

9-30-2025

The Impact of Hot and Arid Conditions on Dehydration Levels, Some Physiological Variables, and the Performance Some of Basic Basketball Skills

Ahmed Hassan Yas

College of Physical Education and Sports Science, Al-Mustansiriya University,
yasahmedhasan@uomustansiriyah.edu.iq

Fatmah Abd-Alredah Hatam

College of Physical Education and Sports Science, Al-Mustansiriya University, fatimah-redhaH@uomustansiriyah.edu.iq

Follow this and additional works at: <https://jcopew.uobaghdad.edu.iq/journal>

Recommended Citation

Yas, Ahmed Hassan and Hatam, Fatmah Abd-Alredah (2025) "The Impact of Hot and Arid Conditions on Dehydration Levels, Some Physiological Variables, and the Performance Some of Basic Basketball Skills," *Modern Sport*: Vol. 24: Iss. 4, Article 2.

DOI: <https://doi.org/10.54702/2708-3454.2090>

This Original Study is brought to you for free and open access by Modern Sport. It has been accepted for inclusion in Modern Sport by an authorized editor of Modern Sport.



ORIGINAL STUDY

The Impact of Hot and Arid Conditions on Dehydration Levels, Some Physiological Variables, and the Performance Some of Basic Basketball Skills

Ahmed Hassan Yas *, Fatmah Abd-Alredah Hatam

College of Physical Education and Sports Science, Al-Mustansiriya University

Abstract

The atmosphere in Baghdad and most regions of Iraq during the summer is characterized by extreme heat and aridity. These climatic conditions are among the negative factors that significantly impact cognitive function and the performance of athletic skills.

Consequently, The current study was designed to investigate the impact of hot and arid conditions on dehydration levels, specific physiological indicators, and the performance of key basketball skills among first-stage students at Al-Mustansiriya University. A sample of 30 students was randomly divided into a control group and an experimental group. The control group was permitted to consume water and fluids *ad libitum* (as needed) before the practical lecture. In contrast, the experimental group was prohibited from consuming water and fluids before and during the physical and skill exercises of the lecture, except in critical cases.

Following the practical session, physiological indicators were measured (body temperature, pulse rate, and body weight to determine dehydration levels). Lactic acid concentration was also measured, and skill tests were administered (chest pass and free throw).

After data collection, the results were processed statistically. Several conclusions were drawn. The hot and dry environment significantly affected dehydration levels during physical and skill exercises. This impact was markedly more severe in the experimental group, which was restricted from fluid intake, though the control group was also affected to a lesser degree. These conditions also adversely affected the physiological indicators (increased pulse rate and body temperature) and led to an elevated level of lactic acid.

Based on these findings, the researcher recommends providing ample and regular access to water and fluids during practical lectures. Furthermore,

Keywords: Hot and dry atmospheres, Dehydration level, Physiological variables, Basketball skills

1. Introduction

The climate of Baghdad and Iraq in general during the summer is characterised by high temperatures and aridity, which significantly and negatively impacts learning and physical performance. This is particularly true for the sport of basketball, which demands high levels of physical strength and mental concentration.

“The onset of summer and the rise in temperature and humidity pose specific challenges for athletes, namely an increase in the amount of heat generated

within the body. The inability to dissipate Exposure to high temperatures can result in a variety of serious health conditions collectively referred to as heat-related illnesses.” (Mujika et al., 2010, p. 222).

In the realm of sport, particularly team games like basketball, “maintaining adequate hydration is considered a critical factor for ensuring optimal performance. Fundamental skills such as shooting, passing, and dribbling require a high level of coordination between neurological and muscular functions, which are adversely affected by dehydration” (Baker et al.,

Received 4 September 2025; revised 17 September 2025; accepted 22 September 2025.
Available online 30 September 2025

* Corresponding author.

E-mail addresses: yasahmedhasan@uomustansiriyah.edu.iq (A. Hassan Yas), fatimah-redhaH@uomustansiriyah.edu.iq (F. Abd-Alredah Hatam).

<https://doi.org/10.54702/2708-3454.2090>

2708-3454/© 2025 The Author(s). Modern Sport. This is an open access article under the CC BY 4.0 Licence (<https://creativecommons.org/licenses/by/4.0/>).

2020). Numerous studies have shown that “a body fluid loss of 2% of body weight can lead to a noticeable decline in athletic performance, including reduced accuracy, strength, and endurance” (Judelson et al., 2018).

