

Evaluation of weight loss and sweat rate in an athlete

Abstract

Background: The sweat rate consists of relating the athlete's initial and final weight with the amount of fluid ingested and thus identify how much dehydrated they were dehydration is a state that a person enters after having lost fluids from their body.

Aim: Diagnose the athlete's sweat rate by considering the consumption of the beverages before, during, and after the test. To analyze the correlation of diagnoses according to the intake of hydrating drinks, sweat rate and weight of the athletes.

Methods: This test was carried out at the I.U.D., specifically at the CAF, where an exercise bike was used. The methodological approach is quantitative, a sweat rate was performed in a test for three (3) consecutive days, which consisted of the athlete being subjected to an hour without rest on the exercise bike consuming three (3) types of drinks (water, Gatorade, serum), a different one for each day.

Results: It was evident that with water he lost 2.12% (moderate dehydration), with Gatorade he lost 0.99% (minimal dehydration), we observed that his dehydration decreased thanks to the replacement of fluids lost during physical activity, with serum he lost 1.13%.

Conclusions: According to the study carried out, two drinks stand out, water was the drink that made the athlete lose more weight during his process and we considered whey, since it was the drink that was consumed the least and was the one that kept the athlete hydrated.

Keywords: Sweat rate, dehydration, body weight, athlete, physical activity

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Introduction

Sport in general is of an extremely competitive nature, establishing a relationship with the improvement of the physical condition of each athlete, this being the way in which professionalism prevails at all levels. Such professionalism encourages athletes to increase their inclination for better performance. As a tool, the propensity, profit and water benefit of athletes are evidenced. This study addresses a very common problem today in athletes of different disciplines, which is dehydration. According to Guyton AC, Hall JE¹ "Dehydration occurs when the loss of fluid through sweating is greater than the intake of fluids", this in turn generates a decrease in both the physical and mental performance of an athlete when performing a physical activity or a competition. However, there are two types of athletes, on the one hand, there are those who resort to voluntary dehydration, that is, they do not ingest liquids because they do not feel like it or are not used to hydrating properly and on the other hand there are those who tend to overhydrate, who unfortunately may be at risk of suffering hypothermia due to dilution. Ideally, there should be a water balance, where the amount of fluid necessary to replace the percentage of sweat lost in different physical and competitive activities is consumed.

The percentage of dehydration is determined by weighing the athlete before and after physical activity. Barbero JC, Castaña C, Granda-Vera J state that "body weight control is a simple, valid and non-invasive procedure that allows detecting variations in hydration in team sports, by calculating the difference in body weight before and after exercise". The body can lose up to 2% of body weight during physical activity, which is equivalent to an amount between 1 and 2 liters per hour of exercise.² Solera reports that most of the research carried out in recent years has sought to find the effects of dehydration that affects sports performance in athletes. Finally, this research aimed to evaluate the state of dehydration through the sweat rate in

a basketball player who was a student of the professional program in sports.

Sport, in all its variants, is distinguished by its highly competitive nature, which demands a constant effort from athletes to enhance their physical and mental performance. This competitiveness is not only manifested in the aspiration to obtain victories or stand out, but is closely linked to the constant development of the physical fitness of athletes. In this context, the improvement of physical skills becomes an essential element to achieve success in sport, and it is the path that enables athletes to increase their degree of professionalism. In this scenario of constant search for improvement is where a crucial tool is put in place: the proper management of hydration.

Hydration plays a crucial role in athletes' performance, and its proper management not only helps maintain fluid balance in the body, but can also make the difference between proper performance and exceptional performance. The propensity of athletes to improve their performance is increasingly linked to their ability to make the most of the benefits offered by proper hydration. A well-hydrated athlete can not only avoid problems such as early fatigue, cramping, or exhaustion, but also optimizes muscle resilience, making quick and accurate decisions, and maintaining a high intensity of play for longer.

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Finally, this research seeks to assess the condition of dehydration through the sweating rhythm in a basketball player who is a student of the professional sports program. Proper hydration is essential for physical performance, and athletes, particularly in high-intensity sports such as basketball, are often susceptible to dehydration due to the demanding nature of the activity.

