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Climate change and its impact on sports

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Abstract

We are all experiencing massive climate change globally. In 2024, India faced major challenges due to climate change. Severe heat waves and unpredictable rainfall patterns have been the most significant impacts this year. Northern and central India faced the highest temperatures in over a century, with a record temperature of 52.3°C in Delhi. A change of one or two degrees in the Earth's average temperature can affect life across the planet. This severe heat wave has prompted the Indian Meteorological Department to issue red alerts for several regions. People who work outside are the most affected, including professional and amateur sports athletes. The effect of climate change will increase in the coming years, but the athletes are feeling its impact right now. This paper aims to explore the impact of climate change and its influence on the sports world.

Keywords: Climate change, impact, sports, temperature, athletes

Introduction

We are all experiencing massive climate change globally. It is one of the most prominent challenges faced by the world today. This subsequent change in the climate system resulted in an average increase in temperature, which can bring hazardous changes in weather patterns. A change of one or two degrees in the Earth's average temperature can affect life across the planet. The observable changes that we can see are rising temperatures, melting ice caps and glaciers, ocean acidification, rising sea levels, floods, droughts, excessive rainfall, heat waves, and wildfires. One of the notable impacts of climate change that India faced in the year 2024 has been the occurrence of severe heatwaves and erratic rainfall patterns. Northern and central India faced the highest temperatures in over a century, with a record temperature of 52.3 °C in Delhi. The severe heat wave prompted the Indian Meteorological Department to issue red alerts for several regions. A red alert signifies a high likelihood of heat-related illnesses and heat stroke, particularly impacting vulnerable populations who work outside. Rising temperatures due to climate change significantly affect outdoor sports, which inherently depend on favourable weather conditions. Athletics, Football, Hockey, Cricket, Marathon, cycling, and Tennis tournaments are particularly vulnerable. The effect of climate change will increase in the coming years, and the athletes are feeling its impact right now. This paper intends to discuss its impact and how it is influencing the sports world.

Impact on Athletes

Rise in temperature poses significant challenges to athletes, affecting their performance, health, and overall well-being. Hot weather imposes physiological stress on athletes, leading to a decline in performance. When exposed to extreme temperatures, the body works harder to maintain its core temperature. This increased effort can result in:

- Dehydration: Extreme weather temperatures can have adverse effects on the body.
- Normally body adjusts to regulate its temperature but when the body cannot do this the athlete loses fluids through sweat, which can lead to dehydration and fatigue.
- Heat-Related Illnesses: The likelihood of conditions such as heat exhaustion, heat cramps, and heatstroke increases.
- Heat exhaustion occurs when the body becomes overheated, often due to extended exposure to high temperatures, strenuous physical activity, dehydration, or insufficient

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acclimatization.

- Heat cramps are painful, involuntary muscle spasms that happen during or after vigorous exercise in hot conditions. Although less severe than heat exhaustion and heatstroke, they are still uncomfortable and require proper care.
- Heatstroke is particularly dangerous and can be fatal if not treated promptly. Prolonged exposure to high temperatures, especially in combination with high humidity, is a primary cause of heat stroke.
- Heatstroke is extremely dangerous and is mainly caused by prolonged exposure to high temperatures, particularly when combined with high humidity.
- Reduced Endurance: High temperatures can decrease muscle endurance. Athletes may feel fatigued more quickly, leading to shorter performance durations and lower intensity.

Hot weather imposes psychological stress on athletes, leading to a decline in performance. Sleep Disruption and Fatigue: Studies have shown that being in hot weather for a long time can make people more stressed and irritable. The physical discomfort from the heat can lead to psychological distress. This stress is worsened when the heat disrupts sleep patterns, causing fatigue and problems with thinking clearly. In simple terms, hot weather can make an athlete feel mentally and physically exhausted, making it harder to function well.

Concentration and Focus

The connection between body and mind is essential for overall health, and physical discomfort or illness often affects mental well-being. For example, feeling tired and uncomfortable from dehydration or heat exhaustion can make a person more irritable and have trouble focusing. This shows how physical issues can lead to psychological challenges, impacting both focus and cognitive abilities. This condition can reduce an athlete's ability to concentrate and make quick decisions.

