MORPHOLOGICAL DIFFERENCES OF YOUNG KICK-BOXER CATEGORIES BASED ON RESULTS SUCCESFULNESS

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Abstract

The research has been conducted on 69 junior (18-20) and senior (21 and above) kick boxers from Vojvodina. They are classified according to achieved sporting results into four (4) categories: : I category – athletes who achieved the best results by winning one of the medals at the World or European championship, II category – athletes who won medals at the international tournaments (competitions), III category - athletes who achieved results by winning one of the medals at the national championship, IV category – athletes who did not achieve any significant results. Discriminant analysis provides three discriminant functions. The first discriminant function separates the fourth category (unsuccessful athletes) from other three, especially from the first and second category (the most successful athletes). The second discriminant function dominantly separates those who are exceptionally successful (I category) at the international level from those who are "almost there". The third discriminant function dominantly separates locally successful athletes (III category) from those who are internationally successful (II category). The results of discriminant analysis show the features of analyzed categories in morphological domain in a way that in order to achieve the best result in kickboxing, selection and training should be directed in a way that an athlete should have harmonious morphological structure.

Key words: *kick-boxing, morphology, successfulness*

Introduction

Man is a complex being and lives in such environment. In order to study humans, scientists divided them, according to some logic, on virtual "systems" consisting of interconnected segments that are explored by different sciences. But in the end, all these systems function as a whole – individual entity. The environment in which man lives is divided according to the significance for society, institutions and for entity itself on the basis of some pre-established rules and specific relations. Engaging in sports is one way of making relations and in order to study these relations we also have to study specific systems, primarily, morphological system or physical features of a man. The term morphological dimensions usually implies a system of basic anthropological latent dimensions responsible for all other measurable morphological manifestations. Although there were different models, nowadays this is usually observed on the basis of mathematical models, specifically via longitudinal and transversal dimension, body weight and voluminosity, and subcutaneous adipose tissue (Bonacin, Bilić & Bonacin, 2008). Furthermore, every sport has its own rules and requires the athletes to have certain specific characteristics, for instance, weight dominates in sumo wrestling, while height dominates in basketball and volleyball etc. For modern man, martial arts represent legal and humane form of martial competition, with restrictions that change the real fight between two men into symbolic destruction of opponents (Ćirković & Jovanović, 1992).

Kickboxing belongs to group of acyclic polistructural sports, in which acyclic unpredictable movements are dominant. The result represents a binary variable (win-lose), with the purpose to avoid as many hits as possible and to deliver as many hits as possible with hands and legs. The work takes place in an anaerobic/aerobic mode with submaximal and/or maximal intensity." It is interesting to explore how much influence morphological features have on athlete's success in order to adequately adapt oneself to the training process.

Problem and aim

The topic of this paper is kickboxing athletes and their selected morphological features and who are classified according to achieved results into four categories: *I category* – athletes who achieved the best results by winning one of the *medals* at the World or European championship, *II category* – athletes who won medals at the international tournaments (competitions), *III category* - athletes who achieved results by winning one of the medals at the national championship, *IV category* – athletes who did not achieve any significant results.

The problem the paper is addressing is to determine morphological differences among athletes that belong to defined categories of kickboxing in order to recognize potential influence of these morphological differences on sporting success of athletes.

Methods

The sample is composed of selected kickboxing athletes from Vojvodina, cadet and junior age (age 18 and older, N=69), who are the best young kick boxers in Serbia. The athletes are standard representatives of Serbia in kickboxing and participants at the European and World championship and also multiple winners of the World and European medals. A good medical history, continuous training kickboxing six months to a year, and participation at national championships (at least), were precondition for engagement in the sample.

Sample variables for assessment of morphological status include: *longitudinal dimensions* (body height – BODHEI, leg length – LEGLEN, arm length – ARMLEN), *transversal dimensions* (shoulder width – SHOWID, pelvic width – PELVID, knee diameter – KNEDIA), *weight and voluminosity* (average chest circumference – AVCHCI, body weight – BODWEI) and *subcutaneous adipose tissue* (forearm skin fold – FARSFO, back skin fold – BACSFO, abdominal skin fold – ABDSFO). A multivariate discriminant analysis was conducted within morphological dimensions in order to achieve the goal.

