

50th years of research on doping prevention. A narrative review of tracks and perspectives.

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While the use of Performance-Enhancing and Aesthetic Substances (PAES) has been observed for thousands of years, doping has been conceptualized and regulated only in the modern era. The aim of the present study was to review the doping prevention theme in a narrative manner. The theoretical and research considerations presented in this article overall are guided by the assumption that doping behavior partly depends on the dynamic interplay between a set of individual factors, its environment, and the goal that guide the intentional behavior. Relatedly, this article introduces the general hypothesis that these forms interplay between socio-cognitive variables of particular importance in contributing to the scientific understanding of doping use, as they might help accounting for individual differences in doping intentions and doping use. In doing so, there are described theoretical and research frameworks that indirectly support this general view, and subsequently, is addressed the value of a focus on doping research. Finally, there are reported different research programs that have been tried to find empirical support to the hypothesized linkages between intervention, their efficacy and doping use in various sport contexts.

KEY WORDS: Doping, Health, WADA, Performance.

Introduction

The use of Performance-Enhancing and Aesthetic Substances (PAES) has been observed for thousands of years. Starting in the 1960s, the use of illegal performance-enhancing substances in professional and amateur sports has greatly increased (Calfee & Fadale, 2006; Irving, Wall, Neumark-Sztainer, & Story, 2002; Sjöqvist, Garle, & Rane, 2008). The use of Perfor-

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¹ Controlled PAES are those substances whose use implies legal sanctions (i.e., their use is controlled and regulated by laws) and that are generally indicated as “doping” substances. Thus, these substances are prohibited in competitive sports according to the regulations of the World Anti-Doping Agency (WADA).

mance and Appearance Enhancing Substances (PAES), labelled “controlled”¹, is subject to legal sanctions and it is not only a matter of elite sports, but it has increased among amateur athletes and exercisers at all competition levels (L. Mallia, Lucidi, Zelli, & Violani, 2013). Overall, there are numerous studies that estimate the prevalence of the use of PAES in non-athletes or in low level of sports competition. Studies conducted on large samples in countries, such as the United States (Irving et al., 2002), the United Kingdom (Williamson, 1993), Sweden (Kindlundh, Isacson, Berglund, & Nyberg, 1999; Nilsson, Allebeck, Marklund, Baigi, & Fridlund, 2004), Australia (Handelsman & Gupta, 1997), Germany (Wanjek, Rosendahl, Strauss, & Gabriel, 2007), and France (Laure, Lecerf, Friser, & Binsinger, 2004), suggest that between 0.6% and 5% of adolescents report illegal PAES use. On this target sample, research studies were able also to define some individual specific differences, for example the use of PAES is more frequent among male than female adolescents and, to a lesser extent, among older than younger adolescents (Miech et al., 2018). Use of illegal PAES seems to be related to the characteristics of adolescents’ sport or physical activity, although knowledge on this relation is less established. For instance, some studies suggest that a substantial percentage of adolescents who report using illegal PAES do not engage in competitive sports on a regular basis (Yesalis & Bahrke, 2000).

While we have different results from a number of research projects, grants and data dealing with doping in amateur, adolescents and recreational athletes (Bates et al., 2017; L. Mallia, Lucidi, Zelli, Chirico, & Hagger, 2019; Luca Mallia et al., 2020), the true prevalence of doping in elite sports, and the evaluation of the predictors of doping use, considering the difficulty to obtain data from this target, is rarely faced and often discussed.

Considering the prevalence of doping, various methods exist to estimate it, but recent revelations, for example, within the elite cyclists context underlined a discrepancy between true prevalence figures and positive doping tests (de Hon, Kuipers, & van Bottenburg, 2014; USADA, 2012). This discrepancy is probably not limited to cycling (Montreal, Canada 2013) and casts serious doubts on the effectiveness of current anti-doping policies.

