SOME RELATIONS BETWEEN BOXER'S COGNITIVE ABILITIES AND MORPHOLOGICAL CHARACTERISTICS

Stipe Blažević

Department of Kinesiology, Faculty of Economics, University of Rijeka, Croatia

Original scientific paper

Abstract

The aim of the research was, to apply system of 15 variables (3 cognitive ability variables and 12 morphological characteristic variables) on the sample of 92 boxers from Croatian boxing clubs in different weight categories and determine statistically significant relations between cognitive ability variable system and morphological characteristics variable system. Determining this relation is significant so we could form rational procedures for better sports orientation and selection, planning, programming and controlling transformational process of sportsman. Relation determination of two different multidimensional anthropologic manifest variable systems was carried out through appliance of canonical correlation analysis method. Based on gained results included in canonical structure matrix where we identify statistically significant correlations between first canonical factor and all applied cognitive variables in 88 to 89 spans which can be identified as general canonical factor of cognitive abilities. Span of correlation coefficients between first canonical factor and morphological characteristic variables moves from .21 to .77, so it can be identified as general canonical factor of growth and development. Relations between general canonical factor of cognitive abilities and general canonical factor of growth and development indicates that boxers of such sample with such statistically significant coefficients between two different sets can successfully achieve much better sport results in boxing.

Key words: boxers, cognitive abilities, morphological characteristics, relations

Introduction

People's ability to observe, understand, accept and reproduce some complex movement structures, primarily depends on their cognitive abilities. Cognitive processes and cognitive functioning are main mechanisms of cortical regulation. Central nervous system has primarily integrative function and enables rational and adaptable human behaviour. Integration on cortical level is the most important since rational behaviour is in direct relation with large brain cortex integrated function. The integration exists on sub cortical level, since it is less flexible and enables reaction when automatic reaction is necessary. In scientific literature it's well known that cognitive abilities are very important for every type of structure in daily life activities (Kirkendall & Gruber, 1970; Malacko & Popović, 2001). However, cognitive abilities are not decisive for success in some activity, but only in some indirect and direct relations with most of anthropological characteristics. The influence of cognitive regulation mechanisms on success in some sports activity reveals in different intensity, depend on type of mechanism and type of sports as well as other predictable and unpredictable situations and circumstances.

So the sports achievement is optimal regarding to cognitive ability, sports skills, movement structuring, anthropological segment and sportsman conditioning (Blažević, 2006). There is a large number of research about relations between cognitive dimensions and motor abilities (Blažević, 2007b), but not enough with morphological characteristics which are in statistically significant relations with motor and cognitive abilities. (Blažević, 2007a). It is revealed that cognitive mechanisms with morphological characteristics have positive impact on sport activity success, especially perceptive and special processors. Perception test was constructed with intention to measure perceptive ability that presents perceptive analysis ability synthesis, perceptive structuring and perceptive identification, and specialization was defined as ability to determine relations in space or to solve environment problems. Determining relations of cognitive abilities with other segments of anthropological sportsman status in certain sports currently represents very actual practical and theory issue very significant because of possibility to form the most rational procedures in sports technology and training. (Malacko & Rađo, 2004).

Bearing in mind that boxer in ring resolves many situations that require estimation, prediction and reaction to constant changes in situation it is assumed that analysis of relations between cognitive abilities and morphological capabilities can be one of important indicators of its anthropological status and mutual functioning (Savić, 1986).

The Aim

The aim of this research is to determine statistically significant relations between cognitive ability variable system and morphological characteristics variable system to form rational procedures for better sports orientation and selection, planning, programming of training activities as well as following and controlling transformational process of relevant anthropological characteristics of sportsman. The aim is to determine statistically significant relations between cognitive variable system and morphological variable system on top boxer's sample with intent to form rational procedures for more rational sports orientation, selection, planning and programming of training activities as well as following and controlling of relevant anthropological characteristic transformational processes.

