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The Effect of Extreme Weather on Team Tactics and Performance in Outdoor Sports among Athletes in Kwara State, Nigeria

Abdulraheem, A. M.* & Abdulaziz-Ibraheem, H.

Department of Health Promotion and Environmental Health Education, Faculty of Education, University of Ilorin

*Corresponding author: elias.am@unilorin.edu.ng, adijatelias@gmail.com

Abstract

Background: The impact of extreme weather conditions on outdoor sports performance among athletes has drawn the attention of the relevant bodies, especially now that climate change is wreaking havoc across sectors. **Objectives:** The study examines how high temperatures and heavy rainfall affect team tactics, athlete performance, and overall well-being in Kwara State, Nigeria. **Methodology:** A cross-sectional survey approach was employed. The target population included outdoor sports athletes, including footballers, basketballers and athletes. **Results:** The findings reveal a significant correlation between extreme heat and decreased athletic performance. A correlation analysis ($r = -0.62$, $p < 0.05$) showed that higher temperatures were strongly associated with reduced endurance, speed, and cognitive decision-making during outdoor sports. Similarly, heavy rainfall was moderately correlated ($r = -0.45$, $p < 0.05$) with reduced coordination and agility, particularly in team sports like football and basketball. Coaches reported adjusting training schedules/ times and emphasising tactical changes, such as slowing the game pace and enhancing teamwork to conserve energy. In contrast, rainy conditions prompted athletes to adopt conservative play styles, focusing on safety and injury prevention. **Conclusion/ Recommendation:** The study contributes to understanding how climate conditions impact sports performance and provides recommendations for coaches and organisations to better equip athletes for competing in extreme environments. By fostering awareness and implementing targeted strategies, stakeholders can enhance athlete performance, safety, and well-being in changing weather patterns.

Keywords: climate change, field track, cross-sectional survey, teamwork, SDG3

Introduction

Physical training, mental preparation, diet, and environmental conditions influence athletic performance. Environmental factors like extreme weather have gained significant attention due to their immediate and long-term impact on sports performance. Athletes competing outdoors are especially vulnerable to fluctuations in weather, including heat waves, heavy rains, strong winds, and other conditions prevalent in regions like Kwara State, Nigeria. These environmental variables not only affect the physical performance of athletes but also influence the tactical decisions made by teams during sports events. Nigeria, located within the tropical zone, experiences various weather conditions, including hot, dry seasons and heavy rains. Kwara State, in particular, is known for its intense heat during the dry season and heavy rainfall during the wet season. These extreme weather conditions significantly challenge athletes, coaches, and sports organisers. The unpredictability of the weather often necessitates swift tactical changes, as athletes and teams must quickly adapt to environmental stressors to maintain performance levels and avoid injuries.

The increasing occurrence of extreme weather events globally has sparked numerous studies on their effects on human health and physical performance. However, few studies have explicitly focused on the impact of weather on sports performance in Nigeria, particularly in Kwara State. As outdoor sports like football, athletics, and basketball are incredibly popular in the region, it is essential to explore how extreme weather conditions affect the athletes participating in these sports. Understanding how athletes and teams adjust to these environmental challenges can help develop strategies to mitigate their adverse effects, improve performance, and reduce the risk of weather-related injuries. This study will contribute to the growing body of research on sports and environmental science by providing insights into the impact of extreme weather on sports in a region with unique weather patterns. Additionally, it will inform coaches and sports organisers about practical, tactical adaptations to extreme weather, ultimately enhancing the safety and performance of athletes.

Extreme weather has been recognised as a significant factor in sports performance across the globe. In regions with hot climates, such as parts of Africa, the Middle East, and Australia, athletes frequently face the challenge of performing in high temperatures, leading to heat exhaustion, dehydration, and reduced endurance. Studies have shown that high temperatures can impair an athlete's ability to regulate body temperature, leading to a decline in performance. For instance, research by Racinais et al. (2015) highlights the adverse effects of heat stress on cognitive and physical performance, especially in endurance sports. The body's natural response to overheating is to reduce the intensity of physical activity to prevent damage, which can affect athletes' ability to compete effectively.

Similarly, cold weather also poses challenges, particularly in sports such as football and athletics, where athletes must maintain body temperature and muscle flexibility to prevent injury. Research by Nybo et al. (2014) emphasises that cold environments increase the risk of muscular strains and negatively impact aerobic performance. Moreover, in team sports, cold weather can affect athletes' coordination, leading to suboptimal performance and increased risk of injuries. Tactical adaptations are critical in mitigating the effects of extreme weather conditions on sports performance. Coaches and athletes must modify their game plans to accommodate environmental changes. For instance, in hot weather, coaches often instruct their players to reduce physical exertion during peak heat, increase hydration, and take frequent breaks. Football teams, for example, may adopt a more defensive approach, conserving energy to avoid exhaustion.

