

# **SPORTS MEDICINE: PROBLEMS AND PROSPECTS**



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# SPORTS MEDICINE: PROBLEMS AND PROSPECTS

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The scientific papers presented research sports medicine issues, revealing the social aspects of the development of diseases in low physical activity, the need for medical supervision to preserve the health of students, the influence of exercise on the female body. Important issues are discussed in the works devoted to methodological problems of research of athletes, as well features of the cardiovascular system in elite athletes and sports veterans.

The scientific papers will be useful to sociologists, sports physiologists, cardiologists, sports doctors.

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Scientific papers presented in the author's edition.

*На 1-й стор. обкладинки: професор Романчук Олександр Петрович проводить обстеження спортсменів збірної команди України з боксу (Professor Oleksandr P. Romanchuk is conducting a survey of athletes' team of Ukraine on boxing)*

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# INTRODUCTION

In modern conditions the preparation of high qualification sportsmen is aimed at improving sports skills of a particular athlete, and to a large extent depends on the balanced interaction of many functional systems of the body that determine the nature of its adaptive capacity.

These adaptive characteristics include related functioning of the hemodynamic system, metabolism, immunological and hematopoietic values, the general profiles of which, according to the majority of the parameters, must remain within the limits of the statistical fluctuations corresponding to the same sex and age range of people, not deliberately engaged in a certain type of sports activity.

In other words, the optimal method of preparation of highly qualified athletes is the one allowing to achieve rapid growth of sportsmanship at the highest balance of individual performance and integrated level of functional systems that determine the adaptive reserves of an athlete while fully meeting the criteria of the population of people of practically healthy group of people of the same age and gender. However, the range of the variability parameters of homeostasis is much wider in athletes than in those who are not involved in sports; and rather often quite different values exceed the boundary population and can be treated as pre pathological and pathological. These changes reveal a higher adaptive capacity of an athlete.

It is completely obvious today that the diagnosis and correction of the functional state of athletes should be carried out taking into account the results of complex research methods and maximize personalized training plans, the amount and intensity of physical activity, the cycles of competition and recreation that in the future will relieve sport of the problems faced by coaches and doctors at the intensification of the training process.

That is, the diagnostic methods used in sports medicine should contribute to the early detection of conditions that can cause adverse effects of the impact of physical stress on the body, associated with the development of critical conditions and even deaths.

Therefore, an adequate diagnosis and assessment of the state of the body of people engaged in physical exercise seem extremely important area of sports medicine.



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## THE IMPACT OF MOTORING ON SOME INDICATORS OF CARDIOVASCULAR AND AUTONOMIC NERVOUS SYSTEMS IN VETERANS OF SPORTS

**Summary.** In recent years, the interest in the veterans of the sport has come thanks to an active veterans' movement in many countries and the participation of former athletes in the Championships of their countries, of Europe, and of the World.

There are research works in which sports doctors study the echocardiographic indices of the veterans of the sport, the features of central hemodynamics in the process of ontogenesis.

**The aim** is to study and compare the parameters of the cardiovascular, autonomic nervous system and physical performance in sports' veterans who continue to lead an active lifestyle after the sports career and have stopped playing sports and leading a sedentary lifestyle.

**Materials and methods.** The study included 31 male sports' veterans at the age of 32 to 75 years, mean age of  $50,3 \pm 1,85$  years, athletics training length  $11,4 \pm 0,83$  years in the past at a distance runners from 100 to 400 meters, with sports qualifications from the I category to master of sports of international class (MSIC).

Our study has shown that sport veterans (high class runners at a distance of 100-400 meters), that continue active exercises and do not differ from sport veterans, who lead a sedentary lifestyle by age, length of employment on the selected kind of athletics and body length have some advantages. This is primarily a smaller BMI, more common bradycardia, the absence of people with tachycardia, prevalence of parasympathetic effects ANS, hypokinetic TC and the lack of individuals with hyperkinetic TC, the large value of the relative value of the index  $PWC_{170}$  and functional

state. These results confirm the conclusion of many researchers that highly skilled athletes after the cessation of their professional activity in the prevention of cardiovascular events show continuation of physical activity in maintaining mode.

**Key words:** *veterans of sports, male, athletics, electrocardiographic, heart rate variables, central hemodynamics, functional state index.*

The problem of the health level and functional status of high class athletes, who have ceased active sports due to such reasons as a decrease in athletic performance, lack of motivation, serious injuries, etc., is always concerned by sports doctors. The first who conducted medical monitoring for former athletes and published the results of their observations were N.D. Graevskaya [8], V.K. Velitchenko and R.E. Motylyanskaya [3], E.L. Mikhalyuk [14,15,16], F.A. Jordanskaya [9], G. D. Sheliya [25], W. Bringmann [26], S. Israel [28], and others.

