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Athletes using ergogenic and medical sport supplements report more favourable attitudes to doping than non-users

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Abstract

Objectives: Our study objectives were twofold: 1) examine whether users and non-users of different types of sport supplements vary in doping attitudes and sport supplement beliefs, and 2) determine whether the type of sport supplement is directly and indirectly (via sport supplement beliefs) related to doping attitudes.

Design: Cross-sectional survey

Method: Athletes (N = 557; 77% male, mean ± standard deviation; age = 20.8 ± 4.5 years, training = 5.7 ± 4.2 hours per week, competing = 11.1 ± 5.2 years) completed measures of sport supplement use, sport supplement beliefs, and doping attitudes. Sport supplements were classified into: ergogenic, medical, sport food and drinks, and superfoods.

Results: Compared to non-users, users of ergogenic (d = 0.31, p <0.01) and medical (d = 0.42, p <0.01) sport supplements reported more favourable attitudes towards doping. In addition, compared to non-users, users of ergogenic (d = 1.10, p <0.01), medical (d = 0.80, p <0.01) and sport food/drink (d = 0.58, p <0.01) supplements reported stronger beliefs in the effectiveness of sport supplements to improve sport performance. Use of ergogenic, medical and sport food/drink supplements was indirectly related to doping attitudes via sport supplement beliefs.

Conclusions: Researchers examining the relationship between sport supplement use and doping should differentiate between sport supplement types to improve measurement accuracy. Sport practitioners administering ergogenic and medical sport supplements to athletes may need to provide additional anti-doping education to counteract any favourable attitudes towards doping.

Keywords: drug; performance-enhancing substances, sports nutritional sciences; surveys and questionnaires, World Anti-Doping Agency

Introduction

Sport supplements (e.g., creatine, sodium bicarbonate, sport drinks) are widely used by athletes, with prevalence estimated between 40 and 100 percent.[1] It has been proposed that sport supplement users are at an increased risk of using prohibited substances (i.e., doping).[2, 3] Cross-sectional research has consistently reported positive relationships between the use of sport supplements and doping,[4, 5] with a meta-analysis of the predictors of doping[3] indicating that use of sport supplements was amongst the strongest predictors of both doping use (*OR* = 8.24) and doping intention (*r* = 0.36).

Athletes can choose from hundreds of sport supplements, which are often grouped into different types depending on their expected outcome.[6, 7] Although a substantial body of literature suggests that their use constitutes a risk factor for doping, it is uncertain whether all types of sport supplements lead to doping. For instance, an athlete using a superfood, such as goji berries, to source Vitamin C, is arguably less likely to dope than an athlete using ergogenic supplements, such as amino acids, based on the belief that they boost testosterone.[8] Research on the relationship between sport supplement use and doping has yet to differentiate among different types of sport supplements, and we do not know whether all types of sport supplements exert an equal influence on an athlete's decision to dope.

A second issue that requires research attention is the mechanism through which supplement use may lead to doping. Athletes may attribute improvements in performance to the perceived benefits of supplements, which, in turn, could lead to doping.[9, 10] Hurst, et al. [11] reported that use of sport supplements predicted likelihood to dope indirectly via beliefs about the effectiveness of sport supplements. This suggests that the belief that chemically active substances are effective may, in turn, develop beliefs that doping substances are equally or more effective for improving performance. However, it is currently unknown whether all types of sport supplements predict doping attitudes and behaviours directly and/or indirectly via sport supplement beliefs.

To improve understanding of the relationship between sport supplement use and doping, the purpose of our study was to identify the types of sport supplements associated with stronger pro-doping attitudes, which have been shown to be positively related to doping behaviour.[3, 12] In the present study we used the taxonomy proposed by Garthe, et al. [1] and grouped sport supplements into four types: 1) ergogenic (e.g., creatine), which are used to improve performance; 2) medical (e.g., iron), which are used to treat clinical issues and nutrient deficiencies; 3) sport foods and drinks (e.g., sports protein bar), which provide a practical source of nutrients; and 4) superfoods (e.g., goji berries), which claim to optimise health and performance. Our study aims were twofold. First, we aimed to examine whether users and non-users of different types of sport supplements differ in doping attitudes and sport supplement beliefs. Second, we aimed to replicate and extend the findings of Hurst, et al. [11] by determining whether the type of sport supplement is directly and indirectly (via sport supplement beliefs) related to doping attitudes.