Results and discussion

Table 1 Basic morphological parameters

	X	SE	Med	Mod	SD	Skew	Kurtosis	Rang	Min	Max
TELVIS	178.67	0.93	178.80	168.00	7.74	-0.32	-0.35	34.50	159.00	193.50
DUŽNOG	93.77	0.60	93.60	91.80	5.01	-0.46	0.91	25.80	77.70	103.50
DUŽRUK	70.48	0.41	70.25	70.25	3.44	-0.43	0.33	16.00	60.40	76.40
ŠIRRAM	41.69	0.35	41.80	44.30	2.92	-0.63	-0.35	11.70	34.20	45.90
ŠIRKAR	30.75	0.30	30.90	32.90	2.49	-0.36	-0.61	10.40	25.10	35.50
DJMKOL	10.60	0.10	10.50	10.00	0.84	0.36	-0.58	3.30	9.00	12.30
SOBGRK	99.07	1.24	100.00	98.00	10.29	-0.35	-0.58	41.80	74.20	116.00
TELMAS	78.58	1.71	78.40	75.00	14.23	-0.02	-0.27	67.10	47.30	114.40
KNAPOD	8.84	0.81	7.20	6.80	6.76	5.86	41.85	54.00	4.00	58.00
KNALEĐ	18.16	1.40	14.60	11.40	11.60	4.05	23.89	85.40	6.60	92.00
KNATRB	22.99	1.53	21.70	7.20	12.73	0.87	0.41	51.00	5.80	56.80

Table 2 Correlation of morphological variables

	tv	dr	dn	sr	sk	dk	sog	tm	knp	knl	knt
tv	1	,867**	,838**	,657**	,543**	,437**	,614**	,726**	-,267*	-,079	,283*
dr	,867**	1	,736**	,468**	,427**	,373**	,489**	,580**	-,304*	-,144	,240*
dn	,838**	,736**	1	,530**	,478**	,295*	,400**	,536**	-,292*	-,152	,197
sr	,657**	,468**	,530**	1	,686**	,457**	,849**	,763**	-,218	,061	,394**
sk	,543**	,427**	,478**	,686**	1	,560**	,719**	,818**	,020	,260*	,638**
dk	,437**	,373**	,295*	,457**	,560**	1	,607**	,740**	,017	,166	,608**
sog	,614**	,489**	,400**	,849**	,719**	,607**	1	,867**	-,149	,190	,516**
tm	,726**	,580**	,536**	,763**	,818**	,740**	,867**	1	-,091	,211	,677**
knp	-,267*	-,304*	-,292*	-,218	,020	,017	-,149	-,091	1	,873**	,184
knl	-,079	-,144	-,152	,061	,260*	,166	,190	,211	,873**	1	,404**
knt	,283*	,240*	,197	,394**	,638**	,608**	,516**	,677**	,184	,404**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Testing for significance of differences in multivariate domain shows the situation which can certainly be called ambivalent. As it happens, according to "strict" and narrowly interpreted statistic rules for usual level of security reasoning (p=0.05) every probability value above the critical assumes the absence of differences in discriminant analysis (statistically speaking). However, the real question arises, not when the **p** is higher, but not much higher so that it leaves no doubt in the existence of significant differences, but when its amount is exactly around 0.06 as in this research, and the question is whether this difference should be taken into account and interpreted in light of the amount of information provided by analysis and not in light of narrow set of statistical parameters? With the acceptance of risk (which is in this case 0.01 i.e. difference from 0.06 to 0.05) that mistakes will be made, possibly in one out of 100 cases, author decided to accept multivariate differences as significant information. Considering that discriminant analysis can divide the group to a maximum number of groups – 1, results in this case provide three discriminant functions each having their own contribution in explaining the differences.

Table 3 Canonical correlation analysis

F	Eigen value	% of Variance	Cumulative %	Canonical Correlation
1	0.54	59.60	59.60	0.59
2	0.21	22.90	82.50	0.41
3	0.16	17.50	100.00	0.37

Table 4 Significance

F	Wilks' Lambda	Chi-square	df	Sig.
1	0.47	46.34	33	0.06

Table 5 Discriminant functions

	Function		
	1	2	3
KNAPOD	0.49	0.08	-0.12
KNALEĐ	0.32	0.07	-0.01
DUŽNOG	-0.27	0.59	0.25
DUŽRUK	-0.14	0.32	0.69
TELVIS	-0.24	0.51	0.59
TELMAS	-0.17	0.05	0.54
ŠIRRAM	-0.19	-0.08	0.49
ŠIRKAR	0.17	0.22	0.47
SOBGRK	0.00	0.00	0.41
DJMKOL	0.25	-0.13	0.37
KNATRB	0.04	-0.09	0.33
	Funkction		
Centroidi	1	2	3
I	-0.53	-0.94	-0.15
II	-0.58	0.42	-0.40
III	-0.27	0.14	0.59
IV	1.10	-0.01	-0.10

