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# Ego orientation is related to doping likelihood via sport supplement use and sport supplement beliefs

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## ABSTRACT

A growing body of evidence suggests sport supplement use is positively related to doping likelihood, both directly and indirectly via beliefs that sport supplements are effective for improving performance. However, it is unclear what leads an athlete to use sport supplements and whether such factors play a role in the supplement-beliefs-doping relationship. To address this issue, we examined whether motivational goal orientations were related to doping likelihood directly and indirectly via sport supplement use and sport supplement beliefs. Competitive athletes ( $N = 362$ , 39% female, mean  $\pm$  SD; age =  $23.6 \pm 10.3$  years, hours per week training =  $5.8 \pm 2.1$ , years competing =  $5.8 \pm 5.4$ ) from a range of sports (e.g. athletics, soccer, weightlifting) completed an online survey measuring task and ego goal orientation, sport supplement use, sport supplement beliefs, and doping likelihood. Results indicated that ego orientation, but not task orientation, was indirectly related to doping likelihood via sport supplement use and sport supplement beliefs. This suggests that athletes who are ego oriented are more likely to use supplements, believe supplements are effective, and dope. These data suggest that researchers should consider ego goal orientations when interpreting relationships between sport supplement use and doping likelihood.

## KEYWORDS

Behaviour; doping; motivation; quantitative study; psychology

## Highlights

- Ego orientation is related to doping likelihood via sport supplement use and beliefs.
- Task orientation is not related to doping likelihood via sport supplement use and beliefs.
- Ego-orientated athletes using sport supplements may be more likely to dope.
- Researchers should consider ego goal orientation when interpreting relationships between sport supplement use and doping likelihood.

## Introduction

The use of sport supplements, such as caffeine, creatine, and sodium bicarbonate, is widespread among athletes (Maughan et al., 2018). Athletes' motivation to use sport supplements can be for a variety of reasons, including improvements in performance, facilitating recovery, and preventing illnesses (Dietz et al., 2014; Parnell et al., 2015). A body of evidence (e.g.

Barkoukis et al., 2020; Heller et al., 2020; Hurst et al., 2019) however, indicates that sport supplement use is positively related to the use of substances and methods prohibited by the World Anti-Doping Agency (i.e. doping). However, not all sport supplement users will progress to doping. Individual factors are likely to explain why some sport supplement users are more likely to dope than others. Recently, Hurst et al. (2019) found that sport supplement use was related to doping likelihood indirectly via beliefs that supplements are effective at improving performance. While this research has reported some novel data relating to what may increase the likelihood of sport supplement users progressing to doping, no research has examined whether the motivational orientation for using sport supplements plays a role in the sport supplement use-doping relationship. If knowledge and understanding of the phenomenon is to progress, a need exists in examining the relevant antecedents of sport supplement use and the influence this has on the likelihood to dope. The present study therefore examined motivational

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orientation as a predictor of the relationship between sport supplement use, beliefs, and doping likelihood.

### **Doping likelihood**

Research into the psychological mechanisms related to doping has relied primarily on self-report measures. However, given that direct questioning can be unreliable due to self-presentation bias, research has instead used indirect measures to assess an athlete's likelihood to dope (e.g. Hurst et al., 2020; Huybers & Mazanov, 2012). Doping likelihood can be defined as an athlete's probability to use prohibited substances and methods depending on the situation. It is assessed by asking athletes to indicate how likely they would be to dope depending on certain circumstances, such as the increased chance of financial rewards, low chance of getting caught, and reduced health risks.

A body of research has assessed an athlete's likelihood to dope (e.g. Connor et al., 2013; Kavussanu et al., 2020; Ring et al., 2020). Research has identified strong relationships between doping likelihood and anticipated guilt (Ring, Kavussanu, & Mazanov, 2019b), moral identity (Kavussanu & Ring, 2017; Kavussanu et al., 2020) and moral disengagement (Kavussanu & Ring, 2017; Ring & Hurst, 2019). The validity of doping likelihood can also be evidenced in its ability to differentiate between athletes' likelihood to use a prohibited substance depending on the situation they are presented with, such as financial rewards or being banned from sport (Ring, Kavussanu, Lucidi, et al., 2019a). In short, a body of evidence has shown that doping likelihood is a strong alternative and valid proxy of doping behaviour.

