plus

Product highlights:

- Contains blend of fast realizing carbohydrates utilizing multiple absorption pathways + added electrolytes
- Flavorless tablet, works in conjunction with nuun active or energy
- <6% carbohydrate concentration for increased gastric emptying rates, and fluid retention – creating a hypotonic solution (7,8,9)
- 2:1 Dextrose (d-Glucose): Sucrose ratio for enhanced nutrient absorption
- Ability to maintain blood glucose levels during training w/ fast releasing carbohydrates - helps prevent the onset of bonking (1,2)
- For use in moderate-to-high intensities (where primary fuel source is carbohydrates), and/or durations exceeding 60 minutes
- Combine with external carbohydrate sources (through food) to exceed exercise performance (17,18).
- Ability to customize dosage based on exercise demands.
- Each tablet yields: 5 g of carbohydrates, 25 mg of Na, Mg, Ca, 50 mg of K
- Drop 2-4 tablets in 16 fl oz, depending on duration/intensity. Each serving (w/ nuun active) yields:

Dosage: (in tabs)	Calories:	Total Carb:	Sodium:	Potassium:	Magnesium:	Calcium:
2 + 1 Plus Active	48	11g	410mg	201mg	75mg	63mg
3 + 1 Plus Active	68	16g	460mg	301mg	125mg	113mg
4 + 1 Plus Active	88	21g	510mg	401mg	175mg	163mg

nuun & company
po box 3312, seattle, wa 98114 usa
t: +1 206 219 9237 • +1 855 426 6886 (1 855 h2o nuun) f: +1 206 260 8732 • info@nuun.com

Introduction:

Sports drinks have evolved over the past several years. Research and development in the field has gone to levels where we now better understand how unique the human body is, especially when exercising at a higher intensity or for longer durations. Carbohydrates have been known to increase sport performance in numerous ways; studies have exemplified and proved that (1,2). Hydration is a key component for optimal sport performance; the composition of the fluid you are consuming can either enhance your performance, or degrade it. Over time, newer studies have shown that what was hypothesized in the past regarding the *optimal composition* of your sports drink may not necessarily be wrong, but scientists have newer ways to improve sport performance through new findings, and what some call *new age hydration.* "New age hydration" refers to the move towards lower calorie & osmolality drinks, that contain a fraction of the carbohydrates, but can promote increased rates of fluid and electrolyte delivery.

Note: "New Age Hydration" is a unique term coined by Vishal Patel – Head Nutritionist at Nuun & Company, and should not be considered as a replacement to any scientific characterization of a sports drinks or hydration.

Carbohydrates and Hydration:

Carbohydrates play a key role in sports performance, and hydration. Carbohydrates can help fuel your muscles and enhance the delivery of fluids and nutrients (5). It is widely known that when exercising at a higher intensity and/or longer durations, your body will start using other (stored) fuel sources (carbohydrates) to help maintain performance. When the body beings to deplete its stored muscle and liver glycogen, fatigue can set in. That is where carbohydrates via fluids and external food sources come in hand. They can provide your body with the calories it needs, as well as, increase the rate of nutrient delivery (5).

The concentration and make up of the solution you're consuming can play a key role in how your body will oxidize the carbohydrates and electrolytes you are consuming (7). *PLUS* is flavorless tablet that contains a blend of performance based carbohydrates + electrolyte. The product is formulated to help increase gastric emptying and nutrient delivery by its *hypotonic* solution characterization (7,8,9). Products that are overly concentrated with carbohydrates often only utilize a single absorption pathway, leaving residual carbohydrates floating within your plasma; this has been known to cause gastrointestinal issues (GI) (7,10).

