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Research Paper

Exploring the relationship between mindset and psychological factors linked to doping

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ABSTRACT

Mindset refers to the way in which one attributes his or her abilities and traits as either 'fixed' (e.g., immutable), 'growth' (e.g., highly malleable), or somewhere in between. It is possible that mindset may be related to psychological factors linked to doping – such as doping moral disengagement (MD) and doping self-regulatory efficacy (SRE) – though no research as yet has confirmed this. In the present study, 322 student-athletes completed a questionnaire pack measuring mindset and various psychological factors linked to doping. Structural equation modeling provided strong support for all study hypotheses. Specifically, we established: (a) mindset positively predicted doping SRE, (b) mindset negatively predicted doping MD, (c) doping MD positively predicted susceptibility to intentional and inadvertent doping, (d) doping MD negatively predicted anticipated guilt, (e) anticipated guilt negatively predicted susceptibility to intentional and inadvertent doping. In addition, significant negative correlations were found between MSA and doping moral disengagement ($r = -.19$, $p < .01$), MSA and susceptibility to inadvertent doping ($r = -.11$, $p < .01$), MMC and moral disengagement ($r = -.12$, $p < .05$), and MMC and susceptibility to inadvertent doping ($r = -.13$, $p < .05$). A significant positive correlation was found between MSA and doping SRE ($r = .23$, $p < .01$). Implications of the findings include the potential for early identification of athletes at risk of doping based on their mindset. Future research should look to explore the effectiveness of mindset interventions on reducing transgressive doping attitudes and behaviours.

1. Introduction

Doping in sport has been defined as the "use of performance-enhancing drugs, particularly those that are forbidden by the organizations that regulate competitions" (Lippi, Franchini, & Guidi, 2008, p. 96). Athletes may engage in doping either intentionally (to gain an advantage) or inadvertently (due to misunderstanding or accidental consumption). The World Anti-Doping Agency (WADA) reported data showing that 1.07% of samples were returned with a positive test (WADA, 2019), though many researchers in the field believe this figure to be considerably higher. For instance, Faiss et al. (2020) recently tested the blood samples of 3,683 track and field athletes at the 2011 and 2013 World Athletics Championships and estimated blood doping prevalence to be between 15% and 18%. Findings from another study which utilised an anonymity-guaranteeing questionnaire method suggest an even higher number of between 30% and 45% for overall doping prevalence at two elite athletics competitions (Ulrich et al., 2018).

Doping behaviour has been shown to be predicted by an individual's attitudes and psychosocial processes (see Ntoumanis et al., 2014, for a meta-analysis). A number of studies have utilised Self-Determination Theory (Deci & Ryan, 1985) or Achievement Goals approaches (Nicholls, 1989) as frameworks for investigation, with studies showing that more transgressive doping behaviours and attitudes are associated with greater extrinsic motivation (Chan et al., 2015; Zucchetti, Candela, & Villosio, 2015) and more ego involvement (Allen et al., 2015; Ring & Kavussanu, 2018). Whilst built on some of the same principles as achievement goal theories, a theory that has yet to be explored with regards to doping behaviours and attitudes is the Implicit Theory of Intelligence (Dweck & Leggett, 1988); more commonly known now as 'Mindset' theory (Dweck, 1999).

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1.1. Mindset theory

Mindset refers to the way in which one attributes his or her abilities (such as intelligence or sporting ability) and traits (such as personality and moral character) (Dweck, 2008). At one end of the spectrum is the fixed mindset, in which these abilities and traits are believed to be immutable. Such individuals are characterised by an avoidance of challenge and hard work (Dweck & Yeager, 2019), low persistence in response to failures (Mueller & Dweck, 1998), threatened feelings towards the success of others (Campbell et al., 2020), and a preference for performance-based or no feedback (Forsythe & Johnson, 2017), these last two characteristics demonstrating the link between ego orientation and a fixed mindset. At the other end of the spectrum is the growth mindset, in which the abilities and traits are believed to be highly malleable. Here, individuals are characterised by an embracing of challenges and hard work (Fraser, 2018), high persistence in response to failures (Hochanadel & Finamore, 2015), inspired feelings towards the success of others (Dweck, 2012), and a preference for considerable amounts of primarily process-based feedback (Dweck, 2007); these last two characteristics demonstrating the link between task orientation and a growth mindset. A wealth of literature has found a growth mindset to be associated to high achievement/positive outcomes and a fixed mindset to be associated with low achievement/negative outcomes, particularly in learning contexts (see Costa & Faria, 2018, for a meta-analysis).

