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Geochemistry and healing effects of fresh arzhaans of Tuva  
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#### SUMMARY

One of the popular methods of healing in the Republic of Tuva is treatment on natural healing springs - arzhaans. Fresh arzhaans make up 70% of the 220 names of healing waters of Tuva registered to date. The relevance of conducting hydrogeochemical studies of fresh arzhaans and identifying their healing effect is due to the fact that the indigenous population of the Tuva Republic uses mineral and fresh arzhaans for treatment.

Purpose of the study - study of hydrogeochemical characteristics and assessment health-improving effect of fresh arzhaans of Tuva.

Materials and methods. Analytical studies of the chemical composition of arzhaan waters performed in the accredited problem research laboratory of hydrogeochemistry of the Engineering School of Natural Resources of the National Research Tomsk Polytechnic University. Medico-biological studies were carried out using standardized methods of prenosological diagnostics, which were reproducible in the field of research - integral indicators of the level of somatic health according to the method of G.L. Apanasenko and adaptive potential according to R.M. Baevsky.

Results. The results of hydrogeochemical and medical biological research of arzhaan balneotherapy methods carried out in 2013–2014.

Conclusion. It is shown for the first time that fresh arzhaans of Tuva have a healing effect, like mineral arzhaans.

Key words: folk balneotherapy, arzhaans, geochemistry, medical biological research, Republic of Tuva.

#### RESUME

One of the folk methods of health improvement in the Republic of Tuva is the treatment by natural healing sources - arzhaans. Fresh arzhaans account for 70% of the registered to the present time 220 names of healing waters of Tuva. Indigenous population of the Republic of Tuva since ancient times uses healing springs, both mineral and fresh what is a background for hydrogeochemical researches.

Aims: assess of the hydrogeochemical characteristics and the healing effect of fresh arzhaans of Tuva.

Methods. Analytical studies of the chemical composition of arzhaans water were carried out in the accredited problem research laboratory of hydrogeochemistry of the Engineering school of natural resources of the National research Tomsk Polytechnic University. Medical and biological studies of

unorganized folk arzhaan methods of treatment were carried out using standardized methods of prenosological diagnosis, which were reproduced in the field conditions of this study - integral indicators of the level of somatic health by the method of GL Apanasenko and adaptive capacity by RM Bayevsky.

Results. The article presents the results of hydrogeochemical study of fresh arzhaans of Tuva and medical and biological studies of arzhaan balneotherapy conducted in 2013–2014.

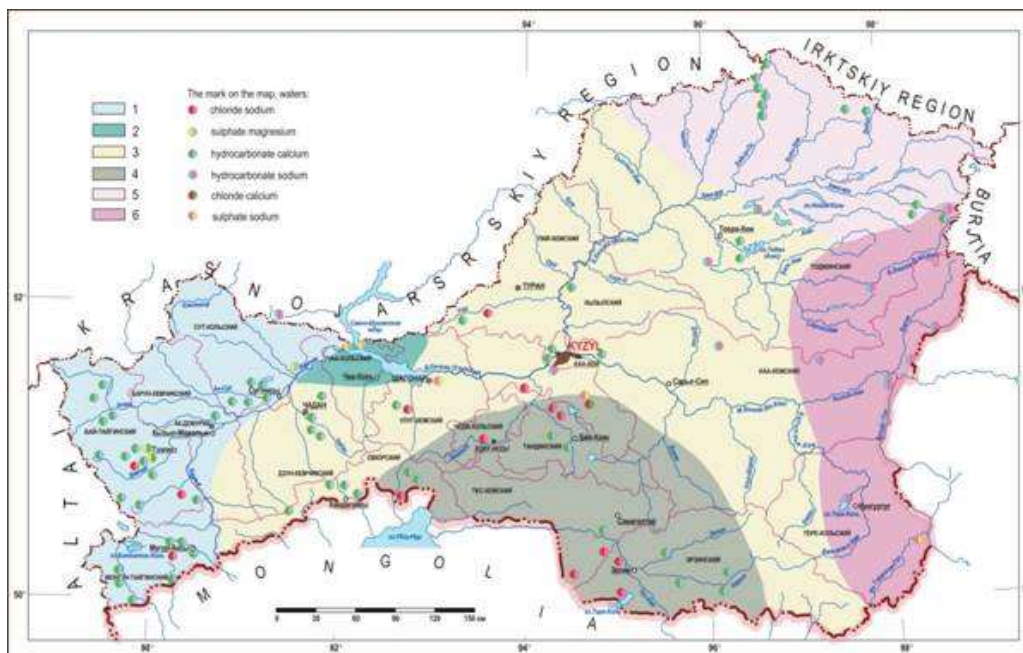
Conclusion. For the first time scientifically proven that fresh arzhaan of Tuva, as well as mineral, have a significant healing effect.

