

How the Iranian Free-Style Wrestlers Know and Think about Doping? – A Knowledge and Attitude Study

F. Halabchi, A. Esteghamati, A. Razzaghi and A. Noori

Abstract—Nowadays, doping is an intricate dilemma. Wrestling is the nationally popular sport in Iran. Also the prevalence of doping may be high, due to its power demanding characteristics. So, we aimed to assess the knowledge and attitudes toward doping among the club wrestlers. In a cross sectional study, 426 wrestlers were studied. For this reason, a researcher made questionnaire was used. In this study, researchers selected the clubs by randomized clustered sampling and distributed the questionnaire among wrestlers. Knowledge of wrestlers in three categories of doping definitions, recognition of prohibited drugs and side effects was poor or moderate in 70.8%, 95.8% and 99.5%, respectively. Wrestlers have poor knowledge in doping. Furthermore, they believe some myths which are unfavorable. It seems necessary to design a comprehensive educational program for all of the athletes and coaches.

Keywords—Attitude, Doping, Knowledge, Wrestling

I. INTRODUCTION

DESPITE the common public beliefs that consider doping as a modern phenomenon, it seems to be as old as competitive sports itself [1],[2]. The earliest cases of doping in sport go back to the Ancient Olympics games when athletes are reported to have taken special dietary substances to improve their performance [3],[4]. Since the athletic competition has been regarded as a measure to achieve publicity, status, money, and prestige, it would be predictable that doping (like other methods of cheating) in sports is neither novel nor scarce [5].

The use of doping substances in many sports and on all continents has become a major public health issue [6]. The struggle against performance enhancing drugs in sport is nearly half a decade old. It has encountered many obstacles, stumbled often, but also achieved outstanding successes [7]. Although it has been assumed that athletes' beliefs and values are important parameters to predict drug misuse in sport, there is insufficient data about knowledge and attitudes of athletes in different sport disciplines. Based on these data, World Anti-Doping Agency (WADA) encourages research in social, behavioral and ethical aspects of drug misuse among athletes [8]. Accordingly, it seems necessary to investigate athletes'

knowledge and attitude toward various fields of doping. Based on the existing findings, it seems that athletes usually lack the proper knowledge in the field of doping [9]. For example, Laure and Reinsberger showed in a study that high-level endurance walkers can only mention on the average 1.5 drugs from prohibited list of doping drugs [10]. Regarding health consequences of doping drugs, Ohaeri et al. found more than 80% of Nigerian athletes were unaware that anabolic steroids may result in tendon injuries, acne or gynecomastia [11]. In another study, Yesalis and Bahrke investigated 155 American athletes participating in winter games (1992). In this study, 80% of Olympic athletes considered steroid use as a serious problem in sports and 43% of them estimate use of anabolic steroids to be more than 10% of participants [12]. According to another survey on 1459 high school athletes in eastern part of France, it has reported that 79% of the respondents think the incidence of doping is increasing, especially among those who practiced an individual sport. Four percent of students stated that they had used doping agents at least once in their life and their main source of supply being peers and health professionals. Seven percent stated that doping is not always dangerous for health and 21 percent assume that refusing to use doping equals to losing all chances of becoming a great champion [13]. Another study on 80 weight-lifters found that users of anabolic steroids scored physicians as no more reliable than their friends, Internet sites, or the person(s) who sold them the steroids [14]. There have been many survey-based studies published on the prevalence of drug misuse. Unfortunately, very few are based on surveys conducted with athletes and even fewer with elite athletes, especially in combat sports such as Freestyle wrestling. Surveys are broadly divided in to those that ask about self-use of drugs and those that seek information on perceived use by others. Results from the former type of study tend to reflect underreporting whilst those on perceived use tend to produce exaggerated claims [15]. Free-style wrestling is a popular and nationally accepted sport discipline in Iran and a great number of people in this country participate in wrestling training and competitions. Otherwise the prevalence of drug misuse in this sport may be high, due to power demanding nature of it. So, the aim of the study was to determine wrestlers' knowledge regarding definition, prohibited list of drugs and adverse effects of popular misused drugs and to assess their attitudes toward critical points of doping.

II. MATERIALS AND METHODS

The study was performed as a cross-sectional survey. It was carried out in wrestling clubs of Tehran (the capital of Islamic

F. Halabchi is with the Sports Medicine Research Center, Tehran University of Medical Sciences, Iran (phone: +9821-88630227; fax: +982188003539; e-mail: fhalabchi@tums.ac.ir).

