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AGING PECULIARITIES OF STRESS RESISTANCE IN ELITE ATHLETES

In last decade Olympic sports are characterized by the presence of «older» athletes who have reached high athletic results.

The purpose of the study was to research the age peculiarities of stress resistance and psycho-emotional states in elite wrestlers.

A total of 19 elite athletes (different age), members of the Ukrainian National Team in Greco-Roman wrestling were examined. The perception and processing of visual information, the balance of the nervous system and psycho-emotional stability were studied.

The deterioration of neurodynamic functions in emotional stress situations was more evident in older age group comparing with the younger age group due to age weakening of afferent system of information perception, analysis, and processing.

The connection between the age in elite athletes and stress resistance to psycho-emotional tension was recorded. In particular, it reflected in considerable changes in heart rate regulation in older age group comparing with younger age group where the optimal reaction of heart rate regulation to psycho emotional tension was observed.

Keywords: *age, stress resistance, elite wrestlers, psycho-emotional states, neurodynamic functions, functionality.*

Introduction. Modern development of sports science is characterized of elaboration of different biotechnologies which influence on maximum performance of athletes in competition conditions. All of this technologies include the peculiarities of individual ability of human. But, sports activity as extreme of human activity is related with psycho-emotional factors which influence on the efficacy of sporting results.

In last decade Olympic sports are characterized by the presence of older athletes who have reached high athletic results. The age of champions and runners-up of International championships in some Olympic sports could be 36-42 years in individual sports and up to 52 in such sports as horseback riding and sailing.

Sports activities as extreme kind of human activities are connected with the presence of psycho-emotional factors which can influence the efficiency of sport results. [1, 2, 3].

Human activities including sports are determined by different levels of regulation and complex mechanisms of psychophysiological functions organization. Various psychic phenomena can be characterized by their specific influence on inner processes. Such specificity can be represented by the changes of psychophysiological states. Intimate connection between psychic and physiological parameters forms a psycho-physiological state of a person. Each psychic phenomenon appears to be related to physiological structures - it can influence physiological processes or be conditioned by them [4, 5]

Considering that psycho-physiological functions constitute a major link of formation of psycho-emotional reactions in the situations of extreme conditions, it is logical to expect the connection between the athlete's age and the level of stress resistance, indicators of perception and processing of visual information.

The purpose of the study was to research the aging peculiarities of stress resistance in elite athletes.

Methods and organization research

19 elite athletes, members of the Ukrainian National Team in Greco-Roman wrestling took part in the research. The athletes were divided in two groups according to their age. 12 athletes age 19-24 were placed in one group and 7 athletes age 27-31 - in another group.

Information perception and processing were studied by using the methodology "perception speed" which is included in apparatus-program diagnostic complex "Multipsychometr -05". The methodology "perception speed" evaluates the speed and accuracy of identifying geometric figures, comparing the given fragments with the set-up targets. The task for the athlete in research was to determine which of the given target figures was the particular fragment part. The athlete was answering the question by pressing the button (with according number) on a special digital keyboard, the component of apparatus-program diagnostic complex "Multipsychometr -05"[6]. The tests results reflected productivity, speed, accuracy and efficiency. A criterion of productivity indicates the speed of perception and processing, and depends on mobility of nervous processes. The speed with which athlete fulfills the task is essential indicator of speed and efficiency of perception and processing. High speed variables mean that the specified processes of perception and processing are mobile and effective. [7,8]

To determine the balance between acceleration and deceleration of the central nervous system (CNS) we used the methodology called "Reaction to the Moving Object". Reaction to the moving object is a type of a complex sensory-motor reaction which in addition to sensor and motor periods includes period of relatively complicated processing of a sensory signal by central nervous system (CNS). This methodology is included in apparatus-program psycho-diagnostic complex "Multipsychometr -05". The test results showed the indicators of accuracy, stability, excitability, and trend (by excitability). The balance of nervous processes is defined by a combination of 2 factors: correlation between advancing and impediment and value and sign of average deviation of the marker from the target at the moment of pressing the button.

