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Article

Exploring Knowledge, Attitudes and Abuse Concerning Doping in Sport among Syrian Pharmacy Students

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Abstract: This study aimed to assess pharmacy students' knowledge about doping substances used in sport, explore their attitudes toward doping and investigate their misuse of doping drugs. A questionnaire was developed and employed to collect data from bachelor of pharmacy (BPharm) students at the International University for Science and Technology (IUST). Two-hundred and eighty students participated in this self-administrated, paper-based survey. Around 90% of the students did not appear to know that narcotics, β-blockers and diuretics were used in sport as doping agents. Additionally, proportions between 60% and 80% considered vitamins, energy drinks and amino acids as substances that possess performance-enhancing effects. The main reason for doping, based on students' response, was to improve muscular body appearance. The vast majority of students agreed that pharmacists should play a major role in promoting awareness about risks of doping. While students showed negative attitudes toward doping, approximately 15% of them, primarily males, had already tried a doping drug or might do so in the future. More than 60% of the students believed that sports-mates and friends are the most influential in encouraging them to take a doping agent. The study highlights the need to provide pharmacy students with advanced theoretical background and practical training concerning doping. This can be achieved by adopting simple, but essential, changes to the current curricula.

Keywords: doping; performance-enhancing substances; drug abuse; pharmacy students

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1. Introduction

The use of performance-enhancing methods in sport was reported as early as more than two thousand years ago during the ancient Olympic Games held in 668 BC; a special diet of dried figs was taken by Charmis, the Spartan winner of the stade race [1]. However, the emergence of doping as a modern issue first came to prominence in the 1960s when amphetamines were widely used among professional European cyclists and blamed for causing the tragic death of the English cyclist Tom Simpson, during the 1967 Tour de France [1].

The sport industry has witnessed a drastic booming in the last few decades progressing from an amateur era into highly competitive professional business that attracts billions of dollars in investment [2]. The desire to achieve superiority, glory and even wealth seems to be a driving force for athletes to try legal and illegal performance-enhancing substances and/or methods [3]. Most dangerously, doping is no longer restricted to elite athletes. Numerous studies have reported the use of doping agents among young sportspeople in schools, non-competing amateurs and gymnasium clients; for many of whom body appearance, and not in necessary competing in games, is a priority [4–10]. Estimates reveal that between 1–3 million Americans [11] and 50,000–100,000 Swedish [12], equate to approximately 1% of the population of both countries, have misused anabolic steroids. Likewise, it was found that up to 5% of US high-school students had used growth hormone as an anabolic aid [13]. Furthermore, in 2001 it was estimated that 2.8 million US recreational athletes had tried ephedrine as a stimulating agent [14].

In 1999, the International Olympic Commission (IOC) issued the Olympic Movement Anti-Doping Code in which doping was defined as "the use of an expedient (substance or method) which is potentially harmful to athletes' health and/or capable of enhancing their performance, or the presence in the athlete's body of a prohibited substance or evidence of the use thereof or evidence of the use of a prohibited method." A list of prohibited substances and methods of doping that are banned by the IOC is issued and annually updated by the World Anti-Doping Agency (WADA) [15]. Beside well-known illicit performance-enhancing substances, such as anabolic steroids, growth hormone and stimulants, the list contains less popular doping agents, e.g., narcotics, diuretics and β-blockers. While narcotics can reduce the sensation of pain associated with fatigue and serious injuries, diuretics are employed to decrease an athlete's weight and prevent detection of banned agents by depleting their concentration in urine as a result of increased urination [16]. β-blockers, however, are beneficial in particular sports that require mental concentration such as archery and shooting [15]. Food supplements and products that have not yet been proved to neither enhance sport performance nor be harmful, e.g., amino acids (AAs), vitamins and energy drinks, are not included in the WADA list. Although AAs are the structural units that make up proteins, the major constituents of muscles, there is no evidence that these supplements have performance-enhancing effects in sport [17]. This also applies to vitamins which are only needed in limited amounts. Energy drinks that contain stimulant substances such as caffeine, taurine and ginseng may provide a little, insignificant boost in performance for a very short time [18]. However, it is important to point out that large quantities of the legal substances mentioned above can carry major health risks, such as dehydration and heart and kidney problems [17,18].

