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Implicit versus explicit attitude to doping: Which better predicts athletes' vigilance towards unintentional doping?

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Abstract

Objectives: This preliminary study examined whether implicit doping attitude, explicit doping attitude, or both, predicted athletes' vigilance towards unintentional doping.

Design: A cross-sectional correlational design.

Methods: Australian athletes (N = 143; M_{age} = 18.13, *SD = 4.63*) completed measures of implicit doping attitude (brief single-category implicit association test), explicit doping attitude (Performance Enhancement Attitude Scale), avoidance of unintentional doping (Self-Reported Treatment Adherence Scale), and behavioural vigilance task of unintentional doping (reading the ingredients of an unfamiliar food product).

Results: Positive implicit doping attitude and explicit doping attitude were negatively related to athletes' likelihood of reading the ingredients table of an unfamiliar food product, and positively related to athletes' vigilance toward unintentional doping. Neither attitude measures predicted avoidance of unintentional doping. Overall, the magnitude of associations by implicit doping attitude appeared to be stronger than that of explicit doping attitude.

Conclusions: Athletes with positive implicit and explicit doping attitudes were less likely to read the ingredients table of an unknown food product, but were more likely to be aware of the possible presence of banned substances in a certain food product. Implicit doping attitude appeared to explain athletes' behavioural response to the avoidance of unintentional doping beyond variance explained by explicit doping attitude.

Keywords: implicit association test; doping in sport; prohibited substances; performance enhancing drugs;

Introduction

Doping is prohibited in sport because it contravenes rules and is against the spirit of fair play. The World Anti-doping Agency's (WADA) strict liability policy states that doping is a violation, regardless of whether it is intentional or unintentional. Athletes found guilty of doping in sport are often blamed for their intention to cheat by illegally enhancing their sport performance[1]. Of course, intentional doping does occur and anti-doping procedures are geared toward identifying and sanctioning cheats, but research also indicates that athletes can dope accidentally if they unintentionally or unwittingly take banned substances through the form of food/drink, medication, and/or nutritional supplements[1]. Accordingly, athletes and their entourage (e.g., trainers, coaches, managers, and parents) need to be vigilant in ensuring that the foods or substances consumed by the athletes do not contain ingredients that are prohibited in sport. The issue of unintentional doping is increasingly complex given that athletes often feign unintentional doping as a mitigating circumstance for failing a doping test. Psychological research on doping has tended to assume that doping is intentional, and has neglected the potential for unintentional doping and the psychological factors that may determine its occurrence[2-7]. The present study examined whether athletes' attitude toward doping, measured both explicitly and implicitly [8], predicted athletes' awareness of unintentional doping, as well as behaviours in relation to the avoidance of such doping.

In recent research, attempts have been made to understand factors that help athletes to prevent unwitting consumption of banned performance-enhancing substances. To date, research has identified a number of psychological factors (e.g., self-control, motivation) that have been shown to align with athletes' intended or actual participation in behaviors related to vigilance in avoiding unintentional doping (e.g., avoid taking or consuming unfamiliar food/drink/supplement products, reading the ingredients table of unfamiliar foods and supplements, being aware of the presence of banned performance-enhancing substances in unfamiliar foods and supplements)[2-4, 6, 7]. Studies have also indicated that individuals who hold positive beliefs with respect to the avoidance of unintentional doping (i.e., perceiving