Methods

We used convenience sampling to recruit 583 athletes (77% male, mean ± standard deviation; age = 20.8 ± 4.5 years, hours per week training = 5.7 ± 4.2, years competing = 11.1 ± 5.8 years) to participate in the study. We recruited participants from team (78%) and individual (22%) sports, who competed at club (26%), county (37%), national (28%) and international (9%) level. Stakeholders of sports clubs (e.g., coaches, managers) were contacted via telephone or email, and were informed about the study purposes. After gaining permission to visit the club, participants were recruited in person at the club's training facility. Inclusion criteria were regular sport participation (i.e., trained twice or more a week) and aged 16 and over. Eligible participants were informed about the purpose of the study, that participation was voluntary and data would be kept strictly confidential, before providing informed consent. The study protocol was approved by the lead author's Institutional Ethics Committee.

Participants were presented with the following definition: “Sport supplements are a food, food component, nutrient or non-food compound that is purposefully ingested in addition to the habitually consumed diet with the aim of achieving a specific health and/or performance benefit”.[6] They were then provided with a list of 10 of the most common types of sport supplements (e.g., creatine, energy gels, multi-vitamins[1, 6, 13]) and asked to select all the supplements that they currently use. Participants also had the option to list other sport supplements not on the list. Sport supplement use was then grouped into the following types: 1) ergogenic (e.g., amino acids, creatine, sodium bicarbonate), 2) medical (e.g., calcium, iron, probiotics), 3) sport food and drinks (e.g., sports drink, sports gel, sports bar), and 4) superfoods (e.g., herbs, goji berries, maca). Participants were coded as non-user (0) or user (1) for each sport supplement type and depending on their responses, could be coded in one or more type of sport supplement.

We used the short version[14] of the Performance Enhancement Attitude Scale[15] to measure doping attitudes. Participants were asked to respond to five items representing their general doping attitudes (e.g. “doping is an unavoidable part of competitive sport”, “the risks related to doping are exaggerated”) on a 6-point Likert scale, ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). The mean of the five items was calculated, and used in all analyses, with higher scores indicating more favourable attitudes towards doping. The scale has shown very good internal consistency (α ranging from 0.71 to 0.91[12]). Internal consistency was also very good in this sample (α = 0.84).

We used the Sports Supplements Beliefs Scale (SSBS) to measure participants’ beliefs in the effectiveness of sport supplements to support performance.[16] Participants were provided with six statements (e.g., “sport supplements improve my performance”, “sport supplements improve my confidence”) and asked to indicate their responses on a 6-point Likert scale, ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). The mean of the six items was calculated, and used in all analyses; higher scores indicate stronger beliefs in the

effectiveness of sport supplements. The scale has shown very good internal consistency (α = 0.91[11]), which was similar in this sample (α = 0.89).

Data were entered into SPSS version 24.0 (IBM, Armonk, NY, USA). Preliminary screening of data identified 26 participants who did not complete the PEAS or SSBS measures and five careless respondents (e.g., participants randomly responding to items or responses coded the same[17]). Their data were removed from the analyses leaving a final sample size of 557. Little's Missing Completely at Random test (MCAR)[18] identified 15 participants with missing data, which were missing completely at random (p = 0.92). Given that missing data can create considerable challenges in the analyses and interpretation of results,[19] we used a multiple imputation model that generated five data sets with a maximum number of parameters set at 100.[20, 21] The mean of the five data sets was used to replace missing data. Descriptive statistics were computed, with the prevalence of participants using each type of sport supplement expressed as a percentage.

In order to examine our first study aim, we conducted a series of independent samples *t* tests to examine differences in PEAS and SSBS scores between types of sport supplement use. We applied Levene's test of equality of variance to establish homogeneity of variance and report adjusted coefficients where heterogeneity of variance was violated. Cohen's d (*d*) effect size statistic was calculated using an online calculator[22] for differences between users and non-users of each type of sport supplement, with values of 0.2, 0.5 and 0.8 indicating small, medium and large effects, respectively.[23]

For our second study aim, we used the PROCESS v3.4[24] SPSS macro (model 4), to test direct and indirect (via sport supplement beliefs) effects of type of sport supplement use on doping attitudes.[25] We report the Partially Standardised Indirect Effect (PSIE), with values of 0.01, 0.09 and 0.25 indicating small, medium and large effect sizes, respectively.[26] Data are reported as mean difference (*MΔ)* ± standard error of the mean (SEM). Statistical significance was set at $p < 0.05$.

