Self-Control, Self-Regulation, and Doping in Sport:

A Test of the Strength-Energy Model

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Abstract

We applied the strength-energy model of self-control to understand the relationship between self-control and young athletes' behavioral responses to taking illegal performance-enhancing substances or 'doping'. Measures of trait self-control, attitude and intention toward doping, and doping avoidant intention and behavioral adherence were administered to 410 young Australian athletes. Participants also completed a 'lollipop' decision-making protocol which simulated avoidance of unintended doping. Hierarchical linear multiple regression analyses revealed that self-control was negatively associated with doping attitude and intention, and positively associated with the intention and adherence to doping avoidant behaviors. Hierarchical logistic regression analyses showed that self-control was positively linked to the refusal to take or eat the unfamiliar candy offered in the 'lollipop' protocol. Consistent with the strength-energy model, athletes with low self-control were more likely to have heightened attitude and intention toward doping, and reduced intention, behavioral adherence, and awareness of doping avoidance.

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Using prohibited performance-enhancing drugs or methods in sport (i.e., “doping”) not only violates the anti-doping rules of the World Anti-Doping Agency (World Anti-Doping Agency, 2009), but is also related to many negative consequences for athletes including bans from participating sport, impaired reputation, sport titles being stripped, and adverse health side effects. Most athletes are aware of these facts but some might still engage in doping behaviors because they are unable to resist the temptations and other social pressures to engage in doping (Lentillon-Kaestner & Carstairs, 2010; Wiefferink, Detmar, Coumans, Vogels, & Paulussen, 2008). Importantly, athletes might also fail to effectively avoid unintentional intake of illegal substances in foods and nutritional supplements, which could lead to a positive test for those substances with similar possible consequences like loss of reputation and bans from competition (Chan, Dimmock, et al., 2015; Chan, Donovan, et al., 2014; Chan, Hardcastle, et al., 2014). Although official figures suggest that the incidence of doping across most elite Olympic sport events is less than 2.0 % (World Anti-Doping Agency, 2012), anti-doping is relevant applicable to all athletes because the potential to engage in unintentional doping through the intake of banned substances in foods and supplements is a very real threat. Avoiding unintentional doping requires considerable vigilance, awareness, conscious effort, and cognitive resources to recognize potential situations where taking such substances may be a risk and undertake behaviors to avoid them (Wiefferink, et al., 2008). The primary aim of the present study was to examine the relationship between athletes’ trait self-regulatory capacity and anti-doping behaviors based on the strength-energy model of self-control (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister, Gailliot, DeWall, & Oaten, 2006).

The strength-energy model defines self-control as a limited capacity or resource that enables individuals to regulate their cognitive, emotional, and behavioral effort for achieving desired goals or outcomes (Baumeister, et al., 1998; Ginis & Bray, 2010; Leventhal, Leventhal, & Contrada, 1998; Tangney, Baumeister, & Boone, 2004). This self-regulatory capacity is important because it allows individuals to delay short-term gratification for long-term benefits or goals by effectively overcoming the impulses, temptation, or challenges that could potentially hinder distal goal attainment. However, according to the model, individuals will experience self-regulatory failure when their self-control resources are either insufficient due to limited capacity in a ‘trait’ or individual difference approach (Baumeister, et al., 1998; Baumeister, et al., 2006; Tangney, et al., 2004) or become depleted through excessive exertion over a period of and inadequate opportunity for recovery in a ‘state’ or resource availability approach (Baumeister, et al., 1998). Research has highlighted a number of maladaptive behavioral outcomes associated with low self-control or reduced self-control resources such as poor treatment adherence, inability to regulate eating, relapse during smoking cessation, alcohol consumption, and substance abuse (Hagger, Leaver, et al., 2013; Hagger, Panetta, et al., 2013; Hagger, Wood, Stiff, & Chatzisarantis, 2009, 2010a, 2010b; Vohs & Heatherton, 2000).