Of greater relevance to the present study is the recent finding that growth mindsets also have a significant, negative relationship with academic dishonesty (Thomas, 2017). The author suggests that believing skills and abilities as malleable reduces one's attitudes and behaviours towards unacceptable conduct. Similarly, a study by Corrion et al., (2010) found that judgements of cheating acceptability were significantly and positively correlated with entity theory beliefs (akin to a fixed mindset) and significantly and negatively correlated with incremental theory beliefs (akin to a growth mindset). These findings align with the theoretical basis of mindsets. Focusing on self-improvement as opposed to social comparisons, embracing challenges and feedback, and having high levels of persistence and effort (i.e., the characteristics of a growth mindset) all lead to a belief that one can improve one's skills without the need for transgressive means such as cheating (with the opposite being true for characteristics of a fixed mindset). Conceptually then, it is possible that fixed mindsets may also be associated with attitudes towards other reprehensible behaviours, such as doping, though as yet no research exists to confirm this. Such a finding may open the door to the possibility of growth mindset interventions, which have proliferated the educational domain over the last two decades (see Cheng et al., 2021, for a recent review).

1.2. Social cognitive theory of moral thought and action

One theory that may help us understand doping is Bandura's Social Cognitive Theory of Moral Thought and Action (1991). This theory suggests that moral behaviour occurs because of one's desire to avoid personal (e.g., guilt) and social (e.g., shame) rebuke and to maintain positive self-reactions (such as pride, satisfaction, and self-worth). Normally, *immoral* behaviours generate negative self-reactions, and therefore require internal rationalisation to ensure emotional homeostasis. These social-cognitive rationalisations are what Bandura termed 'mechanisms of moral disengagement', and include: moral justification, euphemistic labelling, advantageous comparison, displacement of responsibility, diffusion of responsibility, distortion of consequences, dehumanization, and attribution of blame. Numerous studies have been carried out finding evidence connecting the first six (see Table 1) of these mechanisms of moral disengagement and doping (Boardley & Grix, 2014; Boardley, Grix, & Dewar, 2014; Boardley, Grix, & Harkin, 2015), with research by Corrion et al., (2009) suggesting displacement of responsibility to be most prevalent, at least in a sample of basketball and taekwondo athletes.

Table 1
Six of Bandura's (1991) Eight Mechanisms of Moral Disengagement; found in research to be linked to doping behaviour and/or attitudes.

Mechanism	Description	Example
Moral Justification	Cognitively restructuring the transgressive act such that it is perceived as positive for the moral or social benefits it produces.	Believing that by doping yourself, you are better able to advice and teach others how to do so safely.
Euphemistic Labelling	Using obscure or more favourable language to conceal the transgressive nature of the act.	Discussing steroid use by using the term 'juice' instead.
Advantageous Comparison	Comparing the transgressive act to something that could be perceived to be more harmful to minimize the seriousness/negativity of it.	Comparing the act of doping to binge drinking or smoking.
Displacement of Responsibility	Decreasing one's accountability for the transgressive act by attributing it as a consequence of explicit or implicit pressure from others or the environment.	Attributing doping to the explicit instructions of other gym users, or the implicit encouragement of the gym environment.
Diffusion of Responsibility	Reducing one's accountability by attributing the transgressive act as a consequence of group-based action or decision-making.	Perceiving an instance of doping to be less immoral because the athlete was only involved in the taking of the PED, and not the acquisition, preparation, and concealment of it.
Distortion of Consequences	Cognitively restructuring the actual consequences of the transgressive act such that it is perceived in a more favourable light.	Attributing a probable side-effect of doping (e.g. mood swings) to other, unrelated reasons (e.g. poor sleep, stress at work).

Research has connected other psychological factors to doping that may also, in turn, be linked to mindset. For instance, high doping self-regulatory efficacy (SRE) – the confidence an individual has to resist internal and external pressures to dope – has been found to have a negative relationship with doping intentions (Lucidi et al., 2008) and behaviour (Boardley, Smith, Mills, Grix, & Wynne, 2017). It is conceivable to think that individuals who believe their sporting ability to be immutable (i.e., a fixed mindset) may have lower doping SRE.

1.3. Potential links between mindset theory, social cognitive theory of moral thought and action, and doping

Whilst no published research currently exists exploring the relationship between mindset and doping moral disengagement, it is reasonable to think that an association exists given the underlying theories from which this work is based on. Mindset theory (Dweck & Leggett, 1988) asserts that those with a fixed mindset have a static and innate perception of abilities. Believing that one's ability cannot be changed through natural means (i.e., effort and training) may encourage the use of other methods to achieve success (i.e., doping). This fixed perception ties into several of Bandura's (1991) mechanisms of moral disengagement that allow an individual to rationalise doping to minimize the negative self-reactions (e.g., guilt and shame) associated with it. For instance, if an athlete believes that their sporting ability cannot be changed with hard work and training, and that they have reached the limits of what they were 'born with', then it is reasonable to assume that they may seek other methods of improvement such as performance enhancing drugs (PED). In doing so, they may justify their behaviour by stating that, because of their perceived genetic disadvantage, doping is simply 'evening up' an unfair situation (moral justification) or is a necessary aspect of success in the competitive sporting environment

(displacement of responsibility). Furthermore, unlike growth mindset individuals, individuals with a fixed mindset view success as a zero-sum game, and therefore if they perceive others to be doping, they may be more inclined to feel that they need to do the same (diffusion of responsibility). Similarly, a fixed mindset individual would likely not appreciate the extent of training and hard work undertaken by their competitors, and thus, may not perceive the consequences of their doping to others as being so severe (distortion of consequences). Finally, research by Boardley et al., (2015) has shown that PED users often perceive doping to be less harmful than certain other transgressive acts sometimes witnessed in sport, such as physically assaulting a competitor or match-fixing (advantageous comparison). It is possible that a growth mindset individual is less likely than a fixed mindset individual to engage in justifications such as this because their focus tends to be on personal progression as opposed to social comparisons (Lee et al., 2021).

