

Are nutritional supplements a gateway to doping use in competitive team sports? The roles of achievement goals and motivational regulations

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1 **Abstract**

2 **Objectives:** The study investigated the moderating role of achievement goals and motivation
3 regulations on the association between self-reported nutritional supplement (NS) use, doping
4 likelihood, and self-reported doping behaviour among competitive athletes.

5 **Method:** Four hundred and ninety seven competitive team sport athletes (64% males; *M* age = 23.54
6 years, *SD* = 5.75) completed anonymous questionnaires measuring self-reported use of prohibited
7 substances and licit NS; beliefs about the "gateway" function of NS; achievement goals; and
8 motivational regulations.

9 **Results:** Hierarchical linear regression analysis showed that self-reported doping was associated
10 (Adjusted $R^2 = 33\%$) with NS use, a stronger belief that NS use acts as a gateway to doping,
11 amotivation, controlled motivation, mastery approach, and performance avoidance goals. Higher
12 likelihood to use doping substances in the future was associated (Adjusted $R^2 = 41.7\%$) with current
13 NS use, stronger belief that NS act as a gateway to doping, autonomous motivation, and performance
14 avoidance goals. A series of moderated regression analyses showed that NS use significantly
15 interacted with mastery approach, mastery avoidance, performance avoidance goals, autonomous
16 motivation controlled motivation, and with amotivation in predicting self-reported doping. Finally,
17 NS use significantly interacted with mastery approach goals, performance avoidance goals, and
18 controlled motivation in predicting future doping likelihood.

19 **Conclusions:** Achievement goals and motivational regulations are differentially associated with both
20 doping likelihood and self-reported doping, and may account for the observed association between
21 self-reported NS use and doping substances; thus, providing an alternative explanation to the
22 "gateway hypothesis" that emphasizes the role of motivation.

23

24 **Keywords:** performance enhancement; motivation; motivational regulations; drug use; gateway
25 hypothesis.

26

27 **Are nutritional supplements a gateway to doping in competitive team sports? The roles of**
28 **achievement goals and self determination**

29 Despite efforts to control doping use in sport, this behaviour represents an ongoing challenge
30 to the spirit of sport values and fair play rules. A recent literature review showed that between 14%
31 and 39% of elite athletes intentionally engage in doping behaviour¹, whereas research using indirect
32 questioning methods has shown that doping prevalence in elite athletes can range between 43.6% to
33 57.1%². Reviews and meta-analytic studies of the risk factors for doping use have shown that using
34 legal nutritional supplements (NS) is one of the most important risk factors for doping intentions and
35 actual use³. Prevalence studies have shown that more than 60% of competitive athletes use NS
36 routinely as a performance enhancement aid⁴. However, Ntoumanis et al.'s meta-analysis showed that
37 NS users were at much higher risk for doping than non-users⁵, and other studies have demonstrated
38 that doping was 3.5 times more prevalent among competitive athletes who used NS⁶, suggesting that
39 NS acts as a gateway to doping.

40 Petroczi et al. argued that the association between NS and doping use can be explained by a
41 "shared mental representation", that is, a common mental representation for chemically-assisted
42 performance enhancement that familiarises users with the concept and practice of doping⁷. Barkoukis
43 et al. provided an alternative explanation of this process, by arguing that the association between NS
44 use and doping is not necessarily direct, and that psychological (e.g., cognitive, emotional,
45 motivational) processes may intervene to increase the risk for doping use⁸. In support of this
46 hypothesis, they found that adolescent competitive athletes who used NS reported more favourable
47 attitudes and beliefs towards doping, stronger intentions to engage in doping in the future, and were
48 twice as likely to self-report doping use in the past compared to non-users of supplements. Therefore,
49 it is plausible that mental processes can explain the association between NS use and doping, but more
50 research is needed to determine the type and nature of those processes. A focus on motivational
51 processes, such as motivational regulation and achievement goals, can be particularly relevant here for
52 the following reasons. Theoretical models of doping have emphasized the relevance of motivation and
53 achievement goals on the decision to engage in doping. For instance, the life-cycle model⁹ and the
54 Sport Drug Control Model¹⁰ posit that athletes' goals towards success and achievement represent

55 systemic factors that influence their decision-making process and goals relevant to performance
56 enhancement substance. Hence, athletes may be motivated by external rewards, such as anticipated
57 glory, fame and monetary rewards, as well as "legitimate" and intrinsic rewards, such as the goal to
58 becoming the best one can be. Furthermore, NS use reflects the goal to enhance performance through
59 substance use⁷. This goal originates in the need to improve performance either for intrinsic and task-
60 oriented or for extrinsic and ego-oriented reasons. In this respect, achievement goals and reward
61 expectations represent the motivational engine that directs effort, persistence and behaviour towards a
62 specific direction: performance enhancement. This argument implies that NS do not represent a
63 gateway to doping behaviour, but rather, gateway psychological processes (in this case motivational
64 processes) can explain the or co-occurrence of NS and doping use.