Methods

On the sample of 92 boxers from Croatian boxing clubs in different weight categories, we applied system of 15 variables, 3 variables of cognitive abilities and 12 morphological characteristics variables. To estimate cognitive abilities from bank KOG 3 (Wolf, Momirović & Džamonja, 1992) the following variables were applied; 1. test IT – 1 to estimate perceptive processor efficacy 2. test AL-4 to estimate efficacy of serial processor and 3. test S-1 to estimate efficacy of parallel processor. For morphological characteristics estimation the following variables were applied: longitudinal skeleton dimensionality – 1. body height (AVISTEL), 2. leg length (ADUŽNOG) 3. arm length (ADUŽRUK), transversal skeleton dimensionality – 4. shoulder width (ABIKROM), 5. pelvic width (ABIKRIS), 6. wrist diameter (ADIJRUK), body mass and volume 7. body weight (ATEŽINA), 8. upper leg volume (AOBNATK), 9. upper leg volume in flexion (AOBNADF) and subcutaneous fatty tissue – 10. upper arm skin fold (NABNAD), 11. back skin fold (ANABLED) and 12. stomach skin fold (ANABTRB). Mentioned variables were measured applying method of International biological program (IBP), and their measuring reliability controlled by Stojanović, Solarić, Momirović and Vukosavljević (1975). For each variable applied, the following central and

dispersive parameters were calculated: arithmetic mean (M), minimal value (min), maximal value (max), standard deviation (S) and standard arithmetic mean error (Se). Normality of variable distribution was tested by skewnes (Sk) i kurtosis (Ku). During calculating relations between cognitive ability variable system and morphological variable system we applied canonical correlation analysis. Testing statistical significance of hypothesis about global connection between two different anthropological variable systems was conducted through λ - statistically significant specific roots, Rc – coefficient of canonical correlation of statistically significant canonical factor pairs, Rc2 canonical correlation squares, χ2 _ Bartlett's Hi – square test, and p – testing statistical significance on the level .05 to .00 (p = .05-.00).

Results

In table 1 we have results of central and dispersive statistical parameters of cognitive and morphological variables as well as their discrimination. With analyzing skewness (Sk) by bolding and star (*) marking many variables with normal (symmetric) distribution were specified which means result goes from 0 – 1.00 of standard deviation. Results from parameter of cognitive variables largely differ from normal distribution toward zone of upper values (negative asymmetry) perceptive processor efficacy (IT1), serial processor efficacy (AL4) and parallel processor efficacy (S1). That points out the fact that majority of boxers has well developed perceptive ability (fast in solving perceptive problems), then verbal understanding (fast in verbal understanding) and visual specialization (ability to notice relevant relations in space) which is extremely important in boxing. In this table is obvious that all applied morphological variables of dimensionality and body volume distribution normal (symmetric), because they don't exceed values bigger then 1.00 of standard deviation and variables of subcutaneous fatty tissue are abnormally distributed and their asymmetry goes in positive direction (2.91, 2.87, 3.18), which means that more examinees has less amount of fatty tissue. Other morphological variables have suitable discrimination which in this research is very important; considering that is research about their relations with cognitive variables. Analyzing matrix of cross correlation between cognitive variable system and morphological variable system (table 2), medium high and statistically significant correlations of variable pairs with all variables applied, except with variable wrist diameter (ADIJRUK) with efficacy variables of perceptive space (IT1) and parallel space efficacy variables (S1).

Table 1: Central and dispersive parameters of cognitive and morphological variables

Variable	M	min	max	S	Se	Sk	Ku
IT1	33.25	21.00	39.00	3.30	.34	-1.71	3.68
AL4	35.97	26.00	40.00	2.55	.26	-1.85	5.31
S1	22.11	13.00	28.00	3.03	.31	-1.12	1.93
AVISTEL	176.97	159.20	196.60	8.51	.88	.12*	-.47
ADUŽNOG	99.37	89.10	118.20	6.03	.62	.86*	.40
ADUŽRUK	78.05	68.30	91.40	5.70	.59	.35*	-.77
ABIKROM	42.81	36.10	55.10	5.04	.52	.90*	-.39
ABIKRIS	29.11	24.00	39.40	3.55	.37	.79*	.32
ADIJRUK	6.26	4.90	7.80	0.72	.07	-.03*	-.81
ATEŽINA	70.22	51.80	108.70	12.94	1.34	.80*	.24
AOBNATK	53.80	43.10	68.00	6.09	.63	-.01*	-.71
AOBNADF	34.18	29.20	43.10	3.09	.32	.61*	-.01
ANABNAD	4.90	3.00	17.00	2.70	.28	2.91	9.15
ANABLED	5.07	3.00	18.00	2.93	.30	2.87	8.76
ANABTRB	6.41	4.00	24.00	3.79	.39	3.18	10.68

Legend: M – arithmetic mean, min – minimal value, max – maximal value, S – standard deviation, Se – standard arithmetic mean error, Sk - skewnes, Ku – kurtosis

