

New protein heralds next generation of sport drinks

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The market for sport beverages has grown significantly in recent years as consumers increasingly associate them with healthy lifestyles, making the market worth \$5 billion in the US alone (1). So many beverages have flooded the market that manufacturers are now seeking ways to differentiate their sports drinks from others on the market.

Sports drinks are traditionally defined as beverages with carbohydrates and sodium that help restore the essential fluids and minerals the body loses during exercise. Carbohydrates provide the energy the body needs to refuel. The majority of sports drinks fall into three categories; isotonic, hypotonic and hypertonic - each with varying levels of carbohydrate content. Isotonic drinks are the most common drinks consumed by athletes as they contain a carbohydrate electrolyte concentration similar to the body's own fluids. Hypertonic drinks contain extremely high levels of carbohydrates and are therefore best used as energy supplements during periods of heavy training, when energy expenditure is likely to be high. In contrast, hypotonic drinks contain very low levels of carbohydrates that the body can easily absorb beginning the rehydration process while simultaneously helping to replenish carbohydrate energy reserves.

ESSENTIAL PROTEIN

So, if we know that carbohydrates are a key ingredient for sports beverages, why should manufacturers also include protein in their sports drinks? By mixing protein with carbohydrates and minerals in sports beverages manufacturers are able to offer consumers an additional advantage in terms of exercise recovery. Protein supplies essential building blocks for the body to produce muscle tissue, repair damaged structures, maintain immune function and transport oxygen and other nutrients around the body. Studies have shown that protein consumed with a sports drink during exercise helps to protect muscle mass and to reduce exercise-induced muscle damage.

The human body contains several kilograms of protein which comprises approximately 50 percent of the body's cellular dry weight. Protein drinks were launched on the market in the 1990's to enable sports people to recover from strenuous exercise. However, until quite recently scientific evidence was not able to pinpoint the precise benefits of protein consumption before, during and after exercise.

FAST TRACK PROTEIN - SPORTS APPLICATIONS

Protein is an essential nutrient for athletes to provide energy to muscles, help reduce fatigue, protect muscle, promote faster recovery and repair damaged muscle tissue. Saunders (2004) found that protein could benefit athletes before during and after exercise as the results in table 1 illustrate. The study demonstrated that by combining protein and carbohydrates in a beverage, there was increased time before exhaustion, meaning that sports people are exercise for longer. Importantly, the trial also indicated that the inclusion of protein significantly reduced the level of damage to muscles.

PROBLEMS WITH PROTEIN IN THE PAST

Although protein ingredients are valued in so-called sports foods and beverages, they have often been associated with gastrointestinal problems - diarrhoea, flatulence and allergy for example. The reason for this is that they are relatively indigestible. The human body cannot absorb the protein directly; it must be digested and cleaved into small peptides or separated into single amino acids, which takes both time and energy (only the very small di- and tri-peptides and the single amino acids can be directly absorbed into our body). Although protein mixes are readily available for reconstitution in milk or water and are convenient, they do consist of intact proteins, which undergo complex digestion when consumed. Unpleasant side effects, together with an expected poor mouthfeel and unpleasant taste profile, have conspired to keep their popularity at bay.

The industry has developed many protein products to overcome this, and from many sources - milk whey and casein, soy and egg. Even the most popular development to-date - protein hydrolysates, which dissolve better in water, are more bioavailable and easier to digest often have a bitter,

Protein Drink vs CHO drink during exercise

	CHO	CHO + PRO	Dif %
Time to exhaustion Trial 1 (75% VO2Max)	82.3 min	106.3 min	+ 29%
Time to exhaustion Trial 2 (85% VO2Max)	31.2 min	43.6 min	+40%
Plasma creatine phospho kinase (CPK)* levels after exercise	1318.1	216.3	-83%

*CPK is a muscle enzyme which should be only in the muscle. If CPK is released to the blood, then this is sign that muscle tissues are damaged and leaking CPK into the blood. The plasma CPK is therefore marker of the degree of the muscle damage. The higher plasma CPK is, the higher is the muscle damage.