A. Esteghamati, is with Division of Endocrinology, Diabetes and Metabolism, Vali-Asr Hospital, Tehran University of Medical Sciences (e-mail: esteghamati@tums.ac.ir).

A. Razzaghi is with the Sports Medicine Research Center, Tehran University of Medical Sciences, Iran (e-mail: alirezarazzaghi_21@yahoo.com).

A. Noori is with the Sports Medicine Research Center, Tehran University of Medical Sciences, Iran (e-mail: adelnoore@gmail.com).

Republic of Iran) selected by randomized clustered sampling method. The study was approved by the national wrestling federation, and the Research Ethics Committee of Tehran University of medical sciences.

The sample consisted of 426 wrestlers from 25 randomly selected clubs from all 4 geographically identified districts of Tehran (North West, North East, South West and South East). In November 2008, all wrestlers of selected clubs were interviewed in place to request their participation in the survey. They received information about the study (the background of the project and project objectives, the possibility of refusing to answer specific questions, etc) and a questionnaire was distributed. Participation in the study was voluntary and the subjects were free to withdraw from the study without any prejudicial consequences. Confidentiality and anonymity were ensured for the respondents. The researcher made questionnaire was adapted from studies published elsewhere and the national doping experts' opinion.

This questionnaire consists of 88 different questions. It is subdivided into:

1. Questions on definition of doping (10 items)
2. Questions on popular drugs (20 items)
3. Questions on side effects of anabolic steroids (20 Items)
4. Questions on attitude toward use of sport supplements (8 items)
5. Questions on attitude toward the best anti –doping strategy (11 items)
6. Questions on attitude toward the main rationale of sport authorities to combat against doping (6 items)
7. Questions on attitude toward the main consultants of athletes for drug misuse (8 items)
8. Questions on wrestlers' estimates of doping prevalence in other wrestlers (5 items)

III. RESULTS

Table I shows the frequency of true answers to questions aimed to assess wrestlers' knowledge in three fields of doping definitions, familiarity with banned drugs and side effects of anabolic steroids.

TABLE I
FREQUENCY OF CORRECT ANSWERS TO QUESTIONS AIMED TO ASSESS WRESTLERS' KNOWLEDGE

Subdivision	True answer	Frequency of correct answers(%)
Doping definitions		
Administration of prohibited substances by physician	Yes	216 (50.7%)
Announcement of special financial rewards for moral enhancement	No	390 (91.5%)
Enhancing performance with high altitude training	No	407 (95.5%)
Inadvertant use of prohibited drugs by athletes	Yes	135 (31.7%)
Power enhancement using special nutritional supplements	No	337 (79.1%)
Presence of prohibited substance in doping urine sample	Yes	183 (43%)
Refusing to doping sample collection	Yes	164 (38.5%)
Tampering with doping sample collection	Yes	181 (42.5%)
Trafficking in prohibited substances by coach	Yes	170 (39.9%)
Use of vitamins and nutritional supplements	No	365 (85.7%)
I don't know		40 (9.4%)
Drug names		
Amino acids	No	359 (84.3%)
Amphetamin	Yes	68 (16%)
Anabolic steroids	Yes	73 (17.1%)
Antibiotic	No	397 (93.2%)
Antihistamin	No	410 (96.2%)
Canabins	Yes	231(54.2%)
Corticosteroids	Yes	84 (19.7%)
Creatin	No	333 (78.2%)
Diazepam	No	361 (84.7%)
Diuretics	Yes	79 (18.5%)
Expectorant syrup	No	414 (97.2%)
Growth hormone	Yes	158 (37.1%)
Insulin	Yes	87 (20.4%)
Luxatives	No	392 (92%)
Metocarbamol	No	408 (95.8%)
Morphine	Yes	180 (42.3%)