The aims of prohibiting doping in sport are not just to prevent athletes from gaining unfair competitive advantage, preserve the honesty of sport and fair-play's principle and set a good example for many young people who regard sporting heroes as role models to be emulated, but also to protect

athletes' health against potential hazards of doping [19]. Many illicit performance-enhancing substances, such as anabolic-adrenergic hormones and stimulants, are notorious for causing life-threatening health problems including cardiac events [20,21]. Furthermore, several death incidents have been linked to misuse of doping agents [1,22–24].

Several reports [25–29] have suggested a variety of roles for pharmacists to assist in doping control. Pharmacists who are drug experts can be a good resource of information to the general public and athletes on doping substances and associated hazards. Thus, they can help spreading anti-doping awareness. Additionally, pharmacists can provide counseling to athletes to prevent them from accidentally taking medical substances that are banned in particular sports. Furthermore, the emerging field of "sports pharmacy" has highlighted new duties for pharmacists in sports medicine and doping control [28,29]. Sport pharmacists are responsible for dispensing, advising, prescribing and monitoring sport medications and supplements whether they are intended for therapeutic or performance enhancement reasons. Pharmacists' anti-doping roles and responsibilities can be of particular interest in countries where doping control experts and sports medicine specialists are not commonly found, such as in developing countries. However, the major concern remains whether pharmacy programs provide adequate education and training that allow graduates to take over these roles. A French survey [25] concluded that pharmacists did not have the general knowledge and skills necessary to engage effectively in doping prevention. Similarly, a study in Slovenia found that 35% of the responding pharmacists had poor knowledge about doping in sports [26]. A more recent study [27], published whilst the current work was in the writing up stage, revealed that pharmacy students in Japan did not have opportunities to learn about doping and supplement intake and that the basic knowledge they had might cause confusion. Most interestingly, pharmacy students are at an age group to which significant proportions of doping abusers belong [4–10], hence, some of them might have a personal experience with doping abuse. Therefore, beside good knowledge about doping it is equally important for pharmacy students, who are the future pharmacists, to develop proper attitudes that allow them to participate efficiently in the fight against doping when they become qualified pharmacists. Thus, our aims were to assess Syrian pharmacy students' knowledge about doping substances used in sport, explore their attitudes toward doping and its control and investigate their misuse of doping drugs.

2. Methods

This cross-sectional study was carried out on a group of students enrolled in the College of Pharmacy at International University for Science and Technology (IUST) during the 2011–2012 academic year. The school of pharmacy at IUST is a relatively new private school which was founded in 2005. It offers a credit-based system leading to a Bachelor Degree in Pharmacy (BPharm). In 2011, approximately 1,000 students were enrolled in the pharmacy program. The study was approved by the Scientific Affairs Council of IUST.

2.1. Questionnaire Development

In order to perform the study, a questionnaire was designed and employed. To develop the questionnaire 10 randomly selected individuals from the expected study population were invited for voluntary participation in the questionnaire development. A draft of the questionnaire was constructed

taking into account these individuals' comments and responses to issues related to doping agents, their uses and consumption and doping control. For evaluation and clarity purposes, another group of 20 randomly selected pharmacy students was requested to complete the questionnaire and to comment on any item they did not understand or found confusing/ambiguous. Suggestions from this group were used to improve the questionnaire.

2.2. Instruments

The questionnaire consisted of five parts (Appendix I). Items in the first part of the questionnaire gathered personal information on gender, age and year of study. The second part collected data on students' knowledge of the concept of doping. This part comprised a list of nine substances known to be used by athletes and students were asked whether they agree, disagree or not sure if each one of these substances has a doping or performance-enhancing effect. In the third part, items were designed as statements to investigate students' views on reasons for using doping agents. In the fourth part, the items were formulated to probe students' attitudes toward consumption of doping agents. The final (fifth) part was dedicated to explore the use of performance-enhancing drugs among students and the role that awareness can play in preventing doping abuse. In the third, fourth and fifth parts, a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5) was utilized to evaluate students' responses to items in these parts.