Prevalence rates are varying across studies, in 2014 De Hon and colleagues (de Hon et al., 2014) in their review highlighted how the problem of estimating the prevalence of doping in elite sport vary greatly depending on the method used. Data from anti-doping control agencies considering the number of samples analyzed and the proportion of Adverse Analytics Findings of WADA accredited laboratories between 2003 and 2015 showed an incidence between 1% to 3% (+1%) (Aguilar-Navarro, Muñoz-Guerra, del Mar Plara, & Del Coso, 2020). Considering biological parameters a preva-

lence rate of about 14% was estimated (Sottas et al., 2011), while standard questionnaires show rates from 1 to 15% (Laure, 1997) and the application of Randomized Response Technique (RRT) showed estimates of 10 to 62% (Pitsch & Emrich, 2012; Pitsch, Emrich, & Klein, 2007; Ulrich et al., 2018). Remarkably, few scientific articles have addressed this subject so far, as a consequence, the true prevalence of doping in elite sports is unknown.

The use of controlled PAES has important health implications, since it tends to be associated with a wide range of adverse mental and physical health problems (e.g., Bird, Goebel, Burke, & Greaves, 2016). Furthermore, the use of controlled PAES among athletes practicing elite sports is perceived as a clear violation of sports rules. Indeed, their use is strictly regulated by sports authorities governing competitive sports (e.g., WADA and NADOs). In contrast, the legal and social sanctions associated with the use of controlled PAES among those practicing fitness and recreational sports are less clear, a fact that tends to induce greater acceptance in society (Lazuras et al., 2017), and greater possibility to acquire the data from the participants. Other differences related to the use of PAES considering the competitive level is that Elite athletes primarily use illegal PAES to improve their performance, while non-athletes or amateurs do so mainly to enhance their physical appearance (DuRant, Escobedo, & Heath, 1995; Kindlundh et al., 1999), this poses another important aspect related to the measurement issue, since the same behavior seems to be directly moved by different motives, also the assessment method should follow a broad reflections on theoretical framework that could guide the assessment.

How The “Doping” Is Conceptualized

In recent years, the study of the socio-cognitive determinants and correlates of doping use has been the focus of much psychological and psychosocial inquiry. Much of this scientific focus has departed from the general consensus that doping use is an illicit behavior which is unhealthy and intentionally adopted to achieve a specific objective or goal. In the broad sport arena, the specific objectives may obviously also vary with the professional level one has reached in a particular sport. It is, for instance, of no surprise that doping studies conducted with high-level athletes have shown that performance enhancement represents one of the key objectives that athletes seek to achieve by using doping substances. Conversely, at a lower level of sport practice, the use of banned substances by an athlete can be also oriented toward increasing performance competing with him/her-self or toward increasing physical appearance. At the same time, the meaning attributed to

“performance” at a lower level of sport competition is articulated in different ways than how it is in the high level, where it is strictly related with an absolute rank. At a low level of sport practice, the meaning of the “performance” is more complex – and often less related to a challenge over an opponent, then to the challenge of the athlete with him/her-self.

From Goal To Theoretical Framework

Research devoted great interest in stepping forward the understanding of the mechanisms underlying doping intentions, regardless of the specific reasons identified by the scientific literature, the analysis of the use of doping as a goal-directed behavior, has prompted researchers to analyze the explicit intentions of individuals relating to behaviors regarding doping and, in line with some important theoretical models, in search of the predictors antecedents of these intentions. Thus, starting from the first studies on the application of socio-cognitive models to the intention to use of doping substances (Lucidi, Grano, Leone, Lombardo, & Pesce, 2004), interest in these aspects has rapidly grown and came to consolidate a literature that, starting from well-defined theoretical models according to a ‘top-down’ approach, addressed the analysis of socio-cognitive predictors of doping intentions and behaviors, mainly through the use of self-report questionnaires. The theoretical model most used in this area is certainly represented by Theory of Planned Behavior or TPB. Central to this theory is the idea that the performance of one behavior is determined by behavioral intention, that represents individual plans to perform or not a specific behavior (Ajzen, 1980). Behavioral intention is determined by three belief-based social cognition behaviors: attitudes, subjective norms and Perceived Behavioral Control (PBC). Specifically, attitudes towards the behavior represents favorable or unfavorable evaluations or appraisals of the behavior; subjective norms, considered as a social variable, represents social pressure, generated by the ‘important others’, to perform or not the behavior; lastly, PBC refers to the beliefs people hold about resources they have to enact the behavior, and their capacity to overcome behavior related barriers. The TPB has represented and still represents the theoretical guiding framework of doping research in different sports contexts, from those related to high level sport (e.g., Lazuras, Barkoukis, Rodafinos, & Tzorbatzoudis, 2010), to those carried out in youth sport and in populations in school age (e.g., Lucidi, Zelli, & Mallia, 2013; Lucidi et al., 2008; Luca Mallia et al., 2016; Zelli, Mallia, & Lucidi, 2010), to those carried out involving gym goers (e.g., Wiefferink, Detmar, Coumans, Vogels, & Paulussen, 2008). This aspect is particularly relevant because it