TABLE I (CONT'D)
FREQUENCY OF CORRECT ANSWERS TO QUESTIONS AIMED TO ASSESS WRESTLERS' KNOWLEDGE

Subdivision	True answer	Frequency of correct answers(%)
Drug names	Yes	168 (39.4%)
Nandrolone		
Salbutamol	Yes	25 (5.9%)
Testosterone	Yes	183 (43%)
Vitamin E	No	415 (97.4%)
I don't know		62 (14.6%)
Side effects of anabolic steroids		
Aggression	Yes	74 (17.5%)
Alopecia	Yes	82 (19.3%)
Arthritis	No	390 (92%)
Asthma attacks	No	390 (92%)
Constipation	No	401 (94.6%)
Cough and dyspnea	No	402 (94.8%)
Drug dependence	Yes	77 (18.2%)
Gastric ulcer	No	390 (91.5%)
Growth arrest in adolescents	Yes	27 (6.4%)
Gynecomastia	Yes	115 (27.1%)
Hyperlipidemia	Yes	41 (9.7%)
Icter	Yes	17 (4%)
Infertility	Yes	97 (22.9%)
Irritability and restlessness	Yes	61 (14.4%)
Muscle weakness	No	413 (97.4%)
Nausea and vomiting	No	393 (92.7%)
Severe acne	Yes	93 (21.9%)
Sleepiness	No	398 (93.9%)
Tendon injuries	Yes	34 (8%)
Voice deepening in women	Yes	74 (17.5%)
I am totally unaware	No	186 (43.9%)

Regarding doping definitions, inadvertent and unplanned use of prohibited drugs by athletes, refusing to provide sample to doping control officers and trafficking of prohibited drugs by the coaches were regarded as doping only in less than 40% of participants.

On the subject of familiarity of wrestlers with generic names of popular prohibited drugs, a few athletes know Salbutamol, Amphetamine and Anabolic steroids as doping agents. The frequency of true answers was a little more in the case of Canabics, Testosterone and Morphine. These results are somewhat compatible with a study on high-level endurance walkers who can only cite on the average 1.5 drugs from prohibited list of doping drugs [10].

Regarding side effects of anabolic steroids, wrestlers were not so familiar with side effects of these drugs, especially icter, growth arrest in adolescents and tendon injuries which wrestlers select true answers only in 4%, 6.4% and 8%, respectively. The frequency of true answers was slightly more in some other side effects such as gynecomastia, infertility and acne. These findings are relatively similar to another study on Nigerian athletes, in whom more than 80% of participants were unaware that anabolic steroids may result in tendon injuries, acne or gynecomastia [11].

Level of wrestlers' knowledge toward each field was categorized using sum score of each wrestler (1 point for each true answer). These scores were considered good, moderate and poor, if the calculated sum scores were more than 70%,

40-70% and less than 40%, respectively. Frequency of wrestlers by their knowledge in three categories of doping definition, familiarity with drug names and side effects of anabolic steroids has been shown in table 2.

TABLE II
FREQUENCY OF WRESTLERS BY THEIR KNOWLEDGE IN THREE FIELDS OF DOPING

Knowledge	Good	Moderate	Poor
Definitions	125 (29.3%)	184 (43.2%)	117 (27.5%)
Drug lists	18 (3.2%)	302 (70.9%)	106 (24.9%)
Side effects of anabolic steroids	2 (0.5%)	137 (32.5%)	283 (67.1%)

Accordingly, knowledge of wrestlers in three categories of doping definitions, recognition of prohibited drugs and side effects was poor or moderate in 70.8%, 95.8% and 99.5%, respectively.

Tables 3 illustrate the attitudes of free-style wrestlers toward different fields of doping, including supplement use, the best Anti-doping strategy, the main rationale of sport authorities to combat against doping and the main consultants of athletes for drug misuse.

In table 4 the wrestlers' estimates on relative frequency of doping in different situations are illustrated.

