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A national anti-doping education programme reduces doping susceptibility in British athletes

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ABSTRACT

The World Anti-Doping Agency's International Standard for Education instructs that national and international sport organisations evaluate their education programmes. We addressed this directive by examining the effectiveness of a national anti-doping programme. Athletes (N = 302, 41% female) completed measures of doping susceptibility, intention to use dietary supplements, Spirit of Sport and moral values, anti-doping knowledge and practice, and whistleblowing, prior-to and three-months after attending an anti-doping education programme. At three-month follow-up, athletes reported decreased doping susceptibility and intention to use dietary supplements coupled with increased importance of values, anti-doping knowledge, anti-doping practice and whistleblowing. Within-participant, moderated-mediation analyses revealed that programme-related changes in doping susceptibility were indirectly related to changes in intention to use dietary supplements, and, that this indirect relationship was moderated by moral values. These findings confirm the effectiveness of a national anti-doping education programme and highlight the contribution of dietary supplement use and personal values to changes in doping susceptibility.

1. Introduction

Athletes using prohibited performance-enhancing substances (i.e., doping) are at increased risk of acute and chronic disease (Birzniece et al., 2011; La Gerche & Brosnan, 2017), and being banned from competition. Globally, sport organisations deliver anti-doping education programmes to athletes to prevent intentional and unintentional doping and help athletes make a more informed decision about using prohibited substances. The World Anti-Doping Agency (WADA) seeks to standardise anti-doping education programmes to over 700 international and national sport organisations (WADA, 2022). WADA requires organisations to develop and deliver programmes that: raise awareness of anti-doping rules and regulations; provide accurate information about anti-doping procedures; develop personal values and principles; and build an athlete's competency to follow anti-doping rules. However, while anti-doping education programmes are delivered globally (Gatterer et al., 2020; Gatterer et al., 2021; Hoberman, 2013), there is a paucity of evidence examining their effect on athletes' doping susceptibility over time and if they are effective in achieving their goals. Indeed, an international Delphi study (Boardley et al., 2020) highlighted understanding of the long-term effectiveness of anti-doping education programmes as the highest research priority.

1.1. Anti-doping education

In 2021, WADA published the International Standard for Education (WADA, 2020), requiring that international and national organisations need to plan, implement, monitor and deliver anti-doping education programmes, with the ultimate aim to prevent doping. While the most accepted definition of doping is the use of a prohibited substance, WADA's definition is much broader. Specifically, WADA defines doping as the occurrence of one or more of 11 anti-doping rule violations, such as refusing to provide a urine sample, trafficking, and discouraging another person against reporting doping (WADC, 2021). As a result, anti-doping education programmes are multifaceted and include information that aims to prevent athletes from violating anti-doping rules and help them make a more informed decision about using prohibited substances.

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One of the main objectives of anti-doping education is to deter an athlete from intentionally using a prohibited substance. That is, education aims to discourage athletes from knowingly using a prohibited substance to facilitate their performance. To help achieve this, athletes are informed that doping is against the rules and that anyone found to have doped can be banned from competing. Athletes are educated about the health (e.g., cardiovascular disease), social (e.g., being classified as a cheat) and economic (e.g., loss of sponsorship) consequences of using a prohibited substance (Bloodworth & McNamee, 2010; Hallward & Duncan, 2019; Masucci et al., 2019), and this information in turn, is anticipated to reduce their susceptibly to dope.

While athletes may dope intentionally to benefit their performance, they can unintentionally violate anti-doping rules (Chan et al., 2017; Chan et al., 2018; Hurst et al., 2019). A fundamental tenant of the World Anti-Doping Code is the principle of strict liability, whereby an athlete can fall foul of an anti-doping rule violation without demonstrating intent, fault, negligence or knowing use (WADC, 2021). Such examples include using a prescribed medication on the prohibited list, being unaware of the anti-doping rules, or using a dietary supplement (e.g., protein shake, creatine, caffeine) that is contaminated by a prohibited substance. In the event that an athlete needs to use a medication that is on the Prohibited List, they can obtain a therapeutic use exemption (TUE) in line with the International Standard for Therapeutic Use Exemptions (WADA, 2021a). Anti-doping education programmes therefore encourage athletes to engage in anti-doping practices, such as being proactive in checking the prohibited status of medications, checking whether a dietary supplement has been batch-tested for prohibited substances, and informing them of how to apply for a TUE.

Given that doping is against the rules of sport, thereby violating fair play, it is vital to consider athletes' personal morality in their decision to dope. Morality concerns what is right and wrong. It plays a prominent role in WADA's anti-doping policy and education programmes, and is embodied in its Spirit of Sport construct (WADC, 2021). WADA's Spirit of Sport includes 11 values that are considered core principles of what is intrinsically valuable about sport, such as health, respect for the rules, ethics, honesty and fair play, and hard work. Athletes who place greater importance on the Spirit of Sport values are less likely to dope than those who consider these values less important (Hurst et al., 2022; Mortimer et al., 2021; Ring et al., 2020). Further, as instructed by the International Standard for Education, anti-doping organisations, such as Anti-Doping Agency of Kenya, Comisión Nacional Antidopaje Argentina, and UK Anti-doping, need to implement "values-based education" in their programmes to ensure that athletes recognise the importance of the Spirit of Sport and the ethical foundations underpinning their decisions about doping (WADA, 2020).

Finally, anti-doping programmes aim to educate athletes about the importance of whistleblowing. In the last decade, several high-profile doping cases, such as Lance Armstrong, the Bay Area Laboratory Co-operative (BALCO), and Russia's state-sponsored doping programme, were uncovered by witnesses or users disclosing information about suspected doping. Accordingly, anti-doping organisations have established phonelines and websites to enable the reporting of suspected violation of anti-doping rules by athletes and athlete support personnel (Erickson et al., 2017; Erickson et al., 2019). Anti-doping education is therefore aimed at increasing athletes' understanding and willingness to whistleblow.

1.2. Evidence of anti-doping programmes effectiveness

Anti-doping education programmes have been delivered globally for decades (Hoberman, 2013; Woolf, 2020). While a number of researchers have examined the efficacy of bespoke anti-doping educational programmes (Elbe & Brand, 2016; Elliot et al., 2008; Goldberg et al., 2000; James et al., 2010; Kavussanu et al., 2021; Kavussanu et al., 2022; Nicholls et al., 2020; Ntoumanis et al., 2020; Sagoe et al., 2016), three studies have examined whether programmes implemented by international and national sport organisations are effective in preventing doping.

