Short Reports

THE SPORTS QUALIFICATION AND SPECIALIZATION IMPACT UPON THE SPORTSMEN'S FUNCTIONAL STATE

[1]Khaybullin M.P., [2]Dzhankuldukova A.D., [2]Bitleuov B.A., [2] Bakhtaulova A.S.

[1]The Institute of Human and Animal Physiology, Almaty, e-mail marvatkh@ya.ru;
[2]The Zhetysusky State University after E. Zhansugurov, Taldykorgan

The students' functional state peculiarities have already been revealed, in terms of the heart rate variability (HRV), depending on the sports training level and the type of sports. The necessity to be personalized the physical activities and its loads in the educational process have already been shown, in accordance with the students' overall functional state indicators.

The adaptation reserves are the foundation of the human health, having allowed the human organism to be stayed healthy in the wide range of the living conditions changes. At the same time, the autonomic nervous system is practically played the significant role. The special peculiarities and the features of its functional organization are regarded, as the one of the main characteristics, having formed the human organism response type upon the impacts [1]. So, the sportsmen and the athletes are usually classified to the persons' category, that are the most subjected to the stress factors, so the functioning special peculiarities record of the vegetative and the autonomic nervous system is the significant one for the human organism adaptation possibilities and predicting its responses upon the stresses and the loads evaluation [2].

The Objective. To be investigated the functional state peculiarities, depending on the skill level and the sport specialization.

The Object and Methods. The functional state of the 62 sportsmen and the athletes of the varying skill and the sports specialization – the students of the 1–2 courses by «The Physical Culture» specialty has already been studied. All of them have been undergone the special medical examination, and they have been referred to the «practically healthy» group. So, the heart rate variability (HRV) analysis method has already been used for the functional state level assessment. Thus, the obtained final research results have already been evaluated, according to the functional states classification [3].

The Results and Discussion: The Functional State Evaluation of the Human Body Regulatory System, Depending on the Sports Qualification

So, all the students have already been divided into the 3 groups, according to their sorts training level. In the group 1 (e.g. 18 sportsmen and the athletes of the high qualification) – are the Masters of Sports and the International Masters of Sports, including the champions and the winners of the major and the largest International and the Republican and the national competitions (including the World and the Asian ones. The students, having had the Candidate Masters ranks, have already been included in the group 2 (e.g. 14 persons). The third group (e.g. 30 persons) has already been made the students, who do not have any sports categories, or they are with the 1–2 sports categories.

So, the heart rate mathematical analysis [4] has already been shown, that the adaptation possibilities level of the human organism is depended on the sports training level. The highest average rates of the RR-intervals (M), the root-mean-square deviation values of the RR-intervals (RMS), the variation range (VR), the mode (Mo), and the lower rates of the mode amplitude (MoA), the tension index of the regulatory systems (TI), the vegetative balance index (VBI), the adequacy of the regulatory processes index (ARPI), the rhythm vegetative rate index (RVRI) are observed at the sportsmen and the athletes of the group 1. This is demonstrated the parasympathetic nervous system activity dominance and the high adaptation possibilities. At the same time, the rates decline in M, RMS, VR, Mo, and the higher rates of MoA, TI, VBI, ARPI, RVRI have been revealed in inverse pattern at the students of the groups 2 and 3 (Table 1). This is shown the increased activity of the sympathetic nervous system, which is the sign of the regulatory systems high energy of the human organism for the homeostasis maintenance.

The examination has been carried out just after the graduated physical exercise (e.g. the 3 – staged test on the bicycle ergometer) for the adaptation abilities assessment. They have already separated the vagotonic, the normotonic, and the sympathicotonic types of the human organism response upon the load, according to the tension degree of the regulatory mechanisms. So, the changes' nature at the sportsmen and the athletes of the group 1 just after the physical exercise (e.g. the slight decrease of M, RMS, Mo, ARPI and the moderate growth of VR, MoA, TI, VBI, RVR) is quite corresponded to the normotonic type, and it is indicated the economic activity efficiency of the functional systems after the load, which is confirmed the adaptation high level in the given group. So, the interesting results have already been obtained in the examined groups 2 and 3. The reliable and the significant decrease of the M, RMS, VR, Mo indices and the MoA, TI, VBI, ARPI, RVRI higher rates are quite met to the sympathicotonic type of response, and it

