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THE THERAPEUTIC PROPERTIES OF NATURAL CLIMATIC CONDITIONS (MICROCLIMATE) AND THE SCIENTIFIC BASIS FOR THEIR USE

ABSTRACT

In the contemporary era, the comprehensive study of factors influencing human health has become one of the priority directions of global scientific research. In particular, the analysis of climatic and microclimatic conditions as an integral part of the natural environment and their impact on the human organism represents an important interdisciplinary field formed at the intersection of physical geography, bioclimatology, and environmental medicine. Ongoing global climate change, landscape transformation, and urbanization processes are significantly altering the balance between nature and human systems, thereby increasing the relevance of microclimatic factors.

From a physical geographical perspective, microclimate is defined as a local climatic system formed within a specific landscape complex, which is closely associated with relief, land surface cover, hydrological features, and biota. For instance, in mountainous regions, altitude zonation, atmospheric pressure variation, and radiation balance determine microclimatic characteristics, whereas in forest landscapes, vegetation cover regulates air humidity, temperature, and gas composition. These processes are governed by the principles of landscape systems and geographical zonation.

Microclimatic factors exert a direct influence on the human organism, affecting its physiological state and functional systems. Changes in environmental parameters activate internal regulatory mechanisms responsible for maintaining stability, which are realized through homeostasis and physiological adaptation processes. In this regard, the study of interactions between natural geographical environments and human health holds both fundamental and applied significance.

Furthermore, the effective use of natural microclimatic resources in medical practice—climatotherapy—is currently considered one of the key directions in preventive and rehabilitative medicine. This approach is scientifically grounded within the framework of sanatorium and resort therapy and involves the targeted utilization of the therapeutic potential of different landscape–climatic conditions.

KEYWORDS: microclimate, climatotherapy, health, adaptation, air ionization, environmental factors.

INTRODUCTION

Natural climatic conditions refer to a complex of environmental factors that develop over a long period within a specific geographical area and characterize the general state of the atmosphere. These conditions are defined by parameters such as temperature regime, air humidity, atmospheric pressure, wind dynamics, solar radiation, precipitation distribution, as well as the compositional and ionization characteristics of the air.

From a scientific perspective, natural climatic conditions represent a comprehensive system formed through the interaction between the Earth’s surface, oceans, and atmosphere. This system directly influences the life processes of all living organisms within the biosphere. Climatic conditions manifest at macroclimatic, mesoclimatic, and microclimatic levels, thereby determining human health status, ecosystem stability, agricultural productivity, and the potential use of natural resources (1).

The formation of climatically beneficial environments for the human organism is a global geosystem process based on energy and matter exchange. It is regulated by atmospheric radiation balance, convection and advection processes, the hydrological cycle, and the laws of geographical

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zonation. These processes operate across different spatial scales, including macro-, meso-, and microclimates.

Thus, natural climatic conditions represent a long-term dynamic equilibrium state of the Earth's surface system and serve as a fundamental natural factor determining the ecological, biological, and geographical characteristics of any region.

Favorable climatic conditions significantly enhance the effectiveness of balneotherapy, as they contribute to the normalization of key physiological systems, including thermoregulation, blood circulation, respiratory function, and immune response. In addition, such conditions strengthen the body's adaptive mechanisms and create a favorable biophysical and biochemical background that supports therapeutic processes.

Natural climatic environments also improve the general condition of patients by reducing psychological stress and nervous system tension, accelerating rehabilitation processes, and increasing the preventive effectiveness of spa and resort-based treatments.

Climatotherapy is defined as a systematic therapeutic approach that utilizes natural climatic factors—such as solar radiation, air, water, atmospheric pressure, humidity, and related environmental parameters—for the improvement of human health, treatment of diseases, and prevention of pathological conditions (2).

