

ОРИГІНАЛЬНІ ДОСЛІДЖЕННЯDOI: 10.21802/artm.2023.2.26.8
UDC 612.882:612.17:615.322**THE INFLUENCE OF THE PLANT ADAPTOGENE "VICTORIN" ON THE FUNCTIONAL STATE OF THE CARDIOVASCULAR SYSTEM IN PERSONS WITH INCREASED THERMAL SENSITIVITY**

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Abstract. Global warming is the most urgent environmental problem today. It has been established that the optimal functioning of the cardiovascular system is necessary for the survival of the human body in the conditions of climate change. Violation of its activity affects thermoregulation, reduces tolerance to extreme temperatures and, thus, limits adaptation potential. Adaptogens are used to increase the resistance of the circulatory system to adverse environmental factors. It should be noted that herbal preparations of this group have an advantage over synthetic ones, as they are well tolerated by the body and do not cause negative effects. Since in the available literature there is no data on the influence of adaptogens on tolerance and resistance to increasing air temperature in conditions of global warming, which is especially important for people with higher heat sensitivity, this became the reason for conducting our study.

The aim. To study the influence of the plant adaptogen "Victorin" on the functional state of the cardiovascular system of healthy individuals with increased sensitivity to heat.

Materials and methods. A group of people with increased heat sensitivity was previously formed using the questionnaire "Levels of heat sensitivity" (author's certificate No. 115529 dated November 1, 2022), heat test and mathematical analysis of heart rhythm. 14 healthy students aged 17-20 years with increased sensitivity to temperature were selected. All persons were suggested to use 1 capsule of the herbal preparation "Victorin" daily in the first half of the day for 30 days. Assessment of subjective changes in the general state, well-being and functional state of the cardiovascular system using the Robinson index, the index of the response of the cardiovascular system to psycho-emotional stress, the Kerdo index, determination of adaptation potential according to the method of R.M. Baevsky was conducted on the 1st, 15th and 30th days of the study. Statistical processing of the obtained results was carried out with the help of Microsoft Excel and Statistica 12 programs.

Results. All those examined on the 30th day of the study noted that they feel better heat tolerance, feel more comfortable in conditions of increased ambient temperature. The established tendency to decrease the average value of the Robinson index by 10 points. (10.1%), compared to the 1st day of the study. The average value of the index of the response of the cardiovascular system to psycho-emotional stress on the 30th day decreased by 0.147 points. (11%) ($p < 0.01$). After a 30-day intake of the plant adaptogen "Victorin", a decrease in the tone of the sympathetic nervous system and its shift towards autonomous balance was revealed. The value of adaptation potential on the 30th day of the study is 9.3% less, compared to the initial indicators ($p < 0.01$).

Conclusions. Taking a plant adaptogen in people with a higher sensitivity to heat caused a tendency to increase the reserve capacity of the cardiovascular system and its more economical activity, contributed to an increase in stress resistance, a decrease in the tone of the sympathetic nervous system, and an increase in the adaptation potential. This substantiated the expediency of further study of the effect of plant adaptogens, including the drug "Victorin", on the functional state of the cardiovascular system of people with higher heat sensitivity in order to develop recommendations for its use to prevent the development of negative consequences of global warming on them.

Keywords: increased heat sensitivity, cardiovascular system, adaptation potential, stress resistance, plant adaptogens.

Introduction. Global warming is the most urgent environmental problem today [1]. Foreign scientists consider modern climate change to be a catastrophe that is progressively approaching and poses a serious threat to the environment and people's lives [2,3]. It is an indisputable fact that one of the main reasons for this is human activity, as a result of which greenhouse gases are released [4]. In Ukraine, the consequences of global warming are felt even more strongly, taking into account the fact that in the east of the country hostilities have been going on since 2014,

and since February 2022, the entire country has been engulfed in a full-scale war. As a result, according to Eco-Politics research, carbon emissions increased by 23% in 2022 compared to 2021, and about 33 million tons of CO₂ entered the atmosphere [5].