Keywords: folk balneotherapy, arzhaans, geochemistry, medical and biological researches, the Republic of Tyva.

#### INTRODUCTION

The Republic of Tyva has a unique geographical position - at the junction of the South Siberian taiga forests and the Central Asian steppes and deserts. The peculiarities of its relief, climate, geological structure and hydrogeological conditions predetermined the distribution in the republic of various types of natural water medicinal resources - arzhaans, mineral, which include underground mineralized springs and salt-mud lakes, and freshwater, which include underground freshwater springs.

Almost all types of mineral waters known in the territory of the Russian Federation and the former Soviet Union are found in Tuva. To date, 220 names of natural water treatment facilities have been recorded on the territory of the republic. The main types of medicinal waters in Tuva are shown in Fig. 1.



Rice. 1. Types of medicinal waters in Tuva:

- 1 - Altai-West Sayan region of cold radon waters;
- 2 - Kurtushibinskaya region of acidic waters;
- 3 - Central Tuva region of ground and surface waters of various composition;
- 4 - Tannu-Ola (Ubsu-Nur) area of surface and ground salt waters;
- 5 - East Sayan region of thermal and cold carbonic waters;
- 6 - Khuvsgul region of nitrogen thermal (hydrogen sulphide).

Fresh arzhaans are natural springs that are popularly known as medicinal, but due to the level of mineralization and due to the absence of biologically active components (carbon dioxide, silicic acid, hydrogen sulfide, iron, radon, etc.)

officially recognized definition of medicinal mineral waters [4]. Their total mineralization is less than one gram per liter; these are mainly fresh and ultra-fresh waters with an average temperature at the exit from the ground from 1.5 to 10 °C. The number of fresh arzhaans on the territory of the republic is more than 70% of all sources registered to date. They are found almost everywhere, many of them in accessible areas, close to transport and energy communications.

In the middle of the twentieth century, unleavened arzhaans were classified as "false arzhaans", on which there was no need for treatment, since these are ordinary fresh waters, which do not contain, unlike mineral, biologically active components [6]. However, the indigenous population of Tuva has been treated with arzhaans since ancient times, including fresh ones. To find out whether arzhaans have a healing effect, large-scale multicenter biomedical studies of the effectiveness of folk balneotherapy methods were carried out on 30 arzhaans of Tuva, both mineral and fresh, in 2013 and 2014. In parallel, a hydrogeochemical survey of the waters of these arzhaans was carried out.

Purpose: assessment of hydrogeochemical characteristics and identification of a healing effect fresh arzhaans of Tuva.

The tasks of the hydrogeochemical survey of arzhaans were: 1) study of the chemical composition of source waters; 2) study of individual characteristics of the territories of their location and places of their water occurrence. The task of biomedical research was to analyze the dynamics of somatic health and functional reserves of the body before and after recovery on arzhaans using established folk methods.