The level of psycho-emotional resistance (stress tolerance) was determined by the results of test called "Stress Test" with analysis of information regarding the positioned selection of objects in appropriate cells in adopted mode. Thus, the certain time limit for selection of objects is reached and this creates psycho-emotional informational tension (load). This methodology is included in apparatus- program psycho-diagnostic complex "Multipsychometr -05". The results of the tests allowed determining the criteria of stress resistance, capacity and impulsiveness [9].

Statistical analysis was performed with the help of programming package Statgraphics 5.1 (Manugistics, Inc.). Since the data obtained in research didn't correspond to the normal distribution of studied data, the methods of nonparametric statistics of Wilcoxon rank-sum test were applied. To reflect data distribution we used interquartile range, thus specifying first quarter (25%) and third quarter (75%) [10].

Results and discussion

As a seen the tab. 1 illustrates median of perceptive speed variables of the athletes in different age groups. Comparing the groups according to perceptive speed test results, it's important to point out the actual differences in the indicators of productivity and efficiency (tab. 1). This demonstrates the higher level of information processed by athletes in the younger age group and confirms the superior capabilities of cognitive functions of the athletes in this group.

It is possible to conclude, that athletes in younger age group (19-24 years) show more productive visual perception and higher efficiency of visual information processing comparing with older age group (27-31 years). We can also state that there is a correlation

between elite athletes' age and cognitive component in perception and information processing.

Table 1

Parameters of perceptive speed of the athletes in different age groups (n=19)

Variables	First Age Group (n=12)			Second Age Group (n=7)		
	Median	Lower Quarter	Upper Quarter	Median	Lower Quarter	Upper Quarter
Productivity (secret unit)	21,50	18,50	22,00	19,00*	14,00	20,00
Speed (stimuli/min)	4,39	3,91	5,10	4,00	3,17	4,98
Accuracy (secret unit)	0,88	0,79	0,92	0,88	0,75;	
Efficiency (secret unit)	72,84	54,49	82,80	66,95*	47,36	74,80

Note: * - p < 0,05, comparing with the first age group of the athletes.

The tab. 2 illustrates the data according to methodology "Nervous Process Balance" demonstrated by athletes of different age groups.

Table 2

Parameters of balance of nervous processes in different age groups (n=19)

Variables	First Age Group (n=12)			Second Age Group (n=7)		
	Median	Lower Quarter	Upper Quarter	Median	Lower Quarter	Upper Quarter
Accuracy (secret unit)	2,76	2,41	3,04	3,97	2,86	4,85
Stability, cV (%)	3,28	3,02	3,96	3,00	2,55	4,57
Accelaration (secret unit)	-0,28	-1,10	0,37	-1,27*	-3,60	0,01

Note: * - p < 0,05, comparing with the first age group of the athletes.

The tab. 2 data analysis indicates that there are no actual distinction between age groups in the measurements of accuracy and stability. This means that age component doesn't really matter in the measurement of efficiency of execution of the motor tasks with external stimulus in conditions of psycho-emotional stress.

The measurements of acceleration show the actual differences between age groups (table 2). According to actual scale, median of acceleration in the first age group reflects the balance of acceleration and deceleration of nervous processes. In the second age group, acceleration median indicates the prevalence of acceleration of nervous processes (tab. 2).

Therefore, athletes in a younger age group (19-24 years) show the balance of nervous processes of acceleration and deceleration. This balance is in agreement with the presence of higher productivity of visual perception and visual information processing efficiency comparing with older age group (27-31 years). Consequently, prevalence of acceleration processes in older age group leads to deterioration of visual information perception and processing.