It has been established that optimal functioning of the cardiovascular system is necessary for survival in conditions of global warming of the human body [6]. Violation of its activity affects thermoregulation, reduces tolerance to extreme temperatures and, thus, limits adaptation

potential. The better the reserve capabilities of the circulatory system and the more economical its operation, the higher the adaptability and stress resistance of such individuals in the conditions of an increase in the average annual temperature of the environment [7].

Scientists have also proven that people differ in their sensitivity to environmental factors, some are more sensitive than others [8]. We found that among healthy young people there are those who have a lower sensitivity to the effect of the heat factor, and there are those who have a higher sensitivity [9]. People with higher heat sensitivity, compared to people with lower heat sensitivity, have lower reserve capabilities of the cardiovascular system, lower stress resistance, predominance of the tone of the sympathetic nervous system, as well as straining adaptation mechanisms [9,10].

In the available literary sources, it was found that such means as adaptogens are used to increase the resistance of the human body to the action of adverse environmental factors [11,12,13]. It should be noted that herbal preparations of this group have an advantage over synthetic ones, as they are well tolerated by the body and do not cause negative effects [14].

Since in the available literature there is no data on the influence of adaptogens on tolerance and resistance to increasing air temperature in conditions of global warming, which is especially important for people with higher heat sensitivity, this became the reason for conducting our study.

The aim of the study. To study the influence of the plant adaptogen "Victorin" on the functional state of the cardiovascular system of healthy individuals with increased sensitivity to heat.

Materials and methods. A group of people with increased heat sensitivity was previously formed using the questionnaire "Levels of heat sensitivity" (author's certificate No. 115529 dated November 1, 2022), heat test and mathematical analysis of heart rhythm [9]. 14 healthy students aged 17-20 years with increased sensitivity to temperature were selected.

All subjects were informed, in accordance with bioethical norms, about the procedure for conducting the study, and written informed consent was obtained from them to conduct the examination and use the results in scientific work. After that, all persons were offered to use 1 capsule of the herbal preparation "Victorin" every day in the first half of the day for 30 days. This remedy belongs to adaptogens of plant origin, which contains dry ground rhodiola rosea root and dry ground ginseng root [15]. Assessment of subjective changes in the general state, well-

being and functional state of the cardiovascular system was carried out on the 1st, 15th and 30th days of the study.

The functional state of the circulatory system was assessed using the following tests:

1. The reserve capabilities of the heart and the economy of its activity were determined according to the Robinson index, which is calculated according to the formula:

$IR (n.u.) = (SBP-HR)/100$, where SBP is systolic blood pressure, mm Hg, HR - heart rate, bpm. The evaluation of the obtained IR results was carried out according to generally accepted norms [16]: a high level of the functional reserve of the heart - $IR < 74$ n.u., higher than the average - 80 - 75 n.u., average - 90 - 81 n.u., lower than average - 91 - 100 n.u., low - >101 n.u.

2. Stress resistance was assessed by determining the index of the response of the cardiovascular system to psycho-emotional stress (PRS). PRS was calculated according to the formula: $PRS, n.u. = HR1 / HR2$; where HR1 is heart rate in conditions of relative rest, bpm in 10 seconds; HR2 - heart rate after artificially created psycho-emotional stress, bpm in 10 seconds. Artificially created psycho-emotional stress was achieved when the subject was asked to subtract an odd number from a whole odd number as quickly and correctly as possible out loud within 30 seconds. The value of $PRS > 1.3$ n.u. indicates a low degree of stress resistance of the cardiovascular system to external influences of various nature [17].

3. To establish the tone of the autonomic nervous system, which regulates vital activity and functions of the body as a whole, including the circulatory system, the Kerdo Index (IK) was determined [18]. $IK = (1 - (DBP - HR)) \times 100\%$, where DBP is an indicator of diastolic blood pressure, mm Hg; HR - heart rate, bpm. An indicator close to 0 indicates autonomous equilibrium, while the deviation of the index towards it a positive value indicates an increase in the tone of the sympathetic nervous system, a negative value indicates an increase in the tone of the parasympathetic nervous system.

