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	ISRA (India) = **6.317**	**SIS** (USA) = **0.912**	**ICV** (Poland) = **6.630**
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	GIF (Australia) = **0.564**	**ESJI** (KZ) = **8.100**	**IBI** (India) = **4.260**
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Issue **Article**

Artur Aleksandrovich Blagorodov
Institute of Service and Entrepreneurship (branch) of DSTU
postgraduate student

Yulia Igorevna Prokhorova
Institute of Service and Entrepreneurship (branch) of DSTU
bachelor

Svetlana Yurievna Korablina
LLC TsPOSN «Ortomoda»
Ph.D., deputy Director

Galina Yurievna Volkova
LLC TsPOSN «Ortomoda»
Doctor of Economics, Professor
Moscow, Russia

ON PSYCHOLOGICAL TRAINING OF CLIMBERS FOR THEIR SUCCESSFUL CONQUERANCE OF MOUNTAIN PEAKS

Abstract: *Currently, there are a large number of studies devoted to the psychological characteristics of people involved in extreme sports, the main vectors of which are volitional regulation, the emotional sphere of the individual ("search for sensations" or the desire for risk), some character traits (introversion, suicidal tendencies, etc.). In our opinion, the study of the psychological characteristics of climbers seems interesting because extreme sports require a high level of all types of sports training from the individual: physical, technical, tactical, psychological, comparative characteristics of psychophysiological capabilities of elite athletes - representatives of difficulty and speed climbers and mountaineers. It is shown that athletes reproduce a time interval of 30 seconds much more accurately, compared to a time interval of 1 minute. It was revealed that climbers (speed climbing) and, in some cases, climbers (difficulty climbing) show significantly better results in reaction speed tests in difficult conditions. Higher rates of mobility and strength of nervous processes were revealed in climbers compared to mountaineers. This fact is associated with the specificity of training and competitive activities of climbers, requiring global concentration under conditions of maximum or near-maximum strength stress. The article considers the problem of disproportionality in a higher heart rate value during climbing relative to running loads at a lower level of oxygen consumption. The purpose of the study is to determine the effect of the functional state on the special training of climbers. The study involved 24 children of both sexes aged 8–12 years who were at the sports and health training stage. The heart rate variability (HRV) assessment technique was used to assess the stress of the regulatory systems. The study used a method for calculating special preparedness that takes into account the number of the most difficult bouldering routes completed by an athlete during training and their number. The final score largely depends on the complexity of the route being climbed. It was found that when climbing simple routes (below 6A according to the international classification), there is no pronounced stress on the regulatory systems of the body. With an increase in specific physical loads in rock climbing (route level 6A-6B), athletes face physical efforts that require the development of coordination and physical capabilities that are incomparable with the previous level (routes 5A-5C). This level also involves greater psychological stress. With further complication of specific loads in rock climbing (route level 6C), adaptation of those involved to the presented psychophysical efforts is observed. It is concluded that a gradual increase in the value of the functional reserve of the heart rhythm indicates an adaptation of the arm muscles according to the type of development of respiratory abilities, the most important of which include an increase*

in the value of tissue capillaryization, an increase in the number of mitochondria and an increase in myoglobin in muscle fibers performing specific work in rock climbing.

***Key words**: rock climbing, mountaineering, speed, strength, endurance, psychophysiology, reaction, nervous system, complexity, selection, rock climbing, children's rock climbing, heart rate variability, functional reserves of the body, adaptation.*

***Language**: English*

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Introduction

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Successful ascents of various difficulty levels require maximum development of physical qualities (strength, endurance, agility), technical training (rock climbing skills, rope handling, as well as rock or ice equipment, techniques for moving along scree or avalanche-prone slopes), tactical training (preparation of appropriate equipment and nutrition, consideration of climatic conditions, calculation of the time required to complete the ascent, assessment of the preparedness and health of group members, etc.). Psychological preparation for ascents plays a particularly important role. In the psychological preparation of climbers, motivational-volitional, emotional, and cognitive components can be distinguished.

Motivational and volitional training of athletes is directly related to the specifics of sports activities – during ascents, climbers have to act in conditions of physical exhaustion and monotony. In this regard, at the initial stages of mountaineering (up to 2-3 categories), the motivation of athletes may depend on the instructor's ability to "cheer up" the athlete, set specific tasks and guidelines along the way ("go slowly, without accelerating, at your own pace," "try to place your feet in the same way as I do," "another 30 minutes – and then stop"). The need for external motivating influence from the instructor is explained by the insufficiently developed technique of novice climbers – with his recommendations, the instructor gradually develops in the athlete the ability to move along different forms of relief, take into account his own pace, and avoid unnecessary stops. At subsequent stages, individual methods of self-regulation and self-orders become increasingly important. The emotional component of psychological training reflects the athlete's attitude to mountaineering. Often, the states associated with the experience of climbing (at the top of the mountain or immediately after climbing) are characterized by spiritual uplift, "a surge of joy", "a feeling of harmony and unity with nature", "a feeling of the highest knowledge and acceptance of oneself". In turn, dangerous moments also leave vivid impressions in the memory of athletes - describing the avalanches and rockfalls they have seen, athletes note them as "terribly beautiful", "so scary that you immediately begin to feel the desire to live". Such "peak experiences" require special personal maturity, the ability to accept and interpret the experience gained. It should be noted here that a person "comes" to mountaineering in his youth - early adulthood, and achieves his main athletic successes already in adulthood, which may indicate a fairly mature motivation and awareness of the athlete's choice. The emotional component of psychological preparation is also associated with the regulation of acute states that arise during the route: fear reactions, hysteria, affective reactions caused by the state of mono-infusion. In this regard, the athlete's preparation should be focused on the ability to diagnose and promptly correct such manifestations in himself and the participants of the sports group. The cognitive component is associated with the peculiarities of assessing the situation of the ascent: determining the approximate time of movement to the summit, the ability to make a "mental map" of the route. The cognitive component of preparation can also include the use of ideomotor (mental) training in sports activities. An example can be the presentation of a "metaphor of movement" in mastering rock climbing skills or mentally "scrolling" any aspects of technical training - tying knots, organizing stations, belaying, etc. At the present stage of rock climbing development, the identification of psychophysiological characteristics of elite athletes specializing in different types of rock climbing and mountaineers is of particular relevance. These sports place high demands on the nervous system due to the need to make quick decisions in non-standard conditions with almost maximum tension of the main muscle groups. It should be noted that it is this aspect of rock climbing that distinguishes this sport from other sports that also require maximum strength. For example, in weightlifting, an athlete performs a standard, pre-determined action, and in the process of its implementation, he is focused mainly exclusively on the manifestation of maximum strength. In rock climbing, along with the need to endure maximum and near-maximum strength loads, a necessary condition for successfully completing the distance is also a high level of activation of operational thinking, concentration, spatial orientation, etc., which requires a high level of psychophysiological capabilities. In

