TOURO COLLEGE & UNIVERSITY SYSTEM

The Science Journal of the Lander College of Arts and Sciences

Volume 8
Number 2 *Spring 2015*

1-1-2015

Should Sports Drinks Be Given To Children And Adolescents Engaged In Athletics As An Effective Source Of Hydration?

Zeev W. Rubinson
Touro College

Should Sports Drinks be Given to Children and Adolescents Engaged in Athletics as an Effective Source of Hydration?

Zeev W. Rubinson
Graduated in January 2015 with a B.S. degree in Biology.

Abstract
Dehydration in children and adolescents is a major concern for caretakers. Often children are not drinking enough, particularly while participating in physical activity. Utilizing data drawn from pediatricians, nutritionists, and bio-scientists, this paper will examine whether sports drinks are a good source of fluids for the exercising child. The results of the research indicate that the advantages generally associated with sports drinks, to achieve higher body water absorption levels, prevent electrolyte deficits, and maintain proper electrolyte/water concentrations, are reserved for unique circumstances. Sports drink intake should be encouraged only when the child is participating in prolonged physical activity, in intense exercise with short break intervals, or in hot/humid environments. In these instances, sports drinks adequately resupply the lost fluids and electrolytes. Furthermore, the carbohydrates contained in sports drinks replenish energy supply. However, under normal conditions, sports drinks are associated with health risks, primarily due to their excess of sugar. Care should be taken to encourage children to avoid sports drinks and instead encourage them to consume plain water at a rate equal to sweat loss. The research establishes that health risks involved with sports drink intake outweighs the benefit of increased voluntary consumption.

Introduction

The Importance of Hydration

Water is an essential nutrient required for life. It is the most abundant compound found in the human body and is responsible for moving nutrients along the body's pathways. Water is also involved in biochemical reactions as a solvent and reagent; its physical properties affect reaction rates and mechanisms of various processes. Dehydration, an imbalance between water intake and body water loss, which can be caused by sweating, respiratory process, and/or urine production, is generally defined as a loss of 1-2% of body weight (Kliener, 1999). This level of dehydration increases the core body temperature (Ganio et al., 2007), impairs aerobic capacity, decreases plasma volume, and increases cardiovascular strain (Hill et al., 2008). Furthermore, studies indicate a correlation between insufficient fluid intake and different forms of cancers (Kleiner, 1999). Even when the water concentration deficit is less than 1% there can be negative effects, such as headaches, digestive problems, lack of concentration, and dry skin (The Expert Group on Hydration, 2005).

"Sports drinks are beverages that may contain carbohydrates, minerals, electrolytes, and flavoring and are intended to replenish water and electrolytes lost through sweating during exercise" (Pediatrics, 2011).

Children

The average daily total water recommendation for children aged 6 to 11 is 1.5 liters for girls and 1.7 liters for boys (National Academy of Sciences, 2005). Children aged 11 and above should be drinking approximately 2 liters per day. Special care needs to be taken to ensure that children and adolescents are properly hydrated. They are less likely to take the time to drink regularly, especially when in school where decisions are made for them (The Expert Group on Hydration, 2005). Due to their smaller size, children are at greater risk of the effects of poor hydration (Pediatrics, 2000).

Data from the U.K.'s National Diet and Nutrition Survey of 2000 are cited to demonstrate that most children are not drinking enough and most parents are not aware of this issue. In the study, 40% of 11-18 year olds were consuming less than the Food Standards Agency's minimum of 1.2 liters. In schools, 38% of students were not offered sufficient fluids even after physical education (The Expert Group on Hydration, 2005), despite the fact that the effects of dehydration can be especially severe when children exercise. They generate more metabolic heat per mass unit than adults do during exercise, even when just walking or running (Pediatrics, 2000).

Due to the high risk of dehydration, should sports drinks be given to children and adolescents engaged in athletics as an effective source of hydration?

Method

Critical analyses of research articles were utilized to gather this information. These articles were collected from online databases and journals, such as, Touro College's online databases, PubMed, and Google Scholar.

Sport Drinks: A Source of Hydration

Many experts assert that sports drinks are an invaluable source of hydration, as they maintain body electrolyte concentrations and lead to greater fluid consumption.