4. The adaptation potential of people with different sensitivity to heat was determined according to the methodology of R.M. Baevsky [19] according to the formula: $AP, n.u. = 0.011 \times HR + 0.014 \times SBP + 0.008 \times DBP + 0.0014 \times A + 0.0009 \times W - 0.0009 \times H - 0.273$, where: HR - resting heart rate (bpm); SBP - systolic blood pressure (mm Hg); DBP - diastolic blood pressure (mm Hg); A - age (years); W - body weight (kg); H is height (cm). The obtained results were evaluated using the scale according to R.M. Baevsky (Table 1).

Table 1

General evaluation of adaptation possibilities (according to R.M. Baevsky)

Points	State of adaptation
$\leq 2,1$ n.u.	Satisfactory adaptation
2,11-3,2 n.u.	Tension of adaptation mechanisms
3,21-4,3 n.u.	Unsatisfactory adaptation
$\geq 4,31$ n.u.	Disruption of adaptation mechanisms

Statistical processing of the obtained results was carried out using the programs "Microsoft Excel" and "Statistica 12". The results of the study were checked for compliance with the law of normal distribution using the Shapiro-Wilk test. Non-parametric statistics (Mann-

Whitney rank test) were used to compare the reliability of the differences between the two samples.

During the research, bioethical standards in Ukraine and the world were followed (protocols of the meeting of the Commission on Bioethics of the Ternopil

National Medical University named after I. Ya. Gorbachevskiy №73 from April 3, 2023).

Research results and their discussion. During the 30 days of observation, all subjects were asked about changes in their general condition after taking the herbal adaptogen "Victorin". Most people noted that their well-being, sleep, and headaches have improved significantly. 2 students said that they did not notice any changes in their general condition. However, all examinees from the selected group noted that they feel better heat tolerance, feel more comfortable in conditions of increased ambient temperature. It should also be noted that 2 people observed

slight drowsiness in the afternoon, however, as a result of a more detailed survey, it turned out that this may be related to periodic intake of the drug not in the morning, but in the evening, as they forgot to drink in the first half of the day.

The analysis of data on the Robinson index on the 1st, 15th, and 30th days of the study showed a tendency to decrease this indicator, in particular, its average value at the end of the month was 10 n.u. (10.1%) less, compared to the 1st day. Individual changes of this indicator are presented in Figure 1.

