BG Pulse Journal USA
ISSN:1947-2536 http://www.bgpulseusa.com/index.php/bg
BG PULSE JOURNAL

HYGIENIC ASSESSMENT OF INDOOR MICROCLIMATE INDICATORS

Azimjonova Zuhraxon
Ismoilov Dilmurod Tavakkalovich
Fergana Medical Institute of Public Health
Fergana, Uzbekistan
doi:https://doi.org/10.5281/zenodo.23527716

Abstract: Indoor microclimate is a critical environmental determinant influencing human health, thermal comfort, productivity, and physiological adaptation. This article analyzes the hygienic significance of air temperature, relative humidity, air velocity, and thermal radiation in residential, educational, healthcare, and occupational settings. A theoretical and analytical review was conducted using environmental health principles and hygienic assessment approaches. The findings indicate that deviations from optimal microclimatic conditions may adversely affect thermoregulation, cognitive performance, respiratory health, and occupational efficiency. Comprehensive monitoring and regulation of indoor environmental parameters are essential for ensuring safe and comfortable living and working conditions.

Keywords: indoor microclimate, hygienic assessment, thermal comfort, relative humidity, air velocity, thermoregulation, public health.

Introduction

A significant portion of human life is spent in residential spaces, educational institutions, hospitals, and workplaces. Consequently, the indoor air environment directly or indirectly influences health, mood, sleep quality, concentration, and work capacity. The "indoor microclimate" refers to the combination of physical factors within an enclosed space—such as air temperature, relative humidity, air velocity, and thermal radiation. The interplay of these factors plays a crucial role in maintaining the human body's thermal balance.

A change in one microclimatic parameter can alter the impact of others. For instance, when high temperature and high humidity occur together, the evaporation of sweat slows down, making it difficult for the body to cool itself. Conversely, a cold room combined with strong airflow can accelerate heat loss. Therefore, evaluating an indoor microclimate based solely on a thermometer reading is insufficient; other parameters must also be assessed in conjunction.

The purpose of this article is to describe the key indicators of an indoor microclimate, explain the principles for their measurement and hygienic assessment, and summarize preventive recommendations aimed at ensuring a comfortable and safe indoor environment.

In the fields of hygiene and occupational health, the indoor microclimate is studied as a significant factor affecting human thermal comfort and well-being. Thermal comfort depends not only on room temperature but also on humidity, air movement, the temperature of surrounding surfaces, clothing, and physical activity. The same temperature can be perceived differently by an individual depending on the circumstances.

Thermoregulation is a set of physiological mechanisms that serve to maintain a relatively stable internal body temperature. In warm conditions, blood vessels in the skin dilate, and sweating increases; the evaporation of sweat facilitates the release of heat from the body. In cold conditions, blood vessels in the skin constrict, reducing heat loss; in cases of intense cold, muscle shivering can increase heat production. These adaptive mechanisms may prove insufficient when exposed to an uncomfortable microclimate for an extended period.

International guidelines recommend that, when assessing an indoor environment, factors such as relative humidity, air movement, and thermal radiation should be considered alongside air temperature. In this context, the function of the room, the number of occupants, the type of activity, clothing, the season, and the performance of the ventilation system are all important considerations. It is not appropriate to apply the same universal standards to all types of buildings. The results must be compared with the relevant applicable sanitary standards.

Materials and Methods

Air temperature represents the thermal state of the air in a room and is typically determined using a thermometer or an electronic temperature gauge. Temperature plays a significant role in human thermal sensation and heat exchange. Excessively high temperatures can lead to sweating, thirst, weakness, dizziness, and reduced concentration. Conversely, very low temperatures may cause a feeling of cold, discomfort, and, under certain conditions, a decline in work capacity. When assessing these factors, the purpose of the room, the season, and the type of activity are taken into account.

Relative humidity expresses the amount of water vapor present in the air as a percentage of the maximum amount that the air could hold at that specific temperature. High humidity can hinder the evaporation of sweat, especially when temperatures are also high. Very dry air, on the other hand, can cause dryness or discomfort in the mucous membranes of the eyes, nose, and throat. Relative humidity is measured using a hygrometer or a psychrometer.