that the avoidance of doping is good for sport, morality, career, and health) are more likely to report intentions to prevent unintentional doping[4]. Although positive doping attitudes have consistently been shown to be a direct or indirect positive predictor of athletes' intention to dope[9, 10] and actual use of banned performance-enhancing substances[11], a negative association between doping attitude and behaviours related to the avoidance of unintentional doping cannot be assumed. For example, athletes may express positive attitudes towards doping avoidance in self-report surveys but actually harbor positive attitudes for doping. This is because expressing positive attitudes toward doping is likely to be considered undesirable and socially unacceptable. As a consequence, athletes may explicitly express negative doping attitudes, but covertly hold positive attitudes. Such opposing attitudes have also been identified in other domains whereby overt expression of attitudes is considered distasteful or socially unacceptable, such as sexism or racism[12, 13]. Researchers in these domains, including doping, have therefore employed measures to assess implicit attitudes as a means to identify covertly-held attitudes and test their differential prediction of behavioural outcomes alongside explicit measures from self-report questionnaires. The importance of investigating athletes' doping attitude by both implicit measures and explicit measures is that implicit measures capture an athlete's automatic evaluation, whereas explicit measures reflect responses associated with conscious self-reflection[14, 15].

Although studies on *intentional* doping in sport have included both explicit[10, 11, 16-18] and implicit [14, 19-21] measures of attitudes towards doping, there is a relative dearth of research examining these attitudes in relation to *unintentional* doping. Specifically, the predictive validity of implicit and explicit doping attitudes toward unintentional doping has not been fully explored in terms of awareness of unintentional doping and pertinent behaviours related to the avoidance of unintentional doping. The aim of the present study was to examine the predictive validity of implicit doping attitude and explicit doping attitude on athletes' behaviours related to the avoidance of unintentional doping. An implicit association test (IAT) was used to measure athletes' implicit doping attitude in the current study. The IAT is a timed

sorting task aimed at measuring the relative strength of associations between a stimuli (i.e. doping) and superordinate categories (i.e. good/bad) via participants' reaction times. Naturally, a faster reaction time would signify a stronger relative association between the categories. IAT measures have been widely used in social and health psychology to measure individuals' implicit attitude toward numerous sensitive issues, such as prejudice and racial bias[8, 12, 13, 22]. Recently, the IAT has been adopted and modified to measure athletes' implicit attitudes towards doping[14, 19, 20, 23, 24], and is believed to be an objective assessment method less susceptible, but not completely free from, socially desirable responses or "faking" responses compared to traditional self-report explicit measures[8, 15]. Prior research has demonstrated that athletes who have previously engaged in doping[15, 20, 24] through the use of nutritional supplements [15], and those who supported the legalization of doping in sport[14], reported greater positive implicit doping attitudes relative to those who did not[14, 20]. However, the predictive power of implicit attitudes toward athletes' actual doping behaviour, or, their behaviour in the avoidance of unintentional doping, has not yet been fully scrutinised. Additionally, scores on previous studies that use the implicit attitude tests to measure implicit attitude towards doping, such as the full-version IAT[14, 19] or the brief-IAT [15, 20, 24], could be a confounding factor as the response latency (i.e., the interference/difference IAT-score for doping attitude) is computed by comparing reaction time of doping-related stimuli against responses towards a reference category, such as nutritional supplements[14, 15, 19, 20] or non-doping words (e.g., 'clean', 'natural')[24]. However, it has been proposed that nutritional supplements (or even non-doping words) may not necessarily be the correct reference category, and furthermore, it has been proposed that there is not a clear definitive opposing category to 'doping substances'[19]. To resolve this problem, researchers in social psychology have advocated the use of the *single-category* IAT[25], in which response latency is computed by comparing the reaction-time between the focal ('doping' and 'I like') and non-focal (e.g., 'doping' and 'I dislike') blocks. As such, no reference category is needed[25], making the *single-category* IAT preferable over traditional IAT in the context of assessing implicit attitudes toward doping. In this study, we introduce a *single-category* brief-IAT to

measure implicit attitude toward doping. Moreover, we evaluate its predictive power on athletes' vigilance towards unintentional doping against that of a traditional measure of explicit attitude toward doping. Based on prior research of the relationship between doping attitude and athletes' behavioural responses to doping[11, 17, 18] as well as the avoidance of doping[2, 4], we hypothesised that (1) athletes' positive implicit and explicit doping attitudes are negatively associated with; behaviours relating to their vigilance toward unintentional doping (e.g., reading the ingredients table of food products, being aware of the risk of unintentional doping prior to consumption, refusal to take or eat suspicious food products,) and to self-reported behavioural adherence to unintentional doping avoidance behaviours. Furthermore, (2) athletes' implicit doping attitude is expected to explain unique variance of the behavioural outcomes related to the avoidance of unintentional doping beyond that of explicit doping attitude.

