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Ugandan athletes' and coaches' experiences and perceptions on the effectiveness and legitimacy of the doping control process

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Abstract

Background Doping undermines competitive integrity and endangers athlete health, with performance-enhancing substances linked to severe adverse effects. While the World Anti-Doping Agency (WADA) provides standardized testing protocols, developing countries such as Uganda face significant enforcement challenges. This study aimed to explore Ugandan athletes' and coaches' experiences and perceptions of the doping control process, emphasizing its effectiveness and legitimacy.

Methods A mixed-methods cross-sectional study was conducted, including a survey of 346 Ugandan athletes using a modified WADA questionnaire to evaluate perceptions on test accuracy, detection likelihood, and enforcement seriousness. Additionally, 196 coaches participated in 12 focus group discussions (FGDs) across four regions of Uganda to provide deeper insights.

Results Athlete participants had a mean age of 24 years (± 6); 82% were male, and only 19% had ever been tested for doping. 56% believed doping tests were more likely during competitions compared to 39% for out-of-competition testing, with 55% confident they could evade detection. Approximately half considered anti-doping procedures fair and transparent. Only 17% felt that "NADO-Uganda" treated athletes equally, with 58% uncertain, indicating limited knowledge rather than a definitive view of unfairness. Coach participants, with a mean age of 32 years (± 14), reinforced the quantitative findings, emphasizing infrequent doping tests and persistent concerns about procedural transparency and fairness, which undermined trust and perceived legitimacy.

Conclusion There are significant gaps in doping control in Uganda, where infrequent testing and ambivalence regarding enforcement transparency diminish anti-doping measures. Strengthening Uganda's anti-doping framework requires increased testing frequency, culturally tailored education to bridge knowledge gaps, and enhanced procedural transparency and consistency. These measures are essential to establish a credible anti-doping system that supports clean sport values despite resource constraints.

Keywords Anti-Doping, Performance-Enhancing Substances, Threat Appraisal, Perceived Legitimacy, Ugandan Athletes, Coaches' Perceptions, Doping Control, Sport Integrity

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Background

Doping in sport is widely recognized as a pervasive challenge that undermines competitive integrity and poses significant risks to athlete health. The use of performance-enhancing substances (PES) has been linked to severe adverse effects, including cardiovascular, hepatic, and fertility-related complications [1, 2]. International initiatives spearheaded by the World Anti-Doping Agency (WADA) have established standardized rules and testing protocols intended to curb doping worldwide. However, while such efforts have been largely effective in high-income countries, their application in resource-constrained environments remains problematic. In many developing countries, the enforcement of anti-doping regulations is hampered by limited funding, inadequate infrastructure, and a shortage of trained personnel, resulting in sporadic and inconsistent testing practices [3].

Historical and socio-economic factors continue to complicate and cripple the implementation of robust anti-doping programs in many African states that had little involvement in shaping the World Anti-Doping Code, and as a result, they often struggle to adapt and enforce these rules within local contexts [3]. In Uganda, for instance, the anti-doping policy has traditionally been underdeveloped, and a fully-fledged national anti-doping organization (NADO) is yet to be established. This situation creates an environment in which athletes and coaches may perceive doping as a low-risk activity, even though the potential health consequences of PES use remain severe. Such gaps in both policy and practice raise important concerns about the extent of anti-doping measures in the region.

In the wake of the declaration of non-compliance of Uganda by the WADA in 2024, it has become apparent that Uganda lacks a code-compliance legal framework and policies to implement antidoping programs. A further complication then is in delivery of the effective anti-doping education, which should precede any exposure to testing. Research has demonstrated that comprehensive anti-doping education is critical for cultivating ethical behavior and ensuring compliance among athletes [4]. Yet, many athletes in Uganda possess only a superficial understanding of what constitutes doping and are often unable to accurately identify prohibited substances [5]. This knowledge gap is exacerbated by limited resources and a lack of targeted educational programs, which, in turn, undermines the credibility of anti-doping efforts and leaves athletes vulnerable to misinformation.