Mood Disturbances

Prolonged exposure to high temperatures can lead to mood swings, emotional instability, and feelings of sadness. It is harder to maintain a steady mood, when experiencing more frequent changes in the emotional state due to the stress and discomfort caused by the heat, thus impacting an athlete's willingness to push through challenges.

Decreased Motivation

Discomfort from heat can lead to increased irritability and anxiety, which can distract athletes and reduce their motivation and enjoyment.

Increased Perceived Effort

The sensation of heat can make physical tasks feel more challenging, increasing the mental effort required to maintain performance levels. Increase in temperature can place additional stress on the body during physical exertion.

Performance Anxiety

Concerns about performing well in hot conditions can increase anxiety levels, leading to a decline in confidence and performance.

Expectations and Pressure

The pressure to perform well despite adverse conditions can

add to stress levels, impacting mental resilience. Additionally, the strain of competing in extreme conditions can heighten the risk of burnout, potentially leading to shorter athletic careers and a decline in overall participation in sports.

Shantanu Srivastava, an associate editor of Sports at Hindustan Times sports covers the plight of athletes training or competing in brutal weather conditions with temperatures exceeding 50°C in Delhi and other Indian states, making outdoor training for athletes extremely difficult. He has shared the experiences of some of the top athletes in India, and how they are facing this scorching heat.

Para high jumper Sharad Kumar, who trains at Delhi's JLN Stadium, feels that the capital's weather (New Delhi) makes it unsuitable for training. "I don't know how athletes are managing these days. It is brutal. I have trained in Panchkula in summers and it was just as bad," said the Tokyo Paralympics bronze medallist. "An athlete cannot give his/her 100% for more than 15 minutes in this heat. After that, it's just war." At a competition in Bhubaneswar, the intense heat and humidity prevented javelin throwers from pushing their limits, even with Olympic qualifications at stake. Coastal cities, while having moderate temperatures, pose challenges for athletes with high humidity and monsoon conditions.

Impact on Training Schedules

Extreme temperatures also affect athletes' training schedules. Many athletes and teams are forced to train during the early morning or late evening hours to avoid the midday heat. They are changing the training session timings to mitigate the risk of heat-related illnesses but it disrupts the regular training routines and can impact performance. Additionally, indoor training facilities are not always available or affordable, particularly for grassroots and amateur athletes.

Adjustments At The Competition Level

Several sports have implemented rule changes and introduced new protocols to address the challenges posed by rising temperatures to ensure the safety and well-being of athletes.

Adjustments due to extreme temperatures are also made at the competition level and were experienced in the year 2018 when the organizers of the US Open in Tennis permitted the players to take "a heat break" during their matches. In Football, FIFA introduced cooling breaks during matches when temperatures exceed a certain threshold. These breaks typically occur around the 30-minute mark of each half, allowing players and referees to hydrate and cool down. Although these cooling breaks are not mandatory, it is the responsibility of the referee to decide when to implement them. England & Wales Cricket Board helped in developing Sun protection guidelines for those participating, spectating, or working in sports or outdoor recreation. These changes and protocols aim to mitigate the impact of rising temperatures on athletes, ensuring their safety and maintaining the integrity of the competition.

Impact on Sports Events

The article from the Hindustan Times discusses the growing concerns about climate change and its impact on the Winter Olympics. The International Olympic Committee (IOC) is considering moving the Winter Games indoors due to rising temperatures and unreliable snow conditions. This decision is based on data indicating that recent years have been the hottest on record globally. The Future Host Commission for the Winter Games has conducted a study to identify countries

with the necessary venues and the likelihood of maintaining suitable winter climates until at least the mid-21st century. The study found that out of 15 countries, two will not have the necessary climate conditions to host the Winter Olympics by 2040, and five will not be able to host the Winter Paralympics. This significantly reduces the number of potential host countries, emphasizing the urgent need to address climate change impacts on winter sports. At the 141st IOC Session in Mumbai, it was emphasized that the timing and duration of the Summer Olympics must be carefully considered, taking into account the unique climate conditions of each host country.