this regard, one of the tasks of developing the theoretical and methodological foundations of rock climbing is the study of the psychophysiological capabilities of representatives of different types of rock climbing and their comparative characteristics with representatives of other types of sports, primarily mountaineering, the type of sport from which rock climbing originated.

Main part

The authors, within the framework of the fundamentals of rock climbing, wanted to give a comparative description of the psychophysiological capabilities of climbers and representatives of various types of rock climbing. Theoretical analysis and generalization of literary sources, psychophysiological research methods (the speed of simple and complex reactions to light exposure in various testing modes, determining the strength and mobility of the nervous system), which were carried out using the computer program "Psychodiagnostics", mathematical and statistical methods.

The study involved 26 athletes, including 10 international masters of sports specializing in speed climbing, 10 international masters of sports specializing in difficulty climbing, and 6 international climbers. The athletes were aged 19-22. The results of psychophysiological testing did not reveal any reliable differences in the tests for reproducing time intervals of 30 sec and 1 min in representatives of different types of rock climbing and mountaineering. It should be noted that the examined athletes reproduce a time interval of 30 sec much more accurately compared to a time interval of 1 min, which is accelerated in their subjective perception. Perhaps, this fact is also associated with the specifics of the training and competitive activities of representatives of these sports.

Regarding the psychophysiological characteristics of representatives of different types of rock climbing and mountaineers, we note the following. Rock climbers (speed climbing), and in some cases rock climbers (difficulty climbing), show significantly better results in tests for reaction speed in difficult conditions. Thus, rock climbers specializing in speed distances and rock climbers specializing in difficulty rock climbing have a significantly shorter latent period of reaction in the test "level of functional mobility of nervous processes" in the feedback mode compared to mountaineers ($p<0.05$). Rock climbers (speed climbing) also have a significantly shorter latent period of reaction in the test "level of functional mobility of nervous processes" in the imposed rhythm mode compared to rock climbers (difficulty climbing) and mountaineers ($p<0.01$, $p<0.001$) and a shorter latent period of reaction in the test "strength of nervous processes" ($p<0.001$). In general, rock climbers, both speed climbers and difficulty climbers, have higher mobility and strength of nervous processes compared to mountaineers. This is evidenced by a smaller number of errors in the tests "reaction of choosing two signals out of three" ($p<0.05$), "level of functional mobility of nervous processes" in the feedback mode ($p<0.05$), "level of functional mobility of nervous processes" in the imposed rhythm mode ($p<0.05$) and "strength of nervous processes" ($p<0.001$), which characterizes the strength of the nervous system (Figures 4, 5).

The mobility of the nervous system was also found to be higher in rock climbers, especially in rock climbers (speed climbing) compared to mountaineers. This is evidenced by the significantly lower value of the minimum signal exposure time in the test "the level of functional mobility of the nervous system" in the feedback mode in rock climbers compared to mountaineers ($p<0.05$).

It should be noted, however, that the reaction speed in relatively unchanged conditions is higher in mountaineers and rock climbers (climbing for difficulty) compared to rock climbers (climbing for speed), as evidenced by the values of the latent period of the reaction to choosing one signal out of three ($p<0.05$, $p<0.001$).

Analyzing the obtained data regarding the psychophysiological characteristics of rock climbers specializing in different types of distances and mountain climbers, we can note higher rates of mobility and strength of nervous processes, as well as lower rates of the latent period of complex reactions in complicated testing conditions in rock climbers compared to mountain climbers. Obviously, this fact is related to the specificity of the training and competitive activities of rock climbers, which require global concentration in conditions of maximum or near-maximum force stress. The properties of the nervous system are innate, however, under the influence of external factors they can change somewhat. In our case, apparently, to international sports results athletes with precisely these properties of the nervous system reached the level, i.e. climbers with more pronounced mobility and strength of the nervous system. Nevertheless, the properties of the nervous system of the examined athletes apparently changed somewhat under the influence of an external factor – the training and competition process (Figure 1).

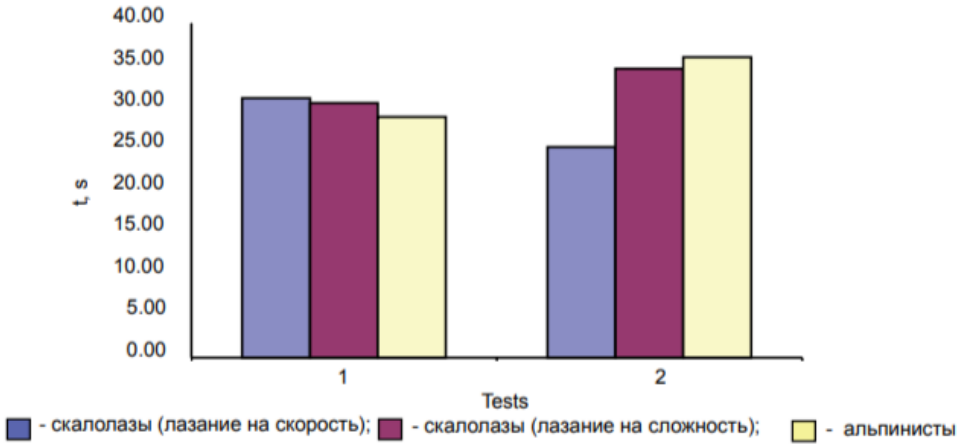


Рис. 1. Воспроизведение временных интервалов элитными спортсменами, специализирующимися в скоростном лазании (n=10), лазании на сложность (n=10) и альпинизме (n=6):

1 - воспроизведение временного интервала 30 с, с

2 - воспроизведение временного интервала 1 мин, с

Figure 1.

