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Research Paper

THE ROLE OF SPORTS DRINKS IN ATHLETES: A REVIEW

K Angamuthu[1]*

Corresponding Author:* ***K Angamuthu* ✉ *kskamuthu@gmail.com*

Athletes challenge their bodies on a regular basis through tough physical training and competitions. At the time of final performance an athlete is supposed to be well nourished, uninjured, fit, focused and ready to compete. They have to meet their daily nutrient requirements to achieve the desired effect in their performance. And this depends on number of factors such as body size, the energy cost of training (volume, frequency, and intensity of workouts) and requirements for growth or changes in body physique. As a result, energy needs vary not only amongst athletes, but vary between phases of the season and over the athlete's career. The ideal sports drink are formulated to meet the individuals needs during training, it helps an individual to tolerate heavy training to a greater degree by helping them recover, faster or help them stay injury free and healthy during intense training. The aim of this review was to summarize and critically analyze the performance beneficial effects of sports drinks in an athlete.

Keywords: Sports drinks, Sports nutrition, Energy, Athletes, Physical performance

INTRODUCTION

The sport of athletics includes a wide range of events whose requirements range from speed to endurance, from a light physique to explosive power, and from multiple events lasting less than a minute to a single race lasting more than 2–3 hours. An athlete challenges his body on a regular basis through physical training and competitions. In order to keep up with requirement of his activity or sport, he requires enough fuel for his body on day to day basis. Sports nutrition is a specialization within the field of nutrition that partners closely with the study of the human body and exercise science. Sport nutrition has been well documented as being an invaluable tool to be used in any athlete's training and competition programme. It is the single most complementary factor to any physically active individual or elite athlete. For optimal performance, athletes should aim to be hydrated and adequately fuelled during exercise. Exercise scientists have extensively researched the best fluid to drink during exercise and there is now the production and sale of sports drinks which has become a lucrative and competitive industry, the rapidly growing variety of products are marketed with reference to

[1] Director of Physical Education, Periyar University, Salem, Tamilnadu, India.

sport or performance being superior to rival beverages.

WHY DO ATHLETES NEED SPORTS DRINKS?

Athletes need that extra feat than a normal person in terms of nutrition and exercise. These needs determine their performance and health. The first and foremost need is energy. Athletes have to meet their daily energy requirement and this depends on number of factors such as body size, the energy cost of training (volume, frequency, and intensity of workouts) and requirements for growth or changes in body physique. As a result, energy needs vary not only amongst athletes, but vary between phases of the season and over the athlete's career. Sports drinks can achieve this important factor by replenishing the energy loss during activity and maintain normal hormonal and metabolic functions that are usually affected due to energy imbalance in the body. To achieve a suitable energy intake athletes consume sports drink from a wide range of commercially available or homemade drinks that promote good health, and adequate fuel for training.

Another important necessity for an athlete is maintaining ideal physique, in many events; the athlete's physique plays an important role in promoting optimal performance. Generally loss of body fat/body mass should be gradually achieved by a program of mild energy deficit that still permits the achievement of the athlete's other dietary goals and allows the athlete to be reasonably free of food-related stress. An increase in muscle mass and strength is achieved by an appropriate resistance program with the support of adequate energy intake and strategic timing of food intake around training sessions. Different sports beverages formulated contain nutrients (carbohydrate, protein, fat, vitamin, minerals, amino acids, water) and other substances (herbs, caffeine) in proportions that are intended to optimize energy levels, hydration, recovery, muscle growth/repair, and, ultimately, performance.

Sports drinks are not nutritional supplements per se they are ergogenic aids that aid in replenishing the lost nutrients during workouts and performance. Although various substrates combine to provide the fuel for exercise, the body's carbohydrate stores are limited and are often less than the fuel cost of daily training. Sports drinks are needed in meeting the fuel requirement during exercise. They are

Table 1: Energy Requirements for Physical Activity

Physical activity level	Kcal/kg/day	kcal/day
General physical activity30-40 minutes/day, 3 times a week	Normal diet,25-35	1800-2 400[a]
Moderate levels of intense training2-3 hours/day, 5-6 times a week[b]	50-80	2500-8 000[c]
High-volume intense training3-6 hours/day, 1-2 sessions/day, 5-6times a week[b]	50-80	2500-8 000[c]
Elite athletes[d]	150-200	Up to 12 000[e]
Large athletes[d]	60-80	6 000-12 000[f]

Note: a: Values estimated for a 50-80 kg individual; b: Moderate levels of intense training use lower level of range, high-volume intense training uses; upper level of range; c: Values estimated for a 50-100 kg individual; d: Depending on training periodisation, and the volume and intensity of training; e: Values estimated for a 60-80 kg athlete; f: Values estimated for a 100-150 kg athlete

categorized into three, hypertonic, hypotonic and isotonic based on the carbohydrate content of the drink. Ideally isotonic drinks with a carbohydrate concentration of 8%, or even be slightly less is preferable over high carbohydrate concentrated drink, as they can impair gastric emptying during exercise.