65 **Self-Determination, Achievement Goals, and Doping**

66 Self-determination theory is based on the distinction between intrinsic and extrinsic
67 motivation, whereby intrinsic motivation is characterized by personal interest, enjoyment, satisfaction
68 and a sense of choice or autonomy, and extrinsic motivation is characterized by external rewards and
69 other external contingencies. Intrinsically motivated behaviours are performed spontaneously when
70 situations arise, and do not require any external reinforcements, whereas extrinsically motivated
71 behaviours are driven by the need to seek approval and rewards, rather than self-actualization¹¹. Meta-
72 analyses have illustrated that intrinsic motivation is associated with more adaptive behaviours in
73 sports, including increased effort, persistence, and satisfaction^{12, 13}. In the context of doping in sports,
74 past evidence showed that athletes with higher scores in intrinsic motivation reported significantly
75 lower intentions for doping, and lower past use of doping substances, as compared to extrinsically
76 motivated athletes¹⁴. Also, low self-determination was positively associated with more favourable
77 attitudes and greater susceptibility towards doping^{15, 16}. Chan et al. demonstrated that self-determined
78 motivation was positively associated with doping-avoidance behaviour in a decision-making task¹⁷.

79 Research using the achievement goal theory (AGT) has provided further insights about the
80 role of motivational processes in doping behaviour¹⁸. The AGT distinguishes between task and ego
81 goal orientations. Goal orientations answer to the question of *what* a person wants to achieve in an
82 achievement environment¹⁸, whereas motivational regulations to *why* a person engages in a

83 behaviour¹¹. Individuals with task orientation are likely to engage in an activity to achieve mastery
84 and personal improvement, and they tend to use self-referenced criteria to judge their goal pursuit
85 ability and resultant success. On the other hand, individuals with ego orientation engage in activities
86 to outperform others and to demonstrate comparatively superior ability, using normative or
87 comparative criteria to judge their perceived ability¹⁸. Task orientation has been associated with more
88 adaptive motivational outcomes in sports, such as greater effort and persistence, fair play, greater
89 enjoyment, and lower anxiety^{18,19}. Elliot and McGregor²⁰ further extended this approach by suggesting
90 the distinction of goals based on the valence and definition of competence. According to this model,
91 competence can be defined as mastery or performance-oriented whereas competence can be valenced
92 as being focused on either desirable/positive or undesirable/negative outcomes (i.e., approach vs.
93 avoidance goals respectively). This distinction resulted in a 2×2 achievement goal model consisting of
94 mastery-approach, mastery-avoidance, performance-approach, and performance-avoidance goals.
95 Research has shown that mastery-avoidance goals in this model were associated with negative
96 responses; thus, mastery-avoidance goals reflect an avoidance orientation²⁰.

97 Using the 2×2 model, Barkoukis et al. reported that mastery oriented elite athletes revealed
98 significantly lower scores on self-reported past use of doping substances and future doping intentions,
99 as compared to athletes with performance-oriented goals¹⁴. Barkoukis et al. further utilized the 2×2
100 achievement goal theory and showed that performance-avoidance (positively) and mastery-approach
101 goals (negatively) predicted intentions towards doping in a sample of athletes who did not report past
102 use of doping substances²¹. In contrast, doping users with high mastery-avoidance goals reported
103 stronger intentions to use prohibited PEDs in the future. Furthermore, a study with adolescent
104 competitive athletes showed that mastery-approach goals (negatively) and performance approach
105 goals (positively) predicted intentions to use prohibited PEDs²².

106 **The Present Study**

107 Taken together, the aforementioned studies indicated that different types of motivational
108 regulations and achievement goals are associated with doping-related attitudes, intentions, and self-
109 reported doping use. Based on this evidence, it is theoretically plausible that self-determined
110 motivation and achievement goals may also explain the association between NS use and doping.

111 Barkoukis et al. showed that NS use was associated with cognitive processes in favour of doping use⁸.
112 The present study aims to extend those findings by examining if maladaptive motivational processes,
113 such as extrinsic motivation and performance-oriented achievement goals, moderate the association
114 between NS and doping likelihood and use in team sport athletes.