Venue and Schedule Changes

Extreme heat necessitates changes in the scheduling and venue selection for sports events. The International Olympic Committee (IOC) moved the marathon and race-walking events for the Tokyo 2020 Olympics to Sapporo, where the cooler climate would offer athletes better conditions. This decision was made to protect athletes from Tokyo's extreme summer heat. The IOC prioritized athlete health and safety, collaborating with Tokyo 2020 organizers and local authorities to implement this change. Adverse weather conditions lead to rescheduling events in order to prioritize athlete safety and provide the best possible environment for peak performance.

Economic Impact

Extreme temperatures have significant economic implications for sports. It indeed increases the costs for sports organizers in several ways. Organizers need to invest in cooling or heating systems to maintain safe conditions for athletes, officials, and spectators. Stadiums and facilities might need upgrades to use materials that can withstand extreme heat without warping or deteriorating. Extreme weather conditions can cause wear and tear on facilities, requiring frequent and costly maintenance and repairs to ensure facilities are safe and operational. For instance, high heat can damage the turf on cricket and soccer fields, leading to increased maintenance costs. Synthetic tracks used for athletics can also deteriorate faster under intense heat, requiring more frequent repairs and replacements. Temporary modifications are sometimes required such as installing temporary shelters or canopies to provide shade for spectators and participants. Extreme temperatures may force organizers to reschedule events to cooler parts of the day or year. This can lead to increased costs due to extended use of facilities, additional staffing, and possible conflicts with other scheduled events. Moving events to different locations with more suitable climates can be expensive due to transportation, accommodation, and logistical challenges. Postponed or cancelled events lead to a loss in ticket sales and broadcasting revenue. Investing in sustainable and environmentally friendly practices, such as solar-powered cooling systems or eco-friendly materials, can be costly initially but may help mitigate the long-term impact of extreme temperatures. Implementation of carbon offset programs to reduce the environmental footprint of events. For example, the Australian Open organizers, have invested heavily in retractable roofs and air conditioning systems for key courts to mitigate the effects of extreme heat. Events like the Winter Olympics (Winter Olympics, Beijing) often require substantial investment in artificial snow production and maintenance to ensure adequate conditions for competition.

Environmental Impact

Sports and the environment are closely linked, with many people engaging in physical activities in both urban and natural outdoor settings. Doctors often prescribe exercise to enhance health. However, there are numerous health implications when this physical activity occurs in areas with poor air quality. Exercising outdoors, when air quality is poor can diminish the exercise benefits and even become harmful. Pasqua *et al.* (2018) indicate that aerobic exercise's health advantages can be compromised after just 15 minutes in highly polluted cities, and after 75 minutes, the extended exposure can lead to negative health effects. Exercising in polluted environments is generally not recommended. For instance, Pun & Ho (2019) found that inhaling particulate matter during exercise can increase systolic blood pressure. Poor air quality affects the performance and the health of the athlete. It also leads to cancellation and postponement of outdoor sports events and imposes limitations on outdoor training. Climate change has a profound impact on snow, which in turn affects winter sports in various ways. Rising global temperatures lead to less snowfall and more rain, reducing the overall snowpack in many regions. The duration of the snow season is becoming shorter, with later snow onset and earlier melting. Fluctuating temperatures cause inconsistent snow conditions, affecting the quality of snow for winter sports. Skiing and snowboarding are highly dependent on reliable snowfall and good snow quality. Reduced snowpack and shorter seasons directly impact the availability and quality of slopes. Similarly, Sports like ice skating and ice hockey are affected by inconsistent freezing temperatures, which can impact the quality of outdoor ice rinks. Cross-country skiing is an endurance event that requires extensive, consistent snow coverage over large areas, making them particularly vulnerable to reduced snowfall and snowmelt. This inconsistency in snow conditions can disrupt training schedules for winter athletes, affecting their preparation and performance. Poor snow quality on the other hand poses safety risks and increases the likelihood of injuries. Higher costs for snowmaking and infrastructure maintenance can strain the financial viability of winter sports facilities. With rising temperatures and unpredictable snowfall patterns due to climate change, natural snow cover is becoming less reliable. As a result, facilities increasingly rely on artificial snowmaking to ensure they can operate throughout the season. Snowmaking is an energy-intensive process, requiring significant amounts of electricity and water. This leads to higher operational costs, particularly in regions where energy prices are high or where water resources are scarce. Investing in and maintaining snowmaking equipment adds to the initial capital expenditures and ongoing maintenance costs. The technology also needs to be updated regularly to improve efficiency and reduce environmental impact. Maintaining lush grass pitches, especially for sports like cricket, football, and golf, requires significant amount of water. This is even more challenging in extreme temperatures and dry seasons. Swimming pools, landscaping, and other amenities at sports complexes also contribute to high water consumption. Water scarcity affects millions of people, limiting access to clean drinking water. In a country like India, where water scarcity is a critical issue, sports organizations have a responsibility to consider the broader impact of their water usage, recognizing their role within the larger community. Effective water management strategies are necessary to balance the needs of sports facilities and local communities. This involves improving efficiency and exploring alternative water sources.