demonstrates the possibility of applying this theoretical model to the analysis of behavioral choices relating to the use of doping regardless of the reasons (aesthetic or performance) for which the individual can decide to use it, and the actual frequency of use, elements which are obviously linked to the specific target population. The studies that used TPB show an effective relevance of the attitudes towards such use and of the perception of approval of the other significant ones on the behavior in question (i.e. Subjective Norms) (e.g., Lazuras et al., 2010; Lucidi et al., 2008; Wiefferink et al., 2008; Zelli et al., 2010). In parallel, the research on PBC on the choice to use doping has received less attention, even if the literature emphasizes the presence of aspects that concern the more or less controllable external situations capable of emphasizing or inhibiting this behavior.

Social structure and environmental factors (e.g. norms, laws, peer influences) may operate in concert with personal factors such as one's internal standards for conduct and self-reflective capacities. A thorough understanding of these complex processes of psychological functioning is at the core of the social cognitive theory. A key social-cognitive construct is that of self-efficacy, which Bandura (Bandura, 1997) introduced as the perception of personal capability allowing one to pursue goals and control behaviour. Mastery beliefs, partly derived from previous experiences, keep conduct in line with personal capacities and standards. Accordingly, people have little incentive to act or to refrain from action when they believe they cannot bring about desired outcomes because of some difficulty or adversity. Research shows that high perceived self-efficacy is a good predictor of people's capacity to refrain from adopting various unhealthy or antisocial behaviors. Importantly, self-efficacy beliefs do not necessarily conform to generalized or undifferentiated trait-like characteristics, but instead refer to and regulate specific domains of functioning and conduct. In this light, the athlete's perceived ability to manage the external pressures related to doping appears operational, as self-regulating self-efficacy (Lucidi et al., 2004, 2008; Luca Mallia et al., 2016; Zelli et al., 2010), as it negatively predicts the intention to use doping substances in the future. Some studies, while remaining in the perspective that frames doping within behaviors aimed at a goal, have also considered socio-cognitive variables that do not fall within the specific perimeter of Planned Behavior Theory. For example, Lucidi and colleagues in various studies (Lucidi et al., 2004, 2013, 2008) have empirically demonstrated the importance of the mechanisms of moral disengagement, or of those cognitive mechanisms that can be used to self-justify the use of doping, 'by disengaging in fact the self-regulatory and self-censorship mechanisms that each of us has.

Besides these socio-cognitive intentions related theories, there is another mainstream, the Self-Determination Theory (SDT) that try to identify the

