

COMUNICACIÓN ENTRE FUNCIONES NEURODINÁMICAS Y COGNITIVAS ENTRE ATLETAS PRACTICANDO VARIAS ARTES MARCIALES

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Abstracta: Objetivo: estudiar un vínculo entre las funciones neurodinámicas y cognitivas entre los atletas que practican diferentes artes marciales.

Métodos: Se examinaron tres grupos de atletas de élite que practicaban diversas artes marciales: 28 luchadores (de 20 a 28 años), 34 judokas (de 19 a 26 años) y 23 boxeadores (de 18 a 25 años). Para estudiar las funciones neurodinámicas y cognitivas se utilizó el complejo psico-diagnóstico «Multipsychometr-05».

Resultados: Los resultados de la investigación demostraron una alta velocidad de procesamiento de información entre los luchadores en comparación con otros atletas. Simultáneamente, este estudio reveló el predominio de las reacciones motoras impulsivas entre los boxeadores. Los judokas se caracterizan por la velocidad media del procesamiento de la información y el sistema nervioso equilibrado. El análisis de la inteligencia no verbal demostró un tiempo reducido para completar la prueba entre luchadores y judokas. Sin embargo, se demostró una mejor eficacia de finalización de la prueba entre los boxeadores en comparación con otros atletas.

Conclusiones: se revelaron diferencias importantes en la velocidad de percepción y se descubrió el procesamiento de la información entre atletas que representan diferentes artes marciales.

Palabras clave: artes marciales, atletas, funciones neurodinámicas, cognitivas

LINK BETWEEN NEURODYNAMICS AND COGNITIVE FUNCTIONS AMONG ATHLETES PRACTICING DIFFERENT MARTIAL ARTS

Abstract: Objective: to study a link between neurodynamic and cognitive functions among athletes practicing different martial arts.

Methods: Three groups of elite athletes practicing various martial arts were examined: 28 wrestlers (age 20-28), 34 judokas (age 19-26) and 23 boxers (age 18-25). To study neurodynamic and cognitive functions the psychodiagnostic complex «Multipsychometr-05» were used.

Results: The results of investigation demonstrated high speed of information processing among wrestlers in comparison to others athletes. Simultaneously, this study revealed the predominance of impulsive motor

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reactions among boxers. The judokas are characterized by average speed of information processing and balanced nervous system. The analysis of nonverbal intelligence demonstrated reduced time for test completion among wrestlers and judokas. However, better test completion efficacy was demonstrated among boxers in comparison to other athletes.

Conclusions: Major differences were revealed in perception speed and information processing among athletes representing different martial arts were discovered.

Keywords: cognitive functions, martial arts, athletes, neurodynamic

COMUNICAÇÃO ENTRE FUNÇÕES NEURODINÂMICAS E COGNITIVAS ENTRE ATLETAS PRACTICANDO VÁRIAS ARTES MARCIAIS

Abstract: Objetivo: estudar uma ligação entre as funções neurodinâmica e cognitiva entre atletas praticantes de diferentes artes marciais.

Métodos: Três grupos de atletas de elite praticando várias artes marciais foram examinados: 28 lutadores (20 a 28 anos), 34 judocas (19 a 26 anos) e 23 boxeadores (18 a 25 anos). Para estudar as funções neurodinâmicas e cognitivas, foi utilizado o complexo psicodiagnóstico «Multipsychometr-05».

Resultados: Os resultados da investigação demonstraram alta velocidade de processamento de informações entre os lutadores em comparação com outros atletas. Simultaneamente, este estudo revelou a predominância de reações motoras impulsivas entre os boxeadores. Os judocas são caracterizados pela velocidade média do processamento de informações e pelo sistema nervoso equilibrado. A análise da inteligência não verbal demonstrou tempo reduzido para a conclusão do teste entre lutadores e judocas. No entanto, uma melhor eficácia na conclusão do teste foi demonstrada entre os pugilistas em comparação com outros atletas.