Air velocity refers to the speed at which air moves within a room. Air movement influences heat exchange: in warm conditions, a moderate airflow can facilitate cooling, while in cold conditions, it may increase heat loss from the body. Air velocity is measured using an anemometer. During measurement, the positioning of the instrument, the status of doors and windows, and the operation of the ventilation system must be recorded.

Thermal radiation describes heat exchange occurring via radiation between the human body and surrounding surfaces, such as walls, windows, heating units, or other hot or cold objects. Even if the ambient air temperature in a room is within an acceptable range, thermal discomfort can still arise near a cold window or a heated piece of equipment. Specialized measurement methods, appropriate for the specific situation, are used to assess thermal radiation and the mean radiant temperature.

When evaluating the microclimate, factors such as temperature variations across different heights and locations within the room, the operation of heating and cooling equipment, exposure to sunlight, and the positioning of people are all taken into account. Taking measurements at only a single point may not accurately reflect the conditions throughout the entire room.

This article was prepared based on a theoretical analysis of scientific and methodological sources concerning indoor microclimate, thermal comfort, and hygienic control. The primary approaches employed include the classification of microclimate parameters, a synthesis of their physiological significance, a description of measurement methods, and an examination of the importance of preventive measures. This article does not claim to present original laboratory or field measurements.

In practical hygienic assessment, the following factors are primarily recorded: the type of room, its intended use, the number of occupants, the nature of activities performed, the season, and the status of heating and ventilation systems. Temperature is measured using a thermometer, relative humidity via a hygrometer or psychrometer, and air velocity using an anemometer. Where necessary, thermal radiation and mean radiant temperature are determined using specialized instruments.

Measurements must be conducted at several points representative of the indoor environment and at appropriate heights, in accordance with established methodological requirements. The operational status and calibration of the instruments, the timing of measurements, the condition of windows and doors, and the performance of the ventilation system all influence the reliability of the results. The obtained values are compared against current sanitary standards applicable to the specific function of the room; if necessary, repeat measurements are performed.

Results

In the first stage of the hygienic assessment, the room and the conditions under which it is used are examined. Factors such as the number of occupants, the nature of activities performed, the presence of natural or mechanical ventilation, the operation of heating and cooling equipment, and the extent of sunlight exposure throughout the day are recorded. This information facilitates the accurate interpretation of measurement results.

In the second stage, microclimate parameters are measured using appropriate instruments. Measurements are not limited to the center of the room; they may also encompass specific work or rest areas, as well as zones potentially prone to discomfort. Since temperature and humidity fluctuate throughout the day, measurements may be repeated at different times as necessary. The results are documented along with the date, time, room type, and details regarding the instruments used.

In the third stage, the recorded parameters are compared against current sanitary standards. These standards may vary depending on the room's function, the season, the physical exertion required by the activity, and other conditions. Therefore, rather than applying a universal figure to all rooms and situations, it is essential to consult the specific provisions within the relevant regulatory documents that pertain to the particular type of room in question.

In the fourth stage, the potential causes of an unfavorable microclimate are identified. A drop in temperature may be linked to a malfunction in the heating system, cold external air, or the infiltration of cold air through windows and doors. A rise in temperature can be caused by a high number of occupants, sunlight, operating equipment, or inadequate ventilation. Changes in humidity and air movement are also examined in relation to ventilation and sources of moisture.

In the fifth stage, corrective measures are determined, and their effectiveness is subsequently measured. Such measures may include adjusting the heating or cooling system, improving ventilation efficiency, properly directing airflow, employing sun-protection measures, and ensuring the number of people in the room aligns with standard capacity limits.

Discussion

Theoretical analysis indicates the necessity for a comprehensive assessment of the indoor microclimate. Air temperature, relative humidity, air velocity, and thermal radiation are interrelated factors that collectively determine human thermal comfort. Measuring temperature alone is insufficient for a complete evaluation of indoor conditions.

