

## Evaluating Popular Sports Supplements



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## Primary Considerations

Two most critical questions: is the supplement safe and effective?<sup>1</sup>

- ♦ Safety:
  - ✓ Primum non nocere – “First, do no harm”
- ♦ Effectiveness:
  - ✓ Biological plausibility/mechanism of action for purported ergogenic effect
- ♦ Considering risks/benefits of use requires information on safety and effectiveness

## Primary Considerations

- ♦ Doping:
  - ✓ Will supplement cause athlete to test positive for a prohibited substance?
- ♦ Quality:
  - ✓ Identity
  - ✓ Potency
  - ✓ Purity
  - ✓ Availability



## Creatine

- ♦ Claims:
  - ✓ Improves high power performance lasting less than 30 seconds
  - ✓ Increases lean body mass
- ♦ Biological plausibility/mechanism of action:
  - ✓ Creatine phosphate provides energy for high power performance via phosphagen system
  - ✓ Creatine increases muscle fiber hypertrophy and cell volume

## Creatine Safety

- ♦ Represents a safe method to enhance muscle size and strength responses to resistance training<sup>2</sup>
- ♦ No strong scientific evidence to support any adverse effects but no studies address issue of long-term creatine supplementation<sup>3</sup>
- ♦ Creatine supplementation lasting 1 to 4 years does not result in adverse health effects<sup>4</sup>

## Creatine Effectiveness: High-Power Performance

- ♦ Short-term creatine supplementation (20 g/day for 5-7 days) increases or improves:<sup>5</sup>
  - ✓ Total creatine content by 10-30%
  - ✓ Phosphocreatine stores by 10-40%
  - ✓ Maximal power/strength by 5-15%
  - ✓ Sets of maximal effort muscle contractions by 5-15%
  - ✓ Single effort sprint performance by 1-5%.
  - ✓ Repetitive sprint performance by 5-15%.

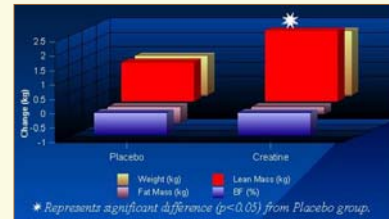
## Creatine Effectiveness: Lean Mass

- Increases body mass by 2 to 5 lb during 4-12 weeks of resistance training
- 6 g/day for 12 weeks during training increased:<sup>6</sup>
  - ✓ Fat free mass
  - ✓ Thigh volume
  - ✓ Muscle strength
  - ✓ Myofibrillar protein content



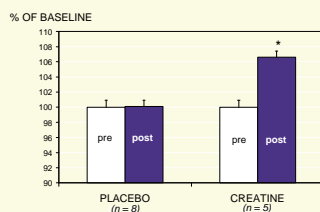
## Creatine Effectiveness: Lean Mass

28 days of creatine supplementation increased fat-free mass by 5.4 lb<sup>7</sup>



## Creatine and Thigh Volume

3 days of creatine supplementation increased thigh volume by 6.6%<sup>8</sup>



## Arginine for “Nitric Oxide”

- Claims:
  - ✓ Increases lean body mass
  - ✓ Improves muscle strength
- Biological plausibility/mechanism of action:
  - ✓ Nitric oxide synthase enzyme catalyzes oxidation of arginine to produce nitric oxide and subsequent vasodilation
  - ✓ Increases blood flow, oxygen transport, and delivery of nutrients to muscle

## Arginine Safety

- 9 g of arginine/day for 1 week was associated with minimal adverse side effects<sup>9</sup>
- 10 out of 12 subjects experienced GI distress at 21 g arginine/day for 1 week<sup>9</sup>
- 12 g of arginine alpha-ketoglutarate per day for 8 weeks appeared to be safe and well tolerated<sup>10</sup>
- No significant adverse effects from 9 g arginine/day for 12 weeks<sup>11</sup>

## Arginine Effectiveness: Lean Mass and Strength

- 12 g arginine/day for 8 weeks:<sup>10</sup>
  - ✓ Improved 1RM bench press
  - ✓ Improved Wingate peak power
  - ✓ No effect on body composition
  - ✓ No effect on aerobic capacity
- No proof that arginine influences nitric oxide levels in muscles<sup>9</sup>

## Arginine Effectiveness: Strength and Peak Power

- ♦ 6 g arginine + 8 g creatine/day or 8 g creatine/day for 10 days:<sup>12</sup>
  - ✓ Arginine + creatine and creatine increased bench press repetitions over 3 sets versus placebo
  - ✓ Arginine + creatine improved Wingate peak power – no change in creatine or placebo
- ♦ More research required for effectiveness