## MATERIALS AND METHODS

Analytical chemical composition studies waters arzhaans executed V  
accredited problem research laboratory of hydrogeochemistry of the Engineering School of Natural Resources of the National Research Tomsk Polytechnic University.

The state of the cardiovascular system was assessed using the method of measuring blood pressure according to Korotkov, electrocardiography, the integral index of the heart (IRS, double product) and the index of functional changes (adaptive potential) according to R.M. Baevsky [7]. The index of functional changes (IFI) or adaptation potential is an indicator of the level of adaptability of the human body to various and changing environmental factors. This is one of the most important physiological indicators of vital activity, the formation of the level of which is carried out by the whole complex of changes in the physiological systems of the body (hormones of the pituitary and adrenal glands, the state of the nervous, cardiovascular, respiratory and other systems) under the influence of stress factors (physical, mental work, shifts in atmospheric pressure, temperature, etc.). At the same time, a new adaptive behavior of the individual is formed, which ensures the most favorable adaptation of the organism to these factors. IFI is a complex indicator built on the basis of regressive relationships - heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP), age (B), body weight (MT) and height (P). A decrease in IRS and IFI indicates an economization of the work of the heart and an improvement in the adaptive capabilities of the cardiovascular system and the body as a whole. Psychoemotional status analysis was carried out using the validated HADS and PSM-25 scales. The functional state of the central nervous system was assessed by the method of E.P. Ilyin using a tapping test, providing the most favorable adaptation of the organism to these factors. IFI is a complex indicator built on the basis of regressive relationships - heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP), age (B), body weight (MT) and height (P). A decrease in IRS and IFI indicates an economization of the work of the heart and an improvement in the adaptive capabilities of the cardiovascular system and the body as a whole. Psychoemotional status analysis was carried out using the validated HADS and PSM-25 scales. The functional state of the central nervous system was assessed by the method of E.P. Ilyin using a tapping test, providing the most favorable adaptation of the organism to these factors. IFI is a complex indicator built on the basis of regressive relationships - heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP), age (B), body weight (MT) and height (P). A decrease in IRS and IFI indicates an economization of the work of the heart and an improvement in the adaptive capabilities of the cardiovascular system and the body as a whole. Psychoemotional status analysis was carried out using the validated HADS and PSM-25 scales. The functional state of the central nervous system was assessed by the method of E.P. Ilyin using a tapping test, systolic blood pressure (SBP) and diastolic blood pressure (DBP), age (B), body weight (MT) and height (P). A decrease in IRS and IFI indicates an economization of the work of the heart and an improvement in the adaptive capabilities of the cardiovascular system and the body as a whole. Psychoemotional status analysis was carried out using the validated HADS and PSM-25 scales. The functional state of the central nervous system was assessed by the method of E.P. Ilyin using a tapping test. Psychoemotional status analysis was carried out using the validated HADS and PSM-25 scales. The functional state of the central nervous system was assessed by the method of E.P. Ilyin using a tapping test. Psychoemotional status analysis was carried out using the validated HADS and PSM-25 scales. The functional state of the central nervous system was assessed by the method of E.P. Ilyin using a tapping test. Psychoemotional status analysis was carried out using the validated HADS and PSM-25 scales. The functional state of the central nervous system was assessed by the method of E.P. Ilyin using a tapping test. Psychoemotional status analysis was carried out using the validated HADS and PSM-25 scales. The functional state of the central nervous system was assessed by the method of E.P. Ilyin using a tapping test. Psychoemotional status analysis was carried out using the validated HADS and PSM-25 scales.

Rapid assessment of the level of somatic (physical) health (HSS) was carried out according to the method of G.L. Apanasenko, R.G. Naumenko [1, 2], taking into account the indicators of physical development (anthropometric data), the state of the respiratory (spirometry, functional breathing tests) and cardiovascular systems (ECG, blood pressure, heart rate) at rest and in the recovery period after dosed physical activity (test with squats). On the basis of HSS, we divided all the surveyed according to the levels of physical health into groups:

“Low”, “below average”, “average”, “above average”, “high” health levels. The ratio of different types of health levels and the average value of health levels before and after the course of health improvement were determined.