Conclusões: Grandes diferenças foram reveladas na velocidade da percepção e no processamento de informações entre atletas representando diferentes artes marciais.

Keywords: Atletas, artes marciais, funções neurodinâmicas, cognitivas

INTRODUCCIÓN

Nowadays, martial arts and combat sports gain popularity among young people. This can be explained by better possibility to develop strength, agility and endurance through martial arts training (Cynarski, 2013; Muiños & Ballesteros., 2015). Moreover, martial arts foster spirit development and emotional control (Vaccaro et al. 2011; Roh et al., 2018). The popularity of martial arts in modern sports is associated also with social activities, art and culture (Jabs, 2006; Cynarski et al., 2018). In addition, it is important to study national traditions of martial arts and link with modern types of sport (Prytula, 2015).

Some authors believe that young people with increased levels of aggression tend to practice martial arts (Graczyk et al. 2010; Groniek et al. 2015). But this opinion is very apparent. Our study showed that increased aggression level among combat sports athletes is associated with lower effectiveness in sports activity (Korobeynikov et al. 2019).

Two reasons for the development of the concept of martial arts are considered. The first is associated with a genetic predisposition to martial arts (Michałowska-Sawczyn et al. 2015), while the second one is associated with an influence of martial arts on the human body (Fong et al. 2015).

Among various topics related to martial arts, assessment of talent and the selection system for martial arts was identified as one of the main challenges (Pion et al. 2014; James et al. 2016).

One of the most important scientific directions in sports is to solve the problem of athletes' selection based on genetically determined characteristics. Especially this topic related to martial arts.

According to the sport theory, capability of athletes during competition activity directly depends on different parts of preparedness: physical, psychological and technical (Issurin, 2013). The physical condition of athletes in martial arts has important, but regulation of main physiological functions of body to realized due nervous system. (Korobeynikova et al. 2016; Chernozub James et al. 2018). Execution of all technical skills during the bout are related to activation of perception system, information processing and athletes' motor response (Iermakov et al. 2016; Korobeynikov et al. 2019). The psychological readiness of

athletes is formed with inclusion of brain activity. But manifestation of athletes' preparedness for sport activities has specific characteristics among different types of martial arts (Cynarski et al. 2018; Chernozub et al. 2019).

Therefore, the study of manifestation of neurodynamic and cognitive functions among athletes practicing different martial arts is extremely important.

Purpose: Study a link between neurodynamic and cognitive functions among athletes practicing different martial arts.

Methods

To study neurodynamic functions, methods of estimated functional mobility and balance of nervous processes were used. The cognitive functions were examined by using tests, which determined nonverbal intelligence: comparison of numbers and speed of perception. Psycho-diagnostic complex «Multipsychometr-05» was used for all tests.

Participants

Three groups of elite athletes practicing various martial arts were examined: 28 wrestlers (Greco-Roman style, age 20-28), 34 judokas (age 19-26) and 23 boxers (age 18-25). According to recommendations of the ethical committee from all of athletes were received of written authorization on the study and processing of the information received.

Statistical Analysis

Statistical analysis of data was conducted by using software package "Statistica 6". For statistical processing of data interquartile range was used with indicate first (25% percentil), and third quartile (75%). For compare groups of athletes the non-parametric statistics, based on Wilcoxon sign sum test, were used.

Results

Functional mobility can be characterized by capabilities to increase speed changes of excitation and inhibition of nervous system. The key role of functional mobility of nervous processes provides perception and information processing of stimulus from outside (Korobeynikov et al. 2017).

Several studies related to nervous processes functional mobility among athletes with various martial arts backgrounds showed differences on some variables (Table 1). There are no significant differences for dynamism variable among athletes practicing different martial arts. However, wrestlers demonstrated higher the capacity to analyze visually than judokas and boxers. This fact indicated that wrestlers have higher level of speed capabilities of visual perception. The average level of speed capabilities for visual information processing are revealed among judokas (Table 1). Lowest level of visual analyzer capacity was registered among boxers.

