be a critical issue in high-level international sports events reflecting the integrity, fairness, and openness of athletic competition. The world is not content with athletes fitting into only two categories: male and female. Instead, the issue has become increasingly complex and diverse, with various gender identities now aligning with the concept of sexual development differences (DSD). This new reality has made gender identification in sports a more complex and multifarious difficulty (Karkazis & Jordan-Young, 2018; Martinková et al., 2022)

Policies and laws have changed greatly as our knowledge of gender identification and its consequences for competitive sports developed. Particularly the International Olympic Committee (IOC), sports governing bodies have had to change their policies to guarantee inclusiveness while preserving fair competition (Pielke et al., 2019). Negotiating complicated biological, ethical, and societal issues in this balance has been difficult.

A divisive topic in women's sports is whether eligibility should be based on testosterone levels. Although some say it offers a clear physiological marker, others say it oversimplifies the complexity of gender and athletic performance (Bianchi, 2017; Handelsman et al., 2018). Beyond athletics, the argument covers more general society issues like gender equality, human rights, and the acceptance of non-binary identities (Yuracko, 2023). While the Paris 2024 Olympics are expected to see some progress in the inclusion of sexual minority and gender diverse athletes, challenges remain. As Mortillaro (2024) points out, the games represent 'one step forward and two steps back' for these athletes, highlighting the ongoing struggle for full acceptance and equal participation in Olympic sports (Mortillaro, 2024).

These problems were highlighted at the 2024 Paris Olympics, most shown by the boxing athletes Imane Khelif and Lin Yu-ting. Their case, which fits the variations in sexual development (DSD) instead of transgender status, generated intense worldwide debate and raised biological, legal, and ethical issues (Aguilar, 2023). This

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episode brought attention to the continuous difficulties sports teams have using inclusive and fair practices.

Policies controlling sporting events have to change as our knowledge of gender identity and its correlation with athletic performance develops. With an eye toward the controversies that surfaced during the Paris Olympics, this paper seeks to investigate the legal, scientific, and ethical underpinnings of gender identity classification in Olympic events. Examining the present situation of research, policy frameworks, and real-world instances will help us to add to the continuous conversation on how best to guarantee justice, inclusion, and respect for all athletes in competitive sports (Larsson & Auran, 2024).

Methods

With a particular focus on the 2024 Paris Olympics, this study conducted a systematic scoping review to explore the complexities surrounding gender identity issues in Olympic sports. The research process was structured as follows:

A comprehensive search was performed across multiple databases, including PubMed, Scopus, and Web of Science, using key terms such as "gender identity," "Olympic gender regulations," "testosterone levels in athletes," and "differences in sex development (DSD)." The search spanned publications from 2000 to 2024. Additional sources included official statements from sports governing bodies, peer-reviewed articles, and relevant case studies. Articles were included if they addressed gender identity issues in sports, particularly those related to Olympic policies or athlete performance. Only peer-reviewed studies and official documents in English were considered. Excluded were opinion pieces, non-peer-reviewed content, and studies unrelated to the Olympic context.

Data was extracted on policy changes, scientific findings, legal precedents, and athlete feedback. Specific cases, such as those of Imane Khelif and Lin Yu-ting at the 2024 Paris Olympics, were analyzed to provide real-world examples of challenges faced by athletes.

Official records from the International Olympic Committee (IOC) and other governing bodies were reviewed to trace the evolution of gender identity policies in sports. An interdisciplinary approach was adopted, incorporating insights from sports science, endocrinology, ethics, and law. A flowchart was created to visually represent the search strategy and selection process. It details the number of articles identified, screened, included, and excluded at each stage. This rigorous methodology enabled an up-to-date and comprehensive analysis of the multifaceted issues surrounding gender identity in Olympic sports. The findings provide a robust foundation for the conclusions and recommendations presented in this study.

Result

In competitive sports, athletes were traditionally categorized as either two basic types to guarantee fairness and integrity (Martínková et al., 2022). Nevertheless, the International Olympic Committee (IOC) established rules to ensure non-discrimination and justice, taking into account the variations in sexual development (Pigozzi et al., 2022). Over years, the IOC's perspective on gender identity in sports has changed dramatically. Originally depending on sex verification tests, which were stopped in 1999 due to their discriminating character and lack of scientific validity, the IOC turned to testosterone levels since they are a main factor influencing women's competition eligibility.