115 Our contention is that the association between NS and doping (and concomitant likelihood)
116 can be moderated by the motivational variables described in the achievement goal and self-
117 determination theories. More specifically, maladaptive motivations (i.e., performance approach,
118 performance avoidance, mastery avoidance, controlled motivation, and amotivation) will interact
119 positively with NS use and strengthen the association between using NS and self-reported doping and
120 likelihood. In other words, athletes who use NS will be more likely to report doping (and concomitant
121 likelihood) to the extent that they are driven by maladaptive motivations. Likewise, the association
122 between NS and doping (and likelihood) should be attenuated by higher scores in adaptive
123 motivations, such as performance approach goals and autonomous motivation. Moderation (instead of
124 mediation) effects were expected for the following reasons. First of all, the association between NS
125 use and doping has been already documented in the previous literature^{5,6}. In our study, we wanted to
126 assess whether the strength of this association is related to individual differences in motivation, that is,
127 whether NS and self-reported doping use are more (or less) strongly associated in athletes with certain
128 motivational profiles. Secondly, previous research in other behavioural domains has shown that past
129 behaviour is more strongly associated with future intentions and behaviour, and with future habitual
130 behaviour depending on the levels of self-determination - in other words, self-determined motivation
131 moderates the association between past behaviour and the frequency/habitual performance of related
132 behaviours in the future^{23,24}. Extending these findings in the context of the present study, it is
133 theoretically plausible that the levels of self-determined motivation moderate the association between
134 NS use and self-reported doping and future doping intentions.

135 Based on previous research about the association between motivation and doping behaviour
136 and intentions^{14, 15, 21}, we formed the following hypotheses: a) mastery approach goals (positively) and
137 mastery avoidance, performance approach, and performance avoidance goals will be associated
138 (negatively) with self-reported doping and likelihood, over and above the predictive effect of NS use

139 (Hypothesis 1); b) performance approach and avoidance goals, and mastery avoidance goals will
140 positively moderate the relationship between NS use and self-reported doping use and future
141 likelihood (Hypothesis 2); c) mastery approach goals will have negatively moderate the relationship
142 between NS use and self-reported doping use and future likelihood (Hypothesis 3); d) autonomous
143 motivation (negatively) and controlled motivation and amotivation will (positively) moderate the
144 association between NS use and self-reported doping use and future likelihood (Hypothesis 4).

145 **Method**

146 Six hundred and fifty team sport competitive athletes were approached and 497 athletes
147 (76.4% response rate) agreed to participate and provided valid data. The mean age of the athletes was
148 23.54 years old ($SD = 5.75$, 64% males), and were recruited from football ($n = 66$), volleyball ($n =$
149 110), basketball ($n = 138$), handball ($n = 44$), and water polo ($n = 42$), and 97 athletes did not report
150 their sport. All participants were training in professional teams competing at national championships
151 and were training systematically in their sport for at least 5 years prior to study. According to Shieh²⁵,
152 a sample size of 226 participants is required to detect a small moderation effect size (f_{xz}) with
153 statistical power set at 0.95 in a moderated regression analysis with binary predictor and mean-centred
154 continuous moderator variables.

155 *Demographic variables:* They were assessed with questions about participants' age (reported in
156 years), gender, type of sport, and years of participation in the sport.

157 *Achievement goals:* The Approach and Avoidance Achievement Goal Questionnaire (AAAGQ)
158 developed for sports²⁶ was used to measure athletes' achievement goals. The scale assesses mastery-
159 approach, mastery-avoidance, performance-approach and performance-avoidance goals (three items
160 for each subscale). Responses were given on a 7-point scale ranging from 1 (*not at all like me*) to 7
161 (*completely like me*). Internal consistency reliability was adequate for the total scale (Cronbach's $\alpha =$
162 .74) and satisfactory for all the four sub-scales (ranging from 0.62 to 0.79). Each of the AAAGQ sub-
163 scales include three items, and internal consistency reliability scores above .60 are considered
164 acceptable and satisfactory for measures/sub-scales with less than four items.

165 *Motivational regulations:* The Sport Motivation Scale (SMS)²⁷ was used to assess motivational
166 regulations reflecting intrinsic and extrinsic motivation and amotivation according to the theory of

167 self-determination. This scale included 28 items, which were scored on a 7-point scale (1 = *doesn't*
168 *correspond at all*, 7 = *corresponds exactly*). In accordance with self-determination theory²⁸ and in
169 order to test a more comprehensive and theoretically driven description of athletes' motivational
170 profile in our study we computed the scores for the sub-scales of autonomous motivation (i.e.,
171 intrinsic motivation subscales and identified regulation; Cronbach's $\alpha = .89$), controlled motivation
172 (i.e., introjected and external regulations; Cronbach's $\alpha = .80$), and amotivation (Cronbach's $\alpha = .72$).

173 *Doping Likelihood*: In order to avoid social desirability and other reporting bias that may be common
174 with the use of direct intentionality items^{29,30}, in the present study we assessed intentionality with the
175 mean of three doping likelihood items (i.e., "*How likely is to use doping substances to improve your*
176 *athletic performance?*", "*Do you believe you will use doping substances to improve your performance*
177 *in the future?*", and "*How likely is to use a doping substance that would improve your athletic*
178 *performance, would be offered to you free or at low cost, and you would be re-assured that it can't be*
179 *identified in a doping control?*"). For this reason, we report doping likelihood scores in the analysis
180 and discussion sections reported below. Scores in this measure were given on a 7-point scale (1 = *not*
181 *likely at all*, 7 = *very likely*), with higher scores denoting stronger likelihood to use prohibited PEDs
182 (Cronbach's $\alpha = .74$).

