

## Features of Tourists Adaptation to Loading in the Mountains Depending on the Level of Preparedness

M. IRGEBAYEV, M. YESKALIYEV, S. MAZHENOV, A. ROMANENKO

Kazakh Academy of Sport and Tourism, Almaty, Kazakhstan

**Abstract.** *The article discusses the issues of the ability to perform physical loads in the process of adapting people to high altitude conditions depending on individual differences. The study of the specific features of the formation of adaptation to long stay in high mountain conditions with the use of standard physical loads as a test is of great theoretical interest and is of great practical importance for solving the problems of selecting tourists for a mountain sports expedition, as well as for persons sent to mountainous areas for performance of various types of professional activity.*

**Keywords:** training process, oxygen deficiency, mountain relief, technical and tactical methods, high mountains, muscular work, metabolic inquiry, pulseometry, oximetry.

### Introduction

In the organization of the training process in preparation for mountain hikes and during the hike, objective methods of control are of special importance as the most important condition for determining the optimal ways to increase the level of physical and special preparedness of mountain tourists of mass ranks.

The adaptation of man to mountain conditions is accompanied by the mobilization of mechanisms of functional adaptation to oxygen deficiency. Due to physiological systems, oxygen transport to tissues is enhanced, and thanks to biochemical mechanisms, the efficiency of using oxygen in the processes of aerobic metabolism is increased<sup>1</sup>.

The features of the mountain relief and associated natural phenomena in and of themselves represent serious obstacles on the route of the tourist route and require both special technical and tactical methods of movement and knowledge that help predict the occurrence of dangerous situations and measures that allow them to be avoided<sup>2</sup>.

But the same features have a direct impact on the human body, disrupting the physiological balance with the environmental conditions and in many ways complicating the human actions in the highlands. Rising to the heights, tourists are exposed to a complex set of environmental factors - hypoxia (oxygen starvation), low air t ° in combination with strong winds, increased air dryness and intense ultraviolet radiation. At the same time, a person still performs heavy muscular work related to movement along various forms of mountain relief in conditions of psychological tension close to stress<sup>3</sup>.

---

<sup>1</sup> N. N. Brimkulov, G. V. Belov, "Vysokogornaja klimatoterapija bol'nyh bronhial'noj astmoj" *VII nauchno-praktičeskaja konferencija vrachej Krasnoznamenogo Sredneazijskogo voennogo okruga*, Tez.dokl. Alma-Ata, 1988, p. 37-38.

<sup>2</sup> O. Budzinskaya, "Competitiveness of Russian Education in the World Educational Environment," in *Astra Salvensis*, VI (2018), no. 1, p. 517-530

<sup>3</sup> I. Smanov, A. Boranbayeva, K. Berkimbayev, K. Arymbayeva, K. Azhibekov, "Approaches to Online Learning: a Study of the Factors affecting Teachers in a Fully Online Faculty", in *Astra Salvensis - review of history and culture*, VI (2018), no. 11, p. 631-640.

"Features of Tourists Adaptation to Loading in the Mountains Depending on the Level of Preparedness," *Astra Salvensis*, VI (2018), no. 12, p. 549-554

Physical work in high altitude conditions requires more energy consumption than it was noted below, the period of working is shortened, the speed of recovery reactions is shortened. In the stage of economic adaptation, the economy of functions at the organ, systemic and, apparently, tissue level is observed. Muscle work requires less oxygen absorption and energy consumption per kilogram of human weight. The duration of these stages depends on the individual characteristics of the person, his fitness, the length of service, the nature of the muscular activity. At the height, the human body adapts faster to volume and slower to the intensity of the training work. The flow of acclimatization processes can be accelerated with the help of physical exercises and short-term ascents to great heights. In the first month after training sessions in the mountains, high hemoglobin content in the blood, increased blood supply to the myocardium, and increased functional capacity of the respiratory system are maintained<sup>4</sup>.

The process of adaptation - adaptation of the body to a lack of oxygen requires a sufficiently high susceptibility, i.e. low thresholds of stimulation of the internal analyzer to a reduced content of oxygen in the arterial blood and optimal excitability of the cerebral cortex. The state of adaptation, achieved as a result of a prolonged or repeated exposure to hypoxia, is characterized by directly opposite parameters - an increase in the thresholds of irritability, in particular, angioreceptors to a lack of oxygen and a decrease in their bioelectrical activity.

### **Material & methods**

The studies were carried out in mountainous terrain in the altitude range from 1820 m to 3500 m, with the participation of young, healthy people aged 19 to 27 years, in the process of mountain hikes of the first and second category of complexity (ks) in the Zailiisky Alatau region.