### **Sport supplements and doping**

The Incremental Model of Doping Behaviour (IMDB; Petróczi, 2013) posits that athletes become accustomed and encouraged to use performance-enhancing methods (e.g. sport supplements), and, over time, develop the belief that doping is another means to improve performance. Underpinned by contextual factors related to accepted norms and practices, whereby sport encourages performance enhancement (Waddington & Smith, 2009), athletes are encouraged to use various methods to enhance their performance, either explicitly (e.g. a nutritionist suggesting the use of a sport supplement) or implicitly (e.g. witnessing successful athletes use sport supplements). As a result, they can develop the mindset that using performance-enhancing methods is an acceptable and needed practice, and over time, the distinction between permitted (e.g. sport supplements)

and prohibited methods becomes blurred (Petróczi, 2013). Moreover, the model recognises that motivational goals influence behaviour and proposes that preferred goals adopted by athletes can change from mastery to performance as they progress in their sport.

While no evidence has established that sport supplement users progress to doping, a growing body of cross-sectional evidence has found that sport supplement users are more likely to dope than non-users. Dietz et al. (2013) reported that doping use was higher amongst sport supplement users (20.6%) than non-users (11.4%), Backhouse et al. (2013) noted that more sport supplements users reported doping than non-users, and Barkoukis et al. (2020) found that sport supplement users were twice as likely to dope than non-users. Meta-analytical evidence (Ntoumanis et al., 2014) indicates that sport supplement use is one of the strongest predictors of both doping use (odds ratio = 8.24, 95% CI = 5.07–13.39) and intention ( $r = 0.36$ , 95% CI = 0.20–0.52).

While the extant literature suggests sport supplement users are more likely to dope than non-users, only a small fraction of sport supplement users will go on to dope. Accordingly, personal factors can be expected to play a role in determining whether a sport supplement user will dope. Recently, Hurst et al. (2019) reported that the relationship between sport supplement use was indirectly related to doping via sport supplement beliefs, suggesting that sport supplement users, who believe that supplements are effective, are more likely to dope than those who do not hold such beliefs. This finding was replicated in a follow-up study by Hurst et al. (2021), who showed that the use of ergogenic and medical sport supplements were indirectly related to doping attitudes via sport supplement beliefs. Although these data provide partial support for the IMDB (Petróczi, 2013) and suggest that users of sport supplements may develop beliefs that using performance-enhancing methods are necessary to improve performance, and in turn, be more likely to dope, no research has examined whether motivational orientation to use sport supplements play a role in the sport supplement use-doping relationship. A need therefore exists in identifying factors that may encourage sport supplement use, and the influence this has on an athlete's likelihood to dope.

### **Achievement goals, sport supplements and doping**

Achievement Goal Theory (Nicholls, 1989) proposes that people participate in achievement contexts to develop or demonstrate competence, which can be embedded

into two distinct types of achievement goals: task and ego. Those who are task orientated tend to evaluate competence using self-reference criteria and feel successful when they master a skill, work hard to accomplish a personal goal, and/or demonstrate personal improvement. In contrast, those who are ego orientated, tend to evaluate competence when winning a competition and/or establishing superiority over others. Task and ego orientations have been found to be orthogonal, whereby an athlete can be high or low on either or both types of goals (Allen et al., 2015).

Given that a central principle of Achievement Goal Theory is that people are motivated to demonstrate competence when engaging in achievement contexts (Nicholls, 1989), it is likely that an athlete's goal orientation is related to their decision to use performance-enhancing methods. Indeed, several studies have reported that goal orientations are related to attitudes towards doping (Allen et al., 2015; Hardwick et al., 2021; Sas-Nowosielski & Swiatkowska, 2008). Using a modified version of the Performance Enhancement Attitude Scale (Petróczi, 2006), Allen et al. (2015) found that athletes' ( $N = 177$ ) ego orientation was positively related to doping attitudes ( $r = 0.31, p < 0.01$ ), whereas task orientation was negatively related to doping attitudes ( $r = -0.34, p < 0.01$ ). More recently, Hardwick et al. (2021) used a shortened version of the Performance Enhancement Attitude Scale (Nicholls et al., 2017) and reported that ego orientation was positively related to doping attitudes ( $r = 0.27, p < 0.01$ ), whereas no relationship was found for task orientation ( $r = -0.13, p > 0.05$ ). In a meta-analysis of psychosocial predictors of doping, Ntoumanis et al. (2014) showed that task orientation was a weak negative predictor of doping behaviour ( $r = -0.09, 95\% \text{ CI} = -0.17 \text{ to } -0.01$ ), whereas ego orientation was not related ( $r = 0.04, 95\% \text{ CI} = -0.02 \text{ to } 0.11$ ). Given the inconsistent findings, it remains to be established whether task and ego goal orientations are related to doping.

