

Comparative Analysis of Psychophysiological and Health Indicators of Aged, Elderly and Long-Lived from Different Mountainous Districts of Azerbaijan

Natavan Karamova^{1, 2, 3*}, *Sitora Primkulova*⁴, and *Bakhtiyor Meyliyev*⁵

¹Western Caspian University, Baku, Azerbaijan

²Azerbaijan and Ministry of Science and Education of the Republic of Azerbaijan, Baku, Azerbaijan

³Institute of Physiology named after academician Abdulla Karaeva, Baku, Azerbaijan

⁴Tashkent Kimyo International University Samarkand Branch, Samarkand, Uzbekistan

⁵Jizzakh Polytechnic Institute, Jizzakh, Uzbekistan

Abstract. The presented article provides a comparative analysis of psychophysiological and health indicators of the aged, elderly and long-lived from different mountainous regions of Azerbaijan. Thus, Azerbaijan has historically been chosen as the land of centenarians and had the terrain in the center of attention. The influence of natural complex terrain on life expectancy is one of the most urgent problems in the scientific literature. The observational studies involved the aged (65-74 years old), the elderly (75-89 years old) and long-lived (90 years and older) from Kalbajar, Lachin and Zangilan districts, which are mountainous territories of Azerbaijan. The studies measured general anxiety, situational and individual anxiety, visual memory and attention, systolic and diastolic blood pressure, and heart rate in 1 minute. In a comparative analysis of the results obtained, again, people living in mountainous areas maintain their health indicators due to strong adaptive processes that allow them to reach the age of longevity, the psychophysiological indicators of long-lived are within the normal range. Compared with the aged and the elderly, low and average levels of anxiety were revealed, visual memory and attention were higher than normal and higher health indicators. A comparative analysis of the results obtained showed that the physiological processes of the inhabitants of high-altitude areas were within the normal range. Kalbajar and Lachin districts are the most mountainous regions, while the Zangilan district is the middle and lower mountainous area. A comparison of the results obtained generally showed that the psychophysiological and health indicators of elderly in Zangilan district differ more sharply from the norm and increase the incidence of neuropsychiatric and somatic diseases.

Keywords: mountainous areas, aged, elderly and long-livers, level of anxiety, arterial pressure, heart rate, visual memory, attention.

*Corresponding author: primqulovasitora@gmail.com

1 Introduction

Historically, Azerbaijan was regarded as a country with a high life expectancy, and the provision of adequate healthcare facilities was a priority. According to the literature, the terrain of the territory of the Republic of Azerbaijan is highly diverse and complex. More than half of the territory is predominantly 400-500 m (800-1000 m in the Middle and Lower Araz depressions), in places 100-120 m (foothills of Talysh, Jeyranchol-Ajinokhur and Langebiz-Alat) and 0-50 m. (Gobustan, Absheron) consists of mountain ranges and ridges, plateaus and plateaus from absolute height, while the rest of the area consists of plains and plains. The mountain's elevation fluctuates between approximately 28 metres along the Caspian Sea coastline and 4,466 metres (Bazarduzu Peak) within the Greater Caucasus Range. Areas located below sea level occupy 18% of the territory of the Republic, territories from 0 m to 200 m - 24%, from 200 m to 500 m - 15.5%, from 500 m to 1000 m - 15.5%, from 1000 m to 2000 m - 19.5%, from 2000 m to 3000 m - 6.5%, and territories located above 3000 m - 1%. The average altitude is 657 m. The main orographic units of the Republic of Azerbaijan are the Greater Caucasus Mountain System, the Samur-Davachi Plain (together with the Gusar Inclined Plain), the Kura Depression, the Lesser Caucasus and the Talysh Mountain Systems. In the Azerbaijani portion of the Lesser Caucasus, there are several prominent mountain ranges, including the Shahdag (Gara-Arkhaj, 2901 m; Khinaldag, 3367 m), Murovdag (Gamishdag), and Karabagh (Boyuk Kirs, 2725 m; Delidag, 3616 m). The Karabakh Mountains, which reach an elevation of 3,724 metres, and the volcanic plateau of the same name, which reaches 3,552 metres at its highest point, dominate the terrain. The Daralyaz (Kukudag - 3120 m) and Zangezur mountains (Mount Gapijig - 3904 m) extend into the territory of Nakhchivan province. The Bichenak Pass (2346 m) is situated at the confluence of the two mountain ranges. The Lankaran lowland is demarcated to the southwest by the Talysh mountain range (Gomurgoi - 2493 m). The front portion of these mountains is bordered by the Burovar Range (914 m) and the central section by the Peshtasar Range (2,200 m).

