Final Report

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Executive Summary

Although non-prohibited forms of performance enhancement (e.g., nutritional supplements, over the counter (OTC) medications) have the potential to facilitate doping, it may be possible to develop interventions that help undermine such effects. However, there is a lack of research investigating how interventions focused on educating athletes to enhance performance through non-prohibited means can most effectively be presented to deter progression to doping. Thus, through WP1 we qualitatively examined factors that may lead university athletes to consider doping, and how non-prohibited forms of performance enhancement can be presented most effectively as alternatives to doping. There has also been a lack of research examining the effects of non-prohibited performance enhancement techniques on doping over time. To address this, through WP2 we examined which non-prohibited forms of performance enhancement were used by university athletes, and longitudinally investigated whether use of such approaches influenced changes in moral and functional doping attitudes.

WP1 consisted of 10 individual interviews, and five focus group interviews with university athletes. Collectively, these interviews revealed several interesting themes relevant to our aims. Data analysis for both the individual interviews and focus group interviews led to the identification of three overarching themes: (a) education and knowledge on diet, (b) factors influencing supplement use, and (c) gateway effects and intervention development. Although each of these overarching themes was underpinned by several sub-themes, with some sub-themes unique to the individual or focus group interviews, there were some key elements of each overarching theme that spanned the two types of interviews. Regarding education and knowledge on diet, the university athletes had received a minimal amount of education on diet and nutrition, and in general their levels of knowledge in this area were low. With respect to factors influencing supplement use, these consisted of both sport (e.g., the competitive level of the athlete, peer influences, coach/personal trainer impacts) and non-sport (e.g., lack of education and knowledge on food preparation, financial considerations, social media, and influencers) factors. More specifically, university athletes were more likely to use supplements if they competed at higher levels, had peers, coaches, or personal trainers who promoted their use, were limited in their knowledge on how to prepare food, were exposed to social media influences promoting their use, or perceived supplements to be cheaper than real food. Finally, in terms of gateway effects and intervention development, several university athletes believed supplement use increased university athletes' chances of going on to use prohibited substances and methods. There were also several recommendations regarding interventions aimed at presenting non-prohibited means of performance enhancement as alternatives to doping, including the inclusion of education on supporting training and performance through nutrition, how to utilise a "food first" approach whereby supplements are only used when there is an identified

need, delivery of nutrition-focused education by nutritionists or peer educators trained by nutritionists, and delivering education early in athletes' development.

WP2 involved longitudinal data collections with two separate samples of university athletes (Sample 1 *n* = 180; Sample 2 *n* = 205). Descriptive analyses revealed that in Sample 1, the most used non-prohibited means of performance enhancement were BCAA, creatine, protein, caffeine, meal replacements, pre-workouts, multivitamins, vitamin C, vitamin D, vitamin E, aspirin, NSAIDS and paracetamol. In terms of prohibited substances and methods, cocaine and modafinil had the highest levels of use. For Sample 2, the most used non-prohibited means were BCAA, creatine, protein, pre-workouts, multivitamins, vitamin C, vitamin D, vitamin E, iron, ibuprofen, paracetamol, and compression garments. In terms of prohibited substances and methods, modafinil was the only substance reported. Next, cross-lagged panel analyses provided support for possible gateway effects of using non-prohibited means of performance enhancement on attitudes towards doping, especially with Sample 2. More specifically, we found evidence of a causal effect over time of using muscle-building supplements (e.g., protein, creatine), health and well-being supplements (e.g., vitamins and minerals), weight-loss supplements (e.g., fat burners, laxatives) and medications (e.g., NSAIDS, paracetamol) that led to reduced moral opposition to doping (i.e., weaker moral attitudes), and of using muscle-building supplements and enhanced perceptions of the functionality of doping (i.e., stronger functional attitudes). Finally, regression analyses identified an interaction effect of moral and functional attitudes on doping moral disengagement that helped identify high- and low-risk profiles for doping. More specifically, university athletes had the highest levels of doping moral disengagement when moral doping attitudes were low and functional doping attitudes were high, and the lowest levels when moral attitudes to doping were high and functional doping attitudes were low.

In conclusion, this mixed-methods project has (a) extended our knowledge on factors influencing university athletes' performance enhancement practices, (b) provided insight from university athletes on gateway effects on doping and how to design interventions to strengthen athletes' reasons not to dope, (c) established the first quantitative evidence supporting a causal link between non-prohibited means of performance enhancement and doping attitudes, and (d) identified attitudinal profiles indicating athletes who may be most at risk of doping.

Project Introduction

Doping in sport is problematic because it (a) provides an unfair advantage over competitors, (b) potentially results in negative health consequences, and (c) contravenes the spirit of sport (WADA, 2021). The Incremental Model of Doping Behaviour (IMDB; Petroczi, 2013a) and the gateway hypothesis of doping in sport (Backhouse et al., 2013) suggest that doping may evolve as part of routine application of non-prohibited performance enhancement practices (e.g., use of nutritional supplements). That is, it is very unlikely that one starts using prohibited substances without prior habitual use of non-prohibited supplements for performance enhancement. Furthermore, instead of viewing non-prohibited methods as alternatives to doping, some athletes view them as precursors to it (Boardley & Grix, 2014; Boardley et al., 2014, 2015). To date, research on this topic has largely been cross-sectional, meaning the effects of non-prohibited performance enhancement on doping over time have not been tested. Thus, the overarching aims of this project are to (a) longitudinally investigate the gateway hypothesis of doping in sport, and (b) investigate how athletes can be encouraged to view non-prohibited forms of performance enhancement as alternatives to – rather than precursors for – doping.

One non-prohibited form of performance enhancement is nutritional supplement use. Consistent with the gateway hypothesis, research evidence demonstrates a positive link between nutritional supplementation and doping. For instance, qualitative work has shown performance enhancing drug (PED) users believe once the performance benefits of nutritional supplementation plateau, athletes often look to doping to facilitate further performance improvements (Boardley & Grix, 2014; Boardley et al., 2014, 2015). Similarly, quantitative research suggests that prevalence of admitted doping is more than three times higher in athletes using supplements compared to athletes who do not, and nutritional supplementation is a strong predictor of doping (Backhouse et al., 2013; Hildebrandt et al., 2012; Ntoumanis et al., 2014). In sum, evidence suggests that performance enhancement practices involving nutritional supplementation could facilitate doping.

Another potential gateway to doping is use of off-label or over-the-counter medications. Medications are drugs or other preparations designed to prevent or treat illness or injury (e.g., painkillers, diuretics, decongestants). However, while some athletes take medications to help cope with pre-existing conditions (e.g., asthma) or injury, there is evidence of inappropriate and excessive use of medications in sport (e.g., Lazic et al., 2011; Tscholl et al., 2008a, 2008b). Although some medications used by athletes may not be prohibited, the increased use of such substances may lead to a reliance on pharmaceuticals that could eventually lead to athletes experimenting with prohibited substances (Donovan, 2009; Petróczi, 2013a). However, as this potential gateway effect has not been investigated to date, research is needed to determine whether medication use could facilitate doping.

Use of performance enhancing technologies may also lead to doping. Performance enhancing technologies include equipment and clothing designed to facilitate performance and/or the training effect (Donovan, 2009), and the IMDB suggests routine application of non-prohibited practices such as these could be part of the path to doping (Petróczi, 2013a). Whilst not contravening the rules of sport, the ethics of applying such technologies has been questioned by some, especially when they enhance performance with no additional effort (Donovan, 2009; Miah, 2005). Thus, performance enhancing technology use may be another gateway influence on doping.

The IMDB also suggests mid-to-late adolescence may be of particular interest for researchers investigating the gateway hypothesis (Petróczi, 2013a). More specifically, increased autonomy from parents and influence from peers mean this may be a period during which athletes are likely to further form and strengthen their attitudes towards doping (ibid). One population that experiences a sudden increase in autonomy from parents and influence from peers during mid-to-late adolescence are university students. This period also coincides with a transitional phase in terms of athletic competition which may present a further motivation towards the use of permitted and prohibited substances and methods. As such, university athletes may be a particularly interesting population to study in research investigating the gateway hypothesis.

Researchers often investigate key determinants of doping in lieu of actual doping due to the difficulties involved in obtaining accurate data on doping behaviour (Morente-Sánchez & Zabala, 2013; Ntoumanis et al., 2014). Explicit doping attitudes represent athletes' positive evaluations of engagement in doping (Ntoumanis et al., 2014) and have been shown to be indicative of doping in athletes (Morente-Sánchez & Zabala, 2013). Further, a recent meta-analysis found positive doping attitudes to be one of the strongest correlates of doping behaviour (Ntoumanis et al., 2014). Importantly, the IMDB suggests the doping mindset consists of both functional (i.e., whether doping is viewed as effective in enhancing performance) and moral (i.e., whether doping is viewed as right or wrong) attitudes, with doping being facilitated by changes in functional attitudes towards doping. As such, if non-prohibited forms of performance enhancement facilitate doping it is reasonable to expect their use should make explicit doping attitudes more positive.

To provide a more complete picture of the mental processes governing supplement and doping use, automatic associations between supplements/doping and other concepts (e.g., *doping* and *good*; *supplements* and *performance enhancement*) can be investigated alongside explicit attitudes (Petróczi, 2013b). Researchers have started to investigate such automatic associations, and variants of the Implicit Attitude Test (IAT) have proved to be a promising approach to assessment (Brand, Heck, & Ziegler, 2014; Petróczi et al., 2010). Work using such approaches has found automatic associations to be more positive in doping

athletes compared to non-users (Brand, Wolff, & Thieme, 2014; Petróczi et al., 2010). It is also generally assumed that IAT-based measures are less susceptible to socially desirable responses than explicit attitude measures.

Moral Disengagement (MD) represents another key correlate of doping (Ntoumanis et al., 2014). MD is a collective term for a series of psychosocial mechanisms that allow athletes to justify and rationalize illicit behaviour such as doping (Bandura, 1991; Boardley & Grix, 2014). Quantitative (e.g., Hodge et al., 2013; Zelli et al., 2010) and qualitative (Boardley & Grix, 2014; Boardley et al., 2014, 2015) research has supported a positive link between MD and doping. With respect to the IMDB, tension between functional and moral attitudes to doping (i.e., doping is functional but against my moral beliefs) can lead to cognitive dissonance (i.e., uncomfortable feelings resulting from conflicting attitudes, beliefs or behaviours that motivate alteration in attitudes, beliefs, or behaviours to reduce discomfort; Festinger, 1962). The incongruent functional and moral attitudes associated with the doping mindset may result in increased MD, as MD allows people to violate their moral standards without experiencing negative emotion (Bandura, 1991).

MD may also be representative of the cheating culture in sport. For example, Hildebrandt et al. (2012) showed the relationship between supplement use and doping was mediated by beliefs about the safety of doping. One MD mechanism representing such beliefs is distortion of consequences (i.e., avoiding, or minimising harm caused by reprehensible action). PED users demonstrate this mechanism when describing how following the advice of others helps them to avoid negative health consequences when doping (Boardley et al., 2014, 2015). Also, inflated descriptive social norms (i.e., beliefs regarding prevalence of a behaviour; Judge et al., 2012) regarding doping – a known aspect of the cheating culture in sport – allow MD though diffusion of responsibility (i.e., minimizing personal accountability for behaviour through group action). Finally, doping sub-cultures are thought to use unique language, utilizing terms such as gear and roids when discussing doping substances (Andrews et al., 2005; Boardley et al., 2014, 2015). Such language represents another MD mechanism, euphemistic labelling (i.e., selective use of language to portray culpable behaviours as less harmful). Importantly, the IMDB suggests sporting culture may influence how athletes justify and rationalize doping. Based on the arguments above, increased doping MD may be representative of exposure to such influences.

Although the IMDB suggests sustained use of non-prohibited forms of performance enhancement may eventually lead to doping (Petróczi, 2013a), researchers have not investigated the effects of nutritional supplementation, and use of medications and performance enhancing technologies on determinants of doping over time. As such, research is needed that tracks the influence of potential gateways to doping on key determinants of doping longitudinally. Accordingly, the current project aimed to investigate

the longitudinal effects of using nutritional supplements, medications and performance enhancing technology on explicit functional and moral doping attitudes and automatic associations for doping. Also, to date the effect of conflicting functional and moral attitudes on MD have not been examined. Thus, this project also aimed to examine whether disparity between explicit functional and moral doping attitudes – if present – was linked with doping MD.

Despite non-prohibited forms of performance enhancement being potential gateways to doping, the availability of performance enhancement alternatives is a situational factor that could weaken positive doping attitudes (Petróczi, 2013a). Concordantly, effective anti-doping education programmes have been found to include presentation of alternatives to doping (Backhouse et al., 2007). Further, exposure to information on functional foods as alternatives to doping can change beliefs regarding performance enhancement (James et al., 2010). However, there is a lack of research investigating how licit forms of performance enhancement can be effectively presented as alternatives to doping. Thus, the current project also investigated which non-prohibited forms of performance enhancement are commonly used by university athletes, and how they could be presented most effectively as alternatives to doping.

Project Objectives

The overarching objective of the project was to answer the following research questions:

1. What non-prohibited forms of performance enhancement are commonly used by university athletes?
2. How can non-prohibited forms of performance enhancement be presented most effectively to portray them as alternatives to – rather than precursors for – doping?
3. What are the effects over time of using nutritional supplements, medications and performance enhancing technology on explicit functional and moral doping attitudes and automatic associations for doping in university athletes?
4. Does disparity between explicit functional and moral doping attitudes influence doping moral disengagement in university athletes over time?

Project Hypotheses

When answering these research questions, we also sought to test the following a priori hypotheses:

1. Nutritional supplement, medication, and performance enhancing technology use would lead to positive changes in explicit functional – but not moral – doping attitudes over time (Research Question 3)

2. Nutritional supplement, medication, and performance enhancing technology use

will lead to automatic associations for doping becoming more positive over time (Research Question 3)

3. Increased disparity between explicit functional and moral doping attitudes will lead to increased doping moral disengagement (Research Question 4)

To answer the four research questions stated above, we adopted a mixed-method approach using a triangulation design (Creswell, Plano Clark, Gutmann, & Hanson, 2003), structured under two main work packages. We adopted a triangulation design because we wanted to obtain distinct but complementary data from the two work packages to address the research problem more completely (Morse, 1991), by bringing together the contrasting strengths of quantitative (e.g., hypothesis testing, generalization) and qualitative (e.g., personal insight, depth, and detail) methods (Patton, 1990). Work Package 1 was a qualitative investigation of potential gateways towards, and protective factors against, doping in UK university athletes and was primarily designed to answer Research Question 2. In turn, Work Package 2 was an investigation of the longitudinal reciprocal relationships between non-prohibited forms of performance enhancement and determinants of doping in UK university athletes, and was designed to answer research questions 1, 3 and 4. The methods and results for Work Package 1 and Work Package 2 are described separately over the following sections.

Work Package 1

Methods

Participants

1:1 Interviews. Ten university athletes (5 male, 5 female) currently engaged in competitive sport at British University and College Sports (BUCS) level or higher. Sports represented were netball (*n*=2), rugby (*n*=5), triathlon (*n*=1), basketball (*n*=1) and distance running (*n*=1). Athletes competed at a variety of competitive levels; BUCS (*n*=2), county (*n*=3), regional (*n*=2), national (*n*=2) and international (*n*=1) and had participated in their sport for between three and 17 years.

Focus Groups. 18 university athletes (9 male, 9 female) currently engaged in competitive sport at BUCS level or higher participated across five focus groups (3-4 university athletes per focus group). Sports represented within the focus groups were rugby (*n*=6), distance running (*n*=5), triathlon (*n*=4) and netball (*n*=3). Athletes competed at a range of competitive levels; BUCS (*n*=6), county (*n*=2), regional (*n*=3), national (*n*=4) and international (*n*=3).

Procedures

University athletes were recruited from university sports teams in the west midlands of

England. The project was introduced to prospective participants before they were invited to participate. Data collection took place between March 2020 and March 2021 and included five focus groups and 10 individual semi-structured interviews. Interviews and focus groups were conducted remotely via zoom software due to the Covid-19 pandemic. Focus groups and interviews followed pre-determined schedules (see appendices) investigating issues including: (a) university athletes' knowledge and use of non-prohibited (supplements, OTC medication, technology) and prohibited (i.e., doping) methods of performance enhancement, (b) the notion of a sliding scale of performance enhancement (Boardley & Grix, 2014), (c) whether non-prohibited and prohibited forms of performance enhancement are ever assimilated with – or influence – one another, and (d) how non-prohibited means of performance enhancement can be presented to athletes so they are viewed as alternatives to – rather than prerequisites for – doping. Focus groups lasted between 38 and 51 minutes (*M* = 43 minutes) and interviews lasted between 22 and 69 minutes (*M* = 37 minutes) and were recorded for subsequent transcription and analysis.

Data Analysis

Project data from the individual interviews and focus groups were analysed through thematic analysis (TA), utilising the six steps outlined by Braun, Clarke, and Weate (2016). Consistent with our post-positivist position, we adopted a coding reliability TA approach, conceptualized themes as data domains (Braun & Clarke, 2019). First, the audio files were transcribed, so that they could be read and reread to develop familiarity with them. In the next two steps, the researcher coded the data from a deductive-inductive perspective. Through the initial deductive coding, the data were categorized into higher order themes. Then, through subsequent inductive coding, lower-order themes were produced to describe the key aspects of the higher-order themes. In the fourth step, the researcher drafted a preliminary summary of the higher- and lower-order themes and these themes were then discussed by the researcher and principal investigator. In the penultimate step, the principal investigator re-analysed the data to corroborate the nature of the higher- and lower-order themes, before drafting a refined version of the summary of the higher- and lower-order themes. The final step consisted of writing the final report of the findings.

Results

1:1 Interviews

Analysis of the data from the individual 1:1 interviews led to the identification of three overarching themes. These included education and knowledge on diet, factors influencing supplement use, and gateway effects and intervention development. Each of these themes is outlined – with exemplar quotes provided – over the following paragraphs.

Education and Knowledge on Diet

One overarching theme with several sub-themes (e.g., influence of competitive level; periodization of diet) related to the amount of education athletes had received regarding diet and their general levels of knowledge in this area. In general, levels of knowledge regarding diet were low, as highlighted when athletes were asked to describe their diet and the decision making that underpinned it. Almost all university athletes lacked detail when responding to questions about their diet, and there was a general lack of interest in the topic. A prime example of this is seen in the response from the following athlete, who was a former NCAA Division 1 Basketball player that played at regional level in the UK at the time of interview:

> "I've never really looked into nutrition; I'm vegan now so I think about it a bit more, but I've never been taught anything about it."

Across all competitive levels there was no clear nutritional programme reported by any athlete, and university athletes seemed unclear as to how nutrition could affect their performance. For instance, a BUCS netball player with experience at national level explained how:

> "Nobody is keeping tabs on how we eat, and we don't really talk about it in training, except between us".

University athletes reported little, or no, formal training or education around nutrition, whether for sport performance or otherwise. This applied equally across the cohort, regardless of competitive level. Those university athletes that did have a rudimentary understanding of nutrition were sports science students who either had some basic knowledge of diet through elective nutrition modules and/or through self-directed research using skills and resources available through their degree course. University athletes noted a lack of oversight and direction around nutrition in their training below elite level.

There was a general perception amongst university athletes competing at university and regional level that those competing at higher levels (i.e., national/international) in the same sport received more education relating to diet. This was mainly based upon comments from friends who competed at higher levels, whereby education on diet had been delivered to them during the off-season and when in lockdown due to the Covid-19 pandemic. The responses of interviewees competing at higher levels suggested the level of education was still not that high though. For instance, when asked whether he had received training around nutrition/supplements, a male athlete from a university high-performance rugby squad responded:

> Not in explicit detail. We've had interesting talks like when I was younger. In Academy sets we had nutrition talks and then this past season at uni for the rugby team, we had the baseball nutritionist, kind of like have a chat, but that was very basic, just the ideal intake for each meal".

Some university athletes did report some basic periodisation of their diet based upon

training objectives and levels, but this didn't really extend beyond awareness of which macronutrients to target and overall calorie intake. For instance, a female BUCS rugby player stated:

> So, in the season it's [daily diet] still quite carb and protein heavy, but in off season I don't eat so much, especially protein.

It was clear that the requirements of the specific sport influenced dietary planning for those who did indicate attempts to manipulate their diet in response to the requirements of their sport. This is evidenced by the contrast between the prior quote from a rugby player, and the following comment from a male endurance athlete:

> I'm controlling about my diet about 80% of the time in race season…. try to balance fuel for the race but not add weight. September to March I'm comfortable being a bit heavier… you run more miles because it's cross-country season. You're doing base work for the summer season.

Overall, education and knowledge on diet was generally low, which was somewhat surprising given the level of competition represented in the sample. The small number of university athletes who did attempt to utilise dietary manipulations to support their sport mainly focused on vague control of macronutrient and overall calorie intake.

Factors Influencing Supplement Use

Another central theme reflected the various factors that influence university athletes' supplement use. Various sub-themes subsumed under this overarching theme included lack of knowledge on food preparation, the competitive level of the athlete, peer influences, competing interests, financial considerations, and the physical/physiological requirements of specific sports.

One sub-theme related to the fact that many university athletes – especially during their first year of studies – often have very little knowledge of how to prepare food. Therefore, they are more prone to using supplements in an attempt to bolster a poor diet. For example, a female netball player explained:

> Lots of people I know didn't know how to cook when they got here and some still don't, so they'll buy protein bars and drinks and stuff because it's easier and then that's just part of their normal diet, it's not like, it's not a supplement thing anymore, it's just what they eat.

As this athlete explained, resorting to supplement use for this purpose can over time just become part of a university athletes' diet rather than being viewed as something supplementary to it. Further, some university athletes falling into this category appeared especially susceptible to the allure of supplements that are marketed as "health food" supplements. Thus, it seems low levels of knowledge around food preparation or poor diets may lead to greater use of supplements with some university athletes.

Related to this, some university athletes identified how some people use supplements to address perceived deficits in their diet, basically using them as an easy way of addressing a poor diet. For example, a female BUCS rugby player explained how she thought "…people use vitamin supplements and stuff like that as well, to try and balance out diets.". Time pressure was also suggested as a factor that can make it more likely university athletes will turn to supplements. The same athlete illustrated this well:

> I feel like I don't have the time to fix my diet properly to get that protein… It's the time thing, isn't it? So, like when I was unemployed, it was fine. Now that I'm not I feel stressed all the time.

It was also evident that some university athletes used supplements due to a deficiency that resulted from specific diets (i.e., vegetarian, vegan). This was illustrated by this quote from a female BUCS rugby player, "…you know, Gen-z [generation Z] coming in and half of them are vegetarian… they've got to work harder, have a need to get those.".

Competitive level also appeared to have an influential effect on some university athletes' supplement use. University athletes described how use of supplements is potentially less important for university athletes at lower competitive levels in comparison to those competing at higher levels. Performance margins were considered much narrower and performance expectations much greater at higher levels of competition. These differences may influence decision-making around use of supplements, making it more likely for university athletes to use them. For example, this female triathlete described how:

> I've also just never felt like I needed to [use supplements]. But one of my friends I go to the gym with he's tried creatine and he's like for him, he wants to be a professional football player and that was like his whole thing. So, he was like anything that I can do to boost my performance, even if it's like mentally like I'm going to do it."

The perceived importance of supplement use for some at higher levels of sport was also evidenced by this quote from a male BUCS rugby player:

> …if I was playing at a higher level, say, professional and it was like heh dude you're not going to make it then maybe crossing the line, but just playing University and going no further no…if you kind of need to take it to make it to that next level to in order to maybe start earning then maybe.

At times, the move towards professionalism and money-earning potential also factored into this sub-theme, as evidence by this previous quote. Related to competitive level, certain competing interests also appeared to influence the likelihood of using supplements. Those university athletes who primarily competed at university level noted that their degree was their primary reason for attending university, and as such, progression in their

chosen sport was not of primary importance unless they are on a sport scholarship. This female netball player eloquently explained this:

> The thing is, I'm here to do a degree, not to be a professional athlete. So that's the more important thing for me over extra performance in sport.

Thus, for some university athletes' performance in sport was not a high enough priority to deem supplement use necessary. However, some university athletes did use supplements, but not to enhance performance but to support the student lifestyle. For instance, some described how the use of stimulant-containing-pre-workout drinks was to offset tiredness from late nights rather than to achieve gains in performance.