Electrolytes

Excessive intake of sodium-free drinks, such as plain water, can lead to hyponatremia, a rapid fall in serum sodium concentration and serum osmolality (Maughan, et al., 1993). Even replacing large

fluid losses with equal amounts of pure water may dilute the plasma sodium level (Ganio et al., 2007). Water alone cannot replace electrolytes lost through sweat. Therefore, it has been suggested that electrolytes and water should be replaced with sports drinks that contain the proper amounts and ratios of these elements (Maughan, et al., 1993, Pediatrics, 2000).

Water Absorption

Dr. R. J. Maughan, a Fellow of the American College of Sports Medicine, and his colleagues maintain that electrolytes contained in sports drinks enhance fluid absorption in the body. Sports drinks manufacturers frequently use this assertion when advancing their products and also claim that sports drinks are scientifically formulated to tackle dehydration. Lucozade®, a drink manufacturer states, "Adding both carbohydrate and sodium to a sports drink, helps your body absorb fluids more effectively" (Lucozade, 2015).

Taste

Naturally, people, especially children, tend to consume fluids that they enjoy. The effect of taste is found even within various sources of water. One survey found that out of 124 respondents, 43% said taste was the primary reason they chose bottled water over tap water (Kliener, 1999). Surely, the palatability of cool, pleasant-tasting sports drinks greatly enhance fluid intake. More specifically, sodium chloride, commonly found in sports drinks, has been shown to increase voluntary fluid intake by 90% compared to unflavored drinks (Pediatrics, 2000). Additionally, the carbohydrates that sports drinks contain, to various degrees, may influence palatability (Maughan, et al., 1993). Therefore, while water is an easily available drink, flavored beverages, sports drinks, are often the beverage of choice to increase fluid intake, specifically, in the case of an exercising child, where the need for rehydration and sensitivity to flavor are especially significant.

Thirst Inhibiter

The body's natural reaction to dehydration is thirst. The hypothalamus senses fluid loss when the concentration of sodium in the body rises. It responds by increasing renal sodium and water conservation, which stimulates the sensation of thirst (Noakes, 2012). Drinking plain water could lead to a rapid fall in sodium concentration which could alter the chain of reaction, ultimately inhibiting thirst and causing a reduction of fluid intake. Sports drinks are preferred, since they have accurate water-sodium ratios and do not inhibit thirst.

Refuting the Claims in Favor of Sports Drinks

Taste

While tap water does not have a favorable taste and can lead to children not drinking enough fluids, palatability can be achieved in ways other than sports drinks. For example, parents and caregivers can supply children with filtered, purified, and/or bottled water. If this does not supply the desired fluid intake, taste can be enhanced by adding a minimal amount of flavor, such as lemon slices, to the water (Ahmad, 2008).

Electrolyte

Sweating is the most efficient method that the body uses to dissipate excess heat, either a result of byproducts of muscular work or from a hot environment (Burke, 1997). The water contained in sweat decreases the core body temperature through evaporative cooling at the skin surface. Generally, the sweat produced by the average exercising child or adolescent is a relatively dilute plasma secretion containing far more water than electrolytes. Since the main fluid lost is water, the main replacement should be water, not sports drinks which contain electrolytes (Ahmad, 2008). Nevertheless, to avoid incorrect electrolyte/water ratios, care should be taken not to drink disproportionate amounts of water (Robert Wood Johnson Foundation, 2012, Pediatrics, 2011). Most children's and adolescents' daily electrolyte requirements are met sufficiently by a healthy balanced diet, while sports drinks offer little to no advantage over plain water. Furthermore, sports drinks can be harmful due to excess caloric, fat, and protein intake and the potential nutritional imbalance that can ensue.

In addition, hyponatremia has been observed in cases of dehydration, maintained hydration, and over hydration. Therefore, excessive water intake cannot be correlated to hyponatremia; the cause may be multi-faceted and circumstantial and further studies need to be done before conclusions can be drawn (Ganio, Casa, Armstrong et al, 2007).

Energy Source

Despite the above arguments, some maintain that sports drinks are still advantageous for energy resupply (Maughan, et al., 1993). However, since the average child athlete does not need quick energy supplements, there is little need for energy-containing beverages. The recommended daily intake of fruit juices, low fat milk and other daily diet food supply the appropriate amounts of carbohydrates and proteins that children need (Pediatrics, 2011).

