

Predictors of Fitness Status on Success in Taekwondo

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ABSTRACT

The aim of this research was to determine the order and importance of particular fitness status variables impact on success in taekwondo according to opinions of top taekwondo instructors (experts). Partial objectives included analysis of metric characteristics of the measuring instrument, and determining differences between two disciplines (sparring and technical discipline of patterns) and two competition systems (WTF and ITF). In accordance with the aims, the research was conducted on a subject sample which consisted of 730 taekwondo instructors from 6 continents and from 69 countries (from which we selected 242 instructors), who are at different success levels in both taekwondo competition systems (styles) and two taekwondo disciplines. The respondents were divided into 3 qualitative subsamples using a dependent variable of the instructor's accomplished results. In 6 languages, they electronically evaluated, in percentage value (%), the impact of 8 motor and functional abilities: specific strength (STR), flexibility (FLX), specific endurance (END), speed (SPE), balance (BAL), coordination (COO), agility (AGI) and accuracy (ACC). The analysis of metric characteristics of the constructed instrument showed a satisfactory degree of agreement (Iir) which is proportional to the level of respondent quality, i.e. it grows along with the increase in instructor quality in all analyzed disciplines of both systems. According to the obtained results, speed and specific endurance were ranked as the abilities which are most important for success in the sparring discipline in both competition systems (WTF and ITF), whose instructors also expressed a higher level of agreement in relation of speed and success in the technical disciplines.

Key words: expert system, motor and functional abilities, efficiency

Introduction

Taekwondo (TKD) can be described as a high-intensity martial art and modern Olympic sport, in which the aim is to defeat the opponent using quick and precise kicks¹. During the last century, taekwondo in its present form has expanded worldwide, and today, it is practiced by over 60 million people in 6 continents, in 205 countries around the world. Two competition systems exist in taekwondo (WTF and ITF). In both systems, sparring occurs between two opponents on an identical mat, with more or less similar duration and time for rest between rounds. The fighters are divided into weight categories, and awarded points are scored according to a similar principle. It is clear that the differences in protective equipment worn by WTF (trunk protector) and ITF contestants (gloves and kick shoes), as well as the permitted

light contact punch to the head in ITF competitions, do not have a crucial impact in relation to all other previously stated similarities between the two competition systems. In both competition systems (WTF and ITF) competition is organized in both technical disciplines and sparring. In terms of the number of participants and the media interest, the Olympic sparring is definitely the most popular of the 4 disciplines, and therefore the most challenging in terms of achieving top results. Sport success generally depends upon the characteristics and the level of different anthropological characteristics of athletes. The higher the complexity of a sport's structure, the higher the number of different characteristics which significantly influence success in that sport. Identification of important anthropological characteristics, as well

as partial significance of each segment for sport success is one of the basic problems of kinesiology, as well as of the present study. There are three basic models of determining factors of sport success: a) the experimental model which entails testing elite athletes by a series of tests assessing different characteristics. The results obtained by the testing are then related to the efficiency of the tested athletes; b) Research of instructors' – coaches' opinions – as creators and direct applicants of training processes and activities c) Research of athletes' opinions – as participants of activities and training processes. All the models mentioned have both advantages and disadvantages², and should have very similar or the same results. The majority of previous research studies dealing with these issues in sport in general, including taekwondo, used the first model³⁻⁶. Studies using the second model⁷⁻⁹ are very rare, whereas the number of studies using the third model is negligible – according to the available data there has been no such study in taekwondo. Based on the first group of studies, which tested taekwondo athletes of different quality, it can be concluded that taekwondo fits the category of complex sports disciplines because a great number of different abilities and characteristics significantly affects competitive success^{5,10}. The volume and intensity of the taekwondo combat (3 round of 2 minutes effective fighting time, plus, in case of a tie mandatory 4. round which ends when one of the fighters make a golden score) classifies taekwondo as an anaerobic-aerobic sport^{6,11}. The dominant taekwondo athlete somatotype is proportionally built, with well-developed muscles and skeleton, as well as a low percentage of subcutaneous adipose tissue¹². In the second research category, only a study performed by Čular et al. (2013)² can be singled out. The authors surveyed a relatively large subject sample – taekwondo experts, and based on their responses, established the order and significance of particular anthropological characteristics' impact on taekwondo success in both competition systems (WTF and ITF) and disciplines (sparring and discipline of patterns). Top experts assigned the greatest portion of impact on success to the variable of motor-functional abilities. There were no statistically significant differences in the opinions of coaches of different styles and disciplines in any variable analyzed, except in the variable of athletes' psychological profile which showed to be more important in sparring than in technical disciplines of patterns. The present study builds on the results of the aforementioned study because it attempts to determine the order and importance of particular fitness status variables for success in taekwondo on the same subject sample.