In a sample of 213 German elite student-athletes, Wippert and Fliesser (2016) examined whether the National Doping Prevention Plan, delivered by German Sports Organisations (e.g., The German National Anti-Doping Agency, German Olympic Sports Federation and Federal Ministry of the Interior and Community), increased knowledge about doping (e.g., prohibited substance use, information about anti-doping). Compared to student-athletes who did not attend the programme, athletes who attended sessions over the course of their school semester reported greater scores in doping knowledge. Similarly, Hurst et al. (2020) examined whether UK Athletics' anti-doping "Clean Sport" programme was effective in reducing intentional and unintentional doping in a sample of junior elite track and field athletes (N = 202). This programme involved a single, 60-min session, where athletes were informed about the WADC, anti-doping rule violations, the drug testing procedure, how to check medications, and the risks of sport supplements. Three months following the programme, authors reported that athletes were more knowledgeable about anti-doping rules and were less likely to use dietary supplements. However, while doping likelihood decreased immediately upon completion of the programme, it returned to pre-programme at follow-up. García-Martí et al. (2022) examined the effectiveness of the Spanish Anti-Doping Commission (CELAD) programme on 145 sport science students' knowledge of prohibited substances and moral judgement. The programme consisted of 27 h (2 h in person, 25 h online) educational material that aimed to help participants understand the anti-doping rules and regulations, psychological risks of doping, and how to resist doping. Authors found that participants knowledge of doping substances improved and reported that doping was morally wrong four months after attending it.

Given the above, partial evidence exists for the effectiveness of national anti-doping programmes improving knowledge of doping and the anti-doping rules, reducing the intention to use dietary supplements, and increasing morality. However, few studies have examined their effectiveness in reducing the susceptibility to dope. Further, as anti-doping programmes are multi-faceted and target, for example, anti-doping practices and whistleblowing, it is important to understand the impact they have on several variables related to WADA's aim of preventing doping (both intentional and unintentional) and increasing anti-doping practices. As a result, the current evidence base is limited in terms of understanding the effectiveness of anti-doping programmes implemented by sport organisations.

1.3. Mechanisms of anti-doping programmes

Of the few studies examining the effectiveness of anti-doping education programmes, none have sought to understand reasons underlying changes in doping-related variables, such as anti-doping knowledge or doping susceptibility. Several psychosocial variables are related to the susceptibility to dope (Ntoumanis et al., 2014), with one of the strongest being the intention to use dietary supplements, such as caffeine, creatine and sodium bicardbonate (Backhouse et al., 2013; Hurst et al., 2022; Hurst et al., 2023). Some have argued that dietary supplement users become comfortable using chemically-active substances and, in turn, progress to using prohibited performance-enhancing substances to gain additional performance benefits (Hurst, 2023; Hurst et al., 2017b; Petróczi, 2013). Use of dietary supplements is related to doping use (Backhouse et al., 2013; Barkoukis et al., 2020; Hurst et al., 2021b), via beliefs that supplements are necessary for performance (Hurst et al., 2019; Hurst et al., 2021b; Hurst et al., 2022). This suggests that if athletes are less likely to use dietary supplements, they should be less susceptible to dope in the future. However, no study has considered whether changes in dietary supplement use are related to changes in doping susceptibility.

Recent research has suggested that moral values play an important role in the relationship between supplement use and doping.

Specifically, Hurst et al. (2022) found that dietary supplement users, who believe supplements are necessary for performance, reported a higher likelihood to dope, but only if their moral values are not strong. Based on this evidence, athletes who are less likely to use dietary supplements and have strong moral values should be less susceptible to dope. However, evidence to support this conjecture is based on cross-sectional data, and, as such, it is unknown whether changes in intentions to use dietary supplements are related to changes in susceptibility to dope, and, whether this relationship is moderated by moral values.

1.4. Present research

International and national organisations worldwide implement anti-doping education programmes to prevent athletes committing anti-doping rule violations. These multifaceted programmes aim to prevent intentional and unintentional doping and encourage an athlete to engage with anti-doping practices, such as reporting doping and checking whether a dietary supplement has been batch tested. However, evidence to support their effectiveness is limited, and it is unknown what may influence changes in doping susceptibility. Given this context, the aims of our study were twofold. First, we examined the effect of attending an anti-doping education programme on athletes': 1) susceptibility to dope; 2) intention to use dietary supplements; 3) importance placed on Spirit of Sport and moral values; 4) knowledge of anti-doping; 5) engagement with anti-doping practices; and 6) whistleblowing behaviours. Second, we explored what doping-related variables may explain changes in doping susceptibility following the national anti-doping programme.

2. Method

2.1. Study design

We used a pragmatic, within-participant, pre/post-test design to examine changes in outcomes assessed immediately prior to an anti-doping education programme (pre) and three months later (post). A pragmatic, pre-post-test design was deemed most appropriate given that this programme is being implemented across the United Kingdom, whereby athletes are asked to attend these sessions on an annual basis. This type of design also helps maximise applicability and generalisability of findings (Patsopoulos, 2022), which can better inform sport organisations understanding of their education programmes. As previous research reported changes following an anti-doping programme return to baseline after 3-months (Hurst et al., 2020), we therefore assessed post outcomes 3-months later.

2.2. Participants

Athletes attending the UK Anti-Doping Clean Sport education programme across three locations in England (i.e., East Midlands, Northwest, and Southeast) were invited to participate in the study. Convenience sampling was used. Eligibility criteria stipulated that participants needed to be 16 years or older, intended to compete in the forthcoming season, and registered to a sport signatory to the World Anti-Doping Agency (WADA, 2022). G*Power v3.1 (Faul et al., 2009), with an α priori Multivariate Analysis of Variance (MANOVA) repeated measures statistical test, effect size of $d = 0.2$, power at .95 and $\alpha = 0.05$, indicated a minimum sample size of 165 was required to achieve the desired effect size.

2.3. Anti-doping education programme

The anti-doping education programme comprised a single 60-min session. The programme was delivered in a classroom setting by one of three facilitators. The facilitators were male (n = 2) and female (n = 1), each with over five years' experience of delivering anti-doping education programmes to athletes, and whom themselves had competed as an athlete (athletics, n = 2; rugby union, n = 1).

The programme content was in line with WADA's International Standard for Education (WADA, 2020). A description of the programme is given in Table 1. Briefly, the programme began with an introduction to the World Anti-Doping Code and the Spirit of Sport values. The 11 anti-doping rule violations and the Prohibited List were explained before highlighting the consequences (e.g., physical, economic, and social) of doping. Participants were then provided with an overview of the doping control testing procedures and their rights and responsibilities under the World Anti-Doping Code. The requirements of the whereabouts system, use of the Anti-Doping Administration Management System (ADAMS), and Strict Liability principle were explained. Afterwards, participants were informed how to check the prohibited status of medications and the Therapeutic Use Exemption process, before highlighting the risks of using dietary supplements that could be contaminated with prohibited substances. Finally, the session concluded with an overview of whistleblowing and how athletes could report and share information about suspected doping with UKAD and WADA. Where possible, the facilitator would encourage questions from athletes in attendance, group discussions and role playing.

