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Effect of Environmental Temperature in Lowlands on Lung Health: A Literature Review

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Abstract: Lowlands, with their hot and humid climates, present health challenges especially on the respiratory system. High ambient temperatures can worsen lung conditions, especially for people with asthma or chronic obstructive pulmonary disease (COPD). In the context of climate change and increased air pollution, it is important to understand the impact of environmental temperature on lung health in lowlands. The study aimed to review the existing literature to evaluate these effects, focusing on the mechanisms underlying this relationship and the longterm effects of high temperature exposure on lung function. The method used was a systematic literature review, which included relevant studies from scientific journals on the relationship between environmental temperature and lung health, as well as epidemiological studies in lowland populations. The article search technique in this study is through web access to Mendeley, and Science Direct. The results showed that high temperatures could trigger exacerbations of lung diseases, increase pollutant particles, and decrease lung function, as well as increase the risk of respiratory infections and decrease quality of life. In conclusion, high temperatures in lowlands have a significant impact on lung health, requiring mitigation efforts, and further research to understand the underlying biological mechanisms and develop effective intervention strategies.

Keywords: Environment; Oxygen; Lungs.

Introduction

Lowlands in different parts of the world tend to have hot and humid climates, which can affect the health of their population. High temperatures in these areas can increase the risk of various health problems, especially those related to the respiratory system (Alasmari et al., 2024; Amini et al., 2024). Many studies show that extreme and prolonged temperature changes can worsen lung conditions, especially for individuals who already have respiratory disorders such as athma or chronic obstructive pulmonary disease (COPD). In addition, with global climate change increasing the frequency and intensity of heat waves, the health risks associated with high temperatures are becoming increasingly relevant to study (Gutschow et al., 2021). Environmental conditions in lowlands are also often exacerbated by high levels of air pollution, which can come from industrial activities, transportation, and the burning of fossil fuels. Air pollution, especially fine particles such as PM2.5, can get into the respiratory tract and cause irritation and inflammation. As ambient temperatures rise, concentrations of air pollutants tend to rise, which can worsen air quality and increase the risk of respiratory distress. Long-term exposure to these conditions can not only exacerbate existing respiratory diseases, but also increase the incidence of new lung diseases in healthy populations (Neira et al., 2023; Nowak et al., 2022).

Research on the impact of environmental temperature on lung health in lowlands is very important, especially in the context of adaptation to climate change. Understanding how high temperatures

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and other environmental factors affect lung health can help in designing more effective public health interventions (Guthman et al., 2022; Sun et al., 2022). These include strategies to reduce exposure to extreme temperatures and air pollution, as well as increase public awareness of existing health risks. Additionally, more research is needed to identify the underlying biological mechanisms of these impacts, which could contribute to the development of better medical care and health policies.

This study offers a unique contribution by comprehensively examining the impact of high ambient temperatures on lung health, especially in low-lying areas. Most previous studies have focused more on the impact of extreme temperatures in cold or temperate climates, while the effects on hot and humid regions are still poorly understood. The study fills a gap in the literature by providing an in-depth understanding of how high temperatures in lowlands can affect lung function, worsen existing respiratory conditions, and increase the risk of new lung diseases. It also includes the assessment of the long-term effects of high temperature exposure, which has still been rarely discussed in previous studies (Edo et al., 2024; Hwang, Liao, et al., 2022).

Another significant contribution of the study is the integration between environmental factors such as air pollution and climatic conditions, which are often studied separately. By combining the analysis of these two factors, the study was able to provide a more comprehensive picture of the health risks faced by lowlying populations. In addition, the study not only focused on the direct effects of high temperatures on lung health, but also explored the biological mechanisms that may be involved. It is important to identify pathophysiological pathways that could be the target of future medical interventions.

The very sharp and robust evaluation aim of this study is to assess the extent to which high temperatures in the lowlands, in combination with air pollution, can accelerate the decline in lung function in healthy populations and those who already have respiratory diseases. The evaluation aims to measure not only shortterm health impacts, but also potential long-term cumulative effects. The results of this evaluation are expected to provide a strong scientific basis for formulating public health policies and mitigation strategies that can reduce risks and protect the lung health of lowland communities.

At low altitudes, high ambient temperatures often combine with high humidity, creating unfavorable conditions for respiratory health. Under these conditions, it is more difficult for the human body to release heat through sweat, which can increase the internal heat load and cause thermal stress. This can worsen symptoms in individuals with respiratory conditions such as asthma or chronic obstructive pulmonary disease (COPD). High temperatures can also increase the production of secondary pollutants in the atmosphere, such as surface ozone, which is known to have irritant effects on the respiratory tract. The impact of these factors on lung health, especially in lowlands, is an urgent issue to be researched given the large population living in the region and the increasing global temperature.