Results

About half of the athletes (53%, *n* = 295) used sport supplements, with 42% (*n* = 237) using ergogenic supplements, 21% (*n* = 117) using sport food and drinks, 18% (*n* = 100) using medical supplements, and 2% (*n* = 12) using superfoods. Moreover, 29% (*n* = 159) indicated using one, 18% (*n* = 103) two, and 6% (*n* = 32) three types of sport supplement currently. Only one participant (0.02%) used all four types of sport supplements.

Our first study aim was to examine whether users and non-users of different types of sport supplements vary in doping attitudes and sport supplement beliefs. In terms of attitudes towards doping, scores for doping attitudes (Figure 1A) were higher for users than non-users of ergogenic (*MΔ* = 0.25 ± 0.07, t_{555} = 3.67, p <0.01, *d* = 0.31) and medical (*MΔ* = 0.34 ± 0.09, t_{555} = 3.83, p <0.01, *d* = 0.42) sport supplements. Scores on the PEAS were similar for users and non-users of sport foods and drinks (*MΔ* = 0.11 ± 0.09, t_{555} = 1.24, p = 0.20, *d* = 0.14) and superfoods (*MΔ* = -0.22 ± 0.27, t_{555} = -0.81, p = 0.35, *d* = 0.27).

In terms of beliefs about the effectiveness of supplements, SSBS scores (Figure 1B) were higher for users than non-users of ergogenic supplements (*MΔ* = 1.08 ± 0.08, t_{555} = 13.05, *p* < 0.01, *d* = 1.10), medical supplements (*MΔ* =0.85 ± 0.11, t_{555} = 7.27, *p* < 0.01, *d* = 0.80), and sport foods and drinks (*MΔ* = 0.56 ± 0.11, t_{555} = 5.02, *p* < 0.01, *d* = 0.58). Scores for beliefs in the effectiveness of sport supplements were similar for users and non-users of superfoods (*MΔ* = 0.21 ± 0.32, t_{555} = 0.66, *p* = 0.51, *d* = 0.19).

Our second study aim was to determine whether the type of sport supplement is related to doping attitudes directly and indirectly via sport supplement beliefs. The results of these analyses are illustrated in Figure 2. Ergogenic supplement use had a medium-to- large indirect relationship to doping attitudes via sport supplement beliefs (*PSIE* = 0.23, 95% *CI* = 0.13 to 0.33). There was no direct effect of ergogenic supplement use on doping attitudes. Medical sport supplement use had a medium-to-large indirect effect on doping attitudes via sport supplement beliefs (*PSIE* = 0.17, 95% *CI* = 0.10 to 0.26). There was also a direct effect of medical sport supplement use on doping attitudes. Sport food and drink supplement use was not directly related to doping attitudes but was indirectly related to doping attitudes via

sport supplement beliefs, with a medium effect size (*PSIE* = 0.13, 95% *CI* = 0.07 to 0.20). Superfood supplement use had no direct effect on doping attitudes. The path via sport supplement beliefs was not significant (*PSIE* = 0.05, 95% *CI* = -0.14 to 0.23). In sum, use of ergogenic, medical and sport food and drink supplements was indirectly linked to doping attitudes via sport supplement beliefs. No such relationship was found for superfood sport supplement use.

Discussion

The purpose of our study was to refine our understanding of the relationship between sport supplement use and doping attitudes by examining the effects of different types of sport supplements on doping attitudes. We found that users of ergogenic and medical sport supplements reported more favourable attitudes towards doping than non-users. We also found that users of ergogenic, medical, and sport food and drink supplements reported stronger beliefs about the effectiveness of sport supplements compared to non-users. Moreover, the relationship between medical, ergogenic, and sport food and drink supplement use on doping attitudes was mediated by sport supplements beliefs. Taken together, these data suggest that the association between sport supplement use and doping is influenced by the type of sport supplement athletes use.

Two in five athletes (42%) used ergogenic supplements, whereas one in five used medical sport supplements (18%) and sport foods and drinks (21%). Superfoods were rarely used (2%). Comparing these prevalence rates with past studies is problematic, since estimates can depend on type of sport, level of competition, and the definition of sport supplement.[1, 6, 27] Nonetheless, in athlete populations, it has been reported that prevalence ranges between 60 and 79%[27] and 40 and 100%.[1] By comparison 53% of the current sample used at least one sport supplement.