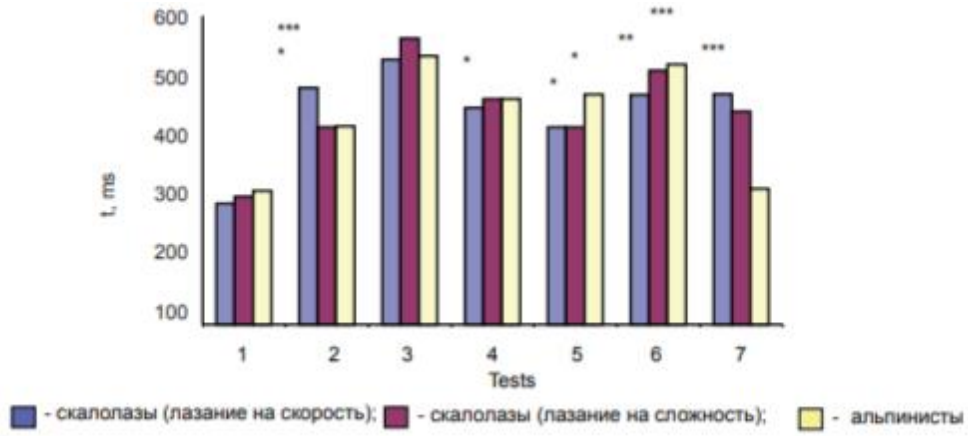


Рис. 2. Латентное время реакции у элитных спортсменов, специализирующихся в скоростном лазании (n=10), лазании на сложность (n=10) и альпинизме (n=6):

1 – латентный период простой зрительно-моторной реакции, мс;

2 - латентный период реакции выбора одного сигнала из трех, мс;

3 - латентный период реакции выбора двух сигналов из трех, мс;

4 - латентный период реакции в тесте «уровень функциональной подвижности нервных процессов» в режиме обратной связи, мс;

5 - минимальное время экспозиции сигнала в тесте «уровень функциональной подвижности нервной системы» в режиме обратной связи, мс;

6 - латентный период реакции в тесте «уровень функциональной подвижности нервных процессов» в режиме навязанного ритма, мс;

7 - латентный период реакции в тесте «сила нервных процессов», мс;

* - различия достоверны при $p<0,05$;

** - различия достоверны при $p<0,01$;

*** - различия достоверны при $p<0,001$.

Figure 2.

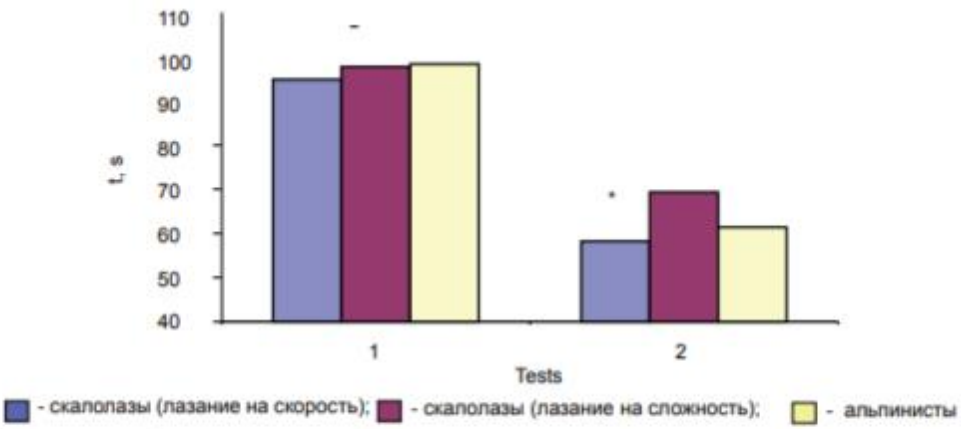


Рис. 3. Показатели подвижности нервной системы у элитных спортсменов, специализирующихся в скоростном лазании (n=10), лазании на сложность (n=10) и альпинизме (n=6):

1 - время выполнения теста «уровень функциональной подвижности нервных процессов» в режиме обратной связи, с;

2 - время выхода на минимальную экспозицию в тесте «уровень функциональной подвижности нервных процессов» в режиме обратной связи, с;

* - различия достоверны при p<0,05.

Figure 3.

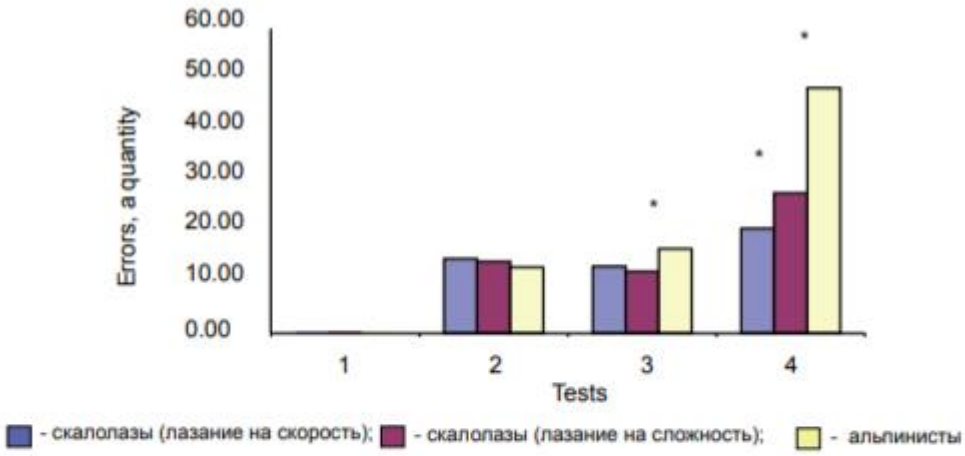


Рис. 4. Количество ошибок при выполнении тестов на определение латентного времени реакции у элитных спортсменов, специализирующихся в скоростном лазании (n=10), лазании на сложность (n=10) и альпинизме (n=6):

1 – Ошибки в тесте «простая зрительно-моторная реакция», кол-во;

2 - Ошибки в тесте «реакция выбора одного сигнала из трёх», кол-во;

3 - Ошибки в тесте «реакция выбора двух сигналов из трёх», кол-во;

4 - Ошибки в тесте «уровень функциональной подвижности нервных процессов» в режиме обратной связи, кол-во. мс;

* - различия достоверны при p<0,05.