Therefore, the main or global aim of this research is to determine the order and importance of impact of particular fitness status variables on success in taekwondo according to the opinions of top taekwondo instructors (experts). Partial objectives refer to determining metric characteristics as well as differences between the two disciplines (sparring and technical discipline of patterns) and two competition systems (WTF and ITF) in the analyzed variables.

Methods

Subject sample

For the purposes of this study, out of the overall 730 subjects testes, from 6 continents and 69 countries, 242 coaches and national team managers of various levels of education and competitive success, of two taekwondo disciplines (sparring and technical discipline of patterns) and from both taekwondo competition systems currently in place on the international level (WTF and ITF) were selected. The subjects were 1 to 9 DAN black belt holders who have been practicing taekwondo as instructors or national team coaches for averagely 8.6 to 12.4 years. The choice of instructors for the purposes of this study was made according to very strict criteria which required a correctly filled-out questionnaire and a precise identification via IP address and personal information (name, surname, address and e-mail address).

A division of respondents into 3 qualitative subsamples according to particular style (WTF and ITF) and discipline (SPB – sparring and THN – technical discipline of patterns) was set out: 1st (VRH) – a subsample comprised of elite instructors awarded medals at continental and world championships and the Olympic Games; 2nd (USP) – a subsample comprised of successful instructors awarded medals at national championships and international competitions; 3rd (OST) – a subsample comprised of the rest of the instructors, who have had no competitive success or have achieved results in local competitions.

Variable sample

Although subjects were interviewed using a long questionnaire, in this paper we have analyzed only the responses on physical fitness capacities potentially related to taekwondo performance. Coaches were asked to rank the importance of eight predictors: taekwondo specific strength (STR), flexibility (FLX), specific endurance (END), speed (SPE), balance (BAL), coordination (COO), agility (AGI) and accuracy (ACC)

Procedure

For the purposes of this study, a measuring instrument-questionnaire was created for the identification of respondents (instructors) and the evaluation of the impact of some physical fitness capacities on success in taekwondo (the sum total of all 8 fields had to be 100%). The process of filling out the questionnaire was conducted electronically (over the Internet), in 6 world languages (English, German, Russian, French and Croatian). The questionnaire was hosted on a specialized server which enabled access control by password and automatic respondent identification when filling out the questionnaire from a particular computer defined by an IP address and personal information. The respondents received personal invitations to participate in the research via e-mail (through national taekwondo associations and clubs), along with explanatory information and a link to access the survey.

Data analysis

All variables applied were subjected to standard descriptive processes for determining basic statistical parameters. Metric characteristics of the questionnaire's variables were determined for each subsample and separate variable group by calculating: sensitivity – Kolmogorov-Smirnov test (KS), objectivity – Cronbach's alpha coefficient (α) and degree of agreement among the respondents – inter-item correlation (Iir). For the purposes of determining the differences between styles (WTF-ITF) and disciplines (SPB-THN) with regard to opinions about the impact of anthropological characteristics on success in taekwondo, the method of univariate analysis of variance (ANOVA) was used. A level of significance of 95% was applied.

The subsample of respondents of the highest available quality based on the criterion variable of the highest instructor achievement was used as representative of each discipline in a particular style for the creation of an expert model of the impact of certain variables on the rate of success in taekwondo.