This was not the case for all though, as some university athletes did make a clear distinction between supplements that are used for performance enhancement purposes, and those that were used for other purposes. Caffeine was probably the best example here, where it was clear that people who used it were doing so for perceived performance-enhancing properties. A female BUCS rugby player provided one example, "People use caffeine, especially like on match days we use it". Another came from an elite distance runner, "…you're using it for its caffeine content… coffee drinking, Pro Plus, and caffeine ingestion on a competition day.". Interestingly, the extent to which some university athletes attached performance-enhancing properties to certain supplements was illustrated when this athlete went on to describe how some university athletes react when a certain supplement is not available:

> And panic on someone if they haven't got a beetroot shot before because they suddenly attached the fact that [they] are running well because I'm taking a beetroot shot…

For some university athletes, there seemed to be an acknowledgement that performance enhancing benefits don't even need to be real, just perceived, almost trying to capitalise upon a placebo effect. This female BUCS rugby player explains this through her own experiences and those of her teammates:

> …the girls always have Lucozade when there playing kind of thing so for the sugar. It is far more psychological… I do sometimes take pre-workout or like drink a sugar free Red Bull or something before a game. But again, I'm fully aware that I think that is psychological for me…

Peer influences on supplement use were also evident. University athletes would pay attention to the performance enhancement methods of other university athletes, and if these methods included supplement use, then others would start to adopt similar strategies. This effect appeared particularly powerful when several university athletes were engaging in a particular supplementation strategy, as shown by the account of this male BUCS rugby player:

> A lot of people in my circle starting to take protein and stuff and being like, "yeah, I'm taking protein and like" …and I actually did the same.

Peers (and coaches) also appeared to influence supplement use by emphasising the importance – and prioritisation – of developing overall mass and size in some sports. This was particularly evident in rugby, whereby teammates and coaches emphasised the importance of developing muscle mass, and university athletes would then turn to supplements to increase their protein intake to help achieve this. This was especially the case when the timeframe to achieve increases in mass was perceived to be short. For instance, a male rugby player from the high-performance squad said:

> …There's so much emphasized on 'size now' and the idea that we will teach you the skills later.

Other vicarious influences were also evident, such as disease prevention based upon family histories that suggested an athlete may be vulnerable to specific diseases. For instance, a female BUCS rugby player described how she took cod liver oil "…because my mom has rheumatoid arthritis and I'm terrified of getting it".

Financial considerations were also considered important for some university athletes, suggesting that available finances can play an important role in determining whether to use supplements. For some, the use of supplements represented a cheaper way to access better quality nutrition, whilst also recognising that some supplements were simply too expensive to consider on limited finances. For instance, in some sports supplements were viewed as a financially astute way of achieving high macronutrient demands (e.g., protein for rugby players).

Gateway influences

The final overarching theme related to possible gateway effects of non-prohibited supplements on use of prohibited substances and methods. Although not all university athletes had considered the possibility of such gateway effects, some did express how such effects could be relevant for some university athletes. For example, this female BUCS rugby player explained with reference to non-prohibited supplement use:

> I think it steps you on that like escalation ladder… if you see that something is working… the advantage you get from the legal ones or the ones that are allowed… to the ones that are not… if you start going up that ladder… I'm getting bigger, I'm getting better, I'm getting noticed, you want to keep improving… the more you start doing these things.

Some university athletes also referred to the presence of a grey area that may facilitate the transition from non-prohibited substances to use of prohibited substances and methods that involved off-label use of medications to enhance performance. For example, a male elite middle distance runner explained how "Eventually it comes a point where they see the world

list not as black and white, but as sort of shades of grey", going on to provide examples:

> There's a bizarre amount of asthmatic distance runners at the highest level now… supplementing salbutamol… you find a lot of people taking a few puffs of their inhaler prior to a 1500 meter or 5k.

This athlete went on to suggest that the perceived functional effects of non-prohibited supplements may lead people into this grey area and beyond through the desire to progress to something with greater enhancing effects on performance:

> So, from a functional aspect. I'm taking a substance that is improving my performance… it's improved my performance brilliant… and then move to the next list of substances.

Other university athletes also made the distinction between different non-prohibited substances, suggesting that their perceived functionality may be important in progressing people towards non-prohibited substances and methods. A female BUCS rugby players explained how,

> … as you start to edge towards the top end of the allowed substances for multiple reasons, you'd probably be way more likely to start with the banned ones.

Others recognised this too, and purposely stayed away from use of more enhancing non-prohibited substance use for fear of straying towards the grey area, with an elite middle-distance runner stating, "…my psychology of approaching the grey area, stay as far away from that as possible".

There was clearly a recognition, too, that just because some people may progress from non-prohibited substance use to use of prohibited substance and methods, this was not an inevitable progression, and many university athletes would not follow such a progression. With reference to his own use of caffeine, this athlete explained:

> It helps me feel dialled in. It just gives you that tiny bit of boost, essentially, but there's no way I'm going to be looking thinking caffeine just didn't stimulate... what other stimulants can I take what's banned, even though I've only been tested once in my life.

Another example of this was seen with a male BUCS rugby player, who having just acknowledged there could be a link between supplement use and progression to prohibited substance use for some university athletes, this didn't apply to him,

> I think when I first started using supplements, I was quite naïve thinking this is just going to be the miracle and I'm going to get really big and really strong and really fast… but at no point have I ever thought, "Oh, I'm going to go take steroids.".

The suggestion here was that it was his personal moral beliefs as a clean athlete that prevented progression to prohibited substances and methods, not the fear of testing positive. This was reinforced when discussing those who may be susceptible to it:

> There are more people who are morally going if you want to reach the top of your sport, you must do absolutely everything you can. And you might have to sacrifice a few of your morals, because you need to perform up here… If you had an athlete with flexible morals, who would then [be] going right, okay. Brilliant.

Thus, both functional and moral attitudes towards doping were seen as potentially important in facilitating gateway effects, with high functional attitudes and low moral attitudes towards doping representing the most at-risk profile.

Focus Groups

Analysis of the data from the focus groups again revealed the presence of three overarching themes (i.e., education and knowledge on diet, factors influencing supplement use, and gateway effects and intervention development). However, within these principal themes some new sub-themes emerged. Each of the themes and sub-themes is described – along with model quotes – over the following paragraphs.

Education and Knowledge on Diet

As with the individual interviews, education and knowledge on diet was fairly limited. Overall, there was some evidence of rudimentary knowledge regarding nutritional approaches though. However, knowledge in this area appeared to be largely based on experience rather than any formal education, as evidenced by this quote from a male national-standard rugby player:

> We had a sports nutritionist when I played for [County team] but that was basically just pointing out vegetables aren't bad and explaining the pros and cons of different supplements and eating some foods before training, but it wasn't in much detail, so I mostly just worked it out myself.

This description suggests that nutrition education being pitched at a very basic level led to the player taking it upon himself to be educated. That the limited education that rugby players had received was at a very low level has also evident in the following quotes from male BUCS rugby players:

> We had some brief talks but mostly, the boys coming into the club talk quite a bit with the seniors about how to do nutrition…. it's not really scientific based it's more just, make sure you drink your milk yeah.

> We had some do a talk which was kind of interesting, but it was very general healthy eating, kind of like don't eat too many takeaways and make sure you get a balance of macros, but it didn't really tell me anything I felt I needed to know.

When describing their perspectives on key elements of nutrition, the focus was more on timing of nutrition rather than nutritional content, although there was some recognition that certain foods were not ideal. As such, there was a tendency to attend to what not to eat rather what they should eat to support training and competition. For instance, a national-standard rugby player described the effect of a poor food choices in the twenty-four hours before a match:

> If I have a really crappy meal, like the night before and the morning before I play, I feel horrific, like really sluggish, really slow".

Again, this belief seems to have been informed more by experience than by education. The limited knowledge and understanding of nutrition were also evident when university athletes were asked to describe their diet plan, as shown here by a male rugby player:

> Not so much like a hard and fast [diet] plan and so let's say, for example today was a heavy leg session so I usually just consume more calories if it was a heavy session, if it was. And after training I consume more.

This tendency to focus on timing of nutrition and calorific content rather than having a more detailed nutrition plan, was also seen in some endurance university athletes, as this quote from a female BUCS triathlete demonstrates:

> If I'm doing like a longer session or like something actually like more demanding than I think it through more so, like have a proper meal like two hours before running or cycling or harder sessions……. And if I am, then, I was thinking about like after training like electrolytes and like recovery food a bit more.

Factors Influencing Supplement Use

As with the individual interviews, a central theme related to factors that influence university athletes' supplement use was again identified. Sub-themes subsumed under this overarching theme in the focus groups included peer influences, coach/personal trainer impacts, the role of social media and influencers, training and competition impacts, and risks relating to inadvertent doping.

One sub-theme related to peer influences on supplement use. In essence, this sub-theme represented the potential impact of the attitudes towards and behaviours surrounding supplement use of those people who surround an athlete. Basically, favourable attitudes towards supplement use and/or frequent use of supplements by one's peers increased the likelihood an athlete would adopt supplement use. For example, a female netball player explained:

> …like literally living with other university athletes, other students who are all taking supplements, like many of them like friends with lots of people who play sport as well, I feel that definitely does increase your exposure to like talk about nutrition supplements, which would probably increase my own like thinking about

> that compared to if I wasn't at university…

It was suggested this effect may be more likely if the experiences of others appear positive, as this National male rugby player described:

> …if you know some friends have tried it… if increasing their protein use is working for them, then you're probably more likely to give it a go yourself.

Alongside the influence of peers, coaches were also mentioned as important authority figures who could influence the initiation and continuation of supplement use. A good example of this is seen here with a male rugby player:

> Probably peers and then almost like peers and significant others, so if your coach is saying, "I think you should be like… maybe start supplementing protein, you're more likely to do it…".

Similar in some ways to coaches, personal trainers were also mentioned as potential catalysts for supplement use for those who train in a gym. The account of a male triathlete described how this could occur:

> Yeah, I was just gonna say every like personal trainer or person that works in the gym they're all like most of the time they use it and if I asked them, "I'm like struggling to put on weight, I want to put a bit of muscle mass on" then that's what they normally say, to take a protein supplement as well as doing this gym programme.

A further initiator of supplement use identified through the focus groups described the potential role of social media. This related to how sponsorship of influencers on social media heightens university athletes' awareness of specific supplement brands and the proposed benefits of using them, as represented in this quote from a female netball player:

> …my influencers from Instagram are often promoting it or like associated with like My Protein or like Women's Best or things like that, and so yeah definitely these things have influenced me…

This was also corroborated by others, including this male rugby player,

> There's influence from like social media seeing, like all the advertising that whoever it is, is sponsored by Maximuscle that does influence you to go to that brand or just to use protein in general, or it's the new beta-alanine or whatever that player is going on about, it's influence from people who have succeeded.

Some did feel, however, that the effects of influencers may wane over time, as this female netball player described,

> …I don't tend to like influencers and stuff like that anymore. Like when you were younger, or you see on Instagram like they're taken stuff not now I just ignore

that.

There was also some discussion of why influencers may be more influential for some university athletes than professional athletes, including this comment from a female netball player:

> I follow like female influencers. To be honest I'm more like, kind of like, you can relate to them more…

However, it did seem some university athletes perceived their supplement use had been influenced by their use by professional and elite athletes. One example of this was provided by the following quote from a national rugby player:

> …maybe from what you see professional players or some of the role models or individuals at [a] high level doing it, then again, because you think it was working for them so give it a go.

This wasn't just restricted to high-level athletes from the same sport either, as seen in this example from a male BUCS triathlete, who described how he had been influenced by a specific high-level athlete from another sport:

> …I'm sort of like, going to, watching Eddie Hall a lot, you know the strong man because he's got a boxing fight in something, fighting another strong man that's going to be quite big. And he's sponsored by My Protein, and he gives you like a great discount and he's always saying "Oh, this is good".

As with the individual interviews, the potential influence of training volume came up. The suggestion here was that use of supplements is potentially more important for athletes when they are training hard. For example, this male county rugby player described how:

> …like in the last year, with Covid, I haven't really been taking any supplements just haven't thought I really needed it. But when we're in season and we're training a lot and trying to keep the weight on, I'll be taking protein shakes…

Related to this, it was also suggested that certain training environments may lead some university athletes to rely on supplements more. This possibility was raised by an elite distance runner who said, "I suppose when I lived at altitude, I maybe took a bit more…".

Some of the higher-level university athletes also described disincentives for supplement use relating to risk surrounding inadvertent doping. For example, a male elite distance runner described how avoiding supplements altogether is a safer option than using batch-tested supplements,

> I don't really want to have to worry about any of that being contaminated, even though you'd go down that route of batch testing and making sure you do your due diligence on that. I just don't see the point, if it's not anywhere near me then I don't really have to worry about it.

Another athlete, a female BUCS triathlete, described the research she did to try to reduce the risk of inadvertent doping and ensure the potential benefits meant it was worth taking,

> …before I started taking my supplements when I was about 16… I did a lot on the research side like sit through papers and actually like read what was like beneficial and what wasn't and then obviously like the informed sport so whether it's actually accredited and like sort of supported by researchers and science, before taking it, but it would take me like a good couple of weeks of reading information before thinking I'm actually going to take it.

Thus, the focus groups identified some influences upon supplement use that overlapped with those from the individual interviews, as well as several novel influences.

Gateway Effects and Intervention Development

The final overarching theme that we identified related to possible gateway effects of non-prohibited supplements on use of prohibited substances and methods, alongside possible interventions to reverse such effects. In terms of possible gateway effects, as with the individual interviews there were several university athletes who believed supplement use increased university athletes' chances of going on to use prohibited substances and methods. One female elite distance runner, for example, was quite categorical in making this link:

> You're more likely to dope if you take supplements, because you're more likely to do everything you can to get the best out of yourself… you're looking at all different things, you can [take].

The link here, it seems, is the desire to utilise any means available to enhance performance. Others made similar links, including these two male county rugby players:

> I think there definitely might be a link, because the people who are more willing to explore non-prohibited stuff even when it gets to the more extreme end of the stuff, they're probably more likely to be the people who are going to be really trying to get the most from supplements and stuff, so maybe they think they've been doing all of this stuff already maybe, why not just take the jump…
>
> Yes, definitely soon as you start taking protein or whatever, then you move on to the next, and it starts getting closer and closer and your opinion of supplements may start getting more and more blurred and you just, as the gains get smaller and smaller when you're on 20 supplements a day or whatever the gains get smaller, it's more likely to have that big jump and then it's obviously going outside legal realms.

There was an acknowledgement by some, though, that use of supplements doesn't represent an inevitable gateway to use of prohibited substances and methods for all university athletes, with university athletes' moral beliefs representing a potential barrier

to such progression. The account of this male BUCS triathlete provides a good example of this sentiment:

> I don't think there's a massive like pathway of take this and then that and then that… I don't think [it] is huge… people doing sports and like athletics… it's all no, this is wrong, I shouldn't be taking it.

Similarly, a female regional netball player, when describing what progression from supplement use to use of prohibited substances and methods may look like, identified whilst anti-doping rules would represent a barrier to progression for many, the use of supplements may encourage university athletes to progress further:

> …so they might start off by taking vitamins and increase to protein and then… I wouldn't be surprised if… it's a gateway if that makes sense, like once you've started like yeah it's a path that you kind of continue down, and I think most people wouldn't obviously because [if] they aren't permitted it wouldn't then but, I think, once you start it definitely makes you more inclined, possibly to see the benefits of prohibited substances, because you see the benefits of the non-prohibited substances.

Regarding interventions to halt or reverse such progression, there was general support for the idea that interventions could be designed to present use of non-prohibited forms of performance enhancement (e.g., dietary education, nutritional supplements) as alternatives to doping and therefore reduce any potential for nutritional supplements being seen as pre-cursors to doping in some university athletes. The groups felt that such education would be best framed within a wider conversation about how nutrition and supplementation affect performance in training and competition. A good example of this was provided by a male national rugby player, who suggested:

> I think yeah definitely as a base to kind of educate people… you take a look at someone's diet and you go, "oh because your diet's crap", or "the training is off"… if you do this, then you actually find out... [if] you say like upskill people they know more, and then they're aware that it's not an overnight thing. I think they're less likely to then dope.

The following quote from a female national netball player illustrates well the underpinning philosophy:

> …it's basically moving away from saying like how bad doping was and how it's morally wrong and prohibited you shouldn't do it. Rather than tell them what not to do, tell them what to do and say you should be able to get most of what you need from really good, healthy, balanced diet and consulting with a specialist and nutrition coach and S&C coach, it's more about the training and overall nutrition, rather than just saying don't.

University athletes also highlighted several important considerations when designing interventions targeting knowledge around nutrition and supplementation. First, there was a belief that such interventions are probably best delivered when young athletes start to show some commitment to the sport beyond simply playing at school (i.e., joining clubs, playing competitively outside of school environment), with the level and volume of content increasing as athletes progress to higher competitive levels. This was evidenced by a county male rugby player:

> I think, around 15-16 is probably where most people will start really getting into the gym stuff and so maybe quite competitive, so I think if you can get in early around the early to mid-teens like 14, 15, 16, that's probably a good time, so educating people before they start down the wrong path.

However, there was also a feeling that education on nutrition and supplements should start at school, as there is a potential benefit to everyone in understanding the role of nutrition and supplementation in maintaining our health and fitness. This was considered especially relevant in modern society, whereby everyone is likely to be exposed to information and advice on these topics via social media, and without appropriate education it can be difficult to determine what constitutes reliable information on the subject. These sentiments were expressed well through this exchange between two female BUCS triathletes:

> Athlete 1: I would say education in schools is probably my main thing yeah and educate people younger, even if they're not athletes, because then they might become athletes and it's still relevant.
>
> Athlete 2: Yeah, I'd say the same, I think, although it's important to have that education from a young age, I think, to a certain extent, it is already done in schools it's just not done to a level that's... like kind of like you get taught general nutrition in like science courses, but obviously it's not specific to training in sport.

This latter comment suggesting that school-based interventions could potentially take advantage of the current curriculum, just taking the level of education to a higher – and more appropriate – level.

The potential benefit of also including parents when delivering education to children was also proposed, as expressed by this male national rugby player:

> ...like 16 you're starting to think about your own you're more likely to be doing something, or to have something, but you'll probably still have food bought by your parents so [it] needs to be to both parties. But if you wait until 20 [for nutrition education] then you've got a few years of doing things wrong.

University athletes also discussed the importance of who should deliver this education, with a general agreement that education around nutrition should be delivered by someone

who is perceived as an expert in the field (e.g., dietician/sport nutritionist). Aligned with this, there was strong agreement coaches should not be delivering this education as they don't have the necessary education or credibility on this topic. A good example of this was provided by a female BUCS netball player, who suggested:

> Unless they were like specialists in nutrition, or they had a background [in nutrition] like, I'm a coach and I don't have to have any nutritional background or qualifications… I wouldn't then trust what they were saying or listen to them, you'd almost want that professional advice to actually know that that's what is right.

Similarly, a male BUCS triathlete proposed:

> We don't always have the same coaches and they're not very clued up on nutrition and stuff, plus our training sessions are really focused on skills and building endurance so I think it should be separate sessions with people who really know their stuff, not the coaches.

The importance of developing interventions that are sport specific was also expressed across groups. This would help focus the content on the specific physiological demands of that sport and how nutrition and supplementation could be optimised specifically to enhance performance and recovery to meet those demands. This proposition was underpinned by the belief that broad nutritional programmes are less useful and potentially less engaging for the athlete. This belief was expressed in the following quote from a female county triathlete:

> I feel like, I would be more interested in learning about nutrition for my performance if I knew how it could help me in my own sport. Like I don't need to know what a weightlifter does or like, a rugby player. I need to know what's going to help me run and cycle and swim and recover from that. If it was too general, I'd be like, how do I use this?

There was definitely a feeling amongst some that the more targeted you make the education, the more athletes will engage with it. This was again highlighted by this female BUCS triathlete:

> Yeah I think if people understood like if that if their nutrition and supplementation was like tailored and suited to them and it was really fine-tuned and they understood all the benefits, I think they'd be less likely to feel the need to try stuff that's banned because they would be experiencing such good benefits from that, but if you do tailor it, so you do experience really good benefits that they wouldn't really feel the need, so I do think it would definitely decrease that.

Thus, as well as being supportive of the potential for nutrition/supplementation

interventions to direct athletes towards non-prohibited performance enhancement methods and away from prohibited methods, the focus groups also help identify several ways in which such interventions could be designed and delivered to optimise their effectiveness. Interestingly, in one focus group there was discussion of existing interventions that adopt a food-first philosophy to encourage athletes to maximise the benefits they derive from their diet and supplement use. This interchange between two elite male distance runners portrays the philosophy behind the intervention, as well as some of its content:

> Athlete 1: In terms of teaching people to get their fuelling from food not supplements or further down the line steroids, and so it is sort of a food first, food before everything, provide education so people can fuel without that need, and I think that the principle's great, but I just don't think there's, as you've already mentioned, or what you seem to be working out from the interviews and focus groups, is there's no structured approach from the national governing bodies or from [redacted NADO] and no one's pushing it.
>
> Athlete 2: So, I've been working as the [redacted NGB] anti-doping program officer, so our whole approach with rugby is to try and explain to the young academy kids that they can reach their goals in terms of mass and size and strength through food rather than through supplements and put together loads of videos like England nationals cooking with the [redacted NGB] head chefs like I'm trying to do that. Change that culture a bit because… that ties into the anti-doping message quite strongly and gives people practical advice if your coach is saying you need to be 90kg by the time you're 18 teaching them how to do that, using food, you know what I mean and actually don't just say don't take drugs like provide a viable means, allowing them to meet the targets [that] are being set… It's not come from [redacted NADO], it's coming from the [redacted NGB].

Work Package 2

Methods

Participants

Our original plan was to collect longitudinal data from just one sample. However, issues (i.e., change of PhD student, participant attrition, pandemic) with data collections for Sample 1 led us to collect data from a second sample. Although it was not our intention to collect data from two samples, this adjustment to our plan provided the opportunity to look for consistency in findings across the two samples. It also allowed us to refine our assessment strategy between the two data collections. Thus, throughout the methods and results we present information for both Sample 1 and Sample 2. Table 1 presents the main participant characteristics data for both Sample 1 and Sample 2.

Table 1. Sample 1 and Sample 2 Participant Characteristics

Characteristic	Sample 1		Sample 2	
	n	%	*n*	%
Gender				
Male	132	73.3	105	51.2
Female	48	26.7	100	48.8
Main Sport				
Netball	0	0.0	40	19.5
Cricket	28	15.6	0	0.0
Triathlon	0	0.0	22	10.7
Water Polo	20	11.1	0	0.0
Soccer	17	9.4	18	8.8
Swimming	17	9.4	0	0.0
Rugby	16	8.9	75	36.6
Field Hockey	14	7.8	15	7.3
Marial Arts	13	7.2	0	0.0
Gymnastics	12	6.7	0	0.0
Boxing	0	0.0	11	5.4
Other Sports	43	23.9	24	11.7
Age				
18-20 years	140	77.8	141	68.8
21-23 years	39	21.7	56	27.3
24-26 years	1	0.6	4	2.0
27-29 years	0	0.0	3	1.5
30-32 years	0	0.0	1	0.5
Years Playing Main Sport				
<1 year	29	16.1	11	5.4
1-3 years	27	13.2	36	17.6
4-7 years	34	18.9	35	17.1
>7 years	90	50.0	123	60.0

Note. Data presented for both Sample 1 and Sample 2 reflect values at Time Point 1. For Sample 1, 180 athletes participated at all time points (attrition rate = 42.9%. For Sample 2, 205 athletes participated at all time points (attrition rate = 28.8%).

Measures

Sample 1. The questionnaire pack (see appendices) contained measures of non-prohibited and prohibited performance enhancement, explicit moral and functional attitudes towards doping, and doping moral disengagement. Use of non-prohibited and prohibited performance enhancement methods was assessed using the approach of Boardley et al. (2016) when

assessing use of performance-enhancement methods in dancers; this measure was expanded to additionally assess performance enhancing technology use. Here, university athletes were provided with a list of supplements, medications, technologies, and methods and asked to indicate whether they had used each in the past 6 months for the purpose of performance enhancement or enhanced recovery. Frequency (i.e., <1 time/week; weekly; 3-4 times/week; 5 or more times/week) of use was then recorded for each supplement/medication/technology/method used during the past six months. Explicit moral and functional doping attitudes were assessed using a measure developed and validated based upon the work of Petroczi (2013a; 2015). Doping moral disengagement was assessed using a measure developed and validated by Boardley et al. (2018).

Sample 2. Measures for Sample 2 (see appendices) were the same as for Sample 1, except for some minor changes to the measure assessing use of supplements, medications, technologies, and methods. Due to the shorter time gap between assessment points, the assessment period was changed from the past six months to the past month. The response options for frequency were modified, providing three options (i.e., <1 time/week; weekly; 3 or more times/week) rather than four to simplify completion. The list of supplements, medications, technologies, and methods was also simplified to make completion easier.

Procedures

Sample 1. University athletes were recruited from the University of Birmingham, Kingston University and Liverpool John Moores University. Participants were recruited with the assistance of local contacts for some collections. At Time Point 1, for Kingston University and Liverpool John Moores University introductions to the project and invitations to participate were presented at the end of Year 1 and Year 2 undergraduate lectures delivered by members of the research team or close colleagues (all sessions were previously agreed). Those students who expressed an interest in participating were provided with an information sheet informing them of the aims of the research and their rights as a participant. They were then provided with the opportunity to have any questions answered and those volunteering to participate were asked to provide written consent. In contrast, at the University of Birmingham coaches of sports teams were contacted directly to determine the possibility of attending training sessions to recruit participants. For those coaches who agreed, a convenient training session was identified, and the researcher attended to recruit participants. At the agreed training session, the procedures for recruitment and obtaining written consent then followed those for Kingston University and Liverpool John Moores University. Most data were collected through face-to-face completion of a paper-based questionnaire pack when the researcher attended lectures or training sessions. A small number of participants who could not provide data at the time, provided data by completing an online questionnaire containing identical measures to those in the paper questionnaire pack. Time 1 data were collected in October/November

2018 and Time 2 data in March/April 2019. This time lag was designed to allow the examination of potential gateway influences across a competitive season (October to April in UK University sport).

