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An Explanatory Model of Doping Susceptibility Examining Morality in Elite Track and Field Athletes: A Logistic Regression Analysis

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Abstract: The aim of the present study was to develop an explanatory model of doping susceptibility among competitive track and field athletes using a logistic regression analysis accounting for some morality-related variables which were not explored in previous studies. A total of 281 Spanish elite track and field athletes (49.5% women, 48.4% have competed with the national team) completed an online survey measuring different constructs in relation to doping susceptibility. The final model demonstrated that nutritional supplements (OR: 2.39; CI: 1.16–4.90; $p < 0.05$), moral disengagement (OR: 2.17; CI: 1.48–3.19; $p < 0.001$), acceptance of gamesmanship (OR: 1.29; CI: 1.12–1.49; $p < 0.001$), and descriptive norms (OR: 1.21; CI: 1.04–1.41; $p < 0.05$) are the factors better explaining doping susceptibility. The profile of the athlete at risk of being more susceptible to doping is represented by someone who is aged under 20 years, believes that doping is present in his/her sport, has positive attitudes of acceptance of gamesmanship, is morally disconnected from doping, and frequently consumes nutritional supplements. It is recommended to deliver education related to the use of sports supplements and potential ill-effects of performance-enhancing substances or methods, and to engage athletes in doping prevention programs at an early age.

Keywords: doping behavior; moral disengagement; decision making; competitive sport; sport supplements

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1. Introduction

Anti-doping rule violations (ADRV) not only address the use of prohibited performance-enhancing substances or methods (PESM) in sport, but also other types of doping behavior (i.e., whereabouts failures, trafficking, complicity, etc.), reflecting the dual dimension of the fight against doping in sport: protecting athletes' health and the integrity of sport. In fact, the fundamental rationale for the World Anti-Doping Code is preserving "the Spirit of Sport", the essence of Olympism [1] (p. 14) and is reflected in twelve values among which four are morality-related: ethics, fair play, and honesty; character and education; respect for rules and laws; and respect for self and other competitors [2]. Ultimately, "the Spirit of Sport" is the moral basis for the international effort against doping [3].

Doping in sport represents a current sociological problem which leads to the matter of how values inherently associated to sport can be either positive or negative [4]. Since the 1990s, the number of research studies on psychosocial doping factors have substantially increased [5], alongside with the promotion of fairness and equality worldwide with the aim of instilling the values of sport through an educational approach. Morality construct has a central role in the psychology of doping in sport and has been reported in the literature as a key and protective factor influencing attitudes towards doping and, ultimately, modifying

behavior [6,7]. Researchers have measured the morality construct through the analysis of different morality-related variables. Jalleh et al. [8] analyzed morality through moral stance and moral affect. Mazanov et al. [9] described the concept of morality using the "Spirit of Sport" statement. Likewise, Mortimer et al. [10] recently found that morality-related values were the only ones from those belonging to the World Anti-Doping Agency's (WADA's) Spirit of Sport Values. Hurst et al. [2] reported that moral values and moral identity moderate the indirect relationship between sport supplement use and doping use, and García-Grimau et al. [11] found that moral disengagement is a strong predictor of doping behavior.

In summary, the construct of morality is paramount in social science antidoping research, nevertheless the existence of a wide range of morality-related variables attempting to explain attitudes towards doping may hinder the study of the psychology of doping while increasing its complexity. To the best of authors' knowledge, no study has attempted to analyze which of the morality-related variables are the most accurate and suitable for the study of doping variable (i.e., doping attitudes, susceptibility, intentions, or use), thus simplifying the process for researchers. Moreover, a great proportion of quantitative studies used descriptive and correlation statistics. Few in-depth studies were carried-out through predictive modeling by developing algorithms based on regression analysis explaining the association between morality variables and doping likelihood. Moreover, the lack of some relevant variables explaining those analyzed in the models being used could be biasing the estimation of the parameters.