PLUS contains a blend of fast-releasing carbohydrates that can be used by the body immediately to increase the rate of hydration and provide the body with the nutrients it needs to perform at a high level. *PLUS* uses multiple carbohydrates sources (d-Glucose, Sucrose) to help the athlete utilize several absorption pathways, helping increase the efficiency of what you are consuming (5,6,7). Consuming multiple sources of carbohydrates will also help your body oxidize more carbohydrates resulting in faster more effective hydration (6,7). Consuming these additional sources of carbohydrates will also decrease the onset of fatigue, and gastrointestinal issues (GI) (5,).

nuun & company
po box 3312, seattle, wa 98114 usa
t: +1 206 219 9237 • +1 855 426 6886 (1 855 h2o nuun) f: +1 206 260 8732 • info@nuun.com

Nutrient Modularity and Exercise Performance:

As training intensity and duration increases, your need for fluids and nutrients change (increase) as well. As you begin to exercise for longer durations, your body has the ability to oxidize more carbohydrates, which in turn well help you perform at a higher level (5,19). What industry leaders once thought about how many carbohydrates the body can utilize per hour is being re-examined; to see if ingesting more carbohydrates (through fluids and food) can help the athlete perform at a higher level (17,18).

It was initially understood that 22g of carbohydrates per hour had a superior impact (vs placebo) on exercise performance when durations exceed 4 hours (15). Previous studies have also shown that carbohydrate intake was only necessary when durations exceeded two hours, which led to the American College of Sports Medicine to recommend an intake of 30-60 grams of carbohydrates, per hour (23). The wide range is heavily based on the activity, intensity level, duration, and individual needs. The range also came to fruition from the initial belief that the human body could only oxidize 1g of carbohydrate(s) per min (due to intestinal limitations) (14,15). However, since then, studies have proved that when multiple carbohydrate (sources) are consumed, up to 75% more carbohydrates can be oxidized (2,3). When additional sources are consumed, multiple transport proteins can be utilized to help efficiently promote the uptake of carbohydrates (3). The less residual carbohydrates floating around in plasma, the less GI issues can occur. Though this ability to oxidize more carbohydrates per hour cannot be achieved solely through fluids; consuming carbohydrates through food can also help increase the rate of carbohydrate oxidation, thus improving the efficiency of absorption (5, 17,18).

Newer studies on dosage-specific intakes of carbohydrates have shown that athlete need(s) increase as duration increases (20,21,22). But it is important to note, that when consuming carbohydrates through fluid and food, provides the athletes with the *ability* to oxidize more carbohydrates, hence decrease the onset of fatigue, as well as, GI and stomach issues (17,18). Below is chart breaking down carbohydrate needs as duration increased (19).

plus nuun Usage Guidelines

per hour of exercise

	Recommended Carbohydrate Intake	plus Servings & Fluid Needs	Additional Carbohydrate Needs (to be consumed through gels or foods)
up to 1 hour	No external carbohydrate needed	None - use Nuun Active or Nuun Energy	None
1-2 hours	30g/hour	1 serving of plus for Nuun 2 tabs Plus, 1 tab Active 16-24 fl oz/hour	15-20g/hour
2-3 hours	30-60g/hour	1.5 serving of plus for Nuun 3 tabs Plus, 1 tab Active 16-24 fl oz/hour	40-45g/hour
3-4 hours	60-90g/hour**	1.5-2 serving of plus for Nuun 3-4 tabs Plus, 1 tab Active 16-24 fl oz/hour	70-75g/hour
4+ hours	Up to 90g/hour**	2 serving of plus for Nuun 4 tabs Plus, 1 tab Active 16-24 fl oz/hour	70g/hour

**Nutritional training to adequately metabolize up to 90g/hour of carbohydrates is crucial. Individual needs may vary.

nuun & company
po box 3312, seattle, wa 98114 usa
t: +1 206 219 9237 • +1 855 426 6886 (1 855 h2o nuun) f: +1 206 260 8732 • info@nuun.com

Electrolytes and Hydration:

Electrolytes play a key role in hydration and sport performance. The blend of electrolytes all nuun branded products contain; sodium, potassium, magnesium, and calcium. Sodium is the most abundant mineral lost in sweat, it not only aids in fluid retention, but it plays a crucial role in helping maintain a positive water balance (1). Potassium has the ability to alleviate and prevent cramps, it also aids in keeping internal mechanism (for hydration balanced) (1). Magnesium is important for muscle function, and relaxation (1). Calcium plays a key role in bone health and muscle contraction (1,).