183 *Gateway belief*: A single item was used to assess participants' belief about whether nutritional
184 supplements serve as a gateway to doping ('Do you believe that frequent use of licit nutritional
185 supplements can lead an athlete into doping?'). Responses were anchored on a 5-point Likert scale
186 ranging from 1 (*definitely no*) to 5 (*definitely yes*).

187 *Doping*: Past and current use of doping substances and methods were assessed with a single question
188 (Have you ever used prohibited substances or methods to enhance your performance?), followed by
189 four different response options (1 = *No, I have never used prohibited substances to enhance my*
190 *performance*; 2 = *Yes, I have used prohibited substances to enhance my performance once, but not*
191 *ever since*; 3 = *Yes, I use prohibited substances occasionally to enhance my performance*; and 4 =
192 *Yes, I use prohibited substances systematically to enhance my performance*). This question was
193 preceded by a short description of doping substances and methods based on the updated anti-doping
194 code by WADA. For reasons of subsequent analyses (i.e., differences between dopers and never-

195 dopers), scores in these variable were used to create two main categories of never dopers (i.e., athletes
196 reporting they never used doping), and ever dopers (i.e., athletes reporting the use of doping at least
197 once in their lifetime).

198 *Nutritional supplement use:* Participants' use of NS was measured with a single question (How often
199 do you use licit nutritional supplements?), followed by six different response options (1 = *Never*; 2 =
200 *Rarely*; 3 = *Sometimes*; 4 = *Often*; 5 = *Very often*; and 6 = *Systematically*).

201 The study design was in line with the Aristotle University of Thessaloniki, Greece, Code of
202 Ethics in Research. Sports clubs were contacted and the aim of the project was described to the
203 administrative boards and coaches. Following obtaining permission from the club officials, athletes
204 were briefed about the project, and informed consent was requested from those wishing to participate.
205 The athletes completed the questionnaire anonymously in the locker rooms. Athletes were asked to
206 return the completed surveys in envelopes, and put the envelopes in a box to ensure confidentiality.
207 Both oral and written instructions were given to participants regarding the completion of the
208 questionnaire. Moreover, the athletes were reassured about voluntary participation, anonymity, and
209 confidentiality of their responses, and encouraged to ask any questions regarding the
210 understanding/comprehension of the questionnaire items.

211 SPSS 25 was used to conduct the analyses. Hierarchical regression analyses was used to
212 assess the association between self-reported NS use, achievement goals and motivation types, and
213 gateway beliefs. Moderated regression analyses were further used to examine whether achievement
214 goals and motivation moderated the association between NS use, doping likelihood and self-reported
215 doping behaviour³¹.

216 Results

217 Means and standard deviations scores, internal consistency reliability, and intercorrelations
218 are presented in Table 1 (see supplementary file). In this section we describe a) the hierarchical
219 regression analyses indicating the significant predictors of doping likelihood and behavior (i.e., the
220 variables that should be mean-centred to test for moderation) and b) the moderated regression
221 analyses with the moderation effects that significantly predicted doping likelihood and behavior. In
222 the figures, we present the simple slope analyses that illustrate the reported moderation effects.

223 Hierarchical regression analysis was completed in two steps. Age, gender, NS use and
224 "gateway" belief were entered at Step 1, and achievement goals (i.e., mastery/performance approach;
225 mastery/performance avoidance), and types of motivation (i.e., autonomous and controlled
226 motivation, and amotivation) as predictor variables were entered at Step 2. Self-reported doping was
227 the dependent/criterion variable. The overall model predicted 33% of the variance (Adjusted R^2 , $F =$
228 18.96, $p < .001$) in self-reported doping. In the first step of the analysis, only self-reported use of NS
229 and gateway belief were associated with self-reported use of doping substances. The addition of
230 achievement goals and motivation types in the second step significantly increased predicted variance
231 in self-reported doping ($\Delta R^2 = 9.3\%$, $F_{\text{change}} = 7.98$, $p < .001$). The significant correlates of self-
232 reported doping in the last step of the analysis included NS use ($\beta = .347$, $p < .001$), "gateway" belief
233 ($\beta = .307$, $p < .001$), amotivation ($\beta = .167$, $p < .001$), controlled motivation ($\beta = -.204$, $p = .001$),
234 mastery approach ($\beta = -.173$, $p < .001$), and performance avoidance ($\beta = .134$, $p = .013$). The findings
235 from the regression analysis are summarized in Table 1.