## Arginine Effectiveness: Vascular Disease

- ♦ May improve nitric oxide formation and endothelium-dependent vasodilation
- ♦ Arginine may benefit patients with endothelial dysfunction:
  - ✓ Heart failure (8 g/day for 4 weeks)<sup>13</sup>
  - ✓ Claudication (6.6 g/day for 8 weeks)<sup>14</sup>
  - ✓ Angina (6 g/day for 3 days)<sup>15</sup>

## “Nitric Oxide” Supplement

### SUPPLEMENT FACTS:

**Serving Size: 3 Caplets**  
**Servings Per Container: 60**

**Amount Per Serving:**

**VASODILASE: 1.8 g**

- L-arginine hydrochloride
- L-arginine alpha ketoglutarate

**STIMUGROW: 1 g**

- Creatine monohydrate
- L-leucine
- L-valine



## Directions

Directions for men and women: Please refer to the dosing chart below. Based upon your gender and bodyweight, take one serving (2 to 5 caplets) with an 8 fl. oz. glass of water, 2 times daily. On days of your workout, take 1 of these servings 30 to 60 minutes before your workout. Do not exceed 10 caplets in a 24-hour period. Consume ten 8 fl. oz. glasses of water daily for general good health.

[http://www.nitroxy3.com/product\\_info/faqs.shtml](http://www.nitroxy3.com/product_info/faqs.shtml)

## Whey Protein

- ♦ Claims:
  - ✓ Increases lean body mass and strength
  - ✓ Enhances immunity
- ♦ Biological plausibility/mechanism of action:
  - ✓ High biological value and rapid digestion rate
  - ✓ Elevates glutathione levels (due to high cysteine content) – reduces oxidative stress
  - ✓ Contains bioactive components lactoferrin, beta-lactoglobulin, immunoglobulins, and alpha-lactalbumin

## Whey Protein Safety

- ♦ 20% of milk protein
- ♦ As a constituent of milk, whey protein is presumed to be safe
- ♦ People with allergies to milk are likely to be allergic to whey (even partially hydrolyzed forms)<sup>15</sup>



### Whey Protein Effectiveness: Strength

- ◆ Compared to casein, 20 g whey/day for 3 months (no training) increased:<sup>16</sup>
  - ✓ peak power
  - ✓ work capacity
  - ✓ glutathione levels
- ◆ May enhance performance by reducing oxidative stress and subsequent muscular fatigue

### Effectiveness of Whey Protein Compared to Casein

- ◆ Subjects consumed 1.5 g/kg/day of whey or casein during 10 weeks of resistance training<sup>17</sup>
- ◆ Whey supplementation promoted:
  - ✓ Greater gain in lean mass
  - ✓ Greater decrease in fat mass
  - ✓ Greater improvements in strength, even when expressed relative to body weight

### Effectiveness of Whey Protein Compared to Soy

- ◆ Subjects consumed 1.2 g/kg/day of whey, soy, or isocaloric placebo during 6 weeks of resistance training<sup>18</sup>
- ◆ Compared to placebo, protein supplementation (independent of source) increased:
  - ✓ Lean mass
  - ✓ Strength

### Effectiveness of Whey Protein Compared to Casein

- ◆ Based on digestion rate, whey is “fast” protein and casein is a “slow” protein
- ◆ 20 g whey or casein ingested 1 hour after resistance exercise:<sup>19</sup>
  - ✓ Different patterns of arterial amino acid responses
  - ✓ Similar amino acid uptake relative to amount ingested
  - ✓ Similar increases in muscle protein synthesis

### Whey Protein Effectiveness: Lean Mass and Strength

- ◆ Subjects consumed 1.2 g/kg/day of whey, whey and creatine (0.1 g/kg/day), or isocaloric placebo during 6 weeks of resistance training<sup>20</sup>
- ◆ Whey increased knee extension peak torque and lean mass more than placebo
- ◆ Creatine and whey increased bench press and lean mass more than whey or placebo
- ◆ No differences in squat strength and knee flexion peak torque between creatine and/or whey and placebo

### Whey Protein Effectiveness: Immunity

- ◆ Whey processed using ion exchange methodology appears to retain bioactive components purported to enhance immune function
- ◆ “Immune support” claims are largely speculative and have not been adequately proven in human subjects

## Beta-Alanine

- ♦ Non-essential amino acid; substrate for carnosine which buffers lactic acid
- ♦ May enhance aerobic and anaerobic performance by increasing buffering capacity due to elevated carnosine levels<sup>21-24</sup>
- ♦ Beta-alanine (3.2 g/d) and creatine (10.5 g/d) enhance performance and improve fat free mass more than creatine alone<sup>21</sup>
- ♦ Further research on safety and effectiveness warranted