In recent years, the interest in the veterans of the sport has come thanks to an active veterans' movement in many countries and the participation of former athletes in the Championships of their countries, of Europe, and of the World. Scientists, mostly pedagogues, recommended approximate plans and characteristics of sports training in weightlifting [17], judo [19], cycling [7], and technical and tactical training of athletes in martial arts [1], the application of interval hypoxic training in the preparation of swimmers-veterans [10]. Some authors propose the optimal motor activity for basketball players [4], as well as the study of the age of age-regression of physical qualities and psychomotor functions [20].

There are research works in which sports doctors study the echocardiographic indices of the veterans of the sport [21,22,23], the features of central hemodynamics in the process of ontogenesis [5,6].

For many generations of athletes who are actively involved in sports, sooner or later there comes a time when they due to their age, have to stop regular training and performances in competitions. Athletes very painfully, and sometimes even dramatically, experience the retirement, believing that it was the best period of his life when they were young and healthy [24]. Speaking about the regularities of the adaptation process among the veterans of sport, some researchers propose to interpret the changes occurring in the body of an athlete with a sharp cessation of sporting activity, from the viewpoint of the theory of stress [5]. The authors believe that the stressor

may be not only athletic training with her physical and emotional impacts, but also an abrupt shutdown from the training process. The termination of sport activities creates a need to adapt to the new environment with a significantly lower motor mode, unusual mental and social factors that often turn out to be unsafe to the health of veterans.

Sports longevity as an important social and cultural phenomenon in recent years has increasingly become the object of scientific research. It is difficult to imagine the existence of more convincing arguments about the importance of healthy lifestyle and, as an illustrative example that can serve as sporting and professional achievements of the veterans of sports [10].

Concern about the health and motor activity of persons who have ceased sports activities should be an important national priority. Therefore, the study of all body systems and, in particular of the circulatory system in a remote period of the training process, is very important [9,16,28].

In most cases the basic indicators of hemodynamics in former athletes are within the lower limits of the age norms of persons who were not engaged in sports [9,27]. In particular, the main manifestations are tendency to lower values of blood pressure (BP), reduced heart rate, peripheral resistance at high values of the stroke and minute blood volume.

In individuals who have discontinued sports, but, however, carry on active motor mode showed the significant differences in the settings of cardiodynamics that characterize the favorable changes in the activity of their hearts [25,26].

Sports in case history have positive impact compensatory abilities of the cardiovascular system with the development of atherosclerosis and coronary heart disease (CHD) in athletes and help to improve clinical course and prognosis of treatment of CHD [12,13], have a positive impact on the prevention of the development of heart disease and overall life expectancy [29]. There is evidence showing that the veterans of the sport, who ceased active sports, revealed a high degree of the development of cardiovascular diseases (26%), while those who continued occupation revealed 4,5% [21].

Peculiarities of hemodynamics arising under the influence of training of athletes core-throwers according to our data [16] persist in individuals who have ceased active sports in a period of 5 to 25 years, though they are much lesser extended. However, such peculiarities remain not only in former athletes who continue to be engaged in physical activity but also in sports' veterans, leading a sedentary lifestyle, although in latter their expression is diminished. The persistent hemodynamic features can be considered as a factor that reduces the risk of developing of hypertension [16].

**The aim** is to study and compare the parameters of the cardiovascular, autonomic nervous system and physical performance in sports' veterans who continue to lead an active lifestyle after the sports career and have stopped playing sports and leading a sedentary lifestyle.