Azerbaijan's climate and terrain are conducive to maintaining optimal human health. This is the reason why Azerbaijan is known as the country of longevity. However, recent studies have demonstrated a precipitous decline in the longevity index and a marked divergence in health indicators from the norm, resulting in an earlier age of mortality. In light of these findings, the objective was to examine the factors influencing the longevity index, to assess the psychophysiological and health indicators of the elderly and long-lived individuals under study, and to investigate the characteristics of mountainous regions in Azerbaijan, specifically the districts of Lachin, Kelbajar and Zangilan. The research surveys were conducted on a voluntary basis in the in the Gurtulush Residential Community, 'Town of Zangilan' located in Masazir, and in the population of refugees and internally displaced persons (IDPs) living in Sumgayit. It is noteworthy that the subjects were born and have resided in the aforementioned districts for a minimum of 35 to 60 years. The following section will provide information on the natural relief and climate of the districts in question. The terrain of the Kelbajar District is mountainous, comprising Murovdag (Gamishdag 3724 m, Beyuk-Hinaldag d. 3367 m), East Geycha, Mihtoken, Karabakh ridges and part of Karabakh Volcanic Highland (Dalidag d. 3616 m). Kipchak Pass, Agababa Mountain, Aichingili Mountain, Buzlug Mountain, Chilet, Chilgaz, Dikpillekan, Egerurd, Gomurdag, Hojayurd, Ilandag, Kechaldag, Ketidag, Kilsalidag, Kirkhgiz Mountain, Gochdag, Gongurdag, Lachin Mountain, Mamedvali Mountain, Oyugludag, Rumbahar, Sagagan, Sarybulag, Saribulag, Sarimsagi, Sichanlydag, Suzlug, Timarri, Yuzbulag. Jurassic, Cretaceous, Palaeogene, Neogene and Anthropogenic sedimentary, volcanogenic-sedimentary and volcanic rocks are widespread. The climate is characterised by cold temperatures and a mountain-tundra climate. The average temperature in January ranges from -3°C to -10°C, while in July it

ranges from 5°C to 20°C. The annual precipitation level ranges from 700 to 900 mm. The Kelbajar district is home to a multitude of mineral springs. The most renowned of these are Yukhari Istisu, Ashagi Istisu, Goturlu Istisu and Turshsu. The district is home to a number of mineral waters, including those of Istisu, as well as springs of acidic waters of the Narzan type with a high flow rate. Rhodium-containing waters are located approximately 1–2 km to the southeast of Upper Istisu. These waters have been demonstrated to be efficacious in the treatment of conditions affecting the nervous, musculoskeletal, and cardiovascular systems. The quality of the mineral water emerging from Lower Istisu is markedly superior to that of the mineral water of Karlovy Vary in the Czech Republic. The region is home to over three thousand springs. The Kelbajar district is characterised by a plethora of flowing rivers. The most prominent of these is the Tartarchay, which is fed by several tributaries, including the Tuthun River, the Lev River, the Zailik River, the Keshdak River (Alolar water) and the Karaagach River (Sarkar water). Additionally, the Nargiz River, Umudlu River, Lenjimek River, Maral River and several smaller rivers flow directly into the Terter River.

The soil types observed in Kelbajar include grassy mountain meadows, brown soils, and brown mountain forest soils. The district encompasses 147 settlements, comprising one city, one settlement, and 145 villages. It is the most extensive district in the country. The population of the district in 2020 was 77,003 people. The majority of these individuals settled in other regions, including Absheron, Ganja, and Sumgayit, due to the forced displacement caused by the outbreak of the War in 1993-1994.