Moreover, the concepts of threat appraisal and perceived legitimacy are central to understanding doping behavior in any context [6, 7]. Threat appraisal encompasses an individual's assessment of the risk of being tested and the potential consequences of a positive test. Prior studies have shown that a high perceived risk of detection serves as a powerful deterrent against doping [8]. However, in environments where testing is rare or predictable, this deterrence mechanism is weakened considerably. Perceived legitimacy, which refers to the extent to which athletes and coaches view anti-doping rules and their enforcement as fair, transparent, and justified, is equally important [7]. When the system is seen as arbitrary or subject to corruption, stakeholders are less likely to abide by the regulations, thereby further undermining the integrity of sport [9].

In light of these challenges, our study was designed with the aim of exploring the perceptions of Ugandan athletes and coaches regarding anti-doping practices, with a particular focus on the constructs of threat appraisal and perceived legitimacy. Specifically, the study sought to determine how athletes assess the likelihood of being tested for doping and the severity of the associated consequences, and to evaluate the extent to which they view anti-doping enforcement as fair and transparent.

Methods

Study design

This study employed a mixed-methods, cross-sectional design integrating both quantitative and qualitative approaches. The quantitative component consisted of a survey administered to 346 professional and amateur Ugandan athletes, while the qualitative component involved focus group discussions (FGDs) with 196 coaches who had participated in regional and national competitions between 2019 and 2020.

Participants and sampling

Athlete participants, aged 18 years and above, were recruited from seven sports disciplines: athletics ($n = 53$), basketball ($n = 53$), boxing ($n = 54$), cycling ($n = 35$), football/soccer ($n = 59$), rugby ($n = 37$), and weightlifting ($n = 43$). Athletes were sampled from four geographical regions of Uganda: Northern, Western, Eastern, and Central. The coaching sample included participants from the same sports, with the following distribution: athletics ($n = 28$), basketball ($n = 28$), boxing ($n = 28$), cycling ($n = 28$), football/soccer ($n = 28$), rugby ($n = 30$), and weightlifting ($n = 28$). Using Cochran's Modified Formula for Finite Populations [10], a sample size of 346 athletes was determined based on an estimated total population of approximately 3,500 athletes in Uganda. This calculation ensured an adequate sample size to capture anticipated variability in responses, with a confidence level of 95% and a margin of error of 5% (refer to Section A of the Supplementary information document for sample size calculation details). Discrepancies in the numbers of responses for various questions are attributable to some athletes opting not to answer specific items.

Data collection tools and procedures

Questionnaire

Athletes completed a modified version of the World Anti-Doping Agency (WADA) questionnaire [6, 11], adapted for the Ugandan context. The reliability and validity of the original WADA questionnaire have been established in prior research [12]. Modifications included tailoring the wording to reflect the Ugandan setting and translating it into local languages where necessary. First, threat appraisal was measured through athletes' perceptions of the likelihood of being tested in and out of competition and their confidence in evading detection if they used banned substances. Second, perceived legitimacy was assessed through perceptions of fairness in rule enforcement, and satisfaction with anti-doping authorities. Third, athlete testing experiences were examined, including history of being tested, interactions with doping control personnel, and perceptions of procedural security and transparency. Fourth, law enforcement perceptions were evaluated to determine athletes' views on the effectiveness and seriousness of police and customs officials in preventing the trafficking of performance-enhancing substances. Lastly, athlete characteristics such as sport type, years of experience, level of competition, and Therapeutic Use Exemption (TUE) status were recorded. Responses were collected on a 5-point Likert scale and later transformed into a 3-point scale (agree, neutral, disagree) to enhance clarity during analysis. The full questionnaire is provided in the supplementary information.

Focus group discussions (FGDs)

Focus group discussions (FGDs) were conducted with 196 coaches across 12 sessions in Uganda's four [4] regions to explore key constructs and themes underlying anti-doping perceptions. Coaches were recruited as peer leaders through national sports associations. Each focus group ranged from roughly 10 to 18 participants and was held in designated venues to ensure comfortability, privacy, and conduciveness of discussion environment. The sessions were facilitated by trained moderators who employed a semi-structured interview guide with systematic probing to elicit detailed insights on critical constructs such as threat appraisal and perceived legitimacy. Specifically, discussions probed coaches' understanding of performance-enhancing substances and methods, perceptions regarding the prevalence of doping in Uganda, and opinions on the likelihood of one's athletes being caught using banned substances out-of-competition. A significant emphasis was also placed on evaluating the legitimacy of anti-doping enforcement; coaches discussed the security of "NADO-Uganda's" sample collection and testing procedures, and assessed the overall seriousness and effectiveness of the country's anti-doping authorities. The focus group process was structured to encourage open dialogue and to capture both individual and collective perspectives. All discussions were audio-recorded, transcribed verbatim, and coded using HyperResearch software (ResearchWare, USA), with peer leaders assisting with language interpretation and translation to ensure socio-cultural relevance. The detailed FGD guide is provided in the supplementary information.

