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A Strategy for Maintaining Fluid and Electrolyte Balance in Aerobic Effort

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Abstract

During endurance exercise, approximately 2% of the body weight is lost through sweating, although the adaptive phenomenon of water "conservation" (slow blood flow to the kidneys) and prevention of dehydration is triggered in the athletes' body. Higher losses emphasize this situation, because hydrostatic pressure differences within the internal compartment causes fluid transfer. Such gradients occur during exercise, when due increase of the osmotic pressure water is redistributed from the blood vessels to the muscles. The internal environment's electrolyte homeostasis is highly influenced by daily intake of water with or without minerals. The desire to minimize hyperthermia, dehydration and mineral imbalances in the athletes' body, as well as overall hydration - pre, intra and after effort - is a constant concern for sports specialists. Obtaining the "ideal" drink for athletes during recovery, in order to stimulate intestinal absorption of water, to maintain the electrolyte balance of the body and to provide energy to support muscular activity continues to be a challenge for most producing companies

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1. Background

During rest, the relatively constant amount of water in the body is ensured by fluid intake (60%), by solid intake (30%) as well as through energy-producing biochemical reactions (10%). The electrolyte balance of the internal environment is maintained by the activity of the hypothalamic regulatory system, through the renal and the endocrine functions of the body. Any disturbance of the normal fluid limits leads to great losses or excessive accumulations of water. These can be conditioned by the climate, the nature of nutrition, health and physical activity. Thus, at high ambient temperatures, during intense physical activity and fever, water elimination can

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exceed 2.5 l/h. The restoration of the fluid balance is directly modified by daily water needs. For example, an athlete performing moderate physical activity in a moderate climate requires 1500-2000 ml water/day. These values can increase by 500-1500 ml/day at high temperatures, in pathological conditions or during long-term aerobic effort. In all cases described, the fluid intake should be strictly adhered to. Loss of only 1-2% of global water from the body inevitably leads to serious diseases or cell death (Apostu, 2003).

The level of dehydration of the body is proportional with the duration of exercise and dependent on weather conditions. The human body cannot spontaneously compensate electrolyte losses because there is a disproportion between the retention capacity and the degree of loss, caused by the appearance of "the involuntary dehydration phenomenon" (Guyton, 1996). This paper attempts to highlight the importance of re-establishing the electrolyte balance, as one of the objectives of supporting sports performance, drawing special attention to the amount, composition and the time of the hydrating drink intake. The information below is supported by the data analysis in the literature and experimental results obtained by evaluating the functional and biochemical parameters.

2. Material and methods

During physical exercise, the intensity of the catabolic reactions increases leading to body overheating and massive loss of body water. Prolonging physical activity magnifies the aerobic degradation rate of metabolic water. This is, however, insufficient to maintain the stability of fluid volume, which is affected by heavy sweating. Thus, 245 g of metabolized carbohydrate during an hour of exercise at medium intensity can release 146 ml of metabolic water – a very small amount as compared to the 1500 ml of sweat lost at the same time (Wilmore and Costill, 2001).

2.1. Hydration before exercise

When it comes to endurance athletes, the hydrations level of the body conditions the exercise capacity. Decreased by only 2% through sweating (1200-1600 ml water) one's body weight modifies thermoregulation and cardiovascular activity. Also, disruption of mineral balance has negative effects on the contractile function of the myocardium and skeletal muscle (Guyton, 1996).Generally speaking, assessing the degree of dehydration is based on the appearance of "thirst". For sportsmen this is not an indicator edifying, because there may be a slight dehydration even before the "thirst" appeared. In addition, this feeling disappears before the necessary body's fluid is covered. There is also a great variety of ways to react to thirst, depending on each individual, some athletes are "big drinkers" when dehydrated, others are less receptive.

In this context, hydration before effort limits dehydration in terms of aerobic exercise and is one of the strategies to maintain fluid level in the athlete's body. Experiments conducted by Montain & Coyle (1992) and R. Maugham (1996) demonstrated a limit of 3% dehydration, accompanied by a 6-7% increase in exercise capacity and cardiovascular function by 2% if athletes consumed between 2.7 to 4.6 litres of liquid the day before exercise and 500 ml two hours before the start.

The American College of Sports Medicine (2007) recommends the use of glycerol (1g/kg body weight) before exercise, after numerous studies have shown an increase in aerobe effort capacity during physical activity under a high environmental temperature. The trihydroxylic compound got the attention of specialists thanks to its high degree of saturation that can ensure good hydration of the internal environment through direct involvement in carbohydrate metabolism. Due to the maximum glycemic index, glucose drinks should not be included in the hydrating drinks ingested 2 hours before exercise, as they raise blood glucose levels, already high as a result of the starting state. In this case, limiting endocrine factors, as well as the effects of hyperglycemia and hypoglycemia which can appear during aerobic exercise may have negative effects on the athletes' performance.

Special attention is given to the "pre-effort hyperhydration" technique, a strategy that is more and more seen among in athletes, due to their desire to limit dehydration during exercise. In this practice glycerol ingestion is

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