Results and Discussion

Table 1 shows that the investigation included the total of 40 national team coaches or 17% of the selected coaches, as opposed to the 83.5% of the club coaches. It can also be noticed that the study included 36 elite coaches who won medals in continental, world championships and the Olympic Games (WTF N=12, ITF N=24), which makes 15% of the overall sample. It is a relatively large number of elite experts which surely adds significant quality to this research.

The values of the Cronbach's alpha coefficient ($\hat{\alpha}$) in all the analyzed subsamples of variables of physical fitness capacities, except in the subsample of coaches with the lowest quality level of technical disciplines of patterns, ranged above the acceptable level which is 0.70¹³. The highest level of agreement in the opinions about the order and importance of fitness status variables impact on taekwondo success was found in »elite« coaches (from 0.40 to 0.60), whereas the lowest values were recorded in the subsample of the coaches with no results (OST). The shown indicators of metric characteristics of the created measuring instrument point to the existence of a satisfactory connection between opinions of instructors belonging to high-quality subsamples. The values of the Kolmogorov-Smirnov test for all the variables and subsamples were within the D-max limit value, confirming the satisfactory sensitivity of the questionnaire used. The values obtained showed no statistically significant deviations from normal distribution, which is why the parametrical method of variance analysis (ANOVA) could be used for analyzing the differences.

Table 3 shows different analysis of differences (ANOVA) combinations in the applied variables, between the two styles (WTF and ITF) and the two disciplines (fight and pattern), on a sample of elite coaches. The results con-

firm that there were no statistically significant differences in the opinions between elite coaches of WTF and ITF competition system about the order and importance of the fitness status variables on success in the sparring discipline. However, by comparing the same subject sample in the technical discipline of patterns, a statistically significant difference was found in the coordination variable, which, according to the WTF coaches' opinion as opposed to the ITF coaches' opinion, is much more important for success (WTF=19.9%, ITF=10.3 %). By analyzing the differences between the two disciplines within the same style, significantly higher numerical values of F-test for the applied variables were noticed. Statistically significant differences between the disciplines of sparring and patterns in elite experts of the WTF style were found in 5 of the applied variables. According to the respondents' opinion, variables of agility and specific endurance have a significantly higher influence on success in the sparring discipline in relation to the technical discipline of patterns. On the other hand, achieving success in the discipline of patterns, in relation to the sparring, is significantly more affected by variables of balance, coordination and accuracy. Based on the analysis of differences in ITF experts' responses between the two disciplines, a significant difference can be noticed in the specific endurance variable. This variable, according to the ITF experts' opinion, has a significantly higher influence on success in sparring than in technical patterns.

As can be noticed, the research plan called for the creation of a total of 12 subsamples (3 per each style and discipline), but after analyzing the obtained data, we managed to create a total of 11 subsamples (5 WTF 5 and 6 ITF subsamples). The reason for not creating a subsample of top WTF instructors of the technical discipline of patterns lies in the fact that the authors were not able to identify, within the sample, a number of top instructors for the aforementioned speciality which would be sufficient for statistical processing and obtaining interpretable results. Seeing that the WTF sparring discipline is an Olympic discipline, we can presume that most Olympic style instructors would consider it primary. For this reason, the instructors who were technically obliged to choose a discipline in the electronic questionnaire opted for sparring although they instruct and achieve results in the technical discipline of patterns. Since there was a relatively high degree of agreement within the subsample of successful WTF instructors (USP) in the technical discipline of patterns, (Iir=0.44), this group was used in further analyses as the sample of highest quality.