For all these reasons, the main objective of this study was to develop an explanatory model of doping susceptibility among competitive track and field athletes using a logistic regression analysis accounting for some of the absent morality-related variables in previous studies to obtain more robust and consistent results. A secondary aim was to determine other variables (i.e., use of nutritional supplement, psychological factors, sociodemographic, etc.) that can influence doping susceptibility and establish recommendations for assessing anti-doping attitudes, which may be adopted by anti-doping organizations and researchers conducting further doping-related quantitative research. We hypothesized that constructs related to morality and social norms are those significantly explaining doping susceptibility.

2. Materials and Methods

The sample of participants consisted of 281 Spanish competitive track and field athletes, of whom 49.5% were women, 80.1% were aged between 18 and 28 years, and 48.4% competed in international competitions with the national team. Athletes were contacted personally or through their respective coaches and were invited to participate in an online survey using the WhatsApp mobile application (v2.18.52, Mountain View, CA, USA). Athletes and coaches were informed about the aims and objectives of the study. Of the 339 surveys distributed, n = 281 were returned (82%). All the participants signed a consent form to participate in this study, were informed that they could withdraw at any time, and reassured about their anonymity and confidentiality of their data.

A cross-sectional online survey was conducted using as an instrument a validated questionnaire from WADA's Social Science Research Package (SSRP) for Anti-Doping Organizations [12]. The questionnaire was previously translated into Spanish and provided validity and reliability [11]. In the first part of this study, a descriptive analysis of morality-related variables was conducted. In the second part, a logistic regression was carried out and a model of doping susceptibility among elite track and field athletes was developed.

The variables included in the present study were as follows:

Doping susceptibility is the dependent variable of the logistic regression model. Susceptibility to doping has been found to be strongly correlated with attitudes toward doping [13,14] and was estimated through three items: (1) "If you were offered a banned PESM under medical supervision at low or no financial cost and the banned PESM could make a significant difference to your performance and was currently not detectable, how much consideration do you think you might give to this offer?" (Ranging from 1 = none at all

to 4 = a lot of consideration); (2) "Given the pressures athletes are often under to win, how confident are you that you could refuse this offer?" (Ranging from 1 = very confident could refuse to 4 = not confident at all could refuse); and (3) "How confident are you in being able to resist pressure from your team mates to use a banned PESM?" (Ranging from 1 = very confident could refuse to 4 = not confident at all could refuse). The Factor Analysis technique was used to construct a single composite indicator of the abstract concept to be measured. The final indicator was standardized on a scale with scores from 0 to 10. A moderate variability in the scale scores was observed due to the sensitivity of the question, therefore a binary variable was created using codes of 0 for scores from 0 to 3.3 and 1 for the rest (no/yes).

Moral Stance is the extent to which an athlete believes that doping is morally right or wrong. Participants were asked to choose the statement that best describes their own personal feelings about deliberately using banned PESM (1 = is morally wrong, 2 = is morally OK under some circumstances, but wrong under others, and 3 = is morally OK).

Moral Affect refers to emotions related to having violated one's moral stance. To assess the emotional responses of guilt, shame, and embarrassment, athletes were asked to rate from not at all (1) to a great extent (5) to what extent would they experience these feelings if they were caught using banned PESM.

Moral decision-making measures attitudes towards moral decision-making in sport with a focus on cheating behaviors that are not covered in the rules of the sport but enable one to gain an unfair advantage [15]. This construct is composed of three subscales: acceptance of cheating (seven items), keeping winning in proportion (six items), and acceptance of gamesmanship (seven items). Participants were asked to rate from strongly disagree (1) to strongly agree (5).

Moral disengagement was measured using the six-items from the Moral Disengagement in Doping Scale which has shown good internal consistency, reliability, and validity [16]. Participants were asked to rate from strongly disagree (1) to strongly agree (7).

Legitimacy perceptions refers to how athletes perceive anti-doping organizations to have strong authority to enforce anti-doping regulations. We assessed distributive justice (the perceived fairness of the outcomes of the drug testing process) with two items ranging from 1 very fair (1) to not at all (4).