Ethical considerations

Informed consent was obtained from all participants. Participants were assured of confidentiality and anonymity; no identifying information was recorded in the questionnaires. While participants were asked to share their names at the beginning of the Focus Group Discussions (FGDs) for facilitation purposes, no identifying information was recorded in the FGD transcripts or included in the final analysis for reporting. The study protocol was approved by the School of Biomedical Sciences Research Ethics Committee (Protocol #: SBS-REC-764) at Makerere University and registered with the Uganda National Council of Science and Technology (Protocol #: SS507ES). Data were stored on a password-protected computer accessible only to authorized personnel.

Data analysis

Quantitative analysis

Data from the athlete surveys were analyzed using SPSS 24.0 (IBM Corporation, New York, USA). Continuous variables (e.g., age, years of experience) were summarized using means and standard deviations, while categorical variables (e.g., sports, education levels) were summarized using frequencies and percentages. Inferential statistical tests, including chi-square tests and t-tests, were employed to explore group differences. We fitted a linear regression model using Poisson regression to determine the relationship between the specific categorical variables and whether the athlete has "ever been drug tested." Results were reported as relative risk, with statistical significance tested at 95% confidence interval. The transformation of the Likert scale responses into a 3-point scale was done to simplify data presentation and facilitate clearer interpretation.

Qualitative analysis

The FGDs were audio-recorded, transcribed verbatim, and analyzed using thematic analysis, following Braun and Clarke's (2006) framework. The transcripts were coded using HyperResearch software (ResearchWare, USA), allowing for the systematic organization of developing themes. Peer leaders who facilitated the FGDs assisted with language translation, ensuring that nuanced meanings were preserved in the transcription process. Thematic analysis identified key themes related to coaches' perceptions of doping control, the effectiveness

of current anti-doping measures, and suggested improvements. The integration of quantitative and qualitative data was achieved by comparing key themes from the FGDs with patterns observed in the survey data, allowing for a more comprehensive understanding of the study findings.

Results

Participant characteristics

A total of 346 athletes and 196 coaches participated in the study. Athletes' mean age was 24 years (± 6), and 82% were male. Coaches' mean age was 32 years (± 14), with a near-even gender distribution (51.5% male). Participants represented diverse educational backgrounds and were drawn from seven sports. National-level competition was the highest level for 39% of athletes, though only 4% had competed in the Olympics. Notably, only 19% of athletes reported ever being tested for doping, reflecting substantial gaps in enforcement (see Table 1). Discrepancies in the numbers (e.g., 346 total athletes versus 334 athletes with available sport data, etc.) are due to missing responses, as some athletes did not answer all survey items.

Table 1 Characteristics of study participants

Variable	Athlete's n (%)	Coaches' n (%)
Age(years) (mean ± SD)	24 ± 6	32 ± 14
Sex	(n = 332)	(n = 196)
Male	273(82)	101(51.5)
Female	59(18)	95(48.5)
Education level	(n = 326)	(n = 196)
Completed nursery school	6(2)	0(0)
Completed primary school	41(13)	73(37)
Completed O level	96(29)	53(27)
Completed A level	48(15)	19(10)
Some technical college	12(4)	14(7)
Some University	23(7)	9(5)
Currently enrolled in Technical college	2(1)	2(1)
Currently enrolled in University	44(13)	22(11)
Completed technical college	14(4)	0(0)
Completed University	40(12)	4(2)
Main sport	(n = 334)	(n = 196)
Basketball	53(16)	28(14)
Athletics	53(16)	28(14)
Rugby	37(11)	30(15)
Football	59(18)	26(13)
Weight lifting	43(13)	28(14)
Boxing	54(16)	28(14)
Cycling	35(11)	28(14)
Highest level of competition		
Olympics games	14(4)	
World championships	51(16)	
National competition	125(39)	
State competition	12(4)	
Regional competition	54(17)	
City/district competition	64(20)	
Competed in events for athletes with disabilities	36	-
Athletes that have ever been tested for doping	60	-
Athletes tested for doping in past year	51	-