In contrast to the body of evidence examining goal orientations and doping, the association between goal orientation and sport supplements has received little attention. Based upon Achievement Goal Theory (Nicholls, 1989), it is likely that both task and ego-orientated athletes are likely to use sport supplements. For a task-orientated athlete, sport supplements could enhance training intensity or recovery from competition, which, in turn, will help improve their performance. A task-orientated athlete could use a sport supplement to facilitate recovery from an intense training session and allow that athlete to train at a similar intensity the next day. Similarly, for ego-orientated athletes, sport supplements could help outperform others and win.

An ego-orientated athlete could ingest a sport supplement prior to competition to improve their chances of winning. Accordingly, it is likely that both task and ego-orientated athletes may use sport supplements to help demonstrate competence and achieve their goals.

To our knowledge, only one published study has examined relationships between goal orientations and sport supplement use. Using Elliot and McGregor's (2001)  $2 \times 2$  Achievement Goal theory, Barkoukis et al. (2020) found that sport supplement use among competitive athletes was not related to any types of achievement goals ( $r$  range =  $-0.07$ – $0.05, p > 0.05$ ). Given the theoretical relevance of goals regarding the use of substances for performance enhancement (Petróczi, 2013), there is a need to determine whether these findings are replicated in the context of Nicholls' (1989) Achievement Goal Theory and whether task and ego orientations are related to sport supplement use and doping likelihood.

### **The present research**

Sport supplement users are more likely to report using doping substances than non-users (Backhouse et al., 2013; Barkoukis et al., 2020; Dietz et al., 2013), and, moreover, the relationship between sport supplement use and the likelihood to dope is indirectly related via beliefs that sport supplements are effective (Hurst et al., 2019; Hurst et al., 2021). However, to date, only one study has investigated whether achievement goals are related to sport supplement use (Barkoukis et al., 2020), and none has examined the path between achievement goals, supplement use and doping (e.g. achievement goals  $\rightarrow$  sport supplement use  $\rightarrow$  sport supplement beliefs  $\rightarrow$  doping likelihood). To help develop knowledge and understanding of what may increase the likelihood of an athlete doping, a need exists to examine relationships between achievement goals, sport supplement use, sport supplement beliefs, and doping likelihood. Therefore, the aims of our research were to determine whether task and ego orientation were associated with doping likelihood, both directly and indirectly via sport supplement use and sport supplement beliefs.

## **Materials and methods**

### **Participants and sample size**

Participants were 362 (mean  $\pm$  SD; age =  $23.6 \pm 10.3$  years, hours per week training =  $5.8 \pm 2.1$ , years competing =  $5.8 \pm 5.4$ ) competitive male (61%) and female (39%) athletes. The sample was represented by 27 different

sports, with the majority competing in football (32%), athletics (24%) and weightlifting (9%), at club (39%), university (6%) county (15%), regional (11%), national (23%) and international (6%) level. Eligibility criteria stipulated that participants were registered with a sports team, trained twice or more per week, and aged 16 or over. A post-hoc power analysis was conducted using G\*Power version 3.1 (Faul et al., 2009) with a linear multiple regression model (Fixed model,  $R^2$  deviation from zero). Squared multiple correlations amongst variables associated with doping likelihood indicated a medium effect ( $f^2 = 0.17$ ) and using an alpha of 0.05 with three predictors indicated the sample size of 362 has a power of 0.99 to detect effects.

