



Global Warming Towards Human Health: A Literature Review

Schillaci Valley Mucci¹, Bafirman¹, Hendri Neldi², Donal Syafrianto¹, Dally Rahman^{3*}, Fiky Zarya¹

¹Department of Sports Science, Universitas Negeri Padang, Indonesia

²Department of Sports Education, Universitas Negeri Padang, Indonesia

³Department of Medical Surgical Nursing and Emergency Nursing, Universitas Andalas, Indonesia

Received: August 1, 2023

Revised: October 17, 2023

Accepted: December 25, 2023

Published: December 31, 2023

Corresponding Author:

Dally Rahman

dallyrahman@nrs.unand.ac.id

DOI: [10.29303/jppipa.v9iSpecialIssue.8705](https://doi.org/10.29303/jppipa.v9iSpecialIssue.8705)

© 2023 The Authors. This open access article is distributed under a (CC-BY License)



Abstract: Global warming is a phenomenon of an increase in the average temperature of the earth's surface due to an increase in the concentration of greenhouse gases in the atmosphere, which not only affects the global ecosystem and climate, but also has a significant impact on human health. These impacts include an increase in heat-related diseases, the spread of infectious diseases, a decrease in air quality, and changes in disease patterns due to climate change. This study aims to identify and analyze the impact of global warming on human health through literature review from various sources such as journal articles, research reports, and health organization documents. The results showed that global warming increases the risk of heat stroke and dehydration, especially in vulnerable groups such as children and the elderly, as well as affecting the geographical distribution of disease vectors such as mosquitoes that can spread malaria and dengue fever. Rising temperatures also worsen air quality by increasing the concentration of surface ozone and airborne particles, which has an impact on the increase in respiratory diseases, as well as changing the seasonal and geographical patterns of diseases, including impacts on people's food security and nutrition. The conclusions of this study underscore the importance of coordinated mitigation and adaptation actions to reduce the health impacts of global warming, including policies to reduce greenhouse gas emissions, improve health systems, and educate the public on preventive measures, with the need for further research for effective and specific adaptation strategies for different affected regions and populations.

Keywords: Temperature; Pollution; Human health.

Introduction

Global warming is an environmental issue that is increasingly receiving global attention because of its wide and complex impacts. This phenomenon is characterized by an increase in the average temperature of the earth's surface, which is largely caused by human activities, such as the burning of fossil fuels and deforestation, which increase the concentration of greenhouse gases in the atmosphere (Yang et al., 2024). This increase in temperature has a variety of consequences, including melting polar ice, rising sea levels, and extreme changes in weather patterns (Zhou et al., 2024). These conditions not only affect ecosystems

and biodiversity, but also have serious implications for human well-being and health around the world (Ge et al., 2024).

The health impact of global warming is one aspect that is increasingly recognized as important. Rising global temperatures can worsen health conditions in a variety of ways. For example, more frequent and intense heat waves can lead to heat-related illnesses such as heat stroke and dehydration, especially among vulnerable populations such as children, the elderly, and those with chronic health conditions (Ayugi et al., 2023). In addition, climate change can affect the distribution and spread of infectious diseases, such as malaria and dengue fever, by changing the habitat and migration

How to Cite:

Mucci, S. V., Bafirman, Neldi, H., Syafrianto, D., Rahman, D., & Zarya, F. (2023). Global Warming Towards Human Health: A Literature Review. *Jurnal Penelitian Pendidikan IPA*, 9(SpecialIssue), 267–274. <https://doi.org/10.29303/jppipa.v9iSpecialIssue.8705>

patterns of disease vectors such as mosquitoes. Additionally, increased concentrations of surface ozone and other pollutant particles triggered by higher temperatures can worsen air quality, negatively impacting the human respiratory system (Thompson et al., 2023; Zhang et al., 2022). Therefore, understanding the impact of global warming on human health is crucial to design effective mitigation and adaptation strategies in order to protect public health.

In particular, global warming poses a serious threat to human health through increased frequency and intensity of heat waves. Extreme heat waves can result in increased cases of heat-related illnesses, such as heat stroke and dehydration, which are potentially fatal, especially in urban areas with a "heat island effect." Vulnerable groups such as children, the elderly, and individuals with certain health conditions, such as heart or lung disease, are at higher risk (T.-Y. Liu & Lin, 2023). In addition, extreme temperature changes can affect labor productivity, which has an impact on economic and social well-being. With the increasing frequency of extreme heat events, public health systems face major challenges in dealing with the increasing number of patients and providing adequate medical services.