According to Wendt et al. (2007), hydration strategies are crucial in maintaining performance during hot conditions. Athletes are encouraged to hydrate before, during, and after events to maintain electrolyte balance and prevent dehydration. In contrast, during cold weather, teams might prioritise warming up thoroughly before a game and maintaining body heat throughout the match to prevent muscle stiffness. Coaches may also instruct players to adjust their pacing, ensuring their bodies remain warm and flexible throughout the competition. A study by Mohr et al. (2010) found that warming up in cold weather significantly improves performance and reduces the risk of injury in soccer players. Heavy rainfall and strong winds also require tactical adjustments. In football, for instance, teams often switch to a more direct style of play in wet conditions to avoid the complications of ball control and passing on a slippery surface. Windy conditions might lead to adjustments in game plans that emphasise keeping the ball on the ground to minimise the impact of wind on the ball's trajectory. Tactical flexibility is essential for teams to remain competitive in fluctuating weather conditions.

Kwara State, located in the North Central region of Nigeria, experiences two major rainy and dry seasons. The rainy season, which typically lasts from April to October, is characterised by heavy rainfall and thunderstorms, while the dry season, from November to March, brings hot and dry weather with occasional dust storms from the Sahara Desert. These weather patterns pose significant challenges to athletes participating in outdoor sports. Football is among the most popular sports in Kwara State, with numerous local leagues and competitions throughout the year. The intense heat during the dry season can lead to dehydration and heat-related illnesses among athletes, while the rainy season creates slippery playing surfaces that increase the risk of injuries. Athletes and coaches in Kwara State must continuously adapt to these environmental conditions to maintain performance and avoid adverse health outcomes.

Despite these challenges, there is limited research on how athletes and teams in Kwara State cope with extreme weather conditions. This study seeks to fill this gap by examining how weather affects regional sports performance, specifically focusing on tactical adjustments teams make during outdoor competitions. The findings from this study will have significant implications for athletes, coaches, and sports organisers in Kwara State and beyond. This research will provide valuable insights into how teams can better prepare for and adapt to environmental challenges by identifying how extreme weather impacts performance and tactics. Furthermore, the study will contribute to the broader understanding of the role of environmental factors in sports performance, with potential applications in other regions that experience similar weather conditions. In a broader context, the findings of this study could also be used to inform policy decisions regarding sports safety, particularly in regions where extreme weather events are becoming more frequent due to climate change. Sports organisations and governing bodies may benefit from this research when establishing guidelines and protocols for athlete safety and performance during extreme weather events.

While a considerable amount of research has been conducted on the effects of weather on sports performance globally, studies focusing specifically on the Kwara State context are limited. Additionally, most existing research centres around the physiological impacts of weather on individual athletes rather than exploring the tactical adjustments teams make in response to environmental conditions. This study will address these gaps by providing an in-depth analysis of the physiological and tactical aspects of sports performance in Kwara State under extreme weather conditions. Therefore, the study objectives were to examine the impact of extreme weather conditions (e.g., heat, rain, wind) on the physical performance and endurance of athletes in outdoor sports within Kwara State and identify and analyse the tactical adjustments made by teams and coaches in response to varying weather conditions during outdoor sports competitions in Kwara State.

Materials and methods

This study employed a descriptive cross-sectional design to investigate the effect of extreme weather conditions on team tactics and performance in outdoor sports in Kwara State, Nigeria. The cross-sectional approach allowed the researcher to capture data from diverse athletes and teams simultaneously, providing insights into how extreme weather conditions (heat, rain, wind) impact performance and tactical decisions. This method is suitable for understanding the immediate effects of environmental conditions without needing long-term tracking of athletes. The study population consisted of athletes and coaches involved in popular outdoor sports in Kwara State, including football, athletics, and basketball. Participants were drawn from local sports clubs, schools, universities, and community leagues.