This approach is based on medical climatology and investigates the complex effects of multiple environmental factors on the human organism, including:

- ✓ air temperature
- ✓ air humidity
- ✓ atmospheric pressure
- ✓ solar radiation
- ✓ precipitation patterns
- ✓ wind characteristics and air composition

A key aspect of climatotherapy is that it does not rely on a single isolated factor; instead, it emphasizes the therapeutic role of the entire climatic environment as an integrated bioclimatic system.

Climatotherapy enables the restoration of physiological functions and supports disease treatment through the controlled application of climatic factors such as heliotherapy, aerotherapy, thalassotherapy, and others. Depending on the dominant influencing factor, climatotherapy is classified into several types.

1. Aerotherapy

Aerotherapy (from Greek aer — air, therapeia — treatment) is a method of climatotherapy aimed at treatment, rehabilitation, and prevention of diseases through the controlled exposure of the human body to natural or artificially created environments of clean air.

It is one of the key branches of clinical physiology and medical climatology, based on the activation of the body's adaptive responses to environmental conditions.

2. Heliotherapy

Heliotherapy (from Greek helios — sun, therapeia — treatment) is a climatotherapy method based on the controlled exposure of the human body to natural solar radiation, including ultraviolet, infrared, and visible light spectra, for therapeutic, preventive, and rehabilitative purposes.

It represents an important field of medical climatology and physiotherapy and is based on the biological effects of solar radiation on human physiological processes.

3. Thalassotherapy

Thalassotherapy (from Greek thalassa — sea, therapeia — treatment) is a climatotherapy method that involves the combined and controlled therapeutic use of marine environmental factors, including seawater, sea air, saline aerosols, marine mud (peloids), water temperature, and hydrostatic pressure.

It is a branch of medical climatology and physiotherapy based on the biophysical and biochemical resources of the marine environment, which collectively contribute to its therapeutic effects.

4. Mountain Climatotherapy

Mountain climatotherapy is a method of treatment, prevention, and rehabilitation based on the controlled application of natural climatic factors of high-altitude regions on the human body. These factors include low atmospheric pressure, a low-oxygen environment (hypoxia), high levels of ultraviolet radiation, clean and ionized air, low temperatures, and reduced humidity.

This approach represents an important branch of medical climatology and physiotherapy, primarily focused on activating the body's hypoxic adaptive responses.

The use of natural climatic conditions as a form of climatotherapy is widely developed in many countries around the world. This field plays a significant role, particularly in sanatorium and resort medicine, as well as in rehabilitation and preventive healthcare systems. Below, countries with advanced experience in this area are analyzed from a scientific and practical perspective[2] (Table 8).

Table 8

Countries that widely utilize natural climatic conditions (climatotherapy)

No.	Country	Famous Resorts	Main Climate Type	Primary Type of Climatotherapy	Application Area	Therapeutic Effects
1.	Switzerland	Davos, Schatzalp	Mountain climate	Aerotherapy, high-altitude therapy	Tuberculosis, asthma	Reduced atmospheric pressure enhances hemoglobin production
2.	Germany	Baden-Baden, Black Forest resorts	Forest and maritime	Aerotherapy, landscape therapy	Nervous and cardiovascular diseases	Phytoncides and humid air effects
3.	Russia	Sochi, Lake Baskunchak	Maritime and continental	Thalassotherapy, peloid therapy	Respiratory and joint diseases	Sea air and mineral-rich mud therapy
4	Italy	Rimini, Alpine resorts	Maritime and mountain	Thalassotherapy, heliotherapy	Skin diseases, stress	Humid air and solar radiation effects
5	France	Nice, Biarritz	Oceanic climate	Thalassotherapy	Allergies, pediatric conditions	Iodine-rich marine air
6	Israel	Dead Sea, Ein Bokek	Subtropical desert	Heliotherapy, aerotherapy, thalassotherapy	Psoriasis, asthma	Filtered UV radiation, oxygen-rich air
7	Japan	Fuji region, forest zones	Humid monsoon	Landscape therapy	Stress, hypertension	Forest bathing improves health outcomes
8	Uzbekistan	Zomin, Chimgan	Continental climate	Aerotherapy, heliotherapy	Rehabilitation	High insolation and dry air
9	Jordan	Dead Sea Spa Resort, Mövenpick	Desert and marine	Complex climatotherapy	Skin and rheumatic diseases	Mineral-rich environmental conditions

[2] https://zenodo.org/records/18314501

		Resort				

Note: The table was compiled by the author based on data from studies published in international scientific databases such as PubMed (https://pubmed.ncbi.nlm.nih.gov), the World Health Organization (https://www.who.int), Springer Link (https://link.springer.com), and JAMA Network (https://jamanetwork.com).