contextual and environmental factors than can increase or decrease the quality of the individual's motivation (Deci & Ryan, 1985). Central to the theory is the distinction between two types of motivation: intrinsic and extrinsic (Ryan & Deci, 2000). Specifically, intrinsic motivation pertains to engagement in a specific action for the pleasure and satisfaction. In fact, intrinsically motivated a behavior is performed to experience the interesting factors related to the activity itself (Chatzisarantis & Biddle, 1998). Conversely, extrinsic motivation refers to tasks that are performed to obtain separable outcomes (Ryan, Williams, Patrick, & Deci, 2009), or to a behavior associated with pressure, tension and decrease in enjoyment (Chatzisarantis & Biddle, 1998). According to SDT, motives vary along a continuum: at the lowest end, there is the so-called amotivation (i.e., when people do not motivate at all); then the external motivation; while, at the highest end, there is the intrinsic motivation. Furthermore, these theories have been integrated with the definition of the athlete's goal, Elliot and McGregor (2001) suggested that goals can be better understood along the dimensions of mastery vs performance, and valence (i.e., approach vs avoidance) of competence. Hence, their 2 (valence) x 2 (definition) achievement goal model includes four combinations of goals: mastery approach, mastery avoidance, performance approach, and performance avoidance. Mastery approach goals reflect involvement with an activity for self-improvement and achievement, whereas mastery avoidance goals reflect the tendency to avoid displaying task failure and lack of skills. Accordingly, performance approach goals refer to motivation to demonstrate superior to others performance, and performance avoidance goals imply the tendency to avoid displaying low competence. The 2 x 2 model is the current state of the art in the achievement goal literature with recent research exploring achievement goals' antecedents and consequences during sport involvement. This line of research revealed that mastery avoidance goals were associated with negative emotional and behavioral responses (Elliot & McGregor, 2001). On these lines, some authors (e.g., Barkoukis, Lazuras, Tsorbatzoudis, & Rodafinos, 2011; Donahue et al., 2006; Lucidi et al., 2013) have pointed out that sportsmen characterized by high sportiness or 'sportspersonship' (e.g., pro-social attitudes and behaviors), from motivations towards autonomous sport (i.e., linked to the intrinsic pleasure of sport) and from motivational orientations towards 'mastery-oriented' perspectives (i.e., towards the search for personal improvement through effort and commitment), are typically less inclined towards use of doping. In essence, the choice to make use of doping substances can be conceived as linked to a complex system of dynamic interactions between motivations, cognitions, beliefs and moral evaluations, as it has been optimally summarized in a the meta-analysis of the doping literature funded by the World

Anti-Doping Agency (Ntoumanis, Ng, Barkoukis, & Backhouse, 2014). The authors suggest that there are some specific mechanisms or variables of particular interest. Attitudes, norms and a-motivation have been found to be the best predictors of the doping behaviors and its intentions, while negative effects on doping behaviors were found from self-efficacy to refrain from doping and morality. Therefore, it is clear that the single variables coming from the psychological theories are not able to completely predict doping intentions, but their complex analysis within a general plan of theories in interaction could contribute a better understanding, unfortunately, research rarely considers these variables in an integrated system, and this is even more true in elite athletes sport where research is scarce given the importance of the problem and the relationship of doping with the career of an athlete.

Therefore, the application of alternative models and methods is encouraged in this field in order to improve our understanding of the complex doping phenomenon. Further, in scientific literature, new approaches have been proposed suggesting that doping use is influenced by the interplay of socio-cultural, socioeconomic, and personality factors. For instance, Donovan et al. (Donovan, Egger, Kapernick, & Mendoza, 2002), Petroczi and Aidman (Petroczi & Aidman, 2008), and Strelan and Boeckmann (Strelan & Boeckmann, 2003) discussed the role of personality factors, decisions regarding the pros and cons of doping use, the legislative system, the affordability, and availability of prohibited substances. Stewart and Smith (Stewart & Smith, 2008) provided a macro-analysis of doping use in sport suggesting that, alongside to personality factors, globalization and commercialization of sport, and sport cultures are key factors in explaining doping use.

Between the more recent models and theoretical frameworks, a contemporary and overarching behavioural model is the Capability, Opportunity, Motivation—Behaviour [COM-B] model. The COM-B model tries to understand the predictors of human behaviors considering the behavior (B) as the result of an interaction between three different conditions: capability, opportunity and motivation. In order to engage a behavior, the model propose that an individual need psychological and physical capability (C), opportunities (O) both in terms of social and physical ones, and the motivation (M) to voluntarily engage the behavior. Motivation covers automatic processes, such as habit and impulses, as well as reflective processes, such as intention and choice (Michie, van Stralen, & West, 2011).

The model has been recently successfully applied in doping context by Allen et al., (2019) in order to review and critically appraise recent changes to anti-doping policy and the Code in the context of asthma management, evaluating the impact of asthma medication use on sports performance.(Allen, Backhouse, Hull, & Price, 2019) However, researches

testing these ideas are still scarce and future studies which take into account these other variables are encouraged.

How To Measure Doping Use?

