Coll. Antropol. **37** (2013) Suppl. 2: 179–186
Original scientific paper

Sport Nutrition and Doping Factors in Swimming; Parallel Analysis among Athletes and Coaches

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A B S T R A C T

The sport nutrition and doping are known to be important issues in sports, but there is evident lack of studies which investigated those issues in swimming, especially with regard to parallel analysis of coaches and athletes. The first aim of this study was to compare knowledge of swimming coaches and their athletes about nutrition and doping. Also, we have identified interrelationships between studied sociodemographic-, sport-; nutrition- and doping-related-factors. The sample of subjects comprised 55 athletes (20.3±2.2 years of age; 24 females) and 22 coaches (mean age 36.5±7.8 years; 4 females) from Croatia (98% of respondents). In the first phase of the investigation we have validated specific questionnaires to determine the knowledge of sport nutrition (KSN), and knowledge on doping (KD). The test-retest correlation and percentage of equally responded queries revealed both questionnaires as reliable. The discriminative validity was proven also since coaches scored better than their athletes on both questionnaires. Athletes declared their coaches as the primary sources of knowledge about nutrition and doping. Among coaches, formal and self-education are equally important sources of information about doping and nutrition. The age is negatively, while the formal education is positively correlated to KD and KSN scores among coaches. Consequently, permanent educational programs about nutrition and doping are emphasized, especially among older coaches and younger athletes.

***Key words**: nutritional supplementation, substance use, sport, education*

Introduction

The genetic background, training and overall socio--cultural context where the athlete was raised are the main factors which define the athletes' development and achievement. But, nutrition (including hydration) is known to be one of the essential factors which allow optimization of the sport-development process[1]. The lack of some important nutrients is known problem among athletes[2]. Consequently, dietary supplementation (DS – preparations intended to supplement the diet and provide nutrients such as vitamins, minerals, fiber, fatty acids or amino acids that may be lacking in a person's diet) in sport is highly popular.

Doping is one of the most important problems in contemporary sport. According to World Anti-Doping Agency (WADA) doping is defined as the occurrence of one or more anti-doping code violations, usually observed by the presence of a prohibited substance, its metabolites or mar-kers in a biological specimen from an athlete. It is frequently elaborated that usage of doping is connected to several serious health problems, including death[3,4]. Therefore, anti-doping campaign and efforts are one of the most important issues in the sport today.

Swimming is an Olympic sport with the goal to swim a given distance in the shortest time. Various factors influence swimming performance, the main ones being physiological, morphological, biomechanical, technical, and psychological[5]. Traditionally, swimming training has focused on developing techniques and physiological capacity. In recent years, however, coaches have shown increasing concern for controlling and improving their

Received for publication November 20, 2012

swimmers' nutrition, although this growing interest has not been reflected in scientific studies. Most of the works that do at least in part cover this topic include swimmers as part of a general sample of sportspersons[6,7]. Studies done exclusively on swimmers mostly focused on DS usage and performance enhancing substances[8,9].

Although known to be highly important for athletes' health status and overall sport-development, nutrition, DS and doping issues are not sufficiently studied in swimming sport. It is mostly related to the fact that studies rarely investigated problem of knowledge about sport-nutrition (including dietary supplementation) and doping issues (health-hazards, anti-doping regulative, etc.). It is especially important since proper knowledge of sport-nutrition, dietary supplementation and doping are crucial for appropriate nutritional practices and awareness of doping health-hazards. Knowing the problem of the possible contamination of the DS with doping agents[10], the problem of knowledge on these issues becomes an imperative.

The aims of this study were: (A) to evidence the knowledge of sports nutrition and doping and (B) to clarify the factors related to knowledge of doping and sports nutrition. Both aims are studied separately aims swimming coaches and athletes. In the first phase of this investigation, we designed and validated a questionnaire that sought to provide evidence of knowledge concerning (a) nutrition and nutritional supplementation (knowledge of sports nutrition – KSN) and (b) doping issues in sports (knowledge of doping – KD). Although there are validated questionnaires on nutrition[11,12], we decided to construct and validate a novel measuring tool to include important sport-specific questions.