In addition to the direct impact of rising temperatures, global warming also contributes to changes in the distribution patterns of infectious diseases. Climate change that alters rainfall, temperature, and humidity patterns can expand the habitat of disease vectors such as mosquitoes and ticks, increasing the risk of spreading diseases such as malaria, dengue fever, and Lyme disease to previously unaffected areas (Ueta et al., 2024). These changes not only affect the health of individuals, but also burden health systems with the increasing need for disease prevention, treatment, and control (Chen et al., 2023). In addition, deterioration in air quality due to increased concentrations of surface ozone and other pollutants triggered by higher temperatures can worsen respiratory health conditions, including asthma and chronic obstructive pulmonary disease (COPD). This underscores the need for a deeper understanding and focused mitigation actions to effectively deal with the health impacts of global warming.

Research on the impact of global warming on human health has grown rapidly in recent years, with a growing number of studies showing a direct link between climate change and various health problems. The research includes epidemiological analysis, climate model studies, and public health monitoring. For example, the use of climate models to predict the frequency and intensity of heat waves has helped identify associated health risks, such as increased mortality from heat (Robert et al., 2024). In addition,

epidemiological research has documented an increase in cases of heat-related diseases in various regions, as well as changes in the distribution patterns of infectious diseases caused by changes in temperature and humidity. The study also included an analysis of air quality, which showed increased levels of surface ozone and pollutant particles that worsened respiratory health conditions.

Further, there is a growing interest in research exploring the indirect impacts of global warming on health, such as declining food and water security, which could exacerbate malnutrition and water-related diseases. The study also includes studies on the effects of thermal stress on work productivity and mental health (Buguet et al., 2023; Meng et al., 2022). In addition, there are efforts to develop early warning systems and adaptation strategies that can help communities and health systems to be better prepared for these changes. However, while much progress has been made, there are still many challenges to overcome, including the need for more detailed and specific data for different regions, as well as the development of more accurate predictive models. This demonstrates the importance of ongoing research and international collaboration to understand and manage the health impacts of global warming.

This research adds to the understanding of the specific impacts of global warming on human health by focusing on the complex interaction between environmental and health factors. The novelty of this research lies in a holistic approach that combines epidemiological analysis, climate modeling, and air quality studies to provide a comprehensive picture of the health impacts of global warming. In addition, the study explores under-researched indirect effects, such as decreased food and water security, that can worsen overall health conditions. By identifying the most vulnerable population groups and the most affected geographic regions, this research makes an important contribution in supporting the development of more targeted and effective health policies (Mousavinezhad et al., 2024; Xu et al., 2023).

In addition, this study also highlights the importance of strengthening early warning systems and community preparedness in dealing with the health impacts of climate change. This contribution is crucial in the context of community adaptation to climate change, by providing data and analysis that can be used to design more efficient public health interventions. The study also provides new insights into how changing patterns of infectious diseases can affect health systems, which has important implications for health resource planning and disease control. Thus, this study makes a significant contribution in informing health policy

strategies that can help reduce the negative impacts of global warming.

The purpose of this very sharp and robust evaluation of this study is to measure the effectiveness of existing health policies and interventions in addressing the impact of global warming on human health. Through this evaluation, the study aims to identify gaps in the health system that may exist, as well as evaluate whether the adaptation strategies implemented are appropriate and adequate. The evaluation also focuses on the cost-benefit analysis of existing interventions, with the aim of optimizing the use of resources in the face of health threats from climate change. The results of this evaluation will be the basis for more appropriate policy recommendations, which are not only aimed at short-term mitigation but also for long-term adaptation in order to protect public health from the effects of global warming.

Method

In order to improve the research analysis, this study employs a qualitative descriptive research model, which is a literature study that makes use of several literature reviews. The present study commences with the gathering of multiple literatures, followed by a review of several key terms in the research, the gathering of pertinent research literature, an analysis based on the literature obtained through the compilation of a discussion, the compilation of conclusions derived from the analysis, and the formulation of recommendations based on the conclusions reached.

The data used in this study is using secondary data. According to Sugiyono, (2015) explains that secondary data is information gathered indirectly that might be useful to data collectors. The data sources used in the model of implementing blended learning in physical education and sports are actual scientific reports drawn from recognized and indexed published scientific publications and journals, both print and non-print.