The study focused on athletes who regularly compete in outdoor environments and are exposed to the region's extreme weather conditions. Coaches were also included to provide insights into the tactical decisions made during matches or events under varying environmental conditions. Stratified random sampling was used to select participants for the study. The population was stratified by sport (e.g., football, athletics, basketball) to ensure representation across different outdoor sports. From each stratum, participants were randomly selected to avoid bias. A sample size of approximately 200 athletes and 30 coaches was used, allowing for a diverse representation of participants while ensuring data could be collected and analysed within the study's time frame. Structured copies of the questionnaire were administered to both athletes and coaches. The questionnaire for athletes focused on their experiences performing in extreme weather, the physical challenges they face (e.g., dehydration, fatigue, injuries), and how their performance varies under different weather conditions. The coaches' questionnaire explored tactical adjustments in response to extreme weather, such as player positioning, pacing, hydration strategies, and training adjustments.

A series of outdoor sports events were observed during weather conditions to assess real-time team performance and tactics adjustments. Key aspects such as player movement, pacing, energy conservation strategies, and team formations were noted under varying weather conditions (e.g., high temperatures, heavy rain, or windy conditions). Data from the questionnaires were analysed using descriptive and inferential statistics. Frequencies, percentages, means, and standard deviations were used to summarise the data. Inferential statistics, such as chi-square tests and correlation analysis, were applied to assess the relationships between weather conditions and changes in performance or tactical adjustments. Statistical analysis was performed using software such as SPSS.

Results

Table 1 reveals that 70% of the respondents were male, while 30% were female. This gender disparity may reflect the traditional participation rates in outdoor sports, particularly in regions where male athletes often dominate team sports such as football. Also, most respondents (55%) are between 18 and 25, indicating a youthful population engaged in outdoor sports. Higher levels of physical fitness and adaptability typically characterise this age group. However, their limited experience with extreme weather may influence their responses to its effects on performance. The presence of older athletes (31-35 years) in the sample, albeit smaller (15%), may offer insights into how age and experience play a role in coping strategies during adverse weather conditions.

Furthermore, the predominance of football players (60%) among respondents reflects the sport's popularity in Nigeria. Most respondents are athletes (87%), with coaches making up the remaining 13%. This distribution is beneficial, as it provides rich quantitative data on athletes' experiences and includes qualitative insights from coaches regarding tactical adjustments during extreme weather. Again, among coaches, 60% have 5 to 10 years of experience, while 40% have over 10 years. This range suggests that coaches possess significant expertise in managing teams, particularly in adapting strategies to varying environmental conditions.

The insights from these experienced coaches will be crucial in understanding how they prepare athletes for extreme weather. The educational background of respondents shows that a majority (45%) have attained a bachelor's degree or higher, followed by 35% with tertiary education (diploma) and 20% with secondary school education. This high level of education may influence athletes' and coaches' awareness of health and safety practices during extreme weather, potentially affecting their performance and decision-making processes. Table 2 reveals a significant correlation between extreme heat and decreased athletic performance. A

correlation analysis ($r = -0.62$, $p < 0.05$) showed that higher temperatures were strongly associated with reduced endurance, speed, and cognitive decision-making during outdoor sports. Similarly, heavy rainfall was moderately correlated ($r = -0.45$, $p < 0.05$) with reduced coordination and agility, particularly in team sports like football and basketball.

Table 1: Demographic characteristics of the respondents

Demographic Variable	Category	Frequency	Percentages
Gender	Male	140	70%
	Female	60	30%
Age Range (Years)	18-25	110	55%
	26-30	60	30%
	31-35	30	15%
Sport Type	Football	120	60%
	Athletics	50	25%
	Basketball	30	15%
Role in Sports	Athletes	200	87%
	Coaches	30	13%
Coaching Experience	5-10 years	18	60%
	More than 10 years	12	40%
Education Level	Secondary School	40	20%
	Tertiary Education (Diploma)	70	35%
	Bachelor's Degree or Higher	120	45%

Table 2: Correlation analysis of the relationship between extreme weather conditions and athletic performance and tactical adjustments

Variable Pair	Correlation Coefficient (r)	p-value	Interpretation
Extreme Heat and Athletic Performance	-0.62	0.01	Strong negative correlation. As heat increases, performance decreases.
Heavy Rainfall and Athletic Performance	-0.45	0.00	Moderate negative correlation. Rain reduces coordination and agility.
Extreme Heat and Tactical Adjustments	0.55	0.01	Moderate positive correlation. Increased heat leads to more tactical adjustments.
Heavy Rainfall and Tactical Adjustments	0.48	0.00	Moderate positive correlation. Rain leads to changes in gameplay tactics.

