

Analysis of the amount of lost fluids, some blood components and mineral salts in volleyball under hot weather conditions

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ABSTRACT

The research objective was to study the amount of lost fluids, some blood components and mineral salts in volleyball players under hot weather conditions. The sample of the present study was composed of 12 volleyball players of Al-Sinaa Club (Baghdad, Iraq) in the 2022/2023 season. The variables analyzed in this study were: Heart rate before and after exercise, internal and external body temperature before and after exertion, potassium ion, sodium ion, calcium ion, and the amount of fluid lost (the player's weight) before and after the exercise. The tests were conducted at a temperature between 42-47 degrees Celsius. The maximum anaerobic exercise was performed with volleyball. The results showed that to play volleyball under hot weather conditions (42-47 degrees Celsius) significantly increased the following variables in volleyball players: heart rate, external body temperature, internal body temperature, sodium ion and calcium ion. However, potassium ion significantly decreased. Therefore, training in hot weather has positive physical repercussions. The authors recommend to train in different weather conditions.

KEYWORDS

Sweat; Heart rate; Body; Potassium; Sodium; Calcium; Temperature; Volleyball.

1. INTRODUCTION

Scientific work and strong and accurate research must be based on accurate scientific foundations and rely on modernity in study and solving problems and obstacles that may be encountered in many fields, including the sports field. Physiology is an expression of the physical and chemical state of the various vital systems of living organisms with their various classifications and designations, as well as the close connection of physiology with the science of sports training, which are the representatives of the basic and correct rule that is of great importance and effective in

relation to the progress of the athletic level if it is based on correct scientific foundations. It is appropriate and efficient for the individual's vital organs and capabilities to achieve the desired goals of training and to avoid negative effects on the functional organs, especially the rise and fall in temperatures and the subsequent changes in the variables of blood and mineral salts (and the amount of lost fluids) to preserve the players when practicing physical stress under different environmental conditions, especially the rise or fall in temperature.

When the temperature rises and falls, the need for water increases because of the fluids lost by the body through sweating, and the amount of fluid lost by sweating changes greatly depending on the physical activity and the temperature of the environment (Jasm et al, 2021; Morad & Shbeeb, 2023), in addition to the loss and deficiency in the composition of mineral salts, such as sodium and potassium in the blood plasma, which leads to disturbances in the work of the heart and muscle work (Fashoggi, 1994). This process, whether in hot or cold weather, causes physiological responses and changes, which requires interaction with these responses with caution.

The problem of this research is that the sporting achievements of the players vary according to different environmental conditions (whether cold weather or hot weather) or what are the physiological repercussions of the atmosphere on blood variables and mineral salts. The research objective was to study the amount of lost fluids, some blood components and mineral salts in volleyball players under hot weather conditions.

2. METHODS

2.1. Design and participants

The researchers used the experimental method. One of the things that the researcher must accurately define is the research community, which refers to all individuals who are the subjects of the research problem (Mahjoub, 2002). The sample of the present study was composed of 12 volleyball players of Al-Sinaa Club (Baghdad, Iraq) in the 2022/2023 season. The sample was chosen in a deliberate manner. The health status of the players was confirmed by conducting some clinical examinations.

2.1. Instruments and procedures

The instruments used in this study were medical syringes with a capacity of 5 ml, medical cotton, sterile materials, medical plaster, tubes to save blood, Bo Hui external body temperature measuring device, and medical oral thermometer to measure internal body temperature.

The research variables were determined according to accurate and solid scientific sources in line with the study. The variables analyzed in this study were: Heart rate before and after exercise, internal and external body temperature before and after exertion, potassium ion, sodium ion, calcium ion, and the amount of fluid lost (the player's weight) before and after the exercise. The internal body temperature was measured through the use of a mercury thermometer placed under the tongue, and the external body temperature through the use of a thermometer placed on the player's forehead (Obaidat, Kayed & Adas, 2015). The tests were conducted at a temperature between 42-47 degrees Celsius. As indicated by Hadi (2009), the maximum anaerobic exercise was performed with volleyball.