According to the 2015 IOC rules, transgender women could enter the female division provided their testosterone levels were less than 10 nmol/L for at least 12 months before competition (Jones et al., 2017). This method was attacked, meantime, for

oversimplifying the complicated relationship between testosterone and athletic performance (Bianchi, 2017).

Emphasizing that there should be no presumption of advantage due to sex variances, gender identity, or transgender status, the 2021 framework marks a dramatic shift from past regulations (Pigozzi et al., 2022). This change reflects global human rights standards and acknowledges the variety of gender identities existing outside the binary male-female classification (Yuracko, 2023).

The current IOC structure encompasses important features.

- Inclusion and non-discrimination.
- Individual sports federations determine unfair advantages to ensure fairness.

- Evidence-based approach.

- There is no assumption of advantage based on sex variations or gender identity.

- Bodily autonomy and discouragement of invasive medical testing.

This new strategy has received praise for its inclusivity, but it has also faced criticism for potentially compromising the integrity of women's sports (Hilton & Lundberg, 2021; Raden, 2023).

Gender Verification: Historical Challenges and Evolution

Over time, it became apparent that laboratory procedures for establishing an athlete's gender were insufficient. Relying on genetic testing caused various problems for athletes and authorities, as these tests occasionally classified individuals with a feminine phenotypic as having a male genotype. Androgen insensitivity syndrome is a typical example of such intersex disorders, affecting around one in every 60,000 boys. Individuals with this disorder have the 46XY genotype (normal male chromosomal composition) yet do not acquire masculine features because their cells are unable to react to testosterone. Despite having a Y chromosome, these people are phenotypically feminine, with female appearance and physiology, and are often reared as girls. The presence of the Y chromosome and testosterone confers no physical benefit (Reeser, 2005).

Historically, sex verification in sports was introduced to prevent men from competing in women's events, a concern that emerged as women began participating more actively in competitive sports. Initial methods of verification were invasive and often demeaning, including physical examinations and chromosomal testing (Rogol & Pieper, 2017; Sánchez et al., 2013). These methods aimed to identify male imposters but often resulted in the exclusion of women with differences of sex development (DSD), who naturally produce atypical levels of sex hormones (Rogol & Pieper, 2017) (Sánchez et al., 2013).

In the mid-1960s, gender verification entailed rudimentary and degrading physical tests. This technique rapidly transitioned to the identification of 'sex' chromatin using buccal smear analysis. However, due to many uncertainties associated with this method, The International Association of Athletics Federations (IAAF) finally gave it up in 1991 and the International Olympic Committee (IOC) in 2000 (Singh et al., 2010).

The IOC formally instituted gender verification for female athletes from 1968 to 1998. This policy aimed to prevent men from masquerading as women and to exclude women with "unfair, male-like" physical advantages from competing in female-only events. The initial methods included visual observation and gynecological examination, which were later replaced by laboratory-based genetic tests. These tests, however, were found to be discriminatory and caused emotional trauma for many females with intersex conditions who were screened out from competition (Elsas et al., 2000).

The concept of gender has evolved significantly over time. Initially understood as a sociological category rather than a biological

cal one, the distinction between sex and gender became more pronounced in research on intersex individuals during the 1950s and later gave rise to transsexual identities in the 1960s. This evolution enabled new categories such as transgender and transsexual identities, challenging traditional binary views of gender (Tarasevich et al., 2019).

Differences in Sexual Development (DSD) in Sports: Challenges and Controversies

Differences in Sexual Development (DSD) are a group of birth defects that cause sexual development to happen differently in the chromosomes, the gonads, or the body (Tarasevich et al., 2019). These anomalies may manifest in several forms, including ambiguous genitalia, atypical development of internal reproductive organs, or discrepancies between genetic and phenotypic sex characteristics. DSD has been a contentious issue in athletics, particularly concerning competitors with 46, XY DSD who compete in women's events. People who have XY chromosomes, which are usually linked to male development, may not be able to fully respond to androgens, or they may not have enough 5 α -reductase, which can cause female external genitalia and changes in gender identity (Handelsman et al., 2018). The presence of functional testes in these individuals may lead to testosterone levels within the male range, which has been associated with potential performance advantages in some sports (Bermon & Garnier, 2017). The International Association of Athletics Federations developed rules requiring athletes with 46,XY DSD and testosterone levels exceeding 5 nmol/L to reduce their testosterone levels to compete in certain women's events (Pielke et al., 2019; Rogol & Pieper, 2018). This verdict has sparked a debate over the balance between competitive equity and the rights of athletes with DSD.