Table 1 Variables of functional mobility of nervous processes among athletes practicing different martial arts (Median, Lower and Upper quartiles)

Variables	Wrestlers (n=28)	Judokas (n=34)	Boxers (n=23)
Dynamism, secret unit	72,75 65,77; 82,49	75,91 66,54; 83,54	73,17 63,78; 81,21
Capacity of the visual analyzer, secret unit	1,84 1,695; 1,97	1,78* 1,65; 1,98	1,68* 1,54; 1,80
Limited time of information processing, ms	335,46 305,37; 410,36	350,46* 320,32; 410,83	365,64* 320,35; 410,65
Impulsiveness, secret unit	-0,03 -0,11; 0,03	-0,005* -0,17; 0,05	-0,006* -0,11; 0,09

Notes:

* p<0,05 – significant changes in comparison to wrestlers;

** p<0,05 – significant changes in comparison to judokas.

Results of data Tabl.1 are indicating the lower values of limited time in wrestlers in comparison to judokas and boxers (Table 1). The time spent on information processing reflects the duration of perception, processing and efferent response on different stimulus. The low values demonstrated among wrestlers by limited time variable proves the higher level of information processing speed. The low level of speed of visual information processing was shown among boxers, while average level was found among judokas (Table 1).

One of the main characteristics of nervous processes functional mobility is impulsiveness, which can be used as an indicator for capabilities of nervous system to quickly shift during excitation and braking conditions. Our results revealed the higher level of impulsiveness among boxers and lower level of impulsiveness among wrestlers (Table 1). This fact testifies higher level of impulsive motor reactions and excitation dominants of response among boxers in comparison to athletes practicing other martial arts.

Table 2 presents the variables of balance of nervous processes among athletes practicing different martial arts. Table 2 shows the absence of significant

differences between athletes practicing different martial arts. However, boxers' group values of excitation are higher than in groups of wrestlers and judokas. As a view of this result boxers' group is characterized by predominance of excitation process of nervous system. Simultaneously, wrestling group has the tendency for reflexivity and balance of the processes of excitation and inhibition of the nervous system. The judokas are characterized by average level of balanced of nervous system.

Table 2 Variables of balance of nervous processes among athletes practicing different martial arts (Median, Lower and Upper quartiles).

Variables	Wrestlers (n=28)	Judokas (n=34)	Boxers (n=23)
Accuracy, secret unit	2,88 2, 51; 3,66	2,67 2,36; 3,17	2,73 2,44; 4,53
Stability, secret unit	3,18 2, 73; 4,08	3,29 2,77; 3,71	3,96 3,16; 1,80
Excitation, secret unit	-0,67 -1,37; 0,16	-0,73 -1,46; 0,04	-0,89* -1,63; -0,20

Notes:

* p<0,05 – significant changes in comparison to wrestlers;

** p<0,05 – significant changes in comparison to judokas.

The results of nonverbal intelligence study (test for numbers comparison) are presented in Table 3. Results of analysis of nonverbal intelligence test showed a reduced latent period of reaction among wrestlers and judokas in comparison to boxers. This fact explains higher speed capabilities for decision making process during solving nonverbal test among wrestlers and judokas.

At the same time, higher efficiency of nonverbal test completion was observed among boxers. Retrieved results proved the lower level of velocity level and higher level of quality level of nonverbal intelligence level among boxers in comparison to others martial arts athletes.

Table 3 Variables of nonverbal intelligence (numbers comparison) among athletes practicing different martial arts (Median, Lower and Upper quartiles).

