



ASSESSMENT OF THE FUNCTIONAL STATE OF THE HUMAN CARDIOVASCULAR SYSTEM IN THE CONDITIONS OF THE REPUBLIC OF KARAKALPAKSTAN

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ANNOTATION

The article is devoted to the assessment of the functional state of the human cardiovascular system in the conditions of the Republic of Karakalpakstan. Assessment of the functional state of the cardiovascular system and the human circulatory system is relevant due to the increased degree of its vulnerability under the influence of various factors, as well as due to the high level of morbidity and mortality of the population due to cardiovascular pathology.

KEY WORDS: *cardiovascular system, degree, level, pathology, assessment, factor.*

Scientific problems of assessing the impact of environmental factors on human health and substantiation of the system of health-improving measures are today the priority tasks of state environmental policy in almost all developed countries. Establishing causal relationships between environmental risk factors and the health status of the population makes it possible to manage risk factors for preventive purposes.

Environmental pollution has an adverse impact on health, both current and future generations. The complexity and contradictory nature of human relations with the environment, increasing urbanization, high rates of industrial production, consumer use of the natural resources of the earth's interior have led to extreme environmental situations in a number of regions of the country.

The negative impact of the environment under conditions of massive anthropogenic load is reflected in the deterioration of demographic indicators, a decrease in the functional capabilities and defenses of the body, an increase in morbidity and mortality of the population (Alnazarova, 2010).

The poor quality of drinking water, superimposed on the hot, sharply continental climate of the Southern Aral Sea region, worsens the living conditions of the population, forms the basis for a

complex of diseases associated with the water factor, because in hot climates, water consumption increases by 8-10 times. In water pipelines supplying water from surface sources, the percentage of water quality deviations in some years reached 38% for chemical indicators and 43% for bacteriological indicators.

The share of water samples that do not meet hygienic standards for microbiological indicators for water pipelines with underground sources is 7.0%, with water intake from open reservoirs - 4.6%, for sanitary and chemical indicators - 15% and 27.7%, respectively (Konstantinova et al., 2001). The influence of the environment is reflected in the functional state of the human body (Agadzhanyan et al., 2006).

Assessment of the functional state of the cardiovascular system and the human circulatory system is relevant not only due to the increased degree of its vulnerability under the influence of various factors (Evdokimov et al., 2007), but also due to the high level of morbidity and mortality of the population due to cardiovascular pathology. The circulatory system is especially sensitive to the influence of the external environment and is relatively early included in the adaptation reactions (Kipshidze, 1985, Dratsev, 2008) and can be considered as a sensitive indicator of the adaptive reactions of the whole organism (Agadzhanyan et al., 2006).



The cardiovascular system, actively participating in the processes of adaptation of the body to the conditions of life, is significantly influenced by the autonomic nervous system (Baevsky et al., 2008).

At present, the method of analyzing heart rate variability (HRV) is widely used to assess the functional state of the human body, which is designed to study the autonomic regulation of physiological functions. As you know, the mechanisms of autonomic regulation play a leading role in the adaptive reactions of the body and the maintenance of homeostasis of its main systems when environmental conditions change (Baevsky et al., 2000).

Analysis of heart rate variability (HRV) is a method for assessing the state of the mechanisms of regulation of physiological functions in the human and animal body, in particular, the general activity of regulatory mechanisms, neurohumoral regulation of the heart, the ratio between the sympathetic and parasympathetic parts of the autonomic nervous system (Dratsev et al., 2008). The current activity of the sympathetic and parasympathetic divisions is the result of the response of a multi-circuit and multilevel circulatory regulation system, which changes its parameters over time to achieve an optimal adaptive response, which reflects the adaptive response of the whole organism (Shabalin, 2001; Konev, 2004).

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Adaptive reactions are individual and are realized in different individuals with varying degrees of participation of functional systems, which, in turn, have feedback that changes over time and has a variable functional organization. The main indication for the use of HRV analysis methods is the presence of probable changes on the part of the body's regulatory systems, in particular, changes in the autonomic balance. Since there are practically no functional states or diseases in which the mechanisms of autonomic regulation are not involved, the scope of the HRV analysis method is truly inexhaustible. This is due to the fact that the method today is, perhaps, the only available, non-

invasive, fairly simple and relatively cheap method for assessing autonomic regulation.

Currently, significant additional information in the analysis of the functional state of the body, which allows to determine the reactivity of the autonomic nervous system and autonomic support of activity, is obtained in the study of heart rate variability in the conditions of functional tests.

We examined 60 apparently healthy men from the Republic of Karakalpakstan, aged 20-50 years, living in various regions of the Republic of Karakalpakstan. The examined persons were conditionally divided into two groups: the first group - 20-39 years old (young age) and the second group - 40-50 years old (more mature age).