2.3. Data Collection

Data were collected during the second semester in the 2011–2012 academic year. The questionnaires were distributed to students in laboratory sessions and retrieved immediately after completion. A quota sampling strategy was used to obtain similar proportions of females and males and of students from different study years. Completion time was estimated at approximately 10 minutes. Participants were made aware of the purpose of the study, that their participation was entirely voluntary and that all data gathered were fully anonymous and to be handled with confidentiality. Questionnaires were distributed to 350 pharmacy students. Two-hundred eighty students completed the questionnaire, with a response rate of 80%. Among these individuals, males and females were almost equal (134 males (47.9%)). The participants from each study year ranged between 37–70 students: 70 (25.0%) first year, 37 (13.2) second year, 44 (15.7%) third year, 61 (21.8%) fourth year and 68 (24.3%) fifth year. The mean age was 21.3 ± 2.1, the minimum age 17 and the maximum age 30.

2.4. Statistical Analysis

The Chi-square test was employed to assess the association between independent (gender and study year) and dependent (responses) variables. The Mann-Whitney U and Kruskal Wallis tests were used to compare the difference in mean values (ordinal data) in two (gender comparisons) or more (study year comparisons) independent samples, respectively. The level of statistical significance for all tests was set at a p value < 0.05.

3. Results

Students' responses concerning their understanding of doping are displayed in Table 1. More than two thirds of the students reported that anabolic and growth hormones were used to enhance athletes' performance. Additionally, slightly more than 50% agreed that stimulants have doping/performance-enhancing effects. However, approximately 90% of the students did not appear to know that narcotics, β-blockers and diuretics were used in sport as doping agents. Whereas, remarkable proportions between nearly 60% and 80% considered vitamins, energy drinks and amino acids (AAs) as substances that possess performance-enhancing effects.

Table1. Students' response concerning potential doping/performance-enhancing effects of several substances used by athletes.

Substance	Doping/performance-enhancing effects		
	Agree, # (%)	Disagree, # (%)	Not sure, # (%)
Amino acids (AAs)	218 (77.9)	23 (8.2)	39 (13.9)
Anabolic (masculine) steroids	208 (74.3)	30 (10.7)	42 (15)
Diuretics	30 (10.7)	186 (66.4)	64 (22.9)
Energy drinks	162 (57.9)	60 (21.4)	58 (20.7)
Growth hormone	192 (68.6)	34 (12.1)	54 (19.3)
Narcotics	34 (12.1)	226 (80.7)	20 (7.1)
Stimulants (such as amphetamine)	152 (54.3)	50 (17.9)	78 (27.9)
Vitamins	231 (82.5)	11 (3.9)	38 (13.6)
β-blockers	39 (13.9)	144 (51.4)	97 (34.6)

By comparing responses from study year groups, a significant difference was found only in answers concerning anabolic steroids ($p = 0.002$), with greater proportions of students at advanced years giving correct answers. No statistical difference was found between males and females.

From mean values of students' responses concerning reasons for doping abuse (Table 2) it can be stated that the most important reason is "to change body shape and build muscle mass" with approximately 80% of the students agreed on this. In addition, students affirmed, but to a less extent, that doping agents may also be used to "enhance performance at local and international sport competitions" or as "an easy and quick approach to achieve desired physical capabilities." To "merely imitate the others" appeared to be the reason least favored by students. Significantly higher mean values were observed at higher study years when comparing responses to items concerning reasons for doping abuse including to change body shape ($p = 0.003$), to enhance sport performance ($p = 0.038$) and to pick the easy option ($p = 0.034$). No statistical differences were observed between males and females.

Table 2. Students' response concerning reasons suggested for doping abuse.

Reason	Strongly disagree, # (%)	Disagree, # (%)	Neutral, # (%)	Agree, # (%)	Strongly agree, # (%)	Mean (SD)
To change body shape and build muscle mass	13 (4.6)	17 (6.1)	32 (11.4)	101 (36.1)	117 (41.8)	4.04 (1.093)
To enhance performance at local and international sport competitions	14 (5)	18 (6.4)	60 (21.4)	132 (47.1)	55 (19.6)	3.71 (1.018)
An easy and quick approach to achieve desired physical capabilities	21 (7.5)	48 (17.1)	63 (22.5)	100 (35.7)	47 (16.8)	3.37 (1.171)
To merely imitate the others	41 (14.6)	67 (23.9)	76 (27.1)	63 (22.5)	32 (11.4)	2.92 (1.230)

Students' attitudes toward the use of doping agents are displayed in Table 3. Almost half of the students either strongly disagreed or disagreed that "taking a doping drug is an ethical deed." A similar proportion of the participants did not appear to show respect to individuals who take doping agents. Interestingly, while approximately three quarters of the students were conscious about the harmful effects of doping agents on abusers' health, more than one third either strongly agreed or agreed that occasional intake of a doping drug is not harmful. Statistical analysis showed no differences in terms of gender and study year.