Water Absorption

The advantage of increased total water absorption attributed to sports drinks is only under conditions where further bouts of exercise occur after short recovery periods. However, during rest or low intensity exercise, sports drinks do not improve the overall water absorption rate or the amount consumed by means of plain water. This assertion is maintained by an innovative experiment using a deuterium dilution technique to compare the hydration ability of commercially available sports drinks versus water (Hill, 2008). Scientists provided three different sports drinks solutions, as well as plain water, ingested with an isotope

tracer, to exercising subjects (aged 18-35) at set intervals over the course of sixty minutes. The team then analyzed their saliva samples; the appearance of deuterium in saliva indicated the uptake of water in the body's tissues and enabled the team to calculate the kinetics of the water absorption. With the aid of proven mathematical modeling, the kinetics data provided the researchers with estimates for the maximum absorption rate, the time at which absorption was complete, and the percentage of solution absorbed, at any given time. This innovative approach measured the gastric emptying rate and the intestinal absorption, two major factors that affect absorption of the solution's water content. It is important to note that the exercise was not intensive, consisting of walking on a treadmill at 55% of heart rate maximum for an hour. The results of the experiment clearly indicated that for the speed of rehydration, the maximum rate of absorption was achieved with sports drinks rather than with water. Nonetheless, by half of the total time of absorption there was no difference in the rate of absorption between the sports drinks and water. Furthermore, by the end of the total time, the sports drinks and water solutions accomplished the same total absorption volumes. Therefore, the study determines, "under conditions where recovery periods occur between further bouts of exercise, sports drinks may be favored due to faster speed at which they reached their max absorption rate." However, for normal, non-intensive, conditions, since there is no advantage in total water absorption and no need for quick rates of rehydration, there is no hydration advantage in providing sports drinks instead of plain water.

Sports Drinks – A Bad Choice For Hydration

Excessive Sports Drink Consumption

Sports drinks contain sugars and recent studies show that most children today consume far more added sugars than the maximum daily recommendation (Johnson RK et al., 2009). Beverage patterns and trends among school-aged children in the United States indicate that, between 1989 and 2008, the percentage of American children aged 6 to 11 consuming sports drinks increased from 2 percent to 12 percent (Lasater et al., 2011). A study by a group of nutritionists measured US children and adolescents per-capita daily caloric intake from sugar-sweetened beverages (SSB) and 100% fruit juice. The authors found that SSB consumption increased from 242 kcal/day in the years 1988-1994 to 270 kcal/day in the years 1999-2004. One hundred percent fruit juice intake increased from 38 to 48 kcal/day. The largest increases occurred among children aged 6 to 11 years (Wang et al., 2008). In another study, researchers asked adolescents why they drank sports drinks. No one claimed they did so to maintain hydration (O'dea, 2003).

Excessive sugar intake causes weight gain, poor nutrition, displacement of healthy ingestion, obesity, and poor dental health. In addition, SSBs lead to type 2 diabetes and cardiovascular disease (Robert Wood Johnson Foundation, 2012). Additionally, the gratuitous amounts of sodium found in sports drinks displace necessary nutrients and results in excessive caloric intake (Pediatrics, 2011). Therefore, to achieve optimal health, sports drinks should not be used as a source for hydration.

The Value of Sports Drinks

In the event that the child is playing in a hot and/ or humid environment maintaining hydration is even more crucial, as children do not adapt to extreme climatic changes as well as adults do. "A child may need as many as 8 to 10 exposures (30 to 45 minutes each) to the new climate to acclimate sufficiently." Hot air temperatures and high humidity levels, even with relatively normal air temperature, may lead to heat stress. Furthermore, children have a large area-to-body mass ratio which results in significant heat gain. Moreover, children's sweating capacity is considerably lower than adults, which diminishes their ability to dissipate body heat via evaporation. Consequently, children exercising in hot and humid environments are at greater risk from the effects of dehydration (Pediatrics, 2000). More specifically, children playing in hot and/or humid conditions for more than one hour lose excessive amounts of electrolytes, such as sodium, potassium, and chloride, which cannot be replaced sufficiently by plain water (Ahmad, 2008). Under these conditions, "[s]ports drinks have been shown to decrease fatigue and replace electrolytes lost in sweat" (Robert Wood Johnson Foundation, 2012).