Benefit Appraisal is measured in terms of (1) perceived performance-enhancing effects of banned substances and methods use and (2) likelihood of potential positive outcomes for performing well in sport [8]. To assess (1), participants were asked to rate from definitely would not (1) to definitely would (5) "If you were to use a banned PESM of your choice, how likely is it that you would improve your performance?". To assess (2), participants were asked "To what extent does your sport offer you these outcomes if you perform well?" and rate from not at all (0) to a lot (4) six answer-items (i.e., national celebrity status, future financial security).

Threats Appraisal relating to (1) deterrence and (2) ill-health effects were measured. To assess (1), participants were asked two questions to measure their perceived likelihood of being tested in and out of competition, using a five-point scale ranging from 1 (very likely) to 5 (not at all likely), and the perceived severity of the sanctions for testing positive using a four-point scale ranging from 1 (very severe) to 5 (very lenient). To assess (2), participants were asked to score the harm level of six different PESM using a five-point scale from 1 (no harm) to 5 (a lot of harm).

The Self-Efficacy to refrain from doping scale [17] was used to assess athletes' ability to avoid the use of PESM or resist doping temptation. The scale includes ten items ranging from not at all capable (1) to completely capable (7).

Goal orientations. In the context of the achievement goal theory in sport, research indicates that ego-oriented goals increase doping likelihood [18]. Participants were asked to indicate their level of agreement with twelve statements (six items assessing ego-oriented subscale, and six items assessing task-oriented subscale) using a five-point Likert scale from strongly disagree (1) to strongly agree (5).

Subjective norms were assessed by asking the participants: "If you decided to use a banned PESM, to what extent do you think each of the following people would approve or disapprove or would not care either way if you did that?". Six-response items were presented to participants (e.g., your coach, parents, teammates, sport doctors, close friends, and manager) and asked them to rate from would definitely approve it (1) to probably disapprove (5).

Descriptive norms were assessed by asking the participants to indicate the percentage of perceived doping prevalence in five statements (i.e., "Out of 100%, how many athletes in your sport do you believe engage doping to enhance their performance?").

Societal influences on doping: pressure to win. Participants were asked two questions: "To what extent, if at all, do you think commercial influences on the Olympics and sport in general have increased a 'win at all costs' attitude amongst elite athletes?" and, "To what extent, if at all, do you think commercial influences on the Olympics and sport in general have increased the temptation amongst elite athletes to use banned PESM?" coded from had no effect (1) to increased a lot (4).

Use of nutritional supplements: Participants were asked to indicate the frequency of supplement use ranging from never (1) to systematically (6), of seven nutritional supplements. A binary variable was created using codes of 0 (low frequency) for scores from 1 to 3 and 1 (high frequency) for the rest.

Sport and sociodemographic variables: Gender, age range, sport income, competition level, and athletic discipline were introduced in the model as categorical variables.

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 27.0 (IBM, Armonk, NY, USA). Data screening revealed that missing values for each variable were relatively low (i.e., from 0.4 to 3.1%) and assumed to be missing at random. They were imputed using the expectation maximization method when necessary [19]. (Means, standard deviations (SDs), and McDonald's ω values were calculated for the variables. Pearson zero-order correlations were calculated to examine the relations between morality-related variables and doping susceptibility. Backward conditional regression was used to evaluate the direct relation of each independent variables with doping susceptibility and to develop the explanatory model of susceptible and non-susceptible to doping. Means and/or Factor Analysis technique were performed to generate explanatory variables to introduce in the model and were indicated as transformed variables in Section 3.2. Estimates of marginal effects derived from each explanatory variable were also analyzed (see Section 3.4). A statistical significance level of 95% ($p < 0.05$) was applied.

3. Results

3.1. Characteristics of the Participants

Participants were 281 Spanish elite track and field athletes: 49.5% women, 80.1% aged between 18–28 years, and 48.4% have competed with the national team. Table 1 displays the characteristics of participants.