The strength energy model may also have utility in explaining athletes’ capacity to control and avoid doping in sport (Wolff, Baumgarten, & Brand, 2013) because athletes are constantly involved in consciously and actively engaging in making moral judgments regarding doping, engaging in expectancy-value judgments relating to doping (Chan, Hardcastle, et al., 2015), or making a decisional-balance in the face of doping temptations (Hodge, Hargreaves, Gerrard, & Lonsdale, 2013; Jalleh, Donovan, & Jobling, 2013; Petroczi & Aidman, 2008; Wiefferink, et al., 2008; Zelli, Mallia, & Lucidi, 2010). Similarly, recent research on anti-doping in sport found that even athletes with strong intentions and high commitment to avoiding doping are required to engage in effortful, conscious deliberation in order to avoid doping or prevent of unintended doping (Chan, Dimmock, et al., 2015; Chan, Donovan, et al., 2014; Chan, Hardcastle, et al., 2015; Chan, Hardcastle, et al., 2014).

As far as we know, only one study explicitly applied the strength-energy model in the context of performance-enhancing substances. Wolff, Baumgarten, and Brand (2013) recently examined the effect of ego-depletion on individuals' intake of neuro-enhancing food product for performance enhancing purposes. Interestingly, it was found that ego-depleted students were three times less likely to consume neuro-enhancing energy bars than non-ego-depleted students (Wolff, et al., 2013). The authors concluded that the pursuit of neuro-enhancement was more likely a conscious attempt by those with sufficient resources to effectively regulate their behavior than an automatic response to low cognitive resources (Wolff, et al., 2013). It may be that those with sufficient resources wanted to make the most effective use of them, or that they were sufficiently motivated, as a result of their self-control, to engage in enhancement to maximize their potential. However, their study is somewhat removed from the context of the current study as the participants were not athletes and neuro-enhancing substances are neither on the WADA prohibited list nor controlled by law. As a consequence, this context is less relevant to a doping context because the neuro-enhancer is likely to be evaluated as something that is to be approached rather than avoided, and therefore, individuals do not take vigilance and cognitive effort to avoid it. In contrast, the context of unintentional doping is one in which serious consequences await those who transgress the rules, so consuming banned performance-enhancing substances unwittingly in foods and supplements, requires considerable effort to do so and, therefore, is likely to be demanding of self-control resources (Baumeister, et al., 2006; Hagger, in press). The role that availability of self-control resources plays in determining efforts to avoid unintentional doping should be regarded as a priority as it will provide essential information to authorities on the factors involved and where intervention efforts might be directed.

The present study applied the strength-energy model (Baumeister, et al., 1998; Baumeister, et al., 2006) to examine the role of individual differences in self-control on doping decision-making and actual behavioral responses. Based on the central tenet of the model (Baumeister, et al., 1998; Baumeister, et al., 2006; Tangney, et al., 2004) and previous research investigating the role of self-control on self-regulatory behaviors (Hagger, Leaver, et al., 2013; Hagger, Panetta, et al., 2013; Hagger, et al., 2009, 2010a, 2010b; Vohs & Heatherton, 2000), we hypothesized that trait self-control would be a negative predictor of (H1) doping attitude and (H2) doping intention, and a positive predictor of (H3) intentions to avoid doping, (H4) actual doping avoidant behavior, and (H5) the prevention of unintended doping.

Methods

After receiving approval of the [University omitted for masked review] human research ethics committee, 410 young elite and sub-elite athletes recruited from sport clubs and teams in Western Australia consented to participate in the study.[1] Participants (mean age = 17.70, *SD* = 3.92; 55.37% male) had an average of 9.05 years (*SD* = 3.52) experience in competitive sport (average training volume = 12.43 hours per week (*SD* = 5.63). They were athletes competing in six individual sports (39.85%; athletics-track, athletics-field, badminton, gymnastics, swimming, and triathlon), and six team sports (60.15%; basketball, cricket, field hockey, rugby, water polo, and soccer) at various competitive levels (22.86% regional level, 29.40% state level, 35.68% national level, 10.30% international level, 1.76% world-class). Each participant was provided with $10 for their participation, paid in advance and non-contingent on completion of the study. They were then asked to complete a questionnaire containing study variables which took approximately 15 minutes to complete.

Trait Self-Control. The brief version of Tangney et al.'s (2004) scale was used to measure individual differences in self-control capacity. It is a single dimension scale with 13 items (e.g., "I am good at resisting temptation") and responses were made on five-point Likert scales ranging from 1 *(not at all)* to 5 *(very much)*.

