

Ergogenic Supplements

“What The Science Says You Should Know vs What You Hear From Your Bro”

Whether you're a recreational athlete or professional, the Olympic motto Citius, Altius, Fortius- "faster, higher, stronger", likely resonates with you.

Many individuals look to get that performance edge by choosing to supplement their diet and training with the latest and greatest ergogenic aids on the market.

An ergogenic aid is any training technique, mechanical device, nutritional ingredient or practice, pharmacological method, or psychological technique that can improve exercise performance capacity or enhance training adaptations. Ergogenic aids may help prepare an individual to exercise, improve exercise efficiency, enhance recovery from exercise, or assist in injury prevention during intense training. This blog will focus on nutritional supplements.

Nutritional supplements can include carbohydrate, protein, fat, minerals, vitamins, herbs, enzymes, metabolic intermediates (i.e. select amino acids), or various plant/food extracts. They are typically used for:

- Energy requirements
- Weight gain
- Weight loss
- Performance enhancement

(Kerksick, C. M., et al., 2018)

There are several factors one should consider when choosing a supplement, some of which include:

- Have there been any adverse events associated with the product?
- What has the supplement company done to prevent adulteration and contamination, e.g. Adhering to current Good Manufacturing Practices (cGMPs)?
- Is the supplement legal and safe- NSF Certified?
- Is one or more of the ingredients on the WADA list?
- Is the supplement certified by Informed Choice?
- Does the supplement contain what the Label Claims (Quality Assurance)?
- Does the theory behind using the supplement make sense?
- Is there any scientific evidence supporting the ergogenic value?
- Does the supplement contain a sufficient amount of the active ingredient to have an effect?

- Can taking a food first approach provide the same benefit?
- Is the cost:benefit worth the investment?

(Kerksick, C. M., et al., 2018)

When it comes to the science, supplements can be categorized as follows:

- I. Strong Evidence to Support Efficacy and Apparently Safe
- II. Limited or Mixed Evidence to Support Efficacy
- III. Little to No Evidence to Support Efficacy and/or Safety

(Kerksick, C. M., et al., 2018)

This blog will categorize nutritional supplement interventions as follows:

Gold- Very strong evidence from multiple studies showing efficacy

Silver- Good or emerging evidence that the intervention will influence the outcome.

Bronze- Weak but promising evidence that the intervention can influence the outcome.

(Currell, Kevin, 2017)

Ergogenic Supplements are commonly used as follows:

- Maximize adaptations to strength training
- Concurrent training and buffering capacity
- Maximize adaptations to endurance training
- Nutrition and the brain, e.g. Enhance reaction time, accuracy and focus
- Endurance events lasting more than one hour
- Endurance training lasting less than an hour with multiple rounds
- Improving team sports performance
- Weight management

(Currell, Kevin, 2017)

Maximize adaptations to strength training

Level of Evidence	Supplement	Use	Dose
Gold	Creatine	Muscle and	20-25 g loading

	Protein - Food first - Whey BCAA/EAA	strength gain Increased muscle mass	dose x 5-7 days Maintenance 3-5g/day 2-3g/kg bw daily divided in 4-6 meals
Silver	Carbohydrate Caffeine	Energy for resistance training (pre and post training) Exercise performance	1g/kg bw pre and post workout 1-3 g/kg bw 30-60 minutes before exercise session
Bronze	Beta- alanine HMB	May allow a greater workload during resistance training Works synergistically with creatine May reduce muscle breakdown leading to increased muscle mass	5g/day 3g/day

Concurrent training and buffering capacity

Level of Evidence	Supplement	Use	Dose
Gold	Carbohydrate	May minimize molecular	1 g/kg bw post aerobic