The results were processed using the statistical package PASW Statistics 18, version 18.0.0 (SPSS Inc., USA). The hypothesis of normal distribution was tested using the Kolmogorov-Smirnov and Shapiro-Wilks tests. The Wilcoxon T test was used to determine the differences between the associated samples. The Chi-squared test was used to test the significance of differences in the distributions of the trait. The critical level of significance when testing statistical hypotheses in the study was taken equal to 0.05. Data are presented as mean value with standard deviation ( $M \pm \sigma$ ).

## RESULTS

### Hydrogeochemical research

Arzhaans surveyed in 2013–2014 are located in 13 kozhuuns of the Tuva Republic: Mongun-Taiginsky (Ala-Taiga, Aspaty), Ovyursky (Adargan, Taldyg-Charyk), Bai-Taiginsky (Bel), Barun-Khemchiksky (Chas -Adyr), Dzun-Khemchiksky (Kegeen-Bulak), Sut-Kholsky (Khattyg-Chazy), Chaa-Kholsky (Kara-Sug), Ulug-Khemsky (Kyzyl-Durug), Kyzylsky (Oorash-Khem), Todzhinsky (Borzu -Khol), Tandinsky (Uurgaylyg, Mannaylyg), Tes-Khem (Duktug-Dyt), Erzinsky (Darhi). The sources are remote from each other and are not geographically connected.

In terms of hydrogeochemical parameters, taking into account the anionic and cationic compositions, the studied fresh arzhaans can be conditionally divided into the following main groups:

- bicarbonate calcium - Borzu-Khol (a distinctive feature is the presence of hydrogen sulfide), Chas-Adyr;
- hydrocarbonate magnesium-calcium and calcium-magnesium - Ala-Taiga, Bel, Darhi, Duktug-Dyt, Kara-Sug, Kegeen-Bulak, Oorash-Khem, Uurgailig, Khattyg-Chazy;
- hydrocarbonate-sulphate magnesium-calcium and calcium-magnesium - Adargan, Mannaylyg;
- sulphate-hydrocarbonate sodium-calcium and magnesium-calcium - Aspaty, Taldyg-Charyk;
- chloride-hydrocarbonate sodium-calcium - Kyzyl-Durug. The main physical and chemical characteristics are presented in table. 1.

Table 1

The main physical and chemical characteristics of fresh arzhaans of Tuva, on which medical and biological studies were carried out in 2013–2014

No. p / p	Name arzhaana, (kozhuun)	T, ° C	NS	M	ORP	Coolant	Kurlov's formula	Rn	y
				g / l	mV	mg- eq / l		Bq / L	µR / hour
Hydrocarbonate calcium waters									
1.	Borzu-Khol, (Toja)	1.5	7.6	0.42	- 170	5.15		0.8	twenty
2.	Chas-Adyr, basic (Barun-Khemchik)	4.0	7.6	0.33	216	4.1		26	22
Hydrocarbonate magnesium-calcium and calcium-magnesium									
3.	Ala-Taiga, basic (Mongun-Taiga)	7.5	8.2	0.17	165	1.9		15	fourteen