The administrative centre of Lachin District is the Town of Lachin. The district is comprised of a single urban centre, a single rural settlement (Gaygi Settlement), and 125 villages. It is situated in the south-western region of Azerbaijan, within a mountainous topography. The district is bordered to the north by Kelbajar, to the east by Khojaly, Shusha and Khojavand, to the south by the Gubadli district and to the west by Armenia. The terrain is mountainous, with the northern part situated on the south-western slope of the Karabakh Range, the northern part on the south-eastern slope of the Mikhtoken Range, and the south-western part on the Karabakh Plateau. The highest point in the region is Mount Kyzylbogaz, which reaches an elevation of 3,594 metres. On the territory of the district there are mountains Agoglan, Alageller, Altintahta, Big Isikli, Chudelar, Chalbair, Dalidag, Farmachtep, Hodjaztep, Isikli, Kesishtepe, Kikch Isikli, Gabagtep, Katyrdash, Kahramanbey hill, Kirhgiz mountain, Gazilbogaz, Gazilgaya mountain, Kiziltepe, Korugundag, Gurgundag, Tarkhanyali, Yahartepe heights. Its rivers are the Khakari and its tributaries. The dominant vegetation types are meadow, mountain meadow, brown mountain forest, and carbonate mountain chernozems. The vegetation is represented by shrubby and sparsely wooded meadows, broad-leaved mountain forests (comprising oak, beech and beech), and subalpine and alpine meadows. The animal kingdom is represented by a variety of species, including skunk, wild mouse, roe deer, wild boar, squirrel, plover, and others. The climate is characterised by mild, dry winters and relatively warm summers, with temperatures ranging from cold in winter to hot in summer. The mean temperature in January is -10°C to 0°C, while in July it ranges from 10-22°C. The annual precipitation is 600–900 mm, with a total land area of 166,488 ha. Of these, 75,781 ha are suitable for agriculture, with 12,102 ha classified as arable land. As of 1 January 2014, the local population of Lachin district was 80,000, with a temporary population of 57,000 residing in various cities and districts within the Republic.

Zangilan district is situated on the left bank of the Araz River, in the south-eastern region of the Little Caucasus Range. The territory is situated in a region characterised by middle and low mountains, exhibiting a complex and fragmented surface structure. To the west and north-west, the region is bordered by the Syunik region of the Republic of Armenia, while to the south and south-east it is bordered by the East Azerbaijan province of the Islamic Republic of Iran. The district is bordered to the north by Gubadli, to the east by Jebail, to

the south by the Islamic Republic of Iran along the Araz River, and to the west by the Mehri and Gafan districts of Armenia. In addition to sedimentary rocks, the region is characterised by the presence of volcanic materials, including Jurassic and Cretaceous sediments. A range of minerals have also been identified, including building stone, a gold deposit, a black marble deposit, a source of lime, and limestone for dehydrated soda. The region's vegetation is dominated by cherophytic forests with Araz oak, as well as thickets in the central and northern parts. Fauna of Zangilan: hedgehog inhabits the south of the district, wild boar, bear, roe deer in the south-east. Among birds there are also widespread pheasant, partridge, woodcock, sparrow, crow, magpie, grebe, wild pigeon, fox, grey rabbit, wolf. Two climatic cycles are established on the territory of the region. They are based on a mild warm climate and a semi-desert-desert climate with dry winters. Zangilan has a complex but interesting, eye-catching landscape with alternating plains, hills and valleys formed by rivers. Four rivers run through the territory of the district: Araz, Okchuchay, Hekari and Basitchay. In the Basitchay river basin in Zangilan, there is a natural plane tree forest on a large territory. It is a world-famous charming place, the second in the world and the first in Europe in terms of the area of natural plane tree forest, which has passed through centuries. It has an area of 730 square km and a population of 45473 people. Currently, a small part of the population has been resettled in the areas liberated from the occupation and rebuilt. Most of its population settled in Absheron, Sumgayit, and other territories.

In order to describe the environment and ecological conditions of the people who took part in scientific research, we have provided an overview of the demographic characteristics of the participants. The surveyed were mainly attended by Azerbaijanis for their ethnic composition and of both sexes. The table below shows the number of people in each age group who were examined:

Table 1. Numbers of surveyed Aged, Elderly and Long-Lived in Different Districts.

District Name	Number of Aged	Number of Elderly	Number of Long-Lived
Zangilan	90	30	14
Lachin	61	17	21
Kalbajar	45	19	18

2 Research methods

The following research methods were used in the research:

1. Determination of Systolic and Diastolic Arterial Pressure by the Korotkoff Method (mm Hg);
2. Determination of Cardiac Beat per Minute (WTO);
3. Spielberger-Hanin Test - Measurement of Situational and Individual Anxiety;
4. Taylor Test - Measurement of General Anxiety;
5. Determination of the Level of visual Memory by the 'Memory by Description' Test;
6. Determination of the Level of Attention by the 'Missing Detail' Test.

3 Results and Discussion

The frequency of arterial pressure and heartbeat from the indicators of activity of the autonomic nervous system in the course of research is the main regulatory and adaptive indicator of physiological processes of the organism in the elderly, the elderly and long-livers.