Table 1. Characteristics of the participants.

n		**281**
Gender	Men	50.5%
	Women	49.5%
Age range (years)	18–20	26%
	21–24	34.5%
	25–28	19.6%
	≥29	19.9%

Table 1. *Cont.*

n		**281**
Competition level	Olympic Games	5.6%
	World Athletics Championships	18.0%
	European Athletics Championships	14.7%
	Other International events with the national team	10.1%
	National Athletics Championships	44.8%
	Regional Championships	6.8%
Athletic discipline	Middle- long-distance running	61.6%
	Race walking	4.3%
	Sprinting/hurdles	17.1%
	Jumping/throwing	13.9%
	Combined events	3.2%
Sport income	<5000€	73.3%
	5000–9999€	11.4%
	10,000–19,999€	8.9%
	20,000–39,999€	4.6%
	>40,000€	1.8%

3.2. Descriptive Statistics and Internal Reliability of the Variables

Descriptive statistics for the different moral variables analyzed indicate that athletes reported on average low levels of susceptibility to doping, moral disengagement, and moral stance (92.5% of participants reported that doping is immoral), and on average they would feel ashamed (96.1%), embarrassed (58.7%), and guilty (90.7%) to a great extent if they were caught using PESM. Regarding moral-decision making, athletes reported on average low attitudes to cheating in sport and rated high in the 'keeping winning in proportion' subscale. In terms of the perceived benefit of doping use, more than 74.4% of the athletes reported that doping substances would probably improve their sport performance and that this improvement would bring them rewards or positive outcomes. Moreover, 18.9% of participants considered the threat from deterrence as high, 33.3% were unaware of the ill-health effect of PESM, and 19.4% perceived a little harm or no harm of health risk. With respect to psychological factors, athletes stated on average a high self-efficacy to refrain from doping and displayed greater task-oriented goals than ego-oriented ones. Regarding social norms, they believed that their reference groups would disapprove doping behaviors and they perceived an average doping prevalence of 22.2%. Most athletes reported having felt social pressure to win and a low frequency of supplement use. Descriptive statistics and internal reliability of the variables used in the model are shown in Table 2.

Table 2. Descriptive statistics and reliability of the model variables.

Variables	**Range**	**Mean**	**SD**	**ω**
Doping susceptibility *	(0) no (1) yes	33.1%	N/A	N/A
Moral disengagement †	(1) strongly disagree to (7) strongly agree	1.51	0.77	0.72
MDM Acceptance of cheating subscale †	(1) strongly disagree to (5) strongly agree	1.16	0.36	0.75
MDM Keeping winning in proportion subscale †	(1) strongly disagree to (5) strongly agree	4.30	0.56	0.45

Table 2. *Cont.*

Variables	Range	Mean	SD	ω
MDM Acceptance of gamesmanship subscale †	(1) strongly disagree to (5) strongly agree	1.75	0.52	0.59
Legitimacy: distributive justice †	(1) very fair to (4) not at all	1.90	0.63	N/A
Benefit Appraisal: performance-enhancing effect †	(0) definitely would not to (10) definitely would	7.55	2.16	N/A
Benefit Appraisal: positive outcomes †	(0) not at all to (10) a lot	4.73	1,92	0.64
Threat appraisal: deterrence †	(1) low threat to (3) high threat	1.72	0.76	N/A
Threat appraisal: ill-health effect †	(0) no harm to (10) a lot of harm	6.19	2.33	0.90
PS: Self-efficacy to refrain from doping †	(0) completely capable to (10) not at all capable	1.74	1.51	0.96
PS: Ego-oriented goals †	(0) strongly disagree to (10) strongly agree	3.93	2.36	0.87
PS: Task-oriented goals †	(0) strongly disagree to (10) strongly agree	7.79	1.57	0.73
Subjective norms: others' opinions towards doping †	(0) would definitely approve to (10) probably disapprove	8.48	1.98	0.78
Descriptive norms: projected doping prevalence †	(0) to (10)	2.50	1.92	0.91
Societal influences: pression to win at "all cost" †	(1) low to (4) high	2.88	0.87	N/A
Use of nutritional supplements	(0) low frequency (1) high frequency	0.28	0.45	N/A

* Binary dependent variable is presented in terms of percentages of (1); † Transformed variables; SD: standard deviation; ω: McDonald's ω; N/A: not applicable. MDM: Moral decision-making. PS: Psychological factors.