A second important aspect is that microclimate requirements depend on the function of the space. The requirements for a residential area, a classroom, a hospital ward, and a workplace involving physical labor may differ. Therefore, when interpreting measurement results, one must take into account applicable sanitary standards, the season, and the type of activity.

A third aspect concerns the proper organization of measurements. Ensuring that instruments are calibrated correctly, and accurately documenting the locations, timing, and conditions of measurements, enhances the reliability of the assessment. Regular monitoring helps identify changes that occur within a space throughout the day or across different seasons. As this article is

theoretical and analytical in nature, its conclusions should not be interpreted as the results of new experimental research.

Heating, cooling, and ventilation systems in rooms must be maintained in good technical working order. The ventilation regime should be appropriate for the room's function, the number of occupants, and external conditions. When ventilating by opening windows, factors such as outdoor air quality, noise levels, temperature, and safety must be taken into account.

It is recommended to periodically measure microclimate parameters according to a schedule, record the results, and address the underlying causes whenever deviations from established standards are identified. If temperatures become excessively high, measures such as providing protection from direct sunlight, managing equipment that generates excess heat, and improving air exchange can be implemented. In cold conditions, the heating system should be checked, and the airtightness of windows and doors should be verified.

In cases of high humidity, any water leaks must be repaired, damp areas dried, and adequate air exchange ensured. If the air is too dry, measures to regulate humidity should be selected in accordance with sanitary requirements. If humidifiers are used, it is essential to clean them regularly and replace the water.

In educational institutions and hospitals, special attention must be paid to ensuring a comfortable microclimate for children, the elderly, patients, and individuals who are particularly sensitive to heat. If discomfort, excessive heat, or cold is experienced in a room, it is advisable—rather than relying solely on subjective perception—to take measurements using instruments and notify the relevant personnel.

REFERENCES

1. Fotimaxon, O., & Tavakkalovich, I. D. (2026). MODERN METHODS AND TECHNOLOGIES FOR IMPROVING THE QUALITY OF DRINKING WATER. BG pulse journal, 2(10), 807-811.
2. Ro'zixon, A., & Tavakkalovich, I. D. (2026). MEDICAL, PSYCHOLOGICAL AND HYGIENIC SIGNIFICANCE OF ARTIFICIAL LIGHTING IN HOSPITAL ROOMS. BG pulse journal, 2(10), 801-806.
3. Tavakkalovich, I. D. (2026). HYGIENIC ASSESSMENT OF ORGANOLEPTIC AND PHYSICAL PROPERTIES OF DRINKING WATER. BG pulse journal, 2(10), 835-838.
4. Tavakkalovich, I. D. (2026). FOODBORNE ILLNESSES AND THEIR PREVENTION. BG pulse journal, 2(10), 844-847.
5. Ismoilov, D., & Abdullajonova, R. (2026). HYGIENIC ASSESSMENT OF THE CHEMICAL COMPOSITION OF WATER. BG pulse journal, 2(10), 557-561.
6. Oltinboy, S., & Tavakkalovich, I. D. (2026). COLLECTION OF WATER SAMPLES FOR LABORATORY TESTING. BG pulse journal, 2(10), 659-663.
7. Tavakkalovich, I. D. (2026). THE WIND ROSE AND ITS HYGIENIC SIGNIFICANCE. BG pulse journal, 2(10), 606-610.
8. Zilolaxon, R., & Tavakkalovich, I. D. (2026). HYGIENIC ASSESSMENT OF THE COMPLEX EFFECT OF METEOROLOGICAL FACTORS ON THE HUMAN BODY. BG pulse journal, 2(10), 544-549.
9. Abdusattorova, B., & Tavakkalovich, I. D. (2026). THE SIGNIFICANCE OF SANITARY INSPECTION AND THE DESCRIPTIVE METHOD IN HYGIENIC RESEARCH. BG pulse journal, 2(10), 670-675.

10. Tolibjon o‘g‘li, M. O., & Tavakkalovich, I. D. (2026). HYGIENIC ASSESSMENT OF INDOOR MICROCLIMATE PARAMETERS. BG pulse journal, 2(10), 642-645.