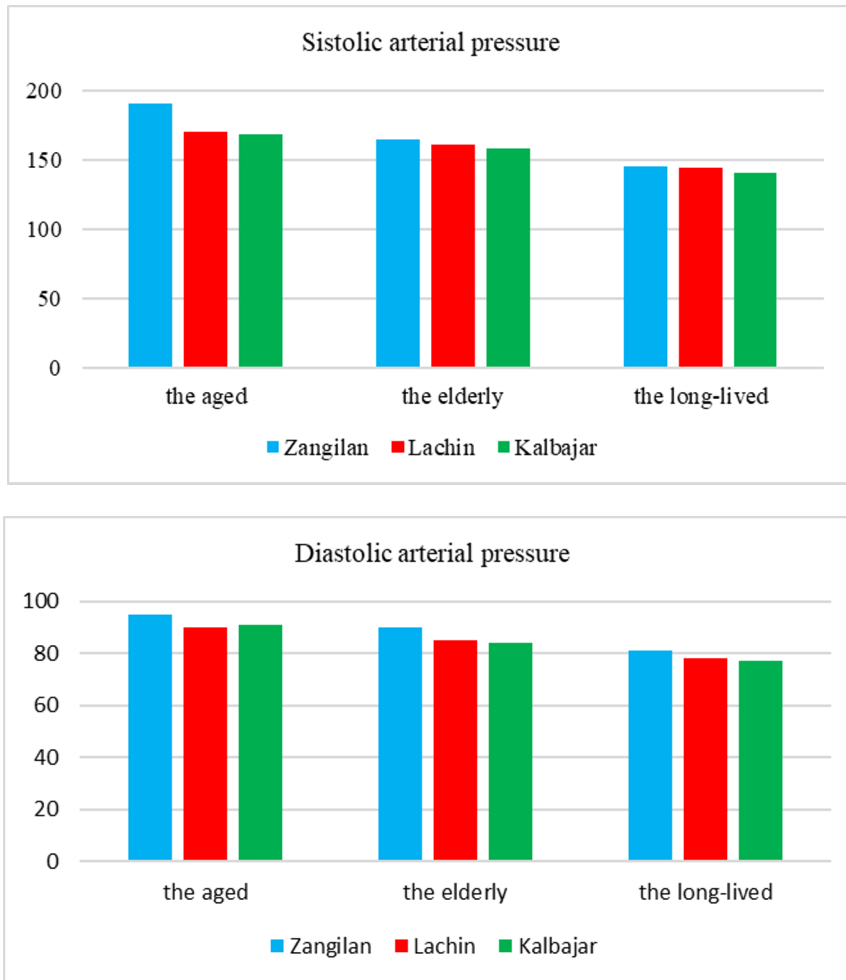


Fig. 1. Comparative Characteristics of arterial Pressure Index in Aged, Elderly and Long-Lived (mmHg).

Thus, in the population of Zangilan district the following indicators were obtained: systolic arterial pressure in the elderly 190 mm. cv. milk, diastolic arterial pressure 95 mm. cv. milk, and the frequency of heart contractions in 1 minute - 96 beats per minute; systolic arterial pressure in the elderly 164 mm. cv. of milk, diastolic arterial pressure 90 mm.cv. of milk and heart rate at 1 minute - 90 beats per minute; systolic arterial pressure in the long-lived - 145 mm.cv. of milk, diastolic arterial pressure - 81 mm.cv. of milk and heart rate at 1 minute - 80 beats per minute (Fig.1).

The elderly from Lachin district have high arterial pressure, with systolic pressure at 170 mmHg and diastolic pressure at 90 mmHg. Their heart rate is also high, at 90 beats per minute. In comparison, the elderly have systolic pressure at 161 mmHg and diastolic pressure at 85 mmHg. The systolic arterial pressure is 144 mmHg, the diastolic arterial pressure is 78 mmHg, and the heart rate is 76 beats per minute.

The systolic arterial pressure of elderly people from Kalbajar district is 168 mmHg, the diastolic arterial pressure is 91 mmHg, and the heart rate in 1 minute is 88 beats per minute. In contrast, the systolic arterial pressure of long-lived people is 158 mmHg, the diastolic arterial pressure is 84 mmHg, and the heart rate in 1 minute is 74 beats per minute. Arterial

pressure is 84 mmHg, and heart rate in 1 minute is 82 beats per minute. In long-lived people, systolic arterial pressure is 140 mmHg, diastolic arterial pressure is 77 mmHg, and heart rate in 1 minute is 74 beats per minute (Fig.2).