236 A second hierarchical regression analysis was completed to assess the association of self-
237 reported use of NS and doping likelihood in the future, after controlling for self-reported use of
238 doping, the "gateway" belief, achievement goals, and types of motivation. The analysis was
239 completed in two steps and the overall model predicted 41.7% of the variance (Adjusted R^2 , $F =$
240 24.98, $p < .001$) in doping likelihood. Step 1 included age and gender, self-reported use of doping
241 substances, use of NS, and the "gateway" belief as predictor variables, and all the predictors were
242 significantly associated with likelihood except the "gateway" belief. Adding achievement goals and
243 motivation types in the second step of the analysis significantly increased predicted variance in
244 likelihood by 3.4% ($F_{\text{change}} = 24.98$, $p < .001$). Significant predictors of likelihood to use doping
245 substances in the future at the last step of the analysis included age ($\beta = -.161$, $p < .001$), gender ($\beta = -$
246 $.167$, $p = .001$), use of NS ($\beta = .156$, $p = .001$), self-reported doping ($\beta = .474$, $p < .001$), autonomous
247 motivation ($\beta = -.124$, $p = .027$), and performance avoidance goals ($\beta = .100$, $p = 0.47$). The findings
248 from the regression analysis are summarized in Table 1.

249 Eight moderated regression analysis models were computed to respectively assess the
250 interaction between performance approach/avoidance goals and use of NS, and mastery

251 approach/avoidance goals and use of NS in predicting self-reported doping and likelihood. To avoid
252 multicollinearity, the predictor variables were mean-centred³¹, and an interaction term was computed
253 (independent variable \times moderator) for each pair of associations, and each moderated regression
254 analysis was completed in two steps. The first step included the main effects of the independent
255 variable and the moderator, and the second step included their interaction term. Unstandardized beta
256 weights (B) and 95% confidence intervals (CIs) were used.

257 The results of the analyses testing the moderating role of achievement goals showed that the
258 interactions of NS use with: mastery approach ($B_{\text{supplement use} \times \text{mastery approach}} = -.115, \beta = -.247, p < .001,$
259 95% CI for B = $-.153$ to $-.078$), mastery avoidance ($B_{\text{supplement use} \times \text{mastery avoidance}} = -.026, \beta = -.099, p =$
260 $.021,$ 95% CI for B = $-.048$ to $-.004$), and with performance avoidance ($B_{\text{supplement use} \times \text{performance avoidance}} =$
261 $.042, \beta = .219, p < .001,$ 95% CI for B = $.026$ to $.058$) significantly predicted self-reported doping
262 (Figure 1). Furthermore, the interactions of NS use with: mastery approach ($B_{\text{supplement use} \times \text{mastery approach}}$
263 $= -.169, \beta = -.185, p < .001,$ 95% CI for B = $-.244$ to $-.094$, and performance avoidance ($B_{\text{supplement use} \times}$
264 $\text{performance avoidance}} = .046, \beta = .122, p = .003,$ 95% CI for B = $.015$ to $.077$; Figure 1) significantly
265 predicted future doping likelihood (Figure 2).

266 Six moderated regression analysis models were computed to respectively assess the
267 moderating role of autonomous and controlled motivation, amotivation, on the effect of NS use in
268 predicting self-reported doping and likelihood. The results showed that the interactions of NS use
269 with: autonomous motivation ($B_{\text{supplement use} \times \text{autonomous motivation}} = -.034, \beta = -.129, p = .004,$ 95% CI for B
270 $= -.058$ to $-.011$), controlled motivation ($B_{\text{supplement use} \times \text{controlled motivation}} = -.035, \beta = -.140, p = .001,$ 95%
271 CI for B = $-.056$ to $-.014$), and with amotivation ($B_{\text{supplement use} \times \text{amotivation}} = .052, \beta = .224, p < .001,$ 95%
272 CI for B = $.033$ to $.072$) significantly predicted self-reported doping(Figure 1). Further analysis
273 showed that the interactions of NS use and controlled motivation ($B_{\text{supplement use} \times \text{controlled motivation}} = -.068,$
274 $\beta = -.140, p = .001,$ 95% CI for B = $-.110$ to $-.027$) significantly predicted future doping likelihood
275 (Figure 2).

276 Discussion

277 The present study investigated the moderating effect of motivational regulations and
278 achievement goals on the association between NS use and self-reported doping use and future

279 likelihood among a large sample of competitive team sport athletes. First of all, and in support of the
280 first hypothesis of the study, motivational variables derived from both self-determination and
281 achievement goal theories were associated with both self-reported doping use and doping likelihood,
282 over and above the effects of NS use. More specifically, amotivation and performance avoidance
283 (positively) and controlled motivation and mastery approach (negatively) were associated with self-
284 reported doping. Accordingly, autonomous motivation (negatively) and performance avoidance goals
285 (positively) predicted doping likelihood. Taken together, our findings are in line with previous
286 research that has emphasized the role of achievement goals and motivational regulations on doping
287 behaviour^{14, 15, 21, 22}.