		<p>perturbations that interfere with strength training adaptations by maximizing muscle glycogen</p> <p>Promotes adaptations to interval training session</p> <p>Maintains performance during interval session</p>	<p>exercise</p> <p>1 g/kg bw 1-3 hours prior to training</p> <p>30-60g/hour</p> <p>Mouth swilling for 20 seconds may provide similar benefits to swallowing</p>
	Caffeine	Performance in high intensity activities	1-3 g/kg bw 30-60 minutes before exercise session
Silver	Creatine	Performance in high intensity intervals	3-5g/day
Bronze	Beta-alanine	<p>Increased muscle carnosine/buffer capacity for events 1-10 minutes.</p> <p>Enhances interval training performance and adaptations</p>	5 g/day
	Sodium bicarbonate	Enhances performance and adaptations in interval training	0.2-0.3 g/kg bw 90 minutes prior to interval training session

		via enhanced lactate transport out of the muscle	
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Maximize adaptations to endurance training

Level of Evidence	Supplement/ Intervention	Use	Dose
Gold	Fasted training	Fat adaptation	1-3 training session/week
	Iron	Maximize adaptations to endurance training	Diet sources: Meat is optimal Check serum levels for those at risk for deficiency to determine dosing. Iron bisglycinate is well absorbed and has less GI side effects
Silver	Glycogen depletion prior to high intensity exercise session with minimal food in between	Enhanced endurance training adaptations	
	Sleep and train with low glycogen	Enhanced endurance training adaptations	
	Protein post exercise	Increased muscle protein synthesis-promotes	0.3 g/kg bw

		adaptations in plasma volume and cardiovascular function	
Bronze	Mouth swilling and caffeine during fasted/depleted training High fat diet	Maintains training and reduces perception of effort during training Improves aerobic adaptations to endurance training. Caution- this reduces ability to produce high levels of force and glycolysis will be inhibited	1-3mg caffeine/kg bw 30-60 minutes prior to training

Nutrition and the brain

Level of Evidence	Supplement	Use	Dose
Gold	Carbohydrate E.g. Low glycemic breakfast Caffeine	Heavy cognitive demand Improves complex cognitive tasks, alertness, reaction time and accuracy	30-60 g 1-3 mg prior

	Fruits and vegetables, e.g. berries, cruciferous		Long-term intakes
Silver	BCAA	May reduce serotonin in the brain during periods of physical fatigue	2-10 g Supplementation is unnecessary if protein intake is 1-1.5g/ kg bw/day or more
	Creatine	Fuel source for the brain	5 g prior to cognitive task
Bronze	L-Theanine	Improves attention	200 mg (Works synergistically with caffeine)
	Polyphenols, e.g. cocoa, green tea, coffee	Improves blood flow to the brain	Long-term Intakes
	Tyrosine	Improves cognitive performance	100-300 mg
	Omega 3 Fatty Acids (DHA)	Improved brain function and reaction time	2.2 g/day for three weeks

Endurance events lasting more than one hour

Level of Evidence	Supplement	Use	Dose
Gold	Carbohydrate	Increased muscle glycogen Delays fatigue Performance enhancement	Load: 8 g/kg bw the day before the race Pre-exercise: 2-3g/kg bw 2-3 hours prior to event (low glycemic) During exercise: 60-90 g/hour (glucose or maltodextrin with fructose 2:1). Start at beginning of event
	Hydration	Optimal performance	Monitor urine color an output. Consume fluid to thirst
	Caffeine	Improved performance	1-3 mg 30 minutes prior to event and 50 mg/hour for longer events
Silver	Nitrates	Improves oxygen efficiency	5-7 mmol/day 3-6 days prior to the race
Bronze	Hyperhydration with sodium	Improves performance in the heat	Pedialyte Sport

Endurance training lasting less than an hour with multiple rounds

Level of Evidence	Supplement	Use	Dose
Gold	Beta- alanine	Increased muscle buffer carnosine. Performance enhancement for events lasting 1-10minutes	4-6g/day
	Sodium bicarbonate	Performance enhancement for events lasting 1-10minutes	0.3 g/kg bw 90 minutes prior to event
	Carbohydrate (High glycemic)	Maximizes glycogen resynthesis	1 g/kg bw immediately post exercise in 2-3 feeds
Silver	Protein	Promotes muscle repair, regeneration and recovery	0.3 g/kg bw post exercise
	Cherry juice (polyphenols)	Promotes recovery	354 ml tart cherry juice
Bronze	N/A	N/A	N/A