3.3. Analysis of Morality-Related Variables and Doping Susceptibility

Significant Pearson's correlations were observed between moral disengagement (r = 0.32, $p < 0.001$) and moral decision-making (r = 0.28, $p < 0.001$) with respect to doping susceptibility. Moral stance (r = 0.05, $p > 0.05$) and moral affect (r = −0.05, $p > 0.05$) did not significantly correlate with doping susceptibility. Therefore, the latter variables were excluded from the regression analysis.

3.4. Logistic Regression Analysis

Results from the logistic regression analysis reveal that predictors of doping susceptibility are age, moral disengagement (OR: 2.17; CI: 1.48–3.19; $p < 0.001$), moral decision-making 'acceptance of gamesmanship' subscale (OR: 1.29; CI: 1.12–1.49; $p < 0.001$), descriptive norms (OR: 1.21; CI: 1.04–1.41; $p < 0.05$), and a high frequency of supplement use (OR: 2.39; CI: 1.16–4.90; $p < 0.05$) (see Figure 1).

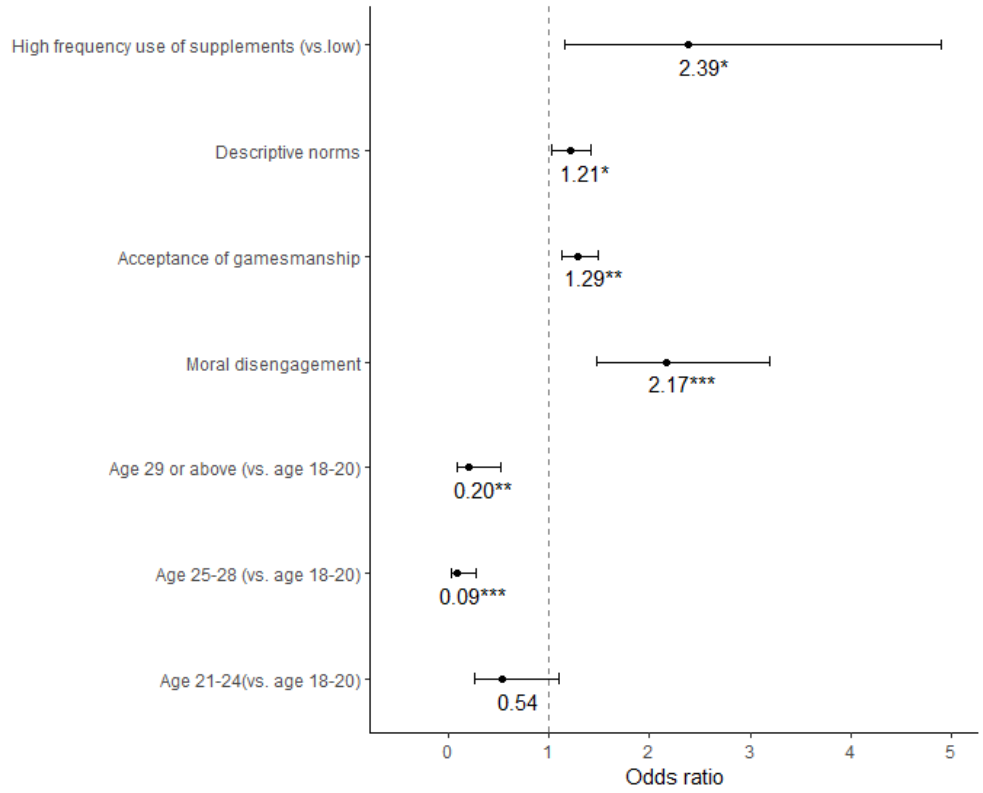

Figure 1. Logistic regression output representing the odds ratio for each variable. * = $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Risk factors of being susceptible to doping were being young under 20, morally disconnected from doping, with acceptance of gamesmanship, a high frequency use of supplement, and the belief that doping is present in sport. Supplement use and moral disengagement displays the highest marginal effects in doping likelihood (see Table 3). With respect to the goodness of fit of the model, at the final step (seventeenth), the model successfully classified 74.1% of the cases.

Table 3. Estimates of marginal effects derived from each explanatory variable representing the predicted likelihood of doping susceptibility as a result of a small increase in each of the variables.

	Baseline OR: 0.495		**Baseline L (Y = 1): 33.1%**
	OR	**ΔOR**	**L (Y = 1) (%)**
Age 21–24 (vs. age 18–20)	0.534	0.264	21%
Age 25–28 (vs. age 18–20)	0.092	0.046	4%
Age 29 or above (vs. age 18–20)	0.198	0.098	9%
Moral disengagement	2.172	1.075	52%
Moral decision-making: cheating behaviors in sport	1.290	0.638	39%
Descriptive norms (projected doping)	1.207	0.597	37%
High frequency of supplement use (vs. low)	2.387	1.181	54%
Constant	0.348	0.096	9%

OR: odds ratio; L: likelihood; Y: doping susceptibility (binary dependent variable); ΔOR = Baseline OR × OR. The marginal effect is the slope of the likelihood curve relating the small increase in an explanatory variable Xk to a relative likelihood of doping susceptibility (L [Y = 1]), while the rest of variables remain unchanged: $L(Y = 1 | Xk) = \Delta OR/(1 + \Delta OR)$.

4. Discussion