Athletes in events requiring strength and power (e.g. sprinters and throwers) often believe that protein intake is their most important nutritional concern, and that high protein diets and protein supplements are a required part of their preparation. In sports beverages, protein is added either in the form of whole protein, such as casein, whey, or soy, as individual amino acids like arginine, glutamine, or more commonly, as branch chain amino acids (BCAA), leucine, isoleucine, and valine. These amino acids are used for energy production (gluconeogenesis) when glycogen and blood glucose levels decline, delay the onset of this central fatigue by decreasing the entry of tryptophan across the blood-brain barrier. Excess consumption of BCAA can increase plasma ammonia, which is related to brain toxicity and derangements in muscle metabolism, as well as decrease water absorption from the intestine, leading to gastrointestinal distress (5).

Athletes are at risk of inadequate intake of electrolytes, vitamins, anti-oxidants, when they restrict energy intake, dietary variety, or both of these factors. These micronutrients affect the performance of an athlete. Sports beverages were developed to provide electrolytes to help replace essential minerals lost through sweating. Electrolytes are minerals, and sweat contains electrolytes in varying quantities. Sodium and chloride are the main electrolytes lost in sweat (3). Fluid replacement is critical to exercise performance due to the role of fluid in body heat regulation (a limiting factor in exercise) and maintenance of adequate hydration levels (1, 14). Adequate hydration translates into lower heart rate, lower core body temperature, lower rating of perceived exertion, higher stroke volume, higher cardiac output, higher skin blood flow, and, ultimately, better performance (17). Sports drinks will keep an athlete hydrated as well as imparting other benefits.

COMPARISON BETWEEN COMMERCIALLY AVILABLE SPORTS DRINKS

There are many commercially marketed sports drinks available to athletes. Sports drinks are designed to meet the athlete's needs and requirements during training and performance. But each drink has different nutritional composition that an athlete should take careful look at before deciding on consuming it. The type of sports activity performed in high temperatures and humidity, individuals' health, food choices and body weight and body composition are also contributing factors in choosing the drink. In order to keep up with demand for stamina of their activity or sport, athlete needs adequate fuel for their body on day to day basis. Table 2 shows the comparison of the contents of popular sports drinks as stated in the label.

HOW TO CHOOSE THE BEST DRINK FOR SPORTS?

Sports drinks were created in 1965 in the United States as dietary supplements for athletes in an effort to address certain sports-related physiological and nutritional issues. These beverages were designed to provide the right balance of carbohydrate and fluid, to ensure that

Table 2: Comparison of the Contents of Popular Sports Drinks as Stated in the Label

Sports Drink	Energy (kCal/ 250ml)	Sodium (mg/ 250ml)	Potassium (mg/ 250ml)	Chloride (mg/ 250ml)	Osmola-lity (mOsm/ kg)	Total carbo-hydrate (g/ 250ml)	Carbo-hydrate concen-tration (%) [w/v]	Sugars (g/ 250ml)	Vitamins	Carbohydrate Source
10K	60	55	30	NS	350	15	6.0	NS	NS	High fructose corn syrup (% NS)
Allsport	80	55	55	NS	NS	21	8.4	10	NS	High fructose corn syrup (56%), glucose(43%), maltodextrins (1%)
Endura	62	80	160	NS	NS	16	6.4	NS	NS	NS
Exceed	70	50	45	80	250	17	6.8	NS	NS	Maltodextrins, fructose (% NS)
Gatorade	63	103	30	1	320-360	15	6.0	14	None	Sucrose (38%), glucose (34%), fructose (28%)
Gatorade (Europe)	50	110	30	8	378	14	5.6	14	NS	Sucrose (38%),glucose (34%), fructose(28%), maltodextrins (8%)
Hydrafuel	66	25	30	NS	NS	17	6.8	NS	C, E	Maltodextrins, glucose, fructose (% NS)
Isosport	42	103	29	NS	NS	18	7.2	15	NS	Sucrose (43%), glucose (24%), fructose (19%), glucose polymers (14%)\
Isostar	70	110	45	8	280	17	6.8	NS	C, E, β-carotene	NS
Powerade	70	70	30	NS	NS	19	7.6	15	NS	High fructose corn syrup, maltodextrins (% NS)
Rivella Marathon	NS	24	136	4	240	12	4.8	NS	NS	NS
Sponser	NS	69	110	11	326	16	6.4	NS	NS	NS
Sport Plus	72	91	54	NS	NS	18	7.2	18	NS	Sucrose (71%), glucose (29%)
Staminade	51	58	49	NS	NS	13	5.2	13	NS	Glucose (100%)
Xcel	62	47	70	NS	NS	15	6.0	NS	NS	NS

Note: NS = not stated.