288 With respect to the direction of the observed associations, adaptive types of motivation, such
289 as autonomous motivation and mastery goals, are expected to promote adaptive beliefs and
290 behaviours in sport settings¹¹. Our findings showed that mastery approach goals and autonomous
291 motivation were negatively associated with self-reported doping and doping likelihood respectively,
292 whereas performance avoidance goals had a positive association with the dependent variables. This
293 suggests that promoting positive motivation in athletes can serve as a protective factor against the
294 decision to dope. A practical implication of this finding is that coaches should learn how to establish a
295 culture in their teams that promotes mastery goals and foster athletes' autonomous motivation. Recent
296 evidence has shown that this approach is effective in reducing the risk for doping among athletes³².
297 Furthermore, athletes with higher scores in performance avoidance goals may feel there is no chance
298 of success unless they engage in doping. Therefore, educating athletes on how to cope with and
299 overcome performance plateaus in legitimate ways can potentially reduce the risk of doping use.
300 Interestingly, our results showed that controlled motivation was negatively associated with doping
301 behaviour and likelihood respectively. These findings are difficult to interpret as a positive association
302 was expected¹⁴. A plausible for the negative association between controlled motivation and doping
303 behaviour and likelihood may pertain to fear of sanctions resulting from (exposed) doping use. It is
304 possible that team sport athletes with controlled motivation may choose other, less risky methods to
305 outperform others, but more research is needed to further examine this effect³³.

306 Importantly, our study addressed, for the first time, the role of motivational processes in the
307 association between NS use and self-reported doping, and the likelihood to use doping in the future.
308 The results largely supported our hypotheses by showing that mastery approach and avoidance goals
309 and autonomous motivation attenuated the relationship between self-reported supplement use and
310 doping. Taken together, our findings make an important contribution to the extant literature by
311 providing a theoretically plausible explanation about the association between NS use and doping
312 behaviour and, therefore, an alternative to the "gateway hypothesis"⁶. Rather than attributing causal
313 influence to specific substances and risking adopting an approach that resembles a new "war on
314 drugs", we demonstrated that motivational processes can explain why some athletes who use NS
315 concurrently use (or plan to use) prohibited performance enhancement substances. It is imperative,
316 therefore, that future research on this topic is concerned with gateway mindsets, that is, cognitive,
317 affective and motivational processes that explain how and why NS use can be associated (or lead to)
318 the use of doping substances.

319 To illustrate, on the basis of our findings it appears that mastery-oriented and autonomously
320 motivated athletes use NS in order to support their training and improve, with legitimate means, their
321 performance according to personally referenced goals and standards. In this case, nutritional
322 supplements serve as an aid to the athletes' effort and represent safe alternatives to the prohibited
323 substances. On the other hand, athletes adopting performance avoidance goals are primarily
324 concerned with avoiding displaying failure and poor performance. To this end, they may use
325 everything that will keep them at adequate performance levels. In this respect, NS use is not
326 necessarily a gateway to prohibited PEDs, but rather another available means to avoiding performance
327 failure. It may actually be the case that NS are used *together* with prohibited PEDs in order to support
328 performance during trainings and competitions (i.e., co-occurrence of NS and doping substances).
329 From a practical point of view, a) interventions and policies aiming to reduce the onset and prevalence
330 of doping in competitive sports should target the safe use of supplements jointly with promoting
331 positive and adaptive motivation in athletes³⁴, and b) practitioners could promote nutritional
332 supplements as an alternative to doping.

333 Our study is not free of limitations. First of all, a cross-sectional design was used and,
334 therefore, causal inferences cannot be made. Secondly, the two approach goals (mastery and
335 avoidance) showed reliability coefficients below .70. Although their reliability values are considered
336 acceptable, future studies may utilise measures with higher internal consistency scores or different
337 measures (such as task and ego orientation) to further examine the association observed in the present
338 study. Thirdly, key variables of the study such as gateway beliefs, and doping and NS use were
339 measured with single items. The use of multi-items scales would provide a more elaborated
340 measurement of these variables in the future. Lastly, as doping is a sensitive behaviour the study
341 would benefit from a measure of social desirability to identify and control for response bias.