Considering the reviewed literature in terms of theoretical framework used to predict doping use, there are at least two different considerations when facing the reliability of data concerning doping intentions or use. The first is related to the limitation of measuring a very sensitive issue for athletes of all categories and sports, such as the intentions or the use of doping substances, this behavior is considered not only wrong by law, but also as contrary to the sport ethics, and a moral burden for all the individuals. Furthermore, any study design relies on personal input from athletes; they cannot be expected to be completely truthful. Particularly when athletes are still active, there is an obvious barrier to discussing doping in detail. Similar concerns are related to the chemical analyses, on which the WADA bases its figures, they cannot detect all the doping substances or methods available to an athlete (de Hon et al., 2014). The pharmacokinetics of doping substances are such that performance-enhancing effects often outlast the time window for detecting traces of a substance in an athlete's bodily specimen (Hatton, 2007).

Overall, straightforward questioning about possible doping is rarely used in scientific studies involving elite athletes. The prevalence rates coming from direct questioning inconclusively ranges from 1% to 70% when extrapolating sub groups of athletes or specific sports. Some scholars that try to overcome the direct questioning through hypothetical questions like the famous Goldmann dilemma "if you would be offered a magic drug that would guarantee that you would win all important competitions in the next 5 years, but you will die from it shortly afterwards—would you take it?" coming to similar inconclusive data ranging from 56% (Goldman & Klatz, 1992; Mirkin, 1984) to 2% (Connor, Woolf, & Mazanov, 2013).

In order to overcome the effect of the socially desirable answers, and the biased response group, recently some researchers applied an alternative questionnaire approach, started in 1960's mostly on social psychology topics: the "Randomized Response Technique" (RRT) (Lensvelt-Mulders, Hox, Van Der Heijden, & Maas, 2005). This technique tries to improve anonymity of the answer's through a known mathematical confounder. Respondent firstly is asked to answer to a question or an activity (i.e. roll of a dice) with a stochastic distribution, and depending on this outcome, then, at the second question (target question on sensitive topic) they are required to answer the truth, or

“yes” or “no”. With this procedure it can be mathematically calculated how many answers “yes” or “not” originated from the probabilistic know distribution of the first question/activity. Benefit of this procedure is that the subject is more confident of the anonymity of the testing procedure, in effect, it is like that, in fact the researcher (and this is the con) can only retrieve a percentage outcome within a confidence interval, without relate any answer of the respondent to other measures (e.g. predictors, other variables). Results of literature shows that prevalence rate on different sensitive topic like... .. are higher than when using standard questionnaire methods.

A second consideration can be made relating to the measurement of psychosocial predictors of doping. Given that, psychosocial variables (e.g., attitudes, susceptibility, and entourage) are associated with doping behavior among athletes (Nicholls et al., 2017), being able to accurately measure and monitor psychosocial variables among athletes is important for identifying those at risk of doping, however, assessing psychosocial variables among athletes is problematic. This is because scholars have used different measures that may or may not be grounded within a suitable theoretical framework, and sometimes measures are used out of the context in which they were validated (e.g., age groups, culture), furthermore scholars tend to not report all the adaptation made to the measure they use for their study, except in some quite uncommon cases (e.g. Nicholls et al., 2019).

Given these issues, few are the studies involved adult elite athletes, Pitsch and colleagues (Pitsch et al., 2007) used RRT trying to control for social desirability, finding a lifetime prevalence of 26-48% and a last-year prevalence of 20-39%. This figure needs to be confirmed in different groups of athletes from different nationalities. These sorts of studies currently give the most accurate estimations of doping use in sports in terms of prevalence. Unfortunately, in order to create intervention to counteract doping, researchers still need accurate method to evaluate some distal precursors or more proximal antecedents of doping.

How To Intervene On Doping?

Given the complexity of these interacting issues, such as the theoretical frameworks, the misuse of instrument and tools, the difficulty to obtain such accurate measuring, what happens moving from theory to action?