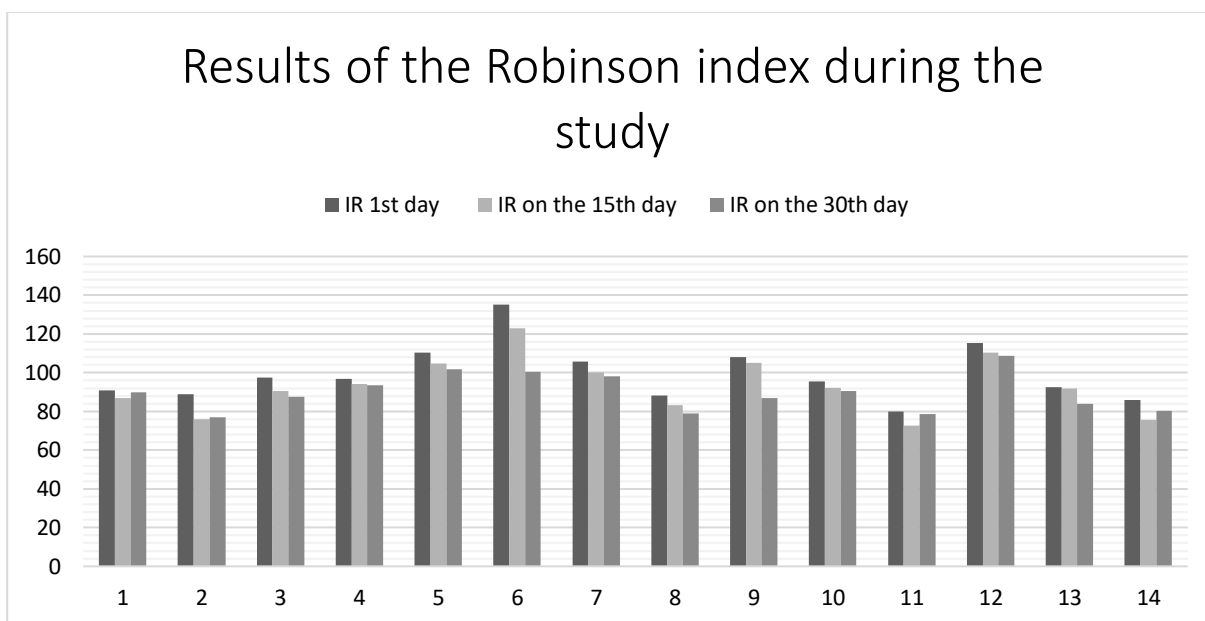


Fig. 1. Changes in the Robinson index on the 1st, 15th, and 30th days of the study

Analyzing Fig. 1, it can be noted that in 4 examinees (28%) the value of IR almost did not change, but in the rest (72%) there is a noticeable tendency to decrease it.

Taking into account the generally accepted norms of IR [16], it was established that before the study was conducted in the group of examinees with higher heat sensitivity, a lower than average level of the functional reserve of the heart was found. On the 30th day, after taking the "Victorin" drug, the average value of this indicator corresponded to the average level of the heart's reserve capacity.

Thus, after taking "Viktorin" the examinees showed a tendency to increase the reserve capabilities of the cardiovascular system and its more economical activity, compared to the initial data, when the value of IR indicated the stress of the heart's activity, the inefficiency of its work.

The obtained results of the indicator of the response of the cardiovascular system to psycho-emotional stress are shown in Fig. 2.

It was established that the average value of PRS on the 30th day decreased by 0.147 n.u. (11%) ($p < 0.01$).

Therefore, taking into account the above, it can be concluded that the stress resistance of the examinees with higher sensitivity to the heat factor significantly increased after taking the drug "Victorin", that is, the body of these

persons became more protected from the negative effects of the current climatic conditions.

Figure 3 shows the results of the Kerdo index during the 30-day study.

It was established that at the beginning of the study, all subjects had a significant predominance of the tone of the sympathetic nervous system, and during the period of taking "Victorin" there is a tendency to decrease its activity.

Thus, after a 30-day intake of the plant adaptogen "Victorin" in healthy young people, a decrease in the tone of the sympathetic nervous system and its shift towards autonomic balance was found. And as you know, the predominance of the tone of the sympathetic system leads to increased energy needs of the human body, and in the final stage, to the development of various pathological conditions and diseases, including cardiovascular ones [20]. Autonomous equilibrium supports the stability of the internal environment, and also ensures the mobilization of sufficient reserve potential for adaptation to climate changes [21].

The results of AP during the study are presented in Fig. 4. The obtained values of adaptation potential on the 1st day of the study show that in persons with higher heat sensitivity, the adaptation activity of their body was carried out at the limit of possibilities.