Likewise, sports drinks are appropriate for children and adolescents who engage in prolonged vigorous physical activity, as the amount of energy and electrolytes lost cannot be regained through plain water alone (Robert Wood Johnson Foundation, 2012). To prevent fatigue and maintain performance it is necessary to resupply muscle glycogen stores through ongoing intake of carbohydrates. The carbohydrates and electrolytes contained in sports drinks restore the loss, and provide the necessary nutrients in the proper ratios.

Discussion

In view of the above, for the average child, water is the best form of hydration. Sports drinks are detrimental, in large part because they provide children with excess sugars. Furthermore, their added ingredients can negatively affect the proper amount and relative proportion needed for a healthy diet. Cohen (2012) affirms that after 38 years of research there is still no scientific proof for sports drinks providing higher fluid intake or better absorption than water. Sports drinks were designed for committed athletes, and they should be restricted to them.

In addition, while sports drinks may be advantageous because of their greater palatability in comparison to tap water, which will

lead to children consuming more fluids, parents and caregivers should keep in mind that the bad health effects far outweigh these benefits. Therefore, water should be the beverage of choice, and if the child is not drinking enough, a parent should seek methods to encourage voluntary water consumption, such as by providing cool, filtered water and promoting the health benefits of water (Loughridge and Barratt, 2005).

Nutritionists offer water drinking guidelines to maintain hydration. In the case of a child participating in normal physical activity, for less than three hours and in normal air/humidity conditions, water intake should occur every 15-20 minutes (Ahmad, 2008). The main body fluid lost is water, therefore, water is the only substance needed to be replenished. Still, care should be taken to replace water at a rate equal to, not greater than, the sweat rate (Ganio et. al, 2007). In events of intensive physical activity, water and a balanced diet, for example, soup, fruits and vegetables, are enough to replace the water, carbohydrates and electrolytes lost during exercise, provided the activity does not last more than an hour (Robert Wood Johnson Foundation, 2012). In the event of prolonged physical exercise, children should be well hydrated before and during the activity. Periodic drinking should be enforced throughout, even if the child does not feel thirsty (Pediatrics, 2000). Also, children and adolescent athletes should drink water even after the activity is over (Pediatrics, 2011).

In cases of hot or humid conditions and during intense exercise lasting over an hour, since there is a greater loss of electrolytes (sodium, potassium, and chloride) and energy, water alone is not enough to rehydrate and replenish energy, and sports drinks should be provided (Robert Wood Johnson Foundation, 2012). Ahmad (2008) advises that every 15-20 minutes the child and adolescent should be provided with five ounces of electrolyte-replacing fluids such as water mixed with juice or sports drinks.

Also, sports drinks are commendable in situations where quick rehydration is critical. It is important to note that the various amounts of sodium, potassium, and magnesium, found in the different sports drinks all achieve quicker retention rates over a short period of time, in relation to plain water (Hill et al., 2008).

Thirst as an Indicator for Hydration

In general, as mentioned in the paper, exercise raises the core body temperature which causes the body to sweat out the heat and to replenish fluids lost in the process by the conscious feeling of thirst (Noakes, 2012). Over the course of the research, however, it was evident that scholars debate whether thirst is a good indicator for fluid replacement in children and adolescents. Some argue that thirst is not a good indicator and relying on it for fluid intake may lead to severe dehydration. Firstly, thirst often-times lags behind changes in hydration (Ganio, et al., 2007). The threshold of the indication of thirst occurs at a point when a person is already dehydrated to a level of .8 % to 2% loss of body weight (Kliener, 2009). Secondly, drinking water creates a reduction in plasma osmolality and reduces the drive to drink, even before sufficient fluid has been consumed to replace loss (Maughan RJ et al., 1993). Thirdly, children frequently do not feel the need to drink enough to replenish fluid loss during prolonged exercise, and if they find plain water non-appealing, they may not drink even if they are feeling thirsty (Pediatrics, 2000). Lastly, environments may alter the thirst mechanism. For example, swimmers may have virtually no thirst response during immersion (Kliener, 2009). Therefore, these researchers conclude that children should be given to drink even if they are not thirsty. The risk of relying on just thirst to identify when to provide fluids is greater in hot/humid environments, where the potential for hypo-hydration in children and adolescent athletes is even greater.