2.4. Measures

Demographics. Participants were asked to indicate their age, gender, nationality, and sport. To help more accurately classify the athletic ability of the sample, we used the methods reported by Swann et al. (2015) and asked participants to indicate their highest level of competition (e.g., semi-professional, national, top tier in professional league), how long they had competed at this level, the greatest success they had in their sport (e.g., league level, international placing) and nationality.

Doping susceptibility. The doping susceptibility measure (Gucciardi et al., 2010) was used to measure susceptibility to doping. Participants read the statement "If you were offered a banned performance-enhancing substance under medical supervision at low or no financial cost and the banned substance could make a significant difference to your performance and was currently not detectable, how much consideration would you give to this offer?" They responded on a 7-point Likert-type scale, anchored by 1 (none at all) to 7 (a lot of consideration), with higher scores representing greater susceptibility to doping.

Intention to use dietary supplements. Participants were presented with a definition of dietary supplements such as a food, food component, nutrient or non-food compound that is purposefully ingested in addition to the habitually consumed diet with the aim of achieving a specific health and/or performance benefit. Similar to previous research (Hurst et al., 2017a; Tsochas et al., 2013), they then indicated how much they agreed, on a 7-point Likert-type scale, with the statement "I intend to use dietary supplements in the next three months". Responses ranged from 1 (strongly disagree) to 7 (strongly agree), with higher scores indicating a greater intention to use dietary supplements.

Spirit of Sport and moral values. The Spirit of Sport Values scale (Mortimer et al., 2021) was used to measure the importance of the Spirit of Sport and moral values. Participants were presented with 11 values (e.g., ethics, fair play and honesty; character and education; respect for the rules) and rated the importance of each value on a 7-point Likert-type scale, with anchors of −1 (opposite of what I believe), 0 (not important) and 5 (important). The mean of the 11 items was computed, with higher scores indicating greater importance of the Spirit of Sport values. Similar to previous research (Hurst et al., 2022), we computed moral values as the average of participants' responses to four items: ethics, fair play, and honesty; character and education; respect for rules and laws; and respect for self and others. Higher scores on this variable indicated stronger moral values and previous research has reported very good-to-excellent internal consistency for both the Spirit of Sport (α =

Table 1
Topic, aim and content of the anti-doping education programme.

Topic	Aim	Content	Approximate length (minutes)
Anti-doping rule violations	Introduce athletes to the 11 anti-doping rule violations and highlight how they can be banned from sport.	The 11 anti-doping rule violations are explained, how each rule can be violated and the length of ban for each violation is given	7
The Prohibited List	Inform athletes of the Prohibited list and what constitutes a prohibited performance enhancing substance or method	The Prohibited list is introduced and the different types of substances and methods that are prohibited are given	2
Consequences of doping	Explain the health, social and economic consequences of doping	The health (e.g., increased risk of cardiovascular disease), economic (e.g., loss of sponsorship) and social (e.g., banned from competing in sport) consequences are provided	5
Doping control procedure	Explain the doping control procedure	The eight stages of the doping control procedure are explained (e.g., reporting for testing, selecting a collection vessel, testing the suitability of the sample) and athlete rights and responsibilities (e.g., check doping control officers ID, having three or more vessels to choose from, carrying a form of photo ID) at each stage are provided	10
Whereabouts	Inform athletes of the Anti-Doping Administration Management System (ADAMS)	The ADAMS is introduced and what athletes are required to do if they are enrolled onto the system	2
Medications	Explain how to check the prohibited status of a medication	Risks of using a prohibited medication is provided and demonstrations of how to use Global Dro (https://www.globaldro.com/Home) is given	10
Therapeutic use exemptions (TUE)	Introduce TUE's and how to apply for one	TUE's are explained and signposting to the UK Anti-Doping Website (https://www.ukad.org.uk/tue-application) for TUE applications is given	2
Dietary supplements	Explain inadvertent doping after using a contaminated supplement	Risks of using dietary supplements are explained and demonstrations in how to use websites such as "We Test You Trust" (https://sport.wetestyoutrust.com/) are provided	10
Whistleblowing	Inform how to report doping in sport	The importance of whistleblowing is explained and systems in which to report doping (e.g., email, hotlines and online forms) are provided	2

0.91) and moral (α = 0.87) value scales (Hurst et al., 2022; Mortimer et al., 2021).

Knowledge of anti-doping. Participants' knowledge of the anti-doping rules was assessed using the questionnaire developed by Hurst et al. (2020). Participants answered seven multiple-choice questions related to the topics included in WADA's International Standard for Education (e.g., "How many anti-doping rule violations are there?" and "What is the definition of strict liability?"). A score of 1 was given to each correct answer, with total scores ranging from 0 to 7, and higher scores indicating greater anti-doping knowledge.

Anti-doping practice. We assessed participants' likelihood to engage in anti-doping practices by using the measure developed by Ntoumanis et al. (2020). Participants were presented with the statement "Typically, over the course of a season, how often would you …" followed by four statements (e.g., check a medication for prohibited substances on the GlobalDro website" and "check if sport supplements are batch-tested"). They then responded on a 5-point Likert-type scale to indicate how frequently they would engage with the practice, anchored by 1 (never) and 5 (often). The average of the four statements was calculated, with higher scores indicating greater engagement in anti-doping practice. The scale has shown very good internal consistency (α = 0.87; Ntoumanis et al., 2020).

Whistleblowing. Four statements related to whistleblowing were presented to participants (e.g., "I am committed to reporting doping in sport" and "I know how to report someone who may be doping in sport"). They then indicated on a seven-point Likert-type scale, how much they agreed with each statement, anchored by 1 (strongly disagree) and 7 (strongly agree). Responses were averaged with higher scores indicating greater likelihood to whistleblow.

2.5. Procedure

The study was approved by the lead author's institutional ethics committee (Canterbury Christ Church University), which was in accordance with the Declaration of Helsinki. Prior to attending the anti-doping session, participants were informed about the purpose of the study, that participation was voluntary and that their data would be kept anonymous and used only for research purposes. The facilitator asked participants to scan a quick response (QR) code on their phone to access the study information sheet, informed consent, and measures. To ensure honesty in responses, participants disclosed no personal information (e.g., name, personal best, address) and created a bespoke password to ensure anonymity and to link participant responses across the two time points. After completing pre-measures, participants were asked if they would be happy to complete a follow-up questionnaire in three-months' time. To keep responses anonymous, they were sent a link to a separate survey and asked to indicate how they would like to be contacted (i.e., via text or email). After three months, participants who responded, were sent a link to the questionnaire, and asked to complete the follow-up measures.

