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KNOWLEDGE ON DOPING: CONSTRUCTION AND VALIDATION OF AN ORIGINAL MEASUREMENT TOOL AND ITS APPLICABILITY TO OLYMPIC SAILING

ZNANJE O DOPINGU: IZDELAVA IN POTRDITEV IZVIRNEGA MERILNEGA ORODJA IN NJEGOVA UPORABNOST V OLIMPIJSKEM JADRANJU

ABSTRACT

The recent literature shows an evident lack of studies dealing with the screening of doping knowledge in athletes and/or their coaches. In this paper, we present and validate a questionnaire aimed at evaluating knowledge about doping problems. The sample of subjects comprised top-level sailing athletes (N = 39; 33 males; 24.1±5.2 years of age) and their coaches (N = 3 4; 31 males; 37.2±11.2 years of age) from Croatia. The questionnaire consisted of 18 questions examining specific knowledge about doping and doping-related problems, with multiple-choice answers. Multiple-choice answers were offered for all questions (True – False – Not sure), while items answered correctly were scored with one point, with a theoretical range of 0–18. The subsample of 39 subjects (21 athletes and 18 coaches) was tested twice, throughout a test-retest procedure within a timeframe of 10–12 days. Reliability observed as a test-retest of Pearson's correlation was 0.90, with concordance of 89%, all indicating the appropriate consistency of the instrument. The coaches and athletes did not differ significantly (t-test = 0.26, p=0.13) in their knowledge on doping (8.01±1.5 and 7.04±1.3 for the coaches and athletes, respectively). The analyses indicated that the questionnaire is a valid and useful measurement tool for objectively screening knowledge regarding doping issues in sport. The results are discussed with regard to previous investigations in the field and potential limitations of the study.

Key words: reliability, validity, measurement, test

IZVLEČEK

V najnovejši literaturi nedvomno primanjkuje raziskav, ki se ukvarjajo s preverjanjem znanja o dopingu pri športnikih in/ali njihovih trenerjih. V tem prispevku smo predstavili in potrdili vprašalnik, katerega namen je bil oceniti znanje o problematiki dopinga. V vzorcu so bili vrhunski jadralci (N = 39; 33 moških; starost: 24,1 ± 5,2 let) in njihovi trenerji (N = 34; 31 moških; starost: 37,2 ± 11,2 let) iz Hrvaške. Vprašalnik je vseboval 18 vprašanj, ki so preverjala specifično znanje o dopingu in z njim povezanih problemih, odgovori pa so bili izbirni. Izbirni odgovori so bili ponujeni pri vseh vprašanjih (drži, ne drži, nisem prepričan). Pravilni odgovori so bili ocenjeni z eno točko, teoretični razpon pa je bil od 0 do 18. Podvzorec 39 merjencev (21 športnikov in 18 trenerjev) je bil testiran dvakrat s postopkom testiranje-ponovno testiranje v časovnem obdobju 10–12 dni. Zanesljivost, zabeležena kot Pearsonova korelacija testiranja-ponovnega testiranja, je bila 0,90, ob konkordanci 89 %, kar kaže na ustrezno konsistenco instrumenta. Trenerji in športniki se v svojem znanju o dopingu (trenerji: 8,01 ± 1,5 in športniki: 7.04 ± 1.3) niso pomembno razlikovali (t test = 0,26, p = 0,13). Analiza je pokazala, da je vprašalnik veljavno in uporabno merilno orodje za objektiven pregled znanja o problematiki dopinga v športu. Rezultati so obravnavani v povezavi s predhodnimi raziskavami na tem področju in v skladu z morebitnimi omejitvami raziskave.