Sample 2. All data for Sample 2 were collected at the University of Birmingham. The procedures followed those for the University of Birmingham collections for Sample 1, apart from two aspects. First, we collected data at three time points, not two. Time 1 data were collected in October 2020, Time 2 data were collected in January 2021, and Time 3 data were collected in March/April 2021. Also, due to the Covid-19 pandemic we moved from in-person paper collections at Time 1, to online collections at Time 2 and Time 3.

Data Analysis

We first conducted descriptive analyses to examine prevalence and frequency for each supplement, medication, technology, and method at Time 1 and Time 2. Following this, we completed descriptive and correlational analyses for doping moral disengagement, functional doping attitudes, and moral doping attitudes to examine their mean levels, variance, and interrelations. Next, we used cross-lagged panel analyses to test a series of models examining the reciprocal causal effects of supplementation/medication/technology use on functional and moral doping attitudes. Each model tested the effects of one independent variable [e.g., muscle building supplement use] on one dependent variable [e.g., functional doping attitudes] between adjacent time points. Finally, we used the hierarchical multiple-regression procedures described by Aiken and West (1991) to determine whether the interaction between functional and moral doping attitudes was associated with changes in doping moral disengagement. The same series of analyses were conducted with both Sample 1 and Sample 2.

Results

Sample 1

Descriptive and Correlational Analyses. Data were collected on reported use and frequency of use for nutritional supplements, performance enhancing technologies, medications and PEDs. Tables 2 and 3, respectively, detail the descriptive statistics on reported use and frequency at Time 1 and Time 2.

Table 2. Time 1 Descriptive Statistics on Reported Use and Frequency

Substance/Method	Use			Frequency			
	Never	Prior to Past 6 months	During Past 6 months	<1/week	weekly	3-4 times/week	5+ times/week
Nutritional Supplements							
BCAA	153	6	21	4	3	12	4
Creatine	147	9	24	3	4	10	8
Protein	98	14	68	7	15	27	21
Caffeine	138	7	35	11	21	1	4
Taurine	171	1	8	8	1	0	0
Other Fat Burners	176	3	1	1	0	0	0
Laxatives	176	3	1	3	0	0	0
Meal Replacements	161	9	10	1	3	5	1
Pre-Workout	133	15	32	11	8	11	1
Multivitamin no Minerals	124	17	39	9	8	9	13
Multivitamin plus minerals	115	16	49	9	11	15	14
Magnesium	170	2	8	2	1	3	2
ZMA	176	3	1	0	1	0	0
Vitamin C	129	9	42	5	11	7	19
Vitamin D	146	12	22	4	3	6	9
Vitamin E	164	4	12	1	5	1	4
Selenium	177	0	2	0	1	0	1
Iron	156	6	17	1	7	0	9
Performance Enhancing Technologies							
Altitude Tent	180	0	0				
Altitude Mask	173	2	5	4	0	0	0
Compression Garment	164	5	11	5	5	1	0
Environmental Chamber	178	0	2	1	1	0	0
Medications							
Aspirin	146	12	22	14	4	2	1
CBD	180	0	0				
Narcotic Analgesics	173	2	5	4	0	0	0
NSAIDS	117	8	55	40	11	3	1
Paracetamol	67	14	99	66	25	7	1
Anticholinergic	180	0	0				
Benylin	177	1	2	2	0	0	0
Beta 2 Agonist	180	0	0				
Prohibited Substances / Methods							
Anabolic Steroids	180	0	0				
Growth Hormone	180	0	0				
Insulin	180	0	0				
Peptide Hormones	178	1	1	1	0	0	0
Prohormones	180	0	0				
Testosterone Boosters	179	0	1				
Amphetamines	176	0	3	1	0	0	1
Cocaine	161	7	12	12	1	1	0

DMAA	180	0	0				
Ephedrine	180	0	0				
Modafinil	168	3	9	1	7	1	0
Adderall	179	1	0	1	0	0	0
Ritalin	179	1	0				
Clenbuterol	179	1	0				
DNP	180	0	0				
Sibutramine	180	0	0				
Triiodothyronine (T3)	180	0	0				
Corticosteroids	179	0	1	0	0	1	0
Beta Blockers	179	0	1	0	0	1	0
Meldonium	180	0	0				
SARMs	180	0	0				
Blood Doping	180	0	0				

Table 3. Time 2 Descriptive Statistics on Reported Use and Frequency

Substance/Method	Use			Frequency			
	Never	Prior to Past 6 months	During Past 6 months	<1/week	weekly	3-4 times/week	5+ times/week
Nutritional Supplements							
BCAA	153	5	22	5	2	11	4
Creatine	145	10	25	5	5	8	7
Protein	89	20	71	4	21	23	23
Caffeine	132	6	42	12	24	4	2
Taurine	159	3	18	10	6	2	0
Other Fat Burners	174	2	4	4	0	0	0
Laxatives	176	3	1	3	0	0	0
Meal Replacements	156	8	16	6	4	6	0
Pre-Workout	142	9	29	6	7	15	1
Multivitamin no Minerals	118	20	42	6	8	11	17
Multivitamin plus minerals	112	13	55	8	6	21	20
Magnesium	171	3	6	3	2	0	1
ZMA	174	3	3	2	0	1	0
Vitamin C	118	10	52	7	7	15	23
Vitamin D	147	11	22	3	4	6	9
Vitamin E	163	6	11	2	3	3	3
Selenium	177	1	2	1	0	0	0
Iron	158	4	18	1	4	3	10
Performance Enhancing Technologies							
Altitude Tent	179	1	0	1	0	0	0
Altitude Mask	177	1	2	1	1	0	0
Compression Garment	167	4	9	5	3	1	0
Environmental Chamber	180	0	0				
Medications							
Aspirin	150	11	19	16	3	0	0

CBD	179	0	1	0	0	0	1
Narcotic Analgesics	174	3	3	3	0	0	0
NSAIDS	117	11	52	34	14	4	0
Paracetamol	64	16	100	72	19	9	0
Anticholinergic	180	0	0				
Benylin	178	0	2	2	0	0	0
Beta 2 Agonist	180	0	0				
Prohibited Substances / Methods							
Anabolic Steroids	179	0	1	1	0	0	0
Growth Hormone	179	0	1	1	0	0	0
Insulin	180	0	0				
Peptide Hormones	180	0	0				
Prohormones	180	0	0				
Testosterone Boosters	180	0	0				
Amphetamines	177	0	3	3	0	0	0
Cocaine	159	10	11	10	1	0	0
DMAA	180	0	0				
Ephedrine	180	0	0				
Modafinil	165	3	12	3	7	2	0
Adderall	179	0	1	1	0	0	0
Ritalin	180	0	0				
Clenbuterol	179	1	0	1	0	0	0
DNP	180	0	0				
Sibutramine	180	0	0				
Triiodothyronine (T3)	180	0	0				
Corticosteroids	178	1	1	0	0	1	0
Beta Blockers	180	0	0				
Meldonium	180	0	0				
SARMs	180	0	0				
Blood Doping	180	0	0				

Regarding Research Question 1, Time 1 and Time 2 data support the common (i.e., $n>10$ at both time points) use of BCAA, creatine, protein, caffeine, meal replacements, pre-workouts, multivitamins, vitamin C, vitamin D, vitamin E, aspirin, NSAIDS and paracetamol as non-prohibited forms of performance enhancement amongst university athletes. In terms of prohibited substances and methods, cocaine and modafinil had the highest levels of use at both time points.

Tables 4 and 5, respectively, detail the descriptive and correlational analyses for the psychometric data collected at Time 1 and Time 2. These show that at both time points on average doping moral disengagement scores were moderately low, functional doping attitudes were marginally above the midpoint, and moral doping attitudes were quite high and positive. In turn, correlations showed university athletes who see doping as a functional way of improving performance tend to have higher levels of doping moral disengagement, and higher levels of moral disengagement were linked with attitudes that downplay the moral

relevance of doping. Finally, functional and moral doping attitudes were distinct from one another, as there was only a weak non-significant correlation between them at both time points.

Table 4. Time 1 Descriptive and Correlational Analyses

		M	*SD*	α	Minimum	Maximum	A	B
A.	Doping Moral Disengagement	2.72	1.02	.93	1.00	6.00		
B.	Functional Doping Attitudes	3.64	6.70	.81	-16.80	18.00	.24**	
C.	Moral Doping Attitudes	11.98	5.16	.78	-12.00	18.00	-.31**	-.14

Note. Possible score ranges were 1-7 for moral disengagement and -18 to 18 for the two attitudes.

Table 5. Time 2 Descriptive and Correlational Analyses

		M	*SD*	α	Minimum	Maximum	A	B
A.	Doping Moral Disengagement	2.73	0.97	.93	1.00	5.39		
B.	Functional Doping Attitudes	3.29	6.40	.79	-18.00	18.00	.27**	
C.	Moral Doping Attitudes	11.30	5.38	.81	-9.00	18.00	-.43**	-.15

Note. Possible score ranges were 1-7 for moral disengagement and -18 to 18 for the two attitudes.

Cross-Lagged Panel Analysis. To help answer research question 3 we utilised two-wave cross-lagged panel analysis (Cook & Campbell, 1979; Kenny & Harackiewicz, 1979). These analyses involve testing models containing three components. The first of these are synchronous correlations; the associations among study variables within each time-point (e.g., supplement use at T1 with doping attitudes at T1). These indicate the magnitude and direction of the cross-sectional relations between variables. The second component are the autoregressive paths; the predictive paths for the same variable assessed at different time points (e.g., supplement use at T1 to supplement use at T2). These paths reflect the stability of variables across time. The third component are the cross-lagged paths; the predictive paths between different variables across time points (e.g., supplement use at T1 to doping attitudes at T2). These represent the proportion of change in one variable across time points uniquely explained by another, once synchronous correlations and autoregressive paths are accounted for. Thus, through interpretation of the cross-lagged effects, we aimed to determine the reciprocal causal effects between supplement/medication use and doping attitudes across two time points spanning a competitive season.

In total we conducted eight series of analyses, separating supplementation into four categories (i.e., muscle-building supplements [e.g., protein, creatine], health and well-being supplements [e.g., vitamins and minerals], weight-loss supplements [e.g., fat burners, laxatives] and medications [e.g., NSAIDS, paracetamol, aspirin][1]) and running separate analysis series for functional and moral doping attitudes. Originally, we had intended to also conduct these analyses for performance enhancing technologies (e.g., compression

[1] These categories were created based upon factor analyses that demonstrated they represented reliable categories of supplement/medication use in our datasets.

garments, altitude tents), but there was insufficient use to support these analyses. Analyses were conducted using Mplus 7.2 (Muthén- Muthén, 1998-2015). The robust maximum likelihood estimation was used to account for missing data under the missing at random assumption (Enders, 2010; Muthén & Muthén, 1998-2015). Based on relevant guidance (Bentler, 2007), we included various fit indices: Chi-square (χ^2); comparative fit index (CFI); standardized root mean square residual (SRMR); and root mean square error of approximation (RMSEA). CFI ≥.90 and RMSEA ≤.08 are indicative of adequate model fit, whereas CFI ≥.95 and RMSEA ≤.05 signify good fit (Hu & Bentler, 1999).

For each of the eight data-analysis series, five competing models were tested (see Nordin-Bates, Hill, Cumming, Aujla, & Redding, 2014; Madigan, Stoeber, & Passfield, 2015; Zacher & de Lange, 2011). First, a temporal stability model (M1) was tested to provide a baseline for comparison with subsequent models; this included synchronous and auto correlations but not cross-lagged correlations. Second, a cross-lagged model (M2) in which attitudes (i.e., functional or moral) affected supplement use (i.e., muscle-building supplements, health and well-being supplements, or medications) over time but without reciprocal temporal effects specified; this model included cross-lagged effects between attitudes at T1 and supplement/medication use at T2. Third, a reverse cross-lagged model (M3) in which supplement use affected attitudes over time but without the reciprocal effects specified; this model included cross-lagged effects between supplement/medication use at T1 and attitudes at T2. Fourth, a constrained reciprocal cross-lagged effects model (M4) in which attitudes and supplement use affected each other equally over time was specified; this model included all cross-lagged effects between T1 and T2, and with the paths between supplement use and attitudes constrained to be equal. Finally, an unconstrained reciprocal cross-lagged effects model (M5) was specified; this model was identical to model M4 except that no constraints were imposed on causal paths between time points. To compare model fit between the five models, χ^2 difference tests were conducted. These were appraised alongside changes in other fit indices (i.e., CFI, RMSEA, SRMR) to determine which model should be interpreted as the best model (i.e., the simplest model that has largely equivalent fit to more complex models).

Tables 6 to 9 present the fit indices and model comparisons for the five models for each combination of supplement/medication and attitude. For the models concerning muscle-building supplements (see Table 6), model comparisons indicated those specifying cross-lagged paths (i.e., M2-M5) had no improved fit over the one with no cross-lagged paths (i.e., M1) for functional attitudes. As such, the model without any cross-lagged paths specified (M1) was accepted and we interpreted the parameter estimates from this model (see Figure 1). First, in terms of the autoregressive paths, these were very strong for muscle-building supplement use and functional attitudes. Next, the synchronous correlations were moderate and positive (T1) and weak-to-moderate and positive (T2). For moral attitudes, the model containing a cross-lagged effect from muscle-building to moral attitudes only (M3) had the

best fit. We therefore accepted this model and interpreted the parameter estimates from this model (see Figure 2). First, for the autoregressive paths, there was a moderate-to-strong positive effect for muscle-building supplement use and a very strong positive effect for moral attitudes. Next, the synchronous correlations showed inconsistent associations, ranging from no effect (T1) to weak-to-moderate and positive (T2). Finally, the cross-lagged path from T1 to T2 for muscle-building supplement use to moral doping attitudes was moderate and positive.

For the models concerning health and well-being supplements (see Table 7), model comparisons indicated those specifying cross-lagged paths (i.e., M2-M5) did not have an improved fit over the one with no cross-lagged paths (i.e., M1). As such, we accepted and interpreted model M1 for both functional and moral attitudes. For functional attitudes, as shown in Figure 3 the autoregressive paths were significant and very strong for both health and wellbeing supplement use and functional attitudes, demonstrating high stability of both variables across time. In contrast, the synchronous correlations were weak and non-significant at both time points. The same pattern of results was seen for the model examining moral attitudes (see Figure 4).

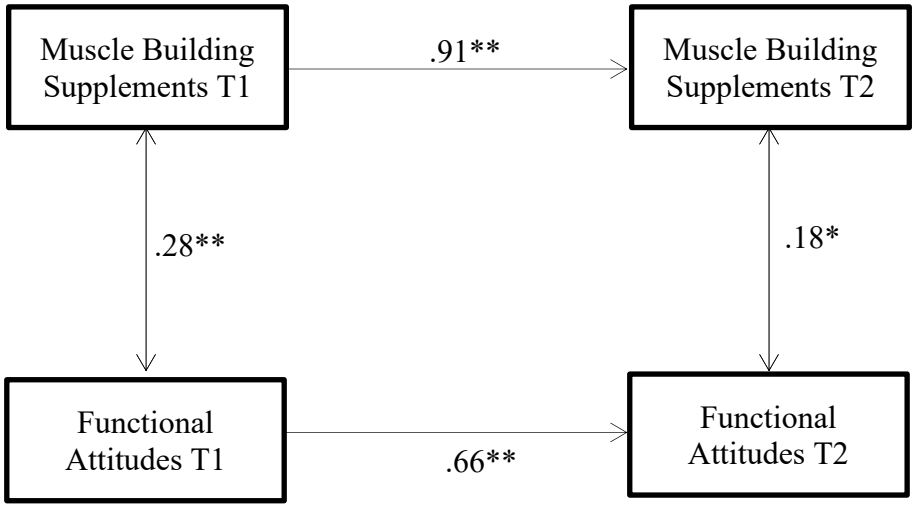
For the models concerning medications (see Table 8), model comparisons indicated those specifying cross-lagged paths (i.e., M2-M5) did not have an improved fit over the one with no cross-lagged paths (i.e., M1) for both attitudes. As such, we accepted and interpreted model M1 for both functional and moral attitudes. For functional attitudes, as shown in Figure 5 the autoregressive paths were significant and very strong for both medication use and functional attitudes, demonstrating high stability of both variables across time. In contrast, the synchronous correlations were weak and non-significant at both time points. The same pattern of results was seen for the model examining moral attitudes (see Figure 6).

Table 6. Fit indices and χ^2 difference tests of nested models for muscle-building supplements *(N = 180)*

Variable	χ^2	*df*	CFI	RMSEA	SRMR	Comparison	$\Delta\chi^2$	Δdf
No cross-lagged effects (M1)	3.27	2	1.00	.06	.03			
Cross-lagged functional attitudes to muscle-building (M2)	1.73	1	1.00	.06	.02	M1 vs. M2	1.55	1
Cross-lagged muscle-building to functional attitudes (M3)	1.39	1	1.00	.05	.01	M1 vs. M3	1.91	1
Reciprocal cross-lagged constrained (M4)	1.16	1	1.00	.03	.02	M1 vs. M4	2.07	1
Reciprocal cross-lagged unconstrained (M5)	0.00	0	1.00	.00	.00	M4 vs. M5	1.16	1
						M3 vs. M5	1.39	1
						M1 vs. M5	3.27	2
No cross-lagged effects (M1)	9.08	2	0.97	0.14	0.08			
Cross-lagged moral attitudes to muscle-building (M2)	16.85	1	0.92	0.30	0.08	M1 vs. M2	0.04	1
Cross-lagged muscle-building to moral attitudes (M3)	3.37	1	0.97	0.09	0.03	M1 vs. M3	5.17*	1
Reciprocal cross-lagged constrained (M4)	17.44	1	0.92	0.30	0.07	M1 vs. M4	0.74	1
Reciprocal cross-lagged unconstrained (M5)	0.00	0	1.00	0.00	0.00	M4 vs. M5	17.44*	1
						M3 vs. M5	3.37	1
						M1 vs. M5	9.08*	2

Note. ** p <.01, * p <.05

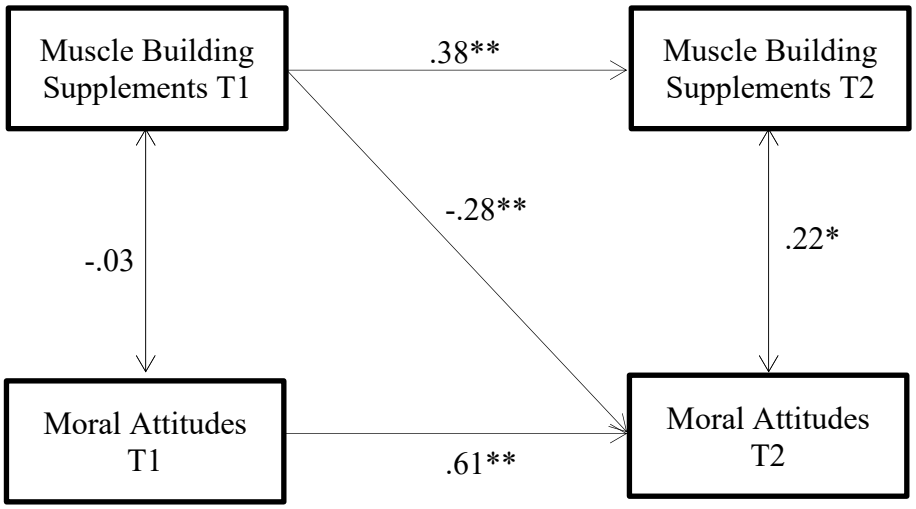
Figure 1. Two-wave panel model linking muscle-building supplement use and functional doping attitudes across time (M1).



Note. T1 = Time 1; T2 = Time 2.

**$p < .01$

Figure 2. Two-wave cross-lagged panel model linking muscle-building supplement use and moral doping attitudes across time (M5).



Note. T1 = Time 1; T2 = Time 2.

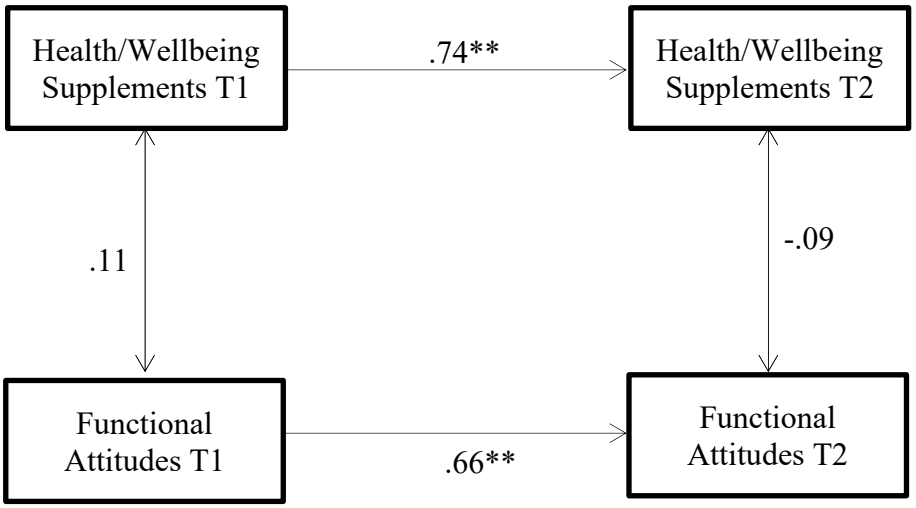
**$p < .01$

Table 7. Fit indices and χ^2 difference tests of nested models for health and wellbeing supplements *(N = 180)*

Variable	χ^2	*df*	CFI	RMSEA	SRMR	Comparison	$\Delta\chi^2$	Δdf
No cross-lagged effects (M1)								
Cross-lagged functional attitudes to health and wellbeing (M2)	0.02	2	1.000	0.00	0.00	M1 vs. M2	-0.59	1
Cross-lagged health and wellbeing to functional attitudes (M3)	0.96	1	1.000	0.00	0.02	M1 vs. M3	0.02	1
Reciprocal cross-lagged constrained (M4)	0.00	1	1.000	0.00	0.00	M1 vs. M4	0.01	1
Reciprocal cross-lagged unconstrained (M5)	0.01	1	1.000	0.00	0.00	M4 vs. M5	0.01	1
	0.00	0	1.000	0.00	0.00	M3 vs. M5	0.00	1
						M1 vs. M5	0.02	2
No cross-lagged effects (M1)	0.48	2	1.00	0.00	0.02			
Cross-lagged moral attitudes to health and wellbeing (M2)	0.09	1	1.00	0.00	0.01	M1 vs. M2	0.40	1
Cross-lagged health and wellbeing to moral attitudes (M3)	0.40	1	1.00	0.00	0.01	M1 vs. M3	0.09	1
Reciprocal cross-lagged constrained (M4)	0.04	1	1.00	0.00	0.00	M1 vs. M4	0.50	1
Reciprocal cross-lagged unconstrained (M5)	0.00	0	1.00	0.00	0.00	M4 vs. M5	0.04	1
						M3 vs. M5	0.40	1
						M1 vs. M5	0.48	2

Note. * p <.05

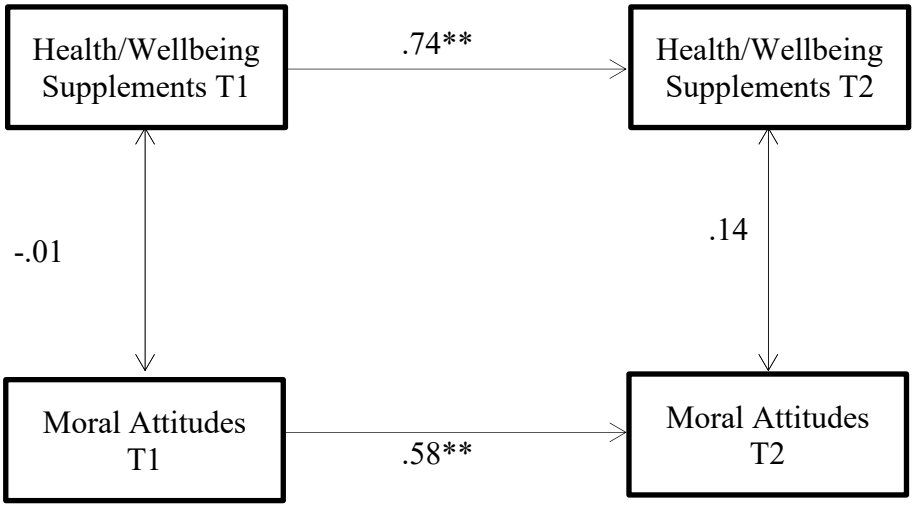
Figure 3. Two-wave panel model linking health and wellbeing supplement use and functional doping attitudes (M1).