We arrived to conclusion that deterioration in the state of neurodynamic functions in the situations of psycho emotional stress in the older age group of elite athletes is not so much the deterioration of afferent compound of perception system, information analysis and processing, but in fact efferent motor compound. Besides, with aging, the connection between effectiveness of visual perception and information processing are improves [3].

The tab. 3 reflects the data of stress resistance in different age groups. According to tab. 3, there is no actual distinction in variables of general intensity and impulsiveness in different age groups. In the same time, there is actual distinction in variables of stress resistance in different age groups. Stress resistance is determined by the ratio of average capacity of visual analyzer in the beginning of the test to the capacity in the end of the test. In other words, the variables of stress resistance indicate the possibility of maintaining of sufficient level of capacity of visual sensor system in situations of psycho emotional stress. Thus, the athletes of a younger age group showed better results of stress resistance comparing with older age group (tab. 3).

Table 3

Parameters of stress resistance in different age groups (n=19)

Variables	First Age Group (n=12)			Second Age Group (n=7)		
	Median	Lower Quarter	Upper Quarter	Median	Lower Quarter	Upper Quarter
Stress Resistance (secret unit)	88,27	79,01	90,33	109,20*	102,83	118,35
General Efficiency (secret unit)	1,09	1,07	1,13	1,10	0,92	1,15
Impulsiveness (secret unit)	-0,04	-0,06	0,00	-0,03	-0,06	0,00

Note: * - $p < 0,05$, comparing with the first age group of the athletes.

Spectral characteristics of cardio intervals were studied to determine the age distinctiveness of heart rate vegetative regulation in situations of psycho-emotional stress.

The tab. 4 reflects the medians of spectral characteristics of heart rate variability in the beginning and in the end of psycho emotional tension in different age groups.

Analysis of data of tab. 4 confirms that there is an actual distinction in heart rate variability HF and LF/HF between different age groups in the beginning of psycho-emotional loading. Actually higher variables of HF confirm the preeminence of parasympathetic activation of heart rate regulation in younger age group. Reduced variables of LF/HF in younger age group indicate the optimization of vegetative balance of sympathetic and parasympathetic influences on heart atrium pacemaker.

Psycho emotional loading leads to heart rate boost (Mean RR), the increase of low-frequency (VLF) and high-frequency (HF) heart rate variations in older age group (tab. 4). This fact indicates the influence of heart rate central contour of regulation in the situations of psycho emotional tension with simultaneous activation parasympathetic link of vegetative regulation and renin-angiotensin-aldosterone system. In the same time the shift of vegetative balance (LF/HF) towards sympathetic activation of vegetative regulation of cardio intervals takes place.

Thus, psycho emotional tension on athletes in older age group causes significant changes in heart rate variability signifying the stress type of loading.

In younger age group the changes of vegetative balance were noticed (LF/HF), and that indicates the amplifications of sympathetic activation of heart rate regulation, although the absolute changes are twice the variables of older age group (tab. 4). This indicates the optimal reaction of heart rate regulation system to psycho-emotional tension.

Table 4

Parameters of spectral characteristics of heart rate variability showed by athletes of different age groups in dynamic of psycho emotional (n=19)

Variables		First Age Group (n=12)			Second Age Group (n=7)		
		Median	Lower Quarter	Upper Quarter	Median	Lower Quarter	Upper Quarter
Mean RR (ms)	in the beginning	1034,25	455,18	1202,70	1009,50	1008,70	1156,60
	in the end	901,15	469,90	995,25	781,40[&]	781,40	871,70
VLF (ms^2)	in the beginning	4285,00	1396,50	10839,50	9239,00	4802,00	10398,00
	in the end	3262,00	2598,50	8553,50	1722,00[&]	1722,00	1977,00
LF (ms^2)	in the beginning	2405,00	1785,50	2591,00	2474,00	2428,00	3906,00
	in the end	1924,00	1558,50	3359,50	2843,00	1400,00	2843,00
HF (ms^2)	in the beginning	2166,00	1358,00	2697,00	1428,00*	1276,00	2586,00
	in the end	1199,50	517,00	2808,00	2843,00*[&]	1400,00	2843,00
Total	in the beginning	11856,00	4483,00	19317,00	14103,00	11294,00	14853,00
	in the end	5257,00	4430,00	20228,00	4887,00[&]	3849,00	4887,00
LF/HF	in the beginning	1,21	0,70	2,30	1,73*	1,51	1,90
	in the end	2,382[&]	1,296	3,96	8,811*[&]	2,966	8,81