Methods

The subjects were junior- and senior-level swimming athletes from Croatia. Altogether, 55 athletes (20.3±2.2 years of age) and 22 coaches (36.5±7.8 years of age) were evaluated. Testing was done in several occasions during the 2011/12 competitive season. The testing design consisted of two parts: the reliability study and the main study. The reliability study was performed to determine the reliability of the KD and KSN questionnaires. In this part of the experiment, 17 subjects (12 athletes and 5 coaches) were evaluated twice within 10 days using a test-retest procedure for both questionnaires. The participants in the study were anonymous, and we did not collect personal data such as date of birth, city of residence, etc. For the purpose of comparison of the test and retest results, we asked the subjects to use a self-determined, confidential code for identification. All of the answer options were in multiple choice closed-ended formats. Prior to study, the procedure and idea were explained to all subjects (coaches and athletes) and to at least one parent of minor subjects (less than 18 years of age). Informed consent was obtained. The subjects were tested in groups of at least three. Each subject was informed that the survey was strictly anonymous, that they could refuse to participate and that they could leave some of the questions and/or the entire questionnaire unanswered. The response rate was over 99%. The study was approved by the Institutional Ethics Board.

Participants were questioned about sociodemographic data, sport-factors, sport nutrition and doping factors, and tested on KSN and KD.

Socio demographic variables included age, and the highest educational level achieved (four-point scale ranging from primary school to university degree).

The sports factors included queries about the subjects' sports experience in years (participation for athletes and years of coaching for coaches) and the achievements in the sport as an athlete or coach.

The sport nutrition and doping factors included question about the consumption of DS (three point scale »I don't consume DS«; »Yes, but not regularly«; »Yes, regularly«), participant's opinion about doping practices in the sport of swimming (a four-point scale ranging from »I do not think doping is used« to »Doping is often«); the primary source of information regarding sport-nutrition and doping (formal education; self-education; coach/physician; have no knowledge on these issues).

KSN and KD were newly constructed questionnaires. Prior to this testing, a panel of experts within the field of sports nutrition and doping (including academics and professionals from the National Anti-Doping Agency) constructed both questionnaires. The idea was to develop the measuring tools which would consist both of general and sport-specific information. Originally, both measuring tools consisted of 18 questions each. Each question (statement) was in a »true or false« form; a correct answer scored one point and an incorrect answer scored a zero. Following a preliminary factor analysis, the retained answers were summed separately for the KSN and KD questionnaires. All of the questions are presented in the tables.

Reliability of the KSN and KD were established using the Pearson's coefficient of the linear test-retest correlation, and the percentage of the equal test-retest answers. To evidence bias between test and retest we have calculated dependent samples t-test

The construct validity of the KSN and KD questionnaires was defined throughout exploratory factor analyses[13] using the principal component analysis and Gutman Kaiser extraction method with subsequent varimax rotation[14]. This procedure determined the factors for the scale and suggested which items should be deleted (facto-

TABLE 1
TEST-RETEST RELIABILITY ANALYSIS OF THE KNOWLEDGE ON SPORT NUTRITION (KSN) AND KNOWLEDGE ON DOPING (KD) QUESTIONNAIRES WITH DEPENDENT SAMPLES T-TEST

	Test X±SD	Retest X±SD	r	%ERQ
KD (score)	5.24±1.99	6.09±2.01	0.91*	86%
KSN (score)	8.51±2.17	9.07±2.69*	0.90*	85%

r – test retest correlation, %ERQ – percentage of the equally responded queries, * denotes significant differences at $p<0.05$

rial load of 0.50 was chosen as the cut-off point). Next, descriptive statistics (means and standard deviations or frequencies and percentages) were calculated. The differences between the coaches and athletes for the KD and KSN scores were calculated using a *t*-test for independent samples. Correlations between variables were established using the Spearman's rank order correlation. Values were considered statistically significant when $p< 0.05$. Statistical analyses were performed with StatSoft STATISTICA Version 10 (Tulsa, OK).

