Latest Developments in Sports Nutrition

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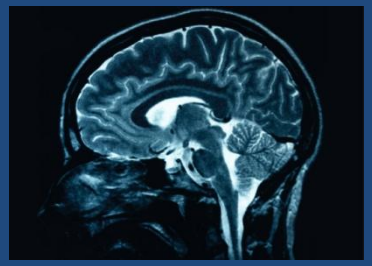
Overview



What is new in sports nutrition?

- Nutrition and the brain
- Carbohydrate blends
- Training low compete high
- Dietary protein and muscle protein synthesis
- Supplementation
- Summary
- Questions

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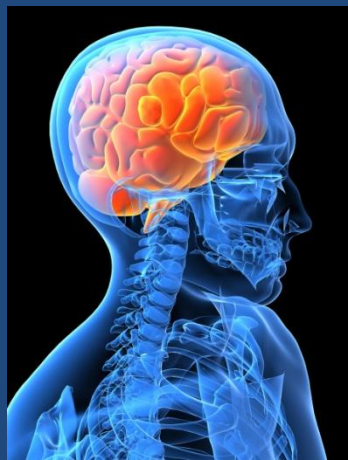
Food for Thought

- Much evidence emerging that the brain takes cues from the body to ascertain what is required from a nutritional perspective.

- Brain and periphery constantly “talk” to determine energy status and metabolic needs.



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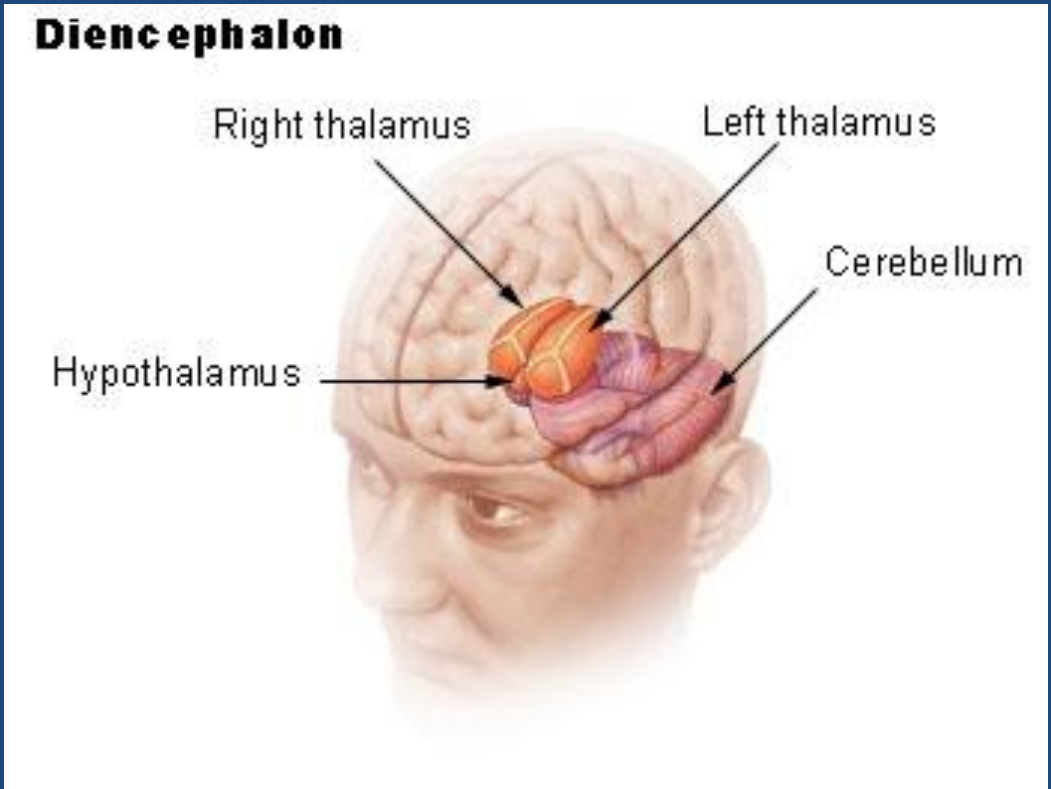
Glucose and the Brain

Hypothalamus major regulatory centre of the brain (thirst, hunger, blood pressure, temperature, water balance).

Hypothalamus uses glucose concentrations to regulate its "firing rate".

Glucose sensing = Glucose levels (and levels of other metabolites such as lactic acid produced during exercise) appear to tell the brain cells what the body needs.