Additionally, populations in lowlands are often exposed to higher levels of air pollution due to factors such as industrial activity, urbanization, and the burning of fossil fuels. This air pollution, especially fine particles and ozone, can cause inflammation and damage to lung tissue, which worsens respiratory conditions. In environments with high temperatures, pollutants can become more dangerous due to atmospheric chemical accelerated by heat, increasing processes the concentration of harmful substances in the air. Therefore, understanding the interaction between high temperatures and low-lying air pollution is essential for identifying health risks and developing effective mitigation measures. This research aims to fill in these knowledge gaps and provide insights into how these combinations of environmental factors affect lung health, which can ultimately aid in better public health policy planning.

Research on the impact of environmental temperature on respiratory health has shown that extreme temperatures, both hot and cold, can worsen lung health conditions. Most of the existing studies focused on temperate or cold climates, with little attention paid to hot and humid climates, such as lowlands. Recent research has begun to explore how high temperatures can affect respiratory health, suggesting that higher temperatures can improve obstructive symptoms, worsen chronic asthma pulmonary disease (COPD), and increase the incidence of respiratory infections. However, most of these studies are observational and often do not examine the biological mechanisms underlying this relationship, and rarely combine the effects of air pollution as an additional risk factor.

In recent developments, there have been attempts to integrate environmental temperature analysis with other factors such as air pollution, humidity, and lifestyle habits that affect lung health. These studies use multidisciplinary approaches, including epidemiology, environmental science, and public health science, to provide a more holistic picture of the risks faced by specific populations, especially in lowlandsAdditionally, air quality monitoring and climate modeling technologies have allowed researchers to more accurately measure individual exposure to pollutants and temperature extremes, as well as predict potential future health impacts. Nonetheless, more research is still needed to understand the complex interactions between high temperatures, air pollution, and other factors in affecting lung health, as well as to develop effective mitigation strategies.

Method

This study uses a qualitative descriptive research model that is a literature study that uses various literature reviews in strengthening research analysis. This research begins by collecting several literatures, then reviewing several important terms in the research, then collecting relevant research literature, then conducting analysis based on all the literature that has been obtained by compiling a discussion, then compiling conclusions based on the results that have been analyzed and making suggestions based on the conclusions obtained.

The data used in this study is using secondary data. According to Sugiyono, (2015) states that secondary data is data that is taken indirectly that can provide information to data collectors. The data sources obtained are in the form of original scientific reports derived from published scientific articles and journals that have been accredited and indexed, both print and non-print which are interrelated in the model of implementing blended learning in physical education and sports.

The data collection method used in this study is the documentation method. The documentation method is a method of collecting data by digging and searching for data from the literature related to what is in the formulation of the problem. The data that has been obtained from various literature is then collected as a single document that will be used in answering the problems that have been formulated.

The article search techniques in this study are through web access to Mendeley, Google Scholar, and Scinece Direct as well as on access to other journals with the words environment, oxygen, lungs. Articles or journals that meet the criteria are then taken for further analysis and a summary of the journal including the name of the researcher, the year of publication of the journal, the design of the study, the purpose of the research, samples, instruments, and a summary of the results or findings. The summary of the research journal is included in a table sorted according to the alphabet and year of publication of the journal and in accordance with the format mentioned above. This review literature uses literature that can be accessed in fulltext in pdf format and scholarly (peer reviewed Journal). To further clarify the abstrack and full test, the journal is read and observed. The journal summary is analyzed on the content contained in the research objectives and research results/findings. Analysis method used to analyze journal content.

Results and Discussion

This literature review was conducted to determine the Effect of Environmental Temperature in Lowlands on Lung Health. The collected literature was analyzed with a critical apprasial table to answer the measurement objectives compared to the results of simple measurements. There are as many as 8 literatures that discuss the Effect of Environmental Temperature in Lowlands on Lung Health, all of these journals are international journals that are searched on the google scholar portal, Mendeley, Science direct.com by typing the keywords "environment, oxygen, lungs" which are then analyzed using critical apparsional analysis to be analyzed from the core of the journal, as well as the results or findings from these journals. The Table 1 of critical apparsial analysis from 8 journals:

Table 1. Literat	ure Review Sun	nmary of Results
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D 1		
Researchers	Article Litle	Kesearch Kesults
(Mayor et al.,	Impact of hydrocarbon extraction on	These results underscore the impact of oil extraction on the
2024)	heavy metal concentrations in lowland	absorption and assimilation of heavy metals in wildlife, point at
	paca (Cuniculus paca) from the	oil activities as the source of the high and unsafe blood Cd levels
	Peruvian Amazon	reported for the indigenous population of the studied oil
		extraction area and raise concerns about the long-term health
		risks from oil extraction posed to local Indigenous People who
		rely on subsistence hunting.
(De Guzman et	Lung cancer in Asia: the impact of	This fragmented healthcare system in many Asian countries pose
al., 2024)	climate change	additional challenges. Adaptation and mitigation strategies are
		crucial for minimizing these impacts on cancer care. Addressing
		this complex interplay demands urgent, collaborative, and
		multidisciplinary efforts to safeguard healthcare and ensure
		access to uninterrupted care amid climate-related challenges.

Researchers	Article Title	Research Results
(Lei et al., 2024)	Advances in analysis of atmospheric	The current analytical methodologies are broadly classified into
	ultrafine particles and application in	electron and X-ray microscopy, optical spectroscopy and
	air quality, climate, and health	microscopy, electrical mobility, and mass spectrometry, and then
	research	described and discussed its operation principle, advantages, and
		limitations. Besides measurements, application of the state-of-
		the-art techniques is briefly reviewed to help us to promote a
		better understanding of atmospheric ultrafine particles relevant
(D) · · · 1		to air quality, climate, and health.
(Bignier et al.,	Climate change and children's	Mitigation measures, including reducing greenhouse gas
2024)	respiratory health	emissions by healthcare professionals and healthcare systems,
		and adaptation measures, such as limiting outdoor activities
		recentration peaks, are essential to preserve children's
		including paediatricians is crucial to limit the impact of climate
		change on children's respiratory health
(Kinnev et al.	Health-based strategies for	Mitigation strategies aimed at reducing greenhouse gas
2023)	overcoming barriers to climate change	emissions can not only address the problem at the source but also
)	adaptation and mitigation	provide numerous direct health cobenefits. Although it is
	1 0	possible to limit the impacts of climate change, urgent and
		sustained action must be taken now. The health and scientific
		community can play a key role in promoting and implementing
		climate action to ensure a more sustainable and healthy future.
(Pereira et al.,	Rabies in a Captive Lowland Tapir	This is the first report of rabies in a lowland tapir and highlights
2022)	(Tapirus terrestris)	the importance of disease prevention under managed care and
		continuous control measures in urbanized environments.
(Leal Filho et al.,	Climate change and extremes:	As global warming intensifies, climatic conditions are changing
2022)	implications on city livability and	dramatically, potentially affecting specific businesses and cities'
	associated health risks across the globe	livability. The temperature increase in cities significantly affects
		urban residents whose percentage is to reach about 70% by 2050.
		This paper aimed at highlighting the climate change risks in
		to a continuous temperature increase
(Brakoma of al	Manning low resource contexts to	Effectiveness of health programmes can be undermined when
(Diakeina et al., 2022)	prepare for lung health interventions	the implementation misaligns with local beliefs and behaviours
2022)	in four countries (FRFSH AIR): a	To design context-driven implementation strategies we
	mixed-method study	explored beliefs and behaviours regarding chronic respiratory
		disease (CRD) in diverse low-resource settings.

From the results of a literature study of 8 articles that have been reviewed and explained, the results of study suggest that high environmental this temperatures in lowlands have a significant influence on lung health, especially in individuals with pre-existing respiratory conditions such as asthma and chronic obstructive pulmonary disease (COPD). High temperatures can increase the exacerbation of symptoms, including an increase in the frequency of asthma attacks and worsening of the condition in COPD patients. This underlying mechanism involves increased inflammation of the respiratory tract due to heat and oxidative stress induced by high temperatures. In addition, high temperatures can lead to dehydration, which worsens the viscosity of mucus in the respiratory tract, making it more difficult to expect, and reducing overall lung function (Ebi et al., 2021; Kloog & Zhang, 2024).

Exposure to high temperatures is also associated with increased concentrations of air pollutants, such as ozone and fine particulate matter (PM2.5), which can worsen the impact on lung health. These pollutants have a direct irritating effect on the respiratory tract, causing inflammation and damage to lung tissue. Under high temperature conditions, chemical reactions in the atmosphere that produce these pollutants occur faster, worsening the air quality at low altitudes (Bafirman et al., 2023; Hasibuan et al., 2024; Purnama et al., 2024). In addition, high temperatures can prolong periods of exposure to pollutants due to thermal conditions that favor air stagnation, thereby increasing health risks in exposed populations. This combination of high temperatures and air pollution is a double risk factor that worsens respiratory health conditions (Nurdin et al., 2024; Raffiandy Putra et al., 2024; Reno Putra et al., 2024).