Results

Test retest correlation coefficients and percentage of the equally responded queries showed high reliability both for the KD and KSN. Since t-test revealed significant differences between test and retest it is clear that subjects which participated in the test and retest increased their knowledge within the 10 days period (Table 1).

Exploratory factor analysis calculated for KD extracted 7 significant factors, while 5 factors were extracted for the KSN. Models explained 81% and 63% of the system's variance for the KD and KSN respectively. Since initially we have decided to use 0.50 as the cut-off point for the questionnaire items, items 4th and 14th for the KD; and items 5th and 16th for the KSN, were excluded from the further analysis. As a result, the theoretical range for both questionnaires was 0 to 16 (initial 18 items minus 2 excluded items equals 16). At the moment

TABLE 2
FACTOR ANALYSIS FOR KNOWLEDGE ON DOPING

	F1	F2	F3	F4	F5	F6	F7
1. Caffeine is considered to be doping if its concentration in urine exceeds a certain level.	0.07	0.09	-0.18	0.26	0.63	0.23	0.07
2. Erythropoietin (EPO) is a doping substance used in strength-and--power sports (e.g., weightlifting).	0.70	0.07	0.42	0.11	0.12	0.30	0.70
3. If sample A is positive for doping, an athlete is entitled to ask for another sampling.	–0.31	0.73	0.21	0.17	0.05	0.22	–0.31
4. Doping control officers should notify athletes of their testing intentions a few hours prior to any testing.	0.18	0.49	0.05	0.24	0.03	0.32	0.18
5. If an athlete has an out-of-competition doping control, four weeks should elapse before the next doping control.	0.04	0.23	0.16	0.75	0.15	–0.03	0.04
6. If a doping control officer does not provide valid proof of identity an athlete can refuse to participate in the testing.	0.08	0.09	0.11	0.06	0.15	0.83	0.08
7. Anabolic steroids used among female athletes have neither positive nor negative effects.	0.06	0.01	0.08	0.79	0.12	0.09	0.06
8. Diuretics are prohibited substances in sport	0.19	0.35	0.27	–0.02	0.56	–0.17	0.19
9. In the case of asthma, I can use diuretics.	0.33	0.23	–0.13	0.50	–0.39	0.37	0.33
10. A »masking agent« is someone who helps an athlete hide their use of doping and is therefore equally responsible for doping offenses.	0.28	0.11	0.74	0.03	0.06	0.09	0.28
11. EPO is detected in blood samples.	0.59	0.62	0.00	–0.01	0.08	0.15	0.59
12. A person caught with material evidence of EPO (for example, ampules containing EPO) can be charged as a doping-offender.	0.33	0.81	0.06	0.08	0.18	–0.16	0.33
13. The use of amphetamines has been related to several cases of death in sport due to cardiovascular failure.	0.25	0.09	0.09	–0.04	0.56	0.43	0.25
14. The use of amphetamines by women is related to male-like body appearance changes.	0.06	0.36	0.40	0.41	0.47	–0.04	0.06
15. The purchase of the nutritional supplement from the authorized dealer is the only proper guarantee that the supplement does not contain doping agents.	0.07	0.10	0.79	0.14	0.03	0.04	0.07
16. Synthetic testosterone increases the quantity of erythrocytes and is therefore common in endurance sports.	0.81	0.08	0.33	0.01	0.12	–0.01	0.81
17. The use of testosterone derivates by women is related to male-like body appearance changes.	0.62	0.13	–0.02	0.29	0.36	0.07	0.62
18. When an athlete reports undergoing official medical treatment they cannot be tested for doping.	0.28	–0.15	0.38	0.35	0.52	0.08	0.28
Expl.Var	2.51	2.28	1.98	2.01	1.94	1.41	2.51
Prp.Totl	0.14	0.13	0.11	0.11	0.11	0.08	0.14

Legend: F – factor structure; Expl. Var – explained variance; Prp.Totl. – total proportion of the explained variance