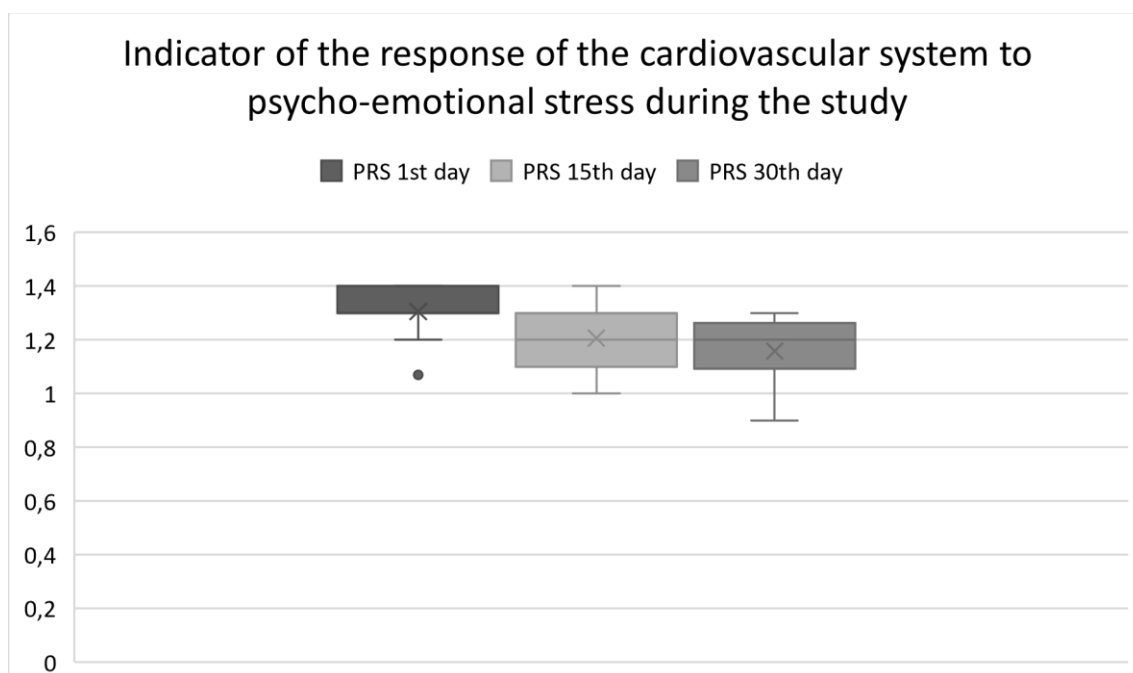


Fig. 2. Indicator of the response of the cardiovascular system to psycho-emotional stress on the 1st, 15th and 30th days of the study