Similarly, the idea that mindset and doping SRE may be linked also has evidential support. Bandura's (1977) self-efficacy theory – from which doping SRE originates – posits that self-efficacy is developed through performance outcomes, vicarious experiences, social persuasion, and emotional states. An individual's mindset could conceivably influence three of these factors. For instance, compared to having a growth mindset, someone with a fixed mindset is more likely to feel less competent following unsatisfactory performances (performance outcomes), will see others' success as threatening rather than supportive (vicarious experiences), and may be discouraged or choose to ignore feedback (verbal persuasion). Although not specific to doping SRE, research supports this association. For example, Dweck and Master (2009) reported that students with a growth mindset had higher self-efficacy than those with a fixed mindset, whilst a number of studies have shown that growth mindset interventions can improve various types of self-efficacy (Burnette et al., 2019, Orvidas et al., 2018; Samuel & Warner, 2021).

A large body of research exists exploring morality-based factors and doping. Mudrak, Slepicka, and Slepickova (2018), for example, found very weak to moderate, significant correlations between doping behaviour and both "winning in proportion" and acceptance of cheating. Similarly, anticipated guilt following hypothetical doping was significantly correlated with doping likelihood (Ring, Kavussanu, & Mazanov, 2019), though it should be noted that work by Barkoukis et al. (2011) did not find a difference in past doping behaviour or future doping intentions between individuals of high and low sportspersonship. With anticipated guilt inextricably linked to moral disengagement, it is again, plausible that mindset may also be associated via similar mechanisms discussed previously.

Finally, much of the existing research investigating psychological and psychosocial factors and doping has focused on intentional doping. It is important, however, to also explore these potential predictors with regards to inadvertent doping. Lack of education on anti-doping regulations has been cited as a key risk factor for inadvertent doping (Chan et al., 2016), and research has found that athletes who undergo just one, 60-minute education programme report lower scores on measures that reflected inadvertent doping (Hurst et al., 2020). Interestingly, the extent of effort that athletes impart to avoid inadvertent doping – such as by educating themselves to the possibility of prohibited substances being contained in legal dietary supplements and being vigilant when using such products – has been found to be predicted by doping moral disengagement scores (Boardley et al., 2019). This motivation has been identified as a key tool in combatting inadvertent doping, with it being suggested that autonomous motivation (doing something for the intrinsic rewards that it brings) is positively related to anti-doping attitudes and behaviours (Chan et al., 2020). Given that research has shown that motivation is also significantly impacted by mindset (see Dweck, 1999, for a review), a potential relationship between mindset and inadvertent doping (via motivation) is a logical but as yet speculative one.

1.4. Aims and hypotheses

To the authors' knowledge, no published research currently exists examining the potential relationship between mindset, doping attitudes, and moral disengagement. The present study aims to address this by testing two models that propose mindset to determine susceptibility to intentional and inadvertent doping via doping SRE, doping moral disengagement, and anticipated guilt. Based on literature presented to this point, it is hypothesised that mindset would positively predict doping SRE, which in turn, would negatively predict doping moral disengagement. The justification for this order (mindset > doping SRE > doping moral disengagement) is based on the work by Boardley et al., (2019) which found a moderate-to-strong negative predictive effect of doping SRE on doping moral disengagement. Furthermore, it is hypothesised that doping moral disengagement would positively predict susceptibility to intentional and inadvertent doping (Boardley et al., 2019) and negatively predict anticipated guilt (Boardley et al., 2017). Finally, anticipated guilt would be negatively associated with susceptibility to intentional and inadvertent doping (Boardley et al., 2017). Dweck, 1999 distinguished between mindset towards abilities (such as intelligence) and mindset towards other attributes (such as morality). Given the topic in question, it is thus appropriate to include two separate models (though with the same hypotheses); one in which mindset towards sporting ability (MSA) predicts initial doping SRE and one in which mindset towards moral character (MMC) predicts initial doping SRE.