*Notes: * 1. * - p < 0,05, comparing with the first age group of the athletes.*
2. & p < 0,05, comparing to the beginning of the loading.

Conclusions

1. The connection between the age in elite athletes and stress resistance to psycho-emotional tension was recorded. In particular, it reflected in considerable changes in heart rate regulation in older age group comparing with younger age group where the optimal reaction of heart rate regulation to psycho emotional tension was observed.

2. The deterioration of neurodynamic functions in the situations of psycho-emotional tension was determined in older age group comparing to younger age group due to age weakening of afferent part of perception, analysis and information processing.

3. The athletes with defensive strategy of the fight has reduction of stress resistance and increasing of information processing speed in comparison to athletes who has attacking strategy.

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Аннотация. Коробейников Г.В., Коробейникова Л.Г., Рычок Т.Н., Мищенко В.С. Возрастные особенности стрессоустойчивости у элитных спортсменов. В последнее десятилетие Олимпийские игры характеризуются наличием «возрастных» спортсменов, достигших высоких спортивных результатов. Цель исследования была исследовать возрастные особенности стрессоустойчивости и психо-эмоциональных состояний у элитных борцов. Обследовано 19 спортсменов (разного возраста), членов сборной Украины по греко-римской борьбе. Были изучены восприятие и обработка зрительной информации, баланс нервной системы и психо-эмоциональной устойчивости. Выявлено ухудшение нейродинамических функций и эмоциональных стрессовых ситуаций у спортсменов старшей возрастной группе по сравнению со спортсменами младшей возрастной группы, вследствие ослабления афферентных систем восприятия, анализа и обработки. Установлена связь между возрастом спортсменов и стрессоустойчивостью к психо-эмоциональному напряжению. В частности, это отражается в значительных изменениях в регуляции сердечного ритма в старшей возрастной группе, как отражение оптимальной реакции регуляции сердечного ритма в условиях эмоционального напряжения.

Ключевые слова: возраст, стрессоустойчивость, элитные спотсмены, психо-эмоциональные состояния, нейродинамические функции.

Анотація. Коробейніков Г.В., Коробейнікова Л.Г., Ричок Т.М., Міщенко В.С. Вікові особливості стресостійкісті у елітних спортсменів. В останнє десятиліття Олімпійські ігри характеризуються наявністю «вікових» спортсменів, які досягли високих спортивних результатів. Мета дослідження була досліджувати вікові особливості стресостійкості та психо-емоційних станів у елітних борців. Обстежено 19 спортсменів (різного віку), членів збірної України з греко-римської боротьби. Були вивчені сприйняття і обробка зорової інформації, баланс нервової системи і психо-емоційної стійкості. Виявлено погіршення нейродинамічних функцій і емоційних стресових ситуацій у спортсменів старшої вікової групи в порівнянні зі спортсменами молодшої вікової групи, внаслідок ослаблення аферентних систем сприйняття, аналізу та обробки. Встановлено зв'язок між віком спортсменів і стресостійкістю до психо-емоційної напруги. Зокрема, це відображається у значних змінах в регуляції серцевого ритму у старшій віковій групі, як відображення оптимальної реакції регуляції серцевого ритму в умовах емоційного напруження.

Ключові слова: вік, стресостійкість, елітні спотсмени, психо-емоційні стани, нейродинамичні функції.

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