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Some New Data about the Bioclimatic Characteristics of the Village of Mukhuri (Western Georgia)

[1]Avtandil G. Amiranashvili, [2]Nana R. Bolashvili,
[1]Victor A. Chikhladze, [3]Nino D. Japaridze, [3, 4]Ketevan R. Khazaradze,
[5]Rusudan R. Khazaradze, [2]Zaza I. Lezhava, [2]Kukuri D. Tsikarishvili

[1]Mikheil Nodia Institute of Geophysics of Tbilisi State University, Tbilisi, Georgia
[2]Vakhushti Bagrationi Institute of Geography of Tbilisi State University, Tbilisi Georgia
[3]Ministry of Labor, Health and Social Affair of Georgia
[4]Georgian State Teaching University of Physical Education and Sport
[5]Agricultural University of Georgia

Abstract

Some new data about the bioclimatic characteristics (Tourism Climate Index and light ions content in air) of the village Mukhuri (Western Georgia), useful for the development of the health resort-tourist potential of this locality are represented. It is shown that for the development of mass tourism the months from March through November are favorable. The results of measurements of light ions concentration in air near the bank of river Khobistskali, in Shurubumu karstic cave and forest showed the prospect of development in the indicated locality ionotherapy. It is noted that all months of year are suitable for the therapeutic and preventive tourism.

Key words: Tourism Climate Index, small ions, health resort- tourist potential

Introduction

Information about different bioclimatic characteristics of known and potential health resort - tourist zones has vital importance for an increase in the effectiveness of their therapeutic, rehabilitative, prevention and reducing properties [1-3]. In particular, they include the so-called Tourism Climate Index (TCI) [4,5], and also the concentration of light (small) ions [6-8].

TCI is a combination of seven parameters, three of which are independent and two in a bioclimatic combination:

$$TCI = 8 \cdot Cld + 2 \cdot Cla + 4 \cdot R + 4 \cdot S + 2 \cdot W$$

Where Cld is a daytime comfort index, consisting of the mean maximum air temperature Ta, max (°C) and the mean minimum relative humidity RH (%), Cla is the daily comfort index, consisting of the mean air temperature (°C) and the mean relative humidity (%), R is the precipitation (mm), S is the daily sunshine duration (h), and W is the mean wind speed (m/s).

In contrast to other climate indices, every contributing parameter is assessed. Because of a weighting factor (a value for TCI of 100), every factor can reach 5 points. TCI values >= 80 are excellent, while values between 60 and 79 are regarded as good to very good. Lower values (40 – 59) are acceptable, but values < 40 indicate bad or difficult conditions for understandable to all tourism [4]. Data about TCI are used for the information on the "Average Tourist" and can be useful for the planning developments of mass tourism.

The content of light ions in the atmosphere (n_+ - positive ions concentration, n_- - negative ions concentration) plays important role in molding of the physiological state of population. Simultaneously light ions are the indicator of the purity of air [9,10]. If sum light ions concentration $n_{+/-}$ is < 600 cm^{-3} (n_+ =300, n_-= 300, less than the minimum level), their physiological action on the human organism is the following: fatigue, weakening attention, retarding of reactions, worsening of the memory, headache, the disturbance of the regime of blood pressure, etc. When $n_{+/-}$ is 1000-8000 cm^{-3} (n_+ =400-3000, n_-= 600-5000, minimally necessary – optimum levels) their physiological action on the human organism is positive and has preventive and therapeutic effect: optimization of blood pressure, positive influence on the course of the diseases of respiratory organs, such as bronchial asthma, also, antiseptic actions, etc. [11].

Optimum, useful for the health of the human concentration of light ions in air, usually is observed in the karstic caves, in the forests, in the mountain locality, near the coasts of rivers and seas, near waterfalls, etc. Therefore, for expanding the health resort-tourist potential of one locality or another, it is desirable to determine places with the increased air ionization. These places can be recommended for organizing the medical and preventive procedures [7,8].

The results of the studies TCI and light ions content in air in some locations of Georgia, which were carried out earlier, were represented in the works [3-8, 10-17]. The data about indicated bioclimatic the characteristics for the village Mukhuri (Western Georgia) are cited below.

The region of studies, material and methods

Village Mukhuri is a populated place in Western Georgia (42.6330 N, 42.1769 E, altitude: 272 m). Mukhuri located on the shore river Khobistskali. Distance from Mukhuri to the capital of Georgia Tbilisi - 240 km, to the capital of the Adjarian Autonomous Republic Batumi - 120 km, to the second in the value city of Georgia Kutaisi - 60 km, to the coast of Black sea - 55 km (fig. 1).