The first discriminant function separates the fourth category (unsuccessful athletes) from other three, especially from the first and second category (the most successful athletes). In the fourth category, the difference is reflected in a very distinct skin fold of the forearm and the back (adipose tissue). Other differences are not so distinct. This means that the amount of adipose tissue has a direct impact on the success of athletes and in that way is an obstacle to achieving the best results. This is because it represents "ballast" which slows the movements, obstructs coordinated performance, demands additional energy and is in general an obstacle to success. Based on the aforementioned facts, one can conclude that training process in kickboxing should be directed in a way that during the selection, transformation and competition, candidates, whose genetic predispositions ensure a lower level of adipose tissue from the beginning, should have an advantage. Although this can apparently be criticized because transformation process itself enables adipose tissue reduction, the fact is that the children who come from environment where deposition of fats is less excessive will be able to adapt more easily to very intensive kickboxing trainings. In case of older athletes there is no need to return to this problem; instead we should concentrate, in energy and nutritional sense, on harmonized composition of energy inputs and energy needed to perform the motion. The second discriminant function dominantly separates those who are exceptionally successful (I category) at the international level from those who are "almost there". The difference is reflected in distinct leg length, arm length and body height. Other differences are less distinct. This means that these values have a direct impact on the success of athletes and in that way is an obstacle to achieving the best results. It seems that a very tall person with very long arm and legs (longitude) will not achieve the best results in kickboxing. This means that primary thing in terms of providing maximum achievements important for kickboxing is the selection, especially in terms of longitudinal dimensions because they are highly genetically defined. The third discriminant function dominantly separates locally successful athletes (III category) from those who are internationally successful (II category). The difference is reflected in distinct arm length, body weight, shoulder width, pelvic width, average chest circumference, knee diameter, abdominal skin fold; to sum up, in variables which all together describe overall body weight. This means that in order to achieve the best results at the international level, especially when it comes to long-term trainings, overweight is not desirable.

Overweight requires more effort and energy accumulation, obstructs coordination and learning new movements etc. Training process should be directed to the development of flexibility and explosiveness and also the formation of elastic muscle spindles without overweight. The results of discriminant analysis show the features of analyzed categories in morphological domain. The basic feature of the fourth category i.e. unsuccessful athletes is subcutaneous adipose tissue which directly influences the result. The basic feature of the third category is the body weight which can be a factor in achieving good results at the local level, probably due to possibility of absorbing opponent's hits and also psychological effects, however, in order to achieve results at international level it is not enough. The basic features of the second category is that athletes do not have excessive subcutaneous adipose tissue or body weight which would obstruct their movements and this separates them from the third and fourth category. However, they have more distinct longitudinal dimensions than expected for the best result which mostly makes them internationally successful but not the best. Taking into account everything mentioned above, it can be concluded that the basic feature of top kick boxer is harmonious morphological structure. Furthermore, the results show profile differentiation of kick boxers within a sample.

Conclusion

The research has been conducted on 69 junior (18-20) and senior (21 and above) kick boxers from Vojvodina. They are classified according to achieved sporting results into four (4) categories: : *I category* – athletes who achieved the best results by winning one of the *medals* at the World or European championship, *II category* – athletes who won medals at the international tournaments (competitions), *III category* - athletes who achieved results by winning one of the medals at the national championship, *IV category* – athletes who did not achieve any significant results. Discriminant analysis provides three discriminant functions.

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MORFOLOŠKE RAZLIKE KOD MLADIH KICK-BOKSERA PO KATEGORIJAMA TEMELJENIM NA REZULTATSKOJ USPJEŠNOSTI

Sažetak

Provedeno je istraživanje na 69 juniora (18-20 g.) i seniora (21 i više g.) kick-boksra iz Vojvodine. Bili su klasificirani obzirom na postignuti Sportski rezultat u četiri kategorije: I kategorija – sportaši kojima je najbolji rezultat bilo osvajanje medalje na Svjetskom ili Europskom prvenstvu, II kategorija – sportaši koji su osvojili medalju na međunarodnom turniru; III kategorija – sportaši koji su postigli rezultat osvajajući medalju na državnom prvenstvu; IV kategorija – sportaši koji nisu ostvarili nikakv značajniji uspjeh. Diskriminativna analiza dala je tri diskriminativne funkcije, a ukupna značajnost bila je na samom pragu (p=0.06), što je prihvaćeno za uvjetnu interpretaciju. Prva funkcija dijeli IV kategoriju (neuspješni) od ostale tri posebno od prve i druge (jako uspješni). Druga dijeli dominantno one koji su izuzetno uspješni (I kategorija) od onih koji su "gotovo na vrhu" (II kategorija). Treća funkcija dijeli dominantno lokalno uspješne (III kategorija) od međunarodno dosta uspješnih (II kategorija). Rezultati pokazuju svojstva sportaša u morfološkom prostoru po analiziranim kategorijama na način da za postizanje vrhunskih rezultat u kick-boksingu, selekcija i trening trebaju biti usmjereni na traženje i postizanje harmonizirane morfološke strukture sportaša.

Ključne riječi: *kick-boksing, morfologija, uspješnost, harmoniziranost*

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