Threat appraisal

Quantitative findings

Survey results indicated that athletes' perceptions of doping control reflect a low likelihood of being tested. Specifically, 56% of athletes believed that testing was more likely to occur during competition than out-of-competition, where only 39% thought testing was likely. Furthermore, 34% of athletes felt it was unlikely they would be tested out-of-competition, and 27% were uncertain about testing frequency (see Fig. 1). Regarding evasion of detection, 55% of athletes believed it was unlikely they would be caught if they used banned substances, while only 27% thought detection was likely.

Qualitative insights

Focus group discussions provided contextual depth to these findings. A Cycling Coach from the Central region stated, "*Testing in Ugandan competition is very rare, and cyclists have never been tested while participating in any national competitions*." Similarly, an Athletics Coach from Eastern Uganda noted that the Uganda National Anti-Doping Agency "*has done only 50% of its duties*," suggesting that limited testing reduces the perceived risk of detection. Coaches expressed that athletes mainly face testing during international competitions, reinforcing the perception that local enforcement is minimal.

Perceived legitimacy

The survey assessed athletes' perceptions regarding the legitimacy of anti-doping measures, revealing ambivalence about the overall fairness and effectiveness of enforcement. Among the 60 athletes who reported ever having been tested, only 17% perceived that NADO-Uganda treated all athletes equally, while 25% perceived unfairness. Notably, a majority – 58%- responded "Don't know," suggesting limited awareness or understanding of the broader anti-doping system rather than a definitive judgment about systemic unfairness. (Table 2). Although interpersonal interactions during testing were generally rated positively—with 68% of athletes describing testing personnel as courteous and 86% as helpful—this favorable perception of individual conduct did not extend to the broader anti-doping system. In addition, only 27% of athletes considered the security of NADO-Uganda's drug testing procedures to be very secure, while a substantial number were either uncertain or rated the procedures as less secure (Table 2).

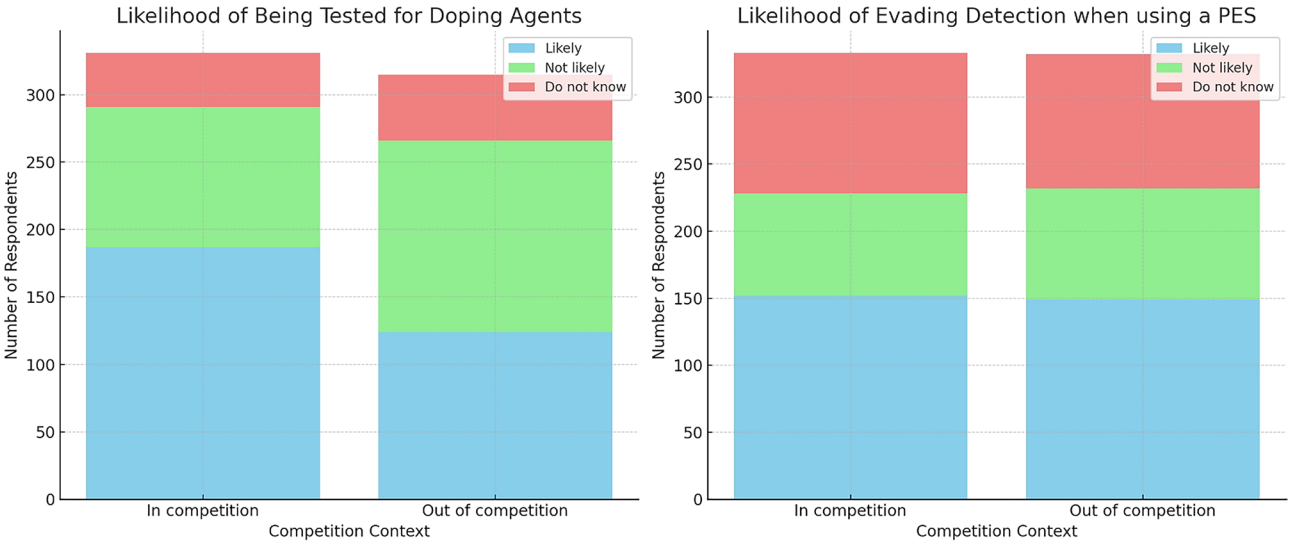

Fig. 1 Athlete perceptions of doping test likelihood and detection avoidance in competition and out of competition