Figure 4.

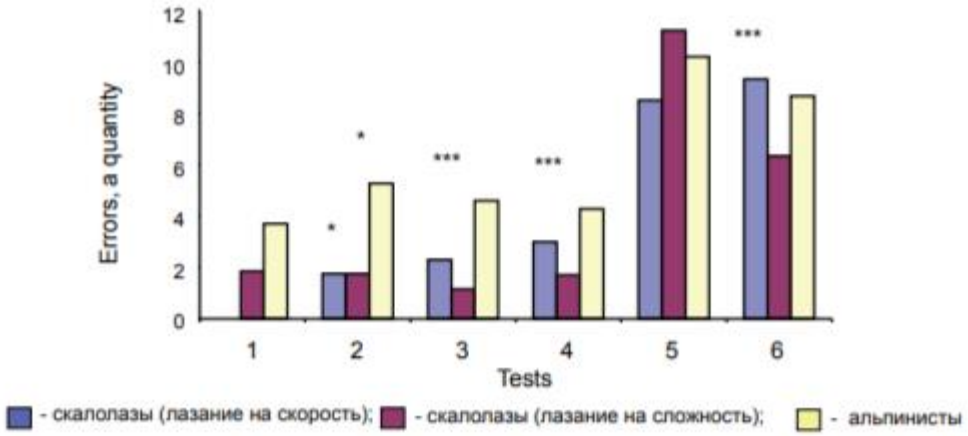


Рис. 5. Количество ошибок при выполнении тесто на определение латентного времени реакции у элитных спортсменов, специализирующихся в скоростном лазании (n=10), лазании на сложность (n=10) и альпинизме (n=6):

1 - ошибки на 1 этапе теста «уровень функциональной подвижности нервных процессов» в режиме навязанного ритма, %;
2 - ошибки на 2 этапе теста «уровень функциональной подвижности нервных процессов» в режиме навязанного ритма, %;
3 - ошибки на 3 этапе теста «уровень функциональной подвижности нервных процессов» в режиме навязанного ритма, %;
4 - ошибки на 4 этапе теста «уровень функциональной подвижности нервных процессов» в режиме навязанного ритма, %;
5 - ошибки на 5 этапе теста «уровень функциональной подвижности нервных процессов» в режиме навязанного ритма, %
6 – ошибки в тесте «сила нервных процессов», %;
* - различия достоверны при $p<0,05$;
*** - различия достоверны при $p<0,001$.

Figure 5.

Of undoubted interest is the obtained fact of higher indicators of strength and mobility of the nervous system in rock climbers compared to mountaineers (Figures 2 - 5). It is known that mountaineering is one of the extreme sports associated with a risk to life, requiring constant attention, caution, spatial orientation. Nevertheless, in rock climbing, a relatively safer sport, higher indicators of strength and mobility of the nervous system were obtained. We associate this with the need to concentrate as much as possible in rock climbing under conditions of maximum or near-maximum manifestations of strength and speed-strength capabilities. In mountaineering, the manifestation of strength capabilities in combination with maximum concentration of attention is more "stretched" in time, more variable, and to a lesser extent requires the manifestation of maximum capabilities both in terms of speed-strength qualities and in terms of psychophysiological capabilities. That is why mountain climbers show better results in strength endurance over relatively long periods of time, they have higher functional capabilities, but rock climbers have better developed speed qualities, speed endurance, strength endurance over short intervals of time in combination with higher indicators of strength and mobility of the nervous system. The obtained data supplement the results of the research of S.S. Ermakov, and [others] on the peculiarities of the properties of the nervous system of representatives of different sports specializations with facts about the peculiarities of the manifestations of the properties of the nervous system of rock climbers and mountaineers. The psychophysiological capabilities of rock climbers and mountaineers are determined in this study for the first time. The peculiarities of the morphofunctional development of rock climbers specializing in passing distances of different types, and mountaineers are also determined for the first time.

We are currently conducting a study of the personality traits of mountaineering athletes. The study involved 42 mountaineering athletes, aged 18 to 35 (average age 25.3-3.8 years). Among them, 9 people met the standards for the 3rd sports category, 28 people - for the 2nd sports category, 5 people - for the 1st sports category. The duration of mountaineering is 5.65-2.18 years. All athletes

regularly (1 to 3 times a year) take part in mountaineering training camps of the Mountaineering Federation. The diagnostic tools of the study were:

1. A modified version of the questionnaire of behavior and experiences associated with sports by W. Schaarshmidt and A. Fischer.
2. F. Zimbardo's Time Perspective Questionnaire adapted by A. Syrtsova.
3. P. Hewitt's perfectionist self-presentation scale, adapted by A.A. Zolotareva
4. Questionnaire "Style of self-regulation of behavior" by V.I. Morosanova.
5. A questionnaire aimed at identifying parameters that could influence the results of the study (age, gender, duration of participation in a given sport, sports category (rank), frequency of participation in training camps, characteristics of the training process, etc.).

An additional method of data collection was the analysis of the rank books of the study participants ("mountaineer's books"), in which it was possible to trace not only the level of physical and technical training, but also the psychological characteristics of the athletes given to them by the instructors. Thus, the main features noted by the instructors as positive, contributing to sports improvement were identified: activity, discipline, communication skills, confidence in the implementation of technical actions, responsibility, organizational skills. The methods of mathematical statistics used in the study: indicators of average values taking into account the standard deviation, Spearman's correlation coefficient, one-factor dispersion analysis. Statistical data processing was carried out using the software packages Microsoft Office Excel, SPSS version 17.0.