Critics argue that these restrictions unfairly impact a specific group of athletes and may violate their human rights (Karkazis & Jordan-Young, 2018). Advocates contend that the legislation is crucial for guaranteeing fairness in women's athletics (Handelsman et al., 2018). The complexity of this issue is intensified by the inconsistent performance advantages associated with elevated testosterone levels in different sports and contests (Bermon & Garnier, 2017). The ongoing discourse over DSD in athletics highlights the challenges of categorizing athletes under a binary paradigm, considering the many biological variations across humans. It underscores the imperative for continuous research and dialogue to develop policies that harmonize competitive equity with inclusiveness and the safeguarding of human rights.

Discussion

International sports governing bodies like the IOC and IAAF have been free to apply eligibility criteria to athletes who seem to challenge traditional categories, as a way to control femininity. These rules have mainly focused on physiological advantages and are based on disputed scientific views of sex and gender. It's clear that human rights considerations have played little role in creating these rules (Patel, 2021). Crucially important in the development of male reproductive organs, secondary sexual characteristics, and muscle and bone mass control, testosterone is a steroid hormone (Alexander et al., 2024; Handelsman et al., 2018). Because of its effect on physical performance, testosterone is frequently mentioned in sports, therefore affecting traits including strength, endurance, and recuperation (Hilton & Lundberg, 2021).

Research on the link between testosterone levels and athletic ability has been somewhat thorough. Higher muscle mass, strength, and haemoglobin levels connected with elevated testosterone levels can help to improve oxygen absorption and endurance (Handelsman et al., 2018).

Particularly for female athletes with DSD, international sports

rules, including those set by the International Association of Athletics Federations (IAAF), base eligibility for these athletes on testosterone levels. Female athletes having testosterone levels above a specific threshold must reduce these levels to qualify for women's competitions, according to the IAAF (Pielke et al., 2019).

The eligibility criteria for testosterone have been the subject of extensive discussion. Critics contend that depending just on testosterone levels oversimplifies the complex interactions of elements influencing athletic performance (Bianchi, 2017). Furthermore, mandating medical procedures to change natural hormone levels raises ethical questions concerning fairness and human liberty (Sudai, 2017).

Emphasizing the need for strong scientific evidence to support such policies, the Court of Arbitration for Sport (CAS) has earlier contested such rules (Pielke et al., 2019). With several studies pointing up methodological errors in the data supporting these rules, the scientific basis for testosterone restrictions has been called into doubt (Pielke et al., 2019).

Different sports federations have responded differently since these rules were adopted. For some events, World Athletics has kept tighter rules on testosterone levels, for example; other sports have embraced more inclusive standards (Bowman-Smart et al., 2024). Prominent cases such as those involving Caster Semenya, Dutee Chand, and Imane Khelif and Lin Yu-ting have raised awareness of the complexity of gender identity in athletics. These cases emphasize the conflict between biological variations and gender identification as well as the requirement of regulations that take human rights into account together with scientific data (De Marcilla Musté, 2022).

With some expressing worries about fairness and competitive equality, the viewpoints of elite and national athletes on the inclusion of transgender athletes in sports differ (Shaw et al., 2024). These points of view are absolutely essential in helping to shape fair and inclusive policy.

Case Study: Gender Identity Controversy at the 2024 Paris Olympics

Particularly in boxing, the 2024 Paris Olympics attracted major debate on gender identification concerns in women's events. At the core of this argument were two athletes: Imane Khelif and Lin Yu-ting. Both had before been removed from global championships because of concerns about their gender identification or assertions of elevated testosterone levels (IBA, 2024). Based on the gender shown in their passports, the International Olympic Committee (IOC) let them compete in Paris, however (International Olympic Committee, 2023). As noted by Mortillaro (2024), Khelif was initially barred from competing in the 2023 Women's World Boxing Championships due to high testosterone levels, but was later cleared to participate in the Paris 2024 Olympics. This case underscores the complex and evolving nature of gender eligibility policies in sports (Mortillaro, 2024).

Emphasizing that both the athletes fit the current eligibility requirements for the women's event, the IOC vehemently defended their ability to compete. The IOC said in their statement that they were depressed about the mistreatment these athletes endured and linked it to an "arbitrary decision" the International Boxing Association (IBA) took in 2023. Given their long-standing participation in elite events, the IOC attacked the IBA's unexpected and lacking due process disqualification of the athletes from the 2023 World Championships (International Olympic Committee, 2023; Mortillaro, 2024).