Table 2 Athlete perceptions and experiences with doping control testing and NADO-Uganda procedures

Variable		Ever been tested ($n=60$)	*P*-value (X^2, or Fisher's exact)
Testing experience traumatic	No	33(58%)	0.002
	A little bit	7(12%)	
	Very much	17(30%)	
Testing personnel courteous/rude	Courteous	39(68%)	0.000
	Rude	6(11%)	
	Neither	12(21%)	
Testing personnel helpful	Helpful	42 (86%)	0.000
	Unhelpful	2(4%)	
	Neither	5(10%)	
Testing personnel sensitive	Sensitive	39(81%)	0.000
	Insensitive	4(8%)	
	Neither	5(11%)	
Fairness of "NADO-Uganda" in treating all athletes equally	Fair	10(17%)	0.016
	Unfair	15(25%)	
	Don't know	35(58%)	
Security of "NADO-Uganda" drug testing procedures	Very secure	17(27%)	0.025
	Quite secure	15(24%)	
	Not really secure	14(23%)	
	Not at all secure	1(2%)	
	Don't know	15(24%)	

Qualitative insights from coaches' focus group discussions provided further context for these findings. In one FGD with coaches from the Central region, a coach remarked, "*The Uganda National Anti-Doping Agency is not effective at all in preventing banned substances because they only focus on international competitions.*" Similarly, a Rugby Coach from the Northern region commented, "*Our anti-doping measures seem to be applied selectively, which makes it hard to trust the system.*"

Table 3 Athlete perceptions on effectiveness and seriousness of law enforcement in doping control

Variable	Response	*n* (%)	Total (*n*)
Athlete perceptions on effectiveness of police in preventing trafficking of prohibited substances	Effective	178(53)	336
	Not effective	158(47)	
Athlete perceptions on seriousness of police in preventing trafficking of prohibited substances	Serious	190(56)	337
	Not Serious	147(44)	
Athlete perceptions on effectiveness of customs officials in preventing trafficking of prohibited substances	Effective	192(62)	310
	Not effective	118(38)	
Athlete perceptions on seriousness of customs officials in preventing trafficking of prohibited substances	Serious	200(63)	316
	Not Serious	116(37)	

Coaches in the Eastern region also highlighted procedural concerns; one coach noted, "*There is no clear protocol, and sometimes I wonder if the samples are handled properly*," reflecting widespread skepticism about procedural integrity. These narratives underscore that while coaches appreciate the courtesy and professionalism of individual testing personnel, doubts about system trustworthiness, consistency in testing and enforcement in all regions persist.

Furthermore, the survey results from athletes on law enforcement support these concerns. Table 3 shows that only 53% of athletes considered the police effective in preventing the trafficking of prohibited substances, with a similar proportion (56%) regarding the seriousness of police efforts. Even more striking, only 62% of athletes regarded customs officials as effective, and just 63% believed these officials acted seriously, indicating that overall confidence in enforcement is moderate at best (Table 3). Such data suggest that the perceived legitimacy

Table 4 Athlete characteristics and their likelihood of participation in doping control testing