Hypothalamus



Glucose Sensing

- Simply rinsing the mouth with a carbohydrate (CHO) wash can lower the perceived exertion of an effort even though the CHO isn't actually ingested.

- Result = Improved exercise performance during exercise lasting approximately 1 hour.

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Carbohydrate (CHO) – A new role

- CHO supplementation is effective in extended exercise performance (greater than 2 hours).
- Evidence is now emerging that CHO supplementation can be effective in higher intensity exercise of an hour's duration.
- A 40km time trial with CHO supplementation resulted in a 1 minute performance improvement over no supplementation.

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CHO – A New Role?

- Why the improvement?
- No hypoglycaemia over this duration, minor use of CHO by the muscles over this period as a fuel source – so CHO utilisation is really insignificant - didn't make sense.
- Provision of fuel not that important in such exercise BUT presence of CHO must in some way influence the brain to assist performance

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CHO- A New Role?

- Hypothesis : CHO influences brain function.
- Study 2 : Cyclists repeated 40km time trial and rinsed their mouths with a non sweet (tasteless) CHO solution and spat it out without drinking any of the solution.
- 1 minute performance improvement was still observed even though no CHO was swallowed.
- CHO in rinse connects with mouth receptors that signal the brain that food is on the way and thus reduce the perception of the effort making it easier to push hard.

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CHO - A New Role for Intense Exercise?

- Intense exercise = negative unpleasant signals sent to the brain (muscles, joints, lungs, skin and core temperature receptors) that typically can inhibit power output.
- Results in athlete consciously or sub-consciously backing off.
- CHO receptors in the mouth may somehow counteract these negative messages.

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Other Findings

- Brain scans showed CHO clearly activated brain areas involved with rewards and muscle activity. Artificial sweeteners did not stimulate pathways from mouth to brain.
- If athletes eat breakfast before rinsing with carbohydrates or drinking a carbohydrate solution the CHO mouth rinse appears to have no effect.

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CHO - Practical Application

- (i) Not necessary to ingest much CHO for events of 30-60 minutes duration, simply rinsing the mouth with a sports drink may be enough.
- (ii) Sucking lollipops or small sweets in the mouth may be beneficial to performance.
- (iii) There's no disadvantage to swallowing the sports drink but some athletes find that intense exercise and drinking sports drinks creates gut upsets.

CHO - Not All Created Equal

- Prolonged exercise (>2 hours) benefits from CHO ingestion. Maintains blood glucose levels and a supply of CHO to working muscle.

- CHO uptake and use from drinks, gels, bars, etc. influenced by (i) feeding schedule, (ii) type of CHO ingested and (iii) exercise intensity.

- Some CHO used more rapidly by the body.

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CHO – Different Forms

Roughly speaking there are two categories:

(i) Slowly oxidised (used) at rates of up to 30 grams/hour (not recommended).

- Fructose (fruit sugar-found in fruit, honey).
- Galactose (a sugar found in sugar beets).

and

(ii) Rapidly oxidised (used) at rates of up to 60 grams/hour (recommended).

- Glucose (most simple sugar – breakdown of starch)
- Sucrose (table sugar-glucose + fructose).
- Maltose (2 glucose molecules).
- Maltodextrins (from starch breakdown).