3. Results

Figure 1 shows a flow diagram of the study. Between April 2021 and July 2022, 831 athletes from 28 anti-doping education sessions were invited to take part in the study and screened for eligibility. Ten participants were excluded for not meeting eligibility criteria. Five hundred and nineteen participants did not complete follow-up measures (37% response rate), leaving a final sample size of 302 (41.4% female and 95.5% British; Mean ± SD: age = 18.71 ± 2.61 years, hours training per week = 10.12 ± 5.07, years competing = 2.85 ± 2.02). Over 12 sports were represented in the sample, with the most popular being track and field (25.8%), football (13.9%) and swimming (12.9%). Participants competed at regional (37.8%), national (32.7%) and international (29.5%) level and were classified as semi-elite (8.9%), competitive-elite (34.1%), successful-elite (54.3%) and world-class elite (2.6%).

3.1. Preliminary analysis

Data were first screened for missing values and outliers. Analyses indicated less than 1% of the data were missing, and as such were replaced with the mean of the respective variable (Tabachnick et al., 2007). Cronbach alphas are reported in Table 2 and all showed good to very good internal consistency (α range = 0.81 to 0.94). Zero-order correlations for all measures are also shown in Table 2.

3.2. Differences between pre- and follow-up-measures

For our first study aim, we used a repeated-measures MANOVA, with two timepoints (pre, follow-up) as the within-participant factor, on seven variables (i.e., doping susceptibility, dietary supplement intention, Spirit of Sport and moral values, knowledge of anti-doping rules, anti-doping practice, whistleblowing). Results revealed a multivariate effect for timepoint ($F_{7,\ 295} = 102.35$, $p < .01$, partial eta squared = 0.71). The means at each timepoint and their differences are presented in Table 3. Briefly, three months after attending the anti-doping education session, participants reported lower doping susceptibility and intention to use dietary supplements, and higher Spirit of Sport and moral values, anti-doping knowledge, engagement with anti-doping practices and whistleblowing.

3.3. Explaining differences in doping susceptibility

For our second study aim, we used MEMORE v3.0 (Montoya & Hayes, 2017) SPSS macro (Model 1) to examine mediators of changes in doping susceptibility scores following the anti-doping programme.

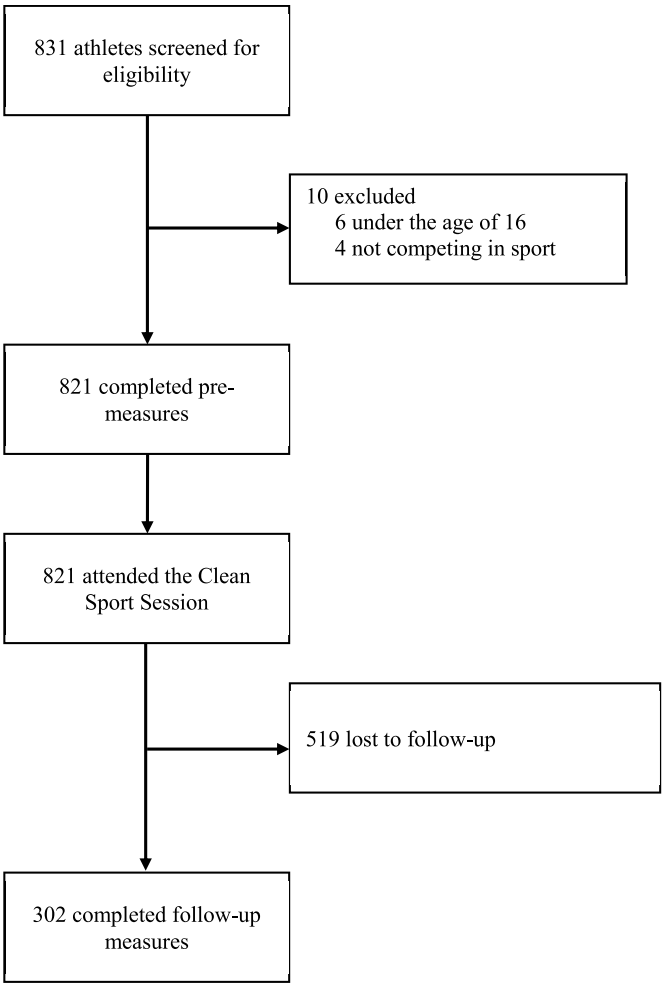

Figure 1. Flow diagram of study design.

MEMORE tests mediation in repeated measures designs by accounting for the difference in the dependent variable (i.e., pre- and follow-up doping susceptibility scores) as a function of the difference in the mediator measured at two timepoints. We ran a series of regressions with pre- and follow-up doping susceptibility scores as the dependent variables and pre-and follow-up scores for all other measures (i.e., intention to use dietary supplements, Spirit of Sport and moral values, anti-doping knowledge, anti-doping practice, and whistleblowing) as mediators. Statistical significance is evident when zero is not included between lower and upper 95% bootstrap confidence intervals.

Results revealed that changes in doping susceptibility were indirectly related to changes in dietary supplement intention. That is, the direct effect of pre-doping susceptibility scores on follow-up-doping susceptibility scores was not significant (b = 0.06, 95% CI = −0.04 to 0.15, p = .27) but instead, indirectly related to change in dietary supplement intention ($b = 0.04$, 95% CI = 0.01 to 0.07, $p < .05$). This suggests that the anti-doping programme lowered doping susceptibility scores via the process of decreasing the intention to use dietary supplements. No other variables were significant mediators (see Supplementary Material for these analyses).

3.4. Moderated-mediation analysis

Given that previous research found that morality moderated the mediating effect of dietary supplement use on doping (Hurst et al., 2022), we explored whether the effect of pre-doping susceptibility on follow-up doping susceptibility via change dietary supplement intention following the programme was conditional on moral values. We used Model 16 to estimate different conditional values of the moderator variable (i.e., moral values) for the indirect effect at three levels (i.e., low, moderate, and high moral values). If moral values moderate the indirect relationship of change in doping susceptibility scores, the strength and/or direction of the mediation effect changes depending on the moral value score.

Pre- and follow-up doping susceptibility scores were included as the outcome variable, pre- and follow-up dietary supplement intention scores as the mediator, and pre-moral values scores as the moderator.[1] Results revealed a conditional indirect effect of dietary supplement intention, whereby the indirect effect was significant when moral values were low and moderate, but not when moral values were high (Table 4). In short, the indirect effect of the anti-doping programme in reducing doping susceptibility via reduction in dietary supplement intention scores were moderated by moral values.