Dehydration and elevated body temperature directly impact key physiological functions in players or students. This includes an increase in lactic acid levels. This occurs because blood volume decreases when the body loses water through sweat without adequate replacement. Consequently, less oxygen reaches the working muscles. Muscles operating without sufficient oxygen (anaerobic metabolism) begin to produce energy but generate lactic acid as a by-product.

“Dehydration increases cardiovascular strain and raises core body temperature during exercise. It also indicates that a dehydration level of 2% of body weight (a common level) significantly impairs performance and accelerates the onset of fatigue, which can manifest in an increased lactate production rate.” (Sawka et al., 2007).

Many researchers have studied the effect of hot conditions on physical and physiological variables, including studies by Al-Horani et al. (2021), Donnan and Williams (2021), and Périard et al. (2021).

The importance of this research lies in understanding the impact of hot and dry conditions on hydration levels, some functional variables, and the performance level of some fundamental basketball skills during practical basketball sessions for students at the College of Physical Education and Sport Science, Al-Mustansiriya University. This risk stems from increased dehydration, which is caused by high temperatures coupled with insufficient water and fluid intake. Maintaining continuous hydration during practical sessions in colleges of physical education and sport science is essential to mitigate this risk.

1.1. Research problem

Based on the researcher’s experience as a lecturer in basketball at the College of Physical Education and Sport Science, Al-Mustansiriya University, the researcher observed noticeable fatigue and exhaustion among students during basketball training sessions, particularly in the second semester. The climate during this semester, starting in April and May, is very dry and hot in Baghdad, with temperatures reaching between 43 and 45 degrees Celsius. This leads to significant fluid loss through sweating, resulting in dehydration. This has a clear effect on the students’ physical capacities, functional variables, concentration levels, and decision-making ability,

causing slower reaction times and impairing the performance of fundamental basketball skills.

1.2. Objectives

- 1- The Effect of Training in Hot and Dry Environments on the Dehydration Levels
- 2- Determination of training variables in hot and dry climates on specific physiological indicators of the sample
- 3- To Identify the Effect of Training in Hot and Dry Environments on the Performance of Fundamental Basketball Skills.

1.3. Hypotheses

- 1- There is a statistically significant effect of training in hot and dry environments on the level of dehydration among the research sample.
- 2- There is a statistically significant effect of training in hot and dry environments on specific physiological variables.
- 3- There is a statistically significant effect of training in hot and dry environments on the performance of fundamental basketball skills.

1.4. Scope of the research

- Human Scope: First-year students of the College of Physical Education and Sport Sciences, Al-Mustansiriya University.
- Temporal Scope: From 1st April 2025 to 15th May 2025.
- Spatial Scope: The outdoor courts and playing fields of the College of Physical Education and Sport Sciences and the outdoor facilities of Al-Mustansiriya University.

2. Methodology

The researcher employed the experimental method, deemed appropriate for the nature of the problem, as it aims to measure the direct effect of an independent variable (hot and dry conditions) on dependent variables (hydration level, and specific physiological and skill-related variables).

2.1. Research population and sample

The research population consisted of first-year students from the College of Physical Education and Sport Science at Al-Mustansiriya University, morning study programme, totalling 272 students. The research sample comprised first-year students from Section E, numbering 36 students. Following a pilot

experiment, 6 students were excluded, resulting in a final sample size of 30 students. This represents 11.03% of the research population. The study groups (control and experimental) were formed by random lottery, with each group comprising 15 students.

2.2. Data collection methods and instruments used

2.2.1. Data collection methods

For data collection, the researcher employed a comprehensive methodology that incorporated diverse practical sources to ensure all aspects of the topic were covered. These included:

- Books, references, and scientific articles.
- Specialised websites dedicated to sport sciences.
- Personal interviews with experts and specialists.
- Laboratory result forms.
- Similar and previous studies.

2.2.2. Instruments used

- A digital medical scale for measuring weight.
- (10) basketballs.
- A basketball court.
- A measuring tape.
- A digital thermometer for measuring temperature.
- A lactate analyser for measuring lactic acid.

3. Measurements used in the research

Following a comprehensive review of the scientific literature and electronic databases, the researcher selected a set of tests and measurements suitable for the nature and objectives of the study. These measurements were carefully chosen to ensure accuracy in testing, thereby enhancing the validity and reliability of the results.

Measurement of **dehydration percentage** to calculate the percentage of fluid loss relative to body weight before and after exertion.

Resting percentage

$$= \frac{\text{Pre-workout weight} - \text{Post-workout weight}}{\text{Pre-workout weight}} \times 100$$

3.1. Physiological measures

- Heart Rate (HR): Measured at rest and post-exertion.
- Core Body Temperature: Measured using a thermometer.
- Blood Lactate: To measure muscular fatigue.