Ključne besede: zanesljivost, veljavnost, meritev, test

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INTRODUCTION

Doping is defined as the occurrence of one or more anti-doping code violations, mostly observable in the use of prohibited substances and consequent presence of a prohibited substance and/or their metabolites or markers in athletes' specimens (Kondric, Sekulic, Uljevic, Gabrilo, & Zvan, 2013; Whitaker, Backhouse, & Long, 2014). In sport, doping is mostly used as a way of dealing with characteristic psychological and physiological stress and/or improving recovery after intensive trainings and competitions (Jenkins, 2002). Apart from the clear and well-proven health hazards, doping is considered as an unfair and unethical way of improving athletes' performance, and therefore as corrupting the essence of sport and fair play (Kobarfard, 2010; Kondric et al., 2013; Sajber, Rodek, Escalante, Olujic, & Sekulic, 2013).

However, with the increasing problem of doping in sport most authorities suggested extensive research on doping within different subsamples (e.g., athletes, coaches, and/or medics, with the World Anti-Doping Agency (WADA) financially supporting medical and social science projects aiming at improvements in general and local anti-doping policies in sport (Corrigan & Kazlauskas, 2003). Studies performed so far have chiefly focused on investigating doping behaviours in athletes, characteristic precipitation and protective factors, and ethical issues related to the doping problem (Corrigan & Kazlauskas, 2003; Striegel, Ulrich, & Simon, 2010). However, recent studies have established the evident importance of the objective screening of the doping knowledge of athletes and their coaches as a particularly valuable topic in global anti-doping efforts (Furjan Mandic, Peric, Krzelj, Stankovic, & Zenic, 2013; Sekulic, Bjelanovic, Pehar, Pelivan, & Zenic, 2014).

Only a few studies have dealt with knowledge on doping, and with only a couple of exceptions most of these studies dealt with medical staff's expertise on doping issues (Backhouse & McKenna, 2011; Greenway & Greenway, 1997; Sajber et al., 2013). Although important, medical personnel's knowledge about doping is hardly as relevant as athletes' and/or coaches' knowledge on the problem. Further, recent studies showed athletes' limited trust in their physicians' and coaches' knowledge about doping issues (Kondric et al., 2013; Sajber et al., 2013). Results showed that athletes are primarily focused on their own opinion and knowledge about this problem. It is not hard to conclude that such a condition is a highly generative basis for substance misuse (and probable anti-doping code violations) and/or eventual direct doping behaviour. The problem arises knowing that prescription drugs and even nutritional supplements used in sports can be the source of a positive doping case, and the origin is found in athletes' (and/or coaches') poor knowledge of doping-related risks (Backhouse, Whitaker, & Petroczi, 2013; Maughan, Greenhaff, & Hespel, 2011; Tscholl, Alonso, Dolle, Junge, & Dvorak, 2010). Recently, some studies have explored the problem of doping knowledge in athletes from different sports, and noted important findings on associations between socio-demographic, sport and educational variables with doping issues (Sajber et al., 2013; Sekulic et al., 2014). However, their results are mostly related to potential doping behaviour while being less oriented to doping knowledge per se (Sajber et al., 2013; Sekulic et al., 2014).

One of the main problems we have recognised is the problem of the efficient (e.g., non-time consuming) and objective screening of knowledge about doping. Questionnaires that are mostly used today as a tool for evaluating doping knowledge are available throughout the WADA quiz

(WADA). Yet, when examined more explicitly, it is evident that WADA experts were primarily focused on 'education' and, only later, on the 'evaluation per se'. More precisely, the WADA quiz consists of very suggestive questions and answers, and this quiz allows one to answer intuitively and 'find' the correct answer (e.g., If a nutrition supplement is bought from a pharmacy, it is definitively permitted in sport? True–False). Consequently, we judged the said questionnaire as a highly important educational material but of limited diagnostic applicability.

Therefore, the aim of the present study was to develop and validate a questionnaire we have originally designed for the main purpose of the precise and objective screening of athletes' and coaches' knowledge and perspectives regarding doping issues in sport.