Methods

Participants.

Athletes (N = 143; M_{age} = 18.13, *SD* = 4.63; female = 33.37%) competing in individual (46.15%; athletics-track, athletics-field, badminton, gymnastics, swimming, and triathlon), and team (54.86%; basketball, cricket, field hockey, rugby, soccer, and water polo) sports volunteered to participate in the study. Participants classified their competitive level as regional (25.90%), state (20.86%), national (39.57%), international (11.51%), and world-class (2.16%). Participants had an average of 9.51 years (*SD* = 3.55) experience in their sport, and spent an average of 12.59 hours (*SD* = 6.73) training per week. Participants did not report any history of taking banned performance-enhancing substances.

Procedure.

The Research Ethics Committee of [university name redacted for masked review] approved the research protocol (ref: HR30/2012), and a signed informed consent form was obtained from each participant (and their parent or legal guardian if under the age of 18) prior to data

collection. Each participant received a $15 inconvenience allowance for their participation, paid in advance and non-contingent on study completion. They were asked to complete the assessments of study variables in sequential order, including (1) implicit doping attitude, explicit doping attitude, (2) self-reported behavioural adherence to the avoidance of unintentional doping, and (3) behavioural vigilance toward unintentional doping (details about the assessments below).

Measures.

Implicit attitude toward doping was measured using a computerised version of the brief single-category IAT[25], modified to measure implicit attitudes toward doping. The single-category IAT is a short, timed-sorting task that requires participants to make associations between each presented stimulus and a superordinate category. Unlike previously developed brief-IATs for doping attitude[15, 20, 24], our single-category IAT did not require a 'non-doping' reference category. The superordinate category labels were presented on the top left and right corners of the screen and the doping-related stimuli were presented in the center of the screen. Participants were instructed to indicate which category closely encompassed the stimuli, and to press the corresponding left ('p' key) or right ('q' key) response on the keyboard. Doping-related stimulus words (*steroid, narcotics, stimulants, diuretics*) were selected based on previously developed IATs of doping attitude[14, 19, 20, 23], and utilised comments from six experts in the area from several explicit measures of doping. The superordinate categories representing 'I like' (*freedom, love, happy, pleasure*) and 'I dislike' (*crash, filth, stink, evil*) were taken from the traditional IAT by Greenwald et al.[8] This current version of the single-category brief IAT is similar to the traditional brief IAT[15, 20, 24, 26], which also uses a standard four-step format consisting of 4 blocks with 20 trials in each block. Each block comprises of a focal stimulus-category ('doping' and 'I like') which contrasts with a single non-focal category (e.g., 'I dislike'). In alternating blocks, the focal categories change (e.g., 'doping' and 'I like' in blocks 1 and 2; 'doping' and 'I dislike' in blocks 3 and 4). Block order was counterbalanced between participants. Each participant completed two

counterbalanced practice trials prior to the experimental block to ensure understanding of the task. Our scoring method followed the scoring algorithm of brief-IAT[26]. More specifically, error responses were accounted for and all responses less than 350ms and non-responses were removed. The key dependent variable representing implicit attitudes toward doping is a score (known as the D-score) based on the average response times in the critical blocks from the single-category brief IAT. D-score was computed by dividing the difference of the average reaction time between Blocks 2 and 4 by the standard deviation of the reaction times of all correct responses in both blocks[25]. As such, a higher positive score (i.e., D-score > 0) indicated a stronger association strength between the target concept (i.e., 'doping') and attribute (i.e., 'I like'), reflecting a greater positive implicit attitude towards doping. In contrast, a lower negative score (i.e., D-score < 0) indicates a stronger association strength between the target concept (i.e., 'doping') and attribute (i.e., 'I dislike'), reflecting a more negative implicit attitude towards doping.