4.	Bel, main (Bai-Taiga)	6.5	8.0	0.20	143	2.3		22	eighteen
5.	Darhi (Erzin)	10.5	7.4	0.27	170	2.35	M0.19 $\frac{HCO_3 89SO_4 10Cl1}{Ca72Mg22Na5K1}$	4	13
6.	Duktug-Dyt (Tes-Hem)	3.0	8.0	0.29	169	3.7		3	12
7.	Kara-Sug, (Cha-Hol)	3.1	7,7	0.52	148	5.9		53	fourteen
eight.	Kegeen-Bulak (Dzun-Khemchik)	5.0	7.5	0.32	400	4.0	M0.32 $\frac{HCO_3 89SO_4 7CO_3 3Cl1}{Ca49Mg36 Na14K1}$	35	12
nine.	Oorash-Khem (Kyzyl-sky)	6	8.0	0.41		4.8		5.9	16
ten.	Uurgailig, basic (Tandas)	7.5	8.4	0.22	112	2.7		3	eleven
eleven.	Khattyg-Chazy (Sut-Khol)	6,7	8.5	0.48	138	5.6		73	23
Hydrocarbonate-sulphate magnesium-calcium and calcium-magnesium									
12.	Adargan (Ovure)	1,2	8.2	0.53	180	7.3		33	29
13.	Mannailig (Tandas)	3	5.5	0.89		12.1		7.9	17
Sulphate-hydrocarbonate magnesium-calcium and sodium-calcium									
fourteen.	Aspaty (Mongun-Taiga)	2.0	8.7	0.12	170	1.65		21	28
15.	Taldyg-Charyk (Ovure)	2.0	8.1	0.36	129	4.5		180	19
Chloride-hydrocarbonate sodium-calcium									
16.	Kyzyl-Durug (Ulug-Khem)	3.1	8.2	0.32	125	3.0		41	15
Designations in the table: T - temperature, °C; pH - acidity (alkalinity); M - mineralization, g / l; ORP - redox potential, mV; Coolant - total hardness, mg-eq / l; the composition of the source according to the Kurlov formula is indicated as follows: first, there is a listing of anions (in the numerator), starting from an anion with a content of at least 20% -eq. and higher, then - enumeration of cations (in the denominator), starting with a cation with a content of at least 20% -eq and above (for example, for arzhaan No. 2 Bel, the water composition is characterized as hydrocarbonate magnesium-calcium); Rn - radon, Bq / l; γ - gamma radiation, hard, in microR / hour.									

The temperature of the surveyed springs ranges from 1.5 to 10.5 °C, pH - in the range of 5.5–8.7, mineralization - from 0.12 to 0.89 g / l. The radon content in the waters of the surveyed arzhaans is below the balneological norm, equal to 200 Bq / l [8]. One can note the arzhaan Taldyg-Charyk, the radon content of which (180 Bq / l) is close to the balneological norm.

Thus, the surveyed arzhaans belong to fresh cold springs that do not contain biologically active substances in balneologically significant quantities.

The radiological situation in the territories of fresh arzhaans, where medico-biological studies were carried out, is in the range from 11 to 29 mcr / hour. The admissible background of radiation is up to 60 μR / hour [5].

#### Biomedical research

Biomedical examination was carried out in more than 2,000 people in arzhaan

seasons 2013–2014 teams of medical workers from central kozhun hospitals with visits to healing springs, of which 1008 people were examined on fresh arzhaans.

As shown by the results of the study, traditional methods of balneotherapy (pouring, bathing, drinking) contributed to the improvement of the psychoemotional status and physical performance in the vast majority of respondents in all studied arzhaans.

In most cases, rehabilitation using folk methods led to an improvement in the volumetric characteristics of the lungs and the functional activity of the respiratory system in the form of an increase in the vital capacity of the lungs, the time of holding the breath during inhalation and exhalation (Shtange, Genchi tests), and an increase in the level of blood oxygen saturation (Table 2).

table 2

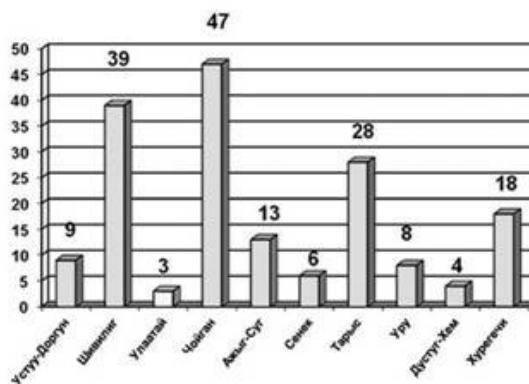
Dynamics of integral indicators of health status in the process of recovery on fresh arzhaans (in% to the initial level) cumulative data for 2013–2014