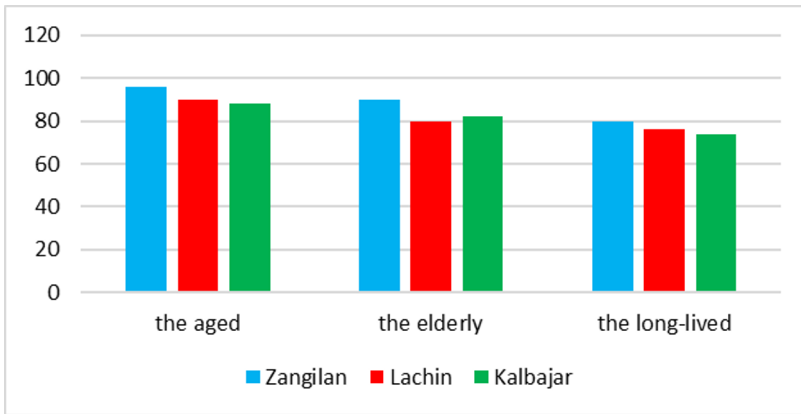


Fig. 2. Comparative Pattern of Heart Rate Index (per 1 Minute) in Elderly, Aged and Long-Lived.

Among the methods of psychological testing, the Spielberger-Hanin test was employed to measure situational and individual anxiety, while the Taylor test was used to gauge the general level of anxiety. In general, the measurement of bodily anxiety is an important indicator of the state of the CNS and of higher nervous activity. A notable divergence from the norm in this indicator is indicative of the presence of neuropsychiatric and somatic diseases within the organism. The level of situational anxiety in elderly people of the Zangilan district was found to be 54.3 points, the level of individual anxiety was 54.7 points (Fig.4), and the general level of anxiety was 48.6 points (Fig.5). The level of situational anxiety in elderly people was found to be 45.9 points (Fig.3), while the level of individual anxiety was 51.8 points and the level of general anxiety was 45.8 points. In long-livers, the level of situational anxiety was 45.1 points, the level of individual anxiety was 45.4 points and the level of general anxiety was 42.5 points.

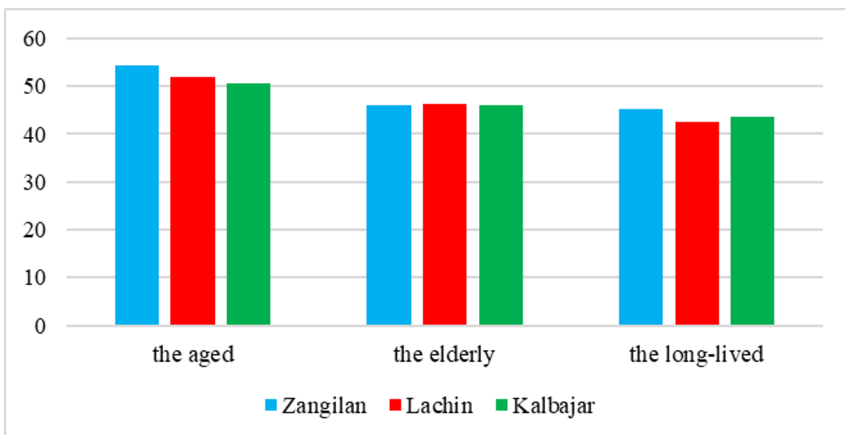


Fig. 3. Comparative Characteristics of the Situational Anxiety Level in the Aged, Elderly, and Long-Livers (according to the Spielberger-Hanin Test, with scores).

The level of situational anxiety is 51.9 points, the level of individual anxiety is 48.3 points, and the general level of anxiety is 36.2 points. In the elderly population of the Lachin district, the level of situational anxiety is 46.3 points, while the the general level of anxiety is 33.9 points, the level of situational anxiety in long-lived individuals is 42.5 points and the level of individual anxiety is 44.4 points. The general level of anxiety is 30.2 points.