## Measures

### Goal orientation

Task and ego goal orientation were measured using the Perception of Success Questionnaire (Roberts et al., 1998). Participants were presented with the following statement “When competing in sport I feel most successful when ...” followed by 12 items measuring task (e.g. “when I work hard” and “when I overcome difficulties”) and ego (e.g. “when I beat other people” and “when I outperform my opponents”) goal orientations. Participants responded on a 7-point Likert type, anchored by 1 (*strongly disagree*) and 7 (*strongly agree*). The mean scores of both task and ego orientation sub-scales were computed and used in all analyses. The same procedure was followed for all scales. Roberts et al. (1998) reported good internal consistency for both task ( $\alpha = 0.88$ ) and ego ( $\alpha = 0.88$ ) sub-scales.

### Sport supplement use

Similar to previous research (Backhouse et al., 2013; Bar-koukis et al., 2020; Hurst et al., 2021), sport supplement use was measured with a single question. Participants were first presented with the following definition of sport supplements: “Sport supplements are 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” (Maughan et al., 2018). They were then presented with four statements and asked to indicate which best represents them: (1) “I have never used a sport supplement”, (2) “I have used a sport supplement once, but never since”, (3) “I use sport supplements occasionally”, and (4) “I use sport supplements regularly”.

### Sport supplement beliefs

We used the Sports Supplements Beliefs Scale (Hurst et al., 2017) to measure participants’ beliefs about the effectiveness of sport supplements. Participants were presented with six statements (e.g. “Supplements improve my confidence” and “Supplements help me realise my potential”) and asked to indicate their responses on a 6-point Likert-type scale from 1 (*strongly disagree*) to 6 (*strongly agree*). The scale has shown very good internal consistency ( $\alpha = 0.91$ ; Hurst et al., 2017).

### Doping likelihood

We measured doping likelihood using measures adapted from previous research (Huybers & Mazanov, 2012; Ring & Hurst, 2019; Ring, Kavussanu, Lucidi, et al., 2019a). Participants were presented with the following statement: “Imagine that you are an athlete who is due to compete in an important sporting event”. They were then asked to indicate how likely they would be to use a prohibited substance in nine hypothetical situations (e.g. “you expect a financial gain of £75,000” and “the chance of being caught is very low”) on a 7-point Likert-type scale, anchored by 1 (*not at all likely*) to 7 (*very likely*). The measure has demonstrated strong relationships to other doping risk factors (e.g. doping moral disengagement and doping self-regulatory efficacy; Ring, Kavussanu, Lucidi, et al., 2019a) and has shown very good internal consistency ( $\alpha = 0.93$ ; Ring et al., 2020).

## Procedure

After obtaining approval from the lead author’s university, we used convenience sampling to recruit participants to the study via social media (e.g. Facebook, Instagram, and Twitter). Participants were first presented with information about the study, its purpose, eligibility criteria for participation, and that all data would be anonymous and confidential. After consenting, they completed measures described above using an online survey.

## Data analysis

Data were analysed using SPSS version 26.0 (IBM, Armonk, NY, USA). Little’s Missing Completely at Random test (MCAR; Little, 1988) identified 7 (1.93%) participants with missing data, which were missing completely at random ( $\chi^2 = 229.687$ ,  $df = 233$ ,  $p = 0.549$ ). Multiple imputation generated five data sets with maximum parameters set at 100, with the mean of the five data sets used to replace missing data. As the doping likelihood measure

**Table 1.** Descriptive statistics, alpha coefficients, and zero-order correlations (N = 362).

Measure	Mean	SD	$\alpha$	1	2	3	4
1. 1. Task orientation	6.26	1.02	0.94				
1. 2. Ego orientation	5.03	1.42	0.92	0.24**			
1. 3. Sport supplement use	2.23	1.22	N/A	0.14*	0.17*		
1. 4. Sport supplement beliefs	2.78	1.21	0.90	0.05	0.23**	0.50**	
1. 5. Doping likelihood	2.27	1.50	0.92	-0.07	0.17*	0.18*	0.29*

Note: Possible range scores for sport supplement use: 1–4; for sport supplement beliefs: 1–6; and for doping likelihood and task and ego orientation: 1–7. \* $p < 0.05$ ; \*\* $p < 0.01$ .

has not been scrutinised for model fit, we used Confirmatory Factor Analysis using AMOS version 26.0 and the maximum likelihood estimation to test the factorial validity of the doping likelihood measure. Model fit was assessed using chi-square to degrees of freedom ( $\chi^2/df$ ). However, given that the  $\chi^2/df$  is susceptible to large sample sizes (Heene et al., 2011), model fit was also assessed using the following fit indices: comparative fit index (CFI), standardised root mean square residual (SRMR), and root mean square error of approximation (RMSEA). Good model fit was inferred when the  $\chi^2/df$  is between 1 and 3 (Kline, 2015), CFI is close to 0.95, the SRMR close to 0.08, the RMSEA is close to 0.06 (Hu & Bentler, 1998) and the lower bound of the RMSEA is lower than 0.05 (Browne & Cudeck, 1992).