The main aim of the present study was to develop for the first time an explanatory model of doping susceptibility among elite track and field athletes, explained through multiple abstract concepts. The final model demonstrated that an algorithm to predict doping susceptibility is explained by only four variables among the 21 explanatory variables used in the first step. Among these four variables, two were moral-related and one was related with social norms, which confirms our initial hypothesis. The present results showed that the profile of the track and field elite athlete at risk of being more prone to doping is represented by someone who is aged under 20 years, believes that doping is present in his/her sport, has positive attitudes of acceptance of gamesmanship, is morally disconnected from doping, and frequently consumes nutritional supplements. These last two variables expose the athletes to a great risk of doping susceptibility (i.e., chance of 52% and 54%, respectively) (see Table 3). Gender, competition level, athletics discipline, and sport income were not explanatory variables. Age was the unique sociodemographic variable which displayed some influence on the risk of doping susceptibility, which means that being younger increases the likelihood of doping use. This evidence highlights the need to receive education aiming at preventing doping use at early age when its impact is more effective. Regarding descriptive norms, our results support those of previous studies in competitive athletes which also reported perceived doping prevalence as an explanatory variable of doping use [20,21]. In addition, our model indicates that the most important risk factor is a high frequency of supplement use. This finding is in line with that of Sekulic et al. [21] who reported that the strongest predictor of potential doping behavior in Rugby Union Players was a higher dietary-supplementation usage. Moreover, Hurst et al. [22] has evidenced the influence of sport supplement use with doping use. A recent study on athletes' doping vulnerabilities [23] showed that sport personnel consider nutritional supplement as the most important factor to increase vulnerability to doping whereas it was the sixth highest ranked factor by athletes. Our results confirm the fact that athletes may be unaware of the risks of supplement use and that education regarding nutritional supplements should be enhanced. In addition, descriptive analysis of the results with respect to benefit and threat appraisals reveal that most of the sample participants believe that the use of PESM would benefit them, whereas half of the athletes were unaware of the potential ill-effects of PESM. Thus, we suggest improving the current anti-doping educational approach and strategies aiming at providing this critical information to athletes.

