

Особливості варіабельності серцевого ритму полярників під впливом загального короткочасного повітряного охолодження

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Features of Heart Rate Variability in Polar Explorers Under Whole Body Short-Term Air Cooling

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Polar expedition suggests the stay of explorers under extreme conditions for a long period of time. It is believed that the pre-adaptation procedures may reduce the negative effects of stress on the body. To test this assumption, there was proposed to use the whole body short-term air cooling. The functional state of winterers was assessed by HRV analysis during orthostatic test before and after exposure to the cryochamber, before and after wintering.

The procedure of whole body air cooling implies keeping a patient into a closed chamber with dry air environment at $-68...-70^{\circ}\text{C}$ during 3 min. The whole body air therapy sessions were performed in the cryosauna TAN series (Oktagon-Turbo, Ukraine) according to the standard protocols. The nervous and humoral regulatory systems of heart activity of polar explorers, preparing for wintering at the Vernadsky Research Base, were the research object. The indices of cardiac activity from the first to the fifth procedures were studied. The HRV results were processed with an electrocardiographic complex CardioLab (XAI MEDICA, Ukraine). The main HRV parameters, such as the adequacy of regulatory processes (PAPR), spectral analysis indices, those of high (HF) and low frequency (LF) power, and the very low frequency (VLF) components, the total power (TP) of the spectrum, that of the activity of regulatory systems (PARS) were measured prior to and after each procedure according to the active orthostatic test protocol [Babijchuk, 2007, Ag-hajanyan, 2012, European Society of Cardiology, 1996].

The adaptation to cold loads in a cryochamber was shown to have the two-stage response for polar explorers. After the first procedures the indices increased, next decreased after the third one, and then augmented again. This effect manifests itself both at the level of general indices of regulatory processes of cardiac activity (PAPR), and at that of redistribution of regulatory mechanisms themselves, that is reflected in HF, LF and VLF indices.

The response strategy of the heart regulatory systems to cryogenic procedures after staying at the Vernadsky Research Base has changed. The spectral distribution was dominated with very low frequency (VLF) components prior to wintering, and by high frequency (HF) ones after it. This suggests the response to functional load after wintering to be stipulated by parasympathetic nervous system.

Thus, a previous stay of polar explorers in a cryochamber with dry air at $-68...-70^{\circ}\text{C}$ for 5 procedures was shown as capable to increase the adaptability of cardiac regulatory systems to cold effect during wintering.

Ферменти бактерій, що асоційовані з червононим моллюском *Nacella concinna*, з акваторії Аргентинських островів (Західна Антарктика)

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Bacterial Enzymes Associated with Gastropod Mollusc *Nacella concinna* from the Water Area of the Argentine Islands (West Antarctica)

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Extremophilic microorganisms living in the polar regions of the Arctic and Antarctic have a cold-adapted enzyme system [Duarte, 2013; Salwoom, 2019]. Due to a high activity and stability at low temperatures, the use of these enzymes in industrial processes may be economically advantageous. The searching for efficient producers of industrially important enzymes of α -L-rhamnosidase and keratinase is a topical task.

The research aim was to isolate the microorganisms from molluscs *Nacella concinna* (Strebel, 1908), common inhabitants of the Antarctic waters and to identify the L-rhamnosidase and keratinase producers among them. The total proteolytic (caseinolytic) activity was determined by the Anson assay with Petrova's modification. The keratinase activity was estimated by UV absorption at 280 nm (spectrophotometer SF 26) of hydrolysis products of keratin-containing raw materials. The α -L-rhamnosidase activity was determined by the Davis method with naringin as a substrate.

The keratinolytic (Ker) activity was revealed in the culture liquids of 26 (76.4%) from 34 investigated strains. The Ker activity varied from 1 to 4 U, both in a medium with maltose and gelatin as a substrate, as well as in that, supplemented with feathers, as the main source of carbon and nitrogen. The highest Ker activity (4 U) was observed in the culture liquids of strains 8a/1 and 8a/2, isolated from one source: seabed sediments of the Skua Creek Strait (Argentine Islands), 10 m depth. Screening of 34 strains showed the α -L-rhamnosidase activity (from 0.0025 to 0.11 U/mg protein) in 8 strains only (23.5%). Two strains (1/9 and 5/4) had a trace quantity of α -L-rhamnosidase activity. The maximum α -L-rhamnosidase activity was detected in the culture liquids of strains 3/1 and 3/4 (0.095 and 0.11 U/mg protein, respectively), isolated from the washout of mollusc shells from the water area of the Uruguay Island (16 m depth), as well as strain 1/11 (0.085 U/mg protein) isolated from the soft tissues of the same mollusc.

For the first time, the producers of proteolytic (keratinolytic) and glycolytic (α -L-rhamnosidases) enzymes were isolated and identified from the *Nacella concinna* molluscan species, inhabiting Antarctic waters.