A complex of medical and biological methods of research was used: the method of control tests, pulseometry, oximetry.

The aim of the study was to compare the dynamics of oxygen transportation in human blood, accompanying in campaigns of various complexity categories in mountainous terrain

### **Results**

The first study was conducted during a mountain hike of the first category of complexity, in September 2016<sup>5</sup>.

For the passage of the mountain hike, a route was developed: Almaty - Prosveshchenets - Kokzhailau Plateau - r. Cossack - the gorge of the Great Almaty - san. Almarasan - ush. Passage - trans. Almaty-Alagiri (n / to) - r. Ozernaya - per. Tourists (1A, 4010 m) - glacier. Tourists - a lion. Talgar - Sunlit Glade - Per. Talgar

---

<sup>4</sup> O. Budzinskaya, "Competitiveness of Russian Education in the World Educational Environment," in *Astra Salvensis*, VI (2018), no. 11, p. 517-530.

<sup>5</sup> A. S. Solodkov, "O mehanizmah razvitiya utomleniya i ego dinamika pri naprjazhennoj myshechnoj dejatel'nosti," in *Gipoksija nagruzki, matematicheskoe modelirovanie, prognozirovanie i korrakcija*. Kiev, 1990, p.78-80.

(n / to) - ice. Bogdanovich - per. Schoolboy (1A, 3650 m) - usch. Maloalmatinskoe - y / k Shymbulak - with / to Medeu - Almaty.

The total duration of the trip is eight days, including the day of rest. The length of the route was 108 km. The beginning of the route at an altitude of 1550 meters above sea level, ending in the high-mountain sports complex Medeu, height 1690 m, the highest point of the route is the Pass of Tourists 1A, 4010 m, the altitude difference is 2460 m.

The measurements were carried out on the third and sixth days of the hike at the same altitude 3200 meters above sea level. The increase in indications on the sixth day of the campaign is 3.7 percent in relation to the indications of the third day of the hike. Accordingly, there is an overall increase in the physical performance of participants in the campaign (Table 1).

Table 1 - Dynamics of the readings of saturation during the hike of the first category of complexity

No	Indications	Age	Saturation O <sub>2</sub>	Heart rate
1	1 measurement	23	85	125
2	2 measurement	23	90,6	87,6
$\bar{X}$		23	87,8	106,3
$m(\bar{x})$			5,6	37,4
C%			3,7	15,9

The second study was conducted during a mountain hike of the second category of complexity, in July-August 2017. From July 27 to August 5, 2017, a second-class mountain hike was conducted along the route: t / b Almaty (1820 m) - trans. Forest (no. 2262 m) - us. Butakovka (1855 m) - Per. Kimasar (no. 2062 m) - with / to Medeu (1690 m) - h / k Shymbulak (2250 m) - trans. Talgar (n / to 3163 m) - trans. Pionersky (1B 3840 m) - glacier. Tuyyksu (3390 m) - trans. Tuysu (1B, 4130 m) - trans. Tourists (1A, 4000 m) - a lion. Talgar (2990 m) - the ice. Dmitrieva - per. Young Guard (1B, 4040 m) - BAO - pos. Kokshoky - Leskhoz (1850 m) - Kokzhailau (2,250 m) - a stan. Akbulak (1550 m) - Per. Kimasar (n / to 2062 m) - head. Butakovka (1855 m) - Per. Forest (n / to 2262 m) - t / b Almaty (1820 m).

The length of the route was 118 km. The total duration of the hike is 10 days, including rest days. The beginning of the route at an altitude of 1820 meters above sea level, the end in the same place, on the tourist base of Almaty, altitude of 1820 m, the highest point of the route is the Tuyyksu pass (1B, 4130 m), elevation 2310 m.

The total climb was 5908 m.

The measurements were carried out on the Bogdanovich glacier, at an altitude of 3200 meters above sea level (the third day of the trek) and on a clearing near the confluence of the Ozerny and Kyzylsai rivers, an altitude of 3200 m (the seventh day of the trek). The results of the measurement of the campaign of the second category of complexity, in contrast to the results of the hike of the first category of complexity, show a small scatter of readings. The participants of the hike, who had preliminary training (in the form of participation in one-day, two-day and four-day hikes), on the first day the passage over 18 km passed without tension

"Features of Tourists Adaptation to Loading in the Mountains Depending on the Level of Preparedness," *Astra Salvensis*, VI (2018), no. 12, p. 549-554 with a high (5.4 km / h) speed. The parameters of saturation and pulse after the end of the transition were almost close to the initial parameters (Table 2).