The obtained results of metric characteristics of the newly constructed questionnaire suggest that numerical values of the respondents' – coaches' objectivity (Cronbach's α), as well as the level of agreement between them (inter-item correlation) differed significantly with regard to the respondents', i.e. coaches' quality level. In other words, the higher the quality of the coaches, the higher the congruence of their responses, with slight divergence in responses – results. Therefore, the authors believe

TABLE 1
FREQUENCY OF RESPONDENTS (COACH) BY COACHING STATUS (CLUB COACH / NATIONAL TEAM COACH)

N=242			N	KLT	KLT %	TNR	TNR %
WTF N= 142	OST	SPB	48	44	18.2%	4	2.0%
	N=65	THN	17	13	5.4%	4	2.0%
	USP	SPB	52	49	20.2%	3	1.0%
	N=65	THN	13	13	5.4%	/	/
	VRH	SPB	12	5	2.1%	7	3.0%
	N=12	THN	/	/	/	/	/
UKU			142	124	51.2 %	18	8.0 %
ITF= 100	OST	SPB	21	15	6.2%	6	2.0%
	N=35	THN	14	9	3.7%	5	2.0%
	USP	SPB	27	23	9.5%	4	2.0%
	N=41	THN	14	14	5.8%	/	0.0%
	VRH	SPB	13	10	4.1%	3	1.0%
	N=24	THN	11	7	2.9%	4	2.0%
UKU			100	78	32.2 %	22	9.0 %
SVUK			242	202	83.5 %	40	17.0 %

N = number of participants, KLT – club coach; KLT % – percentage of club coaches, TNR – national team coach, TNR % – percentage of national team coach, WTF – World taekwondo federation, ITF – international taekwondo federation, OST – other instructors, USP – successful instructors, VRH – elite instructors, SPB – sparring, THN – technique, UKU – in total, SVUK – altogether

TABLE 2
METRIC CHARACTERISTICS OF THE QUESTIONNAIRE FOR THE ESTIMATE OF THE ORDER AND IMPORTANCE OF IMPACT OF MOTOR AND FUNCTIONAL SKILLS ON SUCCES IN TAEKWONDO

WTF (N=142)								
Instructors	SPB (N=112)				THN (N=30)			
	Iir	α	K-S	D- max	Iir	α	K-S	D- max
OST	0.36	0.93	0.16-0.19	0.19	0.16	0.62	0.19-0.30	0.31
USP	0.37	0.94	0.16-0.19	0.19	0.44	0.76	0.23-0.35	0.36
VRH	0.60	0.90	0.16-0.36	0.37	/	/	/	/
ITF (N=100)								
Instructors	SPB (N=61)				THN (N=39)			
	Iir	α	K-S	D-max	Iir	α	K-S	D max
OST	0.12	0.71	0.19-0.28	0.29	0.03	0.26	0.21-0.34	0.35
USP	0.24	0.84	0.20-0.24	0.25	0.34	0.84	0.19-0.30	0.35
VRH	0.47	0.87	0.16-0.30	0.36	0.40	0.85	0.20-0.38	0.39

Iir – inter-item correlation, α – Cronbach's alfa, WTF – World Taekwondo Federation, ITF – International Taekwondo Federation, SPB – sparring, THN – technique, OST – other instructors, USP – successful instructors, VRH – elite instructors, K-S – value of the Kolmogorov-Smirnov test for the estimate of normal distribution, D-Max – maximum deviation of relative empirical cumulative distribution from relative cumulative Gaussian distribution with regard to the number of respondents

that in this type of research it is justified to test only the sample of elite coaches because in that case, the obtained results will be reliable – objective, and therefore relevant for drawing conclusions about the order and importance of particular parameters for sport success. The comparison of the metric characteristics results obtained in this

study and those obtained in some previous studies must be discussed cautiously, given that studies have differed in terms of number and variety of the factors (predictors) included which affect athletes' success in a sport. Some authors studied the influence of hereditary components on sport success¹⁴, as opposed to, for example, Reagner et al.