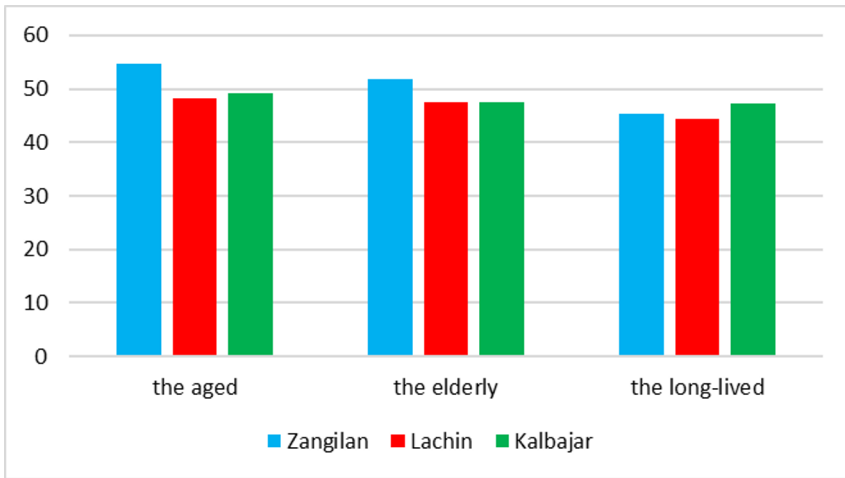


Fig. 4. Comparative Characteristics of the Individual Anxiety Level in Aged, Elderly and Long-Lived (according to the Spielberger-Hanin test, with scores).

In elderly people of Kalbajar district situational anxiety level is 50.7 points (Fig.3), individual anxiety level is 49.1 points (Fig.4), general anxiety level is 36.4 points (Fig.5); in elderly people situational anxiety level is 46.0 points, individual anxiety level is 47.6 points, general anxiety level is 35.2 points; in long-lived people situational anxiety level was 43.6 points, individual anxiety level was 47.2 points, general anxiety level was 33.9 points.

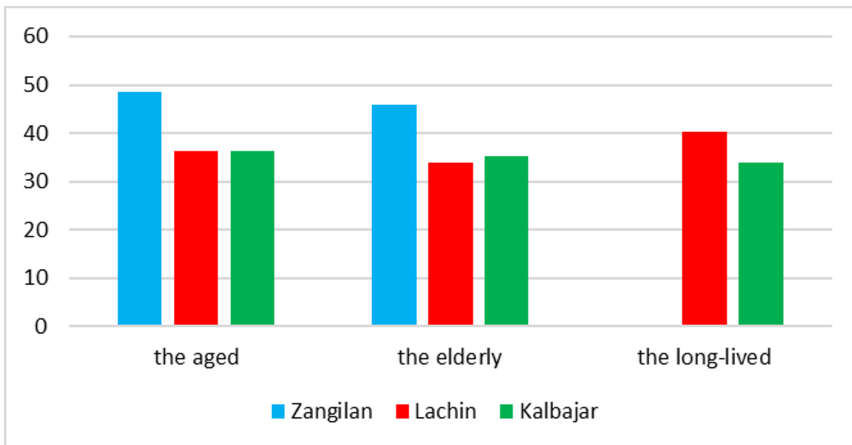


Fig. 5. Comparative Characteristics of the General Anxiety Level in the Aged, Elderly and Long-Livers (according to Taylor Test, with scores).

Since cognitive indices are considered as an indicator of the activity of the cerebral hemispheres and cerebral cortex, the indicators of the level of visual memory and attention were studied for the purpose of comprehensive assessment. The level of visual memory was

determined using the ‘Memory by Description’ test, which is a non-verbal method, and the level of attention was determined using the ‘Missing Detail’ test. The application of these tests was very convenient for all ages, and the statistical analysis of the obtained results was reliable.

Thus, the level of visual memory in the elderly of Zangilan district is 8.1 points, the level of attention index is 5.4 points (55 seconds); the level of visual memory in the elderly is 8.9 points, the level of attention index is 6.3 points (61 seconds); the level of visual memory in the long-lived was 8.5 points, the level of attention index is 7.2 points (70 seconds).