TABLE III
ATTITUDE TOWARD DIFFERENT FIELDS OF DOPING

Attitudes regarding supplement use (multiple choice)	Frequency
If used properly, they have great effects on athletes' performance and success	193 (45.5%)
Although supplements may not have significant benefit, they are harmless.	47 (11.1%)
Use of sport supplement is waste of money without any benefit.	64 (15.1%)
They may contain prohibited substances	122 (28.8%)
Natural and herbal supplements are safe and harmless.	155 (36.6%)
Athlete who have a good and healthy diet, does not need any supplement.	156 (36.8%)
Without supplement use, no athlete can reach a good status in professional sport.	72 (17%)
To avoid inadvertent doping, it is better to introduce standard supplements to athletes by sport authorities.	132 (31.1%)
No idea	40 (9.4%)
Attitude toward the best anti-doping strategy (multiple choice)	
Allow free use of all drugs	25 (5.9%)
Use of indirect measures including cultural interventions	110 (25.9%)
Enhance doping control via increased in-competition testing	159 (37.5%)
Enhance doping control via increased out of competition testing	147 (34.7%)
Educate athletes about effective and safe doping methods	116 (27.4%)
Educate athletes about harms and side effects of prohibited drugs	144 (34%)
Educate coaches about harms and side effects of prohibited drugs	115 (27.1%)
Increase doping sanctions for doping offence	152 (35.8%)
Consider heavy financial penalties for doping offence	108 (25.5%)
Consider imprisonment for doping offence	50 (11.8%)
Deprive doping offenders from all citizenship rights	69 (16.3%)
No idea	62 (14.6%)
Attitude toward the main rationale of anti-doping activities (single choice)	
To maintain athlete's health	138 (32.5%)
To maintain sport dignity	28 (6.6%)
To create a fair medium for athletes' competition	85 (20%)
To prevent national scandals	15 (3.5%)
To combat unreasonable world records	3 (0.7%)
To combat trafficking of prohibited drugs	16 (3.9)
Others	58 (13.8)
No idea	81 (19.1%)
Attitude toward the main consultant of athletes	
Physicians	22 (5.2%)
Friends	173 (40.8%)
Club owners	13 (3.1%)
Physiotherapists	1 (0.2%)
Dietitians	27 (6.4%)
Coach	55 (13%)
Drugstore vender	11 (2.6%)
Senior athletes	10 (2.4%)
Others	57 (13.4%)
No idea	55 (13%)

TABLE IV
WRESTLERS' ESTIMATES ON RELATIVE FREQUENCY OF DOPING

Estimate on relative frequency	<25%	25-50%	50-75%	>75%
Doping among participants of league and national competitions	35.1%	25.9%	19.6%	15.8%
Doping among wrestlers of his own club	63.7%	14.9%	8.3%	4.2%
Wrestlers who have good awareness regarding side effects of prohibited drugs	23.1%	30.2%	22.9%	17.9%
Doping offence, if the authority allows free misuse of drugs	10.4%	17.5%	18.9%	49.8%
Doping, if athlete is notified that he will be the world champion with misuse of specific drug but will die due to its side effects 10 years later	55.9%	10.5%	11.8%	8.3%

Regarding the frequency of drug misuse, 35.4% and 12.5% of wrestlers estimated over 50% prevalence of drug abuse in the professional wrestlers and their own club, respectively.

Also, 217 wrestlers (57%) estimated it less than 50% in both participants of national league and their own club and 27 persons (7%) assessed it more than 50% in both groups. Only 23 participants (6%) estimated higher frequency of doping offence in their own club, compared to national league ($P < 0.001$, $\chi^2 = 57.79$).

IV. DISCUSSION

Due to different methods and instruments used, it is not prudent to directly compare data from diverse studies regarding knowledge of athletes about doping. However, as well as similar studies aimed to investigate athletes' knowledge, our study shows the poor knowledge of wrestlers in different categories of doping.

Unfortunately, 68.3% wrestlers did not regard inadvertent drug use as doping. So, they may not pay proper attention to the use of sport supplements and prescription drugs for their ailments. Thus, it is essential in all educational programs to highlight the strict liability of athletes for use of all drugs and supplements. It means that innocent ingestion of prohibited substances is not an acceptable excuse, and athletes testing positive are liable to penalties.

Also, 61.5% of participants did not consider refusal of sample provision as doping offence. Based on this misconception, they may not cooperate in doping control process and encounter sanctions. Therefore, this point should be emphasized in all educational curriculums.

Another interesting note is that 8.5% of wrestlers regard financial rewards and moral enhancement as doping. It means that some athletes perceive doping as any measure used to improve the performance and therefore, consider positive implications for doping.

A further remarkable point is that 14.3% and 20.9% of athletes believe that power enhancement using special nutritional supplements and use of vitamins and nutritional supplements are types of doping. It indicates that wrestlers have not a good insight to differentiate doping drugs and allowed nutritional supplements. Correction of this common mistake is critical.

More than 50% of wrestlers were not familiar with the names of anabolic steroids and popular generic drugs of this group such as Testosterone and Nandrolone.

The knowledge of athletes about adverse effects of anabolic steroids is scarce and less than 30% of wrestlers knew the most common side effects and almost 40% did not have any idea about side effects.

When the knowledge level of wrestlers were assessed in the fields of doping definitions, drug names and side effects of anabolic steroids, none of participants classified as good in all 3 fields. Among all participants, only 29 wrestlers (6.8%) were familiar with all definitions of doping and none were

completely knowledgeable (full score) about the names of popular prohibited drugs and side effects of anabolic steroids.

