THE CHEMISTRY OF SPORTS DRINKS: A THEMATIC REVIEWED APPROACH

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ABSTRACT

It seems like every second advert on the TV now is for a sports drink. Sports stars are featured using them, from Brian O'Driscoll to Sean Ó Hailpín and Damien Duff. These drinks make a lot of claims about improving performance and endurance, so how do they work?The essential formula for sports drinks has changed little over the years. They contain sugar for energy, water for hydration, electrolytes such as salt to help with water retention, plus color and flavoring. Formulators play around with the sources and relative concentration of these ingredients to make sure they end up where they're needed in the body as quickly as possible.

Keywords: Energy, Sports, Drink and Flavouring.

INTRODUCTION:

Today there is a wide range of energy drinks, sports drinks and soft drinks on the market, whichcan lead to confusion. How do athletes know what to drink during exercise and does it reallymatter? Athletes need to remain hydrated during exercise and that extra bit of 'energy' can boostperformance. So are there any real differences between the types of drinks available?

Water hydrates better than any other liquid, both before, during and after exercise. Cold wateris absorbed faster by your body than water at room temperature or body temperature.However, people don't usually drink enough water.

Soft drinks contain mainly water, sugar and flavouring. They are meant to taste good,encouraging more to be drunk, resulting in better hydration. They can be high in calories.

Sports drinks or isotonic drinks contain similar concentrations of salt and sugar as in thebody. They are designed to replenish the electrolytes lost during physical activity. Sports drinksdon't hydrate the body any better than water, but you are more likely to drink larger volumes,which lead to better hydration. Sports drinks usually contain fewer calories than soft drinks butwill still give a carbohydrate boost.

Energy drinks contain sugar, caffeine and a variety of other ingredients such as taurine,guarana and ginseng. Manufactures claim that they are designed to 'boost' performance andincrease stamina but many health experts disagree and say that any 'boost' in performance isdue only to sugar and caffeine content.

All living cells need energy to function in order for the chemical reactions occurring in the cells totake place. In humans this energy is obtained by breaking down organic molecules such ascarbohydrates, fats and proteins. When the previous substances are broken down at molecularlevel, bonds breaking and forming between the atoms in the molecules release or require energy.The biochemical reactions, which take place in cells when a fuel substance such as carbohydrate(e.g. glucose or fructuose) is broken down, will normally release more energy than they use. Thusenergy is available for other reactions to take place and to provide the energy needed for musclecontraction.

For many years, endurance athletes such as marathon runners have been advised to eat carbohydrate-rich foods such as pasta, leading up, during and after exercise. This is because it isimportant for endurance athletes to maintain good levels of blood sugar so that energy can bereleased by both aerobic and anaerobic respiration during the event. During the 1980scarbohydrate drinks became popular in endurance sports, especially where the sporting activitylasts for more than an hour as they proved to be a good way of quickly getting carbohydrates in tothe bloodstream. Sports performance is dependent on providing the energy required to contractour muscles to move our bodies. Therefore, using sports drinks could make a difference to theoverall performance. Recent research evidence also suggests that consuming carbohydratesduring high intensity exercise lasting less than an hour can also be beneficial to overall performance.

AEROBIC EXERCISE:

Whether you're running, walking, swimming, or playing football, your muscles are working more than they normally would. To work efficiently, your body chemistry changes.

Working muscles need lots of oxygen. This is delivered to your muscles and organs by blood, so exercise puts increased demands on your heart and lungs. Your heart beats faster to supply the blood and your lungs gulp in the air to get the oxygen from it.

Here's the technical bit. The chemical equation for respiration and aerobic exercise is:

$C6H12O6 + 6O2 = ATP + 6H2O + 6CO2$

Or (more simply): glucose + oxygen = ATP + water + carbon dioxide.

What's ATP?

ATP in that equation stands for adenosine triphosphate ($C10H16N5O13P3$).