The documentation approach was the technique employed in this study to collect data. The

documentation approach is a way to gather information by delving into the literature and looking for information pertaining to the issue formulation. After then, the information gathered from diverse literary works is combined into a single document, which will be utilized to address the issues raised.

In this study, the terms temperature, pollution, and human health were searched for in other publications as well as online databases such as Mendeley, Google Scholar, and Science Direct. Articles or journals that fit the requirements are then selected for additional examination and a synopsis of the journal that includes the name of the investigator, the year the journal was published, the study's design, its goal, samples, tools, and an overview of its findings. The research journal's summary is presented in a table that follows the previously described structure and is arranged alphabetically by the journal's year of publication. 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.

Result and Discussion

This literature review was conducted to find out the Impact of Global Warming on Human 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 Global Warming on Human Health, all of these journals are international journals that are searched on the google scholar portal, Mendeley, Science direct.com by typing the keyword "temperature, pollution, human health" which is then analyzed using critical apparsional analysis to be analyzed from the core of the journal, as well as the results or findings of these journals. The following is a table of critical apprasial analysis from 8 journals.

Table 1. Literature Review Summary of Results

Researchers	Article Title	Research Results
(Demir et al., 2024)	Global Warming Communicative Actions of Publics in Türkiye: Utilizing Fuzzy Rule Based System	Based on the results, it is suggested for policy makers and communication strategists to mitigate the negative outcomes of global warming by integrating environmental issues into education at all levels and collaborating with non-governmental organizations for national awareness campaigns which focus on increasing public problem recognition and involvement.
(Gora et al., 2024)	Enhancing productivity, soil health, and reducing global	The study highlights that Conservation Agriculture (CA) practices and diversified crop rotations can address issues

	warming potential through diverse conservation agriculture cropping systems in India's Western Indo-Gangetic Plains	like falling crop productivity, reduced economic returns, soil degradation, and increasing environmental impacts in northwestern India's traditional rice-wheat system. However, widespread adoption requires government policies, including C credit payments and guaranteed markets with supportive pricing.
(Ergin et al., 2021)	A mixed method study on global warming, climate change and the role of public health nurses from the perspective of nursing students	Global warming and climate change are sensitive and important issues that cannot be evaluated considering only knowledge level.
(Zgheib et al., 2023)	Global warming and human health effects of wood heating life cycle in the Grand-Est region in France	the combustion stage of pellets emits less greenhouse gases than the combustion of logs, the stage production contributes for 67% of the total impact. The packaging was the main process having the highest health and environmental impacts. At regional scale, the combustion stage mainly enhances all impacts due to the presence of old appliances with low environmental efficiency. Public policies must continue their efforts to promote the replacement of old household appliances.
(H. Liu et al., 2022)	Deaths attributable to anomalous temperature: A generalizable metric for the health impact of global warming	However, the cold-related deaths estimated from the two methods showed a weaker correlation ($R^2 = 0.07$). Our findings suggest that TA constitutes a generalizable indicator that can uniformly evaluate deaths attributable to anomalous heat in distinct geographical locations.
(Chang et al., 2024)	Changes in characteristics and risk of freshwater microplastics under global warming	The feature importance assessment of the RRF model indicated that concentration was the most influential variable in determining the change in risk values. While other microplastic characteristics had a lesser impact compared to concentration, they still influenced the risk ranking. This study highlights the role of global warming in shaping microplastic risks.
(Lemus-Canovas et al., 2024)	Attribution of the unprecedented heat event of August 2023 in Barcelona (Spain) to observed and projected global warming	In terms of the frequency of such events, we found that extreme heat events, such as the August 2023 heatwave, will become 2 and 5 times more likely with a global summer warming of 2 °C and 3 °C, respectively. This will expose a large portion of the population to dangerous heat levels highlighting the importance of limiting global warming to 1.5 °C to mitigate the impacts on urban populations.
(Kılış, 2024)	Urban emissions and land use efficiency scenarios for avoiding increments of global warming	Informing on the urgency to ensure ambitious mitigation action in urban areas can support a climate future that remains within critical thresholds and tipping elements of the planet.