Note. T1 = Time 1; T2 = Time 2.

**$p < .001$

Figure 4. Two-wave panel model linking health and wellbeing supplement use and moral doping attitudes (M1).



Note. T1 = Time 1; T2 = Time 2.

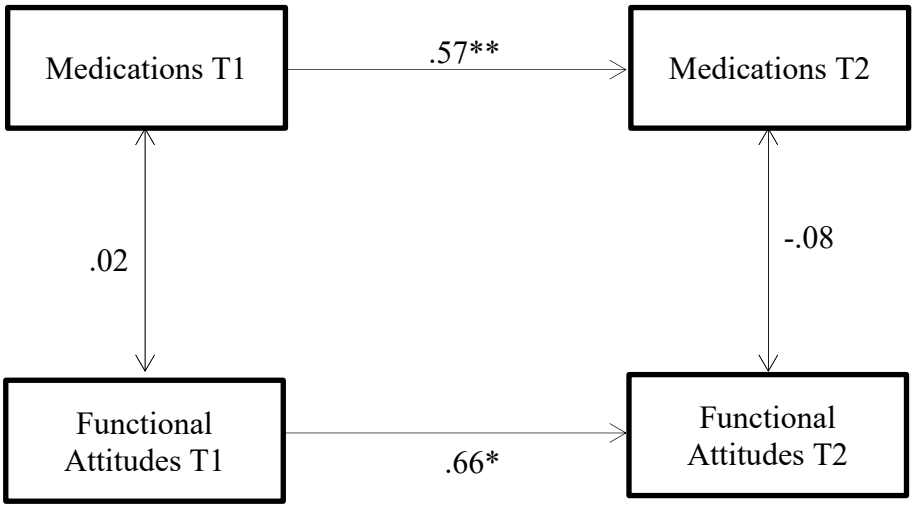
**$p < .001$

Table 8. Fit indices and χ^2 difference tests of nested models for medications *(N =180)*

Variable	χ^2	*df*	CFI	RMSEA	SRMR	Comparison	$\Delta\chi^2$	Δdf
No cross-lagged effects (M1)	2.03	2	1.00	0.01	0.03			
Cross-lagged functional attitudes to medications (M2)	0.96	1	1.00	0.00	0.02	M1 vs. M2	1.07	1
Cross-lagged medications to functional attitudes (M3)	1.07	1	1.00	0.02	0.02	M1 vs. M3	0.96	1
Reciprocal cross-lagged constrained (M4)	0.82	1	1.00	0.00	0.02	M1 vs. M4	1.22	1
Reciprocal cross-lagged unconstrained (M5)	0.00	0	1.00	0.00	0.00	M4 vs. M5	0.82	1
						M3 vs. M5	1.07	1
						M1 vs. M5	2.03	2
No cross-lagged effects (M1)	3.19	2	0.98	0.06	0.04			
Cross-lagged moral attitudes to medications (M2)	1.25	1	1.00	0.04	0.03	M1 vs. M2	2.35	1
Cross-lagged medications to moral attitudes (M3)	2.30	1	0.98	0.09	0.03	M1 vs. M3	1.27	1
Reciprocal cross-lagged constrained (M4)	1.54	1	0.99	0.06	0.03	M1 vs. M4	1.72	1
Reciprocal cross-lagged unconstrained (M5)	0.00	0	1.00	0.00	0.00	M4 vs. M5	1.54	1
						M3 vs. M5	2.30	1
						M1 vs. M5	3.19[a]	2

Note. ** p <.01, * p <.05, [a] p <.08

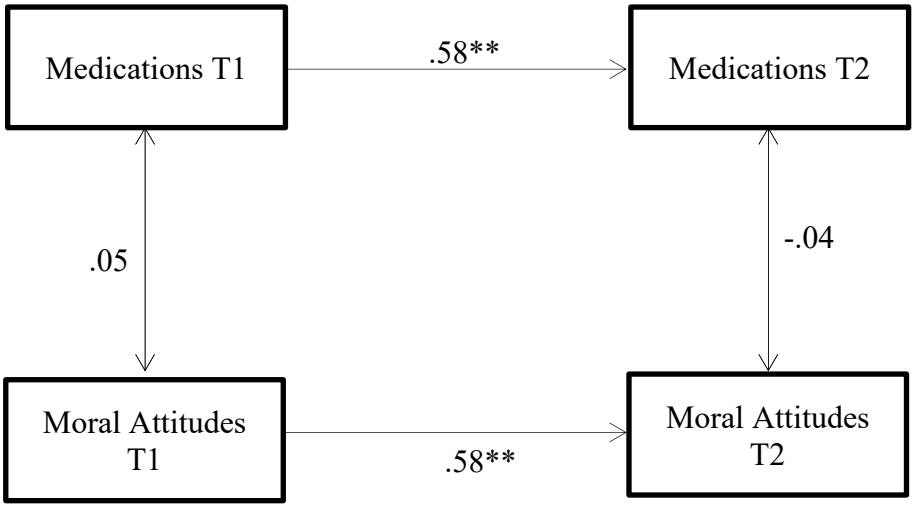
Figure 5. Two-wave panel model linking medication use and functional doping attitudes (M1).



Note. T1 = Time 1; T2 = Time 2.

**$p < .01$

Figure 6. Two-wave panel model linking medication use and moral doping attitudes (M1).



Note. T1 = Time 1; T2 = Time 2.

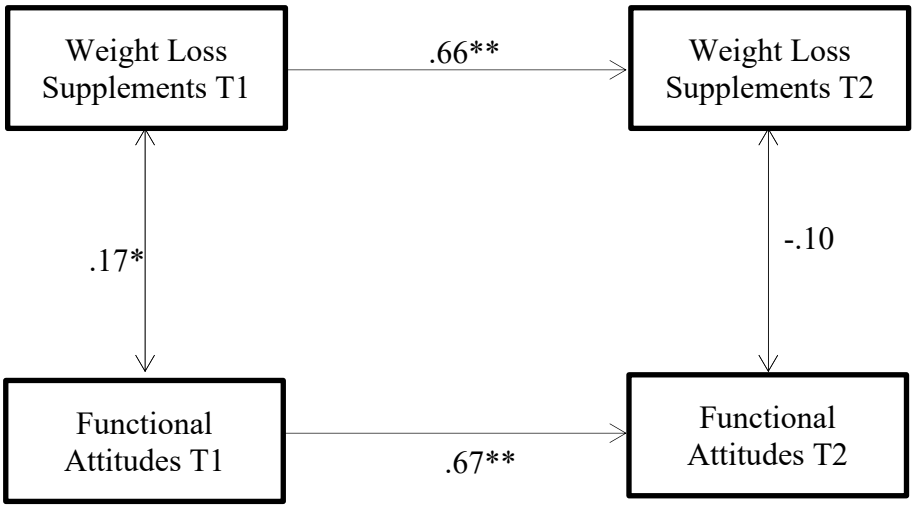
**$p < .01$

Table 9. Fit indices and χ^2 difference tests of nested models for weight loss supplements *(N =180)*

Variable	χ^2	*df*	CFI	RMSEA	SRMR	Comparison	$\Delta\chi^2$	Δdf
No cross-lagged effects (M1)	3.67	2	0.98	0.07	0.05			
Cross-lagged functional attitudes to weight loss (M2)	1.84	1	0.99	0.07	0.03	M1 vs. M2	1.83	1
Cross-lagged weight loss to functional attitudes (M3)	1.80	1	0.99	0.07	0.03	M1 vs. M3	1.85	1
Reciprocal cross-lagged constrained (M4)	1.80	1	0.99	0.07	0.03	M3 vs. M4	1.89	1
Reciprocal cross-lagged unconstrained (M5)	0.00	0	1.00	0.00	0.00	M4 vs. M5	1.80	1
						M3 vs. M5	1.80	1
						M1 vs. M5	3.67	2
No cross-lagged effects (M1)	3.21	2	0.98	0.06	0.05			
Cross-lagged moral attitudes to weight loss (M2)	2.77	1	0.97	0.10	0.05	M1 vs. M2	.14	1
Cross-lagged weight loss to moral attitudes (M3)	0.16	1	1.00	0.00	0.01	M1 vs. M3	2.72[a]	1
Reciprocal cross-lagged constrained (M4)	2.72	1	0.98	0.10	0.04	M1 vs. M4	0.22	1
Reciprocal cross-lagged unconstrained (M5)	0.00	0	1.00	0.00	0.00	M4 vs. M5	2.72[a]	1
						M3 vs. M5	0.16	1
						M1 vs. M5	3.21	2

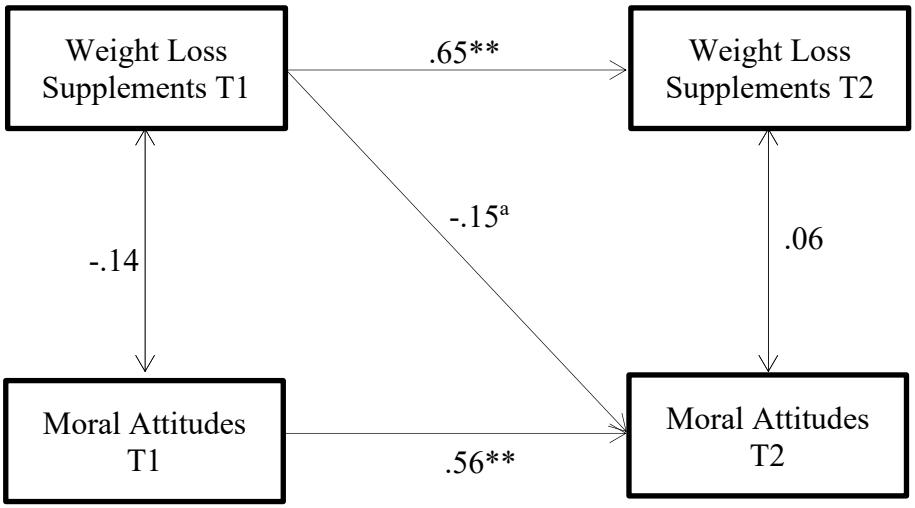
Note. ** p <.01, * p <.05, [a] p <.10

Figure 7. Two-wave panel model linking weight-loss supplement use and functional doping attitudes (M1).



Note. T1 = Time 1; T2 = Time 2.
**$p < .01$

Figure 8. Two-wave lagged panel model linking weight-loss supplement use and moral doping attitudes across time (M3).



Note. T1 = Time 1; T2 = Time 2.
**$p < .01$, $^{a}p < .10$

For the models concerning weight-loss supplements (see Table 9), model comparisons indicated those specifying cross-lagged paths (i.e., M2-M5) did not have an improved fit over the one with no cross-lagged paths (i.e., M1) for functional attitudes. As such, we accepted and interpreted model M1 for functional attitudes. As shown in Figure 7, the autoregressive paths were significant and very strong for both weight-loss supplement use and functional attitudes, demonstrating high stability of both variables across time. In turn, the synchronous correlation at Time 1 was weak-to-moderate, positive, and significant, whereas at Time 2 it was non-significant. For moral attitudes, model M3 had an improved fit over model M1, so we accepted and interpreted this model. As can be seen in Figure 6, this model indicated strong (i.e., moral attitudes) and very strong (i.e., weight-loss supplement use) autocorrelations, signifying high stability in both variables over time. In contrast, the synchronous correlations were non-significant at both time points. Finally, there was a marginally significant negative cross-lagged effect of weight-loss supplement use at T1 on moral attitudes at T2.

Regression Analyses. To help answer Research Question 4, we used the hierarchical multiple-regression procedures described by Aiken and West (1991) to determine whether disparity between explicit functional and moral doping attitudes influences doping moral disengagement in university athletes over time. To do this, we first centred both continuous predictors to reduce potential problems due to multicollinearity. We then conducted the hierarchical regression analysis in two steps. In the first step, we regressed doping moral disengagement on the predictor variable (i.e., functional attitudes) and the moderator variable (i.e., moral attitudes). In the second step, we added the interaction between functional and moral attitudes.

To test our hypotheses with Sample 1, we used Time 1 moral and functional doping attitudes and Time 2 moral disengagement. The regression analyses showed Time 1 functional (β = .23, p = .001) and moral (β = -.23, p = .001) attitudes were significant predictors of Time 2 moral disengagement in Step 1 (R^2 = .12, p = <.001). Then, the interaction between functional and moral attitudes at Time 1 was not a significant predictor of Time 2 moral disengagement (β = -.07, p = >.05) in Step 2 (R^2 = .01, p = >.05).

Sample 2

Descriptive and Correlational Analyses. Data were collected on reported use and frequency of use for nutritional supplements, performance enhancing technologies, medications and PEDs. Tables 10, 11, and 12, respectively, detail the descriptive statistics on reported use and frequency collected at Time 1, Time 2, and Time 3.

Table 10. Time 1 Descriptive Statistics on Reported Use and Frequency

Substance/Method	Use		Frequency		
	Never	Used during the past month	<1/week	weekly	3+ times/week
BCAA	191	14	1	9	4
Creatine	169	36	8	5	23
Protein Powder	118	87	12	16	59
Caffeine	194	11	5	4	2
Taurine	194	11	5	4	2
Fat Burners	203	2	0	1	1
Laxatives	205	0			
Weight Loss Meal Replacements	203	2	0	1	1
Pre-Workout	159	46	20	16	10
Magnesium	197	8	1	3	4
ZMA	203	2	0	1	1
Multivitamins	126	79	12	19	48
Vitamin C	152	53	6	15	32
Vitamin D	167	38	5	10	23
Vitamin E	199	6	0	1	5
Selenium	205	0			
Iron	187	18	2	5	11
Performance Enhancing Technologies					
Altitude Mask	204	1	1	0	0
Compression Garment	164	41	8	18	15
Medications					
Aspirin	195	10	7	1	2
Codeine	200	5	4	0	1
CBD	200	5	2	2	1
Ibuprofen	137	68	53	9	6
Paracetamol	116	89	73	11	5
Prohibited Substances / Methods					
Anabolic Steroids	205	0			
Human Growth Hormone	205	0			
Insulin	205	0			
Testosterone Boosters	205	0			
Amphetamines	205	0			
Cocaine	205	0			
Modafinil	205	0			
Adderall	205	0			
Clenbuterol	205	0			
Thyroid Drugs	205	0			
Beta Blockers	205	0			
SARMs	205	0			

Table 11. Time 2 Descriptive Statistics on Reported Use and Frequency

Substance/Method	Use		Frequency		
	Never	Used during the past month	<1/week	weekly	3+ times/week
BCAA	193	12	2	3	7
Creatine	172	33	2	6	25
Protein Powder	115	90	23	14	53
Caffeine	194	11	7	2	2
Taurine	201	4	2	1	1
Fat Burners	203	2	1	0	1
Laxatives	203	2	2	0	0
Weight Loss Meal Replacements	197	8	3	4	1
Pre-Workout	168	37	18	10	9
Magnesium	192	13	2	6	5
ZMA	203	2	0	0	2
Multivitamins	115	90	14	12	64
Vitamin C	152	53	7	14	32
Vitamin D	153	52	6	14	32
Vitamin E	194	11	1	2	8
Selenium	205	0			
Iron	179	26	3	6	17
Performance Enhancing Technologies					
Altitude Mask	205	0			
Compression Garment	153	52	16	23	13
Medications					
Aspirin	200	5	1	2	2
Codeine	204	1	1	0	0
CBD	200	5	1	2	2
Ibuprofen	157	48	33	11	4
Paracetamol	141	64	44	15	5
Prohibited Substances / Methods					
Anabolic Steroids	205	0			
Human Growth Hormone	205	0			
Insulin	205	0			
Testosterone Boosters	205	0			
Amphetamines	205	0			
Cocaine	205	0			
Modafinil	204	1	1	0	0
Adderall	205	0			
Clenbuterol	205	0			
Thyroid Drugs	205	0			
Beta Blockers	205	0			
SARMs	205	0			

Table 12. Time 3 Descriptive Statistics on Reported Use and Frequency

Substance/Method	Use		Frequency		
	Never	Used during the past month	<1/week	weekly	3+ times/week
BCAA	188	17	4	6	7
Creatine	171	34	3	5	26
Protein Powder	106	99	23	23	53
Caffeine	197	8	2	2	4
Taurine	198	7	4	3	0
Fat Burners	203	2	0	0	2
Laxatives	205	0			
Weight Loss Meal Replacements	200	5	1	2	2
Pre-Workout	163	42	15	17	10
Magnesium	192	13	2	2	9
ZMA	203	2	0	0	2
Multivitamins	123	82	5	16	61
Vitamin C	168	37	5	7	25
Vitamin D	155	50	8	8	34
Vitamin E	200	5	1	1	3
Selenium	205	0			
Iron	186	19	3	2	14
Performance Enhancing Technologies					
Altitude Mask	205	0			
Compression Garment	159	46	11	19	16
Medications					
Aspirin	196	9	5	2	2
Codeine	204	1	1	0	0
CBD	196	9	3	4	2
Ibuprofen	155	50	35	10	5
Paracetamol	144	61	42	10	9
Prohibited Substances / Methods					
Anabolic Steroids	205	0			
Human Growth Hormone	205	0			
Insulin	205	0			
Testosterone Boosters	205	0			
Amphetamines	205	0			
Cocaine	205	0			
Modafinil	204	1	1	0	0
Adderall	205	0			
Clenbuterol	205	0			
Thyroid Drugs	205	0			
Beta Blockers	205	0			
SARMs	205	0			

Regarding Research Question 1, Time 1, Time 2, and Time 3 data support the common (i.e., $n>10$ at all three time points) use of BCAA, creatine, protein, pre-workouts, multivitamins, vitamin C, vitamin D, vitamin E, iron, ibuprofen, paracetamol, and compression garments as

non-prohibited forms of performance enhancement amongst this sample of university athletes. In terms of prohibited substances and methods, there was no reported use at Time 1, and one participant used modafinil at the latter two time points.

Tables 13, 14, and 15, respectively, detail the descriptive and correlational analyses for the psychometric data collected at Time 1, Time 2, and Time 3. These show that at all three time points on average doping moral disengagement scores were moderately low, functional doping attitudes were marginally above the midpoint, and moral doping attitudes were quite high and positive. In turn, correlations showed university athletes who see doping as a functional way of improving their performance tend to have higher levels of doping moral disengagement, and higher levels of moral disengagement were linked with attitudes that downplay the moral relevance of doping. Finally, functional and moral doping attitudes had inconsistent relationships across the time points, being moderately strong and positive at Time 1, yet weak-to-moderate and negative at Time 2 and Time 3.

Cross-Lagged Panel Analysis. To further answer research question 3 we again utilised cross-lagged panel analyses (Cook & Campbell, 1979; Kenny & Harackiewicz, 1979), this time using three waves of data. Through these analyses, we aimed to determine the reciprocal causal effects between supplement/medication use and doping attitudes across three time points spanning a sport season. We again conducted eight series of analyses to examine the effects of different categories of supplement/medication on functional and moral doping attitudes separately. We adopted the same analytical strategy as with the two-wave data, except in these analyses we controlled for unobserved time-invariant factors. We did this because such factors can confound the associations between variables and lead to biased estimates (Oshio, Tsutsumi, & Inoue, 2015), which could have been an issue with the analyses on the Sample 1 data. It is not possible to control for these factors with two-wave data, so we could use this approach for the analyses with Sample 1.

Tables 16 to 19 present the fit indices and model comparisons for the five models for each combination of supplement/medication type and attitude. For the models concerning muscle-building supplements (see Table 16), the reciprocal equal cross-lagged effects model (M4) had the best combination of model fit and parsimony for functional attitudes. We therefore accepted this model and interpreted the parameter estimates from this model (see Figure 9). First, in terms of the autoregressive paths, these were moderate-to-strong and positive for muscle-building supplement use, but non-significant for functional attitudes. Next, the synchronous correlations showed inconsistent associations, being non-significant at T1 and T3, but strong and positive at T2. Finally, the cross-lagged paths from T1 to T2 and T2 to T3 from muscle-building supplement use to functional doping attitudes and from functional doping attitudes to muscle-building supplement use were positive, significant, and weak. For moral attitudes, the model containing cross-lagged effects from muscle-building to moral

attitudes only (M3) had the best combination of parsimony and fit. We therefore accepted this model and interpreted the parameter estimates from this model (see Figure 10). First, for the autoregressive paths, these were strong and positive for muscle-building supplement use, but non-significant for moral attitudes. Next, the synchronous correlations showed inconsistent associations, ranging from non-significant (T3) to moderate-to-strong (T2). Finally, the cross-lagged paths for T1 to T2 and T2 to T3 from muscle-building supplement use to moral doping attitudes were both negative, weak, and marginally significant.

For the models concerning health and well-being supplements (see Table 17), model comparisons indicated those specifying cross-lagged paths (i.e., M2-M5) did not have an improved fit over the one with no cross-lagged paths (i.e., M1) for functional attitudes. As such, model M1 was accepted as the final model, and we interpreted the parameter estimates from this model (see Figure 11). First, autoregressive paths were non-significant for both health and wellbeing supplement use and functional doping attitudes, demonstrating low stability for both variables across time. Synchronous correlations showed inconsistent associations, ranging from no effect (T1 and T3) to moderate and positive (T2). For moral attitudes, the model with cross-lagged effects from health and wellbeing supplements to moral attitudes only (M3) had the best balance of fit and parsimony and we interpreted the parameter estimates from this model (see Figure 12). Autoregressive paths were non-significant for both health and wellbeing supplement use and moral doping attitudes, demonstrating low stability for both variables across time. Synchronous correlations showed inconsistent and non-significant associations, ranging from non-significant (T1 and T2) to weak and marginally significant (T3). The cross-lagged effects from health and wellbeing supplement use to moral attitudes were negative, weak, and marginally significant from T1-T2 and T2-T3.

Table 13. Time 1 Descriptive and Correlational Analyses

	M	*SD*	Minimum	Maximum	A	B	C
A. Doping Moral Disengagement	2.69	0.90	1.17	5.28	.86		
B. Functional Doping Attitudes	1.92	8.14	-17.40	18.00	.30**	.84	
C. Moral Doping Attitudes	10.20	6.62	-9.60	15.60	-.20**	.43**	.88

Note. Alpha coefficients shown on the diagonal.

Table 14. Time 2 Descriptive and Correlational Analyses

	M	*SD*	Minimum	Maximum	A	B	C
A. Doping Moral Disengagement	2.73	0.86	1.00	5.78	.90		
B. Functional Doping Attitudes	3.24	6.51	-16.80	18.00	.34**	.79	
C. Moral Doping Attitudes	14.03	4.29	-3.50	18.00	-.48**	-.24**	.74

Note. Alpha coefficients shown on the diagonal.

Table 15. Time 3 Descriptive and Correlational Analyses

	M	*SD*	Minimum	Maximum	A	B	C
A. Doping Moral Disengagement	2.63	0.84	1.00	5.06	.90		
B. Functional Doping Attitudes	2.85	6.96	-16.80	18.00	.40**	.81	
C. Moral Doping Attitudes	14.10	4.30	-1.50	18.00	-.49**	-.18*	.76

Note. Alpha coefficients shown on the diagonal.