Methods

An 18-year-old student from the national sports school, belonging to the professional sports program, was a basketball player who trains 4 days a week. The student gave his consent to carry out the test of this research and was aware of the main objective of the work. The subject was subjected to several tests, with high demand being the main objective. These tests sought despite being very physical, the technical will also be taken into account, since the technique and mechanical efficiency is usually lost when the demand is high, for this reason physical-technical tests were sought to give a better orientation and focus to the research. Aerobic Capacity Test or SIG/AER Test, is a field test in which the athlete performs different technical-tactical actions of the sport for twelve minutes. The order that structures the sequence of the different technical-tactical actions is designed taking into account the sequential order similar to that which the athlete could find during a match and on the field of play. The other test that also follows the same guidelines for its application in this research is the Anaerobic Lactic Capacity Test. The test that evaluates the most optimally following the criterion of specificity for the sport of basketball is the SIG/ANA Anaerobic Test. The choice of the test is due to the similarity with the competition itself. For the development of this test, the athlete faces a large number of formal and technical-tactical elements in which the competition itself is simulated. The selected test intersperses the period of work and total passive recovery (work: rest ratio is 1:1). Both tests, the SIG/ANA Anaerobic Test and

the AGS/GRA test, retain the same structure. For the validation of the test, the results are correlated with the laboratory test, obtaining a high correlation (Ibáñez et al., 1995). The GIS/ANA Test (Ibáñez et al., 1995b) lasts ten minutes (including five minutes of activity and five minutes of recovery). For him, a less specific and more physical approach was used tests such as Illinois, 30-15 modified with a round trip of 28 meters and a speed of movement test.

Procedure

The athlete performed the same physical activity for three consecutive days. He was subjected to an hour of non-stop aerobic training on an exercise bike, he tried to carry the same intensity and repetitions per minute (RPM) during each session. The test was carried out at the CAF of the National School of Sport where the temperature remained between 26°C and 31°C during the three days and in turn the relative humidity was between 67% and 76%. At the beginning and end of each exercise session the athlete was weighed with as little clothing as possible and completely dry. During the test, the athlete had at his disposal a bottle with enough liquid to hydrate whenever he required it, he was offered water, Gatorade and Pedialyte serum, respectively every day. Finally, heart rate checks were performed at 15, 30, 45 and 60 minutes of physical activity. To carry out the physical test, a Lifecycle GX brand exercise bike from the Physical Conditioning Center (CAF) of the National School of Sport University Institution was used.

Statistical analysis

An analysis of the variables studied was carried out, the initial weight vs. the final weight was related, the percentage of weight lost and the sweating rate was analyzed, which is a predictor variable. On the other hand, other independent variables such as temperature and humidity were taken into account.

Results

The following tables show the results obtained after the “Sweat Rate” test, which was performed on three consecutive days and each day the athlete was hydrated with a different drink, which were: water, Gatorade and serum. Although it was expected that her dehydration would be less with Gatorade, in the results we realized that it was lower when she took serum. Below, each of the tables will be explained where we will talk about the results in more detail.

Table 1 shows the general results of the test performed on the athlete, such as their initial and final weight, weight loss in different measures as well as the amount of fluid ingested, finally obtaining the sweat rate per hour and a brief conclusion about their hydration status.

Table 1 Overall results

Drink	Initial weight (Kg)	Final weight (Kg)	Weight lost (Kg)	Weight lost (g)	Weight lost (%)	Liquid consumed (ml)	Sweat rate (Hr)	State of dehydration
Water	70,9	69,4	1,5	1500	2,12	600	2100	Moderate
Hypotonic drink (Gatorade)	70,8	70,1	0,7	700	0,99	764	1464	Minimum
Isotonic Drink (Serum)	70,9	70,1	0,8	800	1,13	317	1117	Minimum