From the results of a literature study of 8 articles that have been reviewed and explained, the results of this study suggest that the results of this study show that global warming has a significant impact on human health, especially through an increase in the frequency and intensity of heat waves (Bafirman et al., 2023; Hasibuan et al., 2024). Extreme heat waves can increase the risk of heat-related diseases such as heat stroke and dehydration, particularly among vulnerable populations such as children, the elderly, and individuals with pre-existing health conditions. The

study found that higher temperatures not only worsen physical health conditions but can also affect mental health, with increased levels of stress and other psychological disorders (Nurdin et al., 2024). This demonstrates the importance of developing adaptation strategies that include mental health support, in addition to efforts to prevent and treat the physical effects of extreme temperatures.

In addition to the direct impact of rising temperatures, global warming also affects the spread and prevalence of infectious diseases. Climate change is

changing the geographical and seasonal distribution patterns of disease vectors such as mosquitoes, which are responsible for the spread of diseases such as malaria and dengue fever (Raffiandy Putra et al., 2024). The results show that areas previously unaffected by the disease now face greater risk due to habitat changes that allow mosquitoes to breed in new areas (Reno Putra et al., 2024). This requires special attention in public health systems to identify and manage these new threats, as well as to increase the capacity for diagnosis and treatment of infectious diseases in newly affected areas.

The decline in air quality due to global warming is another significant impact identified in this study. Rising temperatures worsen air quality conditions by increasing the concentration of surface ozone and other pollutant particles, which can trigger or worsen respiratory illnesses such as asthma and chronic obstructive pulmonary disease (COPD). This discussion highlights the importance of stricter air pollution control policies as part of adaptation strategies to climate change (Purnama et al., 2024). In addition, the study also shows that the indirect impacts of climate change, such as reduced food and water security, can worsen public health conditions, especially in developing countries that are already facing other health challenges. Therefore, this research supports the need for a holistic approach in responding to climate change involving different sectors and disciplines to mitigate broader health impacts.

Global warming as a global environmental phenomenon affects human health through complex and multifaceted mechanisms. One of the key findings of the study is that a significant increase in the frequency and intensity of heat waves increases health risks, especially among vulnerable groups such as children, the elderly, and those with pre-existing medical conditions. This increase in temperature not only has a direct impact on physical health through heat-related illnesses but also affects mental health by increasing stress levels and psychological disorders. The study underscores that people's adaptation to climate change must include attention to mental health, as the psychological impact of these extreme conditions is often overlooked. Thus, there is an urgent need to expand the capacity of health systems not only in the treatment of physical conditions but also in providing psychological support.

In addition, global warming exacerbates the spread of infectious diseases by altering the geographical and seasonal distribution of disease vectors such as mosquitoes. These changes pose new challenges for health systems in various regions, including areas that were previously unaffected by certain diseases. This shows that climate change is not only intensifying

existing health threats but also creating new risks that require adaptive and proactive responses. Furthermore, the decline in air quality associated with rising temperatures suggests a direct link between climate change and respiratory diseases, which requires stricter pollution control policies. This study emphasizes the importance of an interdisciplinary approach in responding to the health impacts of global warming, including collaboration between the health sector, the environment, and public policy to develop comprehensive and effective mitigation and adaptation strategies.

In this study, it was found that the increased frequency and intensity of heat waves due to global warming significantly increases health risks, especially among vulnerable groups. These findings are in line with other studies, such as research by Shu et al., (2024) which shows a positive relationship between high temperatures and increased mortality due to heat conditions. They found that any increase in daily average temperature was associated with an increased risk of death, especially among the elderly. In addition, research conducted by Barcena-Vazquez et al., (2023) It also shows that the health impacts of heat waves are exacerbated in urban areas that experience the "heat island" effect, where temperatures tend to be higher compared to rural areas. Comparisons with these studies reinforce the finding that heat waves pose a serious threat to public health, especially in regions with limited infrastructure and health resources.

In terms of infectious diseases, this study found that climate change changes the geographical distribution pattern of disease vectors such as mosquitoes, which has the potential to increase the spread of diseases such as malaria and dengue fever. This is consistent with the findings from Liao et al., (2024) which suggests that global warming could expand mosquito habitats to colder regions, increasing the risk of disease transmission. In addition, research by Scafetta, (2024) suggests that rising global temperatures could extend the transmission season and expand the geographic distribution of infectious diseases, which were not previously considered a health risk in certain regions. This data shows that climate change is not only increasing the intensity and frequency of existing disease outbreaks but also introducing new risks, especially in regions that are less prepared for these changes. As such, the findings of this study are consistent with previous research, confirming that the health impacts of climate change are a global issue that requires a comprehensive response.