METHODS

Subjects

In this study, we included sailing athletes (N = 39, all males; mean age, 24.1 ± 6.6 years) and their coaches (N = 34, all males; mean age 37.2 ± 11.7 years) from Croatia. We judged the sport of sailing as particularly convenient for the purpose of this study mostly because of the excellent Croatian achievements in this sport. More precisely, the athletes and coaches we studied are regular participants in the most renowned international competitions, where doping controls are frequent and mandatory. Within the sample of athletes, more than 50% were medallists in the highest ranked competitions, such as the European and/or World Championships, whereas 12 athletes and 8 coaches had participated in the Olympic Games.

Variables

During the first phases of our work, professional and scientific experts within the fields of sport nutrition and doping from Croatia and Slovenia (including academics and professionals from the Croatian Anti-Doping Agency) were included in the panel, with the objective of constructing a clear and understandable questionnaire that would be culturally specific to some extent while simultaneously problem-oriented and valid. The subjects were asked about general data (e.g., age, gender, sport achievement, education); the 18 questions examining specific knowledge on doping (DOP) are as follows: (1) a case of an elevated concentration of caffeine in a urine specimen is considered as doping; (2) erythropoietin (EPO) is a doping substance used in the strength-and-power sports (e.g., weightlifting); (3) if sample A is doping positive, the athlete is entitled to ask for another sampling; (4) WADA officials must inform an athlete a few hours before a planned doping control; (5) between two doping controls, there is a grace period of at least four weeks; (6) if the WADA official does not seem to be legitimate, an athlete is entitled to refuse the testing; (7) the use of amphetamines is related to several cases of death in cycling because of cardiovascular failure; (8) use of the human growth hormone is related to azoospermia; (9) in the case of asthma, I can use anabolic steroids; (10) a "masking agent" is a person who helps an athlete hide doping usage and symptoms; (11) EPO is detected in a blood specimen; (12) a person who is caught with material samples of EPO can be accused of violating an anti-doping code; (13) the use of anabolic-androgenic-steroids (AAS) in women is related to male-like body appearance changes (e.g., body hair development, voice changes, baldness); (14) AAS are injected intravenously; (15) the use of EPO is also known as "blood dop-

ing"; (16) synthetic testosterone increases the quantity of erythrocytes and is therefore frequent in endurance sports; (17) synthetic testosterone and AAS use inhibits the production of natural (endogen) testosterone; (18) in the case of official medical treatment, an athlete must not be tested for doping substances.

Multiple-choice answers were offered for all DOP items (*True – False – Not sure*). Items answered correctly were scored with one point (+1), otherwise "0". The overall result on DOP could range from 0 to 18. The authors are available for any more details and the complete questionnaire. We were able to test the 39 subjects (21 athletes and 18 coaches) twice, through a test-retest procedure within a timeframe of 10–12 days. From our perspective, this type of questionnaire was relatively convenient since there was no problem of interpreting the correct/incorrect answers. The questionnaire was also not time-consuming, which is known to be one of the most important issues in studying high-level athletes (Sekulic et al., 2014).

In addition, the subjects were asked about their age, experience in sailing (in years), whether they compete/coach Olympic or non-Olympic classes and had achieved a competitive result in sailing (a five-point ordinal scale including: National competition – National achievement – International competition – International achievement (in non-Olympic classes) – International achievement (in non-Olympic classes).

Statistics

Two statistical approaches were followed to define the reliability of the instrument and included: (1) a test-retest of Pearson's correlation; and (2) the percentage of identical responses (for more details, see Zinn et al., 2005). Overall validity of the instrument was estimated by the panel of experts involved in the questionnaire development.

Construct validity of the questionnaire was assessed in two phases. The first phase comprised a comparison of the results achieved on the knowledge on doping questionnaire between the athletes and coaches. In the second phase, we calculated the differences between those subjects involved in Olympic and non-Olympic sailing separately for the athletes and coaches. Both were done using an independent t-test.