Countries that widely utilize natural climatic conditions as a form of climatotherapy generally share several common characteristics:

- ❖ The presence of favorable climatic zones
- ❖ A well-developed sanatorium and resort healthcare system
- ❖ A scientifically based medical approach
- ❖ A clean and environmentally sustainable natural environment

Therefore, in these countries, climatotherapy is widely applied on a global scale as an effective, safe, and natural method of treatment.

RESEARCH MATERIALS AND METHODS

This study is theoretical and analytical in nature, and it employs a systematic literature review approach. During the research process, international scientific sources were examined, including articles published in the PubMed, Scopus, and Web of Science databases.

The following methods were used:

- Content analysis (analysis of scientific literature)
- Comparative analysis (comparison of different climatic zones)
- System approach (assessment of the complex effects of microclimatic factors)

Within the scope of the study, the effects of microclimate on the human body were examined from the perspective of homeostasis and adaptation processes.

RESEARCH RESULTS AND DISCUSSION

Systematic theoretical analyses revealed that the effects of natural microclimatic conditions on the human body are manifested through several key geoecological factors. These factors are directly associated with the functional characteristics of the landscape–climate system formed within the framework of physical geography.

The study results demonstrated the following:

Thermal factors (temperature regime) regulate the body's heat exchange processes and activate the thermoregulation system.

Hygrometric factors (humidity level) significantly influence the functional state of the mucous membranes of the respiratory tract.

Radiation factors (solar radiation) activate vitamin D synthesis through ultraviolet radiation and strengthen the immune system.

Aeroionic environment stabilizes nervous system activity and reduces stress levels through the process of aeroionization.

Furthermore, differences in microclimatic conditions across various landscape types were identified:

Mountain regions enhance cardiovascular adaptation through low atmospheric pressure and hypoxic conditions.

Forest zones provide biological air purification through phytoncides.

Water bodies' surroundings create a favorable environment for the respiratory system due to high humidity and ionized air.

CONCLUSIONS

This study demonstrates that natural climatic conditions and microclimate systems represent an integrated geoecological factor influencing human health through complex interactions between atmospheric, hydrological, and terrestrial components within табиий география systems. Microclimatic variability is primarily governed by landscape structure, relief configuration, surface cover, and local atmospheric dynamics, forming a functional landscape–climate interface that directly affects human physiological responses.

The findings confirm that microclimatic environments induce measurable adaptive physiological mechanisms in the human organism, mediated through гомеостаз regulation and адаптация processes. Mountain, forest, and aquatic landscapes exhibit distinct bioclimatic effects, including hypoxic training responses, bioactive air enrichment via фитонцидлар, and enhanced aeroionic conditions, all of which contribute to improved cardiopulmonary efficiency, immune modulation, and neurophysiological stabilization.

From a geoecological perspective, anthropogenic transformation of natural landscapes is altering microclimatic equilibrium, particularly in urban environments where the urban heat island effect intensifies thermal stress and disrupts natural climatic regulation. This highlights the necessity of integrating microclimate-oriented planning strategies within экологик дизайн and sustainable urban development frameworks.

Overall, microclimate-based natural therapeutic resources constitute a scientifically grounded, non-invasive, and ecologically sustainable approach to health promotion. Their effective application requires an interdisciplinary integration of physical geography, environmental medicine, and climatotherapeutic practices, ensuring evidence-based utilization of natural climatic potential in both preventive and rehabilitative healthcare systems.

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