Explicit doping attitudes were measured using the 17-item Performance Enhancement Attitude Scale (PEAS)[10 27]. Participants rated the degree of agreement with the items (e.g., 'Doping is not cheating since everyone does it.') on a six-point Likert-scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Higher scores on PEAS indicated a greater favorability of attitude toward doping in sport. The internal consistency of the scale was acceptable (α = .91).

Athletes' behavioural vigilance in avoiding unintentional doping was measured using a 'lollipop' decision-making protocol developed in previous studies.[3, 6] The protocol simulates the extent to which athletes check for unintentional doping when confronted with a social situation where they are provided with an unfamiliar food or drink. A lollipop was chosen as it resembled a 'daily life' situation, and was less likely to raise athletes' behavioural vigilance towards its performance-enhancing effects compared to sports-associated food products (e.g., energy bars or drinks), making it ideal to test the athletes' vigilance in everyday lives.[3]

In line with the protocol, participants were offered a free lollipop by the experimenter ostensibly as a token of gratitude for their participation in the study. The lollipop did not contain any banned performance-enhancing substances, but was a rare brand with which none of the participants reported being familiar with. Each lollipop contained an ingredients table clearly printed on the packaging. Participants then followed the study procedure for completing the IAT and the questionnaire. At the end of the questionnaire, participants responded 'yes' or 'no' to a brief survey asking whether or not they (1) refused to take the lollipop (*not-taking*), (2) decided not to eat the lollipop (*not-eating*), (3) read the ingredients table (*reading*), and (4) were aware of the risk of unintentional doping (i.e., checking if the lollipop ingredients table contained prohibited substances; *awareness*). The experimenter who delivered the lollipop then cross-checked the participants' self-reported answer with the participants' behaviour (i.e. *not-taking* and *not-eating)* to ensure genuine responses. All "yes" responses were coded as 1, and "no" was coded as 0. Previous research has found this lollipop decision-making protocol to be an ecologically valid test of athletes' natural behaviours and is indicative of behavioural vigilance associated with the avoidance of unintentional doping in everyday situations[3, 6].

Self-reported behavioural adherence to the avoidance of unintentional doping was measured using the adapted version of the Self-Reported Treatment Adherence Scale (SRTAS)[28-30]. SRTAS is a reliable and valid psychometric inventory to measure individuals' self-reported adherence to health behaviours (e.g., rehabilitation, injury prevention)[28-30]. It has been adapted to reflect athletes' behavioural vigilance in avoiding unintentional doping[2, 3]. Four items assessed *effort* (e.g., 'How much effort do you put into avoiding being in a situation where you might unintentionally take banned performance-enhancing substances/methods?'), and three items assessed *frequency* (e.g., 'How often do you check if your supplements or medications contain banned performance-enhancing substances/methods in sport?') of behaviours associated with the avoidance of unintentional doping. The behaviours are: raising awareness of doping, learning/updating knowledge

about doping, and seeking support from others regarding doping. Effort (1 = *minimum*; 7 = *maximum*) and frequency (1 = *never*; 7 = *very often*) were evaluated on a seven-point scale. The effort (α = .87) and frequency (α = .90) dimensions had acceptable internal consistency and their average score were combined to a single dimension representing overall adherence to behaviours for the avoidance of unintentional doping (α = .90) [2, 3].

Data analysis.