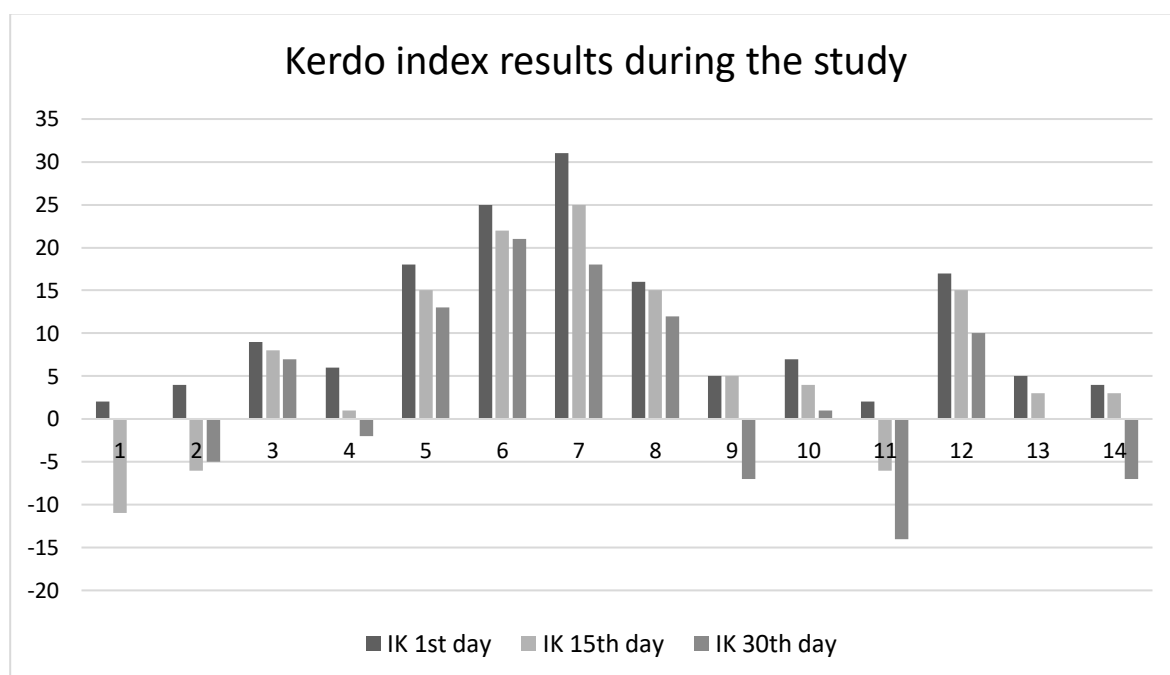


Fig. 3. Changes in Kerdo index indicators on the 1st, 15th and 30th days of the study

After analyzing the received data on adaptation potential, it was established that its average value on the 30th day of the study is 9.3% less compared to the initial values ($p < 0.01$).

According to the above-mentioned norms [19], at the beginning of the study, tension of adaptation mechanisms was found in all participants. 30 days after taking "Victorin", the average value of AP in the examined group indicates satisfactory adaptive capabilities.

In the literature, there is evidence that the complex effect of the components of the drug "Victorin" (ginseng and rhodiola rosea) is aimed at stabilizing the functional state of the nervous system, increasing the body's resistance to environmental stress, normalizing the work of the heart, vascular function, blood pressure level (if necessary) [22], which is consistent with the results of our study.

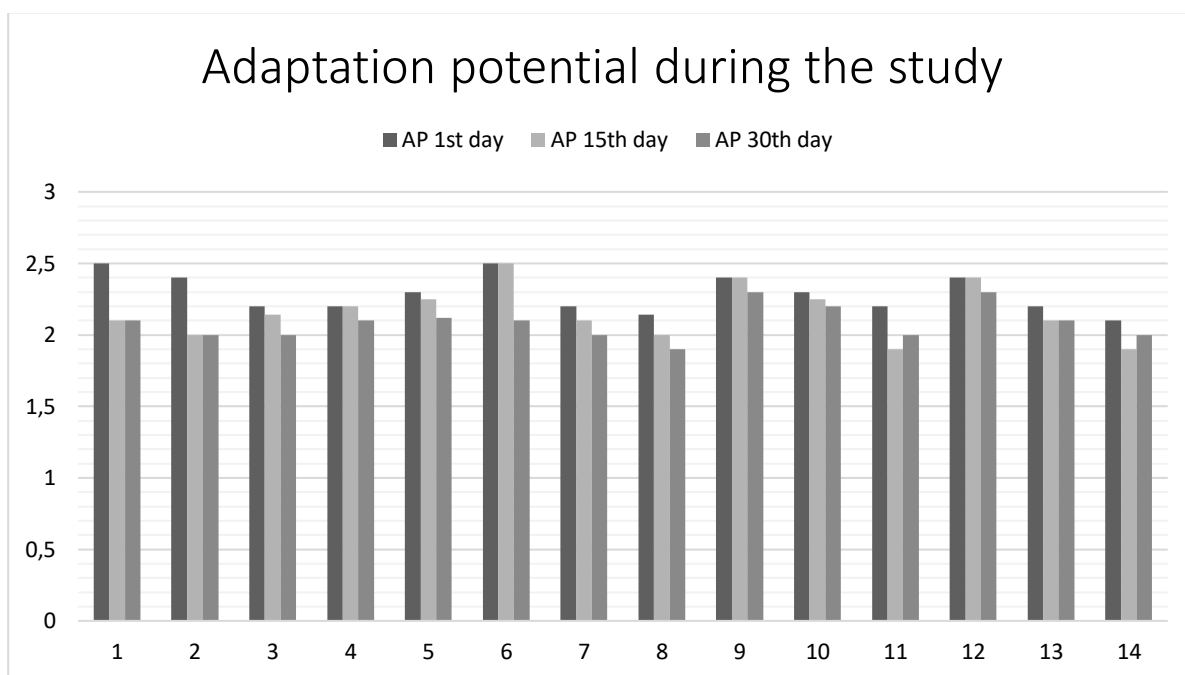


Fig. 4. AP results on the 1st, 15th and 30th day of the study

Conclusions:

1. Plant adaptogen "Victorin" in people with higher sensitivity to heat improved well-being, sleep, headaches, dizziness disappeared, reduced sensitivity to increased ambient temperature.

2. 30-day use of "Victorin" caused a tendency to increase the reserve capabilities of the cardiovascular system and its more economical activity.

3. The stress resistance of people with higher heat sensitivity significantly increased after taking a plant adaptogen.

4. On the 30th day of the study, a decrease in the tone of the sympathetic nervous system and a shift in the direction of autonomous balance were found in the subjects.

5. Taking the drug "Victorin" in young people with a higher sensitivity to the heat factor led to an increase in the adaptation potential.

Prospects for further research. The research substantiated the feasibility of further studying the effect of plant adaptogens, including the drug "Victorin", on the functional state of the cardiovascular system of people with increased heat sensitivity in order to develop recommendations for its use to prevent the development of negative consequences of global warming.

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УДК 612.882:612.17:615.322

ВПЛИВ РОСЛИННОГО АДАПТОГЕНУ «ВІКТОРІН» НА ФУНКЦІОНАЛЬНИЙ СТАН СЕРЦЕВО-СУДИННОЇ СИСТЕМИ ОСІБ ІЗ ПІДВИЩЕНОЮ ТЕПЛОЧУТЛИВІСТЮ

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Резюме. Глобальне потепління – це найактуальніша екологічна проблема сьогодення, що впливає на життя та здоров'я людей. Для підвищення резистентності організму до дії несприятливих факторів навколишнього середовища використовуються такі засоби як адаптогени.

Мета. Дослідити вплив рослинного адаптогену «Вікторін» на функціональний стан серцево-судинної системи здорових осіб із вищою чутливістю до тепла.

Матеріали і методи. Відібрано 14 осіб віком 17-20 років із вищою чутливістю до температури. Усім особам пропонувалось вживати щоденно в першій половині дня протягом 30 днів по 1 капсулі препарату «Вікторін». Оцінка суб'єктивних змін загального стану, самопочуття та функціонального стану серцево-судинної системи проводилася в 1-ий, 15-ий і 30-й день дослідження.

Результати. Усі обстежувані на 30-й день дослідження зазначили, що відчувають кращу переносимість спеки, комфортніше себе почувають в умовах підвищення температури навколишнього середовища. Встановлена тенденція до зменшення середнього значення індексу Робінсона на 10 ум.од. (10,1%), порівняно із 1-им днем дослідження. Середнє значення показника реакції серцево-судинної системи на психоемоційний стрес на 30-й день зменшилось на 0,147 ум.од. (11%) ($p < 0,01$). Після 30-ти денного прийому рослинного адаптогену «Вікторін» виявлено зменшення тонусу симпатичної нервової системи та зсув її у бік автономної рівноваги. Значення адаптаційного потенціалу на 30-й день дослідження на 9,3% менше, порівняно із вихідними показниками ($p < 0,01$).

Висновки. Прийом рослинного адаптогену в осіб із вищою чутливістю до тепла обумовив тенденцію до збільшення резервних можливостей серцево-судинної системи й економнішу її діяльність, сприяв збільшенню стресостійкості, зменшенню тонусу симпатичної нервової системи та збільшенню адаптаційного потенціалу.

Ключові слова: підвищена теплочутливість, серцево-судинна система, адаптаційний потенціал, стресостійкість, рослинні адаптогени.

Стаття надійшла в редакцію 10.06.2023 р.

Стаття прийнята до друку 29.06.2023 р.