Mukhuri is famous as the health resort, with coniferous, mixed forest and alpine mountains. The cool and pure river Khobistskali divided the village with two sides. There are different kinds of fished in the river and also mineral waters runs in it. One of them is 9% - calcium chlorine - "Lugela", which is used for medical treatment– rachitis, allergy, blood bleeding, osteoporosis, skin rashes, parenchymal hepatitis, nephritis, stomatitis, conjunctivitis, also is used in cosmetology. Carbonaceus mineral water "Skuri" is located at a distance of 5 km length from the village Mukhuri, which is used for treatment of intestinal and urogenital organs.

The Shurubumu cave deserves the attention by its uniqueness and extent; its entrance is opened at 3 km away from the village of Mukhuri on the left bank of the Khobistskali River, where the thin layered limestones (0.2-0.3 m) of the Upper Cretaceous (turonuli) age come out on the earth's surface.

Data of Hydrometeorological Service of Georgia was used for the TCI calculation data. Light ions concentration (cm^{-3}) measurements with the aid of the portable ions counter of the production of firm "AlphaLab, Inc." are conducted. Radon content in air (the basic ionizer of

air in the atmospheric boundary layer) with the aid of the portable device PB-4 was conducted.

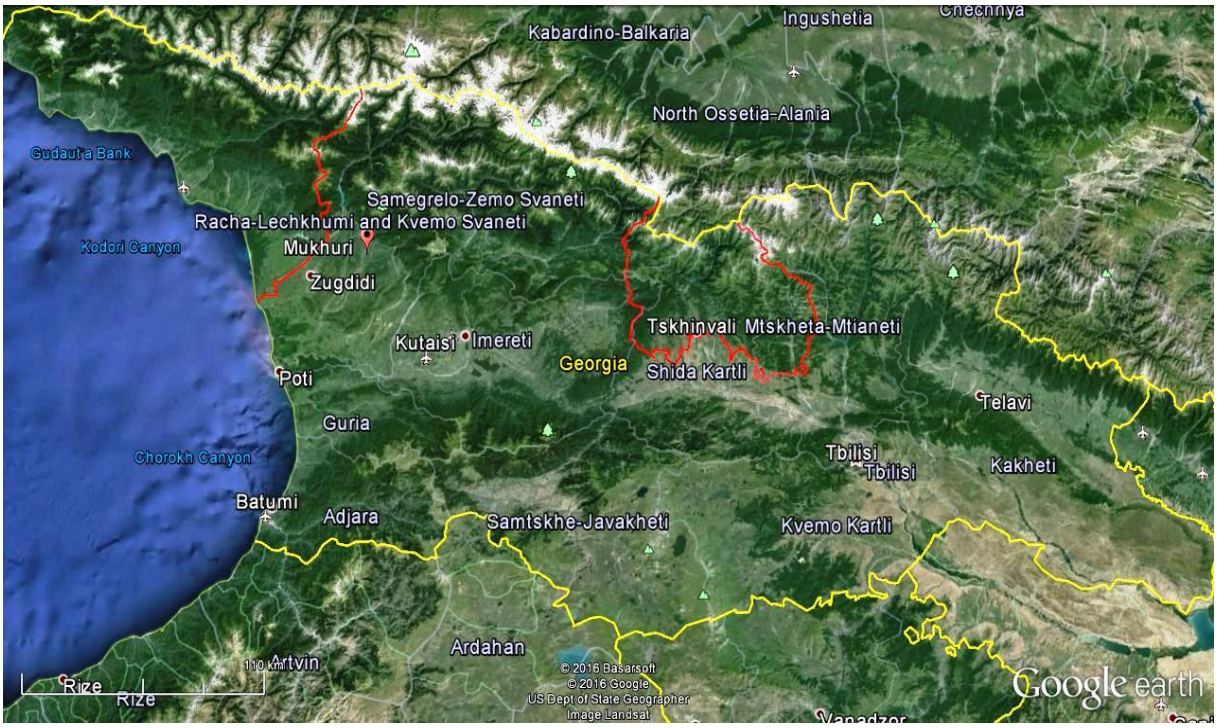

Fig. 1. Location village Mukhuri in Georgia.

Results and discussion

Information about TCI category in fig. 2 and 3 are presented. Data about radon and small ions concentration in some locations of Mukhuri (fig. 4-7) in the table is presented.