TABLE 3
FACTOR ANALYSIS FOR KNOWLEDGE ON SPORT NUTRITION

	F1	F2	F3	F4	F5
1. Proteins consist of amino acids.	0.20	0.12	0.21	0.13	0.72
2. Carbohydrates are types of sugars and table sugar is basically a type of carbohydrate.	0.17	0.05	0.06	–0.13	0.83
3. Amino acids are only useful in endurance sports like the marathon, triathlon, or long-distance open water swimming.	0.66	0.24	–0.02	0.10	0.32
4. Isotonic drinks should be used only during the »dry-land« training, and avoided during the training in the pool (water).	0.04	0.68	0.04	0.32	0.19
5. The negative side-effects of excessive sweating are best prevented by drinking pure water.	0.49	–0.39	–0.02	0.33	0.25
6. Between training sessions and competitive trials a banana is a better choice than a sandwich.	0.43	–0.05	0.57	0.30	0.13
7. After the competition day has finished, it is better to not eat for 4 hours afterwards.	0.77	0.19	–0.09	0.03	0.21
8. Dark yellow urine is a sign of proper hydration of the body.	0.71	0.08	0.03	0.08	0.28
9. A banana has a lower glycemic index if it is green, and not dark yellow with spots.	–0.15	0.08	0.74	0.09	0.02
10. For the first meal after a competition chicken breast (white meat) and eggs are a better choice than pasta.	0.29	0.12	0.66	–0.26	0.19
11. Rice is a better »pre-competition« meal than high-quality steak.	0.16	0.05	0.07	0.89	0.01
12. Fresh fruit and vegetables are the best source of high-quality proteins.	0.73	0.12	0.27	0.18	0.10
13. Red meat and green vegetables are excellent sources of iron	0.74	–0.19	0.20	–0.05	0.19
14. During competitions and training in warm climates black tea can serve as beneficial sport drink.	0.22	0.63	0.12	–0.19	0.10
15. Dried fruit is an excellent source of carbohydrates.	0.35	–0.02	–0.08	0.34	0.52
16. Carbohydrate-laden meals should be avoided before training and competition because they encourage urination and therefore dehydration.	0.36	0.32	0.09	–0.03	0.46
17. Protein supplementation asks for an increased intake of water.	0.67	0.12	0.15	0.14	0.43
18. To prevent mineral loss, excessive water intake is beneficial.	0.69	0.48	0.01	0.07	–0.04
Expl.Var	4.46	1.56	1.54	1.42	2.31
Prp.Totl	0.25	0.09	0.09	0.08	0.13

F – factor structure; Expl. Var – explained variance; Prp.Totl. – total proportion of the explained variance

factor structures are not interpretable since there is no consistent pattern of factor loadings (Table 2 and 3).

More than 20% of the athletes achieved international competitive result (finals at the European and/or World championship). Less than 10% of the athletes do not use DS, while more than 50% of athletes declare coaches as the primary source of information about doping and DS. Almost 50% of athletes participated in the doping testing procedure at least once, while less than 4% of athletes share the opinion that there is no doping in their sport. The opinion about penalties for doping offences tend to more rigid ones, up to lifetime suspensions, while less than 10% of athletes declare eventual doping behavior in future. Majority of the coaches are highly educated but significant proportion declared self-education as the primary source of information about doping and DS, and none of them is of the opinion that there is no doping is swimming. Coaches are more rigorous than athletes with regard to penalties for doping-offenders and this consequently resulted in 90% of coaches who declare that there is no chance for potential suggestion of doping to their athletes (Table 4)

Coaches scored significantly ($p<0.05$) higher than athletes on the KSN (12.18±1.89 and 7.00±5.12 for coaches and athletes respectively) and KD (7.09±2.41 and 4.25±3.63 for coaches and athletes respectively).

The KSN and KD are highly correlated (0.74 and 0.81 for athletes and coaches respectively).

Among athletes the age dependent variables (age, education, experience), sport-achievement, DS usage, and number of doping testing, are all significantly positively correlated to KD and KSN. For coaches, the age is negatively related to KD and KSN scores and potential doping behavior (suggestion on doping usage). Those coaches who possess higher formal education scored better on KD (Table 5).