Table 2 - Dynamics of readings of saturation during the campaign of the second category of complexity

№	Indications	Age	Saturation $O_2$	Heart rate
1	1 measurement	23	90,7	87,4
2	2 measurement	23	91	84,5
$\bar{X}$		23	90,85	85,95
$m(\bar{x})$			0,3	2,9
C%			1,8	5,9

This can be explained, first of all, by the lack of practice among participants in the first hike, since during the summer holidays they had a break in active travel in mountainous conditions; lack of experience of complex trips in the bulk of participants. In the absence of a special pre-training training, the process of adapting the body of the tourist to the march load continues for several days. Especially obvious are shifts in the level of activity of the body systems and its performance in the first three to four days of the movement. It can be assumed that during this period the formation and formation of a dynamic stereotype of marching walking takes place.

And participants of the campaign of the second category of complexity having experience of the first horseman's campaign, were deliberately preparing for a more complex campaign. Therefore, they took into account the old shortcomings and extracted from them the necessary definite ideas about the difficult sections of the route, the mode of movement, the rational use and distribution of forces along the route, and so on. The psychological factor is also important. Education and information in principle, although not in all cases, implies a greater degree of freedom of behavior and occupation. Being more informed, people are less inclined to fear the difficulties of traveling and staying in an unfamiliar place and in an unfamiliar environment, they are more confident in the "sea" of tourist and excursion information that is now available. Accordingly, the results were not long in coming. Increasing the functional training, and therefore the level of acclimatization of participants in the campaign is noticeable (Table 3).

Table 3 - Comparative analysis of the results of campaigns of various complexity categories

№	category of complexity hikes	$\bar{X}$	$m(\bar{x})$	C%
1	I	87,8	5,6	3,7
2	II	90,85	1,7	1,8
		3	3,9	1,5

Based on the generalization of the results of experimental studies related to various conditions of movement in mountainous terrain, there is a tangible difference in the average oxygen transport readings on the third day of the trip, i.e. the level of saturation in the campaign of the second category of complexity higher

by 3% compared with the campaign of the first category of complexity, and the error of the first category trip about 4% relative to the second category of complexity

If you compare the heart rate (HR) for hikes, then the pulse response is significantly higher during the first campaign of 125 versus 87.6 in the second. This speaks of completely different levels of both physical and moral-psychological preparation. Compared with the campaign 2 category of complexity in the campaign 1 category of complexity there is an increased pulse even for high mountains. This state can be explained by the presence of a certain state of excitement or tension associated with weather conditions for a given season (rain, wind, snow), which caused psychological discomfort, i.e. lack of control over the situation.

During the second horseriding, despite the more difficult terrain conditions - more complex passes at an altitude of more than 4,000 meters above sea level, which required a lot of effort and energy, the recovery of the heart rate passed fairly quickly.

### **Conclusions**

1. From the use of pulse oximeters operative data on oxygen saturation in the blood and the frequency of cardiac contractions depends. This makes it possible to control the level of acclimatization of each participant in the hike. Thus, the process of selecting participants into the group is simpler in the process of completing the group during weekend hikes. To conduct measurements, it is sufficient to turn on the instrument during the mooring, to put the sensor on the finger and after a few seconds to remove the data. In addition, the pulse oximeter makes it possible to avoid unnecessary time spent on research.

2. The results of observations show that during the walking on foot in the mountains, even with a small load, an increase in heart rate can cause oxygen deficiency, i.e. transportation of O<sub>2</sub> is complicated, the consequences of which can lead to hypoxia.

3. Acclimatization of the organism to high altitude conditions is a rather lengthy process. The results of the observations show the dynamics of the growth of oxygen saturation readings on the sixth day in relation to the third day of the trip. Therefore, the preparation for height must begin long before the trip.

3. The loads experienced by a tourist in the conditions of a mountain hike, are very large requirements for the capabilities of the organism. Therefore, frequent ascents to a height of 3000 meters above sea level and above favorably affect the acclimatization process. The process of acclimatization depends on the qualifications of the tourist. It is higher for the prepared participant than for the less prepared one.

4. The results of the study make it possible to determine the contribution that increases the load on a person, not only by increasing the walking speed and the weight of the load being carried, but also by various combinations of speed, walking conditions and altitude. Using the data of the tables developed by us, it is

"Features of Tourists Adaptation to Loading in the Mountains Depending on the Level of Preparedness," *Astra Salvensis*, VI (2018), no. 12, p. 549-554  
possible to calculate the optimal speed of movement at different heights, which will provide both a healing and training effect.