Conclusion

This study comprehensively shows that global warming has a significant and far-reaching impact on human health, especially through increased frequency and intensity of heat waves, changes in the distribution pattern of infectious diseases, and a decrease in air quality. These impacts not only worsen physical conditions but also mental health, as well as expand risk areas for diseases that previously did not exist. Based on these findings, It can be concluded that there is an urgent need to strengthen mitigation and adaptation strategies that include air pollution control policies, capacity building of health systems, and public education to be better prepared for climate change. This research emphasizes that the response to global warming must be multidisciplinary and coordinated, involving the health, environmental, and public policy sectors, in order to protect public health holistically and sustainably.

Acknowledgements

Thank you to the lecturers at the Faculty of Sports Science who have provided extraordinary guidance, knowledge, and inspiration. Don't forget to also thank your comrades in arms in the Master of Sports Education Study Program who have always been a source of inspiration and motivation.

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.

Funding

This research received no external funding.

Conflicts of Interest

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

References

- Ayugi, B. O., Chung, E.-S., Zhu, H., Ogega, O. M., Babousmail, H., & Ongoma, V. (2023). Projected changes in extreme climate events over Africa under 1.5°C, 2.0°C and 3.0°C global warming levels based on CMIP6 projections. *Atmospheric Research*, 292, 106872. <https://doi.org/https://doi.org/10.1016/j.atmosres.2023.106872>
- Bafirman, B., Wahyuri, A. S., Vellya, V., Zarya, F., & Munir, A. (2023). Comparison of VO2Max Capacity and Lung Vital Capacity of Junior High School Students: Highlands and Lowlands. *JOSSAE (Journal of Sport Science and Education)*, 8(1), 69–76. <https://doi.org/10.26740/jossae.v8n1.p69-76>
- Barcena-Vazquez, J., Caro, K., Bermudez, K., & Zatarain-Aceves, H. (2023). Designing and evaluating Reto Global, a serious video game for supporting global warming awareness. *International Journal of Human-Computer Studies*, 177, 103080. <https://doi.org/https://doi.org/10.1016/j.ijhcs.2023.103080>
- Buguet, A., Reis, J., & Radomski, M. W. (2023). Sleep and global warming: How will we sleep when the Earth is hotter? *Journal of the Neurological Sciences*, 454, 120859. <https://doi.org/https://doi.org/10.1016/j.jns.2023.120859>
- Chang, M., Sun, P., Zhang, L., Liu, Y., Chen, L., Ren, H., & Wu, B. (2024). Changes in characteristics and risk of freshwater microplastics under global warming. *Water Research*, 260, 121960. <https://doi.org/https://doi.org/10.1016/j.watre.2024.121960>
- Chen, W., Yi, L., Wang, J., Zhang, J., & Jiang, Y. (2023). Evaluation of the livability of arid urban environments under global warming: A multi-parameter approach. *Sustainable Cities and Society*, 99, 104931. <https://doi.org/https://doi.org/10.1016/j.scs.2023.104931>
- Demir, M. Ö., Gök Demir, Z., Karakaya, Ç., & Erendağ Sümer, F. (2024). Global Warming Communicative Actions of Publics in Türkiye: Utilizing Fuzzy Rule Based System. *Heliyon*, e35380. <https://doi.org/https://doi.org/10.1016/j.heliyon.2024.e35380>
- Ergin, E., Altinel, B., & Aktas, E. (2021). A mixed method study on global warming, climate change and the role of public health nurses from the perspective of nursing students. *Nurse Education Today*, 107, 105144. <https://doi.org/https://doi.org/10.1016/j.nedt.2021.105144>
- Ge, S., Zhan, W., Wang, S., Du, H., Liu, Z., Wang, C., Wang, C., Jiang, S., & Dong, P. (2024). Spatiotemporal heterogeneity in global urban surface warming. *Remote Sensing of Environment*, 305, 114081. <https://doi.org/https://doi.org/10.1016/j.rse.2024.114081>
- Gora, M. K., Jat, H. S., Ladha, J. K., Choudhary, M., Sharma, P. C., Yadav, A. K., Singh, L. K., Sapkota, T. B., Singh, Y., Prajapat, K., Yadav, R. K., Jat, M. L., Krupnik, T. J., & Gathala, M. K. (2024). Enhancing productivity, soil health, and reducing global