Nota: Own elaboration

The Figure 1 shows the difference between weight before and after physical activity, with the intake of the three drinks mentioned above as the main factor. On the first day his initial weight was 70.9 kg, he

ingested 600 thousand of water and his final weight was 69.4 kg, on the second day his initial weight was 70.8 kg, he ingested 764 thousand of Gatorade and his final weight was 70.1 kg, and on the third day his

initial weight was 70.9 kg. She ingested 317 mL of serum and her final weight was 70.1 kg. In the three days a fairly considerable weight loss is noticed, when he hydrated with water he lost 1.5 Kg, this being the day that he was dehydrated the most, when he went with Gatorade he lost 0.7 Kg where he noticed a minor weight loss and finally when he ingested serum he lost 0.8 Kg.

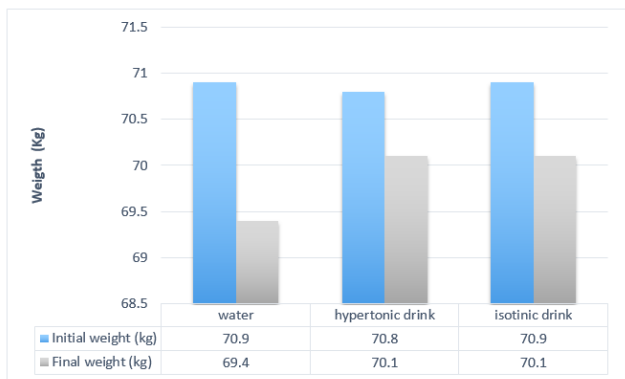


Figure 1 Differences between weight before and after physical activity.

Note: Own elaboration

The Figure 2 shows the hydration status due to weight loss. When water was drunk, a state of moderate dehydration was obtained, since the percentage exceeded 2%, in the case of Gatorade and serum, a minimum dehydration was obtained with percentages of 0.99% and 1.13%, respectively.

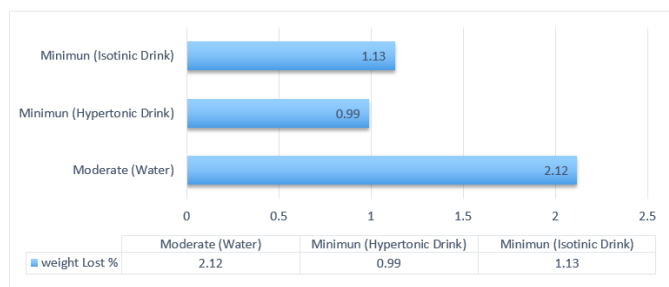


Figure 2 Hydration status due to weight loss.

Note: Own elaboration.

Figure 3 shows the results obtained after taking the athlete’s heart rate every 15 minutes, in order to see the variability of the athlete, taking into account that his speed and intensity of physical activity remained between 25 and 28 km/h.

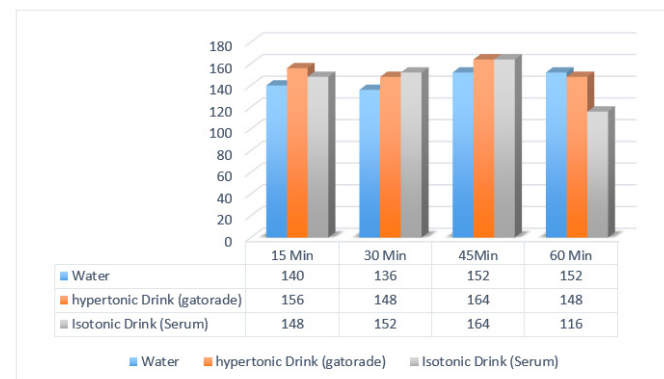


Figure 3 Heart rate every 15 minutes.