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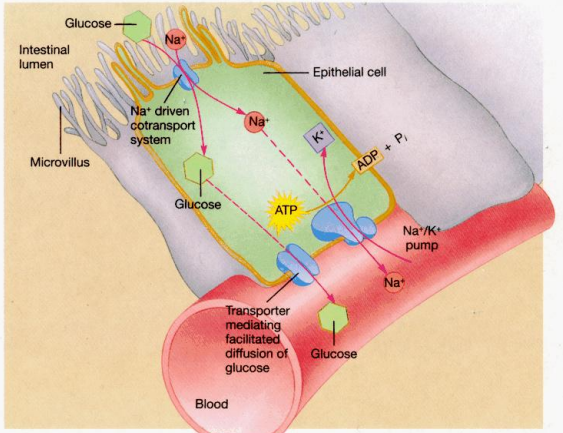
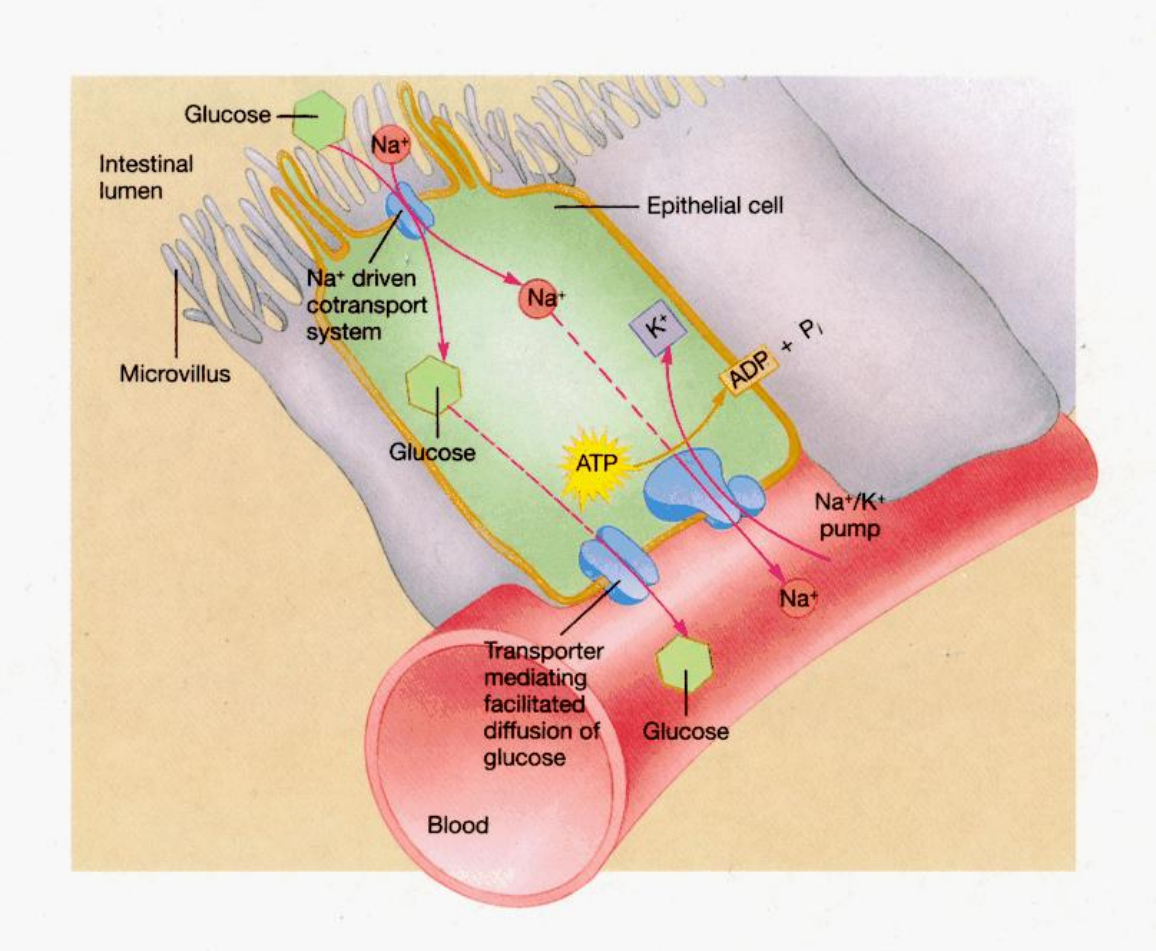
CHO Uptake - Different Forms

- Optimal CHO intake = maximal CHO intake and availability with the least gut problem.

- Recent research has found that different CHO is transported into the cell by different protein transporters.



Protein Transporters for Different CHO



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Protein Transporters for Different CHO

- Glucose is transported at a maximum rate of about 60 grams per hour by the SGLT1 transporter system.
- Fructose is transported by a different system (the GLUT5 transporter).
- By mixing blends of CHO between different CHO sources CHO intake and utilization can be increased significantly with rates in the lab of up to 105 grams per hour seen (i.e. 75% more than once believed to be the maximal limit of CHO ingestion and utilization).

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CHO - Different Forms

Thus a third category known as very rapidly oxidised (used) CHO mixes (90g/h):

- Glucose (60g) + Fructose (30g).
- Glucose (60g) + Maltodextrin + Fructose blend.

CHO mixes have been shown to:

- Increase CHO oxidation.
- Improve fluid delivery.
- Reduce fatigue and gastro- intestinal discomfort.
- Improve performance.

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Practical Implications for CHO

Athletes in endurance sports can push harder and more closely match CHO requirements.

Example:

Chrissie Wellington averaged about 86 grams of CHO/hour during the 2009 IM

Ht=170cm

Wt =~ 60kg

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Practical Implications for CHO

- Studies have also shown that provided fluid intake is maintained whether you get the CHO from drinks, gels or bars makes no difference to uptake and utilization.
- Therefore athletes can self select and work with what they best tolerate.