3.2. Skill performance tests

3.2.1. The push-pass accuracy test

(Chest Pass) (Al-Khalifa & Al-Ghareeb, 2013)

- Purpose: To measure the accuracy of the two-handed chest pass towards a target.
- Apparatus: One basketball, a smooth wall marked with three concentric circles. The inner circle has a diameter of 45 cm, the middle circle 98 cm, and the outer circle 150 cm. All lines are 2.5 cm wide. The bottom of the outer circle is positioned 90 cm from the floor. A line is drawn on the floor 7.5 m from, and facing, the wall.
- Procedure: The subject stands behind the throwing line marked on the floor. Upon the start signal, the subject performs a two-handed chest pass towards the three circles, attempting to hit the target.

3.2.2. Administration conditions

- The test must be performed using both hands.
- The pass must be executed from behind the floor line.
- The subject is permitted to take one step during the pass, provided they do not touch or cross the line.
- Each subject performs ten (10) passes.

3.2.3. Scoring

- A pass hitting the inner circle scores 3 points.
- A pass hitting the middle circle scores 2 points.
- A pass hitting the outer circle scores 1 point.
- If the ball hits the line between two circles, the subject is awarded the higher score of the two adjacent circles.
- The maximum total score achievable is 30 points.

3.2.4. The free throw test

(Abdullah & Hamoudat, 1999)

- Aim of the Test: This test is designed to measure free throw shooting skill in basketball.
- Apparatus and Equipment: One basketball goal (hoop and backboard) and one official basketball.
- Test Procedure: Each subject is allotted ten (10) attempts, taken from behind the free throw line. The subject may perform the free throws using any shooting technique they prefer. The throws are to be executed in two sets of five shots each.

Upon completion, the next subject begins their attempts. This process continues until it is once again the first subject's turn to perform their second set of

five throws, and so on, until all ten throws have been completed by each subject.

3.2.5. Test conditions

- The subject is permitted to perform practice shots prior to the commencement of the test for trial purposes.
- Each subject is entitled to perform ten throws.
- The shooting action must be performed from behind the free throw line.
- Scoring:
- One point is awarded for each successful basket, irrespective of the manner in which the ball enters the hoop (e.g., swish, off the backboard).
- A score of zero is recorded for any missed attempt.
- The maximum achievable score is ten points (one point per successful throw).

3.3. Exploratory study

A pilot study was conducted on Thursday, 1st May 2025, at the outdoor court of the College of Physical Education and Sport Sciences. The study was carried out by the research assistants under the direct supervision of the principal investigator on a cohort of six (6) students, who were subsequently excluded from the main study sample.

The exploratory study aimed to:

- The validity and suitability of the selected tests.
- The time duration required to administer the test battery.
- The competence and efficiency of the assistant research team.

3.4. Pre-tests

Pre-tests were conducted on Monday, 5 May 2025, at the College of Physical Education and Sport Sciences, Al-Mustansiriya University. Resting heart rate and blood lactate levels were measured for both the control and experimental groups. Subsequently, student body weight was measured using a medical scale to assess dehydration levels. Furthermore, The temperature of the sample members of both groups was measured by a thermometer Following the completion of these physiological measurements, skill-based tests were administered to both the control and experimental groups: the chest pass test and the free throw test.

It is noteworthy that the experimental group was not permitted to consume water or any other fluids prior to or during the basketball practical lecture exercises. This was in contrast to the control group, who

were allowed to drink sufficient amounts of water and hydrate themselves before the start of the practical session. The maximum recorded temperature in Baghdad on this day was 45 °C.

3.5. Practical procedures

Following the pilot study and the pre-tests and measurements, the practical basketball session for the first-year students commenced. The session was held in the indoor sports hall of the College of Physical Education and Sport Sciences at Al-Mustansiriya University, with 30 students representing the control and experimental groups. Exercises were conducted inside the sports hall to avoid the risk of heatstroke among the students. It should be noted that the sports hall was not air-conditioned; the external ambient temperature was 42°C with a humidity level of 25%.

The practical basketball lecture curriculum was applied to both groups with identical exercise intensity and volume. However, the experimental group was prohibited from consuming water and fluids except in critical cases. The total duration of the practical session was 90 minutes, divided as follows: 15 minutes of warm-up at a light to moderate intensity; a 15-minute instructional component within the main session; a 45-minute applied component at a moderate to high intensity; and a 15-minute cool-down period comprising recovery exercises.

