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IMPORTANCE OF WATER IN SPORTSMAN NUTRITION

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Abstract: Only a small number of athletes and experts knows that the water has a major role in sports. If the list of nutrition would be compiled on the biological sense, the water would be at the top of the list. Water is constantly lost through breathe out air, through the skin, through the urine and feces, the physiological body cooling, and sweating. Loss of body fluids during physical activity through sweating can range up to 5 liters, which is about 50 times higher than at response, and with exhaled air is lost three times more water than in rest. All the lost water is compensated in that amount which is lost. This is the legality of the athletes, without which it is impossible to achieve superior results.

Key words: water, nutrition, sport

Physical and Chemical Properties of Water

Water is one of the simplest and most common substances in nature, whose physical and chemical characteristics are well known. Some of these features are unique, and because of them water is so important for life on Earth. Pure water is a liquid with no odor, no taste and is usually colorless.

Because of the strong dipole moment of the water molecule it attracts molecules of crystal, penetrating into its structure and therefore well dissociates ions. For this reason, water is very good solvent and carrier for many electrovalent compounds, such as NaCl, and about forty other salts in seawater. Water is less efficient solvent for covalent compounds, and the least efficient for fats and oils. Water is a kind of catalyst for various chemical reactions, as it allows proper orientation of the dissolved ions. So it is no wonder that living matter originate from inorganic compounds in the sea (Dalmacija et al., 2009).

Importance of Water

In the body of an adult man, water content is $60 \pm 15\%$ and in a woman $55 \pm 15\%$, which means that water is one of the fundamental requirements for survival and life of human on Earth. Depending on climatic conditions, water consumption necessary to sustain life ranges from 3 to 12 l/day. 75% of body water is used for thermoregulation, and only 25% for mechanical work.

Water is by far the richest component of all living organisms and is of fundamental importance in maintaining both structure and function of tissues, i.e. cells as the basic units of living things. Faculty of Technology

The percentage of water content in the human body is different in different tissues or organs. It can be said that the greatest amount of water in the body is in the skin and muscles, and the least in skeletal and adipose tissue. Male body of 70 kg body weight contains 9 liters of water in the skin, 22 l in muscles, 2.45 l in skeleton, 4.65 in the blood, and 0.7 l in adipose tissue. Although the heart, lungs, kidneys and brain contain a high percentage of water, their share in the total body weight is low (Tojagić and Mirilov, 1998).

Sportsman Needs for Minerals and Water

It is well known that athletes for a few hours during the contest lose a grate amount of water. Such great water losses during trainings and competitions are through sweating and increased respiration. Since

these losses can amount to more liters, it would be non-physiological to suppress the secretion of sweat by taking smaller amount of liquid, because that could decrease sports form. It is therefore very important that the liquid balance in athletes is well balanced.

The accurate required amount of liquid can be determined easily, by controlling the volume of daily urine output, which should be at least one liter. Natural maximal need for liquid occurs immediately after the exercise performance. It is necessary to take a certain amount of water during exercise performances, especially when these are long-term. At the termination of exercise, water should be recovered firstly, and then minerals. Minerals participate in important regulatory mechanisms and their concentration is very important for the muscles (Sawka and Pandolf, 1990).

Clinical - Physiological Aspect

Loss of water in the human body causes various disorders that are differently manifested in the dependence of the percentage of loss:

1% - the threshold to start feeling thirst, start of thermoregulation disorders, and decrease of sports abilities up to 10%

2% - a strong sense of thirst, discomfort, loss of appetite

3% - a completely dry mouth, increased hemoconcentration with reduced urination. The decrease of sports abilities is up to 20% (especially cardiocirculatory endurance).

4% - reduced sports ability up to 30%, need for expert medical supervision.

5% - difficulty in concentration, the appearance of severe headache, inability to sleep.

6% - a full and serious disorder of thermoregulation with the occurrence of clinical heat stroke (edema, tetany, syncope, hyperventilation).

7% - collapse with heat stroke and possible hypertermic exitus (Erkmen et al., 2010).