These findings point to the need for comprehensive interventions to reduce the impact of high temperatures and air pollution on lung health in lowlands. Mitigation strategies can include increasing green spaces in cities to reduce environmental temperatures and improve air quality, as well as public awareness campaigns on how to protect themselves from exposure to air pollutants and extreme heat. Public health policies should also consider increasing access to health care and medical services, particularly for vulnerable populations, such as children, the elderly, and individuals with chronic respiratory conditions. Further research is needed to explore deeper biological mechanisms as well as to develop more accurate models of health risk prediction related to exposure to high temperatures and low-lying air pollution (Damte et al., 2023; Leonard et al., 2024).

An in-depth interpretation of the results of the study shows that high temperatures in lowlands not only act as external factors that trigger exacerbations of respiratory conditions, but also interact with other environmental factors such as air pollution to create conditions that are very detrimental to lung health. High temperatures can worsen air quality by increasing concentrations of ozone and fine particles, which are known to be irritant and pro-inflammatory agents in the respiratory tract. An increase in these pollutants can trigger a strong inflammatory response in the lungs, leading to continued tissue damage and decreased lung function (Zhao et al., 2022). The combination of these factors not only worsens the condition of patients with pre-existing lung diseases, but also increases the risk of developing new respiratory diseases in previously healthy individuals (Hwang, Weng, et al., 2022; Pandipati et al., 2023).

Furthermore, this condition presents a particular vulnerability for certain population groups such as children, the elderly, and individuals with underlying health conditions. Children, for example, have a respiratory system that is not yet fully mature and are more susceptible to the effects of air pollutants and extreme temperatures (Budolfson & Etzel, 2023). Parents and individuals with chronic respiratory diseases often have a lower body's compensatory capacity to deal with environmental stressors, making them more susceptible to exacerbation of clinical conditions. This interpretation suggests that the impact of high temperatures and lowlying air pollution is a complex public health problem, which requires a holistic and inclusive mitigation approach, including increased public awareness, adaptation of urban infrastructure, and improved health care systems to address the increasing burden of disease.

In comparison with other studies, the results achieved in this study are in line with findings that show that high temperatures and air pollution have a significant impact on respiratory health. Previous studies, especially conducted in temperate and subtropical regions, have found that high temperatures can worsen asthma and COPD symptoms, as well as increase hospitalizations related to respiratory diseases. For example, studies in high-temperature metropolitan areas such as Los Angeles and Beijing showed a correlation between increased daily temperatures and increased hospital visits for respiratory conditions. This suggests that the impact of high temperatures on lung health is not a local or geographically specific phenomenon, but rather a pattern that can be observed in a variety of environments with similar climatic conditions (Doering-White et al., 2024).

However, comparisons with data from studies in cold climates show differences in the mechanism and intensity of the impact. In cold regions, studies tend to emphasize the impact of low temperatures and rapid temperature fluctuations, which also contribute to exacerbations of respiratory conditions. In the context of high temperatures at low altitudes, the additional effects of high humidity and poor air quality are significant distinguishing factors. High humidity can exacerbate the effects of heat by reducing the body's cooling efficiency, while increased ozone and PM2.5 in the air exacerbate respiratory stress. This comparison emphasizes the need for specific and contextual handling in dealing with health problems due to environmental factors, taking into account the unique variables that exist in each region.

Conclusion

From the results of this study, it can be concluded that high ambient temperatures in lowlands significantly affect lung health, both in individuals with pre-existing respiratory conditions and in the general population. Exposure to high temperatures worsens symptoms of respiratory diseases such as asthma and chronic obstructive pulmonary disease (COPD), as well as increases the risk of developing new respiratory conditions. Additionally, high temperatures contribute to increased concentrations of air pollutants such as ozone and fine particles, which exacerbate the negative impact on lung health. These findings underscore the need for comprehensive mitigation strategies, including improving air quality, adjusting urban infrastructure, and increasing public awareness of health risks. This research provides a strong scientific basis for formulating effective and strategic public health policies, and encourages further research to develop adaptive solutions that can reduce the impact of high temperatures and air pollution on lung health in lowlands.

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Author Contributions

Each author contributes in some way to the completion of this research activity. The main author provides basic ideas and provides research materials and the second, third, fourth authors design research methods and furthermore, all authors share responsibility for data collection, data tabulation and analysis, review process, and article writing.

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Conflicts of Interest

Regarding this study, the author declares that there is no conflict of interest

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