* Coombes JS and Hamilton KL. 2000 "The Effectiveness of Commercially Available Sports Drinks" Sports Med 2000 Mar; 29 (3): 181-209 0112-1642/00/0003-0181/$20.00/0

electrolytes lost or utilized during prolonged vigorous physical activity are replenished; they are emptied quickly from the stomach and are rapidly absorbed from the small intestine. When used according to sports nutrition guidelines, sports drinks can have performance benefits. Although individual brands and products might vary, sports drinks typically contain nutrients such as water, electrolytes (primarily sodium and potassium), and carbohydrates. As mentioned earlier these nutrients contribute immensely towards the performance of the athletes. But careful consideration should be given to the content of the drink as well as the consumption frequency, when and how much of the drink is taken also matters.

The potential performance benefits of sports drinks are well documented however, the period of ingestion, before, during and after exercise should be acknowledged so that subsequent selection and consumption of a sports drink is determined.

1. **Before Exercise:** Typically, this pre-exercise meal should be consumed 2-4 hours before exercise (6). Sports drinks may be used by athletes before an event to fine tune their fluid and fuel intake. The carbohydrate tops up muscle glycogen fuel levels, while the added sodium may reduce urine losses before exercise begins. If the athlete's goal is exercise performance, it is crucial that he or she eats before exercise. It is advisable to choose a meal replacement beverage at least more than 2 hrs before exercise. But within 1 hour of exercise it is better to drink a carbohydrate/ electrolyte beverage.
2. **During Exercise:** During exercise there's increased loss of water and electrolytes through sweat. Therefore it is necessary to refill the loss of water and nutrients. For exercise lasting less than an hour, plain water is enough is maintain hydration but exercise lasting more than an hour will affect the energy level of the athlete and a carbohydrate/ electrolyte rich sports drink is suitable. They will allow the athlete to perform for longer and more effectively in training and competition. The nutrient loss through sweat is determined by the type of activity, temperature and humidity, but the current recommendations of the ACSM, ADA, and DC are to consume 30 to 60 grams of carbohydrate for every hour of exercise following the initial hour (1).
3. **Recovery**:Sports drinks are specially designed to meet individual athletes' nutrition recovery goals by replacing fluids lost in sweat and also assist with refueling targets to replenish glycogen stores. The best sports drink following exercise lasting longer than 1 hour is a carbohydrate/electrolyte beverage or carbohydrate, electrolyte, and protein drink, and 2 hours following an exercise a meal replacement drink is the right choice. Substantial research supports the consumption of carbohydrate in the quantity of 1.5 gram/kilogram body weight within 30 minutes following exercise and then again 2 hours later to replenish glycogen stores depleted during exercise lasting longer than 1 hour (6). When aggressive re-hydration strategies are required, drinks with higher sodium content may be more useful. Additionally, recent research supports that a small amount of essential amino acids equivalent to 0.01 g/kg body weight consumed 1 and 2 hours post exercise, and possibly in combination with carbohydrate immediately following exercise, may enhance protein synthesis. But consumption of healthy meal is preferable than a drink. To meet all recovery goals, the ingestion of sports drinks should be complimented with other foods and fluids that provide additional carbohydrate, protein, and other nutrients essential for recovery.

Table 3: American College of Sports Medicine Guidelines on Fluid and Electrolyte Replacement For Physical Activity

	Fluid and electrolyte recommendations for physical activity
Before exercise	Pre-hydration should be initiated several hours before exercise to ensure fluid absorption and normal urine output.Beverages and sodium-containing and salted snacks can increase the sensation of thirst and retain fluids.
During exercise	Fluid programmes should be customized for each individual, based on body weight measurements before and after exercise.Athletes should aim to prevent > 2% body weight loss during exercise.Fluids should contain carbohydrates and electrolytes to maintain fluid balance and exercise performance.
After exercise	Normal meals and beverages will induce euhydration. If more rapid recovery is required, 1.5 l of fluid per kg body weight loss during exercise should be ingested.Beverages and snacks should contain sodium to help with rapid recovery, stimulation of thirst and fluid retention.

CONCLUSION

The aim of this review was to summarize and critically analyze the performance beneficial effects of sports drinks in an athlete. The ideal sports drink are formulated to meet the individuals needs during training, it helps an individual to tolerate heavy training to a greater degree by helping them recover, faster or help them stay injury free and healthy during intense training. The consumption of sports drinks depends on personal taste preferences and individual tolerance. The nutrition compositions of sports drinks must be critically reviewed by sports dietitians in order to assess their suitability to form a part of an athlete's individual fluid plan. In any case, planning a balanced diet and consumption of water and other naturally available foods should take priority over commercial sports drinks.

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