Ever been tested?		**Yes, *n* (%)**	**No, *n* (%)**	**RR (95% CI)**	***p*-value**
Variable	**Category**				
Sport played	Basketball	9 (18%)	41 (82%)	1.0	
	Athletes	9 (17%)	42 (83%)	1.00 (0.75–1.33)	0.990
	Rugby	16 (17%)	30 (83%)	1.00 (0.73–1.38)	0.964
	Football	14 (26%)	40 (74%)	0.95 (0.72–1.28)	0.762
	Weight lifting	10 (24%)	32 (76%)	0.97 (0.71–1.32)	0.836
	Boxing	7 (15%)	40 (85%)	1.02 (0.76–1.36)	0.910
	Cycling	5 (15%)	28 (85%)	1.02 (0.73–1.40)	0.925
Competed in Para sport	Yes	12 (38%)	20 (62%)	1.0	
	No	49 (17%)	233 (83%)	1.12(0.84–1.49)	0.422
Years completed in the main sport	Less than 1 year	4 (12%)	30 (88%)	1.0	
	1 or 2 years	11 (22%)	38 (78%)	0.94 (0.68–1.30)	0.723
	More than 2 but less than 5 years	8 (14%)	51 (86%)	0.99 (0.73–1.35)	0.951
	5 or more years	38 (23%)	129 (77%)	0.94 (0.72–1.23)	0.663
Highest level of competition	Olympics games	5 (36%)	9 (64%)	1.0	
	World championship events	18 (37%)	31 (63%)	0.99(0.63–1.58)	0.979
	National competition	21 (18%)	96 (82%)	1.11(0.72–1.70)	0.640
	State competition	3 (27%)	8 (73%)	1.05(0.57–1.93)	0.872
	Regional competition	9 (17%)	44 (83%)	1.11(0.71–1.76)	0.642
	City/district competition	4 (7%)	53 (93%)	1.17(0.75–1.84)	0.483
Therapeutic Use Exemption (TUE)	Yes – I still have TUE	5 (38%)	8 (62%)	1.0	
	Yes – no longer have TUE	4 (21%)	15 (79%)	1.11(0.64–1.91)	0.712
	No	50 (19%)	219 (81%)	1.12(0.73–1.74)	0.603

of anti-doping enforcement in Uganda is undermined by inconsistent and selective application of rules, which may be compounded by issues of corruption and inadequate oversight, as highlighted by several coaches during the FGDs.

Athlete characteristics and likelihood of doping control testing

Beyond the core constructs of threat appraisal and perceived legitimacy, our additional analyses examined whether athlete characteristics influenced the likelihood of undergoing doping control testing. As illustrated in Table 4, there were no statistically significant associations between the probability of being tested and various characteristics such as type of sport, years of experience, or Therapeutic Use Exemption (TUE) status. For example, only 18% of basketball athletes, 17% of rugby athletes, and 15% of cyclists reported having been tested, with all sport-specific comparisons yielding p-values greater than 0.7. Similarly, while athletes with five or more years of experience had a slightly higher testing rate (23%) compared to those with less than one year (12%), this difference was not statistically significant ($p > 0.6$).

These quantitative findings suggest that the issue of limited testing is universal across all segments of Ugandan sports, regardless of discipline or level of competitive exposure. Coaches' qualitative feedback further underscores this systemic problem. In one focus group discussion, an athletics coach from the Central region commented, "*So far our athletes have had a history of no traces of doping cases and it's rare for the doping agencies to take the tests. It's impossible to know if the player will be caught.*" Likewise, during a discussion with Rugby coaches, a participant explained, "*The status of testing in Uganda is so low that even if athletes dope, they rarely face any scrutiny because testing is not prioritized at the local level.*" These direct quotes reinforce the survey data, indicating that inadequate and irregular testing is a consistent challenge across various sports and regions in Uganda.

Discussion

This study explored athletes' and coaches' perceptions of doping control measures in Uganda—a developing country where limited resources and enforcement capacity create unique challenges for anti-doping efforts. Grounded in the Sport Drug Control Model (SDCM) [6], our investigation focused on two core constructs: Threat Appraisal (the perceived likelihood of being tested and the consequences of a positive test) and Perceived Legitimacy (the fairness, transparency, and effectiveness of anti-doping measures).

Threat appraisal: perceptions and implications

Our study reveals that the perceived low frequency of doping tests significantly impacts athletes' assessment of risk related to doping behavior. According to the SDCM, athletes' decision-making regarding doping is largely

influenced by their perceived likelihood of detection and anticipated severity of sanctions [13]. Although athletes recognized the severity of penalties theoretically, the perceived low likelihood of testing reduces the practical deterrent effect, thereby creating a favorable risk-to-reward scenario that inadvertently encourages doping. Similar observations have been made in other resource-constrained environments, such as Kenya and Nigeria, where sporadic testing diminishes the perceived risk and thus undermines compliance [14–17].

