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EFFECT OF ENVIRONMENTAL FACTORS ON ATHLETIC PERFORMANCE, A REVIEW

Majida Hameed Kambash[1], Alaa Hasan Fahmi[2*], Dina A. Saad[3], Ebada Jassim[2]
[1]College of Physical Education, University of Diyala, Iraq

[2]Department of Soil Science and Water Resources, College of Agriculture, University of Diyala, Iraq

[3]Department of Biology, College of Science, University of Diyala, Iraq

*Corresponding Authors: alaaalamiri2006@yahoo.com; alaahfahmi@uodiyala.edu.iq

Abstract
The International Olympic Committee considers environmental sustainability the Third Pillar of the Olympic Movement. Moreover, several sports organisations and industry segments were paying close attention to the environmental impact of their events and activities. Therefore, it is important to consider an environmental factor affecting various sports and player activities. Earlier research has highlighted the ways in which sporting events benefit our planet, our communities, our economies, our cultures, and our governments. The disadvantages of athletic activities have received less attention. Therefore, the purpose of this study is to provide a high-level overview of the effects of the environment on sports performance.

Keywords: pollution, heat, Air quality, physical activity, Athletic performance

Introduction

Human security, livelihoods, food security, water supply, and health are all threatened by climate change, according to the Intergovernmental Panel on Climate Change (IPCC) (Welsch,2007). Air and water pollution are major contributors to these dangers. Carbon dioxide levels in the atmosphere have increased due to human activities and the use of fossil fuels (Crowley, 2000). Some parts of the world have the highest pollution levels, putting residents at risk for serious illness or even death. Chemicals and toxic byproducts such as Sarin, VX gas, fly- ash, carbon oxides, nitrogen oxides, PM2.5, PM10, volatile organic compounds, arsenic, particulates including Strontium-90, Caesium-137, Sulfur dioxide, heavy metals (nickel, copper, cob), and so on could affect as many as 3,500,000 people in India's Ranipet. As few as 300,000 in Russia's Dzerzinsk, and Most of them are air pollutants, and there is no denying the toll that pollution of this sort takes on human health.

Direct and indirect health consequences from climate change on certain sports are distinguished (Eis et al., 2010). Heatwaves, extreme weather, and ultraviolet (UV) radiation are examples of direct consequences. At the same time, changes to our ecosystem as a result of climate change are examples of indirect consequences (Mücke and Matzarakis, 2019).

The purpose of this research was to examine the moderating effect of residents' access to opportunities for physical exercise on the relationships between air and temperature pollution and

residents' health. Most previous research has looked at the consequences of pollution on people's health on an individual basis, thus this method is new. This research fills a gap in our understanding of the relationship between air pollution and the health of local residents by focusing on the role played by exercise possibilities.

Climate change and sports

There has been a dramatic increase in international media coverage of environmental protection and climate change, two long-debated issues that have just recently aroused transnational interest (Pourpakdelfekr and Oboudi, 2022). Economic, social, cultural, and educational benefits and the chance for tourist expansion in many international destinations make events a vital part of the tourism sector (Schut and Glebova, 2022).

The tourism industry is already feeling the effects of climate change. For example, in 2002, for the first time in its 20-year history, the Golden Rainbow Ice Fishing Contest was called off because of unpredictable and dangerous ice conditions brought on by above-average winter temperatures in recent years (Pourpakdelfekr and Oboudi, 2022). The economic benefits to host communities from hosting major sporting events can be both short- and long-term. At the same time, these gatherings have often been met with criticism due to concerns over the potential negative impacts they may have on the environment and nearby populations. Environmental impacts include using nonrenewable natural resources, releasing greenhouse gases that contribute to climate change, and high energy and water consumption during the event (Ahmed and Pretorius, 2010). These impacts can have a negative effect on natural ecosystems. The frequent travel of teams and spectators by flights, buses, and vehicles, the production of enormous quantities of waste at contests, and the destruction of natural regions for the construction of sports infrastructure like stadiums all contribute significantly to the environmental effect of any big sporting event (Wicker 2019).