Frequencies were computed for sport supplement use and descriptive statistics and zero-order correlations were calculated for all measures. Correlation coefficients ( $r$ ) were interpreted as representing small (0.1), medium (0.2), and large effect sizes (0.3; Gignac & Szodorai, 2016). Cronbach alphas ( $\alpha$ ) were calculated for both goal orientations measures, sport supplement beliefs and doping likelihood, with coefficients interpreted as excellent ( $\geq 0.9$ ), good ( $\geq 0.80$ ), acceptable ( $\geq 0.70$ ), questionable ( $\geq 0.6$ ), poor ( $\geq 0.5$ ) and unacceptable ( $< 0.5$ ; George, 2011).

We used PROCESS v3.5 (Hayes, 2017) SPSS macro to test direct and indirect (via sport supplement use and/or beliefs) effects for both task and ego orientation on doping likelihood. Bootstrapping was set at 10,000 samples and bias-corrected 95% confidence intervals (CIs) were estimated for all effects. An effect was significant when the CI did not cross zero. The completely standardised indirect effect (CSIE) was reported as the effect size, with magnitude of 0.01, 0.09, and 0.25 indicating small, medium and large effects, respectively (Preacher & Kelley, 2011).

## Results

### Model fit of the doping likelihood measure

The 9-item doping likelihood measure had poor model fit ( $\chi^2 (28) = 242.58$ ,  $p < 0.001$ , CFI = 0.933, SRMR =

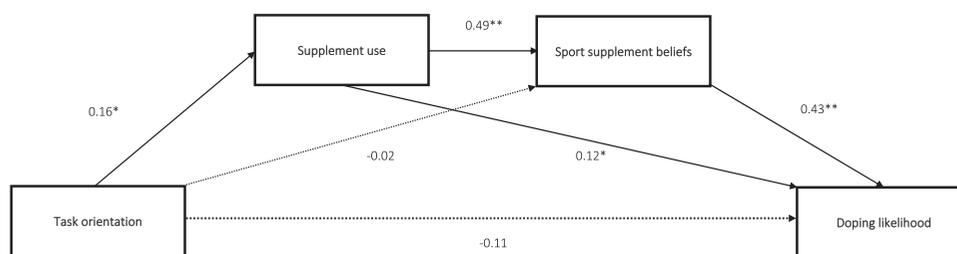
0.063, RMSEA = 0.146, 95% CI = 0.129–0.163). Inspection of modification indices suggested that four items be deleted to improve model fit. These items were: “you expect a financial gain of £75,000”, “it will lead to accelerated career development”, “the chance of being banned is very low”, and “it will help you overcome bad form”. The modified 5-item model had excellent fit ( $\chi^2 (5) = 13.100$ ,  $p = 0.02$ , CFI = 0.994, SRMR = 0.015, RMSEA = 0.067, 95% CI = 0.023–0.113). Factor loadings ranged from 0.77 to 0.88 and were significant at  $p < 0.01$ .

### Cronbach alphas, descriptive statistics, and zero-order correlations

All measures exhibited excellent internal consistency (Table 1). Nearly half of participants reported never have used a sport supplement ( $n = 162$ , 45%). Out of the remaining 55% of athletes who used sport supplements, 9% ( $n = 32$ ) used them once but never since 25% ( $n = 92$ ) used them occasionally, and 21% ( $n = 76$ ) used them regularly. The sample was characterised by high task and ego orientation, moderate beliefs in the effectiveness of sport supplements, and a low likelihood to dope. Zero-order correlations indicated that sport supplement use was positively correlated with sport supplement beliefs, doping likelihood and task and ego orientation. Scores for sport supplement beliefs were positively correlated with doping likelihood and ego orientation, and doping likelihood was positively correlated with ego orientation. Task and ego orientation were positively correlated with each other.