Doping Attitude. The 17-item Performance Enhancement Attitude Scale (Petroczi & Aidman, 2009) was a single dimension inventory used in the present study for the assessment of doping attitudes. Participants rated to degree to which they agreed with items (e.g., "Doping is not cheating since everyone does it.") highlighting the typical favorable beliefs for using banned performance-enhancing methods in sport on a six-point Likert-scale ranging from 1 (*strongly agree*) to 6 (*strongly disagree*).

Intention. We used a three-item measure for evaluating doping intentions (e.g., "Using banned performance-enhancing substances/methods in sport in the forthcoming month is (something)… I intend to do") and intentions to avoid doping (e.g., "To avoid using banned performance-enhancing substances/methods in sport in the forthcoming month is (something)… I plan to do") following Ajzen's (2002) guidelines. The items were adopted from recent studies about the psychological perspectives doping and anti-doping in sport (Chan, Hardcastle, et al., 2015; Lucidi et al., 2008). Responses were made on a seven-point Likert scale with 1 (*strongly disagree*) to 7 (*strongly agree*) scale anchors.

Doping Avoidance Adherence. We evaluated the effort (4 items; 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 frequency (3 items; e.g., "How often do you check if your supplements or medications contain banned performance-enhancing substances/methods in sport?") of doping-avoidant behavior (i.e., actively engaging in anti-doping by, for example, raising awareness of doping, learning/updating knowledge about doping, and seeking help on doping) using the doping-avoidant version of the Self-Reported Treatment Adherence Scale (Chan, Dimmock, et al., 2015; Chan, Donovan, et al., 2014). Participants rated effort (1 = *minimum*; 7 = *maximum*) and frequency (1 = *never*; 7 = *very often*) items on seven-point scales.

Prevention of Unintended Doping. We evaluated three types of behaviors related to the prevention of unintended doping based on a protocol of a recent study on young athletes' awareness of doping in everyday life contexts (Chan, Donovan, et al., 2014). Participants were offered a free lollipop at the beginning of the study ostensibly as a reward for doing the study. The lollipops were from a rare brand to simulate a social situation where athletes were given an unfamiliar food or drink. Given that athletes should be constantly vigilant of the potential for unfamiliar foods to contain banned performance-enhancing substances, the lollipop protocol provides an ecologically valid means to test athletes' propensity to avoid unintentional doping. An ingredients table was clearly printed in the package of each lollipop. After completing the questionnaire, participants were asked whether or not they (1) refused to take the lollipop (*not-taking*), (2) decided not to eat the lollipop (*not-eating*), and (3) read the ingredients table (*reading*). To ensure genuine responses, the answers of *not-taking* and *not-eating* were cross-checked by the experimenter who delivered the lollipop when participants returned the completed questionnaire.

Analyses

To examine the predictive power of self-control on the doping-related outcomes, we used hierarchical linear multiple regression for the analyses with continuous dependent variables (doping attitude, doping intention, and intention and adherence toward doping avoidance), and hierarchical logistic multiple regression for the analyses with categorical dependent variables (*not-taking*, *not-eating*, and *reading*). In Step 1, age, gender, sport type, ad sport level were inserted as control variables consistent with the recommendations of Chan and colleagues (2015). In Step 2, self-control was added as the independent variable such that the parameter estimates would reveal the predictive power of self-control on the behavioral outcome beyond the effects of the control variables.

Results

There were no apparent systematic pattern of missing data (<1%; expectation maximization was used for missing data replacement), non-normality of distribution (Shapiro-Wilk's test p >.05), multicollinearity (variance inflation factors (VIF) < 1.34), or low score reliability (α > .74) in the data. The descriptive statistics, matrix of intercorrelations, and reliability statistics for the study variables are displayed in Table 1.

For continuous outcome variables, hierarchical linear multiple regression models showed that self-control was a statistically significant negative predictor of doping attitudes and doping intention (H1), and it was also shown to be a statistically significant positive predictor of intentions to avoid doping (H3) and actual doping avoidant behavior (H4) (see Table 2 for the model details). For categorical outcome variables, hierarchical logistic regression analysis showed that self-control was a statistically significant positive predictor of participants' not-taking and not-eating the unknown lollipop (H5), but its association with reading the ingredients table was not statistically significant (see Table 3). These significant associations held when statistically controlling for the effects of age, gender, sport type, and sport level on the outcome variables.