Table 16. Fit indices and χ^2 difference tests of nested models for muscle-building supplements (*N* = 205)

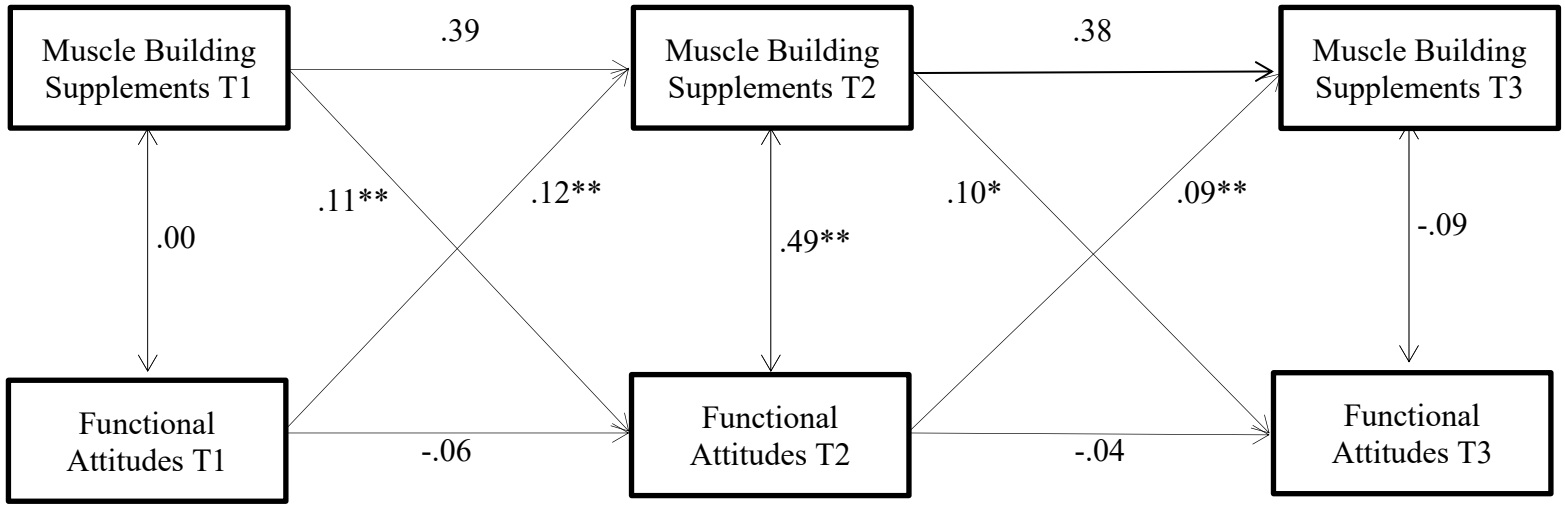
Variable	χ^2	*df*	CFI	RMSEA	SRMR	Comparison	$\Delta\chi^2$	Δdf
No cross-lagged effects (M1)	14.08/1.04	6	0.985	0.068	0.103			
Cross-lagged functional attitudes to muscle-building (M2)	6.95/1.07	5	0.996	0.037	0.069	M1 vs M2	7.86**	1
Cross-lagged muscle-building to functional attitudes (M3)	13.04/0.87	5	0.985	0.075	0.071	M1 vs M3	1.75	1
Reciprocal cross-lagged constrained (M4)	2.32/1.09	4	1.000	0.000	0.028	M3 vs M4	-	1
Reciprocal cross-lagged unconstrained (M5)	2.61/0.91	2	0.999	0.033	0.026	M4 vs M5	0.11	2
						M3 vs M5	10.66*	3
						M1 vs. M5	11.11*	4
No cross-lagged effects (M1)	12.78/1.11	6	0.980	0.063	0.086			
Cross-lagged moral attitudes to muscle-building (M2)	12.21/1.16	5	0.979	0.071	0.086	M1 vs M2	0.01	1
Cross-lagged muscle-building to moral attitudes (M3)	8.47/0.93	5	0.990	0.049	0.036	M1 vs M3	3.11[a]	1
Reciprocal cross-lagged constrained (M4)	9.29/0.84	4	0.984	0.068	0.036	M3 vs M4	0.01	1
Reciprocal cross-lagged unconstrained (M5)	21.76/0.35	2	0.941	0.185	0.035	M4 vs. M5	0.22	4
						M3 vs. M5	0.24	3
						M1 vs. M5	4.45	2

Note. ** p <.01, * p <.05, [a] p <.10

For the models concerning medication use (see Table 18), for functional attitudes the model with cross-lagged effects from medication use to functional attitudes only (M3) had the best balance of fit and parsimony and we interpreted the parameter estimates from this model (see Figure 13). Autoregressive paths were all non-significant. Synchronous correlations were mostly non-significant too, apart from that at T3 which was weak-to-moderate, positive, and marginally significant. The cross-lagged paths from T1-T2 and T2-T3 were both non-significant. For moral attitudes, the reciprocal equal cross-lagged effects model (i.e., M4) had the best balance of parsimony and fit. This model was therefore accepted as the final model, and we interpreted the parameter estimates from it (see Figure 14). Regarding the autoregressive paths, these were all non-significant for medication use and moral attitudes. The synchronous correlations were all non-significant, all the effect sizes ranged from moderate (i.e., T1) to strong (T2). Finally, the cross-lagged paths from medication use to moral doping attitudes from T1 to T2 and T2 to T3 were both weak and negative, whereas the reciprocal effects were weak and positive.

For the models concerning weight-loss supplements (see Table 19), for functional attitudes model comparisons indicated there was no improvement in fit derived from adding cross-lagged paths. As such, model M1 was accepted as the final model, and we interpreted the parameter estimates from this model (see Figure 15). Autoregressive paths were non-significant for weight-loss supplement use and functional attitudes. Synchronous

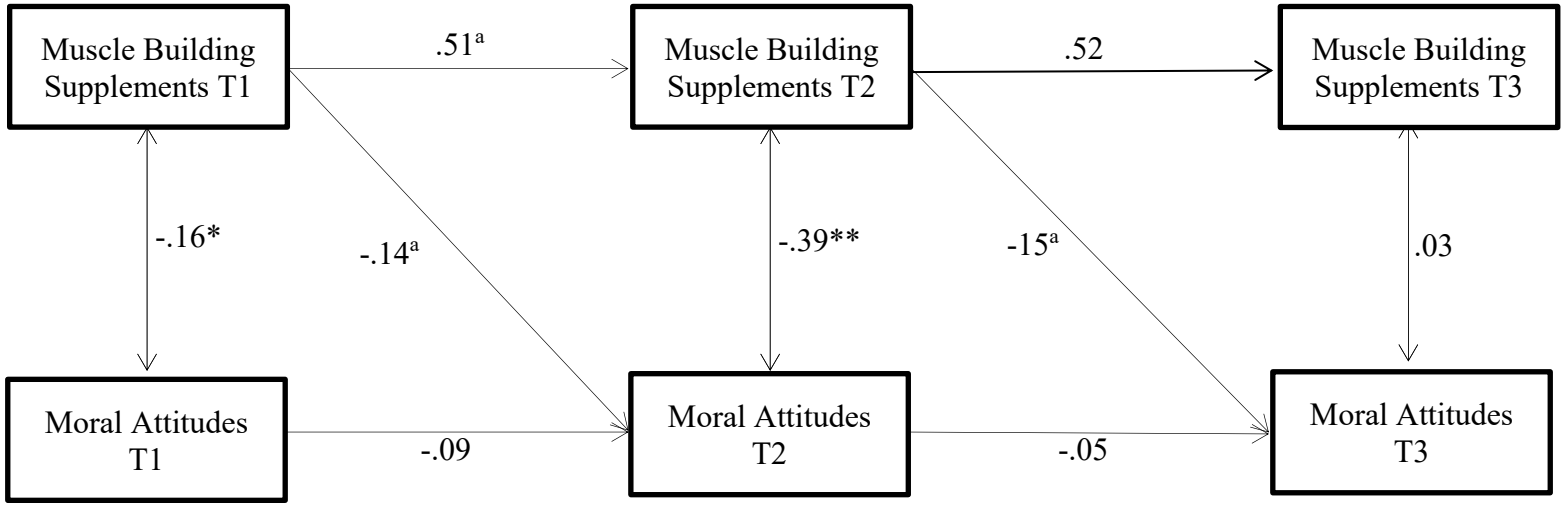
Figure 9. Three-wave cross-lagged panel model linking muscle building supplement use with functional doping attitudes across time (M4).



Note. T1 = Time 1; T2 = Time 2; T3 = Time 3.

*$p < .05$, **$p < .01$

Figure 10. Three-wave cross-lagged panel model linking muscle building supplement use with moral doping attitudes across time (M3).



Note. T1 = Time 1; T2 = Time 2; T3 = Time 3.

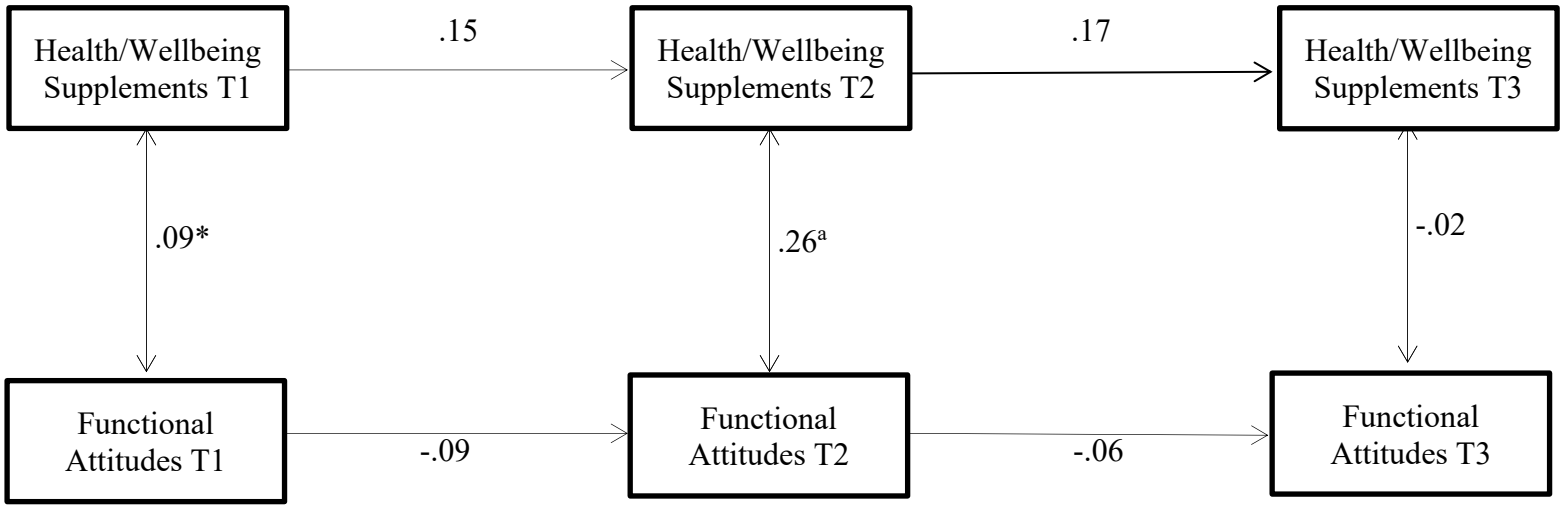
*$p < .05$, **$p < .01$, [a] $p < .10$

Table 17. Fit indices and χ^2 difference tests of nested models for health and wellbeing supplements *(N = 205)*

Variable	χ^2	*df*	CFI	RMSEA	SRMR	Comparison	$\Delta\chi^2$	Δdf
No cross-lagged effects (M1)	2.89/0.94	6	1.00	0.00	0.01			
Cross-lagged functional attitudes to health and wellbeing (M2)	1.99/0.99	5	1.00	0.00	0.02	M1 vs. M2	1.11	1
Cross-lagged health and wellbeing to functional attitudes (M3)	2.88/0.94	5	1.00	0.00	0.01	M1 vs. M3	0.00	1
Reciprocal cross-lagged constrained (M4)	1.93/1.02	4	1.00	0.00	0.02	M3 vs. M4	1.20	1
Reciprocal cross-lagged unconstrained (M5)	1.40/1.29	2	1.00	0.00	0.02	M4 vs. M5	0.23	2
						M3 vs. M5	1.28	3
						M1 vs. M5	1.19	4
No cross-lagged effects (M1)	6.90/1.11	6	1.00	0.02	0.04			
Cross-lagged moral attitudes to health and wellbeing (M2)	6.14/1.19	5	0.99	0.03	0.04	M1 vs. M2	0.53	1
Cross-lagged health and wellbeing to moral attitudes (M3)	4.12/1.10	5	1.00	0.00	0.03	M1 vs. M3	2.64	1
Reciprocal cross-lagged constrained (M4)	3.64/1.17	4	1.00	0.00	0.03	M3 vs. M4	0.32	1
Reciprocal cross-lagged unconstrained (M5)	1.84/1.35	2	1.00	0.00	0.02	M4 vs. M5	1.80	2
						M3 vs. M5	2.20	3
						M1 vs. M5	5.22	4

Note. ** p <.01, * p <.05

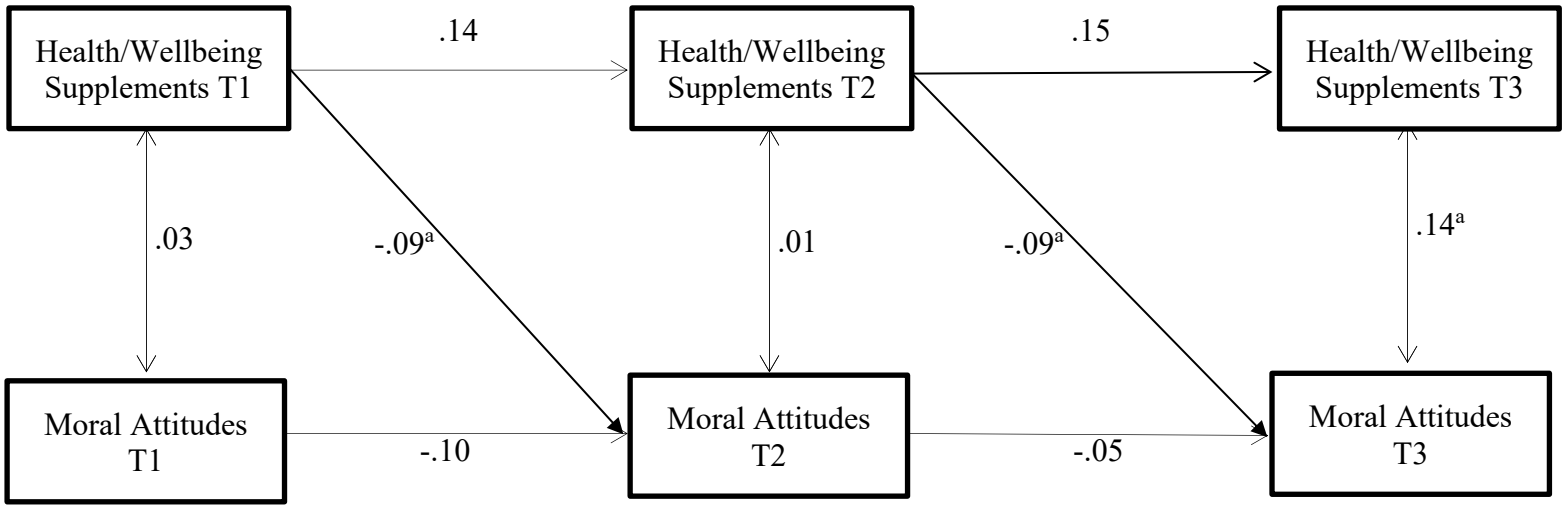
Figure 11. Three-wave panel model examining health and wellbeing supplement use with functional doping attitudes across time (M1).



Note. T1 = Time 1; T2 = Time 2; T3 = Time 3.

*$p < .05$, **$p < .01$, [a] $p < .10$

Figure 12. Three-wave panel model examining health and wellbeing supplement use with moral doping attitudes across time (M3).



Note. T1 = Time 1; T2 = Time 2; T3 = Time 3.

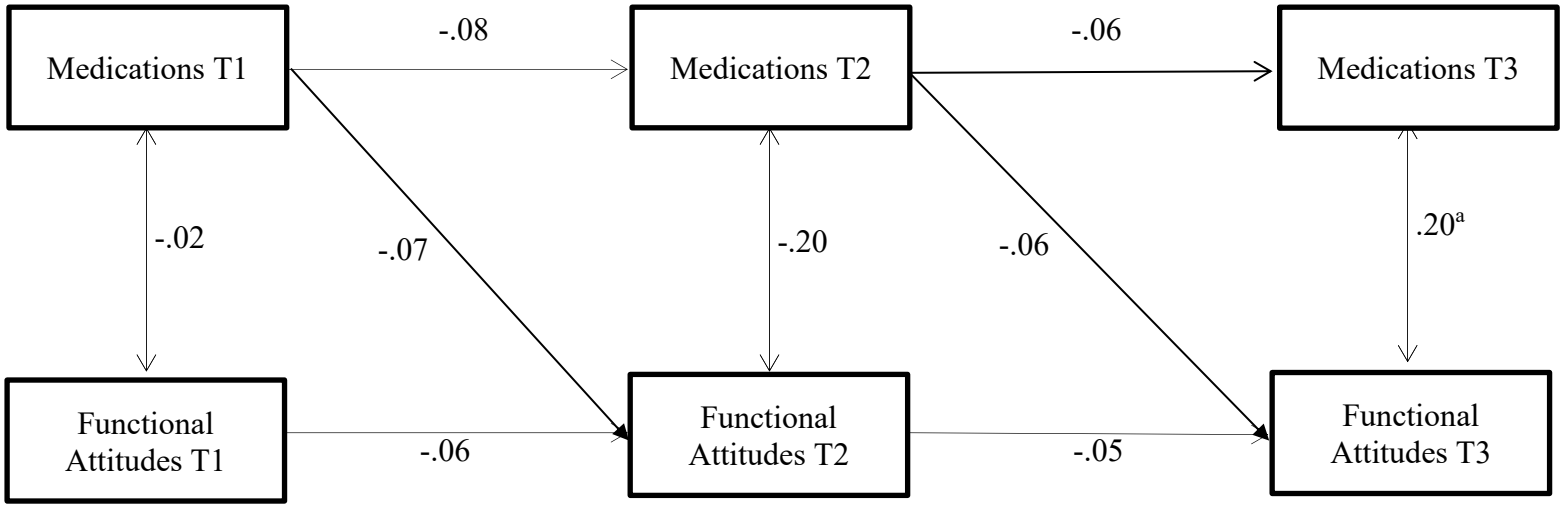
*$p < .05$, **$p < .01$, [a] $p < .10$

Table 18. Fit indices and χ^2 difference tests of nested models for medications *(N = 205)*

Variable	χ^2	*df*	CFI	RMSEA	SRMR	Comparison	$\Delta\chi^2$	Δdf
No cross-lagged effects (M1)	8.104/1.1872	6	0.994	0.035	0.052			
Cross-lagged functional attitudes to medications (M2)	8.168/1.1741	5	0.991	0.047	0.051	M1 vs M2	0.02	1
Cross-lagged medications to functional attitudes (M3)	5.352/1.2205	5	0.999	0.016	0.035	M1 vs M3	3.03[a]	1
Reciprocal cross-lagged constrained (M4)	5.114/1.2191	4	0.997	0.031	0.032	M3 vs M4	0.24	1
Reciprocal cross-lagged unconstrained (M5)	2.066/1.3669	2	1.000	0.011	0.024	M4 vs. M5	3.18	2
						M3 vs. M5	3.30	3
						M1 vs. M5	6.19	4
No cross-lagged effects (M1)	14.81/0.95	6	0.949	0.071	0.042			
Cross-lagged moral attitudes to medications (M2)	8.97/0.98	5	0.977	0.052	0.045	M1 vs M2	6.59*	1
Cross-lagged medications to moral attitudes (M3)	5.89/0.87	5	0.995	0.025	0.031	M1 vs M3	6.60*	1
Reciprocal cross-lagged constrained (M4)	1.32/0.86	4	1.000	0.000	0.013	M3 vs M4	4.41*	1
Reciprocal cross-lagged unconstrained (M5)	0.04/0.99	2	1.000	0.000	0.003	M4 vs. M5	1.50	2
						M3 vs. M5	6.45[a]	3
						M1 vs. M5	15.10**	4

Note. ** p <.01, * p <.05, [a] p <.10

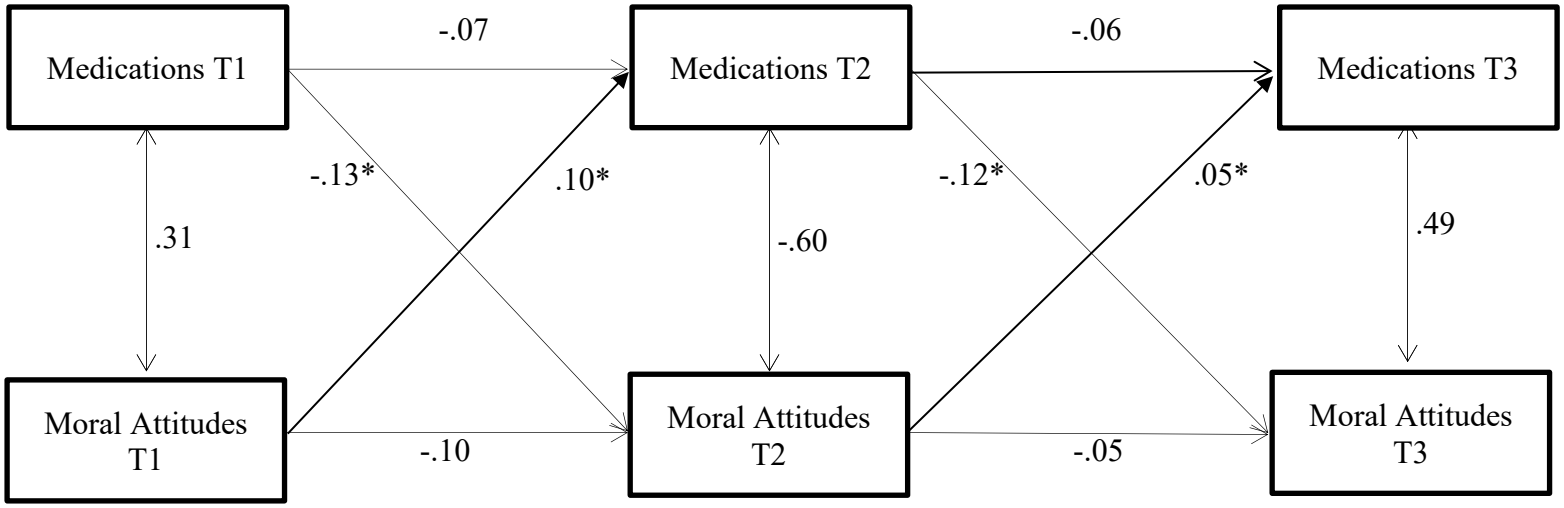
Figure 13. Three-wave panel model examining medication use with functional doping attitudes across time (M3).



Note. T1 = Time 1; T2 = Time 2; T3 = Time 3.

*$p < .05$, **$p < .01$, [a] $p < .10$

Figure 14. Three-wave cross-lagged panel model linking medication use with moral doping attitudes across time (M3).



Note. T1 = Time 1; T2 = Time 2; T3 = Time 3.