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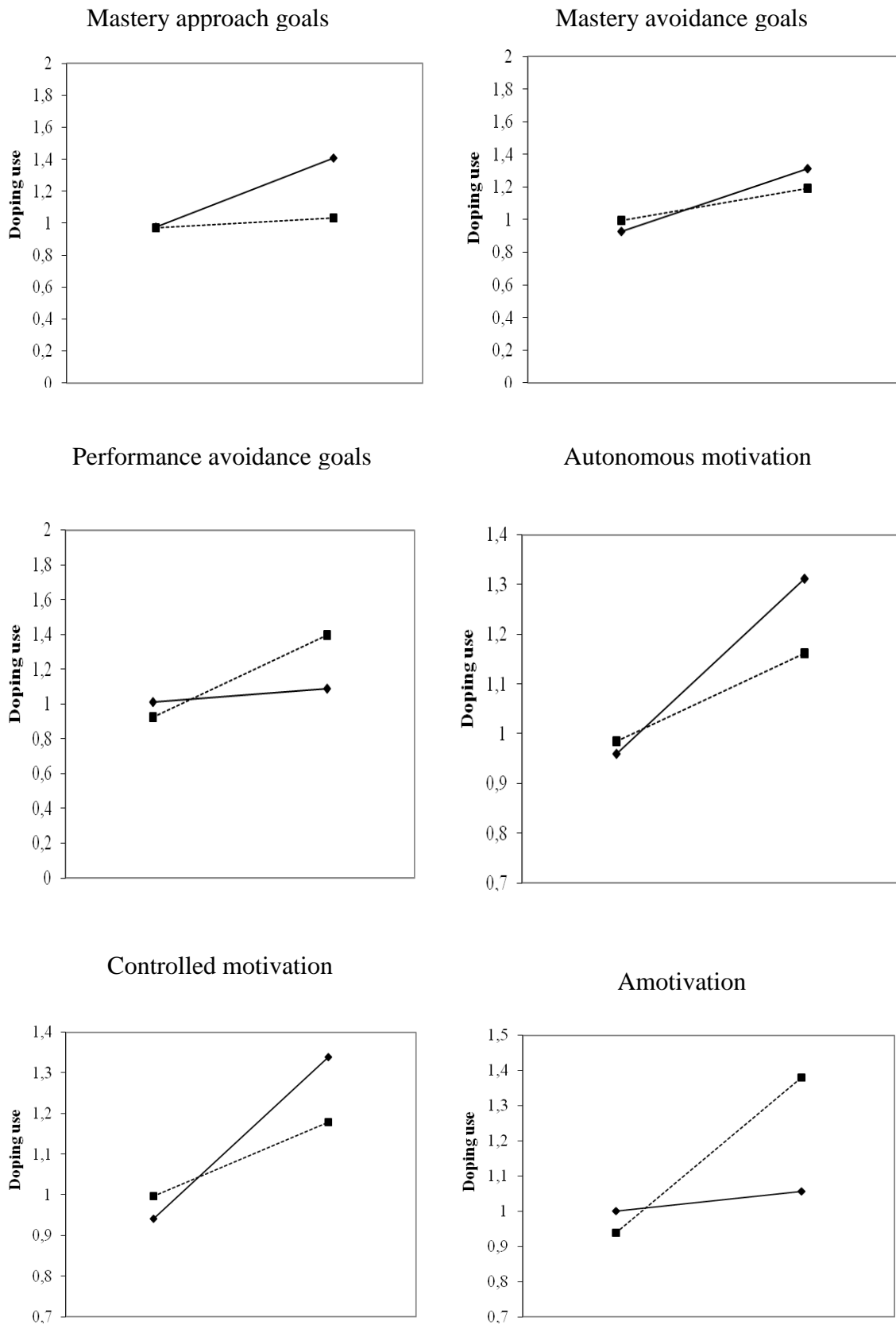
Table 1. Psychological Correlates of Self-Reported Doping Use and Doping Likelihood

Predictors	Self-Reported Doping Use				Doping Likelihood			
	Beta	β	95% CI for B	Adj R^2	Beta	β	95% CI for B	Adj R^2
Step 1				.24				.39
Age	.005	.065	-.003 - .014		-.030	-.193***	-.044 - .017	
Gender	.007	.007	-.095 - .110		-.383	-.206***	-.555 - .210	
NS Use	.125	.376**	.094 - .157		.100	.161**	.044 - .156	
Doping use	-	-	-		.931	.498***	.765 - 1.096	
Gateway belief	.147	.332**	.109 - .185		-.010	-.012	-.078 - .058	
Step 2				.33				.41
Age	.010	.118*	.002 - .018		-.025	-.161***	-.039 - -.011	
Gender	.036	.036	-.070 - .142		-.310	-.167**	-.496 - -.125	
NS Use	.116	.347**	.086 - .145		.097	.156**	.042 - .153	
Doping use	-	-	-		.886	.474***	.713 - 1.059	
Gateway belief	.137	.307**	.100 - .173		-.014	-.017	-.082 - .053	
Amotivation	.065	.167**	.029 - .101		.013	.018	-.051 - .077	
Autonomous motivation	.016	.028	-.053 - .086		-.136	-.124*	-.257 - -.016	
Controlled motivation	-.096	-.204**	-.150 - -.041		.045	.052	-.051 - .141	
Mastery approach	-.141	-.173*	-.216 - -.066		.057	.038	-.076 - .191	
Mastery avoidance	.009	.021	-.026 - .043		.012	.017	-.048 - .073	
Performance approach	.014	.036	-.026 - .054		.063	.088	-.007 - .133	
Performance avoidance	.041	.134*	.009 - .073		.057	.100*	.001 - .113	