Impact on Grass Root Level Sport

Grassroots sports, which are essential for nurturing future talent, are particularly vulnerable. Climate change significantly impacts grassroots sports at multiple levels, influencing the accessibility, quality, and safety of sports activities. Local sports organizations and schools often lack the financial means to invest in necessary adaptations such as indoor facilities, advanced cooling systems, or synthetic turf. This lack of infrastructure makes them highly susceptible to the effects of extreme weather conditions. For example, consistent exposure to extreme heat can make outdoor sports activities uncomfortable and unsafe, leading to heat-related illnesses among young athletes. As a result, both parents and children may become discouraged from regular participation in sports, disrupting the consistent practice and training necessary for athletic development. This can hinder the identification and nurturing of future talent, as reduced participation rates and less frequent training sessions limit the opportunities for young athletes to improve their skills. Additionally, the unpredictable nature of weather patterns can lead to frequent cancellations and rescheduling of events, further affecting the continuity of training programs. Without adequate support and investment in adaptive measures, grassroots sports organizations struggle to provide safe and conducive environments for young athletes, ultimately impacting the overall development of sports at the foundational level. Isabelle Autissier, Honorary President of WWF France, emphasizes the significant impact of climate change on sports: "As sportsmen and women, we also depend on natural elements that are likely to change to a greater or lesser degree depending on the levels of climatic disturbance; we therefore depend on the decisions taken to contain this disturbance and adapt to it. What's a skier without snow? Who's going to play rugby or run a marathon at 40 or 45 degrees? [...] The climate doesn't just influence performance – it affects the practice of sport itself."

This statement underscores the reality that athletes rely directly on stable climatic conditions for both their performance and the very feasibility of their sports. As global temperatures rise and weather patterns become more unpredictable, the implications for sports are profound, necessitating urgent and effective action to mitigate these impacts.

Conclusion

Climate change is no longer a distant threat but an urgent reality, as demonstrated by the recent heatwave in north and central India and severe flooding in various regions. The evolving climate profoundly impacts sports, presenting significant challenges that affect athlete health, disrupt events, and influence economic aspects. The repercussions are far-reaching, necessitating adaptive strategies to mitigate climate change's impact on sports. The paper highlights the well-being of athletes, the effect on facilities, and the evolving nature of sports in the coming years. By fostering resilience and promoting sustainable practices, it is possible to ensure that sports continue to thrive in the face of a changing climate. The urgency for proactive measures is clear, as the health and future of both athletes and the sports they play depend on our response to these growing climate threats. In conclusion, we must focus on enhancing climate protection and promoting climate friendliness while simultaneously adapting to the impacts of climate change. This requires a shift in mindset and innovative solutions to address these challenges effectively.

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