No. p / p	Name arzhaana, number persons, (kozhuun)	IRS (decline)	IFI (decline)	Level health (increase)	Notes (edit)
1.	Borzu-Khol, n = 31 (Toja)	16	7	80	High healing effect, improvement of cardiovascular and respiratory systems
2.	Chas-Adyr, n = 50 (Barun-Khemchik)	17	nine	0	Relief of symptoms gastrointestinal diseases
3.	Ala-Taiga, n = 93 (Mongun-Taiga)	eleven	7	25	Antihypertensive effect, improvement of respiratory performance
4.	Bel, main n = 64 (Bai-Taiga)	ten	eight	29	High healing effect in various pathologies
5.	Darhi, n = 31 (Erzine)	0	0	0	Requires further study
6.	Duktug-Dyt, n = 101 (Tes-Hem)	eleven	7	7	Moderate healing effect
7.	Kara-Sug, n = 61 (Chaa-Khol)	deterioration	0	eight	Weak healing effect only for diseases of the joints
eight.	Kegeen-Bulak, n = 86 (Dzun-Khemchik)	0	0	0	Requires further study
nine.	Oorash-Khem, n = 55 (Kyzyl)	0	7	19	Moderate healing effect for joint diseases
ten.	Uurgailig, main, n = 57 (Tandas)	0	0	0	Requires further study
eleven.	Hattyg-Chazy, n = thirty (Sut-Khol)	eleven	19	42	High healing effect in heart and lung diseases

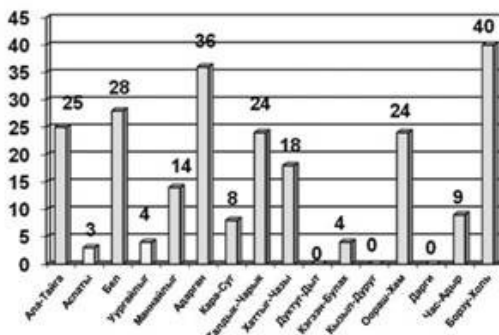
12.	Adargan, n = 77 (Ovur)	17	19	38	Pronounced hypotensive and pulsating effect, high healing effect in CVD
13.	Mannaylig, n = 60 (Tandy)	6	5	fourteen	Moderate revitalizing effect in CVD
fourteen.	Aspaty, n = 55 (Mongun-Taiga)	0	0	0	Used to treat ophthalmic diseases, requires further study
15.	Taldyg-Charyk, n = 60 (Ovure)	eleven	7	36	Improvement of symptoms diseases of the gastrointestinal tract and musculoskeletal system
16.	Kyzyl-Durug, n = 97 (Ulug-Khem)	0	0	0	Requires further study
Legend: IRS - index of heart function, IFI - index of functional changes or adaptive potential.					

At the same time, a detailed analysis of the integral indicators of health made it possible to determine the most promising fresh arzhaans for further development, as well as to identify arzhaans, the therapeutic and healing effect of which was not established in this study and requires further substantiation (Table 2).

To compare the healing effect of treatment with mineral and fresh arzhaans, we cite as an example of the change in the level of somatic health before and after spontaneous folk balneotherapy according to the results of research in 2014 (Fig. 2, 3). In fig. Figures 2 and 3 show that fresh arzhaans are not inferior to mineral arzhaans in terms of their healing effect.



Rice. 2. The level of somatic health in spontaneous balneotherapy on mineral arzhaans, in% of the initial level. Research 2014.



Rice. 3. The level of somatic health in spontaneous balneotherapy on fresh arzhaans, in% of the initial state. Research 2014.