TABLE 3
UNIVARIANTE ANALYSIS OF VARIANCE (ANOVA) RESULTS

	$\bar{X} \pm SD$	$\bar{X} \pm SD$	F-test	p
	WTF-SPB-VRH	ITF-SPB-VRH		
STR	9.6 ± 5.8	10.8 ± 6.1	0.25	0.62
FLX	11.2 ± 6.1	12.3 ± 5.2	0.22	0.65
END	16.7 ± 6.1	16.5 ± 5.9	0.00	0.96
SPE	24.2 ± 9.2	22.1 ± 5.3	0.45	0.51
BAL	6,7 ± 3.2	8.6 ± 4.8	1.38	0.25
COO	11.2 ± 3.8	11.2 ± 6.5	0.00	0.96
AGI	12.9 ± 4.0	10.8 ± 7.0	0.86	0.36
ACC	7.5 ± 4.0	7.7 ± 3.9	0.01	0.90
	WTF-SPB-VRH	WTF-THN-USP	F-test	p
STR	9.6 ± 5.8	10.0 ± 4.6	0.0	0.84
FLX	11.2 ± 6.1	10.0 ± 5.0	0.3	0.58
END	16.7 ± 6.1	8.8 ± 4.2	14.1	0.00*
SPE	24.2 ± 9.2	16.2 ± 11.2	3.8	0.06
BAL	6,7 ± 3.2	13.1 ± 6.0	10.8	0.00*
COO	11.2 ± 3.8	19.9 ± 10.2	7.7	0.01*
AGI	12.9 ± 4.0	7.7 ± 3.3	12.9	0.00*
ACC	7.5 ± 4.0	14.3 ± 6.2	10.4	0.00*
	ITF-SPB-VRH	ITF-THN-VRH	F-test	p
STR	10.8 ± 6.1	14.1 ± 5.4	1.97	0.17
FLX	12.3 ± 5.2	13.6 ± 3.9	0.48	0.50
END	16.5 ± 5.9	10.5 ± 4.7	7.56	0.01*
SPE	22.1 ± 5.3	21.4 ± 7.1	0.10	0.76
BAL	8.6 ± 4.8	11.8 ± 4.6	2.73	0.11
COO	11.2 ± 6.5	10.3 ± 3.6	0.16	0.69
AGI	10.8 ± 7.0	8.0 ± 3.3	1.43	0.24
ACC	7.7 ± 3.9	10.4 ± 5.2	2.05	0.17
	WTF-THN-USP	ITF-THN-VRH	F-test	p
STR	10.0 ± 4.6	14.1 ± 5.4	4.1	0.06
FLX	10.0 ± 5.0	13.6 ± 3.9	3.8	0.06
END	8.8 ± 4.2	10.5 ± 4.7	0.8	0.38
SPE	16.2 ± 11.2	21.4 ± 7.1	1.8	0.20
BAL	13.1 ± 6.0	11.8 ± 4.6	0.3	0.57
COO	19.9 ± 10.2	10.3 ± 3.6	8.9	0.01*
AGI	7.7 ± 3.3	8.0 ± 3.3	0.1	0.82
ACC	14.3 ± 6.2	10.4 ± 5.2	2.8	0.11

specific strength (STR), flexibility (FLX), specific endurance (END), speed (SPE), balance (BAL), coordination (COO), agility (AGI), precision (ACC)., WTF – WTF competition system; ITF – ITF competition system, THN – technical disciplines of patterns, USP – successful instructors, VRH – elite instructors, F-test – analysis of variance, p – significance level

(1993)¹⁵ who presented a model which proves the existence of a hierarchical structure of predictive factors. Some of them are stable and independent (e.g., height), while others are less stable (e.g., speed), and there is also a group of unstable and dependent factors such as motivation. On three occasions, Van Rossum et al. (1994¹⁶ & 1996¹⁷) and Krstulović & Sekulić (2013)⁹ applied studies which are in their structure most similar to the present study. The authors of all three studies mentioned asked the respondents – experts only to rank the characteristics important for sport success without determining the importance of each characteristic. In this way, the results were presented as ranks, and the level of concordance between the responses was calculated by a nonparametric method of Kendall Tau coefficient. Kendall's coefficient of concordance between the coaches ranged between 0.36¹⁶ and 0.56⁹. Since the results obtained in this research and shown in Table 2 do not present significant statistical deviations from the Gaussian distribution in any of the variables or subsamples on a significance level of $p < 0.05$, a Cronbach's alpha coefficient calculation was applied for the calculation of the measuring instrument objectivity, whereas the inter-item correlation (Iir) calculation method was used to measure the degree of agreement between respondents within a particular qualitative subsample. However, unlike all other aforementioned research projects, this research was conducted on a higher global level (in six languages) and it included as many as 730 taekwondo instructors from 6 continents and from 69 countries (from which the authors selected 242 instructors), who are at different success levels in both taekwondo competition systems (styles) and two taekwondo disciplines. All respondents filled out their surveys individually. Therefore, they could in no way influence the opinions of other instructors and the »halo effect« was prevented, as well as the electronic possibility of preventing errors when filling out the survey (the sum of percentages of all fitness status variables had to be 100%) were a prerequisite for realizing the idea of using respondents as measuring instruments and for the purpose of achieving the goals of this research.