2. Methods

2.1. Participants

322 student-athletes (153 female, 169 male) with an average age of 20.28 years (SD = 2.00) took part in the study. A total of 29 sports were represented in the sample, with athletics (18.6%), field hockey (14.9%), American football (10.6%), netball (9.9%), canoe/rowing (9.6%), swimming (8.4%), rugby union (6.8%), and football (6.5%) the most common sports represented (all other sports had frequencies less than 5%). Athletes from individual sports made up 36.3% of the sample, whilst athletes from team sports made up 53.1% of the sample, with the remaining 10.6% either unclassified or a combination of both individual and team. In terms of current level of participation, 1.9% of athletes reported that they play at international level, 8.0% at national level, 3.8% at regional level, 72.2% at University or local level, 13.7% at recreational (i.e., non-competitive) level, and 0.3% did not respond. Inclusion criteria for the study required all participants to be at least 18 years of age, to be students from one of two UK-based universities, and to have been part of a team or individual sports club for a minimum period of six months. Obtaining data from individuals from a variety of sports is a common approach within quantitative doping research on athletes of this age (e.g., Backhouse et al, 2013; Barkoukis, et al, 2014; Hurst et al., 2019).

2.2. Measures

The study employed a cross-sectional design. The full questionnaire consisted of six sections and can be found in the Appendix.

2.2.1. Demographic information and sports experience

The demographic information obtained was age and sex. Individuals were also asked to state their main sport, the highest level at which they had played this sport, and the current level at which they were playing the sport.

2.2.2. Doping moral disengagement scale – short (DMDS-short)

The DMDS-short was used to measure athletes' levels of doping moral disengagement. Participants indicated their agreement with six

statements relating to the mechanisms of euphemistic labelling, distortion of consequences, advantageous comparison, displacement of responsibility, diffusion of responsibility, and moral justification on a 7-point Likert scale ranging from 1 ('Strongly Disagree') to 7 ('Strongly Agree'). Higher scores indicated higher levels of doping moral disengagement. Scores obtained using the DMDS-short have been shown to have good levels of reliability and validity (Boardley et al., 2018).

2.2.3. Doping self-regulatory efficacy scale (DSRES)

The six-item DSRES was used to measure athletes' levels of doping self-regulatory efficacy. For example, their ability to "resist doping even if their training group encouraged them to do it" or "resist doping even if they knew they could get away with it". Participants responded using a 5-point Likert scale ranging from 1 ('No Confidence') to 5 ('Complete Confidence'). The mean score for these six items was calculated and used for the statistical analyses, with a higher score indicating greater confidence to resist/avoid doping. Good levels of reliability and validity have been found for scores obtained using the DSRES (Boardley et al., 2018).

2.2.4. Anticipated guilt to doping

The five items assessing guilt from the State Shame and Guilt Scale (Marschall et al., 1994) were used to measure anticipated guilt to doping. Psychometric support for this scale has been found in previous research (Marschall et al., 1994) and it has been applied within the doping domain by Boardley and colleagues (2018). Specifically, participants were asked to imagine a situation which involved them taking a banned performance-enhancing substance. They then responded to various statements (e.g., "I would feel remorse, regret") using a 5-point Likert scale ranging from 1 ('not at all') to 5 ('extremely'). The mean score for the five items was calculated and used for the statistical analyses, with higher scores reflecting greater anticipated guilt.

2.2.5. Susceptibility to intentional and inadvertent doping

Susceptibility to intentional and inadvertent doping was measured by having participants respond to two imagined situations, based on the approach developed and validated by Gucciardi et al. (2010). Specifically, situation one assessed the degree to which the individual would consider taking an undetectable banned performance-enhancing substance under medical supervision, whilst situation two assessed the extent of effort the individual would exert to avoid inadvertently doping. Situation one required participants to respond on a 7-point Likert scale ranging from 1 ('None at all') to 7 ('A lot'), thus, lower scores indicated less consideration to dope. Situation two required participants to respond on a seven-point Likert scale ranging from 1 ('No effort') to 7 ('Maximum effort'). The scale for the second situation is reverse coded, thus, when applied, lower scores indicated more effort to avoid inadvertently doping/lower susceptibility (in line with intentional doping). Both questions have been used successfully to measure susceptibility to intentional and inadvertent doping in previous research (Boardley et al., 2019).

2.2.6. Mindset towards sporting ability (MSA) and mindset towards moral character (MMC)

Dweck's (1999) Theories of Intelligence Scale and Kind of Person Implicit Theory Scale were used to measure MSA and MMC, respectively. The Theories of Intelligence Scale asks individuals to report their agreement with eight statements relating to their beliefs about intelligence on a 6-point Likert scale ranging from 1 ('Strongly Agree') to 6 ('Strongly Disagree'). The wording of the items was amended such that they address beliefs about sporting ability as opposed to intelligence. For instance, the item: "You have a certain amount of intelligence, and you can't really do much to change it" became: "You have a certain amount of sporting ability, and you can't really do much to change it". The scale requires four items to be reverse coded; when done so, higher scores reflect a more growth mindset and lower scores reflect a more fixed mindset. The Kind of Person Implicit Theory scale contains three items and uses the same 6- point Likert scale for responses. Wording for these items was not changed. Both scales have been found to generate scores with excellent validity and reliability across several samples (Dweck et al., 1995).