Finally, by means of Spearman's rank-order correlations we established associations between age, experience and competitive result achieved in sailing with knowledge on doping.

Statsoft's Statistica Ver. 12.0 was used for all calculations, with a level of significance of 95% ($p < 0.05$).

RESULTS

The reliability of the questionnaire observed as a test-retest correlation was 0.90 (Figure 1). More detailed analysis showed that the tested subjects responded equally to 88% of the queries.

The coaches achieved somewhat higher scores than the athletes (8.01±1.5 and 7.04±1.3 for the coaches and athletes, respectively), but the difference was not significant (t-test = 0.26, p=0.13 (Figure 2)).

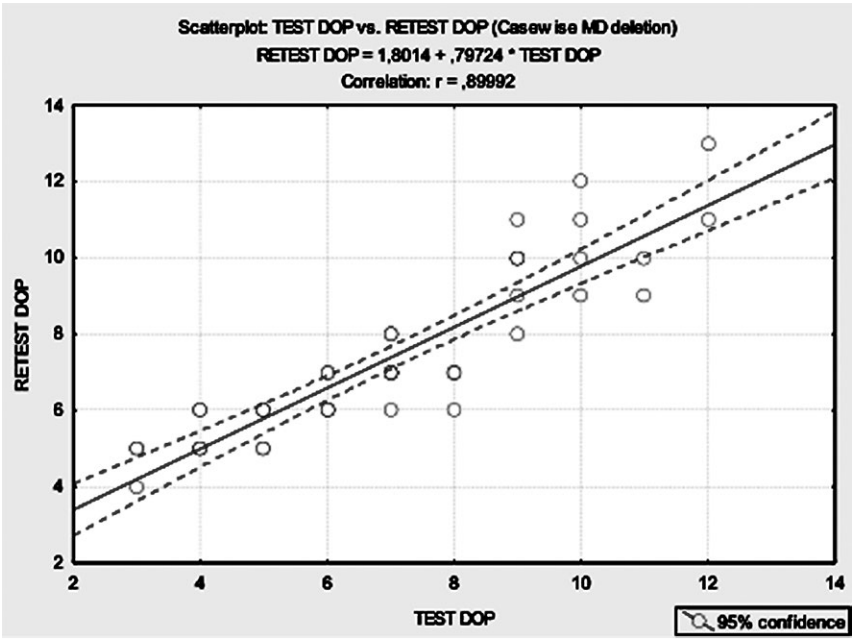

Figure 1: Reliability analysis of the constructed questionnaire: Test (TEST DOP) – retest (RETEST DOP) correlation (some cases overlap and therefore are not apparent on the graph)