With respect to morality-related variables, our results reflect that only moral disengagement and the acceptance of gamesmanship's subscale of moral decision-making influence doping susceptibility. The present results revealed that athletes consider doping as immoral, which agrees with findings of other studies [8,24,25], and that morality is a protective factor of doping behavior, which is also consistent with results of a previous study [26]. Therefore, these results underline the positive impact of the implementation of educational programs by WADA and National Anti-doping Organizations (NADOs); however, the transfer of anti-doping knowledge does not seem to be effective enough in preventing competitive athletes from engaging in cheating and doping behavior in sport. In this sense, the moral identity acquired as a protective element against doping may become vulnerable and ineffective, since athletes may manage to morally disengage and believe that the use of PESM is necessary for optimizing their sport performance. Therefore, our results support the conceptual framework of the Incremental Model of Doping Behavior, which states that doping behavior is a functional choice to achieve a goal (performance) rather than a moral choice [27]. Athletes choose to dope even though they know it is an illegal and immoral act. Indeed, moral disengagement may act at the functional level of the athlete's mental representation of doping. Furthermore, Mazanov and Huybers [3] highlighted the need to treat morality and moral disengagement as separate constructs in the study of the psychology of doping in sport.

It is important to adopt a supportive and preventive approach rather than a strategy based on catching and deterrence. Accordingly, it is crucial to address the doping

phenomenon from an educational perspective [28]. It is necessary to boost interventional programs targeting the development of decision-making processes and raising moral dilemmas from preadolescent to adult ages in athletes [29,30], given that those fostering training skills or values are unfortunately scarce currently [31,32].

A secondary aim of the present study was to establish recommendations for assessing anti-doping attitudes while updating WADA's SSRP, and thus facilitate the completion of further quantitative research in this field. Regarding morality-related variables, measuring moral disengagement, moral decision-making, and clean sport values is recommended to analyze doping variables. The latter indicator was used in a recent study which evidenced that clean sport likelihood was best predicted by moral values [10]. Considering the relevance of nutritional supplement in the analysis of doping likelihood, a more accurate measuring instrument should be included in SSRP. Moreover, our results reveal that testing the SDCM using a logistic regression analysis may be more accurate than a SEM technique [11].

The present study has some limitations. First, the cross-sectional design cannot allow us to make firm assertions about causality. Second, the model may present specificity limitations due to the lack of explanatory variables. Thus, to replicate this study in different countries or cultural contexts and introduce more explanatory variables in the model (i.e., type of sport, perfectionism, narcissism, or coach background) could solve specificity issues. In addition, future research using longitudinal/cohort designs is recommended to provide stronger causal relations. Finally, self-report measures to assess doping susceptibility may have been subject of social desirability bias, further research could use indirect measures to generate the dependent variable [33]. Despite these limitations, our results provide important findings for the development of anti-doping research and educational strategies and suggest the great potential of artificial intelligence to effectively promote clean sport and prevent doping behavior. A continuous dataset inputted over time, with abstract indicators triangulated together with other type of information (i.e., athlete's biological passport biomarkers, number of doping tests, sport performance, sport injury, etc.) may generate a predictive model of doping vulnerabilities based on machine learning algorithms. Embracing artificial intelligence may provide an early and targeted intervention, using both educational and deterrence approaches and, ultimately, make the fight against doping more efficient.

5. Conclusions

An explanatory model of doping susceptibility was developed for the first time among elite track and field athletes. The model revealed that several factors seem to increase an athlete's susceptibility to doping. These factors are moral disengagement, moral decision-making, use of nutritional supplements, descriptive norms, and age. It is recommended to emphasize education related to the use of sports supplements and potential ill-effects of PEMS. Intervention programs should focus on developing training skills, moral dilemmas, and a value-based mindset across the athlete's career, from talented to senior.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

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Conflicts of Interest: The authors declare no conflict of interest.

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