TABLE 4
EDUCATIONAL, SPORT NUTRITION AND DOPING FACTORS AMONG ATHLETES AND COACHES

	Athletes		Coaches	
	F	%	F	%
Education				
Primary school (1)	1	2%		
High school (2)	25	45%	4	18%
Student (3)	21	38%		
College/University degree (4)	8	15%	18	82%
Result achieved				
National competition participation (1)				
National competition success (2)	43	78%	6	27%
International competition participation (3)	7	13%	10	45%
International achievement (4)	5	9%	6	27%
Dietary supplement usage				
No (1)	4	7%		
Yes, but not regularly (2)	16	29%		
Yes, regularly (3)	35	64%		
Primary source of information on sport nutrition and doping				
I have no knowledge about it	7	13%	1	5%
Coach	30	55%	1	5%
Formal education	4	7%	11	50%
Self-education	14	25%	9	41%
Number of doping testing				
None (1)	32	58%		
One or two (2)	10	18%		
Three to five (3)	5	9%		
More than 5 times (4)	8	15%		
Doping in swimming				
I don't think doping is used (1)	2	4%		
Don't know, not sure (2)	12	22%	8	36%
Used rarely (3)	22	40%	6	27%
Used frequently (4)	19	35%	8	36%
Doping penalties				
Lifelong suspension	18	33%	14	64%
First time milder, than lifelong suspension	14	25%	4	18%
Financial punishment	22	40%	4	18%
I' m not sure that doping should be forbidden	0	0%		
Doping should be allowed	1	2%		
Doping likelihood (Coaches: Opinion of doping usage)				
I do not intend to use doping (1) (Coaches: I will not suggest doping usage)	45	82%	20	91%
Don't know, not sure (2)	6	11%	2	9%
I'll use it if it will help me with no health hazard (3) (Coaches: I'll suggest it if convinced that it will help with no health hazard)	4	7%		
I'll use it if it will help me (4) (Coaches: I'll suggest doping usage if convinced that it will help my athletes to achieve the competitive goal)				

Number in parentheses presents ordinal values for each answer

TABLE 5
CORRELATIONS BETWEEN SOCIODEMOGRAPHIC FACTORS, SPORT-, SPORT-NUTRITION AND DOPING-FACTORS AMONG ATHLETES – A AND COACHES – C

		Age	Experience	Education	Result achieved	DS usage	Doping in swimming	Doping likelihood	Doping testing
Experience	A	0.79*							
	C	0.64*							
Education	A	0.80*	0.64*						
	C	0.23	0.46*						
Result achieved	A	0.48*	0.27*	0.38*					
	C	0.13	0.22	0.21					
DS usage	A	0.21	0.24	0.26	0.22				
	C	–	–	–	–				
Doping in swimming	A	0.10	0.01	0.20	–0.02	0.00			
	C	–0.05	0.24	0.28	–0.48*				
Doping penalty	A	0.13	0.07	0.25	–0.07	–0.02	0.01		
	C	0.10	–0.25	–0.04	–0.17	–	0.26		
Doping likelihood	A	0.21	0.19	0.27*	–0.03	0.00	0.09		
	C	–0.45*	–0.52*	0.15	–0.45*	–	0.37		
Doping testing	A	0.69*	0.52*	0.49*	0.66*	0.23	–0.07	0.06	
	C	–	–	–	–	–	–	–	
KSN	A	0.56*	0.50*	0.48*	0.39*	0.40*	0.14	0.15	0.53*
	C	–0.43*	0.15	0.45*	0.49*	–	0.07	0.20	–
KD	A	0.67*	0.52*	0.63*	0.31*	0.40*	0.21	0.18	0.53*
	C	–0.50*	–0.06	0.23	0.08	–	0.09	0.46*	–

Age – age of the subjects, Experience – experience in sport (experience in coaching for coaches), Education – formal education level achieved, Result achieved – competitive result achieved as an athlete (as an coach for coaches), DS usage – usage of the dietary supplements, Doping in swimming – personal opinion about doping behavior in swimming sport, Doping likelihood – potential doping habits in future, Doping testing – number of doping testing before this study, * denotes significant correlation at $p<0.05$

Discussion

In the discussion we will focus on the most important findings, namely; (1) significant differences in KSN and KD scores of athletes and coaches, and (2) inconsistencies of the relationships between socio-demographic-, sport-, nutrition- and doping-factors among coaches and athletes. We will first briefly discuss study limitations and the reliability and validity of the applied questionnaires.