3.6. Post-tests

Post-tests were conducted on the same day, 5th May 2025, at 2:00 pm. The ambient temperature was 42 °C with a humidity level of 25%. Immediately following the conclusion of the applied component of the basketball practical session, body weight, pulse rate, and body temperature were measured post-exercise. After these measurements were completed, blood lactate levels were measured approximately 5 minutes post-exercise. Finally, the skill-based tests (chest pass and free throw tests) were administered. Upon completion of all tests, all students from both groups were permitted to rehydrate.

3.7. Statistical methods used

The results were analyzed using the Statistical Package for the Social Sciences (SPSS). The following statistical operations were employed:

1. Arithmetic Mean, Standard Deviation, Skewness Coefficient, Paired-Samples T-Test

Table 1. Results of the pre- and post-tests and measurements for the control group.

Variables	Unit of Measur	Pre-test Control		post-test Control		Calculated t-value	Tabulated t-value	Significance
		M	SD	M	SD			
Weight	Kg	71.87	3.46	68.74	2.99	1.839	2.145	NS
Heart Rate	Bpm	74.43	3.12	137	4.5	3.23		Sig.
Temperature	°C	36.36	0.44	37.3	0.55	5.58		Sig.
Lactic Acid	ml/l	1.52	0.89	6.5	2.11	3.79		Sig.
Chest Pass	Points	21.6	1.89	22.12	2.03	2.340		Sig.
Free Throw	Points	6.47	1.31	7.6	1.12	2.671		Sig.
Dehydration Rate		4.36 %						

Under a significance level of $n-1$ and a degree of freedom of 0.05.

Table 2. Results of the pre- and post-tests and measurements for the experimental group.

Variables	Unit of Measurement	Pre-test		post-test		Calculated t-value	Tabulated t-value	Significance
		M	SD	M	SD			
Weight	kg	71.17	3.07	67.34	3.67	2.011	2.145	NS
Heart Rate	bpm	75.5	3.83	183	2.45	3.38		Sig.
Temperature	°C	36.3	0.18	38.1	2.27	2.197		Sig.
Lactic Acid	ml/l	1.32	0.43	9.22	2.03	4.76		Sig.
Chest Pass	points	22.06	1.79	15.8	2.16	1.16		NS
Free Throw	points	7	1.22	3.6	1.39	1.98		NS
Dehydration Rate		5.381						

Under a significance level of $n-1$ and a degree of freedom of 0.05.

4. Presentation, analysis, and discussion of the results

4.1. Presentation and analysis of the results of the pre- and post-tests and measurements for the control group

Extract the dryness level according to the equation:

Resting percentage

$$= \frac{\text{Pre-workout weight} - \text{Post-workout weight}}{\text{Pre-workout weight}} \times 100$$

4.2. Presentation and analysis of the results of the pre- and post-tests and measurements for the experimental group

Extract the dryness level according to the equation

Resting percentage

$$= \frac{\text{Pre-workout weight} - \text{Post-workout weight}}{\text{Pre-workout weight}} \times 100$$

4.3. Presentation and analysis of the results of the post-tests and post-measurements for the control and experimental groups

5. Discussion of results

As illustrated in Table 1, the results for the control group—who were permitted *ad libitum* access to water and fluids prior to and throughout the 90-minute practical session—demonstrated statistically significant differences (at a significance level of $p \leq 0.05$) in most physiological variables (heart rate, core temperature, blood lactate) between pre- and post-test measurements.

Despite a slight reduction in mean body weight (from 71.87 kg to 68.74 kg), the change was not statistically significant. The researcher attributes this to the group's permitted fluid intake before and during the practical session, which aided hydration and the replacement of fluids lost through sweating. This finding is supported by Judge et al. (2021), who state that “hydration strategies involving drinking

Table 3. Results of the post-tests and post-measurements for the control and experimental groups.

Variables	Unit of Measurement	Post-test control		Post-test experimental		Calculated t-value	Tabulated t-value	Significance
		M	SD	M	SD			
Weight	kg	68.74	2.99	67.34	3.67	0.9160	2.048	NS
Heart Rate	bpm	137	4.5	183	2.45	3.56		Sig.
Temperature	°C	37.3	0.55	38.1	2.27	2.76		Sig.
Lactic Acid	ml/l	6.5	2.11	9.22	2.03	2.53		Sig.
Chest Pass	points	22.12	2.03	15.8	2.16	1.42		NS
Free Throw	points	7.6	1.12	3.6	1.39	2.013		NS

Under a significance level of $n-2$ and a degree of freedom of 0.05.

to thirst or according to a planned schedule during exercise are effective in reducing body mass loss (as an indicator of dehydration) to less than 1%, thereby minimising the negative impact on physiological performance." Furthermore, the study by [Abou Zaid and Abbas \(2022\)](#) recommended "the necessity of regular fluid intake during physical activity in hot environments to counteract losses and reduce the percentage of body weight loss resulting from dehydration."