Data was analysed using four separate hierarchical logistic multiple regression models for categorical dependent variables (*not-taking*, *not-eating*, *reading*, and *awareness*), and hierarchical linear multiple regression models for continuous dependent variables (self-reported behavioural adherence to the avoidance of unintentional doping). Consistent with previous studies on unintentional doping[3, 6], we controlled for the effects of age, gender, sport type, and sport level in step 1. The explicit and implicit doping attitude variables were subsequently entered in and tested in steps 2 and 3 of the analyses, respectively, to identify their individual effectiveness in predicting variance in the behavioural outcomes beyond the effects of the control variables.

Results

Data screening revealed that a non-random pattern of missing data was not apparent (0% for implicit doping attitude; less than 4.2% for explicit doping attitude; less than 0.7% for behavioural adherence; less than 2.8% for not-taking, not-eating, reading, and awareness); all missing values were replaced using the expectation maximisation method. Shapiro-Wilk's tests showed that the distributions of the continuous variables (i.e., implicit doping attitude, explicit doping attitude, self-reported behavioural adherence) did not significantly deviate from normality. Response patterns of the categorical variables appeared normal for *not-taking* (31.91% refused to take the lollipop), *not-eating* (34.04% refused to eat the lollipop), *reading* (84.17% read the ingredients table of the lollipop), and *awareness* (20.71% claimed that they were aware of the potential for the ingredients of the lollipop to contain banned

substances). We screened the range of reaction-time in the brief-single category IAT, and there were no response faster than 300ms or slower than 3,000ms, so no outliers were eliminated from the computation of the implicit doping attitude scores. Table 1 displays the means and standard deviations of the study variables, as well as Pearson correlations between the variables.

Insert Table 1 about here

Parameter estimates, effect sizes, and confidence intervals of the hierarchical logistic regression models predicting the variables related to athletes' vigilance toward unintentional doping from the 'lollipop' protocol are reported in Table 2. In Step 1, the control variables did not form any significant relationship with the dependent variables, but adding *explicit* doping attitude in Step 2 and *implicit* doping attitude in Step 3 significantly increased the explained variance in the *reading* (Total R^2 = .20) and *awareness* (Total R^2 = .17) variables. Explicit (OR = .54, p = .01) and implicit (OR = .33, p = .01) doping attitudes were both significant negative predictors of *reading*. Explicit (OR = 1.58, p = .03) and implicit (OR = 3.30, p = .01) attitudes significantly and negatively predicted *awareness*. Neither of the attitude measures predicted the *not-taking* and *not-eating* variables.

Insert Table 2 about here

Parameter estimates, confidence intervals, and effect sizes for the hierarchical linear multiple regression analysis predicting behavioural adherence measure on the SRTAS are reported in Table 3. Sport level in Step 1 was a significant positive predictor of self-reported adherence to the avoidance of unintentional doping, but effects of explicit (β = -.05, p = .54) and implicit (β = .12, p = .13) doping attitudes in Steps 2 (explicit) and 3 (implicit) were not significant.

Insert Table 3 about here

Discussion

The aim of the current study was to examine whether implicit and explicit doping attitudes would predict athletes' vigilance toward unintentional doping and self-reported behavioural

adherence to the avoidance of unintentional doping. It was hypothesised that both implicit and explicit doping attitudes would negatively predict athletes' vigilance toward the avoidance of unintentional doping indicated by their refusal to take or eat any suspicious food/ drink product, their reading of the ingredients table, and their awareness of the presence of banned performance-enhancing substances in the given food/drink product. We also hypothesised that implicit doping attitude would have unique effects on behavioural outcomes beyond that of explicit doping attitude. Findings partially supported our hypotheses. Implicit and explicit attitudes toward doping significantly and independently predicted some of the behavioural outcomes related to unintentional doping.