Phases of Liquids Intake in Athletes

Liquids intake for athletes is related to the adequate intake of drinks before, during and after the competition. There are four phases of liquids (water) intake:

1. prehydration
2. hydration
3. dehydration
4. rehydration

Prehydration - it is very important for maintaining body temperature during competition, and in the prevention of weight loss. Two days ahead of the competition extra liquid (water) should be taken. Then, 4 hours before the competition liquid (water) intake should continue every 30 minutes, with the last portion being taken at least 20 minutes before the competition, so much time is needed for pure water to be discharged from the stomach. Then the bladder should be emptied and there should be no fear of voiding needs during the competition because kidneys almost completely stop urine production during physical work.

Prehydration success is closely related with taking some supplements during this period such as supplements containing about 7% of carbohydrate, and also small amounts of potassium, magnesium, phosphate and sodium, which are proven to enhance the absorption of liquid. To start the competition, it is necessary for the athlete to intake 1000 to 1200 ml of water (some authors believe that the ideal intake of 600 - 800ml) 1 - 4 hours before the competition.

Hydration - water should be taken before, during and after physical exercise, being taken almost continuously. If prior to training or competition sufficient hydration of the body is not provided, the deficit could no longer be compensated by drinking water during training or competition. The point is that the body should be fully hydrated for the physical exertions (<http://testiranjeusportu.html>).

Dehydration (water loss) - scientific research has shown that 3-4% loss of total body water leads to decrease of contractile muscle strength by 30%, and the speed and explosiveness of the muscle by 8%. When, during heavy physical exertion, dehydration occurs, the stomach is almost completely empty, containing a small amount of very acidic juice, the muscles are full of decay products of glycogen metabolism and, in the worst case, decay products of catabolism of amino acids (lactic acid, ammonia, various electrolytes) as well. Depot of reserve sugar (glycogen) in the liver and muscles are completely empty, and because of the predominant loss of water, the salt concentration in body fluids and cells is increased. Along with all this, there is also increased production and reduced heat emission, which leads to overheating of the body. All these conditions are extremely unfavorable for the performance of muscular work, and sports scores. Dehydration is caused by sweating due to high temperature, decreased blood volume occurs, and this is all happening at the expense of the extracellular space in thermoregulation and come up with circulatory disorders.

Water leaves the body through evaporation from the skin, evaporation from the lungs or by the secretion of much diluted urine. In all these cases, the water leaves the extracellular fluid, but also some of the cellular water passes by osmosis into the extracellular space, and thus equalizing extracellular and cell osmolarity. The final effect is dehydration (<http://www.pzsport.org.rs/dijagnostika.htm>).

During the competition, it is important that the water is taken more often in quantities of 100-200 ml every 15-20 min (UEFA was considering the possibility of introducing a time-out during the competition for liquid intake).

Rehydration (restoration) of fluids is one of the most important phases of the preservation of muscle glycogen concentration (2.7 g of water bind 1 g of glycogen). In order to preserve muscle glycogen it is best to include 10% carbohydrates in the form of drinks immediately after physical activity, in the first phase, in the second stage after 90-120 min another 4-8% carbohydrates (by body weight), and later energy fats and minerals Na, Mg, K, Ca should be taken. Potassium (500-700 mg) is especially important for the glycogen resynthesis. The temperature of drinking water that is recommended for athletes during winter and summer ranges from 4 °C to 10 °C. It is believed that the greatest loss of water is when the receipt is the biggest.

Rehydration is properly done when the following conditions are reached: storage of muscle glycogen and water consumption is in the same or greater quantities as loss, depending on the effort. Loss of fluids during the effort requires them to be compensated. In cases of high secretion of sweat, daily water needs can grow to several liters. There are several methods to calculate the lack of water and is easily applied by compensating of each kilogram of body weight loss by one liter of water (Murray, 1998).

Means for faster recovery – during recovery time, different substances in the body are restored, according to the principle that the primary decomposition processes still induce or enhance the resynthesis reactions. These fluids contain about 2% fructose (fruit sugar) and about 5% (not more than 7%) glucose polymers that are easily absorbed in the intestine. Fructose is preferred over glucose because it does not cause sudden secretion of insulin in the blood and is much better source for the formation of glycogen in the liver than glucose.