These incidents brought attention to the differences between policies of various sports organizations and spurred heated debates on fairness in competition, the function of testosterone levels, and the wider consequences for gender identity in sports

(Bianchi, 2017; Handelsman et al., 2018). The dispute drew a lot of media coverage and comments from several public personalities, therefore strengthening the discussion of gender identity concerns at the Olympic Games (Cleland et al., 2022).

The IOC underlined that the present eligibility criteria, which were in effect during the Olympic qualifying events, cannot be amended mid-competition and reiterated its dedication to safeguarding the human rights of every Olympic athlete. This position fits the IOC's larger change towards a more inclusive and human rights-based attitude to gender identification in sports, as described in their 2021 framework (Pigozzi et al., 2022).

As we look towards future Olympic Games, it is clear that more work needs to be done to ensure full inclusion and fair treatment of all athletes, regardless of their gender identity or sexual characteristics. As Mortillaro (2024) suggests, the Paris 2024 Olympics represent an important opportunity for progress, but also highlight the persistent challenges facing sexual minority and gender diverse athletes in international. The paper investigates the ethical, legal, and scientific underpinnings for gender identity classification in Olympic events. It addresses the concerns about testosterone use as a regulating agent and its part in sporting performance. The argument captures more general social conversations about non-binary identities and gender equality.

As our understanding of gender identity and its relationship to athletic performance continues to evolve, it is likely that these policies will undergo further refinement and debate in the years to come (Larsson & Auran, 2024). The study emphasizes the need for sports organizations to adopt evidence-based policies grounded in principles of fairness and human rights. It highlights the ongoing challenge of balancing inclusivity with competitive integrity in international sports events.

Conclusions

Particularly in women's boxing, the debate around gender identity concerns at the 2024 Paris Olympics has brought attention to the difficult problems international sports organizations must balance justice, inclusivity, and human rights. The case of Imane Khelif and other athletes with variations in sexual development (DSD) highlights the shortcomings of present classification systems and the necessity of more complex, scientifically-based methods to gender identity in sports.

A major step towards acknowledging the variety of gender identities is the IOC change towards a more inclusive framework, therefore divorcing testosterone levels from the sole eligibility criterion. However, this strategy has also sparked a discussion about maintaining fair standards in women's sports.

Sports organizations have to modify their rules to reflect both

Conflict of Interest

The authors declare that there are no conflicts of interest.

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scientific developments and shifting society expectations as our knowledge of gender identity and its correlation to athletic performance keeps changing. Respecting the rights and dignity of every athlete is the first priority, followed by the ongoing challenge of balancing inclusivity with fair competition.

Based on this analysis, we offer the following recommendations:

- Sports companies should fund strong, long-term studies to better grasp the link between athletic performance, biological elements, and gender identification. Policies should be based on the most recent scientific data.
- Establish multidisciplinary working committees, including athletes, scientists, ethicists, and legislators, to create thorough and equitable eligibility rules.
- Athlete Well-Being: Make sure any rules or testing protocols give athletes' physical and mental health top priority, so avoid intrusive or discriminating practices.
- Establish clear, open procedures with opportunities for appeal and review to determine eligibility.
- Create instructional initiatives for sportsmen, coaches, officials, and the general public to raise knowledge of gender identity issues in their fields of work.
- Establish a mechanism for the consistent evaluation and update of gender identity policies to reflect changing scientific knowledge and society conventions.
- Investigate alternative competition models that might better suit a range of gender identities and physical attributes.
- Support Studies on Non-Binary Athletes: To ensure their inclusion in future policy discussions, it is important to support and finance studies that focus on the experiences and needs of non-binary athletes.
- Apply strong anti-discrimination laws to guard sportsmen against unfair treatment depending on their gender identity and harassment.
- Advocate inclusive language in all government correspondence and inspire media partners to follow suit.

Following these suggestions would help sports teams endeavour towards a more inclusive, equitable, and scientifically based approach to gender identification in athletics. Individual athletes will gain from this, as well as help shape the larger public conversation on gender equality and inclusiveness. We must recognize that this issue will continue to evolve in the future. Effectively addressing the complexity of gender identity in athletics will depend on ongoing communication, research, and policy improvements. Regardless of their gender identity or biological traits, the objective should be to establish an environment whereby every athlete may compete fairly and with respect.

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