In environments where athletes rarely witness or experience doping controls, the abstract notion of severe consequences becomes insufficiently compelling [18]. Athletes are likely to discount future punitive outcomes in favor of immediate performance gains, particularly if they believe doping enhances their competitive prospects without substantial detection risks [19, 20]. Therefore, increasing the visibility, frequency, and unpredictability of anti-doping tests is vital for altering this risk assessment, enhancing perceived detection probability, and improving compliance.

Perceived legitimacy: insight and interpretation

Athletes' perceptions of legitimacy in anti-doping systems extend beyond mere procedural interactions to include broader institutional and sociocultural dynamics. Despite generally positive individual experiences with doping control personnel reported by some athletes in the current study, broader concerns about procedural transparency, consistency, and fairness were prominent. Such skepticism is not unique to Uganda and reflects systemic challenges observed across other African contexts, where anti-doping frameworks are often perceived as externally imposed, inadequately localized, and disconnected from athletes' lived realities [14].

Historical and sociocultural factors further shape these perceptions. In many African countries, including Uganda, anti-doping regulations have often been influenced by international mandates with limited contextual adaptation, leading to perceptions of alienation and external control [15]. This perception is exacerbated when athletes are not sufficiently educated about the rationale behind anti-doping policies or how these systems operate within their national context [16]. In the Ugandan setting, the issue may be less about outright perceptions of unfairness and more about insufficient anti-doping education and awareness of the institutional mandate and procedures of the national anti-doping organization. Many athletes may lack the information needed to assess whether enforcement is fair, secure, or effective, leading to ambivalence or mistrust by default rather than informed critique.

Moreover, perceived institutional barriers such as inconsistent application of testing protocols, concerns about sample handling, and limited procedural transparency as reported by athletes and coaches in our study reinforced doubts about the integrity of the system. These challenges are compounded when athletes do not see themselves represented in the governance or implementation of anti-doping programs. Therefore, fostering legitimacy in Uganda will require more than improving procedural compliance, necessitating a deliberate strategy to strengthen education, promote transparency, and cultivate a sense of shared ownership through the active involvement of local stakeholders in the design and delivery of anti-doping efforts. Only then can trust in the system be meaningfully established and sustained.

Integration of threat appraisal and legitimacy

The dual findings on Threat Appraisal and Perceived Legitimacy highlight a critical interplay: while athletes acknowledge the severe consequences of doping, the low perceived likelihood of testing, coupled with doubts about the fairness and effectiveness of enforcement, weakens the overall deterrent effect. Our FGDs illustrate that athletes and coaches are aware of the potential sanctions, yet the inconsistent application of testing regimes diminishes their motivation to comply. For instance, a Cycling Coach mentioned that athletes may only be scrutinized when competing internationally, creating a loophole at the national level. This pattern mirrors findings from other regions where inconsistent enforcement has led to a trust deficit in anti-doping institutions [9].

The mixed-methods design of our study allowed for a deeper exploration of these phenomena. Quantitative results provided a broad overview of perceptions, while the qualitative data enriched our understanding by revealing underlying beliefs and contextual factors. Participants frequently discussed the cultural and historical dimensions influencing their perceptions, noting that anti-doping efforts in Uganda are often seen as externally imposed, with little local ownership. This historical context is critical; many African nations have inherited anti-doping frameworks developed in the West, leading to skepticism about their relevance and fairness in local contexts [3].

Implications for policy and anti-doping education

Given the findings, several policy implications emerge for strengthening anti-doping efforts in Uganda:

1. **Increase Testing Frequency and Visibility**: To enhance deterrence, it is imperative to expand both in-competition and out-of-competition testing. Randomized and intelligence-led testing approaches could improve the perceived likelihood of detection, thereby reinforcing compliance. Since the enactment of the Uganda Sports Act (2024), the establishment

of an independent NADO in Uganda and the allocation of resources to fulfil its mandate are highly anticipated and should help increase testing frequency at regional and national sporting events.