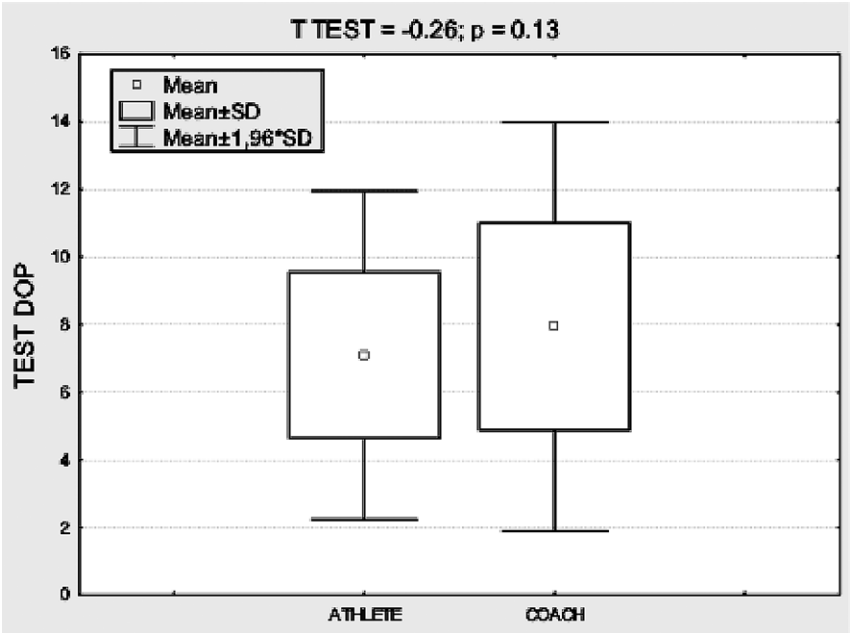

Figure 2: Construct validity of the questionnaire, means (Mean), standard deviations (SD), and independent samples t-test result (t test) and significance (p) of the differences between athletes (ATHLETE) and coaches (COACH) in doping knowledge (TEST DOP)

There was no significant difference in knowledge on doping between the athletes involved in Olympic sailing categories and those involved in non-Olympic sailing categories. However, the coaches who are currently involved in Olympic sailing achieved better results than their peers involved in non-Olympic sailing (Table 1).

*Table 1: Differences between subjects involved in Olympic and Non-Olympic sailing classes among athletes and coaches (data are presented as Mean ± Standard deviation; * denotes significant t–test differences)*

	Athletes		Coaches	
	Olympic	Non-Olympic	Olympic	Non-Olympic
Knowledge on doping	7.35±2.15	6.46±3.12	9.37±3.47	6.95±2.39*

Apart from the expected association between age and experience; and/or experience and competitive achievement, a significant association is found between the achieved result and knowledge on doping among athletes (Table 2).

Table 2: Associations between observed variables for athletes and coaches (denotes significant Spearman's rank order correlations)*

	Age	Experience	Result achieved
ATHLETES			
Experience	0.76*		
Result achieved	0.41*	0.48*	
Knowledge on doping	0.28	0.10	0.34*
COACHES			
Experience	0.67*		
Result achieved	0.01	0.13	
Knowledge on doping	-0.09	-0.17	0.09

Legend: Experience – experience in sailing in years; Results achieved – the best competitive result achieved so far; Knowledge on doping – result achieved on the test on knowledge on doping

DISCUSSION

One of the problems with questionnaires concerns the degree to which the various items collectively cover the material the instrument is supposed to cover (Huck, 2007). Our intention was to construct an efficient diagnostic tool where the questions about doping would be systematically arranged, while covering different doping substances and not only anabolic steroids, which have

almost certainly become a synonym for doping today. It is generally accepted that a minimal acceptable correlation coefficient that indicates a reliable test is 0.75 (Shrout & Fleiss, 1979). The test-retest correlation of more than 0.89 in our case points to the relatively high reliability of the measurement.

Most probably, the design and scoring system applied in our questionnaire is one of the most important reasons for the relatively high reliability of the testing. Namely, in classical 'knowledge tasks' when subjects have to respond to queries indirectly and explain their answer, there is a known problem of interpretative error and consequent evaluator bias (Ellickson, 1994). Oppositely, in our questionnaire evaluator bias is unlikely since the evaluator has to score the results while comparing them to an objective criterion.

Although some similar studies showed even higher reliability coefficients (e.g., authors in New Zealand calculated the reliability of up to 0.93 for an 81-item sports nutrition knowledge questionnaire), knowing the statistical logic underlying the calculation of Pearson's correlation coefficient such a difference is not hard to explain (Zinn, Schofield, & Wall, 2005). Briefly, Pearson's correlation is highly dependent on tests' variance – greater variance of the results numerically increases the correlation coefficient. In multiple-item questionnaires, variability is predefined by the number of items (18 items in our questionnaire vs. the 81 items in the sport-nutrition questionnaire), which probably led to the difference in Pearson's coefficients we previously discussed.

