Nutritional Supplements

Weight	Strength	Other	Energy	Grab Bag
Green Tea	Creatine	Casein/ Whey	Energy Drinks	Post Workout
Chromium	HMB	BCAA	β-Alanine	Glucos Chond
Carnitine	HGH	Taurine	Meldonium	Omega-3
Caffeine	IGF	Arginine	Guarana	Glutamine
Clenbuterol	DHEA	T Boosters	B-Vit	DMAA

"S-O-L-E"

Green Tea

- Camelia sinesis leaf
- Weight loss; alertness
- 2-4% caffeine; polyphenols; antioxidants

- 2 cups/day (~240mg polyphenol) or 100-500mg extract
- Medication interactions (warfarin!)

Chromium

- Enhance insulin activity; regulate food activity
- Weight loss/fat loss
- Most commonly picolinate form. Wide doses in trials

- Doses above 200mcg may be detrimental
- Lack conclusive data
- ?mood and iron storage impact

Carnitine

- L-carnitine (non-essential AA) is biologically active form
- Required for fatty acid breakdown
- Fatty acid breakdown; resist muscular fatigue
- Dietary sources (red meat; fish; chicken)
- Supplement up to 2g/day studied

- SE: N/V, cramping, diarrhe and 'funny odor'
- No evidence supports performance or wt loss

Caffeine

- Most widely used stimulant in the world!
- 200 mg (2 cups coffee) for cognitive performance; 2-6mg/kg for physical performance

- Avoid with alcohol
- SE more problematic with higher doses (palpitations; insomnia; tremors)
- Medication interactions

Clenbuterol

- Sympathomimetic amine; β-agonist; thermogenic agent
- Decreases fat deposition; increase muscle mass

- Increased risk of arrhythmias
- On prohibited list

- "Clen cycle"
- Mexican soccer team

Creatine

- Replenishes ATP
- Increase energy available to muscle

- High intensity exercise
- Dosed properly, likely no harm

Beta-hydroxy-beta-methylbutyrate (HMB)

- Decrease protein degradation
- Increase protein and cholesterol synthesis

- May decrease muscle breakdown
- Lack of safety data

HGH

- Stimulates IGF-1
- Enhance protein synthesis

- Acromegaly; hyperglycemia
- Potential increased cancer risk

IGF-1

- Increase glucose uptake
- Increase protein synthesis
- Increase lipolysis

- Acromegaly; decreased HDL; hypo/hyperglycemia
- Potential increased cancer risk

Dehydroepiandrostenedione (DHEA)

- Build muscle
- Anti-aging
- Libido

- Androgenic effects (women)
- P450 interactions (drug metabolism)
- Cancer risk (breast; ovarian; prostate; liver)

Soy/Casein/Whey Protein

- Whey has all essential AA for muscle growth
- Whey primarily in milk; casein “curds” –whey fast digest; casein slow digest
- Protein requirements 0.8-2 g/kg/day

- No clear benefits over whole food consumption
- 20-30g/scoop (~~3 oz meat)
- GMP/purity??

Branched Chain Amino Acids

- Leucine; isoleucine; valine
- Promote muscle synthesis
- Prevent fatigue

- May improve time to exhaustion in 'lightly trained' individuals
- With normal protein intake through dietary sources, supplementation is not necessary and benefits are limited

Taurine

- First isolated from ox bile; role in bile acid conjugation; membrane stabilization; antioxidant; osmoregulation
- Naturally in fish/meat, … "Red Bull"
- <200mg in diet; 100—2000mg in energy drinks
- Enhance mental performance (with caffeine)

- May improve exercise performance in CHF
- Otherwise unclear

Arginine

- Amino acid with "Nitric-oxide" effects—vasodilation and increased blood flow
- May increase release of endogenous GH
- 0.1mg/kg/day (5-9 g/day)

- Medication interactions (PDE; HTN; Triptans)
- Effects may be more pronounced in trained athletes. Results mixed.
- L-citrulline*

Other Testosterone Boosters

- *Tribulus terrestris* Testosterone booster Similar structure to DHEA
- Aromatase Inhibitors. Breast cancer (women); gynecomastia (men). Block conversion of estrogen to androgen
- Diindolylmethane (DIM)-cruciferous vegetables; augments estrogen metabolism

Energy Drinks

- Wide range of ingredients: Caffeine (primary); taurine; glucuronolactone; inositol; *proprietary blends*
- Energy shots—high-dose B vitamins
- 50-500+ mg caffeine/can (coffee ~ 100mg)

- Caffeine augments performance (2-6mg/kg)
- No data on weight loss
- Risky with alcohol; Risky with HTN
- Withdrawal side-effects (headache; irritability..)

$\mathcal{B}$-Alanine

- Reduce muscular fatigue
- Reduce lactate buildup
- Enhance short-term activity at fatigue threshold

- Paresthesia (dose-dependent)

Meldonium

- Latvian pharmaceutical marketed as anti-ischemic agent. Alpha-adrenergic and NO effects (vasodilation)
- Classified as 'metabolic modulator' (~insulin)
- ?improve metal performance

- Controversial as to effectiveness. In news and on the banned list.

Guarana

- Derived from S. American tree
- High in caffeine (highest of any plant source)
- Combined with caffeine in many energy drinks

- May be part of proprietary blend that includes other caffeine-like products or stimulants
- Bitter orange (synephrine); yohimbine; green tea; green coffee bean; yerba mate, …

B-Vitamins

- Thiamine (B1)
- Riboflavin (B2)
- Niacin (B3)
- Pantothenic Acid (B5)
- Pyridoxine (B6)
- Biotin (B7)
- Folic Acid (B9)
- Cobalamins (B12)

- Co-enzymes for metabolism
- Whole foods
- Adequate in most diets
- Water soluble
- Supplementation does not clearly improve cognition or metabolism

Post Workout Drinks

- Recovery drinks are a top-10 seller

- Chocolate milk

Glucosamine/Chondroitin

- Part of normal cartilage
- Shellfish/shark source

- Likely no harm in normal doses (*warfarin interaction; *glucose metabolism)
- No clear benefit above placebo

Fish Oil

- Omega 3: alpha-linolenic (flaxseed); eicosapentaenoic (fish); docosahexaenoic (fish); polyunsaturated
  - ? Heart disease-fish are part of heart-healthy diet (8oz/week). ?? Role for supplements
  - ? Relief of RA symptoms
  - ? Role in TBI

Glutamine

- Essential AA with role in stress homeostasis
- Promote muscle gain; enhance performance and repair/recovery
- Optimal dose unknown (14g/day proposed safety limit—studies used higher)

- No clear benefit

DMAA

- Dimethylamylamine.
- Geranium extract
- Stimulant linked to a number of adverse outcomes
- Banned in 2013. Food, Drug and Cosmetic Act (Food Safety Modernization Act—FDA can now detain product if believed adultered or misbranded)

- Use may be on rise again

Final Jeopardy

- When did Dietary Supplement Health and Education Act come into being?

- 1994