- warming potential through diverse conservation agriculture cropping systems in India's Western Indo-Gangetic Plains. *Field Crops Research*, 315, 109476.
<https://doi.org/https://doi.org/10.1016/j.fcr.2024.109476>
- Hasibuan, Y. M., Aziz, I., Arsil, A., Pranoto, N. W., Eri, B., Zarya, F., & Roy, T. (2024). Validity and Reliability of Physical Fitness Test of Nusantara Students at SMP Padang City Department of Sports Education , Universitas Negeri Padang , Padang , West Sumatra , Indonesia Department of Sports Coaching , Universitas Negeri Padang , Padang ,. *Poltekita: Jurnal Ilmu Kesehatan*, 17(4), 1284–1291.
<https://doi.org/10.33860/jik.v17i4.3578>
- Kılıç, Ş. (2024). Urban emissions and land use efficiency scenarios for avoiding increments of global warming. *Energy*, 307, 132174.
<https://doi.org/https://doi.org/10.1016/j.energy.2024.132174>
- Lemus-Canovas, M., Montesinos-Ciuró, E., Cearreta-Innocenti, T., Serrano-Notivol, R., & Royé, D. (2024). Attribution of the unprecedented heat event of August 2023 in Barcelona (Spain) to observed and projected global warming. *Urban Climate*, 56, 102019.
<https://doi.org/https://doi.org/10.1016/j.uclim.2024.102019>
- Liao, Z., Yuan, Y.-F., Chen, Y., & Zhai, P.-M. (2024). Extraordinary hot extreme in summer 2022 over the Yangtze River basin modulated by the La Niña condition under global warming. *Advances in Climate Change Research*, 15(1), 21–30.
<https://doi.org/https://doi.org/10.1016/j.accre.2023.12.006>
- Liu, H., Tong, M., Guo, F., Nie, Q., Li, J., Li, P., Zhu, T., & Xue, T. (2022). Deaths attributable to anomalous temperature: A generalizable metric for the health impact of global warming. *Environment International*, 169, 107520.
<https://doi.org/https://doi.org/10.1016/j.envint.2022.107520>
- Liu, T.-Y., & Lin, Y. (2023). Does global warming affect unemployment? International evidence. *Economic Analysis and Policy*, 80, 991–1005.
<https://doi.org/https://doi.org/10.1016/j.eap.2023.09.028>
- Meng, Y., Hao, Z., Feng, S., Zhang, X., & Hao, F. (2022). Increase in compound dry-warm and wet-warm events under global warming in CMIP6 models. *Global and Planetary Change*, 210, 103773.
<https://doi.org/https://doi.org/10.1016/j.gloplacha.2022.103773>
- Mousavinezhad, S., Nili, S., Fahimi, A., & Vahidi, E. (2024). Environmental impact assessment of direct lithium extraction from brine resources: Global warming potential, land use, water consumption, and charting sustainable scenarios. *Resources, Conservation and Recycling*, 205, 107583.
<https://doi.org/https://doi.org/10.1016/j.resconrec.2024.107583>
- Nurdin, R. F., Bafirman, B., Susanto, N., Indika, P. M., Agustian, dede rahman, Suharmadi, S., & Zarya, F. (2024). The Effect of Ambient Temperature and Air Humidity on The Body ' s Hematocrit Levels when Exercising Department of Sports Science , Universitas Negeri Padang , Padang , West Sumatra , Indonesia Department of Medical Education , Universitas Negeri Padang ,. *Poltekita: Jurnal Ilmu Kesehatan*, 17(4), 1292–1298.
<https://doi.org/10.33860/jik.v17i4.3571>
- Purnama, P., Arsil, A., Syahrastani, S., Bafirman, B., & Zarya, F. (2024). The Effect of Highland and Lowland Living on Cardiovascular Ability : a Literature Review. *Jurnal Penelitian Pendidikan IPA*, 9(2023), 231–239.
<https://doi.org/10.29303/jppipa.v9iSpecialIssue.8118>
- Putra, Raffiandy, Bafirman, bafirman, Arsil, arsil, Bahtra, R., Rahman, D., Haris, F., & Fiky, Z. (2024). Innovative Strategies to Increase Public Awareness of the Importance of Physical Fitness to Health: Systematic literature review. *Poltekita: Jurnal Ilmu Kesehatan*, 17(4), 1526–1538.
<https://doi.org/10.33860/jik.v17i4.3635>
- Putra, Reno, Barlian, E., Neldi, H., Yendrizal, Y., Rahman, D., & Zarya, F. (2024). The Effect of Exercise on Mental Health : Coping with Stress and Anxiety Through Physical Activity (Systematic literature review). *Poltekita: Jurnal Ilmu Kesehatan*, 17(4), 1353–1366.
<https://doi.org/10.33860/jik.v17i4.3615>
- Robert, C., Ravey, A., Perey, R., & Hissel, D. (2024). Global warming potential and societal-governmental impacts of the hydrogen ecosystem in the transportation sector. *International Journal of Hydrogen Energy*, 66, 55–65.
<https://doi.org/https://doi.org/10.1016/j.ijhydne.2024.04.085>
- Scafetta, N. (2024). Impacts and risks of “realistic” global warming projections for the 21st century. *Geoscience Frontiers*, 15(2), 101774.
<https://doi.org/https://doi.org/10.1016/j.gsf.2023.101774>
- Shu, Z., Jin, J., Zhang, J., Wang, G., Lian, Y., Liu, Y., Bao, Z., Guan, T., He, R., Liu, C., & Jing, P. (2024). 1.5°C and 2.0°C of global warming intensifies the