Consistent with our hypotheses, both implicit and explicit measures of doping attitude significantly predicted two behavioural outcomes relevant to the avoidance of unintentional doping: reading the ingredients table and conscious awareness of the potential presence of banned performance enhancing substances in an unexpected, unmarked food product. Our analysis indicated that athletes who held higher implicit or explicit doping attitudes were .33 times and .54 times, respectively, less likely to read the ingredients table of the unexpected, unknown food product. This result supported our hypotheses regarding valence of prediction for doping attitude and the predictive power of implicit doping attitude on athletes' vigilance toward unintentional doping beyond that of explicit doping attitude. This is consistent with prior research examining the relationship between doping attitude and athletes' behavioural patterns of doping in sport[10, 11, 17, 18, 24]. On the other hand, athletes with higher implicit doping attitude or explicit doping attitude were 3.03 and 1.58 times, respectively, more likely to report being aware of the risk of unintentional doping. Despite significant findings for awareness, the direction of the effects were contrary to expectations given the negative effect of doping attitude on athletes' vigilance towards unintentional doping. Such findings may have important implications for anti-doping education. Athletes' vigilance of banned performance-enhancing substances in their daily life, on one hand, could be an adaptive behaviour as it may serve the purpose of identifying, and ultimately preventing unintentional

doping. On the other hand, it might also increase athletes' ability to identify, or even consider seeking access to commonly available banned performance-enhancing substances[5]. It is therefore important that anti-doping education focuses not only on increasing athletes' knowledge of doping substances, but also on their beliefs, values, and self-regulation *against* the use of doping substances or methods in sport, such as morality, sportspersonship, fair play, self-control, and the negative health and career consequences of doping[5, 6, 11]. Future studies could further examine the relationship between vigilance of banned performance-enhancing substances and behavioural consequences of doping (e.g., intention[18] or susceptibility of doping[16]), and whether implicit or explicit doping attitude moderate such relationship.

We found no effect of implicit and explicit attitudes on the *not-taking* and *not-eating* variables, and on self-reported adherence to unintentional doping. This implies that implicit and explicit doping attitudes were only linked to certain behaviours related to unintentional doping, which is consistent with the findings of previous studies that utilised the 'lollypop' decision-making protocol[3, 6]. Previous studies utilising the lollipop decision-making protocol found that athletes with high self-control or those who felt they had to avoid unintentional doping via external pressures (i.e., possessed controlled motivation) were more likely to refuse the lollypop [6]. This suggests that self-compulsion or external pressure (i.e., athletes feeling they have to do it), and resilience to temptation are more important, or prominently featured, in decisions to engage in behaviours linked to unintentional doping than doping attitude [6]. An alternative explanation could be the lack of correspondence between the measures of attitude, which focused on doping in sport in general, and the behavioural measures, which focused on unintentional doping. Finally, the measure of adherence to the avoidance of unintentional doping (SRTAS) was self-reported, in that participants could answer the questionnaire without directly, actively accessing their decisions with respect to doping avoidance. On the other hand, it may also be that decisions regarding doping are automatic or non-conscious, consistent with dual-process models of behaviour. Given that previous experience and habits

are strong determinants for behaviour[31], it may be that the SRTAS was not fit-for-purpose as a measure of unintentional doping due to a non-conscious, automatic process that occurs beyond an individual's awareness. This explanation is congruent with previous studies that suggest implicit attitude as an automatic or habitual processes[22, 31]. It is therefore important that future studies adopt measures of implicit attitudes towards unintentional doping and examine their relationships with athletes' behavioural vigilance and non-conscious behavioural responses.