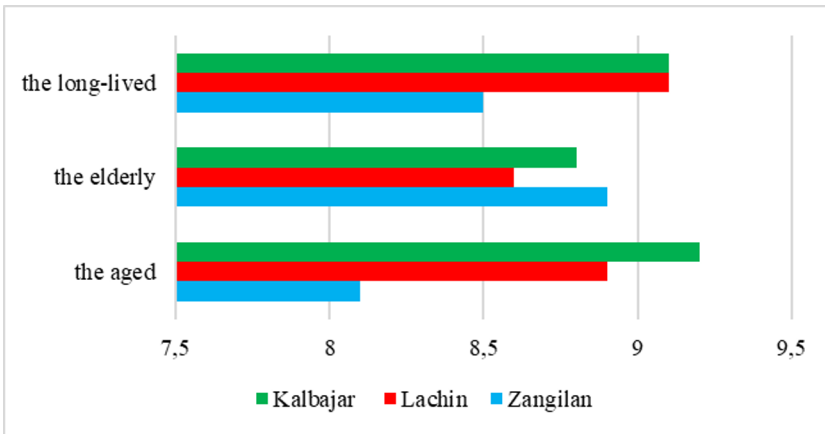


Fig. 6. Comparative Characteristics of the level of Visual Memory Indicator in the Aged, Elderly and Long-Livers (according to the ‘Memory by Description’ test, with scores).

The level of visual memory in elderly people of Lachin district is 8.9 points (Fig.7), the level of attention index is 6.1 points (62 seconds); the level of visual memory in aged is 8.6 points, the level of attention index is 6.6 points (59 seconds); the level of visual memory in long-lived people was 9.1 points and the level of attention index was 7.5 points (75 seconds) (Fig.8).

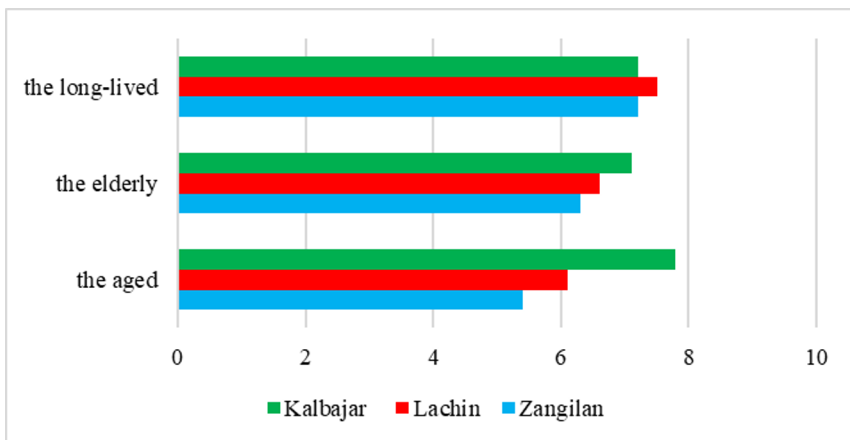


Fig. 7. Comparative Characteristic of the Index of Attention Level in the aged, elderly and long-livers (according to the ‘Missing Detail’ test, with scores).

In elderly people of Kelbajar district the level of visual memory is 9.2 points and the level of attention index is 7.8 points (63 seconds); the level of visual memory in aged is 8.8 points (Fig.7) and the level of attention index is 7.1 points (60 seconds); in long-livers the level of visual memory was 9.1 points and the level of attention index was 7.2 points (73 seconds) (Fig.8).

When comparing the results of all studies, it was found that the physiological processes in older people differ more from the norm and are directed in a pathological direction. Thus, in the elderly of all three districts, the arterial pressure index was significantly higher than normal, and there was also a sharply high incidence of heart attacks. In the elderly and long-lived, the arterial pressure index corresponded to the physiological age, which is one of the facts indicating the normal course of adaptation processes. At the same time, the results of the alarm indicators corresponded to this fact. All elderly people have a very high level of general, situational and individual indicators of anxiety. Indeed, 95% of the elderly have neuroses, cerebral circulatory disorders, depression, post-stroke, etc. Endocrine diseases have been registered and treated for many years. The elderly and long-lived people had an average level of anxiety from moderate to high. Among centenarians, 6 people had a low level of anxiety. The results of cognitive indicators are of particular interest. So, if we take into account that the level of visual memory is 7 points in the norm, then all the examined memory levels were within the normal range. There was also an overall average level of attention index. Thus, an indicator of 4-7 points characterizes the average level of attention. In our results, it ranged from 5.4-7.8 points. It is also very important that the duration of this test is within the normal range. In the studies, this time period was in the range of 55-75 seconds, which once again confirms that the results obtained are an indicator of the average level of attention. The most interesting fact is that long-lived have higher memory and attention than representatives of other age groups.

