

Indoor Air Quality and its Effect on Students' Health

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Abstract:

Indoor air quality in educational institutions is one of the major hygienic factors influencing students' health, mental performance, and learning efficiency. Poor ventilation, excessive dust accumulation, increased humidity, microbial contamination, and elevated carbon dioxide concentration negatively affect the respiratory, cardiovascular, and nervous systems of students. This article evaluates the hygienic significance of indoor air quality in educational environments and analyzes its impact on students' health status. The study involved the assessment of microclimate indicators, air cleanliness, and health complaints among students. The obtained results demonstrated that unsatisfactory indoor air quality contributes to increased fatigue, headaches, respiratory discomfort, and reduced academic performance. Improvement of ventilation systems, regular hygienic monitoring, and preventive measures are essential for maintaining healthy educational environments.

Keywords: Indoor Air Quality, Students' Health, Hygiene, Ventilation, Microclimate, Educational Institutions, Environmental Factors

Introduction

Environmental hygiene is an important branch of preventive medicine aimed at studying the influence of environmental factors on human health. In recent years, the problem of indoor air pollution in educational institutions has become increasingly significant due to urbanization, population density, and insufficient sanitary conditions in buildings [1][2]. Students spend a considerable amount of time inside classrooms; therefore, indoor environmental conditions directly affect their physical and mental well-being. Indoor air may contain various pollutants, including dust particles, microorganisms, carbon dioxide, volatile organic compounds, and allergens [3]. Poor air circulation and inadequate ventilation lead to the accumulation of harmful substances, resulting in decreased oxygen concentration and deterioration of microclimatic conditions. These factors can

provoke respiratory diseases, allergic reactions, fatigue, reduced concentration, and decreased educational productivity [4]. The relevance of this topic is associated with the growing need to create safe educational environments and protect students' health through hygienic control and preventive interventions. The aim of this study was to evaluate indoor air quality in educational institutions and determine its effect on students' health [5].

Materials and Methods

The study was conducted in several educational institutions. Hygienic assessment of indoor air quality included the evaluation of temperature, relative humidity, air movement, ventilation conditions, dust concentration, and carbon dioxide levels in classrooms. A total of 120 students aged 18–22 years participated in the investigation. Data collection included hygienic observations, environmental measurements, and questionnaire surveys regarding students' health complaints and subjective perceptions of classroom conditions. Temperature and humidity were measured using standard hygrometric equipment. Dust concentration was evaluated by gravimetric methods, while carbon dioxide levels were assessed using portable gas analyzers. The obtained results were compared with accepted hygienic standards. Statistical analysis was performed using descriptive analytical methods. Mean values and percentage indicators were calculated to determine the relationship between indoor environmental conditions and students' health complaints.

Results

The investigation revealed that several classrooms demonstrated unsatisfactory hygienic conditions. In some educational rooms, carbon dioxide concentration exceeded recommended hygienic limits due to insufficient ventilation and overcrowding [6]. The average classroom temperature ranged from 24°C to 28°C, while relative humidity varied between 68% and 75%, indicating disturbances in optimal microclimatic parameters. Increased dust accumulation was identified in poorly ventilated classrooms [7][8]. Among the surveyed students, 62% reported frequent headaches and fatigue during classes. Approximately 48% complained of respiratory discomfort, nasal irritation, and dry throat sensations. Reduced concentration and decreased working capacity were observed in students exposed to poor indoor environmental conditions for prolonged periods [9]. Students studying in classrooms with proper ventilation and regular sanitary maintenance demonstrated better subjective health indicators and improved comfort levels. The obtained results indicate a direct relationship between indoor air quality and students' functional health status [10].

Discussion

Indoor air quality represents an important hygienic determinant affecting educational efficiency and general health. The findings of this study confirm that inadequate ventilation and poor sanitary conditions contribute to unfavorable microclimatic changes and accumulation of harmful pollutants inside classrooms [11][12]. Elevated carbon dioxide concentration is associated with decreased cognitive performance and increased fatigue among students. Excessive humidity and dust accumulation create favorable conditions for microbial growth and respiratory irritation. Similar findings have been reported in international environmental hygiene studies emphasizing the necessity of proper indoor environmental management [13][14]. Improving classroom ventilation, ensuring regular sanitary cleaning, and maintaining optimal microclimatic parameters are essential preventive strategies. Educational institutions should implement periodic hygienic monitoring

programs to reduce health risks among students. The study also highlights the importance of environmental hygiene education and awareness among students and educational staff [15-17].

Conclusion

Indoor air quality significantly affects students' health, well-being, and educational performance. Poor ventilation, elevated humidity, excessive dust concentration, and increased carbon dioxide levels contribute to headaches, respiratory discomfort, fatigue, and reduced concentration among students.

Regular hygienic assessment of educational environments, improvement of ventilation systems, and implementation of preventive sanitary measures are necessary to ensure safe and healthy indoor conditions.

Creating favorable indoor environmental conditions in educational institutions is an important component of public health protection and disease prevention.

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