As a result of the study, we were able to identify some features of sports aspirations, self-regulation, perfectionistic self-presentation and time perspective of climbers. The following features were found to be characteristic of them (according to these features, the indicators have high values), namely:

1. Striving for excellence in sports activities, focusing on the quality of actions performed during ascents and training.
2. An active strategy for solving problems that arise during sports camps or training. In our opinion, the climbers' focus on the quality of the actions performed and an active strategy for solving problems are directly related to the specifics of sports activities. Not only sports success, but also the lives of athletes depend on properly organized insurance, making a decision to return or organizing a camp in a situation of worsening weather conditions or poor health of participants.
3. Satisfaction with life (taking into account athletic success).
4. Feeling of social support in sport ambitions, trust and support from close people, feeling of social well-being. These results also confirm the questionnaire data - almost all climbers indicated that they have a large number of friends involved in this sport, or a close person (spouse) who supports them in this.
5. Orientation towards the hedonistic present – a carefree and carefree attitude towards time and life, making risky decisions, orientation towards pleasure, excitement, arousal, search for sensations.
6. Low level of perfectionistic self-presentation, i.e. it is not typical for climbers to demonstrate a desire for perfection in interpersonal contacts. Thus, it can be concluded that people involved in mountaineering are characterized by a desire for perfection exclusively within the framework of achieving sports success, but not by demonstrating their own perfection and superiority in interpersonal communication.
7. High level of self-regulation on the scale "Assessment of activity results", which indicates the development and adequacy of self-assessment, formation and stability of subjective criteria for assessing activity results. Mountaineers tend to adequately assess both the fact of discrepancy between the obtained results and the purpose of the activity, and the reasons that led to it, flexibly adapting to changing conditions.
8. High level of self-regulation on the Flexibility scale. Thus, climbers are characterized by the plasticity of all regulatory processes. In the event of unforeseen circumstances, athletes easily restructure plans and programs of executive actions and behavior, are able to quickly assess the change in significant conditions and restructure the program of actions. In the event of a discrepancy between the obtained results and the adopted goal, they promptly assess the fact of the discrepancy itself and make the appropriate correction. The flexibility of regulatory processes allows climbers to adequately respond to a rapid change in events and successfully solve the task in a risky situation (for example, in the event of a threat of rockfalls, snow avalanches, injury to a group member as a result of a fall, etc.). It turned out that climbers are not characterized by a tendency to refuse in a situation of failure, a tendency to reconcile with the situation and refuse to overcome it.

Correlation links between the identified features were identified, namely:

1. The tendency to refuse in a situation of failure is positively correlated with the time orientation “negative past” ($r_s=0.512$; $p\leq0.01$);
2. Hedonistic orientation positively correlates with readiness for energy expenditure ($r_s=0.479$; $p\leq0.05$) and active problem-solving strategy ($r_s=0.462$; $p\leq0.05$). We can interpret this relationship as follows: in a situation of “conscious risk”, athletes are psychologically ready to give all their strength to solve emerging problems.
3. Satisfaction with life is negatively correlated with verbal non-manifestation of imperfection (rs=-

0.491; p≤0.05) – i.e. the higher the scores on the "satisfaction with life" scale, the less the individual avoids recognizing his or her own imperfections in front of others in interpersonal communication.

4. The indicators of "flexibility of regulatory systems" are positively correlated with an active problem-solving strategy (rs=0.474; p≤0.01) and internal calm and balance (rs=0.348; p≤0.05). Thus, the ability of climbers to successfully carry out activities in constantly changing, risky conditions is ensured by the plasticity of the self-regulation system, internal balance and readiness to solve current problems.

We also obtained interesting data on the influence of the duration of mountaineering, sports category and frequency of participation in training camps. The most optimal duration in terms of sports aspirations, readiness for energy expenditure, a sense of success in sports activities turned out to be periods from 6 to 7 years of mountaineering. Mountaineers with the 2nd sports category have a higher motivation to engage in sports, while life satisfaction, the ability to plan their activities and the general level of self-regulation significantly increase from the 3rd category to the first. At present, the study of psychological characteristics of people involved in mountaineering is ongoing. The results obtained can be used by specialists (sports psychologists, instructors, rescue services) directly training people involved in mountaineering and other activities related to work in extreme conditions.In the existing works devoted to the study of the comparison of peak oxygen consumption (POC) of the arm muscles of rock climbers, heart rate (HR) under a specific load (climbing on rocky terrain), as well as maximum oxygen consumption (VOC) and HR during running, a disproportionate increase in the HR value relative to oxygen consumption during climbing compared to the running load was established. Oxygen consumption during arm work during climbing is observed at higher HR values, relative to the running load or when measured on bicycle ergometers. A high HR value was also established during climbing (up to 80%) with a VOC level not exceeding 45%. It was found that with the same heart rate, the OC level during climbing is reliably lower than during running in the same subjects. These data led the researchers to the assumption of a more significant influence of psychological stress on the body's regulatory systems during climbing compared to running. The work examined the value of the individual stress index, heart rate, lactic acid concentration, and respiratory quotient in climbers. All measured indicators demonstrated significantly higher values during climbing than during running. Based on the use of ECG, it was established that at the initial stages of sports training there are no pronounced differences in the functional activity of the adaptive and regulatory systems of the body. At present, there is an assumption that the disproportionate increase in heart rate during climbing is caused by vegetative reactions of the cardiovascular system due to the peculiarities of the structure of the arm muscles, which have approximately half as many fast glycolytic muscle fibers as the leg muscles. The specific motor activity during rock climbing also contributes: significant amounts of muscle work in isometric mode are characteristic. A significant influence of the psychological component associated with the feeling of anxiety, typical for climbing, is also assumed. To assess the tension of the regulatory systems, the method of assessing the variability of the heart rate (HRV) was used. In its similarity to the device for determining the psychophysiological state of a person - patent for invention No. 2214166. The HRV indicator was measured before the start of the workout, after resting in a sitting position for 5 minutes.