The present study has a number of strengths and limitations. Firstly, research thus far has lacked consistency regarding the methods and procedures used to measure implicit attitudes towards doping. The implicit doping attitude assessed in prior research has been measured with a traditional format IAT[8], in which athletes' responses to doping substances have been contrasted against legal nutritional supplements. As such, the D-score for these measures could be confounded by athletes' general attitude towards legal nutritional supplements. The current study overcame this problem by using a single-category IAT[25]. This method has the advantage of directly measuring the intended construct without the need for a reference category (i.e., legal nutritional supplements). This is the first time this version of the IAT has been applied to anti-doping behaviours in sport, and we have provided preliminary evidence for its predictive validity in the current study. However, the concurrent and predictive validity of the measure has not been fully explored. For example, the association between explicit and implicit attitudes was not significant, although this finding is not alarming, given that correlations have not been consistently established in previous research studies between implicit and explicit measures[14, 15, 19, 21, 24]. One explanation might be that implicit measures have shown to be more resilient to response biases than explicit measures, especially for athletes who deny doping[15]. A more effective evaluation could utilise multiple predictive tests of the measure alongside behavioural and conceptually-related criterion variables to provide converging evidence for its validity. For example, future studies could compare the predictive validity of the measure against other existing measures developed in previous studies[14, 19, 21].

Second, social desirability and response bias apply to all measures used in the present study, including the implicit and explicit doping attitude measures, and the measure of behavioural adherence to the avoidance of unintentional doping[16]. Although the behavioural measures regarding the awareness to unintentional doping (i.e., *not-taking*, *not-eating*) were cross-checked by the experimenter, participants could still claim that they read the ingredients table and were aware of the presence of banned performance-enhancing substances, when in actuality they may have not. While the effect of social desirability is unavoidable in self-report measures for psychological variables related to doping, future studies could attempt to account for individual differences on social desirability scales, or introduce other objective measures to monitor vigilance toward unintentional doping, such as the use of closed-circuit television or eye-tracking devices. Third, in the study procedure, we only randomised the order of the stimuli within the brief-IAT. We did not randomise the order of different assessments (e.g., IAT, PEAS, SRTAS), so earlier assessments might have affected participants' responses to later assessments (e.g., mere-measurement effect, practice effect). A recent randomised controlled trial[32] demonstrated that response order did not significantly moderate factor correlation, at least for samples similar in size to that of the current study. Therefore, the sequential response order may not have has a major impact on our study results, yet future research should consider controlling for the response order effect by counter-balancing the order of assessment. Finally, a strength of the current investigation was that it accounted for both implicit and objective behavioural measures, but it was limited by its cross-sectional correlational design. Therefore, we could not infer causal relations from the current data. Future studies should adopt a longitudinal design or cross-lagged panel designs to explore whether changing athletes' attitude towards doping would link to changes in their vigilance in behaviourally avoiding unintentional doping. Developing future interventions that reduce athletes' doping attitude would be highly meaningful for educational campaigns aimed at promoting anti-doping.

Conclusions

The present study compared predictive powers of both implicit and explicit doping attitudes on athletes' vigilance toward, and adherence to, behaviours in the avoidance of unintentional doping. The findings supported the hypotheses that implicit and explicit doping attitudes predict athletes' unintentional doping avoidance behaviours.

Practical Implications:

- Single category implicit association test of doping attitude developed in this study might serve as an objective screening tool for athletes' vigilance to unintentional doping

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Table 1

Correlation matrix, mean, and standard deviation of the study variables.

	1	2	3	4	5	6	7
Predictors							
1. Implicit Doping Attitude	1						
2. Explicit Doping Attitude	.06	1					
Behavioural Outcome							
3. Not-Taking	.04	.02	1				
4. Not-Eating	.01	-.06	.79**	1			
5. Reading	-.23**	-.21*	.12	.05	1		
6. Awareness	.23**	.15	-.04	-.10	-.68**	1	
7. Behavioural Adherence	.18*	-.08	.04	.11	-.15	.18*	1
Control Variables							
8. Age	.15	.03	-.12	-.10	-.01	.01	.04
9. Gender	-.04	-.02	.05	.05	.10	-.11	.01
10. Type of Sport	.10	.02	.03	-.04	.01	.05	.05
11. Sport Level	.08	-.07	-.17	-.09	-.06	.04	.30**
Mean	-.07	2.39	.32	.34	.84	.21	3.42
SD	.56	1.08	.47	.48	.37	.41	1.63

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

Note. Not-taking (0 = took the lollipop, 1 = refusing taking the lollipop); Not-eating (0 = ate or plan to eat the lollipop, 1 = did not eat or plan to eat the lollipop); Reading (0 = did not read the ingredients table printed on the lollypop, 1 = read the ingredients table printed on the lollypop); Awareness (0 = not being aware if the ingredients contained banned substances, 1 = being aware if the ingredients contained banned substances); Gender (1 = male, 2 = female); Type of sport (0 = individual sport, 1 = team sport); Sport level (1 = regional level, 2 = state level, 3 = national level, 4 = international level, 5 = world top 20).