Table 3. Students' response to statements concerning consumption of doping agents.

Reason	Strongly disagree, # (%)	Disagree, # (%)	Neutral, # (%)	Agree, # (%)	Strongly agree, # (%)	Mean (SD)
Taking a doping agent is an ethical deed	68 (24.3)	75 (26.8)	86 (30.7)	43 (15.4)	7 (2.5)	2.45 (1.094)
I respect individuals who take doping agents	55 (19.6)	86 (30.7)	101 (36.1)	31 (11.1)	6 (2.1)	2.45 (0.998)
Taking a doping agent can harm user's health	5 (1.8)	19 (6.8)	54 (19.3)	100 (35.7)	101 (36.1)	3.98 (0.996)
Taking a doping agent for only a short period is not harmful	31 (11.1)	71 (25.4)	77 (27.5)	81 (28.9)	19 (6.8)	2.95 (1.124)

Table 4 demonstrates students' response to statements concerning their anti-doping behavior and the role of awareness in doping control. Most of the students reported they would advise individuals not to take doping substances. Furthermore, the vast majority of students agreed that proper awareness about potential adverse effects of doping substances can help minimizing their abuse. They also agreed that pharmacists should play a major role in promoting doping awareness. No statistical differences were measured when gender and study year groups were compared.

When students were asked if they had ever taken a prohibited performance-enhancing drug, only 13 (4.6%) admitted they had done so; including 12 males and only one female ($p < 0.001$). Furthermore, 10% of the students confessed that they might consider taking a doping drug sometime in the future.

Significantly more males (19) than females (4) expressed their potential interest in trying such a substance ($p = 0.001$). No statistical difference was found among study year groups.

Students were also asked about the most influential person or factor that would encourage them to take a performance-enhancing drug and in response 34.9% stated a sports-mate, 28% a friend, 21.5 a coach, 12.5% media and only 3.9% chose "else." Statistical tests showed no differences between males and females and among study year groups.

Table 4. Participants' anti-doping behaviors and their attitudes toward doping awareness.

Statement	Strongly disagree, # (%)	Disagree, # (%)	Neutra, # (%)	Agree, # (%)	Strongly agree, # (%)	Mean (SD)
I advise individuals not to take doping substances	15 (5.4)	26 (9.3)	47 (16.8)	107 (38.4)	84 (30.1)	3.78 (1.133)
Proper awareness concerning adverse effects of doping substances can help minimizing their abuse	2 (0.7)	11 (3.9)	43 (15.4)	141 (50.4)	82 (29.4)	4.04 (0.819)
Pharmacists should help promoting awareness about adverse effects of doping substances	4 (1.4)	9 (3.2)	26 (9.3)	90 (32.3)	150 (53.4)	4.34 (0.882)

4. Discussion

A major objective of the current study is to shed light on some aspects of a potential role that pharmacists can play in doping control. Considering this, it is crucially essential for pharmacists to have an adequate knowledge about medicines used in sport and positive attitudes toward doping and its prevention, which can to a great extant be acquired and developed at college.

A list of various substances used by athletes was selected with the aim to assess students' knowledge of the doping concept. Thus, beside well-known performance-enhancing substances, *i.e.* anabolic steroids, growth hormone and stimulants, we incorporated less popular banned doping agents including diuretics, narcotics and β-blockers. Furthermore, a number of non-prohibited substances and food supplements, *i.e.* amino acids (AAs), vitamins as well as energy drinks were also included in this list. Students did not appear to have a comprehensive and clear understanding of doping. While a large number of students knew that anabolic steroids, growth hormone and stimulants were doping substances most of them failed to identify the less popular agents, *i.e.* diuretics, narcotics and β-blockers. On the other hand, non-doping substances, *i.e.* AAs, vitamins and energy drinks, were considered doping agents by a large proportion of the respondents. Furthermore, there was no evidence that students develop a better knowledge about doping agents as they progress in their course of study.