However, it can be argued that thirst is a reliable indicator; it is a natural biological response to dehydration and children rehydrate voluntarily when fluid is available (Kliener, 2009). Cohen (2012) questions the scientific validity of studies that claim thirst to be unreliable, calling it a "war on thirst". The article states that scientists who invalidate thirst as an indicator of dehydration are associated with the sports drinks industry and their results are biased. Instead, Cohen's article maintains that thirst is a good indicator of when to drink. In addition, humans do not need to immediately replace all the fluids lost during routine exercise; humans are delayed drinkers. Individuals can rely on the next meal for most fluid replacement. Thirst is a dependable indicator of water and electrolyte deficits that need to be imminently rectified (Noakes, 2012).

Conclusion

The negative effects of sports drinks render them unfit to properly hydrate children and adolescents; instead plain or flavored water should be the primary beverage. However, if an exercising child is not drinking enough, is playing for more than three hours in normal conditions, is engaging in repeated bouts of exercise interspersed with short breaks, or is exercising in hot, humid conditions for over one hour, then sports drinks would be the best source of hydration.

References

Asma Ahmad. Water is top choice for keeping kids hydrated AAP News 2008;29;29. http://aapnews.aappublications.org/content/29/8/29.4.full.pdf. Accessed January 5, 2015.

Burke LM. Fluid balance during team sports. J Sports Sci. 1997;15(3):287-95.

Climatic heat stress and the exercising child and adolescent. American

Academy of Pediatrics. Committee on Sports Medicine and Fitness. Pediatrics. 2000;106(1 Pt 1):158-9.

Cohen Deborah. The truth about sports drinks. BMJ. 2012;345:e4737. Available at: http://www.bmj.com/content/345/bmj.e4737.full.pdf+html. Accessed at January 4, 2015.

The Expert Group on Hydration. Drinking in schools. A report. 2005. Available at: http://www.montgomeryspring.co.uk/pdf-downloads/Drinking-in-Schools. Accessed January 4, 2015

Ganio MS, Casa DJ, Armstrong LE, Maresh CM. Evidence-based approach to lingering hydration questions. Clin Sports Med. 2007;26(1):1-16.

Hill RJ, Bluck LJ, Davies PS. The hydration ability of three commercially available sports drinks and water. J Sci Med Sport. 2008;11(2):116-23.

Johnson RK, Appel LJ, Brands M, et al. Dietary sugars intake and cardiovascular health: a scientific statement from the American Heart Association. Circulation. 2009;120(11):1011-20.

Kleiner SM. Water: an essential but overlooked nutrient. J Am Diet Assoc. 1999;99(2):200-6.

Lasater G, Piernas C, Popkin BM. Beverage patterns and trends among school-aged children in the US, 1989-2008. Nutr J. 2011;10:103.

Loughridge JL, Barratt J. Does the provision of cooled filtered water in secondary school cafeterias increase water drinking and decrease the purchase of soft drinks?. J Hum Nutr Diet. 2005;18(4):281-6.

Lucozade. Sports drinks and hydration. Available at: http://www.lucoza-desport.com/products/hydrate/. Accessed January 4, 2015.

Maughan RJ, Goodburn R, Griffin J, et al. Fluid replacement in sport and exercise--a consensus statement. Br J Sports Med. 1993;27(1):34-5.

National Academy of Sciences. Institute of Medicine. Food and Nutrition Board. Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate (2004) National Academies Press (2005). http://www.nal.usda.gov/fnic/DRI//DRI_Water/73-185.pdf. Accessed: January 5, 2015.

Noakes TD. Commentary: role of hydration in health and exercise. BMJ. 2012;345:e4171

O'dea JA. Consumption of nutritional supplements among adolescents: usage and perceived benefits. Health Educ Res. 2003;18(1):98-107.

Robert Wood Johnson Foundation. Consumption of Sports Drinks by Children and Adolescents: A Research Review. http://www.rwjf.org/content/dam/farm/reports/issue_briefs/2012/rwjf400046. Published June 2012. Accessed January 4, 2015

Sports drinks and energy drinks for children and adolescents: are they appropriate?. Pediatrics. 2011;127(6):1182-9.

Wang YC, Bleich SN, Gortmaker SL. Increasing caloric contribution from sugar-sweetened beverages and 100% fruit juices among US children and adolescents, 1988-2004. Pediatrics. 2008;121(6):e1604-14.