**Materials and methods.** The study included 31 male sports' veterans at the age of 32 to 75 years, mean age of  $50,3 \pm 1,85$  years, athletics training length  $11,4 \pm 0,83$  years in the past at a distance runners from 100 to 400 meters, with sports qualifications from the I category to master of sports of international class (MSIC). Among them, the finalists and participants of the Olympic Games, the finalists of the World and European championships, winners of international competitions, the champions of the Soviet Union and Ukraine. In order to clarify the influence of the motor mode after an active workout, we have formed 2 groups: the first (I) group included veterans ( $n=17$ ), mean age of  $49,9 \pm 2,64$  years, length of employment on the selected kind of athletics  $12,1 \pm 0,96$  years, length and weight, respectively  $178,3 \pm 1,36$  cm and  $79,9 \pm 2,40$  kg, which continue to lead an active lifestyle, using 3-4 times per week cross jogging, mini-football, basketball, volleyball, swimming. The second (II) group ( $n=14$ ), mean age  $50,6 \pm 2,65$  ( $p > 0,05$ ), length of employment on the selected kind of athletics  $10,6 \pm 1,43$  ( $p > 0,05$ ), length and body weight, accordingly  $174,5 \pm 1,61$  cm ( $p > 0,05$ ) and  $81,6 \pm 2,46$  kg ( $p < 0,05$ ). This group of veterans stopped playing sport and was leading a sedentary lifestyle. The groups for analysis of the studied parameters in veterans did not differ statistically in age, in the number of athletes who have qualification of the category I, Candidate Master of Sports (CCM), Master of Sport (MS) and MSIC. To assess the differences in the reliability of consent used  $\chi^2$  test based on the conventional method of determining the difference between the errors. The value of  $\chi^2$  criterion was 2,103, the relationship between the factor and effective signs was absent, the level of significance was  $p > 0,05$ .

Study of the bioelectric activity of the myocardium was performed by means of ECG in 12 leads to a state of relative calm. For the analysis of the autonomic regulation of cardiac activity mathematical methods of analysis of HRV were used. The following characteristics were singled out: modes (Mo, s), mode amplitude (AMo, %), variation range (D, s). The number of derived indices was counted: the index of vegetative balance (AMo/D, %/s), vegetative indicator rhythm (VIR,  $1/c^2$ ), the index of adequacy of regulation processes (IARP, %/s), tension index (TI, c.u.). Analysis and evaluation of frequency components of the heart rhythm was performed by examining the spectral parameters of the autocorrelation functions: total spectral power TP ( $mc^2$ ), power in the range of



very low frequency VLF ( $mc^2$ ), power in low frequency LF ( $mc^2$ ) and high HF ( $mc^2$ ) frequencies, LF and HF in normalized units (LFn, %, HFn, %), ratio of LF/HF (c.u.).

Central hemodynamics was studied by automated tetrapolar rheography on W. Kubiček et al. (1970) in the modification of Yu.T. Pushkar et al. (1970). The stroke and minute blood volumes were counted (SV, MBV), stroke and cardiac indices (SI, CI) were calculated, general and specific peripheral vascular resistance (GPVR, SPVR) were considered. Determination of physical capacity was performed by the standard technique on the Ergometer using a submaximal test  $PWC_{170}$  [11] and the calculation of the relative value of physical performance, i.e.  $PWC_{170/kg}$ . Functional state index (FSI) was calculated according to the formula proposed and patented by us [18].

The results were statistically processed using "Statistica 6.0 for Windows" program with parametric methods. Values are given as mean values  $M \pm m$ . Taken statistically significant differences in the figures for the value of the significance level of  $p$ , which does not exceed 0,05. Correlation between the variable was evaluated using Spearman's correlation coefficient (R) for variables with abnormal distribution and Pearson's for normal distribution [2].

**Results of the study.** After anthropometric research of sports' veterans, as well as collecting data from the questionnaires, we noted that veterans of both groups during the period of their active sports activity, did not differ in body mass index (BMI), respectively  $23,10 \pm 0,53 \text{ kg/m}^2$  and  $23,01 \pm 0,45 \text{ kg/m}^2$  ( $p > 0,05$ ), whereas in the present time, the veterans of the first group BMI amounted  $25,09 \pm 0,62 \text{ kg/m}^2$  and was significantly less than the veterans of the second group –  $26,86 \pm 0,64 \text{ kg/m}^2$  ( $p < 0,05$ ).

Electrocardiographic data demonstrated that the veterans of the first group showed 94,1% of sufficient voltage and 5,9% of the reduced voltage. The representatives of the second group possessed reduced voltage in 21,4%. Electrical axis of the heart in the first group was not rejected in 64,7% and declined to the left in 35,3%, while the veterans of the second group, respectively, and 78,6% and 21,4%.

Bradycardia was revealed in 58,8% of veterans of the first group, heart rate was in the range of 61-79 beats/min in 41,2%, among the veterans of the second group it was 57,2% of cases with heart rate in the range of 61-79 beats/min, and 35,7% of cases with 80 beats/min or more and bradycardia was detected in only one veteran (7,1%).