Effervescent Technology:

Effervescent delivery forms have been growing in popularity over the last several years. Products that impose effervescent technology serve many benefits to the athlete and the environment. Effervescent tablets ensure a precise, accurate dose while also providing a light, refreshing flavor profile. They are packed in recyclable tube, where each container contains multiple servings, helping eliminating plastic bottle waste. The nutrients within the tablet, when combined with water convert into a 100% bioavailable form: (electrolyte) citrates (24). Citrates have the ability to penetrate blood barriers, which help increase the rate of fluid and nutrient absorption (24,25). Also, during the effervescent process, Carbon Dioxide (CO_2) is released. It is theorized that CO_2 increases the permeability of nutrients by widening the cells (24,25). Scientist believe that CO_2 helps widen intracellular space between the cells, which in turn increases the rate of absorption (24,25,26). Effervescent products, when combined with water create a buffered solution, which then gives your body the ability to absorb nutrients much faster (25,26).

Study Findings:

Nuun & Company conducted an independent study to test the efficacy of *PLUS* when exercising at a moderate-to-high intensity. Six well-trained endurance athletes were asked to participant in a study aimed to showcase the benefits of consuming *PLUS* during moderate-to-high intensities. The athletes were asked to run a total of 70-90 minutes, where the first 10 minutes was a warm-up (~55-60% HR Max), the next 60 minutes were at 78-82% HR Max, which exemplifies a moderate-to-high intensity. After 70 minutes of running, the athletes were asked to run until fatigue was reached, every 5 minutes the facilitator increased the incline by 1% to promote exhaustion. Time to fatigue (TTF) was measured by when athlete's HR Max peaked above 95%, or when the subject could not continue any further. The athletes were asked to participate in the study twice, once while consuming *nuun active,* the other, when consuming *PLUS + nuun active.* The two trials were conducted six days apart. Environmental conditions and fluid temperature were held constant during both trials. The results indicated that the average TTF was increased by 5.7% while HR Max was 1.8% lower, when consuming *PLUS (w/ active)* over *nuun active* alone. The facilitator also measured

Rate of Perceived Effort (RPE) (Scale from 1-10) throughout the study, and the results indicated a 0.5 lower RPE when consuming *PLUS (w/ nuun)* over *nuun active* alone. We also noticed that the speed in which the athletes were running at increased by 0.2 MPH when consuming *PLUS (w nuun)* as opposed to *nuun active* alone. The key findings for this study indicated the subjects were able to run faster, and increase the time to fatigue while having a lower HR Max and RPE average. The results of this study indicated that when exercising at a moderate-to-high intensity, *PLUS (w/ nuun)* should be the preferred beverage to consume.

Additional Resources:

1. Clark, N. (2008). Sports nutrition guidebook. (4 ed., pp.183-185). Champaign, IL: Human Kinetics
2. Jeukendrup AE. (2004): Carbohydrate intake during exercise and performance, Journal of Nutrition, 20:669-677.
3. Coyle EF, Hagberg JM, Jurley BF, et al. (1983). Carbohydrate feeding during prolonged strenuous exercise. J Appl Physiol. 55:230-5
4. Coggan AR, Coyle EF. (1987). Reversal of fatigue during prolonged exercise by carbohydrate infusion or ingestion. J Appl Physiol. 63:2388-95.
5. Jeukendrup A. (2013). Multiple transportable carbohydrates and their benefits. Sports Science Exchange. 108:1-5.
6. Coombes JS, Hamilton KL. (2000). The effectiveness of commercially available sports drinks. Sports Medicine. 29:181.
7. Leiper JB. (1998). Intestinal water absorption – implications for the formulation of rehydration solutions. Int. J. Sports Med. 19:S129-132.
8. Leiper JB. (2001). Gastric emptying and intestinal absorption of fluids, carbohydrates, and electrolytes. CRC Press. 89-128.
9. Maughan RJ. (1998). The sports drink as a functional food: formulations for successful performance. Proc. Nutr. Society. 57:15-23.
10. Morton DP, Aragon LF, Callister R. (2004). Effect of ingested fluid composition on exercise-related transient abdominal pain. Int J. Sport Nutr. Exerc. Met. 14:197-208.
11. Appleton KM. (2005). Changes in the perceived pleasantness of fluids before and after fluid loss through exercise: a demonstration of the association between perceived pleasantness and physiological usefulness in every day life. Physiol. Behavioral. 83:813-819.
12. Maughan RJ, Leiper JB. (1999). Limitations to fluid replacement during exercise. Can J. Appl. Physio. 24:173-187.
13. Jeukendrup AE. (2004) Carbohydrate intake and exercise performance.
14. Fielding RA, Costill DL, Fink WJ, et al. Effect of carbohydrate feeding frequencies and dosage on muscle glycogen use during exercise. Med Sci Sports Exerc. 1985;17:472–6
15. Jeukendrup AE, Jentjens R. Oxidation of carbohydrate feedings during prolonged exercise: current thoughts, guidelines and directions for future research. Sports Med. 2000;29:407–24.
16. Jentjens RL, Moseley L, Waring RH, et al. Oxidation of combined ingestion of glucose and fructose during exercise. J Appl Physiol. 2004;96:1277–84
17. Pfeiffer B, Stellingwerff T, Zaltas E, et al. CHO oxidation from a CHO gel compared with a drink during exercise. Med Sci Sports Exerc. 2010;42:2038–45
18. Pfeiffer B, Stellingwerff T, Zaltas E, et al. Oxidation of solid versus liquid CHO sources during exercise. Med Sci Sports Exerc. 2010;42:2030–7
19. Jeukendrup A. (2014). A step towards personalized sports nutrition: carbohydrate intake during exercise. Sports Medicine. Suppl 1: S25-S33.
20. Jeukendrup AE, Mensink M, Saris WH, et al. Exogenous glucose oxidation during exercise in endurance-trained and untrained subjects. J Appl Physiol. 1997;82:835–40
21. van Loon LJ, Jeukendrup AE, Saris WH, et al. Effect of training status on fuel selection during submaximal exercise with glucose ingestion. J Appl Physiol. 1999;87:1413–20.
22. van Loon LJ, Greenhaff PL, Constantin-Teodosiu D, et al. The effects of increasing exercise intensity on muscle fuel utilisation in humans. J Physiol. 2001;536:295–304.
23. Sawka MN, Burke LM, Eichner ER, American College of Sports Medicine position stand, et al. Exercise and fluid replacement. Med Sci Sports Exerc. 2007;39:377–90
24. Eichman DJ, Robinson JR, Mechanistic studies on effervescent-induced permeability enhancement. Pharmaceutical Research. 1998;15:925-930.
25. Nuernberg B, Brune K. Buffering the stomach content enhances the absorption of diflunisal in man. Biopharm Drug Disp. 1989;10:377-387.
26. Hedenström H, Alm C, Kraft M, Grahnén A. Intragastric pH after oral administration of single doses of ranitidine effervescent tablets, omerperazole capsules and famotidine fast-dissolving tablets to fasting healthy volunteers. Aliment Pharmacol Ther. 1997;11:1137-1141.

nuun & company
po box 3312, seattle, wa 98114 usa
t: +1 206 219 9237 • +1 855 426 6886 (1 855 h2o nuun) f: +1 206 260 8732 • info@nuun.com