An analysis of concordance shows almost 90% of the queries have an equal number of responses. Because we strictly tried to avoid suggestive questions (see the Introduction), such a result reflects the high stability of the measurement. The high reliability of the instrument can be attributed to the fact that we have constructed a relatively short and non-time-consuming diagnostic tool. In particular, the subjects tested in this study completed the questionnaire within 8–11 minutes. This probably allowed them to focus and concentrate on the task, resulting in the small unsystematic error of the measurement and high reliability of the testing (for more details, see other literature (Herzog & Bachman, 1981) where the problem of the testing duration and its influence on the reliability is analysed more specifically).

There are several reasons we decided to study sailing athletes and their coaches. First, as explained in the Methods section, we had to sample high-level athletes and coaches. Second, one of the main prerequisites for the efficient testing of such a 'sensitive' problem as doping knowledge was the absolute confidence of the subjects in the examiners' good intentions (note that the examiner was one of their most trusted coaches and, therefore, an insider). Third, high-level sailing is one of those sports where a single coach rarely trains more than a couple of athletes. This assured an equal number of athletes and coaches in the two groups we compared when evidencing the construct validity of the questionnaire.

Evidently, the coaches and athletes did not differ in their knowledge on doping, which did not surprise us. Shortly, apart from the fact that sailing is an 'individual' sport (see above), it is also a very specific sport where coaches and athletes regularly travel together (mostly by car and/or van and not by aeroplane), live together (mostly in the same apartments and/or cottages and not in separate hotel rooms), cook for each other, or use the same bathroom, meaning that they practically 'grow together'. Such conditions lead to a very close coach-athlete relationship where the obligations of one side are the rights of the other (and vice versa), and any kind of knowledge is

shared between them. Most probably, this led to the equal results concerning the doping-related problems. In our opinion, such results show the appropriate construct validity of the measurement tool we have presented herein.

The association between the achieved result and knowledge on doping in athletes is logical. Namely, the questionnaire consisted of several items where athletes as subjects were asked about the technical procedure of doping control. Therefore, it is reasonable that those athletes who had achieved a better competitive result had a better result in the overall doping-knowledge testing. It is generally accepted that the only true valid test is the one which successfully distinguishes the groups of interest (Furjan Mandic et al., 2013; Uljevic, Esco, & Sekulic, 2014). Therefore, this result indirectly confirms the questionnaire's overall validity.

Study limitations

The main limitation of this study comes from the fact that the questionnaire was designed (and answered) in one specific language (i.e. Croatian). Therefore, the problem appears of the applicability and consequent reliability if the questionnaire is translated into other languages. However, our intention was to design a specific measurement tool and, therefore, further analyses are needed if the questionnaire will be applied to other subjects and in different languages. But, we believe that the questions are generally easily transferable to other languages.

CONCLUSION

In this study, we found the adequate reliability and validity of one specific doping knowledge questionnaire. Although the validation presented herein was performed on a stratified sample of subjects, we believe the questionnaire can be used as a valuable tool in diagnostics of the characteristic doping knowledge of athletes and their coaches, and/or medical professionals in different sports and sport disciplines.

As our intention was to construct a universal, but also somewhat sport-specific measurement instrument, we included a variety of questions of potential interest in different sports. Therefore, we anticipate a potential limitation on usage within some highly specific sports where interest should exclusively concentrate on some specific segment of physical fitness (e.g., marathon running where a more specific insight into knowledge of 'endurance doping' is necessary, or weightlifting where those questions can be omitted). Further, within the subcategory of doping knowledge we did not incorporate questions about psycho-stimulants or opiates (e.g., cannabis, cocaine). As a result, any further study should reconsider these limits and act accordingly.

This questionnaire should be easily adjusted for other sports and activities. In doing so, we strongly suggest incorporating some sport-/activity-specific questions that are characteristic and important for the sport/activity of interest. Otherwise, the questionnaire and testing will only have low real-world applicability.

Acknowledgement:

The support of the Croatian Sailing Federation is gratefully acknowledged. The authors are particularly grateful to all the athletes and coaches who voluntarily participated in the study.

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