An exploratory experiment was conducted on 4 volleyball players that were not part of the sample, on 6/7/2022 at 4:00 pm, in the closed hall of the Volleyball Industry Club, and all the conditions for the tests were created. The researchers checked the ability of the devices and tools to measure the functional variables under study, the validity of the devices for the tests, the efficiency of the assistant work team, and the efficiency of the medical work team to conduct functional tests. The main experiment was conducted on the 12 volleyball players of the sample with the same conditions of the exploratory experiment.

2.3. Statistical analyses

The statistical analyses were carried out with the Statistical Package for the Social Sciences (SPSS), version 23. With SPSS, the researchers calculated arithmetic means, standard deviations, mediators, and t-test for correlated samples.

3. RESULTS AND DISCUSSION

The results are presented in Table 1, which describes the results of volleyball players before and after exercise under hot weather conditions, in the different variables analyzed. The researchers attributed the significant differences between the two tests, before the effort and after the effort, to the training under the hot weather. These results are consistent with El-Din et al (1997). The increase in the concentration of sodium ions in the blood plasma depends on the amount of sweat that is lost. The higher the amount of sweat, the higher the concentration of sodium ions in the blood plasma, because the sweat solution contains more water than salts (Hasan & Shbeeb, 2021). Also, because the physical effort performed by the research sample is an anaerobic effort (maximum), its clear effects appeared on blood chemistry (Nasir, 2021). This process is closely related to the intensity and

duration of the physical effort, and these changes appear in the form of physiological adaptation, so we call it physical training (Faisal & Hady, 2020). Sports training with high-intensity loads (maximal loads) makes the blood more fluid and less able to coagulate, and this adaptation of the trainee or athlete is considered a catalyst for the transfer of oxygen (Al-Nedawy & Saeed Al-Mousawi, 2022), reducing the risk of clotting. This all happens in regular training athletes, and all these factors affect positively sports performance (Suhad Qassim, 2020).

Table 1. Results of volleyball players before and after exercise under hot weather conditions

Functional variables	Before exercise		After exercise		t	p
	Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation		
Heart rate	69.2500	1.8153	176.833	1.7494	13.133	0.000
External body temperature	36.183	0.8211	37.091	0.4420	2.970	0.013
Internal body temperature	36.050	0.26112	37.1583	0.5401	11.580	0.000
Potassium ion	4.0333	0.4868	3.5500	0.2153	3.251	0.000
Sodium ion	135.91	2.353	144.16	2.657	8.004	0.001
Calcium ion	2.229	0.1098	2.545	0.1019	7.976	0.000

As for the element calcium, its ratio in the blood in a balanced way is under the control of the parathyroid hormone, controlling its reabsorption and subtraction from the renal tubes on a regular basis (Ali & Qassim, 2022). The amount of calcium remains within normal limits, depending on the rate of excretion and absorption through urine and blood. The use of tools leads to the adaptation in the skill technique as a result of the repetition of the performance (Jasm et al, 2021), which has a positive impact on the development of the physical and functional capabilities, and as a result works to improve and develop the level of technical and skillful performance (A'shour, 2022). Sports training produces changes as a temporary response to the performance of physical activity (Saeed, Khalifa & Noaman, 2019). The process of sweating is considered a physiological process to rid the body of its high temperature. A rise in temperature above 30 degrees Celsius increases the evaporation of sweat from the surface of the skin and is considered the main way to rid the body of its high temperature (Khalid & Mohammed, 2021). In addition to that, an increase in the concentration of calcium and sodium in the blood plasma is associated with an increase in the

intensity of exercise and a shorter duration of exercise in high temperature conditions, which is associated with an increase in the length of the load performance (Jihad, 2020). In fact, merely staying for a long period in hot and humid weather without any physical effort leads to inability in the body to maintain its normal temperature (Mohammed & Saeed, 2021).

4. CONCLUSIONS

To play volleyball under hot weather conditions (42-47 degrees Celsius) significantly increased the following variables in volleyball players: heart rate, external body temperature, internal body temperature, sodium ion and calcium ion. However, potassium ion significantly decreased. Therefore, training in hot weather has positive physical repercussions. The authors recommend to train in different weather conditions.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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