By comparing the metric characteristics results of the first part of the questionnaire in which the influence of general anthropometric characteristics on taekwondo success was analysed² with the second part of the questionnaire applied in this study, one can notice somewhat lower results of the Cronbach's alpha coefficient and inter-item correlation (Iir). Such results were expected because the second part of the questionnaire consisted of 8 variables of fitness status, as opposed to the 5 variables used in the study by Čular et al. (2013)², so it was much harder for the respondents to rank and assign more precisely the size of impact to each individual variable.

Elite coaches of sparring in both competition systems (WTF and ITF), assigned the highest proportion of the impact on success to the variables of speed (WTF-SPB-SPE=24.2% versus ITF-SPB-SPE=22.2%) and endurance (WTF-SPB-END=16.7%, versus ITF-SPB-END=16.5%). Such opinions were expected in accordance with previous

experimental studies which confirmed the importance of the mentioned abilities⁶. It is interesting to compare and note that in karate, which is similar to taekwondo in many aspects, speed, along with explosive power, is precisely what differentiates successful and less successful fighters as well¹⁸⁻²². Agility (AGI), flexibility (FLX), specific strength (STR) and coordination (COO) were ranked in the middle of the impact importance scale, whereas the coaches assigned the smallest impact and importance to accuracy (ACC) and balance (BAL). By analysing the results of the order and the importance of the fitness status variables' impact on success in technical disciplines of patterns, extremely small differences in the importance of the fitness status variables are observed. Namely, the variable which is most important for success in technical disciplines of patterns (coordination for WTF, i.e., speed for ITF) is about 13% more important than the least important ability (agility) for success in the same discipline. Furthermore, 6 abilities of the fitness status, according to the ITF coaches' opinion, fall within only 4% of importance for success in the observed discipline (STR=14.1%, FLX=13.6%, BAL=11.8%, END=10.5%, ACC=10.4%, COO=10.3%). The results obtained confirm once more the conclusions of a series of studies^{4,5,23}, which established a correlation of success with a combination of numerous factors. From the results of univariate analyses of differences (ANOVA, shown in Table 3, the greatest differences in the opinions can be seen between coaches representing the WTF style of the sparring discipline (WTF-SPB-VRH) and coaches representing the technical discipline of patterns (WTF-THN-USP). The WTF style coaches think that specific taekwondo endurance (END=16.7%) and agility (AGI=12.9%) have a significantly greater impact on success in sparring than on success in technical discipline of patterns. Such a result was expected and logical regarding the characteristics of the sparring discipline and the specificity of the competition system. This was also confirmed by Pieter et al. (1990)³ in their study which analysed 4 subject groups, two of which performed the initial two taekwondo patterns, as opposed to the two groups which performed fighting combinations. During the performance of the activities, statistically significant differences were found in pulse values between the groups which performed patterns (80% Max HR) and fighting combinations (90-91% Max HR). The discipline of sparring as a complex activity has in its structure a greater number of quick changes of movement direction than the technical discipline of patterns. In such conditions agility fully comes to the fore and it is therefore not surprising that the WTF coaches of the sparring discipline considered agility to have a greater impact of success in their discipline as compared to the coaches of the technical discipline of patterns. On the other hand, the coaches of the technical discipline of patterns (WTF-THN-USP) considered balance (BAL=13.1%), coordination (COO=19.9%) and accuracy (ACC=14.3%) to be significantly more important for success in their discipline as opposed to sparring. The technical discipline of sparring belongs to the area of esthetic movement, and it can be defined as choreographed fights