In relation to our first study aim, we found that athletes using ergogenic and medical sport supplements reported stronger doping attitudes scores than non-users. This finding is similar to past research.[2, 11] In contrast, users of sport foods and drinks, and superfoods did not

differ from non-users in doping attitude scores. Given that doping attitudes are implicated in the decision to dope,[3] our finding suggests that athletes using ergogenic and medical supplements may be more inclined to dope than those using sport food and drinks, and superfoods. One explanation for this finding is that users of ergogenic and medical sport supplements become accustomed to performance enhancing methods and develop the belief that chemically active substances are a necessary and acceptable method in which to improve performance.[9, 10] Use of these substances can in turn, influence future behavioural choices about doping. Given that doping is a motivated goal-directed behaviour that is justified on the grounds of functionality,[10] athletes using ergogenic and medical sport supplements to improve performance, both directly (e.g., improvement in strength) and indirectly (e.g., improve recovery between training sessions) can develop the belief that doping is another means to improve performance,[9] and report more favourable attitudes to dope.

Our second study aim was to determine whether the type of sport supplement is related to doping attitudes directly and indirectly via sport supplement beliefs. We found that use of ergogenic, medical, and sport food and drink supplement types predicted doping attitudes via sport supplement beliefs. These findings replicate those reported by Hurst, et al. [11] and suggest that sport supplement users develop beliefs about their effectiveness over time and, as a result, report more favourable attitudes about doping. The perceived beneficial effects of sport supplements may further increase the belief that they are effective, which may, in turn, lead to the development of favourable attitudes towards doping. The finding that ergogenic supplement use did not have a direct effect on doping attitudes indicates the importance of beliefs as a factor that could explain why athletes using this type of supplement report more favourable attitudes to dope.

Collectively, our results have important implications for researchers and sport practitioners (e.g., coaches, nutritionists, sport doctors). Researchers aiming to understand the relationship between sport supplement use and doping should take account of the different

types of sport supplements to improve the accuracy of their models. If, for example, most participants in a sample use only superfoods and very few use ergogenic supplements, it is likely that the strength of the supplement-doping relationship will be reduced. Similarly, the opposite may occur when most participants in a sample are ergogenic supplement users. Future investigations into the sport supplement use-doping relationship should therefore differentiate users by type of sport supplement in their analyses.

Sport practitioners should appreciate that athletes who are administered ergogenic and medical sport supplements may develop more favourable attitudes towards doping. While some sport supplements may be necessary (e.g., iron to combat low ferritin levels, protein supplements to support the adequate intake of macronutrients, vitamin D supplements to maintain optimal bone health), an athlete using ergogenic and medical sport supplements may develop the belief that using chemically active substances is an acceptable method for enhancing sport performance. This belief could then later develop into a rationalisation that doping is another means to enhance performance.[9, 11] Accordingly, under circumstances when a sport supplement is administered to an athlete, it may be necessary to include anti-doping education to temper pro-doping attitudes.[28]

Limitations and future research

Our study has revealed some important novel findings. However, potential study limitations should be considered when interpreting the evidence. First, because self-report measures are not perfect, there will be a difference between what athletes report and what they think and do. Second, we measured attitudes towards doping and did not explicitly measure use of doping substances. Future research should replicate our findings using measures of actual doping behaviour. Third, we did not examine whether sport supplement use and doping attitudes changed longitudinally, or how long athletes had been using sport supplements. It is unknown whether, for example, superfood use leads to ergogenic and medical supplement use, which may in turn, lead to more favourable doping attitudes, or if those who have recently started using ergogenic sport supplements report less favourable

attitudes to dope than those who have used them for longer. To identify changes and sequences in the types of sport supplements used and their relationship to doping attitudes, future research should track athletes sport supplement use over time.

Conclusion

Our study is the first, to our knowledge, to differentiate between types of sport supplements, and identify that users of ergogenic and medical sport supplements report more favourable attitudes to doping than non-users. Our results highlight the need for researchers to group sport supplements by type in order to better understand the relationship between sport supplements and doping attitudes. For sport practitioners, while some sport supplements may be necessary for an athlete's programme, administering ergogenic and medical sport supplements may inadvertently lead to more favourable attitudes towards doping for that athlete. In cases where a sport supplement is administered, athletes might need to receive bespoke anti-doping education to prevent the potential increase in more favourable attitudes towards doping.

Practical implications

- Athletes using ergogenic and medical sport supplements report more favourable attitudes for doping than non-users
- Researchers should differentiate users by different types of sport supplements to improve measurement accuracy
- Athletes administered sport supplements should receive anti-doping education to prevent the potential increase in more favourable attitudes towards doping.