is pointed to the adaptation mechanisms stress. And, if the rest of the significant differences between all the given groups have not been found, then, the reliable and the significant differences are observed after the physical exercise. The more expressed signs of the regulatory mechanisms are observed in the group 3, which is indicated the significant reduction of the human organism's adaptation possibilities. Thus, even the standard physical activities are not always corresponded to the 2-nd and the 3-rd group students' functional possibilities, which could have the negative impact upon their functional state, due to the functional systems overstress of the human organism. The «Physical Culture» specialty specifics is meant the regular increased physical activity in the learning process, and, therefore, it is necessary to be personalized the physical activity level, according to the general functional condition indicators.

Table 1

The Cardio-Intervalography Indicators at the Students of the Different Sports Qualification under the Rest Condition and after the Graduated Physical Exercise

Indices	Group					
	1		2		3	
	Before	After	Before	After	Before	After
M ± m	0,91 ± 0,02	0,89 ± 0,02	0,87 ± 0,01	0,77 ± 0,01**	0,84 ± 0,02**	0,81 ± 0,02**
RMS	0,08 ± 0,004	0,07 ± 0,004	0,06 ± 0,003**	0,06 ± 0,004*	0,05 ± 0,005*	0,05 ± 0,004**
VR	0,35 ± 0,01	0,39 ± 0,02	0,32 ± 0,01**	0,33 ± 0,02*	0,3 ± 0,02*	0,29 ± 0,01**
Mo	0,92 ± 0,02	0,89 ± 0,02	0,85 ± 0,01*	0,77 ± 0,02**	0,83 ± 0,02**	0,8 ± 0,02**
MoA	30,3 ± 1,5	30,7 ± 1,8	35,4 ± 2,07*	37,7 ± 2,4*	32,5 ± 1,7*	36,2 ± 2,7
TI	56,4 ± 5,9	60,09 ± 6,9	85,7 ± 9,08*	102,7 ± 16,8*	71,5 ± 8,3*	108,7 ± 22,3*
VBI	96 ± 9,4	101,7 ± 10,3	132,2 ± 11,7*	153,3 ± 20,6*	112,2 ± 10,6*	153,9 ± 26,5
ARPI	37,3 ± 2,7	35,9 ± 2,6	47,4 ± 4,9*	51,9 ± 4,02**	40,5 ± 2,9	48,2 ± 4,9*
RVR	3,3 ± 0,2	3,4 ± 0,2	4,5 ± 0,3**	4,5 ± 0,4*	4,1 ± 0,3*	4,9 ± 0,5**

N o t e s : $* - p < 0,05$; $** - p < 0,01$ (compared with the group 1 before and after the physical exercise, respectively).

The Functional State Evaluation of the Human Organism's Regulatory Systems, Depending on the Sports Qualification

The training process orientation is the main factor in the function organization of the blood circulation device – the predominant structural support systems principle, having dominated in the adaptation process [5]. So, it can be assumed, that the quite different orientation of the training process will be affected upon the wave structure of the heart rate.

For the impact research by the quite different and the various types of sports studies upon the human organism's functional condition of the elite sportsmen and the highly qualified and the skilled athletes (having had the rank not lower than «The Candidate Master of Sports» – 32 people) have already been divided, depending on their sport specialization: the group 1 – having involved in the different and the various types of sports, having developed their strength – speed qualities (e.g. the jiu – jitsu, the boxing, the judo, Freestyle and the Greko – Roman style wrestling, the rugby); the group 2 – the sportsmen and the athletes, having trained for the endurance powers, the speed (e.g. the soccer, and the field-and-track athletics); the group 3 – the sportsmen and the athletes, having developed their power qualities (e.g. the weightlifting). Thus, the HRV analysis registration has been conducted just before and after usual 60-minite training workout (Table 2).