There are some study limitations. First and probably most important is the fact that this investigation is based on subjects' self-reports and it is possible that they might not have told the truth, especially if they felt uncomfortable. However, we believe that the approach to testing (groups, anonymity, etc.) and our experience from previous studies[3,15–17] decreased this possibility. Second, we must note that we have sampled subjects from only one country. However, we thought that is more important that testing results with high percentage of respondents, as suggested previously[3,15].

The reliability is the main prerequisite for the applicability of the measuring tool[18,19]. In comparison to similar questionnaires[11,12], the KD and KSN are found to be reliable. But, there is evident trend of improvement in KD and KSN scores between test and retest. This is logical since we have tested athletes and coaches who are aware of the importance of the doping and sport nutrition in sport, and therefore naturally improved their knowledge throughout the period of time between test and retest, regardless to our instruction to restrain from learning on these topics before retest procedure. For a moment we cannot define did they systematically learned about a tested topics, or they have improved their KD and KSN scores as a result of the non-formal communications. However, such incidence of the improvement in scores throughout relatively short period of time must be acknowledged if KD and KSN will be used frequently.

We could not clearly define the factor structure (latent structure) of the KD and KSN, and this is not unknown problem when studying reliability of the questionnaires. Mainly, it is not uncommon that empirically identified factors may not be theoretically meaningful because the identified factors may result from either method effect or response sets, rather than from differences in the underlying conceptual interpretations by the respondents.[20] Consequently, logical and interpretable factor structure is hard to be observed, but this does

not necessarily indicate the non-validity of the questionnaire but rather suggests that different statistical approaches in defining validity should be used (e.g., defining is there a difference in the testing scores between groups of subjects, or identifying correlation between some variable of interest and the questionnaire score). Some of these approaches are discussed later.

We cannot define which questionnaire is more difficult and therefore the KD and KSN scores cannot be compared. However, at the moment, we can conclude that the KSN and KD are higher among coaches than among their athletes, which is logical and expected. First, coaches are older than athletes, and their experience allowed them to improve in their knowledge formally (throughout formal education), but also non-formally (significant proportion of coaches declared self-education as the primary source of information on doping and sport-nutrition). Knowing that most of the coaches are highly educated in the field of sport-science (i.e. physical education, kinesiology, etc.) the high incidence of the self-education is particularly important. It probably emphasizes deficiencies in sport-related-education, which is already suggested for the region[2,3]. Meanwhile, we must note that the overall knowledge of Croatian swimming coaches about a problem of a sport nutrition is advanced, since the average KSN score of the coaches (mean value of the coaches was 12) is evidently higher than theoretical average value of the scale after preliminary factor analysis (i.e. theoretical average is about 8). On the other hand, the knowledge on doping may be better. More detailed analysis of the correct answers revealed that most of the correct answers coaches achieved on those questions where they have been asked on doping-regulations, and doping-testing procedures (i.e. items number 4, 5 and 6). Contrary, there is a significant proportion of wrong answers on questions which are oriented on specific doping-agents (e.g. erythropoietin – EPO). It is understandable, since EPO is a drug mostly used in endurance sports like triathlon, cycling, etc. while it is not popular in swimming sport (exclusively of open water long distance swimming eventually)[4]. On the other hand it clearly supports previous discussion about self-education as the primary source of information on studied topics (i.e. throughout self-education one is always oriented toward the problems of interest, like anti-doping regulative in this particular case).