Regarding heart rate measurement, a substantial increase was observed from 74.43 bpm to 137.5 bpm. This elevation represents a normal and expected physiological response to the high physical exertion undertaken by the students during the 90-minute practical session in hot and dry conditions. It reflects the significant effort exerted by the heart to meet the increased demand for oxygen and energy from the working muscles, and to aid thermoregulation by increasing blood flow to the skin. [Al-Zubaidi et al. \(2021\)](#) indicated that a hot environment increases the circulatory load, leading to a notable rise in heart rate during physical activity compared to temperate conditions. Similarly, [Biswas et al. \(2022\)](#) found that heart rate increases significantly during exercise in the heat to compensate for a decrease in stroke volume and to maintain cardiac output, particularly at moderate to high intensities.

Concerning core temperature measurement, it rose from 36.36 °C to 37.3 °C. This increase in core body temperature is a direct result of metabolic heat production during physical activity. Although hydration was permitted, the hot environmental conditions impede the efficiency of heat loss mechanisms, leading to heat accumulation and a rise in body temperature. Although this increase was statistically significant, it remained within a relatively safe range for physical exertion. This may indicate that hydration helped mitigate the severity of the increase, which could have been more pronounced without fluid intake. This is corroborated by [Laitano et al. \(2020\)](#), who stated that "adequate hydration during exercise in the heat does not completely prevent a rise in core body temperature, but it slows the rate of this increase and maintains it within safer limits, thereby improving performance and reducing the risk of heat illness." [Al-Otaibi and Al-Areef \(2023\)](#) also noted that "regular fluid intake during activity in hot environments plays a critical role in regulating the body's core temperature and limiting its excessive rise."

The blood lactate concentration increased from 1.52 mmol/L to 6.5 mmol/L. The researcher posits that this is a clear indicator that the intensity of the physical activity during the practical session, under hot and dry conditions, was sufficiently high to force the body to rely on the anaerobic energy system. This

leads to an accumulation of lactate in the muscles and blood, confirming that the exercise was strenuous irrespective of hydration status. [Al-Shammari \(2022\)](#) found in his study that "physical performance in a hot environment leads to higher blood lactate levels compared to a temperate environment," attributing this to combined thermal and physical stress.

Excessive sweating in hot, dry conditions leads to body fluid loss (hypohydration), reducing blood plasma volume. This reduction in blood volume impairs the transport of oxygen and nutrients to the muscles, increasing reliance on anaerobic metabolism and consequently elevating lactate production. [Goulet et al. \(2021\)](#) state that "dehydration (even a mild 2%) increases blood lactate concentration at the same exercise intensity, due to reduced plasma volume and impaired lactate removal."

Regarding the chest pass test (scores improving from 21.6 to 22.12), the researcher attributes the stable performance to the fact that the execution of this skill was not adversely affected by the physical exertion or hot conditions. This is a positive indicator that sustained hydration helped maintain neuromuscular coordination and the mental concentration required for a skill such as the chest pass, which depends on accuracy and timing.

This also applies to the free throw test, where the mean scores increased (from 6.47 to 7.6). This suggests that performance did not deteriorate, reinforcing the hypothesis that hydration contributed to maintaining technical stability and accuracy under combined physical and thermal stress. This finding is supported by [Gharib and Rafqi \(2021\)](#). The study results showed that consistent hydration (fluid intake) during performance under hot climate conditions enhances basketball players' ability to maintain their skill accuracy and overall performance level.

5.1. Results of the experimental group

Concerning the results of the pre- and post-tests for the experimental group, as observed in [Table 2](#), a decrease in weight from 71.17 kg to 67.34 kg was noted. From a physiological perspective, the researcher contends that any weight loss during the practical session can be primarily attributed to the loss of body fluids (sweat) that was not compensated for, due to the experimental subjects being prohibited from consuming water and fluids. This decrease (approximately 3.8 kg) indicates the occurrence of functional dehydration, even if it was not statistically significant in this specific sample.

The mean pulse rate increased significantly and with statistical significance from 75.5 beats/minute to 183 beats/minute. This elevation is a normal

physiological response to thermal stress and dehydration. In hot and dry conditions, Redirecting blood circulation to the superficial layers of the skin is a basic physiological response to cool the body., This forces the heart to work harder (increased heart rate) to maintain blood pressure and supply oxygen to active muscles and vital organs. Tachycardia is one of the clearest indicators of heat stress and the burden on the cardiovascular system.” (Casa et al., 2015).