To control special training, the complexity of the most difficult climbed bouldering route and their total number during training were measured. The routes were categorized in accordance with the difficulty criteria of rock climbing routes. Due to the fact that not only the level of difficulty of the route climbed by the climber was recorded, but also the number of routes of the maximum accessible level of difficulty, formula 1 was used:

$$Б = \frac{Р^2 + 0{,}1ЧП}{З} \qquad (1)$$

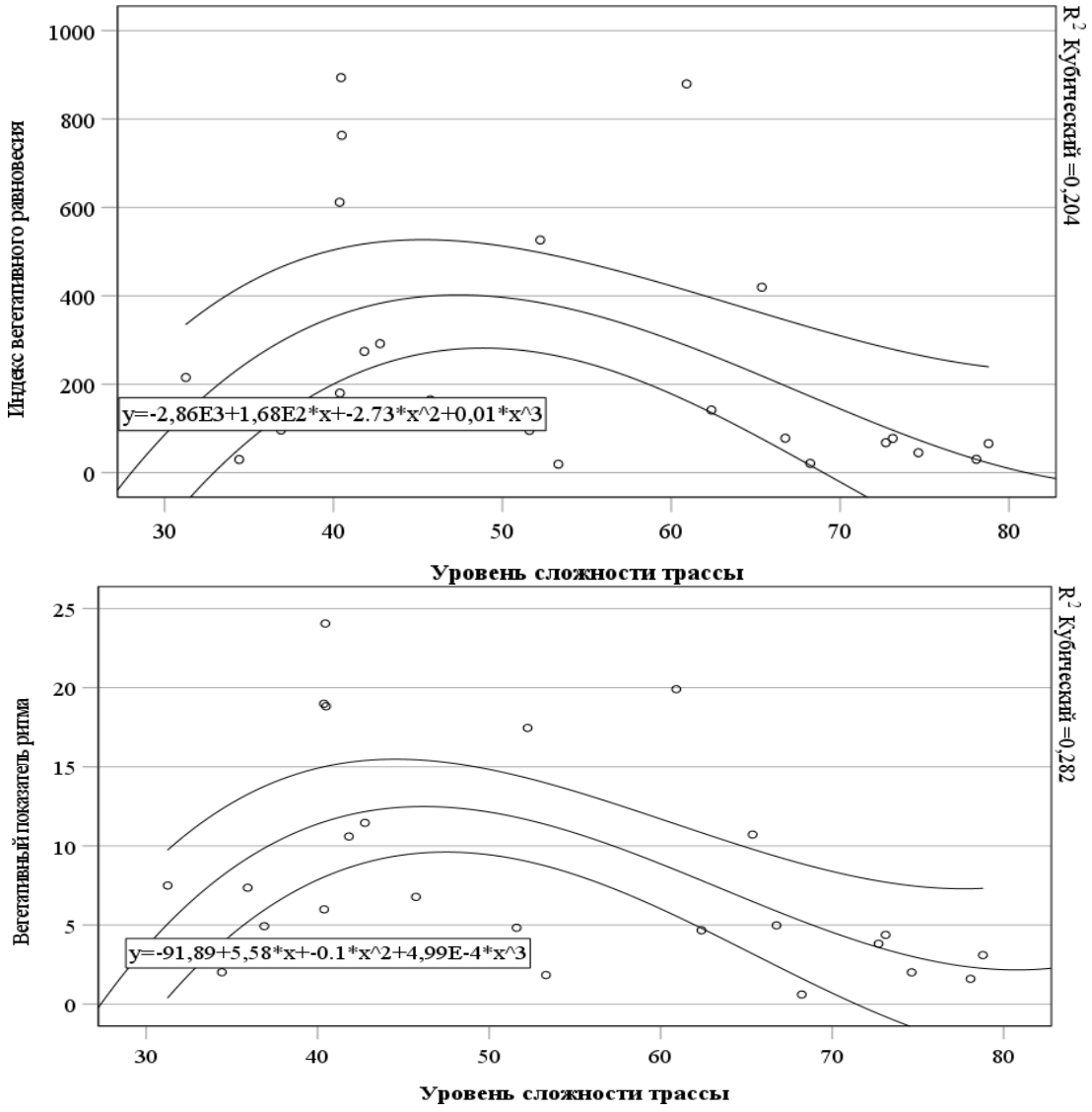
where P is the route score according to the IRCRA scale; CP is the number of passes of the route of the maximum accessible level of difficulty; B is the final score.

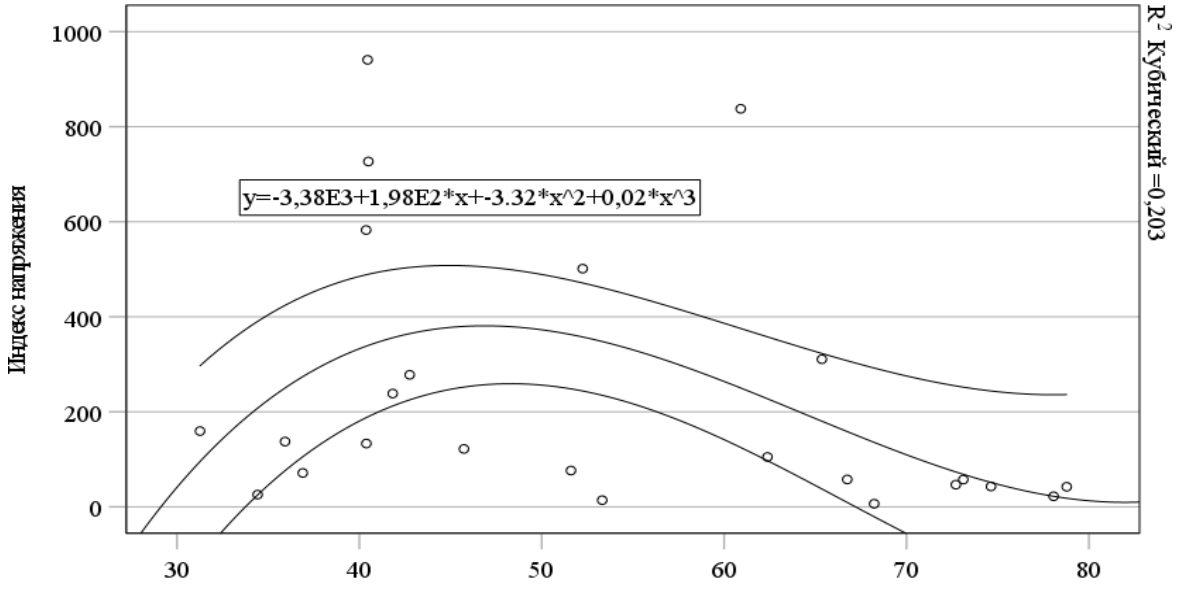
The difficulty value of the climbed route according to the international system corresponds to the IRCRA scale in the following gradations: 6A - 40 points, 6B - 58 points, 6C - 76 points. The results of the participants in each training session were recorded in the current control log, after which the values were calculated according to formula (1) and the subsequent averaging of the indicator for each participant per month (8 training sessions in total). The study involved 24 children of both sexes, aged 8–12, who were at the sports and health training stage. The study was conducted in September 2024, in St. Petersburg, at the Spasatel youth club. Classes were held on artificial terrain – a climbing wall.