Regarding the main consultants of wrestlers for drug use, participants respectively cited the peers and friends (40.8%), coaches (13%), dietitians (6.4%) and physicians (5.2%) as their main advisor. These findings are consistent with another study on French high school athletes who declare their peers as main source of supply [13].

Therefore, they frequently consult with persons who are either not aware of side effects or involve in trade of supplements and attribute factitious and fabulous benefits for their use. On the other hand, they consult so infrequently with medical staff. It may be due to two probable reasons. First, the medical coverage of these young and healthy adults may not be so good. Second, the athletes may not trust medical staff as reliable source of up to date informations, as shown in another study on weight-lifters, in which participants scored physicians as no more reliable than other involved persons [14].

Also, there are some myths among athletes regarding sport supplements including the safety of natural and herbal supplements (36.6%) and being free of harm (11.1%).

Unfortunately, many manufacturers of supplements use terms such as natural and herbal in their products and thereby encourage athletes to buy them.

Less than one third of participants (28.8%) mentioned the possibility that supplements contain prohibited substances. As declared earlier, the likelihood of contamination with drugs is a real risk and it is estimated that near 15% of sport supplements may be contaminated, purposely or unintentionally, with prohibited drugs which are not declared on their labels [16],[17].

In the case of the best strategies for combat against doping, wrestlers believe that direct measures such as increased doping testing may be more effective. However, they also found helpful to use indirect strategies such as education of athletes and coaches about harms and side effects of prohibited drugs. More than 94% of wrestlers were disagree to allow free use of all drugs which indicates their concordance with doping control.

As mentioned earlier, surveys which investigate about self-use of drugs may underreport the prevalence and those that seek information on perceived use by others tend to produce exaggerated claims. Similarly in our study, when the athletes were asked about prevalence of doping in their own clubs, they estimate it less frequent than participants of national league, so that near two third of participants estimate the frequency of doping to be more than 25% among wrestlers of national league and less than one third estimate likewise among their own club.

It may be related to two important reasons. First, they may assume that doping is more prevalent in higher levels of professionalism. Second, they prefer to presume their own sport setting pure and guiltless and may overlook the real prevalence of doping in their club.

These findings are relatively comparable with another study on American athletes of winter games, in which 43% of athletes estimate use of anabolic steroids to be more than 10% of participants [12].

The answer of wrestlers to the question "How do you estimate the relative frequency of drug misuse, if athlete is notified that he will be the world champion with misuse of specific drug but will die due to its side effects 10 years later", is really shocking. Almost one fifth of wrestlers believe that more than 75% of athletes will misuse drugs in this situation. It indicates that the culture of "victory at any cost" is unfortunately prevalent among athletes. In other words, athletes are ready to gamble their health and life, as the human's most valuable wealth to reach a good status in professional sport. Another interesting point is the wrestler's attitude on relative frequency of doping offence, if the authority allows free misuse of drugs. As mentioned earlier, almost half of participants believe that more than 75% of athletes will offence doping, if the authority allows the free use of all drugs. It seems that in their opinion, the main causes of drug abstinence are its illegality and the fear of sanctions and wrestlers. So, it is mandatory to emphasize internal motivational factors for doping prevention and encourage athletes to avoid doping, because it is unfair, non-ethical and contrary to physical and mental health.

V. CONCLUSION

The Iranian free-style wrestlers have poor knowledge in doping and its related issues. It is more prominent in familiarity with the generic names of prohibited drugs and their side effects. In the field of attitudes, there are some myths and beliefs which are unreasonable, nonscientific and even dangerous for health and may contravene the attempts to combat against doping. So, it is mandatory to address and modify these inappropriate attitudes to increase the success of any anti-doping activity.

Finally, it seems necessary to design a comprehensive educational program for all of the audience (wrestlers, coaches, medical team, sport authorities, journalists and) aimed to eliminate the ignorance, correct the unsuitable attitudes, warn about the adverse consequences and pay attention to values in combat against doping.

Furthermore education regarding sport supplements should be planned to establish a reasonable and evidence based approach to their use. Also, the audience should realize the differences of prohibited drugs and permitted nutritional supplements.