From the results in Table 2, a statistically significant rise in body temperature from 36.3 °C to 38.1 °C is observed. The researcher attributes this to the fact that during physical activities in hot, dry conditions, the body produces metabolic heat. Without replenishment of lost fluids, this leads to heat accumulation in the body and a rise in its internal temperature. A temperature above 38 °C indicates mild heat stress and explains the subsequent decline in skill performance, as the body attempts to protect itself from heatstroke (Sawka et al., 2015).

The concentration of lactic acid increased sharply in the body. This acute rise indicates a shift by the body towards reliance on anaerobic metabolic pathways for energy production. Due to dehydration and heat stress, blood flow to the working muscles is reduced during physical and skill-based activities in hot, dry conditions, limiting the body’s oxygen supply and increasing the accumulation of the by-product of anaerobic metabolism, lactic acid. “This accumulation directly contributes to the feeling of early muscle fatigue and pain, hindering the ability to continue performing at a high quality” (Kenefick & Cheuvront, 2016).

Regarding the skill tests for both the chest pass and free throw, the performance of each declined (from 22.06 to 15.8, and from 7 to 3.6, respectively). The researcher attributes the cause of this performance decline to the negative impact of hot, dry conditions and dehydration. Both skills require precision and fine neuromuscular coordination. “Dehydration, even at low levels (2% loss of body weight), disrupts cognitive function, balance, and accuracy” (Baker et al., 2007).

6. Comparative post-test results

Through Table 3 presents a display of the results derived from the post-tests for the control and experimental groups.. The test results indicate the presence of statistically significant differences (at a significance level of $\alpha \leq 0.05$ and degrees of freedom 1–n) in some variables, while differences in other variables were not significant. The critical tabulated T-value (2.145) is the benchmark against which the calculated T-value is measured. If the calculated T exceeds this value, the difference between the two measurements is con-

sidered statistically significant and not merely due to chance.

Regarding weight measurement, it decreased from 68.74 kg to 67.34 kg. This decrease reflects fluid loss through sweating without compensation. Despite the lack of statistical significance, the numerical loss indicates the occurrence of functional dehydration.

The pulse rate increased markedly from 137.4 to 183 beats/minute. This substantial increase indicates the clear thermal and cardiovascular stress experienced by the experimental group. Under conditions of fluid deprivation and heat, the heart works harder to compensate for reduced blood volume and increased blood flow to the skin for cooling. This aligns with the findings of Sawka et al. (2015), who indicated that “dehydration increases the strain on the cardiovascular system”.

Body temperature rose from 37.3 °C to 38.1 °C. This increase indicates a failure of the body’s thermoregulatory mechanisms due to the lack of compensation for fluids lost through sweat. When significant amounts of fluid are lost without replenishment, “the efficiency of evaporative cooling through sweat decreases and the body’s core temperature rises, exposing the individual to the Exposing an individual to heat stress” (Casa et al., 2015).

The concentration of lactic acid increased from 6.5 mmol/L to 9.22 mmol/L. This sharp increase indicates a shift towards anaerobic metabolism due to “a lack of oxygen in the muscle tissues resulting from reduced blood flow caused by dehydration. This decline in metabolic efficiency explains the feeling of early fatigue and impaired performance” (Kenefick & Cheuvront, 2016).

Concerning the skilled performance of the tested skills, performance in the chest pass declined from 22.12 to 15.8. This indicates that training in hot, dry conditions had a negative impact on neuromuscular coordination. “Dehydration affects cognitive function, balance, and motor accuracy” (Baker et al., 2007). Similarly, performance in the free throw declined from 7.6 to 3.6. The researcher attributes this performance decline to the effect of training in hot, dry conditions on skilled performance. This skill requires a high level of concentration and physical stability, both of which are negatively affected by dehydration and heat stress.

7. Conclusions

The researcher reached several conclusions, which are

- 1- The effect of hot and dry conditions on the level of **dehydration** in the experimental sample members.

- 2- The detrimental effect of hot and dry conditions on the investigated **physiological parameters** (core temperature, pulse rate),
- 3- The effect of hot and dry conditions on the level of **lactic acid accumulation**.
- 4- The detrimental effect of hot and dry conditions on the level of **skill performance**. Training in hot and dry conditions leads to **heat strain / exertional heat stress**.