- hydrological extremes in China. *Journal of Hydrology*, 635, 131229. <https://doi.org/https://doi.org/10.1016/j.jhydro.2024.131229>
- Sugiyono. (2015). *Metode Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D*. Alfabeta.
- Thompson, C., Bacha, L., Paz, P. H. C., de Assis Passos Oliveira, M., Oliveira, B. C. V., Omachi, C., Chueke, C., de Lima Hilário, M., Lima, M., Leomil, L., Felix-Cordeiro, T., da Cruz, T. L. C., Otsuki, K., Vidal, L., Thompson, M., Ribeiro e Silva, R., Cabezas, C. M. V., Veríssimo, B. M., Zaganelli, J. L., ... Thompson, F. (2023). Collapse of scallop *Nodipecten nodosus* production in the tropical Southeast Brazil as a possible consequence of global warming and water pollution. *Science of The Total Environment*, 904, 166873. <https://doi.org/https://doi.org/10.1016/j.scitotenv.2023.166873>
- Ueta, H., Kodera, S., Sugimoto, S., & Hirata, A. (2024). Projection of future heat-related morbidity in three metropolitan prefectures of Japan based on large ensemble simulations of climate change under 2 °C global warming scenarios. *Environmental Research*, 247, 118202. <https://doi.org/https://doi.org/10.1016/j.envres.2024.118202>
- Xu, X., Qiu, H., Van Gestel, C. A. M., Gong, B., & He, E. (2023). Impact of nanopesticide CuO-NPs and nanofertilizer CeO₂-NPs on wheat *Triticum aestivum* under global warming scenarios. *Chemosphere*, 328, 138576. <https://doi.org/https://doi.org/10.1016/j.chemosphere.2023.138576>
- Yang, H., Zhang, D., Winkler, J. A., Huang, Q., Zhang, Y., Wu, P., Liu, J., Ouyang, Z., Xu, W., Chen, X., Wu, D., Zhang, J., & Songer, M. (2024). Field experiment reveals complex warming impacts on giant pandas' bamboo diet. *Biological Conservation*, 294, 110635. <https://doi.org/https://doi.org/10.1016/j.bioco.2024.110635>
- Zgheib, M., Quaranta, G., Tschamber, V., & Trouvé, G. (2023). Global warming and human health effects of wood heating life cycle in the Grand-Est region in France. *Biomass and Bioenergy*, 175, 106879. <https://doi.org/https://doi.org/10.1016/j.biombioe.2023.106879>
- Zhang, C., Yin, Y., Chen, G., Deng, H., Ma, D., & Wu, S. (2022). Water use efficiency-based assessment of risk to terrestrial ecosystems in China under global warming targets of 1.5 °C and 2.0 °C. *Ecological Indicators*, 143, 109349. <https://doi.org/https://doi.org/10.1016/j.ecolin.2022.109349>
- Zhou, Z., Nguyen-Xuan, T., Liao, H., Qiu, L., & Im, E.-S. (2024). Characterization of temperature and humidity effects on extreme heat stress under global warming and urban growth in the Pearl and Yangtze River Deltas of China. *Weather and Climate Extremes*, 44, 100659. <https://doi.org/https://doi.org/10.1016/j.wace.2024.100659>