Restoring levels of various blood and muscle parameters in the resting period is achieved heterogeneously. The fastest return to normal levels is for pyruvic and lactic acid in the blood and muscles, and

normalization of acid-base balance. Then the content of creatine phosphate, returns to the initial level and later muscle glycogen and protein, and finally ATP content are normalized. Regardless of the intense ATP production, during the resting period ATP is spent on providing energy necessary for biosynthetic processes and its level is fully restored only at the end of the recovery period (www.kondicijskitrening-sportasa.com).

When the competition is finished, no resting by sitting is recommended, no matter how great effort was. Relaxation of the muscles can cause cramping and even injuries, as tired muscles are not getting enough blood to remove the accumulated products of decomposition. Contraction of muscles is the best pump for blood supply. It is often seen that athletes after the race walk and drink water. Complete rehydration occurs in the next 12 hours by taking liquids to full compensation. At the same time, food should be taken too, mainly complex carbohydrates such as pancakes or pasta from whole grains, oat flakes. Fruits are also good to be taken in this period, especially bananas and fresh apples. Macrobiotic cookies can be taken, too. Carbonated drinks and beer, other types of fruit, yogurt, chocolate, a variety of snacks full of sugar and fat should be avoided. Many commercial drinks and fruit juices contain large amounts of simple sugars, sucrose, glucose or fructose, usually above 10%. These sugars are osmotic active, which means that they bind water and do not allow its absorption in the intestine. Athletes should not use them, especially not after competition and training when the need for pure water is the greatest. Juices of citrus fruits (oranges, lemons) should be especially avoided because they contain much sugar, and also are causing a more acidic internal environment (Hill et al., 2008).

Water During Training

During exercise, it is necessary to recover the fluid which is lost in sweat, because even a low dehydration, 2% of body weight, can significantly affect the athlete. The loss of every 0.5 kg of body weight as a result of exercise is a waste of about 500 ml of fluids and consumption of the same amount is required for the preservation of hydration. Thus, fluid intake during exercise should keep up with fluid loss through sweating.

Before training - Always start training at full hydration by drinking small amounts of liquid frequently in the period before the training or competition.

During the training – liquid intake should start immediately after the start of training or competition. For exercise lasting longer than 45 minutes drinks containing carbohydrates may be useful in maintaining energy levels and as compensation for fluid loss.

After training – intake of adequate liquid content should start immediately to compensate the body weight loss incurred during training.

The adequate liquids will make up the fluid loss, as well as the salt loss through sweating, and will rapidly perform rehydration avoiding problems in the organism. Isotonic drinks have a dual role, firstly, in order to satisfy thirst, and secondly to maintain the balance in body weight. During physical efforts, the body is sweating a lot, and is losing vitamins and minerals. In the drink that is used during the training or in food that is taken after physical activity, small amounts of salt could be added in order to increase rehydration (www.sportforma.com).

How to Intake Water

When to intake water? Water should be intake before, during and after exercise. The liquid should be taken constantly and continuously!

How much to drink? If it is technically feasible, it is recommended to drinking 1 dl of pure water cooled at about 10 ° C every 15 minutes.

What kind of liquids should be taken? Pure and cold water. Cold water is absorbed faster than the water at room temperature; it nevertheless cools the blood preventing the body from overheating. Almost all compounds added to the water slow its absorption. When there is an urgent need, then it is the best to drink pure distilled water.

In endurance sports, often practice is to mix liquids which hydrate the body, such as in cycling where often two bottles are used, in one is just pure water, and in the second some other kind of liquid that fits the best for the athlete. After a hard effort, water should be taken during walking by drinking small portions. Contraction of muscles is the best pump for the supply of blood. When the muscles relax suddenly very often cramps and injuries may occur because the muscles at rest are not getting enough blood to remove the accumulated products of decomposition. Carbonated beverages should be avoided (http://www.savremenisport.com/Medicina_Znacaj_vode_u_organizmu_sportiste.html).

Instead of Conclusion

Water as an environment in which life was created, with all its complexity, is still a great mystery for science and today a number of laboratories in the world, are examining the structure and properties of water molecules, but still there is no a complete answer on the origin and all the biophysical and biochemical characteristics important for optimal health and physical activity of humans.

One thing is certain: **Water is life around us, water is life in us.**

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