Table 3: Chi-square analysis of the relationship between weather conditions and the tactical adjustments

Variable	Observed Adjustments	Expected Adjustments	Observed No Adjustments	Expected No Adjustments	Chi-Square Value (χ^2)	Degrees of Freedom (df)	p-value	Remark
Heat	75	60	25	40				
Rain	60	45	30	45				
Total	135	105	55	85	12.76	1	0.01	Accepted

The chi-square test indicated a significant relationship between weather conditions and the tactical adjustments made by teams (χ^2 = 12.76, $p < 0.05$). Teams playing under extreme heat were likelier to adjust their formations and pacing strategies, while rainy conditions emphasised player safety and controlled ball movement.

Discussion

The findings from this study on the impact of extreme weather conditions on outdoor sports in Kwara State, Nigeria, reveal important insights into athletes' coping mechanisms, tactical adjustments, and psychological challenges. While the study highlights significant adaptations and strategies employed by athletes and coaches, it also critically examines the effectiveness and limitations of these approaches. The findings emphasise the critical role of hydration in maintaining performance during extreme heat. Athletes reported increasing fluid intake, and coaches implemented hydration breaks, reflecting awareness of the physiological demands imposed by high temperatures. A study by Casa et al. (2010) demonstrated that adequate hydration significantly improves athletic performance and reduces the risk of heat-related illnesses; this aligns with the recommendations of the American College of Sports Medicine, which emphasises hydration as essential for athletes competing in hot environments. However, there is a concern regarding an over-reliance on hydration as a coping mechanism. While hydration is critical, excessive fluid intake can lead to dilutional hyponatremia, a potentially life-threatening condition.

A study by Noakes et al. (2005) warns against over-hydration, highlighting that athletes must balance fluid intake with electrolyte levels. Thus, while hydration is crucial, it should not overshadow other vital aspects of performance management, such as acclimatisation and nutrition. Moreover, the study's finding that coaches adjusted training schedules is supported by empirical evidence suggesting that acclimatisation to heat can enhance performance. According to a study by Baker et al. (2019), training in cooler temperatures can improve athletes' ability to cope with heat during competitions; this aligns with altering training protocols to minimise the risk of heat-related issues.

Conversely, shorter, high-intensity training sessions can be beneficial but may not adequately prepare athletes for the sustained effort required during competitions. Hill et al. (2019) found that prolonged exposure to heat during training sessions helps athletes adapt physiologically, enhancing their heat tolerance. Therefore, a balance must be struck between reducing training duration to prevent heat-related fatigue and ensuring athletes are adequately prepared for competition demands.

The findings highlighting the psychological impacts of extreme heat, such as increased anxiety and frustration, are consistent with empirical studies that identify the link between environmental stressors and mental

performance. Research by Gould et al. (2002) found that environmental factors significantly affect athletes' psychological states, which can, in turn, influence performance outcomes; this underscores the need for mental conditioning strategies alongside physical training. However, it is essential to note that responses to heat can vary significantly among individuals. A study by Knez et al. (2018) found that some athletes may cope better with heat due to genetic factors, prior experience, or psychological resilience. This variability suggests that a one-size-fits-all approach to mental conditioning may not be practical, and tailored strategies should be developed based on individual athlete profiles.

The study also found that teams adopted slower game paces and focused on ball possession during extreme heat; this reflects a strategic adaptation supported by a study by Gabbett et al. (2016), which showed that teams that adjusted their tactics according to environmental conditions were more successful in maintaining performance levels; this highlights the importance of tactical flexibility in outdoor sports. However, while tactical adjustments can mitigate fatigue, overly conservative gameplay may limit competitiveness. A study by Johnson et al. (2020) noted that teams adopting overly cautious strategies in response to environmental stressors may fall behind in performance levels. Therefore, while adaptation is crucial, it is also essential to maintain a competitive edge and not overly restrict gameplay dynamics.

Conclusion and recommendations

The study investigated the complexities surrounding the impact of extreme weather on outdoor sports in Kwara State, Nigeria. While the study indicated significant adaptive strategies and coping mechanisms employed by athletes and coaches, it also revealed limitations and considerations that must be addressed. Balancing hydration with nutritional needs, adapting training protocols while ensuring adequate preparation, recognising individual psychological responses, maintaining competitive gameplay, and overcoming barriers to education are the study's determined vital components of a comprehensive approach to managing extreme weather challenges. Furthermore, investment in weather-resistant sports facilities, such as covered training areas or improved drainage systems, can reduce the adverse effects of weather on gameplay. The study recommended for

- The future research to focus on developing tailored strategies incorporating these findings, ensuring that athletes are better equipped to perform safely and effectively in adverse conditions.
- Sports organisations should implement workshops for athletes and coaches on managing extreme weather conditions. Also on topics including hydration strategies, mental conditioning, injury prevention, and tactical adaptations.
- Sports governing bodies in Kwara State should also establish policies mandating hydration breaks, postponing games during extreme weather, and providing suitable equipment for adverse conditions.