The veterans of the first group showed ECG changes which were detected in 52,9% mainly it was SERV (29,4%), AV blockade of the I degree was

founded in 11,7% and 5,9% of incomplete blockage of right bundle branch block (IBRBBB) and incomplete blockade of the anterior branch of the left bundle branch block (IBLBBB). Among the veterans of the second group ECG changes were recorded in 35,7%, 14,4% with the syndrome of early repolarization of ventricles (SERV), and in 10,65% of patients with AV blockage of the I degree and the combination of CRBBB and AV blockage of I degree. It should be noted that most of the observed changes in the ECG in sports' veterans of both groups are a feature of the ECG of athletes. In sports' veterans with CRBBB and IBLBBB according to echocardiography revealed no pathological changes.

HRV data showed that the Mo component, pointing to the dominant level of functioning of the sinus node, the veterans of the first group compared with the veterans of the second group was significantly higher, respectively, with  $0,941 \pm 0,03$  and  $0,804 \pm 0,03$  to ( $p < 0,05$ ), which indicated an increase in the tone of the centers of the parasympathetic innervation of the heart. The indicator of the rate of adequacy of regulation processes (IARP) reflecting the level of correspondence between the sinus node function and sympathetic activity was significantly smaller in the veterans of the first group compared with veterans of the second group, respectively  $54,45 \pm 3,45$  %/sec and  $67,52 \pm 6,47$  %/sec ( $p < 0,05$ ), which also indicates an increase in parasympathetic influences of the autonomic nervous system (ANS). Among other temporary HRV comparisons between the studied groups no significant differences were found. Thus, the analysis of time parameters of HRV indicates the prevalence of parasympathetic effects of the ANS in veterans, leading to an active lifestyle after professional sports.

The spectral analysis of HRV has shown that total spectral power (TP), which reflects the total activity of the autonomic influence on heart rate, was prevalent in veterans of the first group, respectively  $2887,9 \pm 324,1$  ms<sup>2</sup> and  $1946,0 \pm 413,4$  ms<sup>2</sup> ( $p < 0,05$ ), which indirectly may indicate the predominance of the parasympathetic ANS in sports' veterans of the first group. The confirmation of the above, with respect to the enhancement of the parasympathetic, is the presence of bradycardia in veterans of the first group ( $57,8 \pm 1,50$  beats/min) compared to the mean values of heart rate among the veterans of the second group ( $70,4 \pm 2,16$  beats/min,  $p < 0,01$ ).

Comparison of central hemodynamic parameters showed that the integral index SI was significantly smaller in the veterans of the first group, respectively  $2,607 \pm 0,08$  l/min/m<sup>2</sup> and  $3,170 \pm 0,09$  l/min/m<sup>2</sup>,  $p < 0,01$ , and it corresponds to a hypokinetic type of blood circulation (TC) and eukinetic TC in veterans of the second group. Veterans of the first group had such the percentage of

TC: 70,6%:29,4%:0%, when the representatives of the second group had: 7,1%:71,5%:21,4%, respectively hypokinetic, eukinetic and hyperkinetic TC, i.e, veterans of the first group prevails mostly hypokinetic TC and no former athletes with hyperkinetic TC, while in the second group persons have eukinetic TC and hyperkinetic TC. Among the variables of GRPV and HIPS no significant differences were found.

Analysis of the relative magnitude of the values of physical performance ( $PWC_{170}/kg$ ) of the surveyed showed that veterans who continue active physical exercise, the value  $PWC_{170}/kg$  was significantly greater than that of the second group, respectively up to  $18,57 \pm 0,77$   $kgm/min/kg$  and  $13,14 \pm 0,93$   $kgm/min/kg$  ( $p < 0,01$ ). The index of the functional state of the veterans of the first group was  $6,788 \pm 0,44$  rel. units and corresponded to "below average" assessment, while veterans of the second group had this value as  $4,355 \pm 0,43$  rel. units ( $p < 0,01$ ) and corresponded to a "low" estimation.

Individual analysis of the FSI has shown that veterans of the first group of "low" and "medium" rating was, respectively, in 6 people (35,3%), and "below average" – in 5 (29,4 %), where as the veterans of the second group "low" rating was in the 11 (78,6%) and "below average" – in 3 (21,4%). These individual analysis data confirm the average scores for groups.

Our study has shown that sport veterans (high class runners at a distance of 100-400 meters), that continue active exercises and do not differ from sport veterans, who lead a sedentary lifestyle by age, length of employment on the selected kind of athletics and body length have some advantages. This is primarily a smaller BMI, more common bradycardia, the absence of people with tachycardia, prevalence of parasympathetic effects ANS, hypokinetic TC and the lack of individuals with hyperkinetic TC, the large value of the relative value of the index  $PWC_{170}$  and functional state. These results confirm the conclusion of many researchers that highly skilled athletes after the cessation of their professional activity in the prevention of cardiovascular events show continuation of physical activity in maintaining mode.

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