In an effort to answer this question, a valuable contribution is made by Bates et colleagues conducted a review in order to identify the ways in which behavioural strategies changed as a result of interventions aimed at preventing the abuse of drugs to improve muscularity, performance and physical

appearance.(Bates et al., 2017). The scholars considered the characteristics and components of interventions and their settings and target populations, and also checked for the utilization of a theoretical framework in the intervention development, delivery and evaluation. In order to understand the link between theories and interventions, the authors of this review evaluated 14 interventions using the “theory coding tool” (Michie & Prestwich, 2010), a coding scheme designed to identify the extent in which the theory is used in development, implementation and evaluation of interventions. However, theoretical constructs were poorly reported. Where they were reported, they were related to specific theories including ethical reasoning theory(Elbe & Brand, 2016), the Theory of Planned Behaviour (TPB; Allahverdipour, Jalilian, & Shaghaghi, 2012), Social Learning Theory (SLT; Goldberg, Elliot, Clarke, MacKinnon, Moe, et al., 1996; Goldberg, Elliot, Clarke, MacKinnon, Zoref, et al., 1996) and a combination of SLT and the health belief model (Sagoe et al., 2016). In the mediation analysis of ATHENA, models of behaviour including the TPB, social cognitive theory and the information, motivation, behaviour model were described (Ranby et al., 2009). Although no specific theories were described, the Greek anti-doping education intervention (Barkoukis, Kartali, Lazuras, & Tsorbatzoudis, 2016) was based upon establishing social norms and sporting values. Despite the above-mentioned interventions, there are relatively few studies that consider a clear theoretical framework. In fact, for all others, no theoretical bases has been describe and there are no studies in which such theoretical bases has been applied for control groups.

This picture describes clearly that there are not enough studies in the scientific literature to determine what extent relevant constructs have been used in the development and evaluation of interventions since they often do not consider a clear theoretical framework. However, it should be made clear that many interventions and approaches are not reported in the scientific literature since they are applied by different organizations, such as National anti-doping agencies or federations.

Doping And Other Substances: Gateway, Trap Or Opportunity To Prevent Doping Use

The term ‘supplement’ refers to vitamins, minerals, amino acids and other substances generally sold in the form of tablets, capsules, soft gels, liquids, powders, and bars which are taken orally. Unlike drugs, they do not need to be shown their effectiveness before marketing, nor are they subject to prior approval unless they are genetically modified or claimed to be new.

They may also be referred to as dietary, food or nutritional supplements or ergogenic aids (supplements purported to improve athletic performance), often used in sports contexts in order to improve performance in training or during competition. Most of these supplements are not part of the list of banned substances that Wada draws up every year, which is why athletes are often inclined to abuse such supplements. In fact, several studies attested the widespread use of supplements across all levels of sport (Maughan, Depiesse, & Geyer, 2007; Tscholl, Alonso, Dollé, Junge, & Dvorak, 2010), which can reach nearly a 90% of incidence in collegiate sports (Burns, Schiller, Merrick, & Wolf, 2004) and about 70% in adolescent (Hoffman et al., 2008). Excessive consumption of supplements, in addition to posing a health risk, can be a risk factor for doping, as is suggested in a mainstream of literature, namely the “gateway hypothesis”.

The concept of “gateway hypothesis” has been studied since the 1970s (Kandel, 1975), as the theory suggests, an adolescent’s early experimentation with alcohol or tobacco or cannabis is an important risk factor for substance use, and it escalates to more addictive illicit drugs later in adulthood. However, the theory has led to mixed results which, on the one hand, have showed a link between lawful drugs use and illicit drug use (Guxens, Nebot, & Ariza, 2007; Korhonen et al., 2010; Lessem et al., 2006; Mayet, Legleye, Falissard, & Chau, 2012) and, on the other hand, have no association (Golub & Johnson, 1994; Mackesy-Amity, Fendrich, & Goldstein, 1997). Therefore, causal relationship between drug types has been debated in literature without finding a conclusive result (Mayet, Legleye, Chau, & Falissard, 2010; Wells & McGee, 2008). Assuming a parallelism, a risk factor for doping use may be the habitual engagement in performance-enhancing practices, for example the use of nutritional supplements possessing ergogenic properties. Given the young age of the athletes involved in recreational sports context, this could be particularly applicable. The young age of athletes can encourage the use of over-the-counter medications or supplements that may lead up to use of illegal substances (doping) in the future. While the link between supplement use and doping has been also evidenced across countries and population subgroups (Susan H. Backhouse, Biddle, Bishop, & Williams, 2011), the available studies are largely cross-sectional, based on correlational data (De Hon & Coumans, 2007) and, thus, they present only indirect evidence of the hypothesized gateway processes. However, one study with adolescent athletes that used a longitudinal design showed that supplement use at baseline significantly predicted doping use at follow-up measures (Lucidi et al., 2008). Accordingly, a recent meta-analysis confirmed that supplement use had high effect size on the prediction of doping intentions and actual doping use (Ntoumanis et al., 2014). Given that the application of “gateway