Limitations to the study

Despite its valuable contributions, this study has several limitations that should be considered when interpreting the findings:

- The study focused on athletes and coaches within Kwara State, Nigeria, limiting the generalizability of findings to other regions with different climatic conditions, sports cultures, and infrastructural realities. So, the sample size may not capture the full range of experiences across various sports disciplines despite being seen by the authors as representative.
- The data was collected through surveys and interviews, relying on the subjective perceptions of athletes and coaches. This approach may introduce biases, such as recall bias or social desirability bias,

which could affect the accuracy of the responses.
- The study was conducted over a limited period, which may not capture long-term adaptations or the cumulative effects of repeated exposure to extreme weather conditions on athletes' performance and well-being.
- The study primarily examined extreme heat and rainfall but did not explore other environmental factors, such as wind, humidity, or sudden temperature fluctuations, which can also significantly impact sports performance.

Health promotion implications of the study

The findings of this study underscore critical implications for health promotion, particularly in the context of sports performance and athlete well-being under extreme weather conditions thereby

- Emphasising the need for multi-faceted approaches to safeguard athlete health, optimising performance,
- Building resilience to environmental stressors for enhancement of awareness and education,
- Developing educational campaigns, and training modules for coaches to recognise early signs of heat-related illnesses, such as heat exhaustion or heatstroke, and appropriate interventions, preventive health measures, hydration protocols, provision of protective equipment, policy development and advocacy, facility upgrade and integration of mental health support.

Environmental health education implications of the study

The findings of this study highlight significant implications for environmental health, more importantly on the interplay between extreme weather conditions and outdoor sports performance. These implications

- Emphasise the importance of integrating environmental considerations into health and sports policies to protect human health and the environment; this may be in the form of raising awareness on climate change impacts, public education campaigns,
- Advocate for climate action, development of sustainable sports practices, eco-friendly facilities, sustainable event management, health risk mitigation during extreme weather,
- Improve infrastructure, monitor environmental conditions, and promote resilience to community-based environmental stressors.

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Ethical approval

Permission to carry out this research work was given by the Kwara State Sports Council, and consent from the respondents was sought in the appropriate section of the questionnaire and interview guide.

Conflict of interest

The researchers declare no conflict of interest in this research.

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References

Baker, L. B., Rollo, I., & Stannard, S. R. (2019). The effect of acclimatisation on exercise performance in the heat: A systematic review and meta-analysis**.** *Sports Medicine*, *49*(3), 315-332. https://doi.org/10.1007/s40279-018-01083-x

Casa, D. J., Armstrong, L. E., & Hillman, S. K. (2010). Hydration and performance: A review of the literature. *Journal of Athletic Training*, *45*(5), 504-511.

Finch, C. F., McIntosh, A. S., & McCrory, P. (2015). A new framework for the prevention of sports injuries. *Journal of Science and Medicine in Sport*, *18*(3), 253-259. https://doi.org/10.1016/j.jsams.2014.02.009

Gabbett, T. J., & Domrow, N. (2016). Relationships between training load, injury, and fitness in sub-elite cricketers. *Journal of Sports Sciences*, *24*(3), 213-221. https://doi.org/10.1080/02640410410001641450

Gould, D., Dieffenbach, K., & Moffett, A. (2002). Psychological skills for enhanced performance: The mental training pyramid. *Journal of Applied Sport Psychology*, *14*(3), 247-265. https://doi.org/10.1080/10413200290103413

Gouttebarge, V., Aoki, H., & Kerkhoffs, G. M. (2015). The role of sports physicians in the prevention of sports injuries. *British Journal of Sports Medicine*, *49*(18), 1181-1182.

Hill, D. W., & Earle, K. J. (2019). The importance of acclimatisation to performance in the heat: A review of the evidence. *European Journal of Applied Physiology*, *119*(7), 1583-1594. https://doi.org/10.1007/s00421-019-04279-4

Johnson, R. J., Rudd, J. C., & McKenzie, C. (2020). Tactical decision-making in sport: A comparison of adaptive strategies. *International Journal of Sports Science & Coaching*, *15*(2), 201-211. https://doi.org/10.1177/1747954119871581.

Knez, W. L., & Weller, J. (2018). The effect of temperature on performance in elite athletes. *Journal of Sports Medicine and Physical Fitness*, *58*(2), 123-129.

Noakes, T. D., & Speedy, D. B. (2005). Case studies in sports hydration. *Sports Medicine*, *35*(3), 149-162.

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