Note. * $p < .05$; ** $p < .005$; *** $p < .001$; NS = nutritional supplements; doping use was not entered as predictor

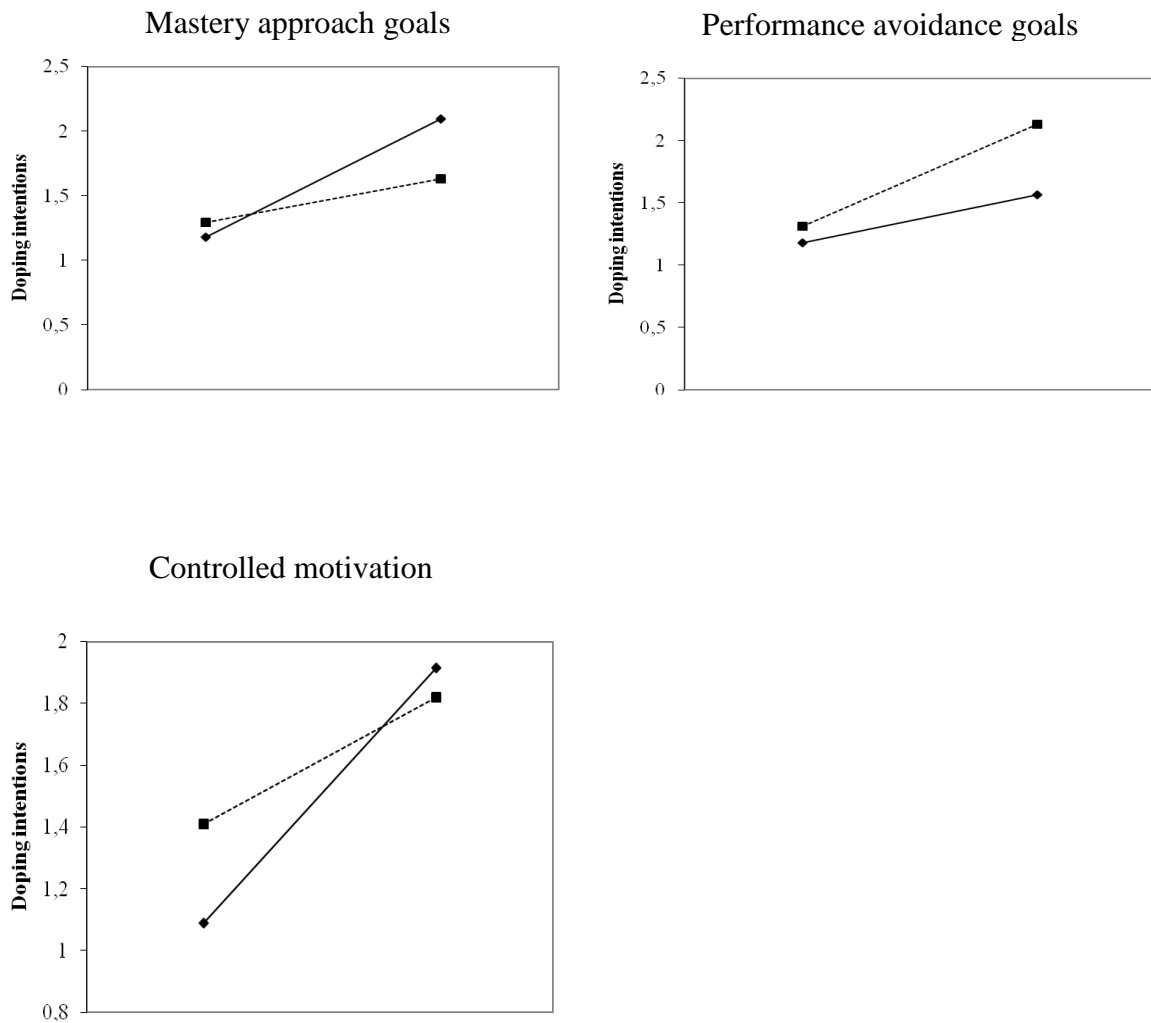
in the regression analysis of Self-Reported Doping Use

Figure 1. Interaction between NS use and motivation in predicting doping use.



Note: The dash line represents low levels of the variable, whereas the dotted line high levels

Figure 2. Interaction between NS use and motivation in predicting doping likelihood.



Note: The dash line represents low levels of the variable, whereas the dotted line high levels