2.3. Procedures

University teams were informed about the study by word of mouth and email communication. Interested participants were then sent an information sheet detailing the specifics of the study and invited to take part in the study. Those who agreed received a link to the online questionnaire. Participants were made aware that their responses would be confidential and were informed of their right to withdraw; consent was then given by selecting 'yes' to the statement: 'I agree to participate in the present study'. Only by selecting 'yes' could the individual proceed to the main part of the questionnaire. The whole questionnaire took approximately 15 minutes to complete. Ethical approval was obtained from institutions of both Universities involved (Ethics Committee Project 1298/15411/2017 and Non-Invasive Human Ethics Committee application number 20/21-07).

2.4. Data analysis

Descriptive statistics, internal consistency scores, and Pearson correlations for all study variables were analysed using SPSS Statistics version 26 and are presented in Table 2. Descriptive statistics included means, standard deviations, skewness, and kurtosis. Internal consistency was assessed using Cronbach's alpha whereby values were deemed unacceptable ($\alpha < 0.5$), poor ($\alpha \geq 0.5$ to 0.6), questionable ($\alpha \geq 0.6$ to 0.7), acceptable ($\alpha \geq 0.7$ to 0.8), good ($\alpha \geq 0.8$ to 0.9), and excellent ($\alpha \geq 0.9$; see Nunnally and Bernstein, 1994). A Pearson's correlation analysis was carried out to investigate the relationships between scores on the various measures described above. Thresholds for the magnitude of correlations were set at small (0.1-0.3), moderate (0.3-0.5), and large (0.5-0.7) based on the work of Cohen (1988). Structural equation modelling (SEM) was used to test the model outlined previously and established in the hypotheses. SEM analysis was carried out using Mplus version 8.4 using maximum likelihood estimation (Muthén and Muthén, 2017). Responses were gathered from all 322 participants except in the case of age ($N = 317$) and three items from the DMDS-short (distortion of consequences, advantageous comparison, and displacement of responsibility; 321 participants). These instances of missing data were likely due to human error on the part of the participant and were not included in any statistical analysis. An alpha level of $p = .05$ was used to indicate significance throughout.

3. Results

3.1. Descriptive statistics and scale reliabilities

Descriptive statistics can be seen in Table 2. Across all participants, reported levels of doping moral disengagement were low and mean doping self-regulatory efficacy scores indicated that most participants were very confident in their ability to resist doping. Similarly, most participants indicated they would feel guilt and remorse in a situation in which they had taken performance enhancing drugs. Participants generally reported that they would not consider intentional doping whilst reporting that they would make considerable effort to avoid inadvertently doping. Mindset scores indicated that most individuals had a growth mindset towards their sporting ability. Individuals also tended to report a slight growth mindset towards their moral character, though this was notably less clear-cut. Skewness and kurtosis values indicated normal distribution for all variables (Curran et al., 1996). Internal consistency for the measures ranged from acceptable to excellent (Taber, 2018).

Table 2
Descriptive statistics and correlations for measures of doping attitudes and mindset.

Variable	*M*	*SD*	Range	Skew	Kurtosis	α	1	2	3	4	5	6
1. Doping Moral Disengagement	2.69	0.86	1.00-7.00	0.55	1.28	.66						
2. Doping Self-Regulatory Efficacy	4.35	0.82	1.00-5.00	-1.55	2.38	.92	-.36**					
3. Anticipated Guilt	3.91	0.86	1.00-5.00	-0.83	0.32	.88	-.34**	.25**				
4. Susceptibility to Intentional Doping	2.87	1.68	1.00-7.00	0.71	-0.29	-	.29**	-.38**	-.23**			
5. Susceptibility to Inadvertent Doping	2.89	1.63	1.00-7.00	0.61	-0.37	-	.27**	-.21**	-.31**	.15**		
6. Mindset towards Sporting Ability	4.28	0.77	2.25-6.00	0.03	-0.25	.84	-.19**	.23**	.11	-.10	-.11*	
7. Mindset towards Moral Character	3.63	1.17	1.00-6.00	-0.09	-0.59	.85	-.12*	.07	.07	-.04	-.13*	.36**

Note. * indicates $p < .05$, ** indicates $p < .01$.

3.2. Correlation analysis

Pearson correlations can be seen in Table 2. For mindset towards sporting ability there were significant, small, negative correlations with doping moral disengagement and susceptibility to inadvertent doping, and a significant, small, positive correlation with doping self-regulatory efficacy. For mindset towards moral character, there were significant, small, negative correlations with doping moral disengagement and susceptibility to inadvertent doping. Several other statistically significant relationships not relevant to the primary aims of the study were found between the various risk and protective factors for doping, as well as between mindset towards sporting ability and mindset towards moral character.