### Direct and indirect effects of task and ego orientation on doping likelihood

Task orientation was not directly related to doping likelihood and there was no indirect effect via sport supplement use or beliefs (Figure 1 and Table 2). Ego orientation was not related to doping likelihood directly, however, it was related indirectly via sport supplement use alone, sport supplement beliefs alone, and the serial combination of sport supplement use and beliefs (Figure 2 and Table 2). The total indirect effect of ego



**Figure 1.** The effects of task orientation on doping likelihood and the mediating role of sport supplement use and sport supplement beliefs. Note. The values presented are the unstandardised regression coefficients. A solid line represents a significant relationship. \* $p < 0.05$ , \*\* $p < 0.01$ .

orientation on doping likelihood was significant and small.

## Discussion

Our study aimed to determine whether task and ego orientation were associated with doping likelihood, both directly and indirectly via sport supplement use and sport supplement beliefs. We found that ego orientation was indirectly related to doping likelihood via both sport supplement use and sport supplement beliefs. Ego orientation was a positive predictor of sport supplement use, which in turn, positively predicted sport supplement beliefs, and doping likelihood. The pathway between sport supplement use, sport supplement beliefs and doping likelihood has been noted elsewhere (Hurst et al., 2019; Hurst et al., 2021). Our results extend current understanding of the sport supplement use-doping relationship and indicate that ego-orientated athletes may be more likely to dope because of their use of sport supplements and belief that they are effective.

The results of our study are similar to Barkoukis et al. (2020) who reported that from a sample of 479 competitive athletes, achievement goals orientations moderated the relationship between sport supplement use and doping, further highlighting the potential of motivational orientations regulating doping decisions. Our results extend this understanding and suggest that ego orientations may lead an athlete to use sport supplements, believe that they are effective, and in turn, be more likely to dope. Similarly, while several studies have reported positive relationships between sport supplements and doping (Backhouse et al., 2013; Heller et al., 2020; Hurst et al., 2019), our results suggest that motivation is a factor to consider when evaluating the association.

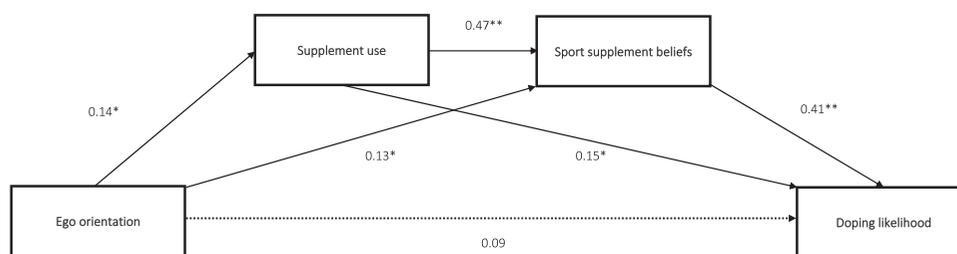
Task goal orientation was not directly related to doping or indirectly via sport supplement use and sport supplement beliefs. This contrasts with previous cross-sectional research (Allen et al., 2015; Sas-Nowosielski & Swiatkowska, 2008) and meta-analytical data (Ntoumanis et al., 2014) reporting small-to-moderate negative relationships. Reasons for these differences

**Table 2.** Direct and indirect effects for both task and ego orientation on sport supplement use, sport supplement beliefs and doping likelihood.

Pathways	B	95% CI	CSIE	95% CI
<i>Direct effects of task orientation on</i>				
Sport supplement use	0.16*	0.04–0.29		
Sport supplement beliefs	–0.02	–0.13–0.08		
Doping likelihood	–0.11	–0.26–0.03		
<i>Indirect effects of task orientation on doping via</i>				
Sport supplement use	0.02	–0.02–0.06	0.01	–0.02–0.04
Sport supplement beliefs	–0.01	–0.05–0.03	–0.01	–0.03–0.02
Sport supplement use and beliefs	0.03	–0.01–0.07	0.02	–0.02–0.04
<i>Direct effects of ego orientation on</i>				
Sport supplement use	0.14**	0.06–0.23		
Sport supplement beliefs	0.13**	0.05–0.20		
Doping likelihood	0.10	–0.02–0.18		
<i>Indirect effects of ego orientation on doping via</i>				
Sport supplement use	0.02*	0.00–0.05	0.02	0.00–0.05
Sport supplement beliefs	0.05*	0.02–0.10	0.05	0.02–0.09
Sport supplement use and beliefs	0.03*	0.01–0.05	0.03	0.01–0.05

Note: Unstandardised coefficients are shown. CSIE = completely standardised indirect effect.