Note: Own elaboration

Discussion

After performing the appropriate procedures to find the sweat rate of the athlete, we obtained quite relevant data, one of them was that water dehydrated him more than Gatorade, water is essential even for the composition of the body, but something particular happens after an hour of training, the body begins to expel substances such as sodium through sweat, chloride, potassium, magnesium and calcium, which are essential bioelements for the body. “Sweat has a salty taste, it contains far fewer minerals than plasma and other body fluids. In fact, it is 99% water”.³ However, the sweat of each individual can vary depending on the sweating rate, the state of performing a physical activity and the state of acclimatization to the heat. So according to the results obtained, it can be said that water for a strong and prolonged workout does not work much or help the recovery of those liquids, which is why Gatorade gains great prominence, since within its composition it has a large part of those lost liquids such as sodium chloride, potassium, citric acid, sucrose, among others, thus helping the body and obtaining very low or almost no dehydration depending on the amount of fluid ingested.

The presence of carbohydrates in Gatorade provides a greater amount of energy and allows physical activity with more intensity and lower percentage of fatigue, on the other hand, it generates a greater reserve of muscle glycogen, facilitates intestinal absorption, which provides faster hydration. It should be noted that this drink, in addition to having sensory marketing, specifically seeks to awaken the sense of taste and turn it into a characteristic product, which will be consumed when we feel thirsty and want to hydrate. The day that the subject had to hydrate with this drink, he said that when he took a drink, he felt the need to consume more and more because of its characteristic flavor and perhaps for that reason that was the drink in which he consumed the most compared to whey and water.

The most important finding of this test was to obtain the percentages of dehydration per weight lost, since we found that whey was the one that hydrated the most, in fact, it hydrated a little more than Gatorade, which was initially believed to generate greater rehydration. The athlete when ingesting the liquid said that with a single sip he felt that they hydrate easily. The ideal optimal amounts for good intestinal absorption for one hour are between 600 ml and 800 ml of water, 60 g of glucose and up to 90 g of fructose, taking into account that the latter can cause gastrointestinal problems.⁴ The form of hydration is also extremely important according to the intensity of the exercise or if it is a competition.

Relative humidity and temperature affect thermal stress as an insensitive increase is generated by fluid loss. As a curious fact in the test carried out it was found that during the test on the first day the temperature was at 26°C, to our amazement the consumption of liquids was in a greater quantity compared to the third day that a temperature of 31°C was presented, being this last day where the least amount of drink was consumed. One of the reasons may have been that on the first day he consumed water and on the last day he consumed serum and this was the most hydrating drink in the study. It is important for athletes to hydrate during physical activity for several reasons such as maintaining body temperature: The body produces heat when exercising, and sweating is the main method to cool it down. Water consumption helps to replenish fluids lost through sweat, preventing overheating and maintaining performance.

An athlete’s endurance, speed, strength, and coordination can be affected by dehydration, reducing their ability to withstand physical exertion. Losing 2% of my body weight in water can reduce me

considerably. For this reason, it is sought that the athlete has good hydration during physical activity. In order for muscles to function properly, they need an adequate supply of water and electrolytes. Dehydration increases the risk of injury by causing cramps, muscle fatigue, and a decreased ability to concentrate. The body loses sodium, potassium, and magnesium as a result of sweating. These are essential for nerve transmission and muscle function. Proper hydration, especially with isotonic drinks, helps maintain electrolyte balance and prevents problems such as cramps and early fatigue. Dehydration can affect blood volume, causing the heart to work harder to pump blood to muscles and organs. Maintaining good hydration makes it easier to hydrate blood circulation and reduce the burden on the cardiovascular system. In summary, proper hydration is essential to improve performance during exercise, as well as to prevent disease and ensure a quick recovery.

Dehydration affects several of the systems of the human body, since as we know our body is made up of 70% water and this is essential to maintain physiological functions in optimal conditions, but as said before if you do not have adequate hydration we will have some complications in our systems such as:

- I. Cardiovascular system:** This could be affected, since if we do not have adequate hydration the volume of blood will be affected and this will cause the heart to have to work even harder to pump more blood to the muscles and organs. There may also be an increase in heart rate and a decrease in blood pressure.
- II. Central nervous system:** In the case of the brain, 90% of its volume is composed of water, so if dehydration occurs, it could present cognitive alterations or mental fatigue.
- III. Muscular system:** When an athlete does not drink enough fluids before, during and after exercise, they can present muscle cramps and spasms, as well as loss of strength and endurance.
- IV. Thermoregulatory system:** Alteration in temperature regulation.
- V. Immune system:** By being hydrated we help our immune system to fight diseases such as the flu, heart attacks, among others.