4. Discussion

In this study, we showed that three months after attending a national organisation's anti-doping education programme, athletes were less susceptible to dope. Moreover, at this follow-up, their intention to use dietary supplements was lower, they reported greater importance in the Spirit of Sport and moral values, their anti-doping knowledge improved, and they were more engaged with anti-doping and whistleblowing practices. We also showed that changes in doping susceptibility from before-to-after the intervention were indirectly related to accompanying changes in the intention to use dietary supplements, and that this indirect relationship was moderated by moral values. Accordingly, this is the first study to provide evidence that changes in doping susceptibility are related to changes in supplement use intention and confirm the key role played by personal morality in an athlete's decision to use prohibited substances.

[1] MEMORE can only include one moderator variable at a time. We also conducted analyses that included follow-up moral-value scores and the average between pre- and follow-up moral scores as the moderator, and these showed similar effects.

Table 2
Cronbach alphas and correlation coefficients between pre- (T1) and follow-up- (T2) measures.

#	Measure	α	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Doping susceptibility (T1)	–													
2	Doping susceptibility (T2)	–	.80**												
3	Dietary supplement intention (T1)	–	.11	.18**											
4	Dietary supplement intention (T2)	–	.03	.14*	.72**										
5	Spirit of Sport Values (T1)	.93	−.19**	−.19**	.03	.02									
6	Spirit of Sport Values (T2)	.94	−.06	−.05	.06	.08	.48**								
7	Moral values (T1)	.84	−.22**	−.21**	.02	.02	.94**	.46**							
8	Moral values (T2)	.87	−.05	−.07	.05	.09	.47**	.95**	.49**						
9	Anti-doping knowledge (T1)	–	−.05	−.03	.05	.04	−.05	−.08	−.02	−.07					
10	Anti-doping knowledge (T2)	–	−.07	−.05	.10	.10	.05	.15**	.08	.19**	.12*				
11	Anti-doping practice (T1)	.81	−.04	.04	.30**	.26**	.10	.09	.07	.07	.15**	−.09			
12	Ant-doping practice (T2)	.91	.05	.06	.23**	.30**	.08	.34**	.10	.31**	.07	.00	.38**		
13	Whistleblowing (T1)	.81	−.14*	−.10	.12*	.10	.25**	.20**	.27**	.20**	.15**	−.02	.23**	.16**	
14	Whistleblowing (T2)	.89	−.02	−.01	.12*	.20**	.25**	.46**	.29**	.50**	.01	.08	.23**	.50**	.28**

Note: α = Cronbach alpha. * = P < .05, **P < .01

Table 3
Mean (SD) pre- and follow-up variables, and their difference.

Variable	Pre	Follow-up	Difference	*p*	*d* (95% CI)
Doping susceptibility	1.58 ± 1.35	1.48 ± 1.20	−0.10 ± 0.05	.04	0.12 (0.00–0.23)
Dietary supplement intention	4.10 ± 2.32	3.55 ± 2.25	−0.72 ± 0.04	<.01	0.40 (0.29–0.52)
Spirit of Sport values	4.17 ± 0.85	4.42 ± 0.80	0.25 ± 0.05	<.01	0.29 (0.18–0.41)
Moral values	4.29 ± 0.50	4.52 ± 0.44	0.23 ± 0.05	<.01	0.28 (0.17–0.40)
Anti-doping knowledge	4.07 ± 1.26	5.57 ± 1.19	1.50 ± 0.09	<.01	0.92 (0.78–1.05
Anti-doping practice	2.38 ± 1.04	3.43 ± 1.25	1.04 ± 0.07	<.01	0.81 (068–0.94)
Whistleblowing	3.99 ± 1.39	5.81 ± 1.28	1.83 ± 0.09	<.01	1.12 (0.99–1.28)

Note: Data are mean ± standard deviation, *d* = Cohen's d effect size, CI = Confidence interval. Possible range scores for doping susceptibility, dietary supplement intention and whistleblowing = 1 to 7; Spirit of Sport Values and moral values = −1 to 5, anti-doping knowledge = 0 to 7; anti-doping practice = 1 to 5.

4.1. Differences between pre- and follow-up outcome measures

Following the anti-doping education programme, athletes were less susceptible to dope and use dietary supplements. These findings are in partial agreement with Hurst et al. (2020) who reported changes in dietary supplement three-months following an anti-doping programme, but no changes in doping likelihood over the same time-frame. The results are also broadly in line with the results of studies showing that athletes were less likely to dope after psychological (Kavussanu et al., 2022), moral (Kavussanu et al., 2021) and coach-created motivational climate (Ntoumanis et al., 2020) anti-doping interventions. Similarly, reducing the tendency to use dietary supplements increases the likelihood of preventing athletes from using a supplement that is contaminated with a prohibited substance (Chan et al., 2018) and/or progress to doping after using these substances (Backhouse et al., 2013; Hurst et al., 2017b; Petróczi, 2013).

As instructed by the ISE, anti-doping organisations aim to foster the Spirit of Sport and build an athlete's capacity to behave ethically in their education programmes. To our knowledge, this is the first study to report that athletes deemed the Spirit of Sport and moral values to be more important to them three months after attending a national anti-doping programme. Given that values are a mental representation stored in memory and their priority is subject to change (Hubbard, 2007; Maio, 2010), it is likely that the anti-doping programme reinforced the message of the importance of the Spirit of Sport and moral values for athletes' attending the programme, and helped those who had not been exposed to it previously understand their importance. These results are noteworthy, given that an athlete who places greater importance on the Spirit of Sport values is less likely to dope (Hurst et al., 2022) and more likely to compete "clean" (Mortimer et al., 2021). Our results indicate that UK Anti-Doping's Clean Sport programme is effective at increasing the importance of these key values, and supports a key aim of WADA, whereby anti-doping organisations are instructed to implement education programmes that aim to develop an athlete's personal values and principles.

Table 4
Conditional effects of the anti-doping education programme on change in doping susceptibility scores by change in intention to use dietary supplement scores (N = 302).

Moral value score	b	Boot SE	Lower	Upper
Low	0.05	0.07	0.01	0.12
Moderate	0.04	0.02	0.01	0.09
High	0.03	0.03	−0.03	0.10

Notes: Boot SE = Bootstrap standard error.