The highest baseline level of the functional condition had already been found in the group 1, which had the balanced influence with the parasympathetic effects predominance (e.g. LF/HF – 0,91) and also the highest power of the general spectrum HRV (e.g. TR – 8,654), having spoken of the good functional condition. So, just after their workout training, the TR reduction has already been revealed in this group, due to the sympathetic (e.g. LF) and, to a greater extent, the parasympathetic (e.g. HF) components and the constituents, which it is shown the further decline of the human organism's adaptation reserves and their working balances. For all this, the LF/HF relationship is not changed significantly (e.g. the moderate sympathetic effects predominance). This is indicated the lack of the adaptation mechanisms stress and the reactivity conservation of the ANS parasympathetic section. So, the VLF growth contribution is, practically, one of the fatigue and the overstrain signs of the human organism, but with the high physical loads consideration, that the sportsmen and the athletes are experienced, even in the normal workout trainings, the obtained final results are indicated the good adaptation reserves and the working balances of the sportsmen and the athletes human organisms. It has also been revealed the good functional state at the sportsmen and the athletes of the group 2 in the rest condition. So, the general spectrum power

is rather slightly lower, but it is also significantly higher, than the norm rates. At the same time, the sportsmen and the athletes of the group 2 had the more balanced influence of the sympathetic – parasympathetic modulation of the HRV (e.g. LF/HF – 0,96). The functional state is not considerably changed just after the working training carrying out. So, the statistically significant changes have already been revealed only in terms of HF. Then, the LF/HF relationship is not actually changed. For all this, the sufficiently initial power, having remained just after the working training, even with the lower spectral activity of HF consideration, is practically shown the high adaptation reserves and the working balances of the sportsmen' and the athletes' human organism, having developed the powers of the endurance and the speed. The quite different another picture has already been revealed in the weightlifting sportsmen and the athletes (e.g. the group 3) at the rest condition: there is the lowest power of the general spectrum with the expressed and the significant predominance of the sympathetic effects (e.g. LF/HF – 1,13). So, just after the workout training, there is the current functional state of the depression that is occurred, at the expense of all the spectral components and its constituents decrease, and, in the first place, – the expressed and the significant reduction in the HF reactivity index, and also the significant increase against this background of the sympathoadrenal activity (e.g. LF/HF – 1,42), the VLF – fluctuations prevalence in the spectral picture. All these given changes are revealed the functioning violation of the braking autonomic and the vegetative effects.

Table 2

The Spectral Analysis Indicators of the Heart Rates at the Sportsmen and the Athletes of the Different Sports Specialization before and after the 60 – Minute Workout Training

The Spectral Power Index HRV (мs^2/Hz)	The Sportsmen's Group					
	1		2		3	
	Before	After	Before	After	Before	After
TP	8654 ± 4789	6212 ± 4120	4639 ± 2411	2984 ± 978	2954 ± 1698	1237 ± 652
HF	3224 ± 1432	1678 ± 536	1936 ± 1153	1282 ± 793	903 ± 597	297 ± 168
LF	2708 ± 165	1876 ± 814	1380 ± 833	1304 ± 986	1080 ± 435	448 ± 292
VLF	2616 ± 2378	2341 ± 2065	1229 ± 769	1100 ± 844	958 ± 976	550 ± 293
LF/HF	$0,91 \pm 0,47$	$1,09 \pm 0,68$	$0,96 \pm 0,42$	$1,06 \pm 0,58$	$1,13 \pm 1,03$	$1,42 \pm 1,16$

Conclusions

1. With the sportsmen and the athletes qualification increase, the parameters shifts are observed, having reflected the autonomic regulation changes, in the direction of the tone predominance of the parasympathetic section of the nervous system.

2. The observed in the weightlifting sportsmen and the athletes just after the physical exercise the expressed and the significant tone reduction and the parasympathetic section reactivity, the significant increase against this background of the sympathetic – adrenal activity, they are revealed the violations in the adaptation process, which are shown by the functioning changes, having returned to the mechanisms' norm.

3. The sportsmen's and the athletes' adaptation reserves and the working balances of the cyclic types of sport and the martial arts are significantly wider, and with their optimal utilization consideration at the physical exercise, they are testified in favor of the most optimal functional state.

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