Variables	Wrestlers (n=28)	Judokas (n=34)	Boxers (n=23)
Efficiency, secret unit	876,24 769,25; 995,24	930,52* 842,77; 1125,8	1046,5*** 891,61; 1200,6
Latent period of reaction, ms	862,55 759,7; 956,36	888,47* 822,18; 1081,8	978,895*** 864,86; 1144,3
Accuracy, secret unit	0,98 0,96; 0,98	0,96 0,94; 0,98	0,96 0,9375; 0,9765
Stability, secret unit	24,69 20,14; 27,97	24,7 20,9; 29,75	26,63 21,774; 30,769

Notes:

* p<0,05 – significant changes in comparison to wrestlers;

** p<0,05 – significant changes in comparison to judokas.

Nonverbal intelligence test results (perception speed test) among athletes practicing different types of martial arts showed meanings increase of speed and efficiency among wrestlers (Table 4). This indicates the better speed of perception among wrestlers in comparison to judokas and boxers. Speed increase and perception quality of nonverbal information among wrestlers, link with peculiarities of wrestling activities technical structure. The availability of average efficiency level of perception within boxers' group corresponded to velocity of nonverbal intelligent.

Table 4 Variables of nonverbal intelligence (perceptive speed) among athletes practicing different martial arts (Median, Lower and Upper quartiles).

Variables	Wrestlers (n=28)	Judokas (n=34)	Boxers (n=23)
Productivity, secret unit	22,45 20,51; 24,43	20,21 18,37; 22,82	21,51 17,13; 25,63
Speed, secret unit	11,68 9,73; 14,58	10,98 9,04; 13,61	10,29* 8,53; 11,97
Accuracy, secret unit	0,73 0,69; 0,88	0,67 0,60; 0,73	0,71 0,57; 0,83
Efficiency, secret unit	48,89 40,82; 60,73	38,89* 30,43; 48,89	46,59** 25,97; 65,97

Notes:

* p<0,05 – significant changes in comparison to wrestlers;

** p<0,05 – significant changes in comparison to judokas.

Discussion

The main purpose of this study was to reveal a link between neurodynamic and cognitive functions among athletes practicing different martial arts. Various types of martial arts develop different qualities. This reflects specifically to motor skills and peculiarities of psychological training (Starosta, 2017; Xianglin

et al. 2019). Therefore, the study of psychophysiological characteristics among athletes practicing various martial arts is extremely important. Potentially, such studies can provide a new knowledge, which can be used to increase efficiency of training process.

The results of investigation showed the high limit speed of information processing among wrestlers in comparison to others martial arts athletes. This result corresponds to our data, which previously showed the high level of information processing among elite wrestlers (Korobeynikov et al. 2019).

Simultaneously, this study revealed the predominance of impulsive motor reactions within boxers' group. This fact indicated on higher level of excitation process of nervous system. Similar results were revealed in the study of Fernández et al (Fernández et al. 2020).

Our study revealed the tendency to reflexivity and balance of the processes of excitation and inhibition of the nervous system among wrestlers. Structure of wrestling skills is related to rigorous tension between partners during bout. Wrestling activity accompanied by manifestation of strength, speed and endurance. This fact indicated required balance of excitation and inhibition processes among wrestlers.

The judo in comparison to wrestling is more dynamic type of martial arts. However, usage of kimono partially restrains athletes' ability to execute action quickly. In our study it was revealed that judokas show average speed of information processing and balanced nervous system.

The results of neurodynamic functions corresponded to the study of nonverbal intelligence among athletes practicing various martial arts. Required time for test completion was used as a criterion for brain processing speed variables, while external information processing among wrestlers and judokas was lower in comparison to boxers. This fact corresponded to the need of quicker response to external stimulus and decision making process during a fight of athletes. Moreover, it was found that wrestlers possess the best level of speed perception in comparison to judokas and boxers.

Thus, wrestlers and partially judokas have higher speed abilities on decision making during intelligence test completion. But the characteristics of qualities of nonverbal intelligence test completion was demonstrated by boxers' group.

Our opinion that received results reflect on peculiarities of special motor skills of various martial arts.

Conclusion

Significant differences were identified in perception speed and information processing between athletes practicing different martial arts. Wrestlers are characterized by balanced nervous processes between excitation and braking states. Judokas have an average speed of information processing. Boxers demonstrated the high excitation level of nervous system.

Study of cognitive functions revealed that wrestlers and judokas are characterized by higher speed capabilities of decision-making process in comparison to boxers. But better level of efficacy to decision making of nonverbal tasks was observed among boxers.

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