A fundamental purpose of anti-doping education programmes is to increase knowledge of the anti-doping rules and regulations, and increase engagement with anti-doping practices, such as checking the prohibited status of medications and the batch testing status of a dietary supplement. We showed that athletes reported greater knowledge of the anti-doping rules and regulations and engaged in more anti-doping practices than three months previously. WADA's policy states that it is an athlete's responsibility to ensure no prohibited substance enters their body (WADC, 2021). Therefore, increasing athletes' knowledge about the anti-doping rules and engagement with anti-doping tools is likely to reduce their risk of inadvertently violating anti-doping rules. While previous studies have shown that national anti-doping programmes improve knowledge of anti-doping (Hurst et al., 2020; Wippert & Fliesser, 2016), to our knowledge, this is the first study to confirm that they also increase engagement with anti-doping practices. This supports a further aim of the International Standard for Education to ensure that programmes help build an athlete's competency to follow the anti-doping rules and develop behaviours that foster and protect the Spirit of Sport (WADA, 2020).

In the past decade, international and national organisations have invested resources in developing methods, such as phonelines and websites, where people can report, in confidence, suspected doping in

sport (i.e., whistleblowing). This has led to a development within anti-doping education programmes of content highlighting the importance of whistleblowing and how to use such reporting tools. We found that the anti-doping education programme increased athletes' understanding of whistleblowing processes and their ability to report doping in sport. This finding suggests that athletes may be more likely to blow the whistle if they suspect doping and better understand the procedures to achieve this. This is an important finding as athletes are reluctant to blow the whistle on others (Erickson et al., 2017) and, therefore, educating athletes about its importance may increase their willingness to report their suspicions.

4.2. Explaining doping susceptibility changes

While a small body of evidence has demonstrated the effectiveness of anti-doping education programmes (Hurst et al., 2020; Wippert & Fliesser, 2016), to date, no research had examined the mechanisms underpinning changes in key doping-related outcome measures as a result of taking part in an anti-doping education programme. Supporting previous cross-sectional research showing that dietary supplements are related to doping (Hurst et al., 2023) we found that the reduction in doping susceptibility was related to the reduction in intention to use supplements. This suggests that athletes were less inclined to use dietary supplements after the anti-doping education programme and, as a result, less susceptible to using a prohibited substance. This finding provides evidence in favour of the proposition that the use of dietary supplements could lead an athlete to the use of doping substances due to their shared mental representation (Hurst et al., 2017b; Hurst et al., 2021a; Petróczi, 2013), and we provide novel evidence to show that an athlete's reduction in intention to use supplements, in turn, reduced their susceptibility to dope.

We also showed that changes in doping susceptibility were only related to changes in dietary supplement intention when moral values were perceived as being of relatively lower importance. This supports cross-sectional data showing that dietary supplement users who place a greater importance on moral values are less likely to progress to doping than those who report lower importance of moral values (Hurst et al., 2022). Given that doping is a moral choice (i.e., it is against the rules of sport), the results of our research suggest that by reducing the intention to use dietary supplements, athletes may be less likely to dope if they believe that morality is important to them. This is line with qualitative research examining combat sport athletes' decision to abstain from using performance enhancing substances, such as dietary supplements and doping (Matthews & Jordan, 2020; Woolf & Perkari, 2021), where some athletes consciously avoided any form of performance enhancement due to the "purity perspective" and the ideal that sporting achievements should be accomplished without the need for any substance use. This is contrary to the belief that morality is unlikely to play a role in an athlete's decision to dope (Ohl et al., 2015; Petróczi, 2013) and our data reveal that athletes for whom moral values are important, are less susceptible to dope. This key finding highlights the need to target morality in anti-doping education interventions (c.f. Kavussanu et al., 2022; Kavussanu et al., 2021).

4.3. Limitations and future research

The results of our study should be interpreted in light of some limitations. First, we did not include a no treatment control group and cannot be certain that changes in outcomes were the result of the anti-doping education programme or methodological artefacts, such as regression to the mean. Including a control group within national anti-doping education programmes is extremely challenging given that all athletes should receive anti-doping education before they are subjected to drug testing (WADA, 2021b). Our sample consisted of athletes competing at regional level or above and finding an equivalent control group of athletes of similar ability who do not receive anti-doping education is unlikely. Second, our doping susceptibility measure is a proxy of actual doping. We did not specifically ask whether participants had or would dope, and thus cannot be certain that they would be less likely to intentionally dope if given the opportunity. Third, it is likely that there may be floor and/or ceiling effects with our measures. Especially in relation to doping susceptibility, where participants reported relatively low scores at baseline. Future research should aim to identify participants more susceptible to dope (i.e., score greater than 2) to see if effects are similar as reported here. Fourth, while our data show changes in various measures related to intentional and unintentional doping, we did not gain an understanding of what participants enjoyed about the programme and what they believe made it effective. To help further explain the changes in doping susceptibility, for example, it would be fruitful for future research to examine participants' perceptions of the anti-doping education programme and what they perceive might lead to changes in outcome measures. Finally, the attrition rate between pre- and follow-up measures was high (37% completion). Given that there are inherent difficulties in sampling elite athletes within the follow-up period, our response rate is similar to previous research (Hurst et al., 2022; Nicholls et al., 2020; Ntoumanis et al., 2020).

5. Conclusion

In conclusion, our findings provide empirical support for the effectiveness of a national anti-doping education programme in reducing an athlete's susceptibility to dope and intention to use dietary supplements. We also found that the programme increased athletes' importance of the Spirit of Sport and moral values, knowledge of anti-doping, and engagement with anti-doping practices and whistleblowing. These findings support WADA's aim to develop education programmes that reduce intentional and unintentional doping and build an athlete's capacity to make a more informed decision towards using prohibited substances. Finally, we found that changes in doping susceptibility scores were indirectly related to changes in dietary supplements, and that this indirect relationship was moderated by moral values. This suggests that changing an athlete's decision to use dietary supplements can also change their susceptibility to dope if they have relatively low moral values.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.psychsport.2023.102512.

References

Backhouse, S. H., Whitaker, L., & Petroczi, A. (2013). Gateway to doping? Supplement use in the context of preferred competitive situations, doping attitude, beliefs, and norms. *Scandinavian Journal of Medicine & Science in Sports, 23*(2), 244–252. https://doi.org/10.1111/j.1600-0838.2011.01374.x

Barkoukis, V., Lazuras, L., Ourda, D., & Tsorbatzoudis, H. (2020). Are nutritional supplements a gateway to doping use in competitive team sports? The roles of achievement goals and motivational regulations. *Journal of Science and Medicine in Sport, 23*(6), 625–632. https://www.embase.com/search/results?subaction=viewrecord&id=L2004553959&from=export.