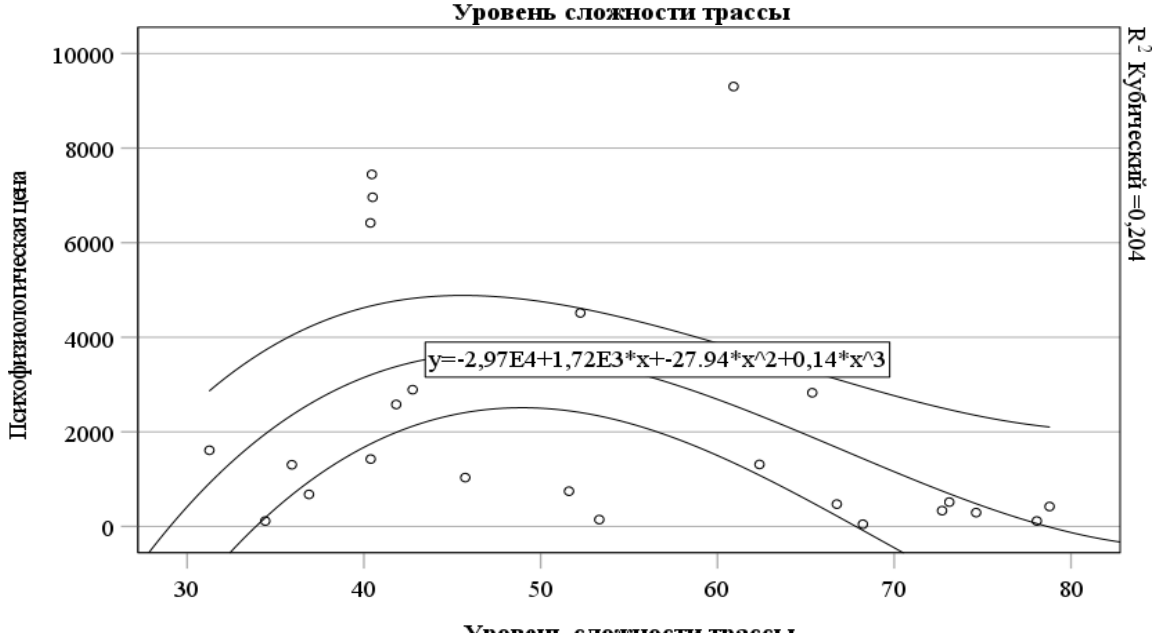
To analyze the relationship between the indicators of functional state and special training, the nonparametric Spearman rho correlation criterion was used, due to the fact that both indicators were measured in quantitative dimensions. As a result of usingThe following criteria were reliably established: the index of vegetative balance decreases at an average level with an increase in the difficulty of climbed routes, ρ = –0.44, p = 0.03; the vegetative rhythm indicator decreases at an average level with an

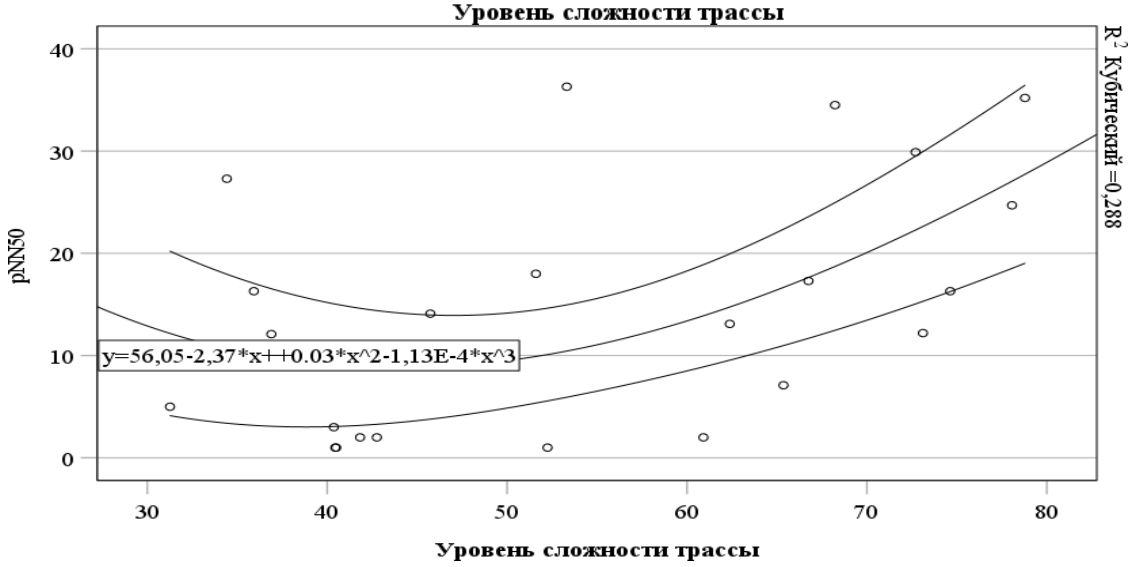
increase in the difficulty of climbed routes, ρ = –0.5, p = 0.013; the stress index decreases at an average level with an increase in the difficulty of climbed routes, ρ = –0.47, p = 0.02; the psychophysiological price decreases at an average level with an increase in the difficulty of climbed routes, ρ = –0.42, p = 0.039; pNN50 increases at an average level with an increase in the difficulty of climbed routes, ρ = 0.44, p = 0.032; RMSSD increases at an average level with an increase in the difficulty of climbed routes, ρ = 0.47, p = 0.019.