3.3. SEM results

Structural equation modelling (SEM) was used to test the hypothesised models. In order to assess model-fit data we used fit indices including chi-square (χ^2), comparative fit index (CFI), Tucker Lewis index (TLI), root mean square error of approximation (RMSEA) and standardised root mean square residual (SRMSR). Values greater than 0.90 and 0.95 for the TLI and CFI respectively and smaller than 0.08 and 0.06 for SRMR and RMSEA respectively indicate excellent model fit (Hu and Bentler, 1999). A two-step approach was used within this study, the first step was to produce a measurement model followed by the structural model.

The Mindset towards Sporting Ability measurement model consisted of latent factors of mindset towards sporting ability, doping self-regulatory efficacy, doping moral disengagement, anticipated guilt, and susceptibility to intentional and inadvertent doping. This model demonstrated good fit to the data, χ^2 (309) = 543.191, $p < 0.001$; CFI = 0.934; TLI = 0.925; RMSEA = 0.048; SRMSR = 0.057. The structural model showed good fit to the data, χ^2 (313) = 566.444, $p < 0.001$; CFI = 0.932; TLI = 0.923; RMSEA = 0.051; SRMSR = 0.059. Fig. 1 indicates mindset towards sporting ability had a moderate positive association with doping self-regulatory efficacy, doping self-regulatory efficacy had a moderate negative association with doping moral disengagement, and doping moral disengagement had a strong negative association with anticipated guilt and moderate positive associations with susceptibility to intentional and inadvertent doping. Overall, the Mindset towards Sporting Ability model accounted for 6.8% of doping self-regulatory efficacy variance, 21.7% of doping moral disengagement variance, 26.6% of anticipated guilt variance, 19.4% of susceptibility to intentional doping variance, and 16.9% of susceptibility to inadvertent doping variance.

The Mindset towards Moral Character measurement model consisted of latent factors of mindset towards moral character, doping self-regulatory efficacy, doping moral disengagement, anticipated guilt, and susceptibility to intentional and inadvertent doping. This model demonstrated good fit to the data, χ^2 (197) = 345.933, $p < 0.001$; CFI = 0.953; TLI = 0.944; RMSEA = 0.049; SRMSR = 0.049. The structural model showed good fit to the data, χ^2 (201) = 370.581, $p < 0.001$; CFI = 0.946; TLI = 0.938; RMSEA = 0.052; SRMSR = 0.057. Fig. 2 indicates mindset towards moral character had a weak non-significant positive association with doping self-regulatory efficacy, doping self-regulatory efficacy had a moderate negative association with doping moral disengagement, and doping moral disengagement had a strong negative association with anticipated guilt and moderate positive associations with susceptibility to intentional and inadvertent doping respectively. Overall, the Mindset towards Moral Character model accounted for 0.6% of doping self-regulatory efficacy variance, 21.3% of doping moral disengagement variance, 27.4% of anticipated guilt variance, 17.0% of susceptibility to intentional doping variance, and 17.5% of susceptibility to inadvertent doping variance.

To test the mediation paths shown in Figs. 1 and 2, we utilised the indirect function in Mplus. This decomposed the model effects into direct, indirect, and total effects (Bollen, 1987). Table 3 outlines the direct, indirect, and total effects, as well as the percentage of the total effect mediated by anticipated guilt for both the Mindset towards Sporting Ability and Mindset towards Moral Character models. Although there were significant total and direct effects for susceptibility to intentional and inadvertent doping, there were no significant indirect results for susceptibility to intentionally dope in either model.

4. Discussion

The present study aimed to test two models that proposed mindset (separately as MSA and MMC) to predict doping SRE, and to predict susceptibility to intentional and inadvertent doping via doping SRE, doping moral disengagement, and anticipated guilt. Interestingly, the

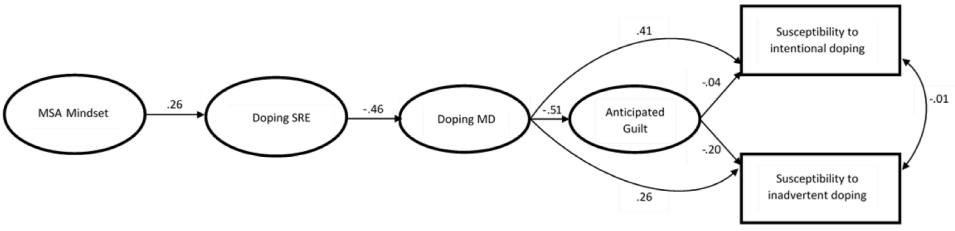

Fig. 1. Model testing mindset towards sporting ability SEM results.
Note: All variables are athlete variables. MSA = mindset towards sporting ability; SRE = self-regulatory efficacy; MD = moral disengagement. All paths significant at $p < 0.01$ except for the non-significant covariance between anticipated guilt and susceptibility to intentional doping; and susceptibility to intentional doping and susceptibility to inadvertent doping.

