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Evidence gaps in the world anti-doping agency's prohibited list: A critical analysis of scientific and policy limitations

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Abstract

Background: The World Anti-Doping Agency (WADA) prohibits substances and methods based on three criteria: performance enhancement, health risks, and violations of the "spirit of sport." However, peer-reviewed critiques highlight inconsistencies in the empirical validation of these criteria.

Objective: To evaluate gaps in the scientific evidence and policy implementation of WADA's Prohibited List using official WADA data and peer-reviewed literature.

Methods: A systematic review of WADA technical documents (2015–2023), Anti-Doping Testing Figures, and peer-reviewed studies (PubMed/Scopus) identified methodological, empirical, and ethical gaps.

Results: Key gaps include insufficient evidence for performance enhancement (only 19% of prohibited substances supported by athlete RCTs), regional disparities in testing (Africa: 0.2 tests/athlete vs. Europe: 2.1 tests/athlete), and ambiguities in transgender athlete policies.

Conclusion: WADA's framework requires urgent reforms, including evidence-based substance evaluations, equitable testing resource allocation and transparent policy development.

Keywords: Anti-doping policy; WADA Prohibited List; Performance-enhancing substances; Evidence-based medicine; Equity

1. Introduction

1.1. The Role of WADA in Global Anti-Doping Governance

The World Anti-Doping Agency (WADA) annually publishes the *Prohibited List*, which is used globally to regulate banned substances and methods. Inclusion on the list requires satisfying two of three criteria: (1) potential to enhance performance, (2) health risk, or (3) violation of the "spirit of sport". Despite the widespread application of this framework, concerns persist about the scientific robustness of these criteria and their consistent enforcement across regions.

1.2. The Evidence–Policy Divide

A 2021 WADA-commissioned review reported that 62% of substances on the *Prohibited List* lack high-quality evidence of performance enhancement in elite athletes. Meldonium, banned in 2016 after the Sharapova case, exemplifies this

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problem—it was added based on theoretical benefits despite the absence of randomised controlled trials (RCTs) in athletic populations.

2. Methods

2.1. Data Sources

The following sources were reviewed

- *WADA Publications*: Annual Prohibited Lists (2015–2023), Anti-Doping Testing Figures (2015–2021), Social Science Research Strategy (2020–2024).
- *Peer-Reviewed Literature*: PubMed and Scopus-indexed studies relating to WADA policy, performance-enhancing substances, and anti-doping enforcement.

2.2. Inclusion Criteria

Included studies and documents met the following criteria:

- Evaluation of WADA-prohibited substances or methods.
- Analysis of empirical evidence for performance enhancement or health risks.
- Examination of regional testing disparities, sanction patterns, or policy transparency.

3. Results

3.1. Methodological Gaps in Evidence Evaluation

3.1.1. Limited High-Quality RCTs

Only 19% (23/121) of substances listed have athlete-focused RCTs supporting performance-enhancing claims. For instance:

- Anabolic agents: RCTs confirm lean mass gains, but often without sport-specific performance metrics.
- Erythropoietin (EPO): Banned in 1990, yet the first elite athlete RCT was not published until 2017, showing a 6% improvement in time trial performance.

3.1.2. Overreliance on Preclinical Data

Several substances (e.g., GW501516, xenon gas) were banned based solely on preclinical rodent data, with no confirmatory human studies.

3.2. Empirical Gaps in Policy Implementation

3.2.1. Regional Testing Disparities

Significant inequalities exist:

- Africa: 0.2 tests per athlete, only one operational lab (South Africa).
- Europe: 2.1 tests per athlete, with twelve labs across the continent.

3.2.2. Transgender Athlete Policy Ambiguities

WADA's 2023 transgender guidelines set a 5 nmol/L testosterone limit but are not supported by pharmacodynamic data in athlete cohorts. Studies show muscle mass advantages persist even at lower thresholds.

3.3. Ethical Gaps: Cultural and Equity Concerns

3.3.1. Cultural Conflicts

Qualitative data indicate that the "spirit of sport" criterion may conflict with culturally normative practices (e.g., khat use among East African runners).

3.3.2. Sanction Inequities

In 2021, African athletes received, on average, 23% longer suspensions than European counterparts for comparable infractions.

3.4. Case Studies

3.4.1. Meldonium Controversy

Rationale: Banned for "evidence of use with intent to enhance performance". Subsequent Findings: A 2020 RCT of 48 cyclists found no performance benefit, though mild improvements in recovery metrics were observed.

3.4.2. Transgender Athlete Eligibility

Policy Basis: Testosterone limits aimed to ensure fairness and inclusion. Critique: Recent literature calls for individualized, sport-specific thresholds rather than uniform criteria.

4. Discussion

4.1. Aligning with Evidence-Based Medicine

WADA's framework would benefit from adopting a tiered model akin to clinical drug regulation (e.g., phased trials and expert consensus reviews). This would reduce reliance on mechanistic speculation and preclinical data.

4.2. Addressing Global Inequities

Budget redistribution toward under-resourced National Anti-Doping Organisations (NADOs) in Africa and Asia would enhance global fairness. Allocating 20% of WADA's research funds could significantly narrow current testing gaps.

4.3. Ethical Reforms

We propose the following reforms

- Independent oversight: Establish a global ethics committee to review policy implications.
- Cultural inclusion: Engage anthropologists and ethicists in the policy review process to improve contextual sensitivity.

5. Conclusion

To maintain legitimacy, WADA must bridge persistent evidence and equity gaps. Evidence-based substance evaluations, equitable policy enforcement, and culturally competent governance are vital steps toward a more credible global anti-doping system.

Compliance with ethical standards

Disclosure of conflict of interest

The author declares no conflict of interest

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