8. Recommendations

- 1- Further research is needed to replicate this study on other sports, both individual and team, with different variables.
- 2- environmental conditions., Provide a sufficient and regular supply of water/fluids during practical training sessions.
- 3- Educate students on the importance of **hydration** before, during, and after physical activity in hot and dry.
- 4- environments., Monitor the early signs of **heat-related illness** to prevent dangerous
- 5- adverse effects., Provide air-conditioned and cooled halls for conducting practical lectures to prevent student heat strain.
- 6- Adjust the **intensity** and **duration** of activity according to the prevailing meteorological conditions.

Conflicts of interest

None.

We confirm that all tables and figures in this article are ours and written by the researchers themselves.

Ethics statement

Approval was obtained from the Head of the Team Games Branch - Assistant Professor Dr. Mohammed Matlak - to commence work with the sample, as he is the direct official responsible for the sample and the official in charge of scientific lessons at the college (College of Physical Education and Sports Science, Al-Mustansiriyah University).

Authors' contribution

Researchers contributed equally to this.

The study (research) was conducted with the participation of the authors in part in terms of the idea and the completion of the study in terms of the applied aspects (experiment - measurements) and extracting the results and costs.

Funding

This research received no external funding.

Data availability

The data that support the findings of this study are available on request from the corresponding author.

References

- Abdullah, M., & Hamoudat, F. B. (1999). Skill, tactical, and physical tests in basketball (pp. 85–86). Amman, Jordan: Dar Al Fikr for Publishing and Distribution.
- Abou Zaid, M., & Abbas, M. (2022). Hydration and fluid replacement strategies for athletes in a hot climate. *Journal of Physical Education and Sport for All*, 7(1), 76–94.
- Al-Horani, H., Abu Al-Ruz, H., & Al-Natsheh, M. (2021). Hydration status and knowledge of dehydration risks among physical education students in Jordanian universities. *Journal of Environmental and Public Health*, 2021.
- Al-Khalifa, H. A., & Al-Ghareeb, A. M. (2013). Al-Ikhtibarāt wal-maqāyīs fī al-tarbiyah al-riyāḍīyah (Al-juz' al-thānī: Al-ikhtibarāt al-ʿamaliyah) [Tests and measurements in physical education (Part 2: Practical tests)]. Dar Al-Fikr Al-Arabi.
- Al-Otaibi, M., & Al-Areef, A. (2023). The effectiveness of a hydration programme on body temperature regulation and athlete performance in hot conditions. *Journal of Scientific Research in Physical Education*, 15(2), 123–145.
- Al-Shammari, A. (2022). Blood lactate level as an indicator of physical load intensity under different environmental conditions. *Journal of Sports Sciences*, 18(1), 88–102.
- Al-Zubaidi, Kh., Al-Jubouri, M., & Ahmed, A. (2021). The impact of hot weather on some physiological variables in football players. *Journal of Educational and Psychological Sciences*, 12(4), 45–60.
- Baker, L. B., Conroy, D. E., & Kenney, W. L. (2007). Dehydration impairs vigilance-related attention in male basketball players. *Medicine and Science in Sports and Exercise*, 39(6), 976–983.
- Baker, L. B., Rollo, I., Stein, K. W., & Jeukendrup, A. E. (2020). Exercise-intensity-dependent alterations in hydration biomarkers.
- Biswas, A., Malhotra, R., & Sen, A. (2022). Cardiovascular responses to exercise in the heat: A systematic review and meta-analysis. *Journal of Thermal Biology*, 105, 103–112.
- Casa, D. J., DeMartini, J. K., Bergeron, M. F., Csillan, D., Eichner, E. R., Lopez, R. M., Ferrara, M. S., Miller, K. C., O'Connor, F., Sawka, M. N., & Yeargin, S. W. (2015). National athletic trainers' association position statement: Exertional heat illnesses. *Journal of Athletic Training*, 50(9), 986–1000. <https://doi.org/10.4085/1062-6050-50.9.07>.
- Donnan, K., & Williams, E. L. (2021). The effects of heat exposure during intermittent exercise on physical and cognitive performance among team sport athletes. *Perceptual and Motor Skills*, 128(1), 439–466. <https://doi.org/10.1177/0031512520983075>.
- Gharib, A., & Rafqi, M. (2021). The effect of consuming carbohydrate-electrolyte solutions on some fundamental skills and performance efficiency in basketball under hot conditions. *International Journal of Sports Sciences*, 9(3), 210–225.
- Goulet, E. D., Assadi, H., & Laforest, S. (2021). Impact of dehydration on muscle endurance and lactate concentration: A meta-analysis. *European Journal of Applied Physiology*, 121(12), 3297–3312. <https://doi.org/10.1007/s00421-021-04788-0>.
- Judge, L. W., Bellar, D. M., Popp, J. K., Craig, B. W., Schoeff, M. A., Hoover, D. L., Fox, B. J., & Kistler, B. M. (2021). Hydration strategies for training and competition in the heat: Practical applications. *International Journal of Sports Physiology and*