hypothesis” to doping behavior has been evidenced only by an association results, it is not yet clear how the presumed gateway mechanism (i.e., the transition from nutritional supplement to doping use) develops. The gateway theory, in fact, does not consider any psychological variables mediating this association, thus, another mainstream started to consider the use of supplement in a different manner, namely as a protective factor.

In fact, by general definition, supplements are one thing added to something else in order to complete or enhance it. Therefore, nutritional supplements are products that are taken with the aim to supplement the diet by increasing the total dietary intake of vitamins and minerals and other non-vitamin non-mineral substances. However, people do not always use it for health maintenance reasons (e.g., balancing the diet or compensating for lack of nutrition in diet), but they may turn to supplements for a wide variety of motivation like performance or aesthetic enhancing. Considering supplement use as a behavior oriented toward a goal, it is important to realize that the use of supplements can be driven by a number of different goals than the use of illegal substances. Sometimes, athletes of different levels (elite, amateur, and recreational) and across age groups turn to the use of dietary products (e.g., proteins, amino acids, creatine, multivitamins, and a wide range of herbal products) with presumed ergogenic properties, namely supplements, as a “safe alternative” to prohibited/illegal substances (Jäger et al., 2008; Petróczi, Naughton, Mazanov, Holloway, & Bingham, 2007). This is the case of athletes during an intensive training period of time, where the efforts need often an increase of specific macronutrients.

There are few studies in scientific literature that focus on the social cognitive aspect of athletes’ supplements use in sport. However, a study of Backhouse (S. H. Backhouse, Whitaker, & Petróczi, 2013) found that users of supplement, compared to non-users, had different attitudes toward doping use. A potential explanation given by the authors is that the habitual use of otherwise legal nutritional supplements familiarizes athletes with the notion of chemically assisted performance enhancement and this can further facilitate the use of doping use. In a similar vein, Barkoukis et al., (2020) (Barkoukis, Lazuras, Ourda, & Tsorbatzoudis, 2020) showed that supplements users displayed biased normative beliefs related to doping use (i.e., they perceived doping as more prevalent in fellow athletes and socially approved).

Besides the possibility to consider the use of supplements as a risk factor (gateway theory) or a protective factor (“safe alternative to doping”) in a deterministic way, it is important to understand which are the psychosocial processes, or common predictors, that are able to drive the same behavior, the use of supplements, toward two very different outcomes.

Unintentional Doping

It is very common for athletes of all levels to use supplements in order to integrate their diet, but the possibility that these supplements can contain banned substances is not rare. Unintentional doping generally refers to the accidental use of banned substances, without the possibility of inferring any type of goal-oriented to this outcome (Chan et al., 2016). However, it is also possible that the athletes declare unintentional doping to explain a positive finding in the doping control test, and there is a literature dealing also with this issue (Whitaker & Backhouse, 2017). Therefore, analyses of a wide range of dietary supplements available for purchase on the internet found that over 17.4% of the products either contained, or were contaminated with, substances banned by WADA (Baume, Mahler, Kamber, Mangin, & Saugy, 2006). Given that these data are based only on prevalence and Hypothesized data, and, at the moment, it is very difficult to evaluate the processes underpinning such outcome, this issue has not been treated in this narrative review.

Future Perspectives

In the last 50th years, research on doping use, the efficacy of interventions devoted to preventing it, have increased and gained high results especially thanks to the focus on the amateur and medium-low category athletes. Researchers have identified and successfully applied different theories and constructs in order to understand the mechanism underpinning doping intention. Major challenges today are in facing the doping issue, its prevalence and prevention within the elite contexts where the social desirability and the sensitivity around the theme is the biggest hurdle to overcome.

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