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Figure Legends

Figure 1. Mean (± SEM) PEAS (A) and SSBS (B) scores for users and non-users of each type of sport supplement. *Note*: * = p <0.01 indicates significant difference in PEAS or SSBS scores between users and non-users of a certain supplement type.

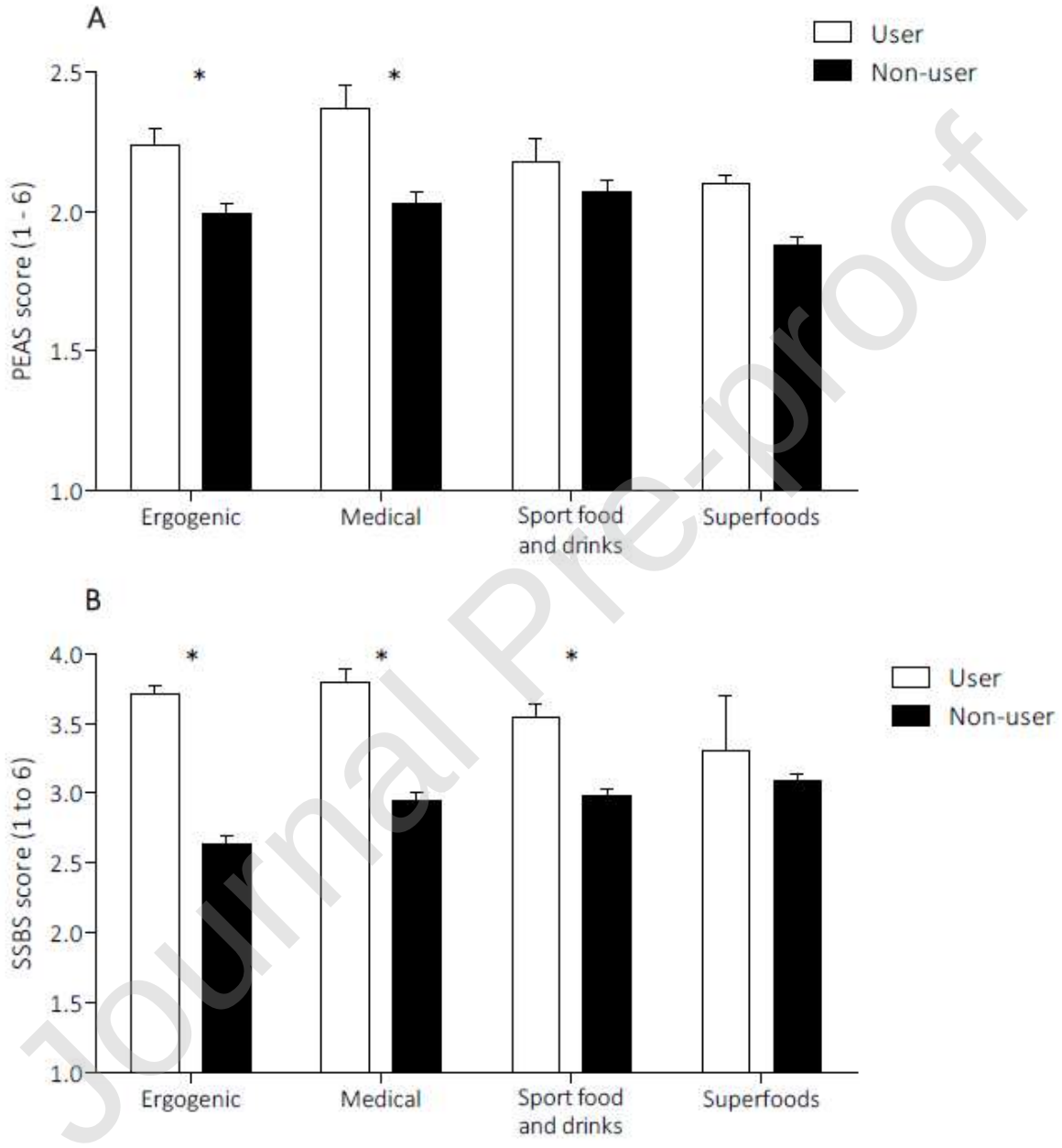

Figure 2. The direct effect (DE) and indirect effect (ie) via beliefs of types of sport supplement use on doping attitudes. *Note:* Unstandardized coefficients are reported, with

95% confidence intervals in brackets. Solid lines indicate significant paths, dashed lines indicate non-significant paths. A path is considered significant if the 95% CI includes zero.