- Performance*, 16(8), 1085–1093. <https://doi.org/10.1123/ijsp.2020-0826>.
- Judelson, D. A., Maresh, C. M., Anderson, J. M., Armstrong, L. E., Casa, D. J., Kraemer, W. J., & Volek, J. S. (2018). Hydration and muscular performance: Does fluid balance affect strength and power? *Sports Medicine*, 48(Suppl 1), 73–84. <https://doi.org/10.1093/nutrit/nuw041>.
- Laitano, O., Runco, J. L., & Baker, L. (2020). Hydration and thermoregulation in the athlete. *Journal of Science and Medicine in Sport*, 24(7), 703–709. <https://doi.org/10.1016/j.jsams.2020.11.016>.
- Mujika, I., Halson, S., & Burke, L. M. (2010). Heat acclimation and acclimatisation: A review for the athlete. In *The Encyclopaedia of Sports Medicine: An IOC Medical Commission Publication* (pp. 217–232). Wiley-Blackwell.
- Périard, J. D., Eijssvogels, T. M. H., & Daanen, H. A. M. (2021). Exercise under heat stress: Thermoregulation, hydration, performance implications, and mitigation strategies. *Physiological Reviews*, 101(4), 1873–1979. <https://doi.org/10.1152/physrev.00038.2020>.
- Sawka, M. N., Burke, L. M., Eichner, E. R., Maughan, R. J., Montain, S. J., & Stachenfeld, N. S. (2007). American College of Sports Medicine position stand.
- Sawka, M. N., Leon, L. R., Montain, S. J., & Sanna, L. A. (2015). Integrated physiological.

دراسة تأثير البيئة الحارة والجافة على مستوى الجفاف وبعض المتغيرات الفسيولوجية وأداء بعض المهارات الأساسية لكرة السلة

أحمد حسن ياس، فاطمة عبد الرضا

كلية التربية البدنية وعلوم الرياضة الجامعة المستنصرية

المستخلص

تميز الجو في بغداد ومعظم مناطق العراق خلال فصل الصيف بالحرارة والجفاف الشديدين. وتعد هذه الظروف المناخية من العوامل السلبية التي تؤثر بشكل ملحوظ على الوظائف الإدراكية وأداء المهارات الرياضية، وبناءً على ذلك، صُممت هذه الدراسة للتحقق من آثار البيئة الحارة والجافة على مستويات الجفاف، ومؤشرات فسيولوجية محددة، وأداء المهارات الأساسية في كرة السلة لدى طلاب المرحلة الأولى في الجامعة المستنصرية. تم تقسيم عينة مكونة من 30 طالبًا بشكل عشوائي إلى مجموعة ضابطة ومجموعة تجريبية. سُمح للمجموعة الضابطة باستهلاك الماء والسوائل حسب الرغبة (حسب الحاجة) قبل المحاضرة العملية. في المقابل، مُنعت المجموعة التجريبية من استهلاك الماء والسوائل قبل وأثناء التمارين البدنية والمهارية للمحاضرة، إلا في الحالات الحرجة. بعد الجلسة العملية، تم قياس المؤشرات الفسيولوجية (درجة حرارة الجسم، ومعدل النبض، ووزن الجسم لتحديد مستويات الجفاف). كما تم قياس تركيز حمض اللاكتيك، وإجراء اختبارات المهارة (تمريرة الصدر والرمية الحرة). بعد جمع البيانات، عُولجت النتائج إحصائيًا. وتم استخلاص عدة استنتاجات، حيث أثرت البيئة الحارة والجافة بشكل كبير على مستويات الجفاف أثناء التمارين البدنية والمهارية. وكان هذا التأثير أكثر حدة بشكل ملحوظ في المجموعة التجريبية، التي قُيدت من تناول السوائل، على الرغم من تأثر المجموعة الضابطة أيضًا ولكن بدرجة أقل. كما أثرت هذه الظروف سلبًا على المؤشرات الفسيولوجية (زيادة معدل النبض ودرجة حرارة الجسم) وأدت إلى ارتفاع مستوى حمض اللاكتيك. واستنادًا إلى هذه النتائج، يوصي الباحث بتوفير إمكانية الوصول الكافي والمنتظم إلى الماء والسوائل خلال المحاضرات العملية.

الكلمات المفتاحية: الأجواء الحارة والجافة، مستوى الجفاف، المتغيرات الفسيولوجية، مهارات كرة السلة