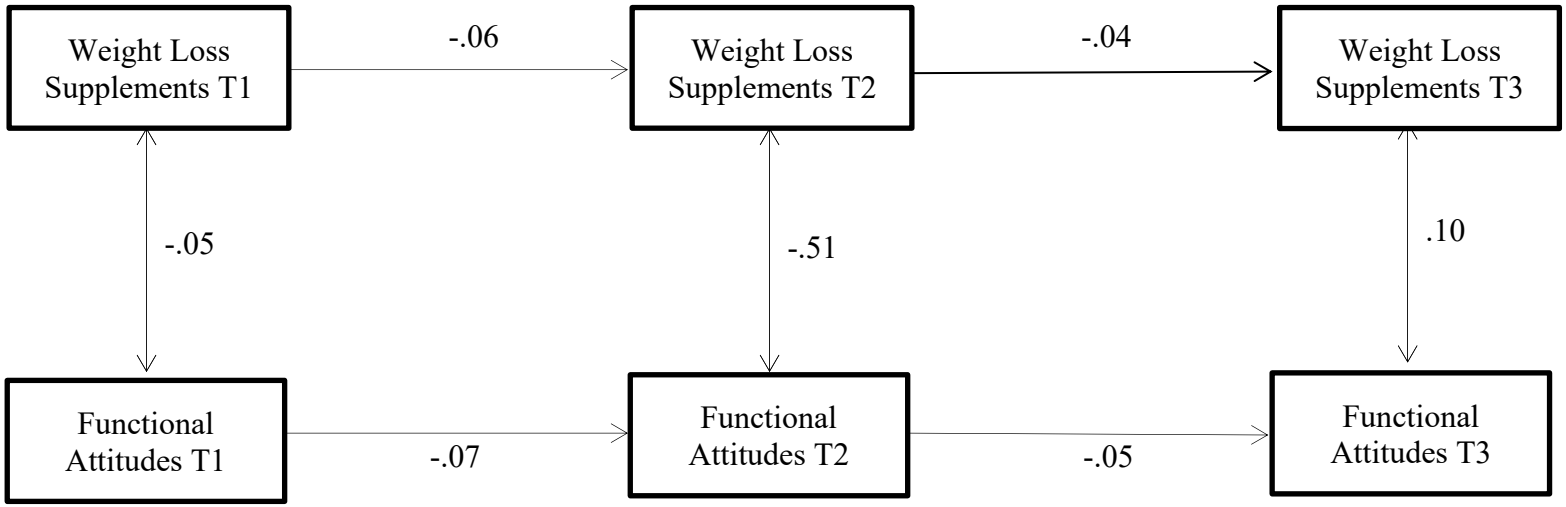
*$p < .05$, **$p < .01$

Table 19. Fit indices and χ^2 difference tests of nested models for weight loss supplements *(N = 205)*

Variable	χ^2	*df*	CFI	RMSEA	SRMR	Comparison	$\Delta\chi^2$	Δdf
No cross-lagged effects (M1)	6.58/0.75	6	1.00	0.02	0.02			
Cross-lagged functional attitudes to weight loss (M2)	6.12/0.76	5	1.00	0.03	0.03	M1 vs M2	0.39	1
Cross-lagged weight loss to functional attitudes (M3)	5.31/0.75	5	1.00	0.02	0.02	M1 vs M3	1.28	1
Reciprocal cross-lagged constrained (M4)	5.37/0.72	4	1.00	0.03	0.03	M3 vs M4	0.15	1
Reciprocal cross-lagged unconstrained (M5)	3.03/0.67	2	1.00	0.04	0.02	M4 vs. M5	2.38	2
						M3 vs. M5	2.44	3
						M1 vs. M5	3.69	4
No cross-lagged effects (M1)	8.81/1.06	6	0.98	0.04	0.07			
Cross-lagged moral attitudes to weight loss (M2)	7.92/1.11	5	0.98	0.05	0.06	M1 vs M2	0.67	1
Cross-lagged weight loss to moral attitudes (M3)	2.19/0.76	5	1.00	0.00	0.02	M1 vs M3	2.98	1
Reciprocal cross-lagged constrained (M4)	0.78/0.77	4	1.00	0.00	0.01	M3 vs M4	1.49	1
Reciprocal cross-lagged unconstrained (M5)	0.26/0.78	2	1.00	0.00	0.01	M4 vs. M5	0.52	2
						M3 vs. M5	1.97	3
						M1 vs. M5	7.62	4

Note. ** p <.01, * p <.05, [a] p <.10

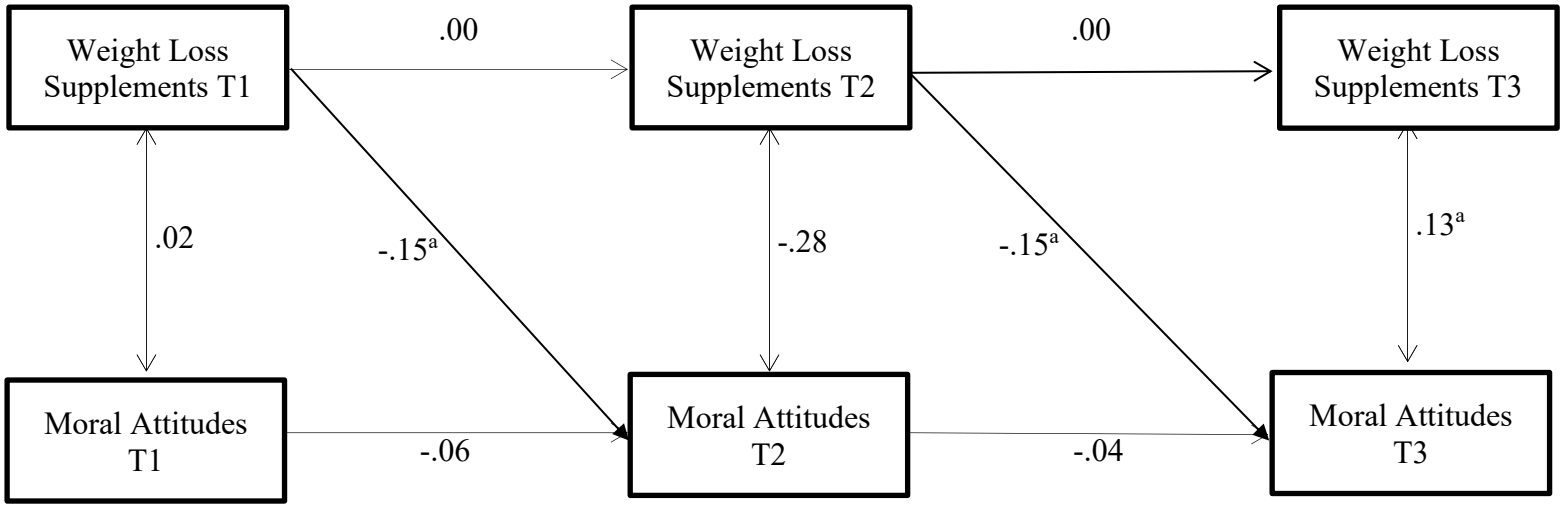
Figure 15. Three-wave panel model examining weight loss supplement use with functional doping attitudes across time (M1).



Note. T1 = Time 1; T2 = Time 2; T3 = Time 3.

*$p < .05$, **$p < .01$

Figure 16. Three-wave panel model examining weight-loss supplement use with moral doping attitudes across time (M3).



Note. T1 = Time 1; T2 = Time 2; T3 = Time 3.

*$p < .05$, **$p < .01$, [a] $p < .10$

Synchronous correlations showed inconsistent non-significant associations, ranging from strong and negative (T2) to weak and positive (T3). For moral attitudes, the model specifying cross-lagged paths from weight-loss supplement use to attitudes only (i.e., M3) had the best balance of parsimony and fit. This model was therefore accepted as the final model, and we interpreted the parameter estimates from this model (see Figure 16). Regarding the autoregressive paths, these were non-significant and weak for weight-loss supplement use and moral attitudes. The synchronous correlations were again inconsistent, ranging from negative, moderate, and non-significant (T2) to weak, positive, and marginally significant (T3). Finally, the cross-lagged paths from weight-loss supplement use to moral doping attitudes from T1 to T2 and T2 to T3 were both weak, negative, and marginally significant.

Regression Analyses. To help answer Research Question 4, we again used the hierarchical multiple-regression procedures described by Aiken and West (1991). The data from Sample 2 provided two opportunities to test our hypotheses relating to this research question. In the first analysis we used Time 1 moral and functional doping attitudes and Time 2 moral disengagement, and in the second set of analyses we used Time 1 moral and functional attitudes and Time 3 moral disengagement. In the first analysis, Time 1 functional (β = .42, p = <.001) and moral (β = -.38, p = <.001) attitudes were significant predictors of Time 2 moral disengagement in Step 1 (R^2 = .19, p = <.001). Then, the interaction between functional and moral attitudes at Time 1 was a significant predictor of Time 2 moral disengagement (β = -.19, p = <.05) in Step 2 (R^2 = .02, p = <.05). In the second analysis, Time 1 functional (β = .34, p = <.001) and moral (β = -.39, p = <.001) attitudes were significant predictors of Time 3 moral disengagement in Step 1 (R^2 = .16, p = <.001). Then, the interaction between functional and moral attitudes at Time 1 was a significant predictor of Time 3 moral disengagement (β = -.22, p = <.05) in Step 2 (R^2 = .02, p = <.05).

For the two significant interactions, we then followed the approach recommended by Aiken and West (1991) to interpret these interactions. For the prediction of moral disengagement at Time 2, Figure 17 reveals that the predicted positive association between functional attitudes and moral disengagement was more pronounced when moral attitudes were lower. This was also the case for the prediction of moral disengagement at Time 3, as shown in Figure 18. We also tested simple slopes for the association between functional attitudes and moral disengagement for the two significant interactions. At one standard deviation above the mean in Time 1 moral attitudes, the simple slope for the prediction of Time 2 moral disengagement by Time 1 functional attitudes was positive and significant, β = 0.55, p < .001. At one standard deviation below the mean, the effect was weaker but still positive and significant, β = 0.28, p = <.01.

There was a significant difference in the slope of the two lines for Time 2 moral disengagement, t = 1.98, p = <.05. Likewise, for the prediction of Time 3 moral

disengagement, at one standard deviation above the mean in Time 1 moral attitudes, the simple slope was positive and significant, β = 0.49, p < .001. In contrast, at one standard deviation below the mean, the effect was not significant, β = 0.19, p = >.05. There was a significant difference in the slope of the two lines for Time 3 moral disengagement, t = 2.16, p = <.05.

Figure 17. Moderation by Time 1 Moral Attitudes of the Prediction of Time 2 Moral Disengagement by Time 1 Functional Attitudes

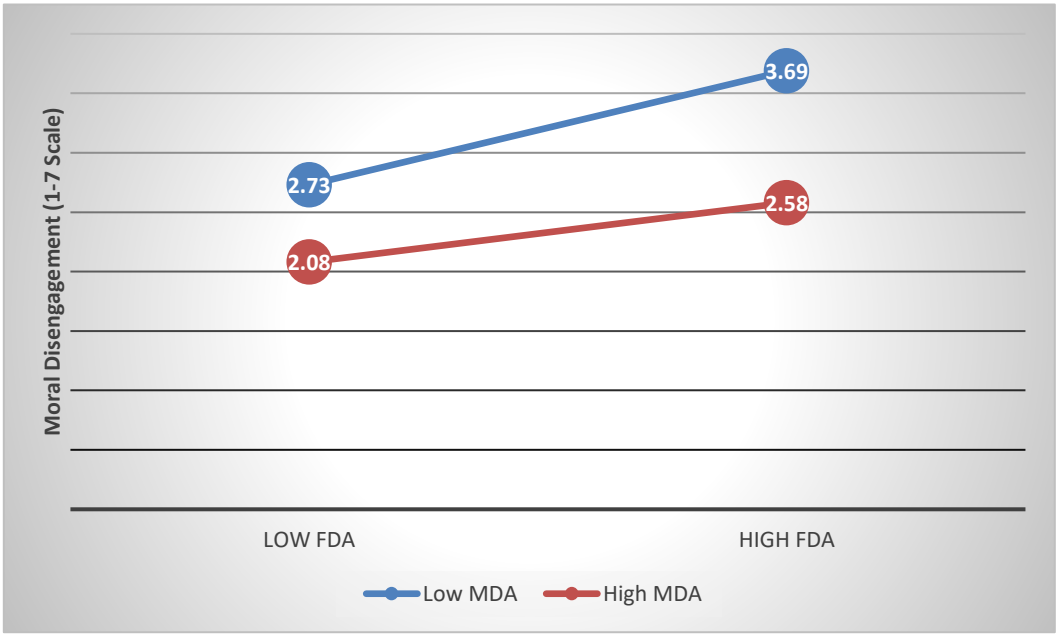
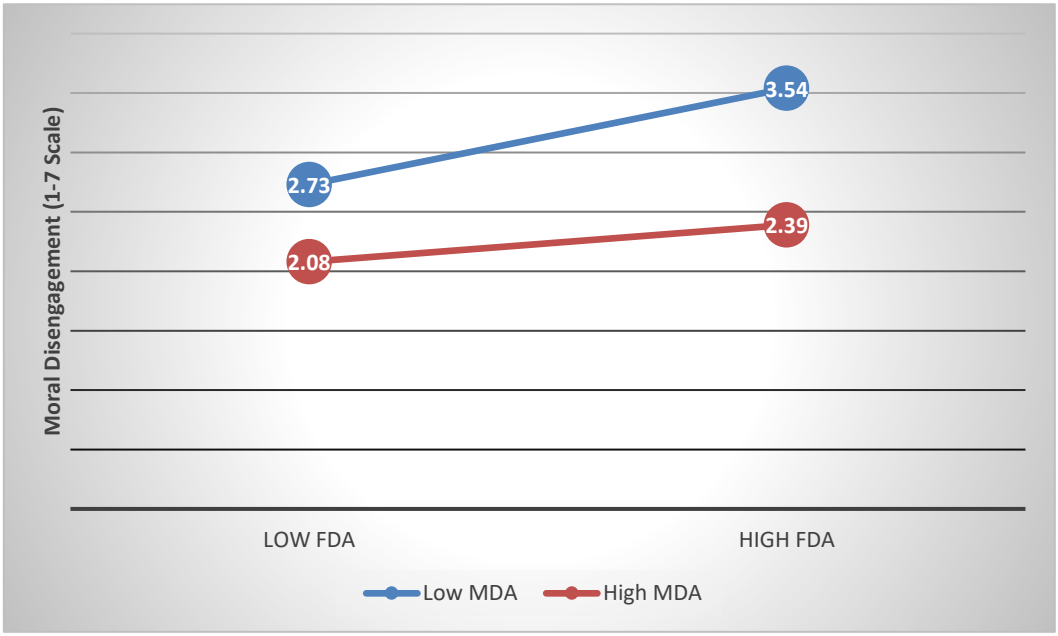


Figure 18. Moderation by Time 1 Moral Attitudes of the Prediction of Time 3 Moral Disengagement by Time 1 Functional Attitudes



Project Discussion

This collaborative project adopted a triangulation-design-mixed-methods approach to the investigation of non-prohibited and prohibited forms of performance enhancement in university athletes, and potential links between the two categories of performance enhancement. First, Work Package 1 utilised 1:1 interviews and focus groups to qualitatively examine university athletes' knowledge on these topics, as well as how non-prohibited means of performance enhancement may be presented to university athletes, so they are viewed as alternatives to – rather than as potential prerequisites for – doping. Next, Work Package 2 comprised of two longitudinal quantitative studies that examined the reciprocal relationships between different forms of non-prohibited performance enhancement and functional and moral attitudes to doping across time. These studies allowed us to test whether changes in use of various forms of non-prohibited performance enhancement were associated with changes in attitudes towards doping across time. They also allowed us to examine whether disparity between functional and moral doping attitudes may lead to changes in doping moral disengagement over time. Over the following paragraphs we highlight, integrate, and discuss the key findings from across the two work packages, structuring the discussion around the four stated research questions.

Our first research question examined which non-prohibited forms of performance enhancement are commonly used by university athletes. To answer this question, we collected data on the topic from two samples of university athletes across two (i.e., Sample 1) or three (i.e., Sample 2) time points. Non-prohibited forms of performance enhancement were categorised into muscle-building supplements (e.g., protein, creatine), health and well-being supplements (e.g., vitamins and minerals), weight-loss supplements (e.g., fat burners, laxatives), performance enhancing technologies (e.g., compression garments, altitude tents), and medications (e.g., NSAIDS, paracetamol, aspirin). Consistently, we found the most frequent use within the muscle-building supplements, health and well-being supplements, and medication categories. Within these categories, the specific substances that were reported as being used most frequently included protein powders, multivitamins and vitamins, ibuprofen, and paracetamol.

Our findings with respect to prevalence of supplement use in university athletes are largely consistent with those reported for athletic populations more widely. Whilst differences in definitions and categorizations across studies makes direct comparisons difficult (see Garthe & Maughan, 2018; Knapik et al., 2016), it is possible to draw general conclusions regarding the most commonly used supplements. As was seen presently, in a recent overview of studies that have reported prevalence of supplement use in university athletes, vitamins and minerals are frequently seen to be the most reported nutritional supplement (Garthe & Maughan, 2018). Protein powders were also frequently reported as one of the more common supplements, also consistent with our findings here. As such, in terms of nutritional supplements, the most used supplements in the university athletes we sampled are consistent

with available data on athletic populations more broadly.

A consistent finding across all five data collections was the low prevalence of weight-loss supplement use (i.e., fat burners, laxatives, weight loss meal replacements). Previous research examining prevalence of this specific category of supplement is limited, making it difficult to judge how representative our data are of the wider athletic population. However, research with US military personnel provides some insight. Jacobson, Horton, Smith, et al. (2012) found 19.4% of active-duty, reserve, and National Guard personnel (*N* = 106,698) reported use of weight-loss supplements (i.e., 15.9% of men, 26.9% of women). Although this rate of use is approximately double what we found for this category of supplement, Jacobson et al. (2012) did find prevalence to be significantly higher in overweight (i.e., 58.5%) and obese (i.e., 31.9%) participants than in underweight (i.e., 0.1%) and healthy weight (i.e., 9.4%) participants. As our sample of university athletes most likely consisted mainly of healthy-weight participants, the prevalence rates we found are largely comparable to what Jacobson and colleagues found for healthy-weight participants. That weight-loss supplement use was relatively low is encouraging news given such supplements are considered a higher risk for inadvertent doping. Specifically, Garthe and Maughan (2018) describe how they can be adulterated with central nervous system stimulants (e.g., ephedrine) and hormones or hormone precursors (e.g., norandrostenedione and norandrostenediol) because manufacturers perceive consumers require prompt perceptible results to motivate continued use. In the interest of increasing efficacy of such products, stimulants as opposed to pro-hormones may be more likely to be the main adulterants of choice.

The most prevalent medications reported across the five datasets were paracetamol, NSAIDs, and aspirin. Of these, aspirin was least prevalent with an average percentage use of 11.4% over the past six months for Sample 1 and 3.9% over the past month for Sample 2. The next most prevalent was NSAIDs/ibuprofen with an average percentage use of 29.8% over the past six months for Sample 1 and 27.0% over the past month for Sample 2. Finally, paracetamol was most prevalent, with an average percentage use of 55.3% over the past six months for Sample 1 and 34.8% over the past month for Sample 2. It is important to highlight that for both samples, university athletes were asked to report use of medications – as for all supplements/substances/methods – only for performance enhancement (i.e., use to help them train or compete). Whilst these prevalence estimates for use of paracetamol and NSAIDs for performance enhancement by university athletes may appear high at face value, they are not inconsistent with available data for other athletic populations. For instance, across a series of studies Tscholl and colleagues used data recorded by team physicians and that reported by athletes on doping control forms during competitions [2] to provide estimates of medication use (Tscholl, Alonso, Dollé, Junge, & Dvorak, 2010; Tscholl, & Dvorak, 2012;

[2] FIFA Men's World Cup 2002-2010; FIFA Women's World Cup 2003-2007; FIFA U-17/U-20 World Cup 2005-2007; 12 IAAF World Championships

Tscholl, Feddermann, Junge, & Dvorak, 2008a; Tscholl, Junge, & Dvorak, 2008b). Average consumption per athlete ranged from 0.63-0.80 per performance across the studies. Quite extreme use of medications was also evident, including 22 out of 23 soccer players from one team taking NSAIDs prior to every match (Tscholl et al., 2008a), one player taking nine substances prior to a match (Tscholl et al., 2008b), and 39.0% of players taking a painkilling agent before every game (Tscholl, & Dvorak, 2012). Further studies with comparable methods and alternative populations have found similar patterns of use with Turkish Football League players (Kavukcu, & Burgazli, 2013), elite Serbian team and individual sport athletes (Lazic, Dikic, Radivojevic, et al. 2009) and Paralympic athletes (Tsitsimpikou, Jamurtas, Fitch, Papalexis, & Tsarouhas, 2009). Although these studies report quite alarming levels of medication use that bring into question whether medications are being prescribed purely for therapeutic reasons, the current data suggest widespread off-label use of painkillers to facilitate performance extends into non-professional athletic populations too. This is supported by a recent scoping review of non-medical or extra-medical use of NSAIDs that found excessive use of NSAIDs amongst elite and non-elite athletes was widespread practice (Brennan, Wazaify, Shawabkeh, Boardley, McVeigh, & Van Hout, 2021).

In terms of performance enhancing technologies, compression garments were the only example of a performance enhancing technology that was used commonly across our data collections. Reported prevalence for recent use ranged from 5-25%, with levels higher in Sample 2 than Sample 1. There was also some sporadic use of altitude masks, but prevalence levels were much lower than for compression garments. Regarding comparisons with the broader literature, such comparisons are difficult for performance enhancing technologies as the literature tends to focus on their effectiveness rather than prevalence of use (e.g., Doan et al., 2003; Wilber, 2001). However, based upon our findings it seems performance enhancing technologies are not a major performance enhancement method within university-athlete populations.

Our second research question investigated how non-prohibited forms of performance enhancement can be presented most effectively to portray them as alternatives to – rather than precursors for – doping. This question was answered through the interviews and focus groups conducted with university athletes as part of Work Package 1. As part of these data collections, we also questioned university athletes about their knowledge relating to diet, with a focus on whether they had requisite knowledge to manipulate their diet effectively to support training and competition. The individual interviews revealed that very few university athletes had received any formal nutrition education, and in general, university athletes' knowledge on diet was poor. Further, the small number of university athletes who did attempt to utilise dietary manipulations to support their training and performance mainly focused on imprecise control of macronutrient and overall calorie intake. This was despite several of the university athletes competing at quite a high level. Although concerning, this finding is not

inconsistent with the extant literature. In a recent systematic review of athletes' nutrition knowledge, Janiczak, Devlin, Forsyth, and Trakman (in press) concluded that current evidence suggests knowledge about nutrition in athlete populations is generally of a low standard.

Janiczak et al. (in press) also found weak-to-moderate positive associations between nutrition knowledge and positive dietary behaviours. Importantly, a related systematic review by Tam, Beck, Manore, Gifford, Flood, and O'Connor (2019) found most (i.e., 86%) education interventions designed to improve nutrition knowledge in athletes have reported significant knowledge improvement, with a mean increase of 16%. Importantly, current evidence suggests athletes generally have low knowledge regarding nutrition, nutrition knowledge is associated with diet quality, and nutrition-knowledge focused interventions have been shown to increase knowledge. Thus, provision of nutrition education to athletes may increase their diet quality and reduce the perceived need to explore other means to support training and competition, such as nutritional supplement use. Moreover, the findings of Work Package 1 suggest university athletes may be one athletic population that would benefit from such interventions. Those on specific diets (i.e., vegetarian, vegan) may benefit most from nutrition education, as relevant participants described how they often turned to supplements because they didn't know how to consume relevant macro- and micro-nutrients through their restricted diets. Clearly there is an opportunity to provide education to university athletes to enhance their knowledge on nutrition, potentially benefiting their performance, health, and the perceived need to utilise nutritional supplements.

Participants in Work Package 1 also identified several components of possible interventions to reverse progression towards doping through education on diet, supplementation, and training. Across these components there was an underlying philosophy of trying to educate athletes on what they can do to support their training and performance, rather than telling them what they are not allowed to do (Petroczi et al., 2017). Based in part on theories relating to motives for doing something versus not doing it (Richetin, Conner, & Perugini, 2011), Petroczi and Boardley (2022) propose that the reasons for and against doping should be addressed separately. Reasons to not dope likely include factors such as doping being viewed as an unnatural way to enhance performance, wanting to see what can be done naturally, and not seeing the need for doping. Providing athletes with education on how to support their training and performance through nutrition and training could each of these reasons, collectively strengthening athletes' reasons not to dope and therefore putting them at a lower risk of doping.

Another theme common across the proposed components was that education should primarily be delivered by nutritionists and not coaches. The former were viewed as expert authority figures on diet and nutrition, whereas the latter were not. Alongside delivery by nutritionists, educational interventions should also capitalise upon peer influence, as peers were identified as a key influence on performance enhancement practices. To capitalise on

both recommendations, qualified professionals such as nutritionists could train peer educators to deliver interventions (Murimi, Kanyi, Mupfudze, Amin, Mbogori, & Aldubayan, 2017). Peer delivery may be particularly important for interventions targeting adolescents, as peer influence is known to be especially powerful within this age group (e.g., Keegan, Spray, & Harwood, 2010). In support of this contention, developmental research on peer influence in other contexts including education identifies the potential benefits of interventions that incorporate peer influence when working with children and adolescents (Gifford-Smith, Dodge, Dishion, & McCord, 2005). Whilst peer-led nutrition education programmes can be effective, emphasising fidelity during training of peer educators should be a major focus, as some programmes have lacked effectiveness due to inconsistent delivery (Murimi et al., 2017). Thus, consistently delivered coach- or peer-led nutrition education programmes could be an effective way of enhancing knowledge on diet and nutrition with university athletes.

A small number of participants suggested a food-first approach could be incorporated within nutrition-focused interventions. In support of this, adopting a "food first" approach is recommended by nutrition experts working in elite sport (Close, Kasper, Walsh, & Maughan, 2022). Importantly, this paper highlights the merits of a food first – but not a food only – approach, recognising supplements can play an important role in sport nutrition in certain circumstances (e.g., repeated bouts of high intensity activity with short recovery periods). Thus, athletes could be taught about selective use of supplements where there is an identified need, utilised as part of an overall food-first approach. As part of this, nutrition-based interventions could include information on functional foods, as research has shown that providing recreational gym users with a brief information pamphlet on nitrite/nitrate supplementation was effective in changing their beliefs such that they viewed beetroot juice as a more effective endurance performance aid and functional foods in general as more effective performance enhancers (James et al., 2010). Thus, interventions combining food-first approaches with education on functional foods may be an effective strategy.

Another suggestion was to start interventions early in athletes' development, before other influences can take hold, or self-education takes place. Such an approach would be consistent with contemporary views on anti-doping education, especially values-based education, with many suggesting this should be delivered as early as possible and well before an athlete's sporting career progresses to an elite level (Gumpenberger, Overbye, Streicher, Schobersberger, & Blank, 2020; Lentillon-Kaestner, Hagger, & Hardcastle, 2012). Consistent with our findings here for nutrition education, research has also shown delivery of anti-doping education early in the life course is supported by athletes themselves (Efverstrom, Backstrom, Ahmadi, & Hoff, 2016; Hallward & Duncan, 2018). This suggestion is also supported by recent mixed-methods research that examined how social media use can inform physical activity and diet-related behaviours, as well as contextual factors that can drive social media use for health-related behaviours (Goodyear, Boardley, Chiou, Fenton, Makopoulou, Stathi... & Thompson, 2021). This research suggested that people are most likely to use internet sources

to try to educate themselves when they have low levels of knowledge on relevant topics. Gravitating towards such information sources makes people more susceptible to inaccurate and misleading information. Thus, through early education on nutrition and diet for athletic performance, it may be possible to reduce the likelihood athletes will turn towards less reliable sources of information. Thus, participants made several useful suggestions regarding ways in which nutrition interventions could be delivered most effectively to try to strengthen athletes' reasons not to dope.