Throughout the course of a pharmacy program, students may learn about many doping agents and their biological effects in several curricular courses, such as pharmacology, toxicology, biochemistry and medicinal chemistry. However, in these courses doping substances are usually studied according to their respective therapeutic or chemical groups and not in one chapter/module under the title "doping." Thus, although students may have some knowledge about general therapeutic uses and adverse effects of the listed substances they did not seem to know much about the potential abuse of some of these substances in sports.

In a similar study conducted in Japan [27], the majority of responding pharmacy students claimed to know what doping was in detail. However, this finding is questionable as remarkable proportions of

the participants did not appear to know that some OTC drugs might contain doping agents and that supplements were originally foods [27].

The majority of students believed that doping agents were used to change body shape and build a muscle mass. This may indicate that users of performance-enhancing substances for bodybuilding purposes exceed those who use them in competitive sports. Most bodybuilders do not participate in sport contests and may, therefore, have no concerns about doping control tests. As a consequence, abusers of this group may consider taking unsafe agents, thus exposing their health to serious hazards. This finding also stresses the fact that doping abuse is not anymore limited to competing athletes. Similarly, other studies demonstrated that main reasons for the intake of doping drugs were to improve muscular body appearance and secondarily to enhance performance in sports [4,6,10].

The negative attitude of students toward use of doping agents may be attributed to their perception concerning the hazardous health effects of doping, beside the illegal and unmerited advantages that doping offer to athletes in competitions. Likewise, it was revealed that 90% of Japanese pharmacy students had negative images regarding doping violation [27]. Even so, a relatively considerable proportion of the students (approximately 15%) either had tried an illegal performance-enhancing drug in the past or might do so in the future. However, the proportion of actual users (4.6%) is in line with percentages suggested for youth users which are between 0.6%–5% [8]. This finding might be correlated to the significant proportion of the students (35.7%) who believe that occasional use of doping agents is not harmful and those (17.9%) who think that taking a doping drug is an ethical deed. An athlete may find it ethically justified to take a doping agent if, for example, he/she thinks it is for the good of his/her team, country, *etc.* Therefore, ethical obligations may contribute to doping use, especially with the absence of an effective system for doping detection and control. Interestingly, a UK study indicated that about 7% of participating young athletes were willing to use a prohibited substance if it would be completely undetectable and not having serious health consequences [3].Most of the students who confessed they had tried a prohibited performance-enhancing drug (12 out of 13) or might consider taking one in the future (19 out 23) were males. This is in agreement with previous studies which all have demonstrated that doping is higher among males [4,6–10,14]. There may be two main reasons for this. First, a muscular body appearance appears to a large extent a character that is preferred by males [6]. Second, men seem far more interested in sports in comparison with women [30]. Therefore, if a doping substance is to be taken for bodybuilding purposes or performance-enhancement in sport competitions more male abusers, compared to females, are likely to be encountered. Apart from the number of abusers, males and females showed similar knowledge and attitudes with regard to doping. Furthermore, there was no evidence that students' knowledge about doping is improved as the students progress in their study year.

In general, students valued the impact of awareness spreading and the role that pharmacists could play in doping prevention. This is of particular importance given that those who encourage doping abuse as identified by this study, such as sports-mates and friends, are not likely to be educated about doping risks and may be giving misleading or incomplete information on these risks. It would be expected that learning about these risks can have a discouraging influence on abusers' decision to take a doping agent. In this context, pharmacists can be a good resource of information for athletes, doping abusers and those who seek appropriate information on adverse effects of performance-enhancing substances.

The current study encompasses a number of limitations pertaining to instrument development, data collection and study sample.

Concerning instrument development, the items included in the instrument may not adequately represent all aspects of issues related to the studied topic. The study methodology would have benefited from previous studies in the literature; however to our knowledge by the time the instrument was developed, no reports on doping among pharmacy students had been published.