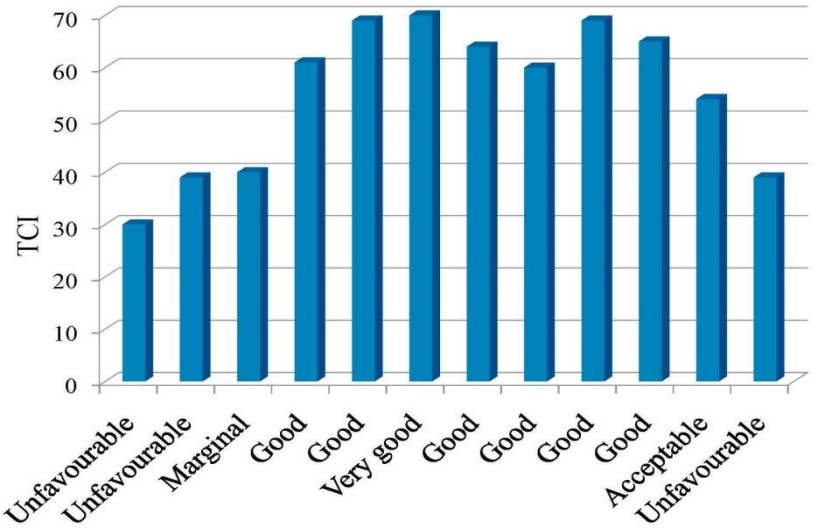

Fig. 2. The intra-annual distribution of Tourism Climate Index in Mukhuri.

As follows from fig.2 the intra-annual distribution of the TCI values for Mukhuri has bimodal nature with the extremum during June and September. It is known, that the bimodal type of distribution of TCI values in many other places is observed [14]. TCI categories change from "Unfavourable" (December, January, February) to "Very good" (June). For the development of mass tourism the months from March through November are favourable.

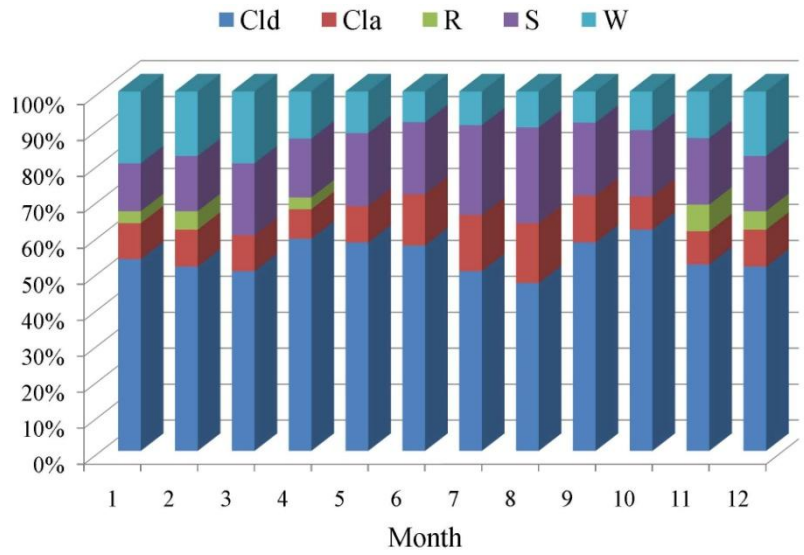

Fig. 3. Share of different components in Tourism Climate Index in Mukhuri.

As it follows from fig. 3 the values of daytime comfort index (Cld varied from 46.7 % 61.5 % with average value 54.0 %) and daily sunshine duration (S varied from 13.3 % to 7.4 % with average value 19.1 %) make the greatest share to the mean annual values of TCI in Mukhuri.

The values of daily comfort index Cla and precipitation R make the smallest share to the mean annual values of TCI (Cla varied from 8.2 % to 16.7 % with average value 11.4 % and R varied from 0 % to 7.4 % with average value 2.0 %).

As a whole, the relatively lowered values of TCI in Mukhuri (in comparison with Baku, Yerevan, Tbilisi, different location of Iran, Turkey etc.) are caused by more rainy climate, decreasing the contribution share R to the general value of TCI [14,18-22]. At the same time values of TCI in Mukhuri are close to their values for the cities Batumi, Kobuleti and Khulo, located on the coast area of Black sea [13, 15].

Table

Radon and small ions concentration in some locations of Mukhuri (September 2015)

Location	Radon Bq/m^3	Small ions, cm^{-3}			Coeff. of unipolarity $\mathbf{n_+/\ n_-}$
		$\mathbf{n_+}$	$\mathbf{n_-}$	$\mathbf{n_{+/-}}$	
At the entrance into the cave		315	1650	1965	0.19
Cave, 1 hall, center	9	250	1570	1820	0.16
Above the cave, forest	4	410	1100	1510	0.37
Near shore river Khobistskali		275-400	1160-1750	1435-2150	0.24-0.23
Court of apartment house near from the river		480	1750	2230	0.27

In the table results of measurements of radon and light ions concentration in some locations of Mukhuri (fig. 4-7) are presented.