Correlates of the KD and KSN among athletes are logical and expected. In short all age-dependent variables are positively correlated to level of knowledge about both topics. Recent studies reported age and sport-experience as positively correlated to nutrition-knowledge-scores[21]. However, in this investigation[21], education was not significantly correlated to nutrition-knowledge. Most probably this difference in findings between ours and cited study (note that we have actually found significant correlation between formal education and knowledge scores), are explainable by the fact that in our case age and formal-education are significantly inter-correlated, while our respected colleagues studied older athletes and the interrelationship between age and education status was not so high as in our study.

One of the important findings is that there is significant and relatively high negative correlation between age of the coaches and scores they have achieved on KD and KSN. It is additionally important since coaches are not particularly old (less than 40 years in average). In explaining such findings we must once again emphasize high results of the coaches on the KSN which means that situation is probably not as alarming as it appears on the surface. However, the fact that the older coaches achieved poorer results on the KD and KSN in comparison to their younger colleagues will be briefly discussed. Previous investigations on the territory acknowledged the problem of the sport-related education and the necessity of the life-long learning on those topics[2,22,23]. Our findings clearly support those suggestions. In short, from our perspectives as University teachers from different institutions and professionals in sports, we are well aware that the sport-nutrition, and especially doping-related--themes are not sufficiently acknowledged in the sport--education curricula in our countries. Meanwhile, there are no formal requirements of the permanent (life-long) education among sport professionals. If we add that the problem of doping is relatively novel in swimming sport, while most of the athletes declared their coaches as the most important source of information about nutrition and doping, the context and potential negative consequences of such condition is even more understandable.

Conclusion

The questionnaires we have applied are reliable instruments for establishing the level of knowledge of sports nutrition and doping in swimming. Since coaches scored significantly higher than athletes on both questionnaires we can define appropriate validity of the questionnaires as well. However, if applying in other sports some sport-specific questions should be adapted.

The self-education is declared as the most important source of information on sport nutrition and doping among coaches, while athletes declared coaches as the primary source of knowledge on sport nutrition and doping. Knowing that we have found negative correlation between coaches' age and knowledge scores all stated is a clear indicator of the lack of systematic life-long formal education about those topics. From our perspective, this is not exclusively related to swimming sport.

Acknowledgements

The support of the Ministry of Science, Education and Sport of Republic of Croatia (project No 315-1773397-3407) is gratefully acknowledged. During the completion of this paper, YE were visiting researchers at the Cardiff Metropolitan University, Cardiff (UK) (European Social Fund, Government of Extremadura, PO10012).

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SPORTSKA PREHRANA I DOPING FAKTORI U PLIVANJU; PARALELNA ANALIZA NA UZORKU SPORTAŠA I TRENERA

SAŽETAK

Sportska prehrana i doping su važne teme u današnjem sportu, ali očit je nedostatak studija koje su ove probleme istraživale u plivanju, a posebno su nedostatne studije koje se bave i sportašima i trenerima. Glavni cilj ovog istraživanja bio je definirati i usporediti znanja i stavove plivača i njihovih trenera o prehrani i dopingu. Dodatno, definirane su povezanosti između sociodemografskih- sportskih- prehrambenih,- i doping-faktora. Uzorak ispitanika sačinjavalo je 55 plivača (20,3±2,2 godine; 24 žene) i 22 trenera (36,5±7,8 godina; 4 žene). U prvoj fazi istraživanja validiran je specifični upitnik za procjenu znanja o sportskoj prehrani (SP) i dopingu (DOP). Test retest korelacija i postotak jednako odgovorenih pitanja ukazali su da su oba upitnika pouzdana. Treneri su postigli bolje rezultate na oba upitnika, čime je utvrđena diskriminativna valjanost upitnika. Sportaši su iskazali da su im treneri osnovni izvor informacija o dopingu i prehrani. Godine starosti negativno, formalna edukacija pozitivno koreliraju s DOP i SP kod trenera. Zaključno, preporučuju se permanentni edukacijski programi o problemima dopinga i sportske prehrane, a posebno pažnju treba posvetiti starijim trenerima i mlađim sportašima.