The interviews and focus groups also identified themes relevant to the gateway hypothesis of doping in sport (Backhouse et al., 2013) and the IMDB (Petróczi, 2013a). Regarding the gateway hypothesis of doping in sport (Backhouse et al., 2013), several university athletes described how they believed that for some people, use of non-prohibited nutritional supplements could represent a step in a process leading them towards use of prohibited means of performance enhancement. Previous qualitative research with participants who had admitted using prohibited substances in sport and exercise identified a similar progression, labelled the sliding scale (Boardley & Grix, 2014; Boardley et al., 2014; 2015). These studies identified a process whereby athletes progress from diet manipulation to supplementation and then to prohibited substance use, with plateaus in performance motivating progression to the next form of performance enhancement. The findings of Work Package 1 provide the first qualitative evidence linking supplement use with doping with a sport population that has not admitted using prohibited substances. Some university athletes also discussed a grey zone of performance enhancement, whereby the off-label use of medications is an intermediary step between nutritional supplement use and use of prohibited substances. This is consistent with the IMDB (Petróczi, 2013a), which describes how some athletes experiment with use of medications to facilitate training and performance before they progress onto doping. An example of this is the prophylactic use of NSAIDs by athletic populations, which was discussed by participants in Work Package 1. Such prophylactic use of NSAIDs by athletes was also supported by a recent scoping review of non-medical and extra-medical use of NSAIDs (Brennan et al., 2021).

To answer our third research question, we examined the effects over time of using nutritional supplements and medications on explicit functional and moral doping attitudes in university athletes across two samples. With respect to performance enhancing technologies, we found the prevalence of use to be too low to examine effects on doping attitudes in both samples. In contrast, we found several interesting effects for use of nutritional supplements and medications. In general, we saw more evidence of cross-lagged effects (i.e., effects over time of supplement/medication use on attitudes and/or vice versa) with Sample 2 than we did with Sample 1. This is likely explained by our inability to control for unobserved time-invariant factors in the two-wave data for Sample 1. With the three-wave data for Sample 2, we were able to control for these factors. When not controlled for, unobserved time-invariant factors can confound the associations between variables and lead to biased estimates (Oshio,

Tsutsumi, & Inoue, 2015), especially when they are subjectively assessed as was the case here, as responses are therefore likely to be related to common individual attributes (Mckenzie, Gunasekara, Richardson, & Carter, 2014; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Our inability to control for these factors when analysing the Sample 1 data may have weakened our ability to detect significant cross-lagged effects, leading to the greater number of significant effects with Sample 2 than we had with Sample 1.

A key finding relating to this research question was that there was far more evidence of cross-lagged effects from supplement/medication use to attitudes than there was in the opposite direction. Specifically, of the 18 instances where there was evidence of a cross-lagged effect, 14 of these were from supplement/medication use to attitudes as opposed to only four in the opposing direction. Further, the nature of these 14 effects consistently supported supplement/medication use having a facilitative effect on attitudes supportive of doping. However, whilst the effects were consistently supportive of doping (i.e., positive for functional [i.e., use leads to more favourable attitudes towards functionality of doping] and negative for moral [i.e., use leads to reduced moral opposition to doping] attitudes), we found more cross-lagged effects on moral attitudes than we did on functional attitudes. This contrasts with our hypothesis that use of non-prohibited performance enhancement techniques would impact functional – but not moral – doping attitudes. Specifically, based upon the tenets of the IMDB (Petroczi, 2013a), we hypothesised that supplement and medication use would lead to positive changes in functional – but not moral – doping attitudes over time. That supplement/medication use led to positive changes in moral attitudes was not anticipated. This suggests that in contrast to the IMDB, weakened moral opposition to doping may be a key component of the doping mindset, and this may be influenced by use of nutritional supplements and medications.

Given this is the first research to test the effects of supplement/medication use on doping attitudes longitudinally, these findings provide the strongest support to date for a causal link between use of nutritional supplements/medication and favourable attitudes towards doping. To date, research establishing links between nutritional supplement use and doping has only been based upon cross-sectional qualitative (Boardley & Grix, 2014; Boardley et al., 2014, 2015) or quantitative (Backhouse et al., 2013; Hildebrandt et al., 2012; Ntoumanis et al., 2014) data. Similarly, although it has been suggested that medication use by athletes may lead to athletes experimenting with prohibited substances (e.g., Donovan, 2009) and the existence of evidence for inappropriate and excessive use of medications in sport (e.g., Lazic et al., 2011; Tscholl et al., 2008a, 2008b), the existence of a causal effect of medication use on doping attitudes has remained untested until now. Finally, the detection of these cross-lagged effects provides support for elements of the IMDB (Petroczi, 2013a) and the gateway hypothesis of doping in sport (Backhouse et al., 2013), supporting their proposition that doping can evolve as part of the habitual application of non-prohibited performance enhancement practices (e.g., nutritional supplements, medications).

Differences were seen regarding which forms of supplementation influenced which doping attitude. Specifically, all four types of supplementation showed cross-lagged effects on moral attitudes, whereas only use of muscle building supplements affected functional attitudes. For moral attitudes, this suggests a more general effect of supplementation on reductions in moral opposition to doping. People who hold strong moral attitudes towards doping feel it represents an unfair advantage, constitutes cheating, causes harm to others, and it is against the spirit of sport (Petroczi, 2013a). The present findings suggest that increased use of all four forms of external supplementation may lead to a weakening of such attitudes. Thus, it may be that greater use of any of the main non-prohibited means of performance enhancement may diminish moral attitudes opposing doping, potentially by normalising external means of performance enhancement.

In contrast, effects of supplementation on functional attitudes were only detected for muscle building supplements, suggesting there may be something specific about these forms of supplementation that links their use with functional attitudes. It is possible that use of muscle-building supplements is driven more by performance enhancement motives than for the other categories of supplements which are likely driven more by health/aesthetic motives. Effects on moral attitudes may be more about external means of performance enhancement more generally, rather than being related to specific motives. People who hold strong functional attitudes towards doping feel it can make their results better, make them more competitive, realise their potential as an athlete, improve their athletic performance, and benefit fully from their training (Petroczi, 2013a). Similarly, use of muscle building supplements (e.g., protein; creatine) has been linked with enhancement in performance. For instance, protein and creatine are two of a small number of nutritional supplements for which there is evidence of their efficacy regarding enhancement of performance (see Hector & Phillips, 2018; Rawson & Persky, 2007; Volek & Rawson, 2004). It is therefore possible that athletes using supplements such as protein and creatine perceive a benefit for performance as a result, which then leads to increased perceptions regarding the efficacy of using other substances linked with performance enhancement, including prohibited means such as doping. Thus, it may be the motives for use that link use of muscle-building supplements with increased functional attitudes towards doping. Future research should also examine motives for use to investigate this possibility.

Our findings also highlight some more general implications for research in this area in the future. For instance, they highlight the importance of considering different types of nutritional supplement in research. Historically there has been a tendency for researchers to assess supplement use as a single category (e.g., Backhouse et al., 2013; Barkoukis et al., 2020), although there have been exceptions (e.g., Hilderbrandt et al., 2013). However, as can be seen by the present results there can be disparities in effects for different categories of supplement. Recently there have been rudimentary attempts to categorise supplements based upon logical groupings (Hurst, Ring, & Kavussanu, 2021), but to date there has been

no evidence provided to demonstrate these groupings reflect athletes' actual use of nutritional supplements. In contrast, for the current research we submitted athlete data on supplement use to factor analysis to determine groupings based upon university athletes' actual reported use. In future, there is a need for researchers to examine the specific patterns of supplement use to try to identify consistent categories of supplement use that should be adopted more widely on research examining the impacts of nutritional supplement use on doping outcomes.

Relatedly, to date the Performance Enhancement Attitude Scale (Petróczi & Aidman, 2009) has been the most widely used instrument to assess doping attitudes. However, although some now conclude that this scale predominantly assesses moral attitudes (Folkerts, Loh, Petróczi, & Brueckner, 2021), it was not designed to assess a specific category of doping attitude and cannot differentiate between different types of doping attitudes. It therefore does not provide the ability to make comparisons between attitude types as we have done presently. Importantly, our findings emphasize the importance of considering different types of doping attitudes given the disparate findings between functional and moral attitudes. Thus, in future work there is a need to further develop instrumentation to assess the full range of doping attitudes. For instance, it is possible that the dimensionality of doping attitudes goes beyond the functional and moral components examined presently, potentially including further components such as attitudes towards the legality and harmfulness of prohibited substance use.

Some aspects of our findings relating to Research Question 3 provide further directions for future research for research testing the effects of using nutritional supplements and medication on outcomes relevant to doping. For one, it will be important to examine why in the present research the effect sizes for cross-lagged effects were generally weak or weak-to-moderate. For example, it may be that the size of any effects of supplementation on doping attitudes is in fact small, or it may be that our methods contributed to these effect sizes. Specifically, the time periods between data collections were quite short, so future work should look to test these effects over more extended time periods to determine whether longer time periods between collections lead to increased effect sizes. Also, whilst we established temporal links between changes in supplementation and doping attitudes, we did not examine whether these links extend to impacts on actual doping behaviour. Thus, future research should look to examine whether use of nutritional supplements and medications is linked with intentional doping, behaviours that put athletes at risk of inadvertent doping, and vulnerability, susceptibility to doping, or doping willingness.

To answer our fourth research question, we examined the predictive effect over time of the interaction between the two doping attitudes on doping moral disengagement. Based upon relevant propositions in the IMDB (Petroczi, 2013a), we hypothesised we would see the highest levels of moral disengagement when there was tension between functional and moral attitudes to doping (i.e., doping is viewed as functional but against an athlete's moral beliefs). This hypothesis was based upon Petroczi's (2013a) proposition that such tension should lead

to cognitive dissonance (Festinger, 1962), and our contention that moral disengagement would increase to manage this dissonance, based upon Bandura's (1991) theory. However, whilst we did detect a significant interaction effect of the two attitudes on doping moral disengagement, the effect was not as we had hypothesised. Whilst based upon the IMDB we hypothesised moral disengagement would be highest when moral and functional doping attitudes were both high, what we found in Sample 2 was it was actually highest when moral doping attitudes had been low and functional doping attitudes high. This suggests that rather than moral disengagement being elevated to relieve tension between functional and moral attitudes to doping, heightened moral disengagement may result from an attitudinal risk profile for doping (i.e., doping is viewed as functional, and the athlete has little moral opposition to it). Thus, university athletes with this combination of attitudes have an ideal combination of attitudes to facilitate doping, and an associated tendency to justify and rationalise it. Further, although the interaction effect was only significant in Sample 2, the regression analyses still showed functional and moral attitudes, respectively, to predict moral disengagement positively and negatively in Sample 1. As such, high levels of functional doping attitudes and low levels of moral doping attitudes should be considered a risk profile for doping.

This finding could have important implications for intervention development. Interventions targeting doping attitudes should address the two attitudes separately, building moral attitudes against doping and tempering the development of functional beliefs about the effectiveness of doping. This contention is supported by our qualitative data, in which several university athletes made a distinction between moral and functional attitudes, alluding to a performance-enhancement mindset reflective of the at-risk profile we identified through our quantitative analyses. Based upon our qualitative data, this performance-enhancement mindset may facilitate the transition from non-prohibited performance-enhancement techniques to prohibited forms, facilitating the gateway effects we detected through our cross-lagged panel analyses. This possibility should be tested statistically through future quantitative research.

Automatic Doping Preferences Measure

To address aspects of Research Question 3 and test Hypothesis 2, during the two years of the project we attempted to develop and validate a measure of automatic associations for doping for use in WP2. Although our initial intention was to develop measures based on the pictorial Brief Implicit Association Test (Brand, Heck, & Ziegler, 2014), during an initial team meeting we decided that identifying images that unambiguously represented doping would not be possible. As a result, we instead decided to develop word-based Single Category-Implicit Association Tests (SC-IATs). During this meeting we developed a series of potential items (i.e., words) for the measures for use during piloting. These items were appraised during pilot interviews and focus groups for Work Package 1, and new items were also developed during these pilot interviews and focus groups. The revised list of words was then used in the initial piloting of four SC-IATs (i.e., Controlled Moral; Controlled Functional; Uncontrolled Moral; Uncontrolled Functional). Piloting was completed with 25 participants (18 female; M_{age} = 26 years; exercising more than three times a week or participating in competitive sport). Subsequent data analyses indicated that these measures – particularly those measuring uncontrolled substances (i.e., nutritional supplements) – were unreliable. As such, at the end-of-year team meeting we took the decision to focus only on developing measures for automatic preferences for controlled (i.e., doping) substances. During this meeting we also made changes to the category labels and stimuli items of the two remaining measures (i.e., Controlled Moral; Controlled Functional) to try to improve their reliability and validity. These revised measures were then piloted with a larger sample of competitive team-sport athletes (n = 72 [36 Female]; M_{age} 33 years; training/competing ≥4 times/week). Data analyses showed that although there was greater evidence for the reliability of these measures in comparison to the original measures, their correlations with explicit measures of doping attitudes were not fully in line with our hypotheses. It also seemed that our goal of developing separate measures for functional versus moral elements may not be viable. As a result, during our next team meeting we decided to focus on developing an SC-IAT for controlled substances using *Allow* and *Resist* as category labels. Over the winter of 2018/2019, this measure was piloted with a sample of recreational and competitive team-sport athletes (n = 61 [39 Male]; M_{age} 30 years). The mean D scores from this measure was 0.11, which if valid would suggest that across the sample there was no real preference for or against controlled substances. However, scores on this measure again did not correlate with explicit measures of doping attitudes. There was also quite a high error rate (data from 16 or the 61 participants had to be excluded prior to data analysis). The continued issues we have experienced with validity and reliability across various iterations led us to conclude at the 2019 annual team meeting that we should continue to collect data for WP2 without a measure of automatic associations for doping. Although this meant we were unable to test Hypothesis 2, given the issues we had experienced across various iterations of the measure we felt further efforts to develop this measure may not have been successful, and have also delayed the start of WP2. We would encourage further work to develop and validate a measure of

automatic associations for doping that would allow the potentially important role of implicit attitudes to be examined.

Effect of Research on Professional Development

Two PhD candidates worked on the project during its life course. The first PhD student (i.e., Alex Olton) worked on the project for one year, and developed her conceptual, statistical, and methodological knowledge through her work on the project. At the end of the first year of her PhD, Alex decided not to continue her PhD studies as she wanted to return to her home country (i.e., Trinidad & Tobago) to work as a sport psychologist. Following Alex's departure from the project, the second PhD student – Mr Martin Chandler – started working on the project, collecting the study data for his PhD. Martin has also developed in the same three areas as Alex, although given the longer period that he has worked on the project he has developed his knowledge much further in all three areas. Martin's considerable previous experience researching PED use in exercise populations (e.g., bodybuilders) also meant that his start point was much higher. His work on the project – and involvement in other activities within the research group – has allowed him to extend his knowledge of PED use into the sport domain. In addition to this development of his conceptual knowledge, Martin has also extended his statistical and methodological skills and knowledge as some of the data analytical (e.g., structural equation modelling) and methodological (e.g., longitudinal research methods) approaches used in the project differed from those he has employed previously.

Implications for Prevention/Translation into Practice

There are several implications or prevention programmes stemming from this project, as well as opportunities to translate the research into practice. First, this project has shown that clean athletes (i.e., those who have not doped) view nutritional supplements and OTC medications as potential gateways to doping, extending past research that has established this link with athletes who admit to having doped. Also, we established the first statistical evidence for a causal link between nutritional supplement/medication use and more favourable attitudes towards doping. Thus, our findings highlight the importance of addressing this issue within ADO's education programmes, extending the current focus on nutritional supplements as a risk factor for inadvertent doping to a potential risk factor for intentional doping too. Next, our qualitative findings identified several recommendations for those developing interventions aimed at presenting non-prohibited means of performance enhancement as alternatives to doping rather than prerequisites for it. More specifically, participants suggested interventions should include education on how athletes can support training and performance through nutrition, including coverage of functional foods and how to use a "food first" approach with supplements only being used where there is an identified need. Further, nutrition-focused education should be delivered by nutritionists or peer educators trained by nutritionists, and should be delivered early in

athletes' development, so they become educated before they are exposed to unreliable sources of information. Finally, our findings support the need to address functional and moral attitudes separately within education, seeking to build moral attitudes against doping from an early age and mitigating the development of functional beliefs about the effectiveness of doping. Aligned with this, educators should be made aware that low moral attitudes against doping and high functional attitudes towards it should be considered a high-risk profile given its temporal links with elevated levels of doping moral disengagement. In sum, this project has successfully generated several areas of new knowledge that can feed valuable information into the development of strategies aimed at preventing doping that will help those who develop anti-doping and clean sport education programmes to tailor them specifically towards athletes' preferences and to target identified risk factors.

Partnerships

The project involved collaboration between colleagues from The University of Birmingham, Kingston University, Manchester Metropolitan University, The University of Derby, Liverpool John Moores University, and The University of Essex. The project was also 50% funded by the University of Birmingham.

Publications

The findings from this research will be published in the form of open-access research articles in peer-reviewed journals. We are currently in the process of writing three articles based upon the three empirical studies (i.e., longitudinal, individual interviews, focus group interviews). Our plan is to also write a separate policy-focused paper that brings together the three studies, to identify relevant implications for policy stemming from the research. Collectively the articles will be aimed at researchers as well as those involved in applied work (e.g., sport psychologists, coaches, and policy makers) in the fields of anti-doping, clean sport, sport psychology, and sport policy. The target journal for the empirical articles will be the Journal of Sport & Exercise Psychology, Psychology of Sport and Exercise, and Qualitative Research in Sport, Exercise, and Health. For policy, the International Journal of Sport Policy and Politics will be targeted.

Seminars

The findings will be further disseminated within the academic community through oral presentations at the ECSS Congress in Seville, Spain in August/September 2022. Abstracts have been submitted for the PhD student Martin Chandler to present the findings from the two qualitative studies, and for the PI Ian Boardley to present the findings from the quantitative longitudinal study.

Further Dissemination

The findings and their implications for those who can have a more direct effect on doping (i.e., athletes and coaches) and doping policy (i.e., professionals working in the field of doping) will be disseminated through a research summary report that will be made available as a download on the website of the PI's research portal and through press releases from the media office at the University of Birmingham. Further, copies of all outputs (i.e., journal articles, conference presentations, summary report) will be sent directly to the education team at United Kingdom Anti-Doping (UKAD). We will also make these available to WADA in case they want to add these to the project location in the Social Science Research section of the WADA website. Finally, we would happily design an infographic with WADA summarising the findings from the project if this was of interest, too.

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Appendix A

1:1 Interview Guide

1. Introductory comments and instructions

Terminology:
'Illicit performance enhancers' = Substances or methods prohibited by WADA that are used in order to facilitate enhanced performance, training effect or recovery.

'Licit sports supplements' = Sports supplements, substances, medicines and technologies used for the purpose of enhancing performance or recovery, that are not explicitly banned by WADA.

- Explain the conditions of the study:
    - All information provided will only be used for research purposes
    - All data will be anonymised before inclusion in project outputs (papers/conferences)
    - All participants are free to withdraw at any time and have their data removed (EXCEPT: Focus group participants. They may withdraw but their data cannot be removed because this may affect data from other participants)
    - Please keep all information from other participants confidential
    - Please do not admit to any illegal activity, including supply of banned substances, or identify others who you know have engaged in such activities
    - The term "Banned substances" refers to any substance explicitly banned by WADA

2. Demographics and sport history
    - What subjects are you currently studying at university/college? (ONLY FOR STUDENTS)
    - What year of study are you in?
        - Postgrads-Have you studied anywhere else aside from here?
        - Yes – what subject and for how long?
    - How many sports do you participate in and what is your main sport?
    - How long have you participated in your main sport?
    - What is the highest level you have competed in, in that sport?

3. Nutrition
    - How would you describe your normal diet during the competitive season?
    - Does your normal diet change in the off-season; if so, how?
    - Has lockdown affected your approach to nutrition and if so, how?

4. Knowledge and understanding of licit forms of sports supplement

    - What sports supplements do you know of? (Prompt: Please list)
    - What do you think are the most widely used sports supplements amongst young athletes?
    - How effective do you think sports supplements are?
    - Do you think any sports supplements are necessary to maintain or improve performance? (Prompt: Which ones and why)
    - Do sports supplements form part of your everyday nutrition? (Prompt: If so, please list and why) and has that changed in lockdown?
    - Do you know anyone in your sport that uses sports supplements you don't use and if so – why do you not use them?

5. Knowledge and understanding of illicit forms of performance enhancement

    - What banned substances do you know of? (Prompt: Please list)
    - What do you think are the most widely used banned substances amongst young athletes?
    - How effective do you think banned substances are?
    - Do you think any of the banned substances may be necessary to maintain or improve performance? (Prompt: Which ones, why, and does this differ by sport?)

- Do you know anyone in your sport that uses banned substances you don't use and if so, why do you not use them? (PROMPT: Please do not identify the individuals)

6. Links between licit and illicit forms of performance enhancement in sport

- What do you think are the key distinctions (ethical/moral/legal) between permitted and banned forms of performance enhancement in sport?
- Do you see any potential links between using permitted forms of sports supplement and subsequent use of banned substances? (PROMPT: Can use of one influence use of the other?)
- Can non-prohibited forms of performance enhancement be presented as alternatives to illicit performance enhancers?

7. Conclusion

- The focus group is now complete. I would like to take this opportunity to thank you for your important contribution to this research project. If you have any questions relating to the study, or would like to see copies of the research outputs in the future, you can contact me at: mdc837@student.bham.ac.uk

Appendix B

Focus Group Interview Protocol

1. Introductory comments and instructions

- First, I would like to explain the main purpose of this interview. The aim is to provide information for a research project that is investigating student's thoughts regarding the use of non-prohibited and illicit performance enhancers in sport. The interview will last approximately 40-50 minutes.
- You have several rights as a participant that I would like to make clear. First, all information that you all provide will remain confidential and will only be used for research purposes. All data will be fully anonymised before being presented in research outputs such a conference presentations and journal articles. Second, you are free to withdraw at any point without giving a reason and your treatment will not be affected by this. Finally, the only people who will see the transcript of this interview are my supervisor and me. All participants are kindly asked to keep any information that is disclosed during these interviews as strictly confidential. Also, could I please ask that nobody admit personally to the use/supply/ production/importing of illicit performance enhancers during this interview, or to identify any other individuals who you know to have done so.
- There are a few terms that will be used repeatedly throughout the interview, and it is important that I define these terms for you. The first of these terms is illicit performance-enhancers. For the purposes of this interview when I use this term I am referring to "illicit substances or methods prohibited by the World Anti-Doping Agency that are used in order to facilitate an enhanced training effect or recovery". The second term is non-prohibited performance enhancers. For the purposes of this interview, I am referring to "non-prohibited supplements or substances, medicines and technologies used for the purposes of enhancing performance or aiding in recovery."

2. Demographics and sport history

- What subjects are you currently studying at university?
- What year of study are you in?
  - Postgrads – Have you studied anywhere else aside from here?
  - Yes – what subject and for how long?
- What sports do you participate in?
- How long have you participated in this sport?
- What is the highest level you have competed in this sport?

3. Nutrition and Sport

1. How do you think nutrition affects your performance and do supplements help (if so, how)?
2. Does your team/sport provide any resources around nutrition?
3. How do you approach your own nutrition?
4. Do you discuss nutrition with teammates (and what do those discussions look like)?

4. Supplement Use in Sport

1. If you use supplements; how and why do you choose which ones to use?
2. How important are supplements (and overall nutrition) to your training?
3. What are the key influences on your use of supplements?
4. Would you like to see more training/education around nutrition and supplement use at your competitive level, and if so, what would you like to see?
5. What would be the best way to implement that training and who do you think should deliver it? (i.e., during sports training sessions, as additional training, should it be coach, or external trainer etc)
6. Do you think the key influences on supplement use change as you progress through competitive levels, if so, how?
7. Do you think University athletes differ in their approach to nutrition and supplement use from other athletes of a similar age? If so, why?

5. Knowledge and understanding of non-prohibited forms of performance enhancement.

1. When you think of non-prohibited forms of performance enhancement in sport what are the first things that come to mind?
2. Can you give me any examples of non-prohibited performance enhancing other than supplements (e.g., substances/medicines/technologies)?
3. What are your thoughts on the effectiveness of each of these? For the substances/medicines/technologies you have identified, how effective do you consider them to be in enhancing performance in your sport and others?
4. What non-prohibited forms of performance enhancement do you use to help your performance in your sports?

6. Knowledge and understanding of illicit forms of performance enhancement.

1. When you think of illicit forms of performance enhancement in sport, what are the first things that come to mind?
2. Can you give me any examples of illicit performance enhancers in sport?
3. What are your thoughts on the effectiveness of each of these? For the illicit performance enhancers, you have identified, how effective do you consider them to be in enhancing performance in your sport and others?
4. What could lead you to use prohibited substances for sports performance?

7. Links between non-prohibited and illicit forms of performance enhancement in sport

1. Do you see any potential links between using non-prohibited forms of performance enhancement (i.e., supplements and other forms) and doping in sport?
2. Do you see any ways in which non-prohibited forms of performance enhancement and nutrition can be used to reduce the likelihood of athletes doping?
    a. Can non-prohibited forms of performance enhancement be presented as alternatives to doping?
    b. Could education around nutritional support for training/performance and appropriate/effective use of supplements and other non-prohibited forms of performance enhancement help reduce temptation to dope?
    c. If so, how do you think this information could be presented most effectively to athletes, so they engage with the education and any links with doping are minimised?
3. Do you see any key distinctions (ethical/moral/legal) between non-prohibited and illicit forms of performance enhancement in sport?