Table 2

Results of multiple linear and linear logistic regression models

Step	Independent Variables	Odds Ratio	(95% CI of *EXP(B)*)	Wald	χ^2	R^2	ΔR^2
			Dependent Variable = Not-Taking				
1	Age	.93	(.85 to 1.02)	.05	7.68	.077	.077
	Gender	1.63	(.73 to 3.76)	.51			
	Sport Type	1.06	(.49 to 2.32)	.51			
	Sport Level	.70	(.77 to 1.23)	.05			
2	Explicit Doping Attitude	1.83	(.73 to 1.46)	.03	.03	.077	.00
3	Implicit Doping Attitude	1.50	(.75 to 2.97)	1.33	1.34	.090	.013
			Dependent Variable = Not-Eating				
1	Age	.94	(.86 to 1.03)	1.78	4.35	.044	.044
	Gender	1.49	(.68 to 3.26)	.99			
	Sport Type	.85	(.40 to 1.81)	.18			
	Sport Level	.81	(.57 to 1.16)	1.31			
2	Explicit Doping Attitude	.88	(.62 to 1.25)	.49	.50	.048	.004
3	Implicit Doping Attitude	1.31	(.67 to 2.54)	.63	.63	.055	.007
			Dependent Variable = Reading				
1	Age	.99	(.89 to 1.11)	.03	2.32	.029	.029
	Gender	2.10	(.68 to 6.45)	1.67			
	Sport Type	1.08	(.41 to 2.88)	.03			
	Sport Level	.82	(.52 to 1.28)	.79			
2	Explicit Doping Attitude	.54**	(.35 to .83)	7.81	8.15**	.129	.100
3	Implicit Doping Attitude	.33*	(.14 to .80)	6.02	6.44**	.203	.074
			Dependent Variable = Awareness				
1	Age	1.01	(.92 to 1.13)	.11	2.91	.033	.033
	Gender	.53	(.20 to 1.41)	1.64			
	Sport Type	1.26	(.53 to 3.03)	.27			
	Sport Level	1.22	(.81 to 1.82)	.91			
2	Explicit Doping Attitude	1.58*	(1.08 to 2.31)	5.63	5.67*	.096	.063
3	Implicit Doping Attitude	3.03**	(1.35 to 6.80)	7.17	7.71**	.177	.081

Note. R^2 = Nagelkerke R-squared. 95%CI of *EXP(B)* = 95% confidence interval of the odds ratio. * $p < .05$, ** $p < .01$

Table 3

Results of hierarchical linear multiple regression models

Step	Independent Variables	β	(95% CI of *B*)	F	ΔF	R^2	ΔR^2
	Dependent Variable = SRTAS Behavioural Adherence						
1	Age	.01	(-.06 to .07)	4.88**	4.88**	.127	.127
	Gender	-.02	(-.65 to .49)				
	Sport Type	.13	(-.12 to .98)				
	Sport Level	.36**	(.30 to .82)				
2	Explicit Doping Attitude	-.05	(-.32 to .17)	3.96**	.37	.130	.002
3	Implicit Doping Attitude	.12	(-.11 to .83)	3.71**	2.28	.144	.015

Note. SRTAS = Self-reported treatment adherence scale; 95% CI of *B* = 95% confidence interval of unstandardised beta. * $p < .05$, ** $p < .01$