Adaptive reactions are individual and are realized in different individuals with varying degrees of participation of functional systems, which in turn have feedback that changes over time and has a variable functional organization. The method is based on measuring the time intervals between the R-waves of the ECG (R-R-intervals). HRV was assessed at 5-25 minute ECG recording periods (300-512 cardiocycle). Registration was carried out in the supine position, at rest, in the waking state, against the background of voluntary breathing.

To assess the sequence of sinus heartbeats, the following indicators were calculated: the average duration of the R-R intervals and the standard deviation of the R-R intervals (SDNN) - a statistical indicator characterizing HRV as a whole. We also calculated the heart rate (HR), stress index (SI), indicator of the activity of regulatory systems (PARS), indicators of systolic (SBP) and diastolic blood pressure (DBP), Robinson's double product (DP).

In the course of our studies, we found that in mature men (40-50 years) SBP is higher than in younger men (133.6 ± 10.1 versus 120.1 ± 7.8 mm Hg, $p < 0.05$). In terms of DBP, there were no significant differences between men in both groups (82.5 ± 6.5 and 80.4 ± 6.0 mm Hg, respectively, $p > 0.05$). In our opinion, a consequence of the high SBP level in the second group is high AP values (44.2 ± 8.1 versus 41.7 ± 3.8 mm Hg, $p < 0.05$). In our opinion, the higher values of blood pressure in the second group, compared with men in the first group, apparently, can also be a consequence of the increased total peripheral vascular resistance.

The heart rate in men of the second group is lower (72.2 ± 8.6 beats / min and 3618 ± 710 ml / min) ($p < 0.05$) than in men of a younger age (20-39 years) living in Karakalpakstan (80.6 ± 7.7 beats / min and 4332 ± 512 ml / min).



To maintain this level of functioning of the main systems of the body, the values of the integral indicator of the activity of regulatory systems (PARS = 3-4 points) in men of mature age (40-50 years) indicate a state of moderate tension of regulatory systems. It was also found that in men of the first age group, the level of functioning of the main systems is within the standard.

When determining the type of autonomic regulation in men of mature age (second group), the prevalence of the number of vagotonics (69%) was noted, in young men (first group) - the number of normotonics (64%).

According to experts, the seasons of the year are an essential factor in the formation of a person's functional state (Veretelnik, 2000; Evdokimov, 2004). Throughout the year, a person goes through cycles of natural seasonal acclimatization. The functional state of the human circulatory and respiratory systems depends on the phase of the annual cycles of natural seasonal acclimatization and the temperature conditions of the environment. Until now, there is no complete picture of the annual dynamics of functional rearrangements in

the body and its influence on human ontogenesis under conditions of aridization and desertification in the South Aral Sea region, although this is of great scientific and practical importance.

The cardiovascular system provides all metabolic processes in the human body and is a component of various functional systems that determine homeostasis. The main indication for the use of HRV analysis methods in both age groups (20-39 years old and 40-50 years old) in the hot period of the year is a somewhat satisfactory adaptation to environmental conditions, in which there are sufficient functional capabilities of the body and homeostasis is maintained at a moderate tension of the regulatory systems. In summer and winter, due to the influence of unfavorable climatic factors (very low / high air temperature, high atmospheric pressure), "younger" and "mature" men develop a pronounced tension of regulatory systems with the mobilization of functional reserves to maintain the balance of the body with the environment (Ribera K., 2000).

Table
Indicators of heart rate variability in the population
different age groups in contrasting seasons

Indicator	Summer period		Winter period	
	"Young" (n=12)	"Mature" (n=13)	"Young" (n=20)	"Mature" (n=15)
SDNN, mc	44,01	41,32	49,30*	36,80*
SI, conventional unit	99,0	102,2	110,0	137,0

In the surveyed men living in Karakalpakstan, a decrease in the activity indicators of the parasympathetic division of the ANS in the cold season was revealed, which allows us to speak about the predominance of the central circuit of the heart rhythm regulation over the autonomous one in both groups of the surveyed men.

In the warm season, the stress index (SI) was at the same level in both age groups, but in winter, "mature" men have a higher value of this indicator, which is at the upper limit of the standard. In all examined men, the indices of central hemodynamics and autonomic regulation did not differ. Age features are manifested both in the hot and in the cold seasons, when in both groups there is a dominance of the central circuit of regulation, with the inclusion of higher levels of regulation of the heart rate in the group of 40-50 years.

It has been established that in men of mature age, the indigenous inhabitants of the Republic of Karakalpakstan, the influence of the central circuit prevails over the autonomous one in the regulation of the heart rate during the annual observation cycle. In the group of men aged 20-39 during the cold period of the year (winter), differences in the functional state of the cardiovascular system and autonomic regulation were revealed, while in the hot period (summer), no particular differences were found.

It was also noted that men living in Karakalpakstan have the most optimal regulation of the heart rate and tension of the regulatory systems. It was revealed that the participation of the central control circuit is minimal. At the same time, it was found that during the off-season (autumn), stabilization of compensatory-adaptive mechanisms occurs.



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