Improving team sports performance

Level of Evidence	Supplement	Use	Dose
Gold	Carbohydrate	Increase muscle glycogen Delay fatigue Improve performance	8g/kg bw the night before the event During event (where feasible) 30-60 g/half
	Caffeine	Greater skill performance	1-3 mg before event
Silver	Carbohydrate	Optimal glycogen resynthesis, allowing return to play as soon as possible	1g/kg bw immediately post match
	Milk	Promotes recovery from damaging exercise	500 ml immediately post match
	High GI Foods Tryptophan	Promotes sleep Promotes sleep	Pre-bedtime 1-2 g 45 minutes Pre-bedtime
Bronze	NAC	Promotes muscle recovery	100 mg/kg bw for 6 days

Weight management interventions

Fat loss is achieved through a sustained caloric deficit, regardless of the dietary approach. A net hypocaloric balance can either be imposed daily or over the course of the week. Higher baseline fat mass levels require a more aggressive caloric deficit, however, slower rates of weight loss will preserve lean mass. Optimal weekly reduction of 0.5–1.0% of body weight has been recommended. Increasing dietary protein up to

3g/kg FFM may be required to maximize muscle retention in hypocaloric conditions as it is thermic, satiating, and lean mass -preserving

The long-term success of the diet depends on one's ability to minimize adaptive thermogenesis. Resistance training and adequate protein can help to circumvent this problem.

(Aragon, A.A., Schoenfeld, B.J., Wildman, R. , 2017)

Timing, optimal dose and intake duration of dietary supplements with evidence-based use in sports nutrition

Supplement	Dose	Timing	Intake Duration
Beta-alanine	3-6 g	Ingest with meal containing carbohydrates and protein	4-10 weeks
Beetroot juice (nitrate)	5-9 mmol	2-2.5 h prior to exercise	1-28 days
Caffeine	3-6 mg/kg bw	60-90 min prior to exercise	N/A
Creatine Monohydrate	20-25 g loading dose 3-5 g maintenance dose	Post exercise with beverage containing carbohydrate and protein	Load 5-7 days Maintenance 4-12 weeks
Sodium bicarbonate	300-500 mg/kg bw	60-180 min prior to exercise	1-3 days
Carbohydrate	300-400 g meal Mouth rinse 30-60 g/h glucose or maltodextrin with 6-8% carbohydrate concentration	3-4 h prior to exercise During exercise < 1 h During exercise 1-2 h	N/A N/A N/A N/A

	<p>90 g/h glucose or maltodextrin + fructose (2:1) with 8-10% carbohydrate solution</p> <p>1.2 g/kg bw or 0.8 g kg bw carbohydrate +0.4 g/kg bw protein</p>	<p>During exercise >2.5 h</p> <p>After exercise</p>	<p>N/A</p> <p>N/A</p>
Protein	<p>20-25 g young adults (0.25-0.30 g/kg each meal)</p> <p>40 g elderly adults (0.4 g/kg each meal)</p>	After exercise	N/A

(Naderi, A., et al., 2016)

Summary

- A food first approach is always optimal, with the focus on optimal energy and macro/micro nutrient intake through a whole foods, varied, nutrient dense diet
- Supplements may provide a 3-5% performance enhancement. Is this a reasonable return on investment, or should you spend your money on high quality food
- You can't "out supplement" a poor diet, improper training and lack of attention to lifestyle factors such as sleep and stress management
- Weight loss strategies are optimal using a weekly reduction of 0.5–1.0% of body weight, increasing dietary protein up to 3g/kg FFM and incorporating resistance training
- If you do choose to supplement, follow "What The Science Says You Should Know vs What You Hear From Your Bro."

References

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