Table 2: Cross correlation of cognitive and morphological variables

Variable	IT-1	AL-4	S-1
AVISTEL	-.27**	-.37**	-.24*
ADUŽNOG	-.39**	-.46**	-.34**
ADUŽRUK	-.28**	-.37**	-.25*
ABIKROM	-.37**	-.43**	-.33**
ABIKRIS	-.41**	-.49**	-.37**
ADIJRUK	-.18	-.30**	-.18
ATEŽINA	-.41**	-.49**	-.37**
AOBNATK	-.24*	-.36**	-.22*
AOBNADF	-.29**	-.39**	-.24*
ANABNAD	-.59**	-.63**	-.55**
ANABLED	-.59**	-.63**	-.55**
ANABTRB	-.60**	-.63**	-.56**
Rc	Rc2	χ2	p
.76	.58	104.77	.00*
.45	.20	32.68	.06
.38	.14	13.28	.20

Legend: Rc – canonical correlation, Rc2 – canonical correlation square, χ2 - Bartlett Hi-square test, p – Statistical significance: ** P.01 = .254, * P.05 = .195

Table 3: Canonical structure of cognitive and morphological variables

Variable	Fc - 1
	Left set
IT-1	.99**
AL-4	.89**
S-1	.94**
	Right set
AVISTEL	-.32**
ADUŽNOG	-.48**
ADUŽRUK	-.34**
ABIKROM	-.46**
ABIKRIS	-.51**
ADIJRUK	-.21*
ATEŽINA	-.51**
AOBNATK	-.28**
AOBNADF	-.34**
ANABNAD	-.76**
ANABLED	-.75**
ANABTRB	-.77**

Legend: Fc - 1 = first canonical factor

During determining relations between cognitive variable and morphological variables applying Bartlett Hi-square test (χ2), the results are high canonical correlations only for the first (Rc=.76) canonical factor, that is statistically significant on the level .00 (p=.00) Solving characteristic equations of canonical correlation for the first factor (Rc2 = .58), that explain mutual variance of two set variables from total variability of analyzed variable systems. Based on gained results contained in canonical structure matrix of cognitive and morphological variables (table 3) we notice statistically significant correlations between first canonical factor (Fc-1) and all applied cognitive and morphological variables. Since applied system of cognitive variables points tight connection (IT1= .99, AL4=.89, S1=.94) with the first canonical factor, it can be interpreted as general canonical factor of cognitive abilities.

The span of correlation coefficients in morphological characteristics space goes from .21 -.77, which proves that we gained statistically significant correlations between all applied morphological variables and the first canonical factor. Regarding that structure of first canonical factor (Fc-1) is made of all applied morphological characteristic variables; it can be identified as general canonical factor of growth and development.

Relations between general canonical factor of cognitive abilities and canonical factor form morphological characteristic system variables, interpreted as general canonical factor of growth and development, points out those boxers of such type and such morphological characteristics can commonly and successfully contribute to achievement of satisfying results in boxing.

Discussion and conclusion

By testing normality of cognitive and morphological variable distribution with skewnes (Sk) and kurtosis (Ku) it is visible that in most variables distribution is normally arranged, which means that during measuring no bigger errors were made so the gained results can be accepted as reliable. With canonical relations interpretation among different anthropological areas the common rule was applied; linear value growth of canonical factor variable resulting vector from the first anthropological area matches to proportionally linear value growth of canonical factor variable vector from another anthropological area. Also the same rule applies during reverse direction of relations; linear reduction of result values in canonical factor of the first area matches to proportionally linear reduction of result values in the first canonical factor of the second area. In this research it means based on the first pair of canonical factors boxers achieve better results in general canonical factor of cognitive abilities due to the high canonical correlations (Rc=.76) and their mutual variances (Rc2 =.58) with general factor of morphological characteristics and the other way around. Specifically in this research, relations among the first canonical factor from cognitive variable system, identified as general cognitive canonical factor, and the first canonical factor from morphological characteristic variables, identified as general canonical factor of morphological characteristics indicates that boxers achieve good results in functioning of skeleton dimensionality and body voluminous if their values are increased in general cognitive factor and the other way around. Based on gained results in this research we can assume that cognitive mechanisms generally impact the success in boxing, but it seems that the influence of perceptive and parallel processor would be the most meritorious. The test of perception (IT-1) was constructed with intention to measure perceptive ability that presents perceptive analysis ability synthesis, perceptive structuring and perceptive identification, and efficacy of parallel space (S1) was defined as ability to determine relations in space or to solve issues that can be presented as space issues. However, the well known fact is that not only cognitive factors are crucial in some activity, and that is also the case in boxing. Regarding to this, it is necessary to apply well known rule that there are no two subjects with completely identical structure of any anthropological characteristics as well as cognitive. Because of that, the knowledge about complexity and interactivity of some activity, including cognitive abilities and morphological characteristics space, are important assumption during operationalisation of each research activity and according to those activities in boxing.