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Practical Implications for CHO

- The human gut is adaptable but needs to be trained to determine individual tolerance.
- Practice makes perfect.
- Trialling carbohydrate (quality and quantity) strategies in high intensity/race pace training is a MUST to increase tolerance.
- Do not experiment during competition!

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Recommendations for CHO Intake

Event duration	CHO required	Recommended intake	CHO type	Glu	Glu-Fru
<45 min	Nil	–	–	–	–
45-75min	Very small amounts	Mouth rinse	Most forms CHO	•	•
1h-2h	Small amounts	Up to 30 g/h	Most forms CHO	•	•
2h-3h	Moderate amounts	Up to 60g/h	CHO that are rapidly oxidised (glu, MD)	o	•
>3h	Large amounts	Up to 90g/h	Only multiple transportable CHO (glu 60g, fructose 30g or MD + fructose)	–	•

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There's More Than One Way To Skin a Cat

Ivy (2009) found the by decreasing carbohydrate content to about 3% and adding 1.2% protein (whey protein isolate) exercise time to exhaustion improved by 16.5% over and above a standard carbohydrate/electrolyte beverage (Gatorade).

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Implications

- Each gram of CHO appears to act as 2 grams of CHO in conventional sports drinks with the protein component of PureSport.
- Lower total energy content means PureSport is more appropriate for inclusion for athletes with body weight concerns.
- Protein component has been shown (in various studies) to enhance recovery and muscle protein synthesis. PureSport provides an “all-in-one” solution (recovery product).
- Lower CHO content of PureSport has less adverse consequences for dental caries.

Training Low Compete High

- Theory: Depleting muscle glycogen stores while training results in the body's ability to adapt, improve and perform at a higher rate when CHO is provided during competition.
- Early studies showed at a *cellular* level that withholding CHO in training resulted in enhanced endurance adaptation.

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Training Low Compete High (TLCH)

- Various studies were completed over 3-10 week duration with well trained athletes and they found increases in the enzymes associated with CHO and fat metabolism and mitochondria formation when training was undertaken with lowered CHO stores.

Practical Application (TLCH)

- In the sporting world performance improvements of a couple of percent make a difference, in the lab such improvements are hard/impossible to measure.
- What happens at a cellular level is different to what happens at a “system” level. Just because cells behave differently doesn’t mean the athlete will.

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Practical Application (TLCH)

- Best approach – Integrate Train Low strategies into the training regimen in much the same way as you periodise your training (e.g. When completing long slow easy aerobic base miles take less CHO onboard as the body is already preferentially using fat as an energy substrate), closer to competition when intensity increases bump up CHO ingestion.

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Practical Application (TLCH)

- Be conscious of potentially adverse effects of CHO restriction. It comes at a cost (e.g. Impaired immune function, inability to recover, inability to hit target training intensities, lethargy, etc.).
- Many athletes diets are not adequately CHO rich anyway so need to assess on individual basis.

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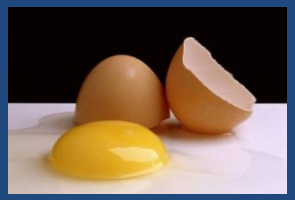
Dietary Protein

- RDI for protein 0.75-0.8 g /kg bodyweight per day.
- Average 70kg moderately active male =

58 grams daily.



- This is for nitrogen balance.
- Endurance athletes may require up to 1.2-1.6g/kg bodyweight.

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Dietary Protein and Maximal Muscle Protein Synthesis (MPS)

- Muscle gain requires positive protein balance.
- Benefit of muscle gain is sport dependent around power to weight equation.

Muscle gain determined by :

- Quantity of protein available.
- Quality of available protein.
- Timing of feeding.
- Other factors - amino acids.

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Quantity of Protein for (MPS)

- 20-25 grams of high quality protein containing 8-10 grams of essential amino acids and 1.5-2 grams of leucine (85kg male).
- Post-resistance training had maximal effect.
- More studies needed to determine if smaller frames require as much protein.
- More is not better.

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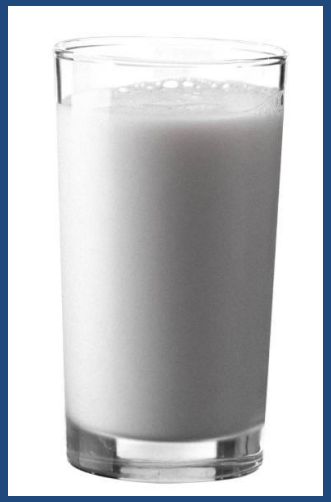
Quality of Protein for (MPS)

- Milk based proteins are superior to soy-based forms (e.g. Skimmed milk vs. soy milk).