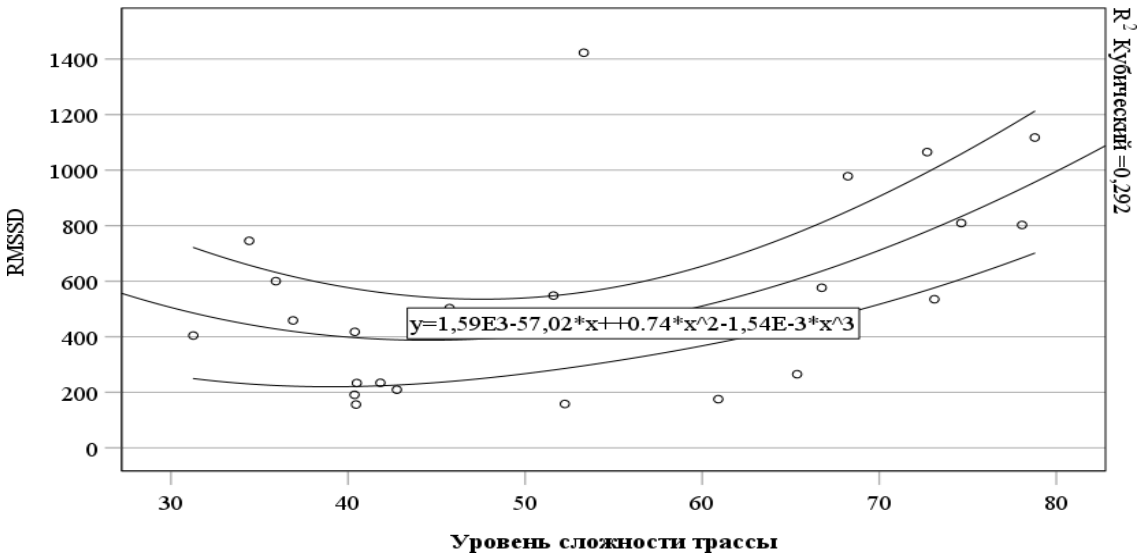
The obtained result is clearly shown in Figures 7–12, indicating the approximation line using the cubic coefficient of determination, the value of which reached at least 20% of the influence for each connection.




Индекс напряжения
y=-3,38E3+1,98E2*x+-3.32*x^2+0,02*x^3
R² Кубический =0,203
Уровень сложности трассы


Психофизиологическая цена
y=-2,97E4+1,72E3*x+-27.94*x^2+0,14*x^3
R² Кубический =0,204
Уровень сложности трассы


pNN50
y=56,05-2,37*x++0.03*x^2-1,13E-4*x^3
R² Кубический =0,288
Уровень сложности трассы



Figures 7–12. The relationship between functional state indicators and the complexity of the routes passed.

The group of HRV indices reflecting the ratio of the sympathetic and parasympathetic divisions of the autonomic nervous system indicates an increase in the value of autonomic tension in athletes when passing bouldering routes of difficulty category 6A compared to less and more difficult routes. The influence of the route difficulty level on the predominance of the sympathetic division of the nervous system reaches from 20% to 28%. With an increase in the difficulty of climbed bouldering routes (from 6A to 6C), a consistent increase in heart rate variability indices (pNN50, RMSSD) is observed, indicating an increase in the level of functional reserves of the heart rhythm in terms of maintaining adequate hemodynamics. The influence of the route difficulty level on the increase in functional reserves of the heart rhythm reaches 28–29%. The value of the confidence interval between the values under consideration categories of routes do not intersect, which confirms the reliability of the obtained result.

Conclusion

1. It has been shown that mountaineers and rock climbers reproduce a time interval of 30 s significantly more accurately compared to a time interval of 1 min, which is accelerated in their subjective perception.
2. It has been found that speed climbers, and in some cases difficulty climbers, show significantly better results in reaction speed tests in difficult conditions.
3. Higher mobility and strength of nervous processes were found in rock climbers compared to mountaineers. This fact is related to the specificity of the training and competitive activities of rock climbers, which require global concentration under conditions of maximum or near-maximum force stress.

In the future, further research is planned to study the structure of the complex preparedness of rock climbers of different specializations and to develop theoretical and methodological foundations for constructing the training process of athletes for rock climbing.

Based on the obtained results, it can be stated that when climbing on simple routes (below 6A according to the international classification), there is no pronounced stress on the body's regulatory systems. Simple climbing does not cause anxiety in those involved, does not place demands on coordination abilities and does not require significant physical effort.

With the growth of specific physical loads in rock climbing (route level 6A-6B), athletes face physical efforts that require the development of coordination and physical capabilities that are incomparable with the previous level (route 5A-5C). This level also involves greater psychological stress.

With further complication of specific loads in rock climbing (route level 6C), adaptation of those involved to the presented psychophysical efforts is observed. Presumably, adaptation to loads at the level of development of specific muscle groups is observed, as well as the absence of a pronounced anxiety reaction. A gradual increase in the value of the functional reserve of the heart rhythm should indicate, in our opinion, an adaptation of the arm muscles according to the type of development of respiratory abilities, the most important of which include an increase in the value of tissue capillarization, an increase in the number of mitochondria and an increase in myoglobin in muscle fibers performing specific work in rock climbing.

The obtained results indicate the need to include in the program training programs at the initial stages of exercises aimed at developing slow muscle fibers and increasing the respiratory capacity of fast oxidative and fast glycolytic fibers, as well as increasing the capillarization of arm muscle tissue.

Provided that the muscles develop their ability to assimilate oxygen and increase the anaerobic metabolism threshold, it is possible to reduce the imbalance in the growth of heart rate under specific loads in rock climbing and, as a result, reduce the time spent on adaptation to difficult routes at the initial stage of training in rock climbing.

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