ACKNOWLEDGMENT

This study was funded by the grant No.4498 from Vice-Chancellor for Research of Tehran University of Medical Sciences (TUMS). The authors also gratefully acknowledge all of free-style wretlers and their coaches in Tehran, as well as Tehran board of wrestling whose full participation and cooperation permit us to conduct this research.

REFERENCES

- [1] F. Halabchi, "Doping in combat sports," in *Combat sports medicine*, 1st ed., R. Kordi, N. Maffulli, R.R. Wroble, W.A. Wallace, Eds. London: Springer- Verlag, 2009, pp. 55-72.
- [2] MD. Silver, "Use of ergogenic aids by athletes," *J Am Acad Orthop Surg.*, vol. 9, no. 1, pp. 61-70, Jan-Feb. 2001.
- [3] RIG. Holt, L. Erotokritou-Mulligan and PH Sönksen, "The history of doping and growth hormone abuse in sport," *Growth Hormone & IGF Research.*, vol. 19, no.4, pp. 320-326, Aug. 2009.
- [4] C.E. Yesalis, M.S. Bahrke, "History of doping in sport," in *Performance-Enhancing Substances in Sport and Exercise*, 1st ed., M.S. Bahrke, C.E. Yesalis, Eds. , Champaign, IL: Human Kinetics, 2002, pp. 1-20.
- [5] M. Kamber and PE Mullis, "The Worldwide Fight Against Doping: From the Beginning to the World Anti-Doping Agency," *Endocrinol Metab Clin N Am.*, vol. 39, no. 1, pp. 1-9, Mar. 2010.
- [6] DH. Catlin, KD. Fitch and A. Ljungqvist, "Medicine and science in the fight against doping in sport," *J Intern Med.*, vol. 264, no. 2, pp. 99-114, Aug. 2008.
- [7] TH. Murray, "Doping in sport: challenges for medicine, science and ethics," *J Intern Med.*, Vol. 264, no.2, pp. 95-98, Aug. 2008
- [8] A. Alaranta, H. Alaranta, J. Holmila, P. Palmu, K. Pietilä, and I. Helenius, "Self- Reported Attitudes of Elite Athletes Towards Doping: Differences Between Type of Sport," *Int J Sports Med.*, vol 27. no. 10, pp. 842-846, Oct. 2006.
- [9] Backhouse S, McKenna J, Robinson S, Atkin A. *International Literature Review: Attitudes, Behaviours, Knowledge and Education – Drugs in Sport: Past, Present and Future*. Available at: www.wada-ama.org/rtecontent/document/Backhouse_et_al_Full_Report.pdf
- [10] P. Laure, and H. Reinsberger, "Doping and high-level endurance walkers. Knowledge and representation of a prohibited practice," *J. Sports. Med. Phy. Fitness.*, vol. 35, no. 3, pp. 228-31, Sep. 1995.
- [11] J.U. Ohaeri, E. Ikpeme, P.U. Ikwuagwu, A. Zamani, and O.A. Odejide, "Use and awareness of effects of anabolic steroids and psychoactive substances among a cohort of Nigerian professional sports men and women," *Human Psychopharmacology: Clinical and Experimental*. vol. 8, no. 6, pp. 429-432, Sep-Dec. 1993.
- [12] CE. Yesalis and MS. Bahrke, "Anabolic – androgenic steroids Current issues," *Sports Med.*, vol. 19, no. 5, pp. 326-340, May. 1995.
- [13] P. Laure, T. Lecerf, A. Friser, and C. Binsinger, "Drugs, recreational drug use and attitudes towards doping of high school athletes," *Int J Sports Med.*, vol. 25, no.2, pp. 133-138, Feb. 2004.
- [14] HG, Pope Jr, G. Kanayama, M. Ionescu-Piooggia and JI. Hudson, "Anabolic steroid users' attitudes towards physicians," *Addiction.*, vol. 99, no. 9, pp. 1189-1194, Sep. 2004.
- [15] DR. Mottram, "Prevalence of drug misuse in sport," in *Drugs in sport*. 4th ed. DR. Mottram, Ed. London: Routledge, 2011, pp. 369.
- [16] O. de Hon, B. Coumans, "The continuing story of nutritional supplements and doping infractions," *Br J Sports Med.*, vol.41, no. 11, pp. 800-805, Nov. 2007.
- [17] PJV. der Merwe, E. Grobbelaar, "Inadvertent doping through nutritional supplements is a reality," *SA Sports Medicine.*, vol. 16, no. 2, 3-7, 2004.