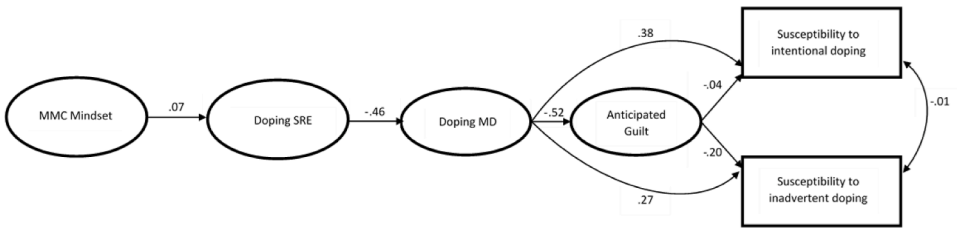

Fig. 2. Model testing Mindset towards Moral Character SEM results.
Note: All variables are athlete variables. MMC = mindset towards moral character; SRE = self-regulatory efficacy; MD = moral disengagement. All paths significant at $p < 0.01$ except for the non-significant covariance between MMC Mindset and doping SRE; anticipated guilt and susceptibility to intentional doping; and susceptibility to intentional doping and susceptibility to inadvertent doping.

Table 3
Mediation effects of doping moral disengagement on susceptibility to intentional and inadvertent doping via anticipated guilt.

Variable	Mindset Towards Sporting Ability Model		Mindset Towards Moral Character Model	
	Susceptibility to Intentional Doping	Susceptibility to Inadvertent Doping	Susceptibility to Intentional Doping	Susceptibility to Inadvertent Doping
Total Effect	0.44***	0.37***	0.41***	0.38***
Direct Effect	0.42***	0.27***	0.39***	0.27***
Indirect Effect	0.02	0.11**	0.02	0.11**
Percentage Total Effect (%)	2.30	10.50	4.10	17.20

Note: * = p < .05, ** = p < .01, *** = p < .001.

findings support the hypothesised relationship between MSA and doping SRE (such that a growth mindset was linked to greater doping SRE), but not between MMC and doping SRE. Associations between the various doping attitudes and susceptibility to intentional and inadvertent doping confirmed previous literature. Specifically, as in Boardley et al., (2017), there was a strong, negative predictive effect of doping SRE on doping moral disengagement (-.46 in the present study compared to -.45 in Boardley et al.) and a very strong, negative predictive effect of doping moral disengagement on anticipated guilt (-.52 vs -.60). Furthermore, compared with Boardley et al., (2019), slightly weaker, but still moderate, positive predictive effects of doping moral disengagement were found with both susceptibility to intentional doping (.38 vs .52) and susceptibility to inadvertent doping (.27 vs .42). However, perhaps surprisingly, for both MSA and MMC, anticipated guilt did not have a significant effect on susceptibility to intentional doping.

The discrepancy between the MSA and MMC models is an interesting one that contributes to the existing mindset literature that has distinguished between different applications of one's mindset. Yeager and Dweck, 2012, in a review of mindset within the education domain, highlighted the possibility for students to perceive their intelligence to be malleable (i.e., have a growth mindset) but for their personality to not be (i.e., have a fixed mindset). It is possible that athletes may see their sporting ability from a similarly distinct perspective, separate to other areas of their lives such as their moral character (Carless & Douglas, 2013). This context-dependent theory of identity is well-founded in sociological research (Baumeister & Muraven, 1996) and may lead athletes to define and characterise their sporting ability differently – for example, by perceiving themselves to have greater control over it. This may explain why MSA predicted doping SRE, but MMC did not. Indeed, whilst there was a significant correlation between MSA and MMC scores, given the similarities between the two constructs, it is perhaps surprising that this correlation was only moderate in strength. Such a distinction is important as it impacts decisions on the most appropriate measures used to ascertain mindsets in athletic populations in future research in the area.

Many of the key characteristics of growth and fixed mindsets are intuitively linked to Bandura's (1991) mechanisms of moral disengagement. For example, as discussed in the introduction, it is conceivable that a fixed mindset individual would have less appreciation for the hard work and training undertaken by their competitors, and therefore may not perceive the consequences of their doping as being so serious (distortion of consequences). The findings here in relation to the MSA model and the correlations between both MSA and MMC and doping moral disengagement support this, as well as that of the similar existing literature (e.g., Corrion et al., 2010;). Future research should look to explore the hypotheses around the individual mechanisms of moral disengagement discussed in the introduction by utilising the long version of the DMDS to attain a more nuanced understanding of the potential direct relationship between mindset and moral disengagement.

Dweck's Mindset Theory has been described as a social-cognitive approach to self-beliefs (Kapasi & Pei, 2022), and it is this cognitive focus which may explain the lack of significant correlations for anticipated guilt. The anticipated guilt measure asks individuals to "rate the extent to which you anticipate you would feel…", and as such, is concerned not with the cognitive response to doping, but rather the emotional response. Whilst cognition and affect are not wholly independent concepts, research within the social and psychological domain has long since established a distinct difference between the two, particularly when it comes to how an individual may interpret and respond to a questionnaire (De Haes et al., 1987; Pedro et al., 2018; Trafimow & Sheeran, 1998). It may be that the MSA and MMC measures of mindset are tapping into cognitive beliefs that are in turn, either reflecting or influencing the cognitively driven concepts of doping moral disengagement and doping self-regulatory efficacy, but not the emotionally driven concept of anticipated guilt.