Birzniece, V., Nelson, A. E., & Ho, K. K. (2011). Growth hormone and physical performance. *Trends in Endocrinology and Metabolism, 22*(5), 171–178. https://doi.org/10.1016/j.tem.2011.02.005

Bloodworth, A., & McNamee, M. (2010). Clean olympians? Doping and anti-doping: The views of talented young British athletes. *International Journal of Drug Policy, 21*(4), 276–282. https://doi.org/10.1016/j.drugpo.2009.11.009

Boardley, I., Chandler, M., Backhouse, S. H., & Petroczi, A. (2020). *Co-creating a social science research agenda for clean sport: An international Delphi study*.

Chan, D. K. C., Tang, T. C., Gucciardi, D. F., Ntoumanis, N., Dimmock, J. A., Donovan, R. J., Hardcastle, S. J., & Hagger, M. S. (2018). Psychological and behavioural factors of unintentional doping: A preliminary systematic review. *International Journal of Sport and Exercise Psychology*, 1–23.

Chan, D. K., Tang, T. C. W., Yung, P. S., Gucciardi, D. F., & Hagger, M. S. (2017). Is unintentional doping real, or just an excuse? *British Journal of Sports Medicine*. https://doi.org/10.1136/bjsports-2017-097614

Elbe, A.-M., & Brand, R. (2016). The effect of an ethical decision-making training on young athletes' attitudes toward doping. *Ethics & Behavior, 26*(1), 32–44. https://doi.org/10.1080/10508422.2014.976864

Elliot, D. L., Goldberg, L., Moe, E. L., DeFrancesco, C. A., Durham, M. B., McGinnis, W., & Lockwood, C. (2008). Long-term outcomes of the ATHENA (athletes targeting healthy exercise & nutrition alternatives) program for female high school athletes. *Journal of Alcohol & Drug Education, 52*(2), 73.

Erickson, K., Backhouse, S. H., & Carless, D. (2017). "I don't know if I would report them": Student-athletes' thoughts, feelings and anticipated behaviours on blowing the whistle on doping in sport. *Psychology of Sport and Exercise, 30*, 45–54. https://doi.org/10.1016/j.psychsport.2017.01.005

Erickson, K., Patterson, L. B., & Backhouse, S. H. (2019). "The process isn'ta case of report it and stop": Athletes' lived experience of whistleblowing on doping in sport. *Sport Management Review, 22*(5), 724–735. https://doi.org/10.1016/j.smr.2018.12.001

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*(4), 1149–1160.

García-Martí, C., Ospina-Betancurt, J., Asensio-Castañeda, E., & Chamorro, J. L. (2022). Study of an anti-doping education program in Spanish sports sciences students. *International Journal of Environmental Research and Public Health, 19*(23), Article 16324. https://doi.org/10.3390/ijerph192316324

Gatterer, K., Gumpenberger, M., Overbye, M., Streicher, B., Schobersberger, W., & Blank, C. (2020). An evaluation of prevention initiatives by 53 national anti-doping organizations: Achievements and limitations. *Journal of sport and health science, 9*(3), 228–239.

Gatterer, K., Streicher, B., Petróczi, A., Overbye, M., Schobersberger, W., Gumpenberger, M., Weber, K., Königstein, K., & Blank, C. (2021). The status quo before the International Standard for Education: Elite adolescent athletes' perceptions of anti-doping education. *Performance Enhancement & Health, 9*(3–4), Article 100200.

Goldberg, L., MacKinnon, D. P., Elliot, D. L., Moe, E. L., Clarke, G., & Cheong, J. (2000). The adolescents training and learning to avoid steroids program: Preventing drug use and promoting health behaviors. *Archives of Pediatrics and Adolescent Medicine, 154*(4), 332–338. https://doi.org/10.1001/archpedi.154.4.332

Gucciardi, D. F., Jalleh, G., & Donovan, R. J. (2010). Does social desirability influence the relationship between doping attitudes and doping susceptibility in athletes? *Psychology of Sport and Exercise, 11*(6), 479–486. https://doi.org/10.1016/j.psychsport.2010.06.002

Hallward, L., & Duncan, L. R. (2019). A qualitative exploration of athletes' past experiences with doping prevention education. *Journal of Applied Sport Psychology, 31*(2), 187–202.

Hoberman, J. (2013). How much do we (really) know about anti-doping education? *Performance Enhancement & Health, 2*(4), 137–143. https://doi.org/10.1016/j.peh.2014.09.002

Hubbard, T. (2007). What is mental representation?: And how does it relate to consciousness? *Journal of Consciousness Studies, 14*(1–2), 37–61.

Hurst, P. (2023). *Are dietary supplements a gateway to doping? A retrospective survey of athletes' substance use* (pp. 1–6). Substance Use and Misuse.

Hurst, P., Foad, A. J., Coleman, D. A., & Beedie, C. (2017a). Athletes intending to use sports supplements are more likely to respond to a placebo. *Medicine & Science in Sports & Exercise, 40*(9), 1877–1883. https://doi.org/10.1249/MSS.0000000000001297

Hurst, P., Foad, A. J., Coleman, D. A., & Beedie, C. (2017b). *Development and validation of the Sports Supplements Beliefs Scale Performance Enhancement & Health, 5*(3), 89–97. https://doi.org/10.1016/j.peh.2016.10.001

Hurst, P., Kavussanu, M., Boardley, I. D., & Ring, C. (2019). Sport supplement use predicts doping via sport supplement beliefs. *Journal of Sports Sciences*, 1–7. https://doi.org/10.1080/02640414.2019.1589920

Hurst, P., Ring, C., & Kavussanu, M. (2020). Evaluation of UK athletics clean sport programme in preventing doping in junior elite athletes. *Performance Enhancement & Health, 7*(4), 1–6. https://doi.org/10.1016/j.peh.2019.100155

Hurst, P., Ring, C., & Kavussanu, M. (2021a). Athletes using ergogenic and medical sport supplements report more favourable attitudes to doping than non-users. *Journal of Science and Medicine in Sport, 24*(3), 307–311. https://doi.org/10.1016/j.jsams.2020.09.012

Hurst, P., Ring, C., & Kavussanu, M. (2021b). Ego orientation is related to doping likelihood via sport supplement use and sport supplement beliefs. *European Journal of Sport Science*, 1–19.

Hurst, P., Ring, C., & Kavussanu, M. (2022). Moral values and moral identity moderate the indirect relationship between sport supplement use and doping use via sport supplement beliefs. *Journal of Sports Sciences*, 1–8. https://doi.org/10.1080/02640414.2022.2053387

Hurst, P., Schiphof-Godart, L., Kavussanu, M., Barkoukis, V., Petróczi, A., & Ring, C. (2023). Are dietary supplement users more likely to dope than non-users?: A systematic review and meta-analysis. *International Journal of Drug Policy, 117*, Article 104077.