It is shown that the chemical composition of the Adargan and Mannaylyg arzhaans is approximately the same - hydrocarbonate-sulphate magnesium-calcium. Arzhaan Adargan has the greatest healing effect in respondents with diseases of the cardiovascular system, Mannaylyg - in the musculoskeletal system and peripheral nervous system. In the process of hydrotherapy on these arzhaans, an antihypertensive effect was obtained; IFI decreased by 19% and 5%, respectively, therefore, the adaptive potential of the organism increased. After treatment on the Adargan arzhaan, the health level of the subjects increased by 38% in relation to the initial level, on the Mannaylyg arzhaan - by 14%.

Fresh arzhaans with a hydrocarbonate magnesium-calcium composition include Borzu-Khol, Bel, Ala-Taiga, Oorash-Khem, Duktug-Dyt, Uurgaylyg, Kegeen-Bulak, Darhi and Chas-Adyr.

The peculiarity of the Borzu-Khol arzhaan, in contrast to the others, is the content of hydrogen sulfide, the smell of which is felt quite clearly. In the process of hydrotherapy on arzhaan Borzu-Khol, the greatest regression was obtained in relation to the clinical manifestations of diseases of the musculoskeletal system, as well as a decrease in the severity of symptoms such as cardialgia, headaches, shortness of breath during exertion. Blood pressure indicators SBP and DBP statistically significantly decreased, there was a decrease in the pulse rate, therefore, the heart function index (IRS) decreased, which indicates an increase in the adaptive potential of the organism in relation to the initial level (an increase was observed by 9%). The level of somatic health after treatment with arzhaan Borzu-Khol increased by 80% in relation to the initial level. This is the highest value

Hydrotherapy on arzhaans Bel and Ala-Taiga turned out to be the most effective in diseases of the musculoskeletal system and cardiovascular system. Recovery on these arzhaans contributed to the implementation of the antihypertensive effect, a decrease in IFI in relation to the initial level by 7.8% on the arzhaan Bel and by 7.4% on the arzhaan Ala-Taiga. This indicates the presence of a corrective effect on the adaptive capabilities of the cardiovascular system. In general, after a course of healing hydrotherapy, the level of somatic health among the surveyed respondents on the arzhaan Bel increased by 29%, on the arzhaan Ala-Taiga - 25% in relation to the initial level.

Arzhaan Oorash-Khem is the most favorable for the treatment of diseases of the musculoskeletal system. The state of the cardiovascular system changed insignificantly, there was a decrease in the index of functional changes in the cardiovascular system. The health level after hydrotherapy increased by 19% in relation to the initial level.

Arzhaans Duktug-Dyt, Uurgaylyg, Kegeen-Bulak and Darhi, which have the same therapeutic effect, are used by the population for diseases of the musculoskeletal system and the cardiovascular system. The waters of arzhaan Duktug-Dyt in the process of hydrotherapy give a hypotensive effect, the average value of the index of functional changes in the cardiovascular system decreased by 7%, which in turn led to an increase in the adaptive potential and level of somatic health. Arzhaans Uurgaylyg, Kegeen-Bulak and Darhi do not have a significant effect on the state of the cardiovascular system; when assessing the adaptive potential, no significant dynamics was obtained, only in the arzhaan Kegeen-Bulak there was a tendency for improvement. The level of health after a course of hydrotherapy on these arzhaans practically did not change.

The main therapeutic effect of the Chas-Adyr arzhaan is a positive effect on cardiovascular diseases, in addition, during the treatment on this arzhaan, the symptoms of the pathology of the gastrointestinal tract were completely stopped (as in the Ala-Taiga arzhaan). When assessing the state of the cardiovascular system, a decrease in heart rate was observed, blood pressure indicators of SBP, DBP and values of the heart function index decreased, therefore, the adaptive potential of the organism increased. The health level after the treatment remained practically unchanged.