This hypothesis may also explain why both models only find anticipated guilt to be related to susceptibility to intentional doping and not susceptibility to inadvertent doping. Whilst the two measures involve making a cognitive decision ("how much consideration would you give/ how much effort would you exert…"), the stem to each question is to "imagine being in the following situation". This requirement to imagine may evoke an emotionally driven process akin to that used when responding to the measure of anticipated guilt. It is also possible that a social desirability bias may be impacting these particular measures. Mindset (both MSA and MMC) was significantly correlated with inadvertent doping but not intentional doping. The questionnaire item about intentional doping is considerably more denunciatory than the item

about inadvertent doping, and therefore it may be that participants were less truthful with their responses to the former as compared to the latter (and other measures of doping attitudes), thus leading to a non-significant relationship.

Given the lack of existing research exploring the impact of mindset on doping attitudes, the present findings should lay the foundation for future work in the area, and in particular, a corroboration of these results. From this, it could prove worthwhile to examine the effectiveness of interventions aimed at fostering a growth mindset in reducing amenable attitudes towards doping and/or actual doping behaviour. WADA's anti-doping system has been reported to cost $228 million per year (Maennig, 2014) and therefore improving anti-doping education through interventions would have a considerable financial benefit, alongside the obvious sporting and health benefits. Mindset interventions are almost exclusively focused on educating individuals as to the benefits of growth characteristics (embracing of challenges, high persistence, preference for process-based feedback, etc.) through various teaching methods such as videos, examples and anecdotes, discussion, and self-reflection (see Yeager & Dweck, 2020 for a review). Whilst there have been no peer-reviewed, published studies examining mindset interventions in the sporting domain (that the authors know of), there exists a large amount of work exploring their effectiveness in the educational domain. For instance, a single, 45-minute, online growth mindset intervention has been shown to predict learning motivation and efficacy (Burnette et al., 2018), whilst students receiving a similar intervention reported enhanced entrepreneurial self-efficacy and task persistence compared to that of a control group (Burnette et al., 2020). It should be noted, however, that overall, findings as to the effectiveness of mindset interventions are mixed (see Campbell, Direito, & Mokhithi, 2021, for a recent review), though given the low-cost and relatively straightforward nature of the method, it nevertheless warrants investigation.

Even before such potential interventions, the present findings may have implications in terms of anti-doping strategies. Transgressive attitudes and behaviours towards doping have been shown to be predicted by doping SRE (Ring & Kavussanu, 2018b; Petrou et al., 2021), and therefore the fact that MSA has now been linked to doping SRE may allow for the identification of at-risk athletes. Assuming coaches are educated on the concept of mindsets, it may be easier for them to identify athletes who show fixed tendencies than it is for them to identify those with high doping moral disengagement. Such identification could then allow coaches and support staff (and potentially even the athletes themselves) to take the necessary steps to help reduce the likelihood of doping behaviours taking place. For instance, evidence-based strategies like developing task-oriented climates (Kavussanu et al., 2020) and discouraging perfectionistic tendencies (Hardwick et al., 2021) may be implemented.

Such suggestions do not come without caveats. It is important to remember that the current findings are based upon cross-sectional data, and therefore there is the inability to separate causation from effect. Whilst higher growth mindset towards sporting ability has been linked to higher doping SRE, it is unknown whether MSA actually *leads* to these doping-related perspectives. Future study designs should incorporate repeated measurements in order to support the results found here. Other limitations also exist within the present study. As with all questionnaire-based research on sensitive topics there is the risk of social desirability bias. Whilst all attempts were made to ensure and remind participants of the confidentiality and anonymity of their data, and that it was imperative that they responded truthfully, it cannot be ruled out that some of the athletes may not have given completely honest answers, particularly to the doping-related questions. How generalisable the findings are at the elite level is also open to debate, with most participants classifying themselves as student-athletes (only 9.9% stated that they currently compete at national or international level).

In conclusion, the present study is the first to explore Dweck, 1999 Mindset theory in relation to attitudes towards doping and factors that have been found to be associated with doping behaviour. Support was found for a model that proposed mindset towards sporting ability to predict doping self-regulatory efficacy (and which provided further confirmation for various relationships between doping attitudes established in the existing literature). Interestingly, no support was found for the same model but with mindset towards moral character replacing the MSA measure. The findings have important implications for the area of anti-doping and future research should look to explore the effectiveness of mindset interventions on reducing transgressive doping attitudes and behaviours.

CRediT authorship contribution statement

Luke Wilkins: Conceptualization, Methodology, Validation, Formal analysis, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration. **Anna Dunn:** Investigation, Resources, Data curation. **Barnaby N. Zoob Carter:** Formal analysis, Writing – review & editing. **Ian D. Boardley:** Writing – review & editing, Supervision, Project administration.

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