8. Conclusion

- The interview is now complete. I would like to take this opportunity to thank you for your important contribution to this research project. Further, I would like to reiterate that the information gained from this interview will only be used for research purposes and transcripts will only be available to my supervisors and me. Finally, you will remain confidential and your data anonymous in any presentation and/or publication that the information you have given is used in.

Appendix C

Questionnaire Pack for Sample 1

WORLD ANTI-DOPING AGENCY
play true

UNIVERSITY OF BIRMINGHAM

School of Sport, Exercise and Rehabilitation Sciences

Dear participant,

Thank you for volunteering to participate in this study. This pack contains a series of questionnaires relating to the use of performance enhancers in sport. We kindly ask that you complete the questions in each questionnaire as honestly as possible.

Prior to starting, please create a participant code below using your mother's maiden name, the first two digits of your date of birth and the final element of your university email address. This code is used to provide an ID code for your data and for no other purpose. _____

What is your age: _____

Gender:
Male ☐ Fema☐ Other (Please specify)_____ Prefer not to say ☐
Year of undergraduate study:
1 ☐
2 ☐
3 ☐
4 ☐
Main BUCS sport played: _____
Number of Years competing in this sport: _____
Highest level of competition in this sport currently:
University level (BUCS)☐
County level☐
National level ☐
Other☐ (Please specify) _____

Anti-Doping Education:

Have you ever completed any anti-doping education?

Yes ☐

No ☐

If **Yes** please specify which course/s and the date/s it/they was completed:

_____

_____

_____

*A number of statements describing **thoughts that athletes might have about doping** are listed below. Please read these statements carefully and indicate your level of agreement with each one by circling the appropriate number. Please respond **honestly.***

*What is your **level** of **agreement** with the following **statements**?*	**Strongly Disagree**	**Disagree**	**Slightly Disagree**	**Neutral**	**Slightly Agree**	**Agree**	**Strongly Agree**
1. It is okay to dope if it helps an athlete to provide for his/her family.	1	2	3	4	5	6	7
2. Saying you "take steroids" feels worse than saying you "use some gear".	1	2	3	4	5	6	7
3. Compared to most lifestyles in the general public, doping isn't that bad.	1	2	3	4	5	6	7
4. Athletes shouldn't be blamed for doping if training partners/teammates pressure them to do it.	1	2	3	4	5	6	7
5. If most athletes in a sport dope, no one athlete should be held responsible for doing it.	1	2	3	4	5	6	7
6. Risks associated with doping are exaggerated.	1	2	3	4	5	6	7
7. Doping is okay if it helps an athlete advise others on how to do it right.	1	2	3	4	5	6	7
8. Using words like "roids", "gear" and "pinning" makes doping feel more acceptable.	1	2	3	4	5	6	7
9. Compared to smoking, doping is pretty safe.	1	2	3	4	5	6	7
10. An athlete shouldn’t be blamed for doping if a member of his/her training group has encouraged it.	1	2	3	4	5	6	7
11. It’s not right to condemn individuals who dope when many in their sport are doing the same.	1	2	3	4	5	6	7
12. Doping doesn’t really harm anyone else.	1	2	3	4	5	6	7
13. It is acceptable to dope if knowledge gained helps an athlete advise others on safe doping.	1	2	3	4	5	6	7
14. Using terms such as "gear" or "juice" makes doping sound less harmful.	1	2	3	4	5	6	7

15. Compared to physical violence, doping isn't that serious.	1	2	3	4	5	6	7
16. An athlete shouldn't be held responsible for doping if his/her coach encouraged him/her to do it.	1	2	3	4	5	6	7
17. If an athlete trains/competes in an environment in which doping is the norm, he/she shouldn't be held accountable for doing it.	1	2	3	4	5	6	7
18. The negative aspects of doping are exaggerated by the media.	1	2	3	4	5	6	7

*Here we would like to get a better **understanding** of **experiences** that can be **difficult** to **manage**. For each of the questions listed below, please **circle the number** that best corresponds to **your level** of **confidence right now**. Please respond **honestly.***

*How **confident** are* you ***right now** in your **ability** to ...*	**No Confidence**		**Moderate Confidence**		**Complete Confidence**
1. …resist doping even if your training group encouraged you to do it?	1	2	3	4	5
2. …resist doping even if you knew you could get away with it?	1	2	3	4	5
3. …ignore the temptation to dope even if you knew it would improve your performance?	1	2	3	4	5
4. …resist peer pressure to dope?	1	2	3	4	5
5. …reject doping even if most of your training partners did it?	1	2	3	4	5
6. …ignore the temptation to dope when feeling down physically?	1	2	3	4	5

*A number of statements describing **thoughts that athletes might have about doping** are listed below. Please read these statements carefully and indicate your level of **agreement** with each one by circling the appropriate number. Please respond **honestly.***

*What is your **level** of **agreement** with the following **statements?***	**Strongly disagree**	**Disagree**	**Slightly Disagree**	**Slightly agree**	**Agree**	**Strongly Agree**
1. Using doping can make my results better.	-3	-2	-1	1	2	3
2. If I use doping, I will remain competitive.	-3	-2	-1	1	2	3
3. If I use doping, I will not know what I am capable of without drugs.	-3	-2	-1	1	2	3
4. Using doping can help to improve my athletic performance.	-3	-2	-1	1	2	3
5. If I don't use doping, I will not benefit from my hard work and training as much as I want to.	-3	-2	-1	1	2	3
6. Using doping will not help me train hard.	-3	-2	-1	1	2	3
7. Using doping after injury will not aid my recovery.	-3	-2	-1	1	2	3
8. If I refrain from using performance enhancing drugs, I can see the results of my natural ability.	-3	-2	-1	1	2	3
9. If I use doping, I will be a more competitive athlete.	-3	-2	-1	1	2	3
10. If I increase my performance with doping, my income will be higher.	-3	-2	-1	1	2	3

*A number of statements describing **thoughts that athletes might have about performance** are listed below. Please read these statements carefully and indicate the degree of **desirability** for each statement for you by circling the appropriate number. Please respond **honestly.***

*Indicate the level of **desirability** to you for each of the following:*	**Extremely Undesirable**	**Undesirable**	**Slightly Undesirable**	**Slightly Desirable**	**Desirable**	**Extremely Desirable**
1. Making my results better is...	1	2	3	4	5	6
2. Remaining competitive for me is…	1	2	3	4	5	6
3. Knowing what I am capable of for me is...	1	2	3	4	5	6
4. Improving my athletic performance is…	1	2	3	4	5	6
5. Getting return on my hard work and training for me is...	1	2	3	4	5	6
6. Training hard for me is...	1	2	3	4	5	6
7. Recovering fully and quickly after injury for me is ...	1	2	3	4	5	6
8. Seeing how far my natural talent can take me is...	1	2	3	4	5	6
9. Being a competitive athlete for me is...	1	2	3	4	5	6
10. Increasing my income for me is....	1	2	3	4	5	6

A number of statements describing **thoughts that athletes might have about doping** are listed below. Please read these statements carefully and indicate your level of agreement with each one by circling the appropriate number. Please respond **honestly.**

What is your level of agreement with the following statements?	Strongly disagree	Disagree	Slightly Disagree	Slightly agree	Agree	Strongly Agree
1. Using doping is morally wrong.	-3	-2	-1	1	2	3
2. Using doping gives unfair advantage.	-3	-2	-1	1	2	3
3. If I use doping, I will feel I cheat.	-3	-2	-1	1	2	3
4. If I use doping, I will not harm others.	-3	-2	-1	1	2	3
5. Using doping is not against the spirit of sport.	-3	-2	-1	1	2	3
6. Using doping is against fair play.	-3	-2	-1	1	2	3
7. If I use doping, I will violate the anti-doping rules.	-3	-2	-1	1	2	3

A number of statements describing thoughts that athletes might have about performance are listed below. Please read these statements carefully and indicate the degree of desirability for each statement for you by circling the appropriate number. Please respond honestly.

Indicate the level of desirability to you for each of the following:	Extremely Undesirable	Undesirable	Slightly Undesirable	Slightly Desirable	Desirable	Extremely Desirable
1. Doing what is morally right for me is…	1	2	3	4	5	6
2. Gaining unfair advantage for me is…	1	2	3	4	5	6
3. Cheating for me is…	1	2	3	4	5	6
4. Harming others for me is…	1	2	3	4	5	6
5. Keeping the sport clean of drugs for me is…	1	2	3	4	5	6
6. Fair play for me is…	1	2	3	4	5	6
7. Adhering to anti-doping rules for me is…	1	2	3	4	5	6

To follow are a series of statements relating to sport supplements. Please read each question carefully and specify your level of agreement (between 'strongly disagree' to 'strongly agree') with the following:

What is your level of agreement with the following statements?	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1. Supplements improve my performance	1	2	3	4	5	6
2. Supplements are necessary for me to be competitive.	1	2	3	4	5	6
3. Supplements improve my confidence	1	2	3	4	5	6
4. My chances of winning improve when I use supplements.	1	2	3	4	5	6
5. Supplements help me realise my potential.	1	2	3	4	5	6
6. Supplements improve the quality of my training.	1	2	3	4	5	6

Below are a number of substances, medications and methods, please record ***all substances, medications and methods you have ever used*** for the purpose of ***performance enhancement*** **or** ***enhanced recovery***.

Muscle Promoters							
Anabolic Steroids	***Please indicate your previous use of this substance***						
	☐ Used in Past 6 Months	☐ Used Prior to Past 6 Months	☐ Never Used				
	If you have used this substance in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week	☐ 3-4 times/week	☐ Weekly	☐ < 1 time/week			
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Branched-Chain Amino Acids (BCAAs)	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months	☐ Used Prior to Past 6 Months	☐ Never Used				
	If you have used this substance in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week	☐ 3-4 times/week	☐ Weekly	☐ < 1 time/week			
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Creatine	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months	☐ Used Prior to Past 6 Months	☐ Never Used				
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week	☐ 3-4 times/week	☐ Weekly	☐ < 1 time/week			
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Growth Hormone	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months	☐ Used Prior to Past 6 Months	☐ Never Used				
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week	☐ 3-4 times/week	☐ Weekly	☐ < 1 time/week			
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Insulin	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months	☐ Used Prior to Past 6 Months	☐ Never Used				
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week	☐ 3-4 times/week	☐ Weekly	☐ < 1 time/week			
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely

Peptide Hormones	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months	☐ Used Prior to Past 6 Months	☐ Never Used				
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week	☐ 3-4 times/week	☐ Weekly	☐ < 1 time/week			
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Protein powder	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months	☐ Used Prior to Past 6 Months	☐ Never Used				
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week	☐ 3-4 times/week	☐ Weekly	☐ < 1 time/week			
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely

Stimulants

Amphetamines	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months	☐ Used Prior to Past 6 Months	☐ Never Used				
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week	☐ 3-4 times/week	☐ Weekly	☐ < 1 time/week			
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Caffeine	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months	☐ Used Prior to Past 6 Months	☐ Never Used				
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week	☐ 3-4 times/week	☐ Weekly	☐ Less than 1/week			
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Cocaine	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months	☐ Used Prior to Past 6 Months	☐ Never Used				
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week	☐ 3-4 times/week	☐ Weekly	☐ < 1 time/week			
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Dimethylamylamine (DMAA)	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months	☐ Used Prior to Past 6 Months	☐ Never Used				
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week	☐ 3-4 times/week	☐ Weekly	☐ Less than 1/week			
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely

Ephedrine	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Modafinil (2-diphenylmethyl sulfinyl acetamide)	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Adderall (amphetamine salts)	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ Less than 1/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Ritalin (methylphenidate)	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ Less than 1/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Taurine	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ Less than 1/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Viagra (PDE5 inhibitors)	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ Less than 1/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely

Cialis (tadalafil)	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ Less than 1/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely

Weight Loss Aids

Clenbuterol	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ Less than 1/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
DNP-2,4-Dinitrophenol	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ Less than 1/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Other Fat Burners	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ Less than 1/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Laxatives	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ Less than 1/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Meal replacements (shakes/teas/tablets)	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ Less than 1/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely

Sibutramine	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ Less than 1/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
T3 (Liothyronine)	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ Less than 1/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Pain Management							
Aspirin	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Canabinoids	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Glucocorticosteroids	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Narcotic Analgesics (e.g. Codeine)	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely

NSAIDs (e.g., Ibuprofen, Diclofenac)	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Paracetamol	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Tramadol	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Vitamins and Minerals							
Beta-Carotene	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Calcium	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Iron	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Magnesium	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely

Potassium	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Selenium	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Sodium	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Vitamins A,B,C,D &/or E	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Zinc	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely

Other Hormones/Modulators

Beta Alanine	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ Less than 1/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Erythropoietin (EPO)	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ Less than 1/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Insulin	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ Less than 1/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Selective Androgen Receptor Modulators (SARMs)	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ Less than 1/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Thyroid Hormone (e.g., L-thyroxine)	***Please indicate your overall use of this substance/method***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ Less than 1/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely

Methods and Technologies

Altitude Tents	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely

Altitude Masks	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Blood Doping	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Compression Garments	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Gene Doping	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	☐		☐		☐		☐
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Environmental Chambers	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely

Other Substances and Methods

Anticholinergics	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely

Antihistamines	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Benilyn Cough Syrup (dextromethorphan)	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Beta-2 Agonists	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Beta Blockers	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Kratom	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely
Meldonium	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely

Robitussin (dextromethorphan and guaifenesin)	***Please indicate your overall use of this substance***						
	☐ Used in Past 6 Months		☐ Used Prior to Past 6 Months		☐ Never Used		
	If you have used this substance/method in the past 6 months, please indicate your average frequency of use						
	☐ 5 or more times/week		☐ 3-4 times/week		☐ Weekly		☐ < 1 time/week
	If you have used this substance/method in the past 6 months, how important is it for your training?						
	☐ 1 Not at all	☐ 2	☐ 3	☐ 4 Moderately	☐ 5	☐ 6	☐ 7 Extremely

Please list any other substances that you feel were not represented in the above categories:

_____

_____

You have now completed the questionnaire pack please see the researcher for further instruction. Thank you very much for participating

Appendix D

Questionnaire Pack for Sample 2

QUESTIONNAIRE PACK

School of Sport, Exercise and Rehabilitation Sciences

Participant Code _____

Thank you for choosing to participate in this study, your responses will help us understand factors that influence supplement use and doping in sport. Please answer every question honestly and remember your responses are completely anonymous.

Age:

- ☐ 18-20
- ☐ 21-23
- ☐ 24-26
- ☐ 27-29
- ☐ 30-32
- ☐ 32+

Gender:

- ☐ Male
- ☐ Female
- ☐ Other (Please specify) _____
- ☐ Prefer not to say

Level of study:

- ☐ Undergraduate
- ☐ Postgraduate

Year of study: _____

Main sport played: _____

Number of years playing main sport:

- ☐ >1 yr
- ☐ 1-3 yrs
- ☐ 4-7 yrs
- ☐ 7+ yrs

Highest level of current competition:

- ☐ University level (BUCS)
- ☐ County level
- ☐ Regional level
- ☐ National level
- ☐ International level

Have you ever completed any anti-doping education?

- ☐ Yes
- ☐ No

If **Yes** please specify which course and the last date it was completed:

_____

_____

_____

*A number of statements describing **thoughts that athletes might have about doping** are listed below. Please read these statements carefully and indicate your level of agreement with each one by circling the appropriate number. Please respond **honestly.***

*What is your **level** of **agreement** with the following **statements**?*	**Strongly Disagree**	**Disagree**	**Slightly Disagree**	**Neutral**	**Slightly Agree**	**Agree**	**Strongly Agree**
1. It is okay to dope if it helps an athlete to provide for his/her family.	1	2	3	4	5	6	7
2. Saying you "take steroids" feels worse than saying you "use some gear".	1	2	3	4	5	6	7
3. Compared to most lifestyles in the general public, doping isn't that bad.	1	2	3	4	5	6	7
4. Athletes shouldn't be blamed for doping if training partners/teammates pressure them to do it.	1	2	3	4	5	6	7
5. If most athletes in a sport dope, no one athlete should be held responsible for doing it.	1	2	3	4	5	6	7
6. Risks associated with doping are exaggerated.	1	2	3	4	5	6	7
7. Doping is okay if it helps an athlete advise others on how to do it right.	1	2	3	4	5	6	7
8. Using words like "roids", "gear" and "pinning" makes doping feel more acceptable.	1	2	3	4	5	6	7
9. Compared to smoking, doping is pretty safe.	1	2	3	4	5	6	7
10. An athlete shouldn’t be blamed for doping if a member of his/her training group has encouraged it.	1	2	3	4	5	6	7
11. It’s not right to condemn individuals who dope when many in their sport are doing the same.	1	2	3	4	5	6	7
12. Doping doesn’t really harm anyone else.	1	2	3	4	5	6	7
13. It is acceptable to dope if knowledge gained helps an athlete advise others on safe doping.	1	2	3	4	5	6	7
14. Using terms such as "gear" or "juice" makes doping sound less harmful.	1	2	3	4	5	6	7

15. Compared to physical violence, doping isn't that serious.	1	2	3	4	5	6	7
16. An athlete shouldn't be held responsible for doping if his/her coach encouraged him/her to do it.	1	2	3	4	5	6	7
17. If an athlete trains/competes in an environment in which doping is the norm, he/she shouldn't be held accountable for doing it.	1	2	3	4	5	6	7
18. The negative aspects of doping are exaggerated by the media.	1	2	3	4	5	6	7

*Here we would like to get a better **understanding** of **experiences** that can be **difficult** to **manage**. For each of the questions listed below, please **circle the number** that best corresponds to **your level** of **confidence right now**. Please respond **honestly.***

*How **confident** are* you ***right now** in your **ability** to ...*	**No Confidence**		**Moderate Confidence**		**Complete Confidence**
1. …resist doping even if your training group encouraged you to do it?	1	2	3	4	5
2. …resist doping even if you knew you could get away with it?	1	2	3	4	5
3. …ignore the temptation to dope even if you knew it would improve your performance?	1	2	3	4	5
4. …resist peer pressure to dope?	1	2	3	4	5
5. …reject doping even if most of your training partners did it?	1	2	3	4	5
6. …ignore the temptation to dope when feeling down physically?	1	2	3	4	5

*A number of statements describing **thoughts that athletes might have about doping** are listed below. Please read these statements carefully and indicate your level of **agreement** with each one by circling the appropriate number. Please respond **honestly.***

*What is your **level** of **agreement** with the following **statements?***	**Strongly disagree**	**Disagree**	**Slightly Disagree**	**Slightly agree**	**Agree**	**Strongly Agree**
1. Using doping can make my results better.	-3	-2	-1	1	2	3
2. If I use doping, I will remain competitive.	-3	-2	-1	1	2	3
3. If I use doping, I will not know what I am capable of without drugs.	-3	-2	-1	1	2	3
4. Using doping can help to improve my athletic performance.	-3	-2	-1	1	2	3
5. If I don't use doping, I will not benefit from my hard work and training as much as I want to.	-3	-2	-1	1	2	3
6. Using doping will not help me train hard.	-3	-2	-1	1	2	3
7. Using doping after injury will not aid my recovery.	-3	-2	-1	1	2	3
8. If I refrain from using performance enhancing drugs, I can see the results of my natural ability.	-3	-2	-1	1	2	3
9. If I use doping, I will be a more competitive athlete.	-3	-2	-1	1	2	3
10. If I increase my performance with doping, my income will be higher.	-3	-2	-1	1	2	3

*A number of statements describing **thoughts that athletes might have about performance** are listed below. Please read these statements carefully and indicate the degree of **desirability** for each statement for you by circling the appropriate number. Please respond **honestly.***

*Indicate the level of **desirability** to you for each of the following:*	**Extremely Undesirable**	**Undesirable**	**Slightly Undesirable**	**Slightly Desirable**	**Desirable**	**Extremely Desirable**
1. Making my results better is...	1	2	3	4	5	6
2. Remaining competitive for me is…	1	2	3	4	5	6
3. Knowing what I am capable of for me is...	1	2	3	4	5	6
4. Improving my athletic performance is…	1	2	3	4	5	6
5. Getting return on my hard work and training for me is...	1	2	3	4	5	6
6. Training hard for me is...	1	2	3	4	5	6
7. Recovering fully and quickly after injury for me is ...	1	2	3	4	5	6
8. Seeing how far my natural talent can take me is...	1	2	3	4	5	6
9. Being a competitive athlete for me is...	1	2	3	4	5	6
10. Increasing my income for me is....	1	2	3	4	5	6

*A number of statements describing **thoughts that athletes might have about doping** are listed below. Please read these statements carefully and indicate your level of agreement with each one by circling the appropriate number. Please respond **honestly.***

What is your level of agreement with the following statements?	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1. Using doping is morally wrong.	-3	-2	-1	1	2	3
2. Using doping gives unfair advantage.	-3	-2	-1	1	2	3
3. If I use doping, I will feel I cheat.	-3	-2	-1	1	2	3
4. If I use doping, I will not harm others.	-3	-2	-1	1	2	3
5. Using doping is not against the spirit of sport.	-3	-2	-1	1	2	3
6. Using doping is against fair play.	-3	-2	-1	1	2	3
7. If I use doping, I will violate the anti-doping rules.	-3	-2	-1	1	2	3

*A number of statements describing **thoughts that athletes might have about performance** are listed below. Please read these statements carefully and indicate the degree of **desirability** for each statement for you by circling the appropriate number. Please respond **honestly.***

Indicate the level of desirability to you for each of the following:	Extremely Undesirable	Undesirable	Slightly Undesirable	Slightly Desirable	Desirable	Extremely Desirable
1. Doing what is morally right for me is…	1	2	3	4	5	6
2. Gaining unfair advantage for me is…	1	2	3	4	5	6
3. Cheating for me is…	1	2	3	4	5	6
4. Harming others for me is…	1	2	3	4	5	6
5. Keeping the sport clean of drugs for me is…	1	2	3	4	5	6
6. Fair play for me is…	1	2	3	4	5	6
7. Adhering to anti-doping rules for me is…	1	2	3	4	5	6

To follow are a series of statements relating to sport supplements. *Please read each question carefully and specify your level of agreement (between 'strongly disagree' to 'strongly agree') with the following:*

*What is your **level** of **agreement** with the following **statements?***	**Strongly Disagree**	**Disagree**	**Slightly Disagree**	**Slightly Agree**	**Agree**	**Strongly Agree**
1. Supplements improve my performance	1	2	3	4	5	6
2. Supplements are necessary for me to be competitive.	1	2	3	4	5	6
3. Supplements improve my confidence	1	2	3	4	5	6
4. My chances of winning improve when I use supplements.	1	2	3	4	5	6
5. Supplements help me realise my potential.	1	2	3	4	5	6
6. Supplements improve the quality of my training.	1	2	3	4	5	6

Performance Enhancing Supplements, Substances & Methods

In this section, we ask about supplements, substances & methods FOR PERFORMANCE ENHANCEMENT ONLY.

For instance; if you used aspirin for a headache, that does NOT count, but if you used it to help you train or compete, it DOES count. Only tell us if you used a supplement/substance to help you to train/compete, recover from an injury or perform better.

Supplement/Substance/Method	Have you used this in the past month?	If used in the past month, how often have you used it?
Anabolic steroids	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
BCAA (Branch Chain Amino Acids)	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Creatine	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Human Growth Hormone	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Insulin	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Testosterone Boosters	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Whey (or other) Protein Powder	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Amphetamines (Not recreationally)	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Caffeine Tablets (for sport purposes)	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Cocaine (Not recreationally)	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Modafinil (for sport purposes)	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Adderall (for sport purposes)	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week

Supplement/Substance/Method	Have you used this in the past month?	If used in the past month, how often have you used it?
Taurine (for sport purposes)	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Pre-Workout Drinks	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Clenbuterol	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Fat Burners	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Laxatives	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Weight Loss Meal Replacement	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Thyroid Drugs (T3/T4)	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Aspirin	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
CBD Oil	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Codeine/Tramadol	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Ibuprofen/Diclofenac	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Paracetamol	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Multi-Vitamins/Minerals	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Magnesium	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
ZMA	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week

Supplement/Substance/Method	Have you used this in the past month?	If used in the past month, how often have you used it?
Vitamin C	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Vitamin D	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Vitamin E	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Selenium	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Iron	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Beta Blockers	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
SARMs	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Altitude Mask	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week
Compression Clothing	☐ Yes ☐ No	☐ Less than once per week ☐ Weekly ☐ 3 or more times per week

Final Question

How important is the use of the supplements used to your training? (Please circle an answer from 1 - 7)

1 (Not at all)

2

3

4 (Moderately)

5

6

7 (Extremely)

The questionnaire pack is now complete, please hand it back to the researcher.

Many thanks for participating in our study.