Self-report techniques are known to present a number of limitations because they assume that the respondent is able to self-report and is willing to self-declare. Furthermore, doping is a highly sensitive topic and self-reported doping attitude/behavior assessment may be subject to social desirability bias [31]. Nonetheless, in the current study although doping misuse among students was observed, the questionnaire was essentially designed to address students as potential future experts in medications, including performance enhancing agents, rather than potential doping abusers.

During data collection, questionnaires were intentionally distributed to comparable numbers of females and males and of students from each of the five years of the BPharm program at IUST. The purpose of this was to make gender and study year comparisons possible and valid. As a consequence, participants' female to male ratio was less than normally seen in Syrian pharmacy schools [32,33], however it is unlikely that this has biased the results. This is because the responses of males and females were similar and only statistical difference was observed in proportions of doping abusers.

The current study was performed on a single population of one pharmacy school in Syria and may, therefore, not be generalizable to all pharmacy schools in the country. Nonetheless, many of our findings were in line with previous studies [25–27]. It is also noteworthy that the proportion of doping abusers reported in our study may not necessarily represent the prevalence among youths in the country. For example, it has been reported that doping was less common among students of biomedical schools including pharmacy, compared to other schools [9].

5. Conclusions

Taking into account the rapid growth of this public health problem among non-competing athletes, it seems vital to involve pharmacists in the anti-doping efforts. The findings of this study, and previous studies [25–29], highlight the need to provide pharmacy students with advanced theoretical background and practical training concerning doping. This can be achieved by adopting simple, but essential, changes to current curricula. One chapter concerning the pharmacology of performance-enhancements in sport, in a course of pharmacology or a similar subject, in addition to another chapter that provides appropriate practical strategies on dispensing, advising, prescribing and monitoring sport medications, in a course of pharmacy practice, may be adequate.

Interestingly, and in agreement with other studies [4,12], the predominantly negative attitude toward doping and reasonable knowledge about its risks among respondents does not appear to prevent some of them from trying doping agents. This suggests that successful doping prevention strategies should go beyond spreading awareness and more studies in this context are required to explore doping abusers' behavioral and psychological characteristics and analyze their motivations. Such studies may also help to identify and develop the optimal approaches that pharmacists can follow to effectively deliver their message to doping drug requestors.

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Conflicts of Interest

The authors declare no conflict of interest.

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Appendix I. The Questionnaire Used in the Study.

Survey on Knowledge, Attitudes and Abuse of IUST Pharmacy Students Concerning Doping in Sport

Please take your time to frankly and carefully answer the following questions, by filling the gaps or ticking the appropriate option – please respond to all questions:

Note: participation in this study is voluntary.

I Personal Information

1. Are you a: ☐ male ☐ female
2. How old are you? _____
3. Please indicate your study year: _____

II Do You Agree that the Following Substances Can Have Doping/Performance-Enhancing Effects in Sport?

Substance	Agree	Disagree	Not sure
4. Amino acids (AAs)			
5. Anabolic (masculine) steroids			
6. Diuretics			
7. Energy drinks			
8. Growth hormone			
9. Narcotics			
10. Stimulants (such as amphetamine)			
11. Vitamins			
12. β-blockers			

III Doping Drugs Are Used in Sport with an Aim To:

Reason	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
13. change body shape and build a muscle mass within a short period of time					
14. enhance sport performance in local and international competitions					
15. pick the easy option as a result of not having a desire to spend enough efforts to achieve the desired physical capabilities					
16. merely imitate the others					

IV To What Extant Do Agree with the Following Statements?

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
17. Taking a doping agent is an ethical deed					
18. I respect individuals who take doping agents					
19. Taking a doping agent can harm user's health					
20 Taking a doping agent for only a short period is not harmful					

V To What Extant Do Agree with the Following Statements?

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
21. I may consider using a doping drug (sometime in the future)					
22. I advice individuals not to take doping substances					
23. Proper awareness concerning adverse effects of doping substances can help minimizing their usage					
24. Pharmacists should help promoting awareness about adverse effects of doping substances					

25. Have you ever taken a prohibited performance-enhancing drug? ☐ yes ☐ no
26. Out of the following options, who/which is the most influential person/factor in encouraging you to take a performance-enhancing drug?

☐ Media ☐ friend ☐ Coach ☐ Sport mate ☐ else (please specify)

Thank you for participating in this study.