The arzhaans Khattyg-Chazy and Kara-Sug belong to the hydrocarbonate calcium-magnesium waters. The first contains a certain amount of radon (73 Bq / l), the second is absent. Their therapeutic effect is different, arzhaan Khattyg-Chazy is most favorable for



diseases of the bronchopulmonary system, ENT organs, musculoskeletal system and cardiovascular system, arzhaan Kara-Sug - only in diseases of the musculoskeletal system. In the course of treatment on arzhaan Khattyg-Chazy, a distinct hypotensive effect was obtained, which led to an increase in the adaptive potential of the organism. After the course of treatment, the level of somatic health increased by 42% in relation to the initial level. The use of arzhaan Kara-Sug contributed to an increase in blood pressure. It should be noted that in the overwhelming majority of the examined patients, SBP and DBP were within the reference values. Heart rate and IRS values increased, but also within normal limits. As a result, the waters of arzhaan do not have a corrective effect on the adaptive potential of the organism.

The arzhaans Taldyg-Charyk and Aspaty have the same anionic composition, the cationic composition is different: the first has sodium-calcium, along with this, it contains radon (180 Bq / l, which is close to the balneological norm), the second has magnesium-calcium, radon is absent. In the course of treatment on arzhaan Taldyg-Charyk, the greatest therapeutic effect was obtained in diseases of the musculoskeletal system and cardiovascular system. When assessing the state of the cardiovascular system, a distinct hypotensive effect is observed, a decrease in the heart rate is noted, the IRS values decreased by 11%, which led to a decrease in the index of functional changes in the cardiovascular system, and, as a consequence, to an increase in the adaptive potential of the body by 7, 6% in relation to the baseline. The health level after the course of treatment increased by 36% in relation to the baseline.

Arzhaan Aspaty is effective in ophthalmic diseases. Surveys of respondents in 2013 showed that the subjective sensations of the surveyed are confirmed by the dynamics of objective data: a decrease in the level of intraocular pressure, an increase in visual acuity (studies were carried out by an ophthalmologist D.Ye. Mongush, the results are presented in [3]. the level of blood pressure, do not have a significant effect on the adaptive capabilities of the cardiovascular system, the level of health against their background tends to increase.

Arzhaan Kyzyl-Durug has a chloride-hydrocarbonate sodium-calcium character. In the course of treatment in the examined patients, a decrease in the level of blood pressure was not revealed; therefore, the adaptive potential of the organism and the level of somatic health practically did not change.

Recommendations: the research materials presented in this article allow us to outline the tasks for further research, in particular, to identify the healing factors of fresh arzhaans of Tuva, taking into account their traditional folk use.

#### CONCLUSIONS

1. For the first time, medical and biological research has shown that the methods of folk balneotherapy on fresh arzhaans of Tuva have a healing effect on the body in various functional states of the body. This refutes the qualification of "false arzhaans" assigned to them in the middle of the twentieth century, i.e. natural sources that do not have a healing, therapeutic effect. The healing effect of fresh arzhaans can be due to the complex effect of various natural factors (water composition, geoclimatic features, vegetation landscape, etc.).

2. The most pronounced health-improving effect was registered in spontaneous folk treatment on arzhaans Borzu-Khol, Adargan, Ala-Taiga, Taldyk-Charyk, Uurgaylyg, Mannaylyg and Oorash-Khem (by improving the condition of mainly the cardiovascular and respiratory systems).

3. With balneotherapy on arzhaans Bel, Duktug-Dyt, Kara-Sug and Khattyg-Chazy the healing effect is realized by improving the condition of the respiratory system and physical performance.

4. When carrying out traditional balneotherapy on fresh arzhaans of Aspaty, Kegeen-Bulak,

Darhi and Kyzyl-Durug, in this study, no statistically significant improvements in the adaptive status and level of somatic health were obtained, however, the identified positive tendencies dictate the need for further study of these sources.

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