Discussion

The present study is the first to examine the central tenet of the strength-energy model of self-regulation (Hagger, et al., 2009, 2010a, 2010b) in the context of athletes' behavioral responses to doping including unintentional doping. The results generally supported our hypotheses based on the proposition that self-control was not only predictive of athletes' doping attitudes and intentions, but also to their intention and behaviors toward doping avoidance and prevention of unintended doping in sport. Such findings are intuitive to the understanding of the self-regulatory process of doping in sport. Doping has been well-regarded as goal-directed and self-regulatory behavior (Gucciardi, Jalleh, & Donovan, 2011; Petroczi & Aidman, 2008), so our findings might supplement the argument by providing initial evidence of the importance of self-control, a finite self-regulatory resource, as a central factor of psychological models of doping and anti-doping behaviors in sport. We see results as paving the way for an experimental study testing whether ego-depletion would moderate the relationship between self-control and behavioral outcomes, in the context of doping (Wolff, et al., 2013).

The only discrepancy was that the hypothesized association between self-control and reading the ingredients table of the unknown food was not statistically significant. This finding could be attributed to the possibility that reading the information in the ingredients table was more related to the awareness of doping. Chan, Donovan, and colleagues (2014) found that young athletes with high autonomous motivation toward doping avoidance were more likely to read the ingredients table of an unfamiliar food. Therefore, investigating whether autonomous motivation moderates the relationship between self-control and the awareness of doping information would be an avenue for future research (Hagger, et al., 2010b). It seems reasonable to assume that the availability of resources may moderate the extent to which individuals act on their intentions and motives, and this may be the mechanisms in operation (Hagger, 2013, 2014; Hagger & Chatzisarantis, 2014).

A few limitations of the study should be noted. The study only included doping intentions and behaviors with respect to doping avoidance as outcome variables, so we were unable to examine the effects of self-control on athletes' actual doping behavior. It must, however, be stressed, that this is a problem endemic in the vast majority of research in the field of doping behavior, given that accurate, objective measures of doping behavior are very difficult to collect and self-reports are heavily influenced by affirmation bias (Gucciardi, Jalleh, & Donovan, 2010; Petróczi et al., 2010). Also, the size of the effects of self-control on the doping-related outcomes was relatively small, and the correlational design of study could not permit us to infer causality, so we have to interpret our findings in the context of these boundary conditions (Chan, Fung, Xing, & Hagger, 2014; Chan & Hagger, 2012). In addition, measures of the psychological variables (e.g., self-control, doping intention) were self-reported and, therefore, were subject to social desirability and response bias. Moreover, other confounding effects such as participants' prior experience, knowledge, and belief of anti-doping were likely to elevate the error variances of the study. Using lollipops as a behavioral means to evaluate preventive action toward unintended doping (Chan, Donovan, et al., 2014) might also be vulnerable to the influences of socially desirable responses and individual discrepancies in food preference. Future studies may adopt more objective psychological measures (e.g., performance on self-regulatory tasks, implicit association test for implicit doping attitudes) and randomized factorial experiments to test the role of self-control on doping intention, awareness, and behavior.

In conclusion, our initial test of the strength-energy model in the context of doping and anti-doping behaviors reveals that young athletes with low trait self-control are likely to have higher attitude and intention toward doping, and increased intention toward, and adherence to, anti-doping behavior.

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Footnote

[1]This study utilized a dataset reported in previous studies (Chan, Dimmock, et al., 2015; Chan, Donovan, et al., 2014; Chan, Hardcastle, et al., 2015) based on a convenience sample of athletes that were used to test different hypotheses.

Table 1

Correlation matrix and descriptive statistics

Correlations	1	2	3	4	5
1. Self-Control	1				
2. Attitude towards Doping	-.26**	1			
3. Doping Intentions	-.19**	.44**	1		
4. Doping Avoidance Intentions	.17**	-.24**	-.26**	1	
5. Doping Avoidance Adherence	.27**	-0.08	-0.05	0.08	1
Control Variables					
6. Age	-.10*	-.01	-.03	.03	-.02
7. Gender	.03	-.12	-.16**	.05	.13**
8. Sport Type	.04	-.04	-.02	-.06	.04
9. Sport Level	.08	-.05	-.01	.08	.36**
Mean	3.10	2.29	1.33	6.18	3.62
SD	.42	1.13	.90	1.60	1.71
α	.74	.94	.89	.89	.91
Composite Score Reliability	.80	.95	.93	.93	.93
Variance Inflation Factor	1.13	1.33	1.34	1.11	1.23