Air quality

As a species, we now spend roughly 90% of our time inside. It could be anything from a home, office, school, mall, or sports stadium. When researchers in the 1970s found a link between poor indoor air quality and low productivity, sickness, and respiratory health issues, the issue garnered much attention (Folkehelseinstituttet, 2015).Air quality, sports performance, and respiratory symptoms: studies on the association promote additional exploration despite a lack of data.(Lichter et al., 2015). soccer players' performance in German stadiums was evaluated for the effects of particle air pollution (Bos et al., 2011), and the results showed a decline. As Quin et al. (2019) noted, exercising in polluted environments may reduce the health benefits of active commuting. As Rundell and Caviston (2008) noted, acute inhalation of PM1 at concentrations typical of many urban environments may reduce exercise performance. Both Carlisle and Sharp (2001) and Cakmak et al. (2011) found that individuals had worse aerobic fitness scores on days with high ozone levels, suggesting that O3 was particularly harmful to athletes. Since ozone concentration is highest between 11 a.m. and 6 p.m. during the summer, outdoor sporting events should be organized at other times of the day (Mathias, 2018).

Asthma, strokes, heart attacks, and SIDS are only some of the immediate dangers that breathing this polluted air poses. Some malignancies, heart issues, and mental diseases like schizophrenia can develop over time as a result of exposure to fetal alcohol (Burchett, 2005). Furthermore, it is a potential risk factor for mortality and plays a significant role in the etiology of cardiovascular illnesses and even diabetes. The World Health Organization (WHO) has identified airborne particulate matter as a possible carcinogen.

Athletes, for instance, can take in more than 150 liters of air per minute (as opposed to 5-6 liters at rest) due to the dramatic increase in ventilation (McConnell et al., 2002) and the volume of air entering the body during exercise. As a result, huge quantities of unfiltered air enter the body, and contaminants are delivered deeper to the lungs as nasal breathing is replaced by mouth breathing during aerobic exercise (mcCreanor et al., 2007).

Temperature

Athletes' core temperatures rise and fall throughout competition, therefore it makes sense that environmental temperature would have an effect on performance. Due to impaired thermoregulation and excessive fluid loss, elevated body temperatures have been linked to reduced sports performance (Siegel & Laursen, 2012). Humidity (vapor pressure) and wind speed together determine the temperature threshold at which the environment limits endurance performance. Since air movement also affects dry heat loss, these two factors together determine the temperature threshold at which the environment limits endurance performance. Humidity (Maughan et al., 2012), wind speed (Morrison et al., 2012; Saunders et al., 2005), and radiation have all been shown to have direct and independent impacts on exercise endurance and physiological responses in lab studies of constant intensity (Otani et al., 2016; Levels et al., 2014).

Comfort, performance, and health and safety are all negatively impacted by heat stress, which is a direct outcome of climate change. Human core body temperature can increase to 41 degrees Celsius during activity (from 37 degrees Celsius at rest), and it may be difficult for the body to cool down in hot and humid environments. As stated by Gassewitz and Radomski (2008), common symptoms of heat stress include vomiting, muscle cramps, cold sweats, lightheadedness, and mental fogginess. Radiation (the transfer of electromagnetic waves), convection (the movement of air), conduction (contact), and evaporation (sweating) are all ways in which the body's temperature can be lowered. When the temperature is high, sweating is the most typical way to cool off. According to research by Graham et al. (2001), 1 litter of perspiration evaporated leads in a heat loss of 600 kcal.

The relative humidity (rh) can exceed 30 degrees Celsius and 70% in several team sports, especially at the highest level. The physical exhaustion from actual games is added to this. Even though at least 25% of matches played at the 2014 Soccer World Cup in Brazil were played in conditions classified as 'high risk' of heat illness/injury (Nassis et al., 2015), major competitions continue to be scheduled in equatorial or Middle Eastern regions (such as the 2022 Qatar Soccer World Cup). Hyperthermia and other negative effects are possible during prolonged high-intensity intermittent exercise due to increased core temperature and individual sweat responses in such extreme environments (Shirreffs

et al., 2005). Both the physical and emotional components of performance could be impacted by these temperature swings in the body.

Performance under normothermia and hyperthermia conditions will be affected by the same factor: the increased work of the respiratory muscles during high-intensity exercise, which causes vasoconstriction and reduces blood flow to the musculature needed for the exercise (Harms et al., 1997; Harms et al., 1998).