- Of milk proteins, whey protein is highly effective.

- Isolated whey proteins promote greater MPS than soy based proteins or sports drinks containing purely carbohydrate.

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Timing of Protein for (MPS)

- Pre-exercise protein is of questionable efficacy.
- During exercise - May provide some benefit if rest periods between exercises is long enough to allow for recovery.
- Post-exercise - Repeatedly shown to be beneficial in stimulating MPS.
- The sooner the better.

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Leucine - A Trigger for MPS

- Leucine (an essential amino acid) long known to be one of the 8 amino acids necessary for protein and thus muscle synthesis.
- New research shows leucine triggers the incorporation of dietary protein into muscle mass post–exercise.
- Proteins within muscle appear to sense leucine resulting in the turning on MPS.

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Leucine Content of Common Isolated Protein Sources

AMINO ACID CONTENT (mg/g)	Milk solids (Non fat)	Caesin	Whey	Soy	Body protein
Leucine	77	82	108	62	75

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Summary
Protein and MPS

- Post-exercise consumption of 20-25 grams of whey based protein with adequate essential amino acids and rich in leucine stimulates greatest gain in muscle mass.
- This does not mean protein powder is needed –500-600ml skim/low fat milk with or without flavouring is adequate – if you can stomach it OR appropriately formulated recovery beverages such as PureSport Recovery are an excellent option.
- Do not over-consume protein at other meals.

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Supplements

- Also known as **food supplements** or **nutritional supplements**, are a preparation intended to supplement the diet and provide nutrients, such as vitamins, minerals, fibre, fatty acids, or amino acids, that may be missing or may not be consumed in sufficient quantities in a person's diet.
- Some countries define dietary supplements as foods, while in others they are defined as drugs or natural health products.

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Types of Supplements

Supplements can be divided into three groups:

- Specialised sports foods that address special nutritional needs of athletes (e.g. gels, sports bars, drinks).
- Vitamin and mineral supplements (e.g. Multivitamin, iron, calcium, glucosamine, fish oils).
- Nutritional ergogenic aids that offer a direct physiological benefit to exercise performance or recovery (e.g. Glycerol, caffeine, creatine, bicarb and some antioxidants e.g. flavonoids, β-alanine).

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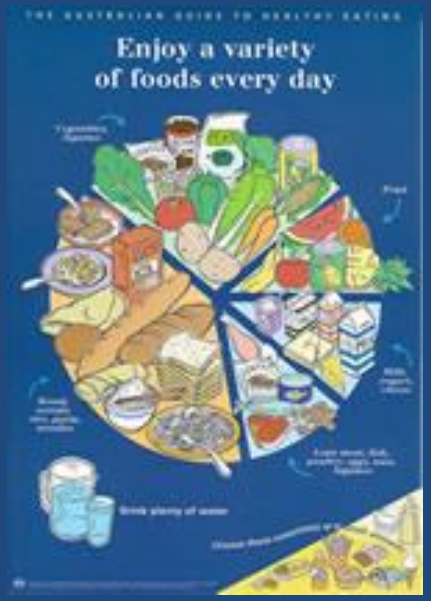
Sports Nutrition - Continuum of Food



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Newest Reviews

Still under scientific scrutiny to assess benefits or practical uses:

- Colostrum, HMB, glutamine (support not conclusive), amino acids (often foods can provide amino acids in the amounts required).

No scientific support for the rest:

- Includes herbals, ginseng, carnitine, inosine, coenzyme Q10, magnesium, network marketing products etc.

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Supplementation

- More is not better – not harmless.
- Pros and cons need to be considered.
- Perceived vs. real need – forget self-medication.
- Real need:

- Food intake severely restricted quantity and quality/variety (e.g. Weight loss, finicky/picky, religious beliefs, dietary allergies or intolerances).
- Extreme training loads (e.g. Iron).
- Travel.

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Supplementation

- Diet, sleep patterns, pathology, training assessment, psychological wellbeing and adequate recovery should all be considered prior to supplementation.
- Length of time of use.
- Science vs. application - Any real benefit for level of competition? Would improved training lead to even more improvement?

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Things to Consider

- Still early days - Limited research studies conducted.
- Consider practical application (e.g. Strength vs. endurance, your personal goals and aspirations).
- Elite vs. age grouper.
- Long term health implications.
- Everyday balanced training diet is key. Get this right!

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Any questions ??