| Nutritional Supplements |          |                         |                   |                 |
|-------------------------|----------|-------------------------|-------------------|-----------------|
| Weight                  | Strength | Other                   | Energy            | Grab Bag        |
| Green Tea               | Creatine | Casein/<br>Whey         | Energy<br>Drinks  | Post<br>Workout |
| Chromium                | НМВ      | BCAA                    | <b>B</b> -Alanine | Glucos<br>Chond |
| Carnitine               | HGH      | Taurine                 | Meldonium         | Omega-3         |
| Caffeine                | IGF      | Arginine                | Guarana           | Glutamine       |
| Clenbuterol             | DHEA     | T Boosters<br>"S-O-L-E" | B-Vit             | DMAA            |

# 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

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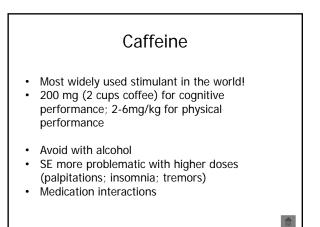
• ?mood and iron storage impact

#### Carnitine L-carnitine (non-essential AA) is biologically active form

Required for fatty acid breakdown

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- 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



# Clenbuterol

- Sympathomimetic amine; *B*-agonist; thermogenic agent
- Decreases fat deposition; increase muscle mass
- · Increased risk of arrhythmias
- On prohibited list
- "Clen cycle"
- Mexican soccer team

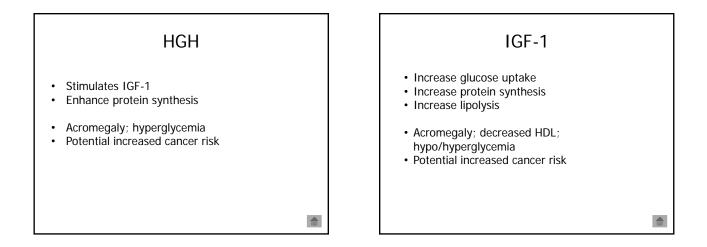
#### Creatine

- Replenishes ATP
- Increase energy available to muscle
- High intensity exercise
- Dosed properly, likely no harm

#### Beta-hydroxy-betamethylbutyrate (HMB)

- Decrease protein degradation
- Increase protein and cholesterol synthesis

- May decrease muscle breakdown
- · Lack of safety data



#### 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</p>
- Enhance mental performance (with caffeine)
- · May improve exercise performance in CHF Otherwise unclear

- Arginine
- Amino acid with "Nitric-oxide" effectsvasodilation 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 ٠
- Withdrawal side-effects (headache; irritability..) •

#### **B**-Alanine

- Reduce muscular fatigue ٠
- Reduce lactate buildup •
- Enhance short-term activity at fatigue threshold •
- · Paresthesia (dose-dependent)

#### Meldonium

- Latvian pharmaceutical marketed as antiischemic 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
  - Pleart disease-fish are part of heart-healthy diet (80z/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