Just like these, there are more of our body's systems that affect them that we are not well hydrated, dehydration can be mild, moderate or severe, when it is already serious it is an emergency that can put life at risk. Some symptoms of dehydration can be: Thirst, Dry or sticky mouth, Not urinating much, Dark yellow urine, Dry and cold skin, Headache, Muscle cramps.⁵⁻¹⁰

Conclusion

It can be concluded that it is important for future Sports Professionals to be able to determine the different substances that can be implemented to keep our athletes hydrated. In addition, it is necessary to know the thousands of tests that exist to know what physical condition they are in, such as the sweating rate. It is essential for us to know the different properties that liquids have, in this particular case it was water, Gatorade and serum. We believe that since it is too easy to apply a sweat rate test, we believe that coaches should keep a more continuous record of their athletes, thus helping to find a drink that contributes to an electrolyte recovery.

Based on the above analysis, we can conclude that as future sports professionals we need to acquire the knowledge and skills to identify

the different substances that can be used to keep our athletes properly hydrated. Hydration is not only a key factor for sports performance, but also for the overall health of an athlete, especially in situations with greater physical demands or in hot climates where water loss and dehydration are inevitable. It is also advisable to familiarize yourself with the different tests and methods used to assess an athlete's physical condition, especially hydration. In this context, there is a need to improve our understanding of the various properties of fluid replenishment. In this particular case, we evaluated three common options: water, Gatorade, and serum.

We find the sweat rate test to be easy to apply and does not require specialized equipment, we believe it would be extremely beneficial for coaches to have a more detailed and continuous record of an athlete's hydration status. This monitoring not only prevents dehydration problems, but also allows you to determine more accurately which drinks or nutritional supplements are most effective for each athlete, helping to recover more effectively from injuries. Taking the above, it is understood that developing a personalized hydration strategy based on constant monitoring of an athlete's physical condition can have a significant impact on their ability to perform optimally and recover properly. As sports professionals, it is our responsibility to ensure that they are fully informed and prepared to implement these measures.

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None.

Conflicts of interest

The authors declare that there are no conflicts of interest.

References

1. Guyton AC, Hall JE. *Medical Physiology*. Madrid: Elsevier Spain, 2007.
2. Noakes TD. Fluid replacement during exercise. *Exerc Sport Sci Rev*. 1993;21:297-330.
3. Wilmore J, Costill D. *Physiology of effort and sport*. Barcelona: Paidotribo. 2004.
4. Pfeiffer B, Stellingwerff T, Hodgson AB, et al. Nutritional intake and gastrointestinal problems during competitive endurance events. *Med Sci Sports Exerc*. 2012;44(2):344-351.
5. Broad EM, Burke LM, Cox GR, et al. Body weight changes and voluntary fluid intakes during training and competition sessions in team sports. *Int J Sport Nutr*. 1996;6(3):307-320.
6. Castro Sepúlveda M, Astudillo S, Álvarez C, et al. Prevalence of dehydration before training in professional Chilean soccer players. *Nutr Hos*. 2015;32(1):308-311.
7. Herrera AS, Aragón Vargas LF. Voluntary dehydration and overhydration during exercise in the heat: possible related factors. *Thinking in Motion: Journal of Exercise and Health Sciences*. 2006;4(1):22-33.
8. Jiménez JG, Lucas JLY. Sweating rate and dehydration levels in professional futsal players during official competition. *Sports medicine archives*. 2010;27(140):457-464.
9. Noakes TD, Goodwin N, Rayner BL, et al. Water intoxication: a possible complication during endurance exercise. *Med Sci Sports Exerc*. 1985;17(3):370-375.
10. Otegui AU, Sanz JMM, Sánchez SJ, et al. PHydration protocol before, during after sport and physical activity. *European Journal of Human Movement*. 2013;31:57-76.