ATP is an energy carrier, a bit like a truck transporting energy from one part to another, so it's needed to think, breathe or contract muscles, and it's recharged with food.

For this to work, your body needs three things to happen:

- As with any form of combustion, your body needs oxygen to burn or use ATP (so you inhale a lot).
- Your body needs to stay cool and get rid of excess heat (you sweat).
- Your body also needs to get rid of waste produced in this process (you exhale and your body breaks down lactic acid into its constituent parts to dump or reuse).

ANAEROBIC EXERCISE:

If you can't get the oxygen to your cells fast enough, your system uses whatever else is available to create ATP: it uses lactic acid. The chemical equation for anaerobic exercise goes like this:

$C6H12O6 = 2\ C3H6O3 + 2ATP$

Or, in simpler terms: glucose = lactic acid + energy.

The presence of this acid is the reason why your muscles feel sore while exercising (although, contrary to popular belief, it's not why they feel sore after exercising).

If Your Body Doesn't Get Enough Water

If you don't have enough water in your system while exercising, your body temperature rises and there's an even greater need to bring water to the sweat glands.

Blood is about 50% water, which is why blood that is being used to transport oxygen and nutrients to your muscles has to be diverted to do this, so your muscles don't get what they need. This leads to a poorer performance.

Sweating also involves the loss of essential salts or electrolytes such as sodium, potassium and calcium ions. These are central to healthy cell communication and affect how your muscles contract, so replacing them is crucial.

Isotonic Drinks

So where do sports drinks come into all this? Isotonic drinks contain electrolytes and carbohydrates. When you're engaged in strenuous activity, secondary bodily functions like digestion often 'shut down'.Isotonic drinks with small amounts of glucose are an alternative to eating solids – they are a quick and light way to give your body the food it needs to keep going. If you can manage a sip or two every 20 minutes during exercise it can prevent an energy crash.The drinks are fortified with essential salts too, so drinking them can help to maintain cell function and prevent dehydration. Flavours are also added, but this is just to make the drinks tastier.

CONCLUSION:

Sodium is the most common electrolyte in sports drinks. It helps the body retain fluid by maintaining osmotic pressure in blood vessels. The amount of salt released in sweat during a given activity varies by individual. Achieving the right amount can be a balancing act for manufacturers: Too much salt tastes bad, but too little won't replace what an athlete needs. For this reason, sports drinks generally contain about 20 mM of sodium at most, which is on the lower end of what average people lose in their sweat.

Finding the right amount of sugar is another tricky feat: Too much lowers the rate at which the drink empties from the stomach and enters the bloodstream, but too little means less energy and a possibly unpalatable drink given the added salt. As a result, an average sports drink contains about 3–7% sugary carbohydrate. Formulators experiment with mixing various types of sugars,

such as glucose, fructose, sucrose, and maltodextrins, so as not to overload any one type of transporter in the gut.

In addition to these three main components, drink developers experiment with other add-ins, such as proteins and branched-chain amino acids to help with muscle repair and growth. But these also run the risk of being absorbed inefficiently in the gut and thus slowing down the overall absorption of other, more essential components of sports drinks.

References

1. Jeukendrup, A.E., Carbohydrate intake during exercise and performance, Nutrition, 20 (2004) 669-677
2. Carter, J., Jeukendrup, A.E., Mann, C.H., Jones, D.A., The effect of glucose infusion on glucose kinetics during a 1 h time trial, Med Sci Sports Exerc, 36 (2004) 9.
3. RSC Advancing the Chemical Science, The Chemistry of Sports Drinks Teachers Notes
4. http://health.howstuffworks.com/wellness/diet-fitness/exercise/sports-physiology3.html
5. http://cen.acs.org/articles/95/web/2017/02/what-are-sports-drinks-and-do-regular-athletes-need-them.html
6. http://www.science.ie/features/archived-feature-articles/the-chemistry-of-sports-drinks.html