\* $p < 0.05$ ; \*\* $p < 0.01$ .



**Figure 2.** The effects of ego orientation on doping likelihood and the mediating role of sport supplement use and sport supplement beliefs. Note. The values presented are the unstandardised regression coefficients. A solid line represents a significant relationship. \* $p < 0.05$ , \*\* $p < 0.01$ .

may relate to the measures used to assess doping. We used a self-referenced measure whereby participants imagine their behaviour in a hypothetical scenario, whereas other studies have used doping attitudes as a proxy of doping behaviour. Specifically, Allen et al. (2015) used the Performance Enhancement Attitude Scale (Petróczi, 2006), which has come under criticism regarding its validity for measuring doping-related cognitions (Folkerts et al., 2021) whereas Sas-Nowosielski and Swiatkowska (2008) used an ad-hoc doping survey that measured attitudes relating to anti-doping controls, doping sanctions, the ethical rationale for anti-doping policy and behavioural dispositions to dope. Thus, differences in results between our study and previous research may relate to the instruments used to measure doping.

Our results partially support the Incremental Model of Doping Behaviour (Petróczi, 2013), which suggest that doping is a learned, goal-orientated behaviour that develops over time from the habitual use of performance-enhancing methods (e.g. sport supplements). While we only took measures at one time point and cannot suggest that ego-orientated athletes are more likely to progress to doping substance use after sport supplement use, our finding suggests that athletes who use sport supplements have stronger beliefs that performance-enhancing methods are effective to achieve their goals of winning, and as result, be more likely to dope. As a next step, it would be beneficial to understand if an athlete is more likely to progress to doping if they are ego involved due to their use of sport supplements and belief that they are effective.

Our findings have implications for those interested in preventing doping in sport. Results suggest that athletes' perceptions of success may influence their reasoning and belief for using sport supplements and their likelihood to dope. Athletes who define success in terms of outperforming others and winning may be more likely to use sport supplements, believe that they are effective, and progress to doping. Although it is

recognised that doping is a complex and multifaceted psychosocial phenomenon (Hauw & McNamee, 2015), involving beliefs, morality, and perceptions of others (see Ntoumanis et al., 2014 for review), it might be beneficial for anti-doping organisations to target ego goal orientations in their interventions. This could be achieved by downplaying the importance of winning and beating others to demonstrate success. Such an approach has recently been included in an anti-doping intervention, which was effective in reducing the likelihood of doping after 6-months (Kavussanu et al., 2021), and may be more effective than interventions focusing solely on disseminating information about anti-doping rules and regulations (Hurst et al., 2020).

### Limitations and future research

The findings reported here need to be considered in light of some potential limitations. First, we used a cross-sectional design and cannot make firm inferences related to causality. It is recommended that future research uses longitudinal and/or experimental designs (e.g. Ring & Kavussanu, 2018) to provide clearer evidence of the influence task and ego orientation have on the relationship between sport supplement use, beliefs, and doping likelihood. Second, recent research has found that the use of certain types of sport supplements (i.e. ergogenic and medical) are related to doping, whereas others are not (i.e. sport foods and superfoods; Hurst et al., 2021). As we did not consider sport supplement type in our analyses, the effects may differ depending on the type of sport supplement used. Future research should consider analysing the use of different types of sport supplements and their relationship with task and ego goal orientation. Finally, given that replication studies in social science are lacking (Shrout & Rodgers, 2018), future research should consider replicating our results to help sport organisations make a more informed decision of the combined risk

ego orientation and sport supplement use have on the likelihood to dope.

## Conclusion

We found that ego orientation, but not task orientation, was indirectly related to doping likelihood via sport supplement use and sport supplement beliefs. This finding suggests that athletes who are ego orientated may be more likely to use prohibited substances due to using sport supplements and believing that they are effective. These results are relevant for organisations aiming to prevent doping and highlight sport organisations should consider targeting sport supplement users who are ego orientated in their education programmes.

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