Fig. 4. Measurement of the radon and light ions concentration at the entrance into the cave. In the foreground: A. .Amiranashvili (to the left) and V. Chikhladze (to the right).

Fig. 5. Measurement of the light ions concentration in the cave (V. Chikhladze).

Fig. 6. Forest in the environments of cave. In the center: V. Chikhladze (to the left) and N. Bolashvili (to the right).

Fig. 7. One of the site of Khobistskali river.

As follows from the table, the light ions concentration in air near the bank of river Khobistskali, in Shurubumu karstic cave and forest are sufficiently high and generally correspond to category minimally necessary – optimum levels.

It should be noted that the first hall of Shurubumu cave (area - approximately 20 square meters, volume - approximately 60 cubic meters) is not isolated from the environment (fig. 4,5). Therefore in this cave the low concentrations of radon and correspondingly the low concentration of light ions for the karstic caves are observed [23, 24]. For applying the cave

for therapeutic purposes it is necessary to install doors in the entrance of the cave. As a result, the concentration of radon and light ions considerably will be increased in the cave.

It should also be noted, that both the cave, forest near cave and some places near Khobistskali river, are located in the out-of-the-way places (fig. 6,7). Therefore for the possibility of the visiting the indicated objects for purposes of ionotherapy it is necessary to create the appropriate infrastructure (stairs, paths, benches for leisure, shelters from the rain, medical consultants, etc.). For ionotherapy (therapeutic and preventive tourism) all months of year will be suitable in this case.

Conclusion

Climate has a strong influence on the tourism and recreation sector and in some regions represents the natural resource on which the tourism industry is predicated. In this work the new data about such bioclimatic characteristics as "Tourism Climate Index" and small ions concentration for the village Mukhuri (Western Georgia) is obtained.

In the future we plan a more detailed study of the climate resources of this location for the tourism development.

Acknowledgement

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სოფელ მუხურის (დასავლეთ საქართველო) ბიოკლიმატურ მახასიათებლებზე ზოგიერთი ახალი მონაცემები

ა.ამირანაშვილი, ნ. ბოლაშვილი, ვ.ჩიხლაძე,
ნ.ჯაფარიძე, ქ.ხაზარაძე, რ.ხაზარაძე,
ზ.ლეჟავა, კ.წიქარიშვილი

რეზიუმე

მოყვანილია ზოგიერთი ახალი მონაცემები სოფელ მუხურის (დასავლეთი საქართველო) ბიოკლიმატურ მახასიათებლების (ტურიზმის კლიმატური ინდექსი და ჰაერში მსუბუქი იონების შემცველობა) შესახებ, რომლებიც სასარგებლო იქნება ამ ადგილის საკურორტო-ტურისტული პოტენციალის განვითარებისთვის. ნაჩვენებია, რომ მასობრივი ტურიზმის განვითარებისთვის ხელსაყრელია თვეები მარტიდან ნოემბრის ჩათვლით. მდინარე ხობისწყალის ნაპირებთან, შურუბუმის კარსტულ მღვიმეში და მიმდებარე ტყეში ჰაერში მსუბუქი იონების კონცენტრაციის გაზომვების შედეგებმა აჩვინა ხსენებული ადგილების პერსპექტულობა იონოთერაპიის განვითარების თვალსაზრისით. აღინიშნება, რომ სამკურნალო და გამაჯანსაღებელი ტურიზმისთვის წლის ყველა თვეა გამოსადეგი

Некоторые новые данные о биоклиматических характеристиках села Мухури (Западная Грузия)

А.Г. Амиранашвили, Н.Р. Болашвили, В.А. Чихладзе, Н.Д. Джапаридзе, К.Р. Хазарадзе, Р.Р. Хазарадзе, З.И. Лежава, К.Д. Цикаришвили

Резюме

Представлены некоторые новые данные о биоклиматических характеристиках (климатический индекс туризма и содержание легких ионов в воздухе) села Мухури (Западная Грузия), полезные для развития курортно-туристического потенциала этой местности. Показано, что для развития массового туризма благоприятными являются месяцы с марта по ноябрь. Результаты измерений коцентрации легких ионов в воздухе около берега реки Хобисцкали, в Шурубумской карстовой пещере и лесу показали перспективность развития в указанной местности ионотерапии. Отмечается, что для лечебного и оздоровительного туризма пригодны все месяцы года.