2. **Enhance Comprehensive Anti-Doping Education**: There is a clear need for culturally tailored anti-doping education programs that address not only the health risks of doping but also the ethical and procedural rationale behind anti-doping measures. Integrating these programs into school curricula and national sports federations, as well as using diverse media channels, could foster a deeper understanding and greater trust among athletes [21].
3. **Improve Transparency and Fairness in Enforcement**: Once established, it is imperative that the NADO in Uganda work towards consistent and transparent enforcement. Adoption of the relevant International Standards currently in force and independent monitoring mechanisms could further strengthen the perceived legitimacy of anti-doping measures in Uganda [9].
4. **Foster Local Ownership and Stakeholder Engagement**: Engaging athletes, coaches, and support personnel in the formulation and oversight of anti-doping policies will help build local ownership. Creating athlete committees or ambassador programs can ensure that policies are reflective of local realities and are more widely accepted. Additionally, regional collaborations with neighboring countries could share best practices and resources to improve overall enforcement [3].

Limitations and future research directions

Despite its contributions, this study has several limitations. First, discrepancies in survey responses – with some athletes opting not to answer certain items – may affect the representativeness of the findings. Such discrepancies, however, reflect genuine differences in participant willingness and understanding. Second, the cross-sectional design limits our ability to infer causality between threat appraisal, legitimacy perceptions, and compliance behaviors. Third, our adapted measures for threat appraisal and legitimacy, while based on established instruments, have not been fully validated within the Ugandan context. Cultural factors unique to Uganda may influence responses differently than in Western contexts. Additionally, our focus groups were conducted among a select group of coaches, and their views may not represent those of all stakeholders, including athletes or sports administrators. Future research should employ longitudinal designs to track changes in perceptions over time, include a broader range of stakeholders (such as officials from the Ministry of Education and Sports, National Sports Federations and the Uganda Olympic Committee), and further refine measurement instruments to ensure cultural validity. Triangulating self-reported data with official doping control records may also yield more accurate estimates of doping behavior.

Conclusion

In conclusion, our study reveals that Ugandan athletes and coaches exhibit a complex interplay between high threat appraisal and mixed perceptions of the legitimacy of anti-doping measures. Although athletes recognize the severe consequences of doping, the low perceived likelihood of testing – combined with doubts about the fairness and effectiveness of enforcement – undermines the overall deterrent effect. Addressing these issues requires an integrated approach that increases testing frequency, enhances anti-doping education, improves enforcement transparency, and fosters local ownership of anti-doping policies. Such measures are crucial for building a robust, credible anti-doping framework in Uganda, ultimately ensuring that clean sport values prevail even in resource-constrained environments.

Abbreviations

PES	Performance–Enhancing Substances
WADA	World Anti–Doping Agency
FGDs	Focus Group Discussions
NADO	Uganda–National Anti–Doping Organization–Uganda
TUE	Therapeutic Use Exemption
SDCM	Sport Drug Control Model

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s13102-025-01206-2.

Supplementary Material 1

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Author contributions

H.M. contributed to the conception and design of the study, acquisition of data, analysis, and interpretation of data, and drafting and critical revision of the manuscript. S.L. contributed to the conception and design of the study, acquisition of data, and critical revision of the manuscript. R.Z. contributed to the conception and design of the study, acquisition of data, and critical revision of the manuscript. R.M. contributed to critical revision of the manuscript. H.K. contributed to the acquisition of data and critical revision of the manuscript. G.K. contributed to drafting and critical revision of the manuscript. N.J.N. contributed to the interpretation of data and critical revision of the manuscript. M.B. contributed to data analysis and critical revision of the manuscript. T.M. contributed to the conception and design of the study, acquisition of data, analysis, interpretation of data, and critical revision of the manuscript. All authors have read and approved the final manuscript.

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Data availability
The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request. However, due to the sensitive nature of the data and the need to protect the confidentiality of the study participants, access to the data will be granted only after a data sharing agreement has been signed by both parties. Additionally, data access and sharing will be governed by the Uganda National Council of Science and Technology (UNCST) data protection guidelines.

Declarations

Ethics approval and consent to participate
The study protocol was approved by the School of Biomedical Sciences Research Ethics Committee (approval number: SBSREC-765) at Makerere University, Kampala, Uganda, and registered with the Uganda National Council of Science and Technology (registration number: SS507ES). The study was conducted in accordance with the principles of the Declaration of Helsinki. All participants provided written informed consent prior to participation and were assured of the confidentiality and anonymity of their responses. Participation in the study was voluntary, and participants were free to withdraw from the study at any time without penalty.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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