against an imaginary opponent, which are performed by a competitor alone, and which have been created with the purpose of developing motor-functional abilities and improving basic taekwondo techniques. A sports discipline, i.e. a system of competition in which performance of certain techniques following a standardized pattern is evaluated has only recently developed from the training operator of performing patterns. Referees in a competition therefore evaluate: balance, breathing, coordination, motion radius and order, speed, power, accuracy, rhythm, general impression, etc. It can be assumed that the abilities of balance, coordination and accuracy are more emphasized in performing technical forms, i.e., are visually more noticeable than, for example, the abilities of strength or endurance. Namely, it is known that referees evaluate, primarily based on visual impressions^{24,25}, the level and quality of performing patterns, which affects the result of every competitor, which was in this case recognized and valorized by the experts.

Conclusion

The analysis of metric characteristics of the constructed instrument showed a satisfactory objectiveness and degree of agreement (Iir) which is proportional to the level of respondent quality, i.e. it grows with the increase of instructor quality in all analyzed disciplines of both systems. Therefore, it might be concluded that in this type of research it is not necessary (as in most other

studies) to have a large subject sample, it is rather more important to include top experts from the analyzed field. Significant differences were obtained in the order and importance of fitness status variables on success in taekwondo with regard to the style (WTF and ITF) and the discipline (sparring and technical patterns). According to the obtained results, speed and specific endurance were ranked as the abilities which are most important for success in the sparring discipline in both competition systems (WTF and ITF). The results obtained are for the most part congruent with previous findings obtained by testing elite taekwondo fighters. Finally, the results obtained and the conclusions drawn definitely do not present a final solution to the problem of evaluating the impact of different factors on success in taekwondo. However, they should be accepted primarily as a starting point with a scientific foundation of good quality for future empirical research. Future research should determine the order and importance of anthropological characteristics' impact on taekwondo success in women and, in doing so, differentiate the weight categories fighters compete in.

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PREDIKTORI FIZIČKE SPREME NA USPJEH U TAEKWONDYOU

SAŽETAK

Cilj provedenog istraživanja je utvrđivanje redosljeda te važnosti utjecaja pojedinih motoričko-funkcionalnih sposobnosti na uspješnost u taekwondo sportu prema stavovima vrhunskih taekwondo trenera (eksperata). Parcijalni ciljevi obuhvaćaju provjeru metrijskih karakteristika mjernog instrumenta i utvrđivanje razlika između dvaju disciplina (sportske borbe i tehničke discipline izvođenja formi) i dvaju sustava natjecanja (WTF i ITF). U skladu s ciljevima istraživanje je provedeno na uzorku od 730 ispitanika taekwondo trenera sa 6 kontinenata iz 69 država, različite razine rezultatskog uspjeha obaju taekwondo sistema (stilova) natjecanja i dviju taekwondo disciplina. Ispitanici, kriterijskom varijablom postignutog trenerskog rezultata, podijeljeni u 3 kvalitativna subuzorka (OST-USP-VRH) su na 6 svjetskih jezika elektroničkim putem vrednovali postotni (%) utjecaj specifične taekwondo snage (STR), fleksibilnosti (FLX), specifične taekwondo izdržljivosti (END), brzine (SPE), ravnoteže (BAL), koordinacije (COO), agilnosti (AGI) i preciznosti (ACC) na uspješnost u taekwondou. Analiza metrijskih karakteristika konstruiranog instrumenta pokazala je zadovoljavajući stupanj slaganja (IIR) proporcionalan razini kvalitete ispitanika, odnosno isti raste sa porastom kvalitete trenera u svim analiziranim disciplinama obaju sustava natjecanja. Prema dobivenim rezultatima brzina i specifična taekwondo izdržljivost su od strane eksperata rangirane kao najvažnije sposobnosti za uspjeh u disciplini sportske borbe u oba sustava natjecanja (WTF i ITF), a eksperti su također pokazali visok stupanj slaganja o utjecaju brzine na uspješnost u tehničkoj disciplini izvođenja formi.