References

Blažević, S. (2006). *Relacii pomegu specifičnite motorički sposobnosti i morfološkite karakteristiki, bazičnite motorički sposobnosti, kognitivnite sposobnosti i konativnite karakteristiki kaj vrvnite bokseri*. (Dissertation). /In Macedonian/. Skopje: Fakultet za fizička kultura.

Blažević, S. (2007a). Relations between morphological and specific motor dimensions at boxers. *Acta kinesiologica, 1* (1), 20-25.

Blažević, S. (2007b). Relations among specific motor function abilities and cognitive characteristics with top class boxers. *II. Međunarodni simpozijum "Nove tehnologije u sportu", Zbornik radova*, 479-482. Sarajevo: Fakultet sporta i tjelesnog odgoja.

Kirkendall, D.R., & Gruber, J.J. (1970). Canonical relationships between the motor and intellectual achievement domains in culturally deprived high school pupils. *Research Quarterly of Exercise and Sport, 41*, (4), 496-502.

Malacko, J., & Popović, D. (2001). *Metodologija kineziološko antropoloških istraživanja*. [*Methodology of kinesiology anthropologic researches*] /In Serbian/. Leposavić: Fakultet za fizičku kulturu.

Malacko, J., & Rađo, I. (2004). *Tehnologija sporta i sportskog treninga*. [*Tehnology of sport and sports training*]. /In Bosnian/. Sarajevo: Faculty of Sport and Physical Education.

Savić, M. (1986). *Relacije između bazičnih psihosomatskih dimenzija i specifičnih sposobnosti boksera*. [*Relations between basic psyhosomatic dimensions and specific abilities at boxers*]. (Dissertation). /In Serbian/. Novi Sad: Faculty of Physical Education.

Stojanović, M., Momirović, K., Vukosavljević, R. & Solarić S. (1975). Struktura antropometrijskih dimenzija. *Kineziologija*, 5, (1–2):194-208.

Wolf, B., Momirović, K., & Džamonja, Z. (1992). *KOG 3 - baterija testova inteligencije*. [*KOG 3 - Battery of test for measuring inteligence*]. /In Serbian/. Beograd: Savez društava psihologa Srbije, Centar za primenjenu psihologiju.

RELACIJE KOGNITIVNIH SPOSOBNOSTI I MORFOLOŠKIH ZNAČAJKI BOKSAČA

Sažetak

Cilj istraživanja je bio da se na uzorku 92 boksača iz hrvatskih boksačkih klubova i različitih težinskih kategorija, primijeni sustav od 15 varijabli (od toga 3 varijable kognitivnih sposobnosti i 12 varijabli morfoloških karakteristika), i utvrde statistički značajne relacije između sustava varijabli kognitivnih sposobnosti i sustava varijabli morfoloških karakteristika radi formiranja racionalnih procedura za što učinkovitiju sportsku orijentaciju i selekciju, planiranje, programiranje i kontroliranje transformacijskih procesa kod sportaša. Utvrđivanje relacija između dva različita multidimenzionalna antropološka sustava manifestnih varijabli vršeno je primjenom metode kanoničke korelacijske analize. Na temelju dobivenih rezultata sadržanih u matrici kanoničke strukture u kojoj se uočavaju statistički značajne korelacije između prvog kanoničkog faktora i svih primijenjenih kognitivnih varijabli u rasponu od 89-99, on se može interpretirati kao generalni kanonički faktor kognitivnih sposobnosti. Raspon koeficijenata korelacije između prvog kanoničkog faktora i varijabli morfoloških karakteristika kreće se od .21-.77, tako da se on može interpretirati kao generalni kanonički faktor rasta i razvoja. Relacije između generalnog kanoničkog faktora kognitivnih sposobnosti i generalnog kanoničkog faktora rasta i razvoja pokazuje da boksači ovog uzorka sa takvim statistički značajnim koeficijentima između dva različita skupa mogu na vrlo uspješan način doprinijeti postizanju sportskih rezultata u boksačkoj borbi.

Ključne riječi: boksači, kognitivne sposobnosti, morfološke značajke, relacije