James, R., Naughton, D. P., & Petroczi, A. (2010). Promoting functional foods as acceptable alternatives to doping: Potential for information-based social marketing approach. *Journal of the International Society of Sports Nutrition, 7*, 37. https://doi.org/10.1186/1550-2783-7-37

Kavussanu, M., Barkoukis, V., Hurst, P., Yukhymenko, M., Skoufa, L., Chirico, A., … Ring, C. (2022). A psychological intervention reduces doping likelihood in British and Greek athletes: A cluster randomized controlled trial. *Psychology of Sport and Exercise, 61*, 102099. https://doi.org/10.1016/j.psychsport.2021.102099

Kavussanu, M., Hurst, P., Yukhymenko-Lescroart, M., Galanis, E., King, A., Hatzigeorgiadis, A., & Ring, C. (2021). A moral intervention reduces doping likelihood in UK and Greek athletes: Evidence from a cluster randomized control trial. *Journal of Sport & Exercise Psychology, 43*(2), 125–139. https://doi.org/10.1123/jsep.2019-0313

La Gerche, A., & Brosnan, M. J. (2017). Cardiovascular effects of performance-enhancing drugs. *Circulation, 135*(1), 89–99. https://doi.org/10.1161/CIRCULATIONAHA.116.022535

Maio, G. R. (2010). Mental representations of social values. In *Advances in experimental social psychology, 42* pp. 1–43). Elsevier.

Masucci, M. A., Butryn, T. M., & Johnson, J. A. (2019). *Knowledge and perceptions of doping practices and anti-doping education among elite North American female triathletes*. Performance Enhancement & Health.

Matthews, C. R., & Jordan, M. (2020). Drugs and supplements in amateur boxing: Pugilistic amateurism and ideologies of performance. *Qualitative Research in Sport, Exercise and Health, 12*(5), 631–646.

Montoya, A. K., & Hayes, A. F. (2017). Two-condition within-participant statistical mediation analysis: A path-analytic framework. *Psychological Methods, 22*(1), 6.

Mortimer, H., Whitehead, J., Kavussanu, M., Gürpınar, B., & Ring, C. (2021). Values and clean sport. *Journal of Sports Sciences, 39*(5), 533–541. https://doi.org/10.1080/02640414.2020.1835221

Nicholls, A. R., Morley, D., Thompson, M. A., Huang, C., Abt, G., Rothwell, M., Cope, E., & Ntoumanis, N. (2020). The effects of the iPlayClean education programme on doping attitudes and susceptibility to use banned substances among high-level adolescent athletes from the UK: A cluster-randomised controlled trial. *International Journal of Drug Policy, 82*, Article 102820. https://doi.org/10.1016/j.drugpo.2020.102820

Ntoumanis, N., Ng, J. Y., Barkoukis, V., & Backhouse, S. (2014). Personal and psychosocial predictors of doping use in physical activity settings: A meta-analysis. *Sports Medicine, 44*(11), 1603–1624. https://doi.org/10.1007/s40279-014-0240-4

Ntoumanis, N., Quested, E., Patterson, L., Kaffe, S., Backhouse, S. H., Pavlidis, G., … Staff, H. R. (2020). An intervention to optimise coach-created motivational climates and reduce athlete willingness to dope (CoachMADE): A three-country cluster randomised controlled trial. *British Journal of Sports Medicine, 55*(4), 213–219. https://doi.org/10.1136/bjsports-2019-101963

Ohl, F., Fincoeur, B., Lentillon-Kaestner, V., Defrance, J., & Brissonneau, C. (2015). The socialization of young cyclists and the culture of doping. *International Review for the Sociology of Sport, 50*(7), 865–882.

Patsopoulos, N. A. (2022). A pragmatic view on pragmatic trials. *Dialogues in Clinical Neuroscience, 13*(2), 217–224. https://doi.org/10.31887/DCNS.2011.13.2/npatsopoulos

Petróczi, A. (2013). The doping mindset—Part I: Implications of the Functional Use Theory on mental representations of doping. *Performance Enhancement & Health, 2*(4), 153–163. https://doi.org/10.1016/j.peh.2014.06.001

Ring, C., Kavussanu, M., Gürpınar, B., Whitehead, J., & Mortimer, H. (2020). Basic values predict unethical behavior in sport: The case of athletes' doping likelihood. *Ethics & Behavior*, 1–9.

Sagoe, D., Holden, G., Rise, E. N. K., Torgersen, T., Paulsen, G., Krosshaug, T., Lauritzen, F., & Pallesen, S. (2016). Doping prevention through anti-doping education and practical strength training: The Hercules program. *Performance Enhancement & Health, 5*(1), 24–30. https://doi.org/10.1016/j.peh.2016.01.001

Swann, C., Moran, A., & Piggott, D. (2015). Defining elite athletes: Issues in the study of expert performance in sport psychology. *Psychology of Sport and Exercise, 16*, 3–14.

Tabachnick, B. G., Fidell, L. S., & Ullman, J. B. (2007). *Using multivariate statistics, 5*. MA: pearson Boston.

Tsochas, K., Lazuras, L., & Barkoukis, V. (2013). Psychosocial predictors of nutritional supplement use among leisure time exercisers. *Performance Enhancement & Health, 2*(1), 17–23. https://doi.org/10.1016/j.peh.2013.02.001

WADA. (2020). *International Standard for education motreal, Canada*. https://www.wada-ama.org/en/resources/the-code/international-standard-for-education-ise.

WADA. (2021b). *World anti-doping code international standard testing and investigations*. https://www.wada-ama.org/sites/default/files/resources/files/international_standard_isti_-_2021.pdf.

WADA. (2022). *Code signatories*. Retrieved 12/04/2022 from https://www.wada-ama.org/en/what-we-do/the-code/code-signatories.

WADC. (2021). *The world anti-doping code*. https://www.wada-ama.org/sites/default/files/resources/files/wada-2015-world-anti-doping-code.pdf.

Wippert, P. M., & Fliesser, M. (2016). National doping prevention guidelines: Intent, efficacy and lessons learned - a 4-year evaluation. *Substance Abuse Treatment, Prevention, and Policy, 11*(1), 35. https://doi.org/10.1186/s13011-016-0079-9

Woolf, J. J. R. (2020). *An examination of anti-doping education initiatives from an educational perspective: Insights and recommendations for improved educational design.* Performance Enhancement & Health, Article 100178.

Woolf, J. J. R., & Perkari, K. (2021). Fighting and doping: Professional mixed martial artists experience and exposure to performance-enhancing substances and supplements. *Performance Enhancement & Health, 9*(1), Article 100190.