Saunders MJ, Kane MD, Todd MK. Effects of a carbohydrate-protein beverage on cycling endurance and muscle damage. *Med Sci Sports Exerc.* 2004 Jul;36(7):1233-8.

Table 1. Benefits of protein in sports beverages

unpleasant taste which limits both their application and their appeal. During or directly after intensive exercise, athletes often feel sick after consumption of protein drinks as their metabolism finds it difficult to digest a complex protein while under duress. These problems can be reduced through combining proteins with carbohydrates prior, during and after exercise. The proteins maximise the anabolic response, increase net protein synthesis, protect muscle damage and accelerate recovery.

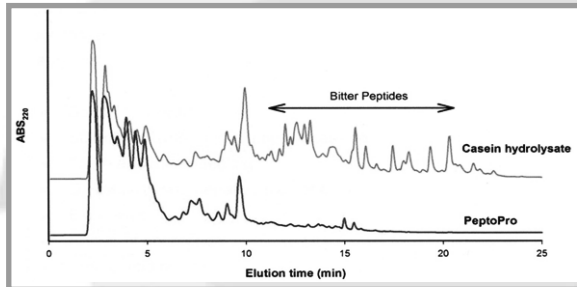


Table 2. HPLC comparison between a general casein hydrolysate and PeptoPro®

DRINKABLE PROTEIN

In response to these problems, manufacturers have long sought to create protein-based products which offer the benefit of protein without its negative side effects. DSM has now created a new taste-optimized peptide ingredient PeptoPro®, available for use in sports and other beverages, which contains 80 percent protein but in a pre-digested form as very small peptides. In PeptoPro, casein is enzymatically hydrolysed into peptides using a new and patented enzyme. PeptoPro® enters the bloodstream faster without having to be broken down and digested because of its high concentration of small and soluble di- and tri-peptides.

PeptoPro® is highly hydrolysed (30 percent) and it tastes better than other hydrolysates of comparable degree of hydrolysis. PeptoPro® therefore

avoids the unpleasant side-effects of whole protein forms and can be used to create a new generation of delicious soft drinks and milk beverage type products. With its high concentration of small peptides, PeptoPro® is an easily digestible and stable natural source of drinkable milk protein, which has almost no allergenic potential, making it highly suitable for sports people wanting a good recovery from exertion.

BEYOND BITTERNESS

PeptoPro® is unique in terms of its good taste thanks to its patented enzyme technology. With traditional enzymes, conventional hydrolysis of casein leads to an extremely bitter tasting product due to the high level of proline. Until the introduction of PeptoPro®, the proline bonds in peptide chain could not be effectively or actively cleaved. The patented enzyme from DSM acts to cut the bonds of the peptide chain creating new shorter di and tri peptides where the proline is relocated in the chain, reducing the bitterness of the hydrolysate, as illustrated in table 2.

These results were further supported by taste testing. During the development of PeptoPro®, DSM tested the bitterness of hydrolysates utilising six professional tasters. In a double blind procedure, all six testers claimed that the hydrolysate PeptoPro® tasted far less bitter after the second hydrolysis. This allows manufacturers to create great tasting sports beverages which can appeal to a wider audience.

GREAT TASTE GREAT LOOK

Unlike other protein hydrolysates, with PeptoPro® it is now possible to make clear protein drinks. PeptoPro® is highly water-soluble and easy to formulate in drinks so avoiding thick, foaming suspensions often associated with intact insoluble proteins and the lack of clarity associated with soluble whey proteins. This allows manufacturers to create visually appealing sports beverages with enhanced nutritional benefits.

CONCLUSION

Protein is an essential building block for healthy body function. Incorporation of protein hydrolysates such as DSM's PeptoPro® into sports beverages offers an instantly-absorbed source of protein in a convenient and deliciously tasting form. Manufacturers will benefit from the ability to offer a product which is different from the majority currently on the market. Sports people at every level, from Sunday morning joggers to professional athletes, will benefit from PeptoPro® enriched sports drinks where popular taste profiles can be created to give consumers an added edge in terms of sports performance and recovery in this area of growing demand.

REFERENCES AND NOTES

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