Cold Environment

Exercising in a chilly setting has been demonstrated to affect performance as much as exercising in a hot environment. Cold air's impact on the respiratory system is a crucial consideration when planning outdoor winter workouts. Inhaling dry, chilly air during exercise can cause bronchospasm, tightness of the airways that can increase breathing rate. As a result, you have to put in more effort and see less output (Lindberg et al., 2012). In addition to keeping one's physical abilities in good shape, it's crucial to take care of one's mental health as well (Jones et al., 2017; Mugele et al., 2021). The capacity of the circulatory system to provide oxygen to the working muscle, the efficiency with which the metabolism generates sufficient energy mostly from stored substrates, the health of the neuromuscular system, and so on are all crucial.

Optimal performance can't be achieved at a single temperature. Cold air exercise (70% V O 2max for 90 minutes) may benefit from low ambient temperatures because they cause lower muscular temperature, which is detrimental to high-intensity exercise (Galloway & Maughan, 1997). According to research by Smith and Hanna (1975), a guy relaxing in shorts and a vest needs air temperatures between 24 and 268 degrees Celsius, whereas water temperatures between 32 and 348 degrees Celsius are optimal for maintaining body temperature.

No single temperature is ideal for peak performance across the board. Low ambient temperatures that cause decreased muscle temperature are detrimental to high-intensity exercise. Still, they may be advantageous for events like cold-air exercise (70% V O 2max for 90 minutes) (Galloway and Maughan, 1997). For a man wearing shorts and a vest to maintain body temperature while resting, the ambient air temperature must be between 24 and 268 degrees Celsius (Smith and Hanna, 1975), while the water temperature must be between 32 and 348 degrees Celsius.

No single temperature is ideal for peak performance across the board. Performing in temperatures below 208°C may be advantageous for specific events, such as exercise in cold air (70% V O2max for 90 minutes) (Galloway and Maughan, 1997). Still, cold environmental temperatures that lead to reduced muscle temperatures are detrimental to high-intensity exercise (Ball et al., 1999). A man athlete in shorts and a vest would need air temperatures between 24 and 268 degrees Celsius, and water temperatures between 32 and 348 degrees Celsius, to maintain body temperature while at rest.

Many studies have demonstrated that as the temperature of working muscles drops, dynamic performance decreases by roughly 10% (Sargeant, 1987). This is especially true during high-intensity exercise. Multiple factors, including fast-twitch fiber recruitment, thermogenesis, and a larger proportion of anaerobic glycolysis, contribute to athletes' poor performance in cold conditions,

as shown by VO2sub and VO2 peak tests (Lindberg et al., 2012). Marathon runners actually did better when the race was held at a temperature of around 14 degrees Celsius. Because of the mild chill in the air, runners didn't overheat but also didn't suffer any ill effects from their bodies' attempts to regulate their temperature (Peiser et al., 2006). atmosphere (Smith & Hanna 1975).

Effect of sport activities on the environment

One of the most consequential discoveries for enhancing environmental conditions is the significance of infrastructure and building. Sporting event managers need to consider the negative and influential effects of sloppy building practices and subpar infrastructure on the surrounding environment. The first step toward mitigating the environmental impact of sporting events may be to conduct market research on supporters and spectators to ensure they understand the series and its environmental message. Second, if it turns out that these huge sporting events do have an adverse effect on the environment, they can still be a force for good by drawing attention to the necessity of social change. It's heartening that there will be a forum for discussing environmental concerns at the athletic event. Good news for anyone working in the field, as this could lead to more series focusing on sustainable/climate innovations/agenda. Therefore, the sporting event can recognize their fans' vital role in battling climate change and incorporate steps to address climate change and environmental concerns into their sustainability strategy (Pourpakdelfekr, and Oboudi, 2022).

Conclusion

1- The majority of research indicates that moderate and high levels of outdoor air pollution may be harmful to the health of the general public and athletes in particular.

2- Air pollution is a persistent problem, especially for those who suffer from asthma, allergies or lead active lifestyles.

3- Because of the increased minute ventilation brought on by the metabolic demands of exercise, athletes are particularly vulnerable to this impact.

Conflict of interests

The authors do not declare any conflict of interest.

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