**$p < .01$ at 2-tailed, *$p < .05$ at 2-tailed.

Table 2

Results of hierarchical linear multiple regression models

Step	Independent Variables	β	(95% CI of *B*)	F	ΔF	R^2	ΔR^2
			Dependent Variable = Doping Attitude				
1	Age	.00	(-.02 to .02)	1.66	N/A	.02	N/A
	Gender	-.11*	(-.49 to .01)				
	Sport Type	-.05	(-.31 to .20)				
	Sport Level	-.04	(-.09 to .17)				
2	Self-Control	-.26**	(-.93 to -.38)	7.07**	28.27**	.08	.06
			Dependent Variable = Doping Intention				
1	Age	-.02	(-.02 to .01)	2.80*	N/A	.03	N/A
	Gender	-.16**	(-.43 to -.07)				
	Sport Type	-.00	(-.18 to .19)				
	Sport Level	-.01	(-.09 to .10)				
2	Self-Control	-.18**	(-.57 to -.16)	5.17**	14.26**	.06	.03
			Dependent Variable = Doping Avoidance Intention				
1	Age	.02	(-.03 to .04)	.44	N/A	.00	N/A
	Gender	.01	(-.47 to .24)				
	Sport Type	-.05	(-.52 to .22)				
	Sport Level	.02	(-.17 to .19)				
2	Self-Control	.17**	(.27 to 1.09)	2.58*	11.11**	.03	.03
			Dependent Variable = Doping Avoidance Adherence				
1	Age	-.04	(-.04 to .03)	18.04**	N/A	.15	N/A
	Gender	.06	(-.27 to .44)				
	Sport Type	.13	(.16 to .89)				
	Sport Level	.38**	(.47 to .84)				
2	Self-Control	.23**	(.50 to 1.31)	20.58**	26.26**	.20	.05

Note. The coding of the control variables was as follows: gender (1 = male, 2 = female), type of sport (1 = individual sport, 2 = team sport), and sport level (1 = sub-elite, 2 = national level, 3 = international level, 4 = world-class). 95% CI of *B* = 95% confidence interval of unstandardized beta. * $p < .05$, ** $p < .01$

Table 3

Results of hierarchical logistic multiple regression models

Step	Independent Variables	Odd Ratio	(95% CI of *EXP(B)*)	Wald	χ^2	R^2	ΔR^2
			Dependent Variable = Not-Taking				
1	Age	1.00	(.96 to 1.04)	.05	1.26	.01	N/A
	Gender	1.18	(.75 to 1.86)	.51			
	Sport Type	1.19	(.74 to 1.90)	.51			
	Sport Level	.97	(.77 to 1.23)	.05			
2	Self-Control	1.83**	(1.07 to 3.12)	4.91**	4.98**	.06	.05
			Dependent Variable = Not-Eating				
1	Age	.98	(.94 to 1.02)	.90	2.05	.01	N/A
	Gender	1.18	(.75 to 1.86)	.52			
	Sport Type	.87	(.54 to 1.39)	.35			
	Sport Level	1.05	(.83 to 1.34)	.19			
2	Self-Control	2.17**	(1.26 to 3.72)	4.40	8.12	.04	.03
			Dependent Variable = Reading				
1	Age	1.01	(.95 to 1.06)	.05	6.84	.04	N/A
	Gender	1.98*	(1.04 to 3.78)	4.29			
	Sport Type	1.03	(.55 to 1.92)	.01			
	Sport Level	.74	(.53 to 1.02)	3.44			
2	Self-Control	.89	(.44 to 1.80)	.12	6.96	.04	.00

Note. R^2 = Nagelkerke R-squared. Not-taking = refusing taking the lollipop (0 = No, 1 = Yes); Not-eating = refusing eating the lollipop (0 = No, 1 = Yes). Reading = reading the ingredients table printed on the lollypop (0 = No, 1 = Yes). 95%CI of *EXP(B)* = 95% confidence interval of the odd ratio. * $p < .05$, ** $p < .01$