Thus, it was noted that all the studied physiological processes in centenarians were within the normal range, against the background of a sharp difference in the health indicators of elderly people in the Zangilan, Lachin and Kalbajar districts. According to the scientific literature, the results obtained can be explained as follows: first of all, highly developed adaptive processes in centenarians ensure the regulation of physiological mechanisms. A high level of stability of neurohumoral regulatory processes allows the regeneration and adaptation of the body to live in accordance with physiological age. In particular, this fact is confirmed by the fact that the indicators of the autonomic nervous system are within the normal range. Considering that centenarians lived for at least 60-70 years in the mountainous areas where they were born; healthy physiological development of the body in a natural and environmentally friendly environment, as well as a high level of adaptation mechanisms important for health in conditions of physical activity, mineral-rich water and nutrition [1,7,8,9,13]. As a result, even if there was forced displacement, the psychophysiological indicators of these people were within the normal range compared to other groups. In general, it is known that people living in mountainous areas have a high longevity index. The fact of longevity of the offspring was also determined according to the anamnesis of the studied longevity. If environmental factors are unfavourable, this fact does not matter. Thus, despite the fact that the parents of the majority of the studied elderly people are long-lived, their health indicators do not allow them to reach this age [2,6,10,17,21].

It's worth to note another interesting fact: our results have once again shown that people living in high-altitude areas have normal physiological processes. The Kalbajar and Lachin districts are the most mountainous regions, while the Zangilan districts are the middle and lower mountainous regions. A comparison of the results obtained in general showed that the psychophysiological and health indicators of elderly people in the Zangilan district differ more sharply than the norm. Most of these people suffer from neuropsychiatric and somatic diseases. The findings indicate a sharp decline in the longevity index in the near future.

It is also documented in the literature that mountain communities have a history of distinctive cultural development, robust psychological resilience and self-reliance. The harsh and changeable mountain environment has necessitated social and technical adaptation over time. The concepts of adaptation and resilience may be of a different nature. It is considered that both ecological and psychological resilience are central to mountain populations. Mountain ecosystem resilience ensures that all four types of key ecosystem services (supply, regulation, culture and support) are maintained for the populations of neighbouring plains (5,19,24).

Psychological resilience can be defined as an individual's capacity to adapt and adjust to adversity [4]. The experience of positive emotions [19] and the capacity for emotional intelligence [1] facilitate the exertion of greater effort by individuals in order to ensure their survival and maintain their health [18]. In recent years, in contrast to the multitude of studies on psychological, community and social resilience, there has been a paucity of research conducted on the resilience of mountain communities [11, 15, 25]. The identification of positive psychological, social and governance factors is crucial for the comprehension of strategies that may be employed to enhance the resilience of mountain communities. In our studies, situational and individual anxiety in long-lived individuals is at medium and low levels, which can be regarded as evidence that they live in stable emotional conditions for a long time as a community in mountain ecosystems. A stable emotional state enables the normal functioning of cognitive processes and the establishment of a calm life free from emotional stress [4, 19, 21, 22, 27]. Despite the forced eviction of long-livers from their place of birth and upbringing under war conditions, which resulted in adverse emotional states and stress, the preservation of the CNS had a limited impact on the regulation of neuroendocrine mechanisms. The high level of adaptation and resilience to environmental conditions enabled long-livers to maintain stable psychophysiological processes and health indicators, which were superior to those of the elderly [12, 14, 16, 20].

In general, mountains and foothills have a beneficial impact on human health and emotional stability. For the treatment and prevention of certain diseases, it is recommended that hospitals and sanatoria be established in ecologically pristine mountainous regions with oxygen-rich, mineral-rich water.

4 Conclusions

1. Due to strong adaptation processes, people living in mountainous areas maintain health indicators that allow them to reach the age of longevity.
2. People living in mountainous areas showed activity of cognitive processes against the background of a low level of anxiety.
3. Compared with the aged and the elderly, the main vegetative indicators (blood pressure and HCV) of the examined long-lived were within the normal range.
4. All the studied psychophysiological and health indicators of the aged significantly differed from the norm. This can lead to a decrease in the longevity index.
5. Our results showed that people living in very high-altitude areas have physiological processes within the normal range. Kalbajar and Lachin districts are the most mountainous regions, while Zangilan district is the middle and lower mountainous area. A comparison of the results obtained in general showed that the psychophysiological and health indicators of the aged and the elderly in Zangilan district differ more sharply from the norm. This increases the incidence of neuropsychiatric and somatic diseases in them.
6. Mountains and foothills have a positive effect on maintaining human health and emotional stability. For the treatment and prevention of certain diseases, it is advisable to create hospitals and sanatoriums in ecologically clean mountainous areas with oxygen-rich, mineral water.

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