## HMB

- ♦ Beta-hydroxy-beta-methylbutyrate (HMB): metabolite of essential amino acid leucine
- ♦ May be responsible for the well-known anticatabolic actions of leucine<sup>25</sup>
- ♦ May protect against muscle damage or improve muscle repair<sup>25</sup>
- ♦ May maintain muscle cell integrity during periods of stress<sup>25</sup>

## HMB and Untrained Subjects

- ♦ 1.5 to 3 g/day increased fat-free mass and strength in a dose dependent manner – not statistically significant<sup>25</sup>
- ♦ Significantly decreased exercise-induced rise in muscle proteolysis<sup>25</sup>
- ♦ Significantly increased fat-free mass by 0.28% and strength by 1.4% per week<sup>26</sup>
- ♦ May have greater effects on lean body mass and muscle strength when combined with creatine<sup>27</sup>

## HMB and Athletes

- ♦ No effect on muscular strength or body composition in college football players<sup>28</sup>
- ♦ No effect on fat-free mass, strength, or catabolism in resistance trained males<sup>29</sup>
- ♦ HMB may increase muscle mass and strength in untrained individuals but not athletes



## Glutamine

- ♦ Major fuel for cells of immune system and gut
- ♦ Conditionally essential during metabolic stress, critical illness
- ♦ Claims:
  - ✓ reduces muscle catabolism
  - ✓ promotes tissue repair
  - ✓ increases muscle cell volume
  - ✓ reduces infections<sup>30</sup>



## Glutamine and Athletes

- ♦ Benefits for preventing illness not well-established<sup>31</sup>
- ♦ 0.9 g glutamine/kg/day for 6 weeks: no effect on body composition, catabolism, or performance<sup>32</sup>
- ♦ Adequate calorie, protein, and CHO intake:
  - ✓ maintain normal glutamine status
  - ✓ boost immunity
  - ✓ stimulate muscle synthesis

## Supplements and Doping

- ◆ Some supplements contain prohibited substances (anabolic steroids and their prohormones; ephedrine) not declared on label<sup>33</sup>
- ◆ Contamination due to poor manufacturing practices or deliberate adulteration<sup>33</sup>
- ◆ Strict liability applies: innocent ingestion of a prohibited substance is not an acceptable excuse<sup>33</sup>
- ◆ Athletes who test positive are liable to penalties (loss of medals and eligibility to compete)<sup>33</sup>

## Analysis of Non-Hormonal Nutritional Supplements for Anabolic Steroids<sup>34</sup>

Country	# of Products	# of Positives	% of Positives
Netherlands	31	8	25.8 %
Austria	22	5	22.7 %
UK	37	7	18.9 %
USA	240	45	18.8 %
Italy	35	5	14.3 %
Spain	29	4	13.8 %
Germany	129	15	11.6 %
Belgium	30	2	6.7 %
France	30	2	6.7 %
Norway	30	1	3.3 %
Switzerland	13 - -		
Sweden	6 - -		
Hungary	2 - -		
Total	634	94	14.8 %

## “After testing positive for nandrolone, Fritz Aanes suffers two heartbreaks”<sup>35</sup>

- ◆ Lost the bronze medal
- ◆ Banned for two years from competition
- ◆ Protested drug test
- ◆ Denied taking steroids
- ◆ Lab confirmed dietary supplement contained nandrolone – not listed on label



## Safety and Effectiveness

- ◆ “First, do no harm” (Hippocratic Oath)
- ◆ Is purported action of supplement biologically plausible?
- ◆ If product is unfamiliar, visit websites that sell supplement to determine ingredients and supposed method of action
- ◆ Meticulously examine quality and quantity of studies that support the supplement’s safety and effectiveness

## Internet Resources

- ◆ National Library of Medicine database: [www.ncbi.nlm.nih.gov/PubMed](http://www.ncbi.nlm.nih.gov/PubMed)
- ◆ ConsumerLab: [www.consumerlab.com](http://www.consumerlab.com)
- ◆ Natural Products Encyclopedia by EBSCO
- ◆ Natural Medicine Comprehensive Database: [www.naturaldatabase.com](http://www.naturaldatabase.com)
- ◆ Dietary Supplement Information Bureau™ [www.supplementinfo.org](http://www.supplementinfo.org)

## Doping Concerns

- ◆ Will supplement cause athlete to test positive for a prohibited substance?
- ◆ NSF International: [www.nsf.org](http://www.nsf.org):
  - ✓ National Football League and National Football League Players Association (NFLPA) supplement certification
- ◆ ConsumerLab: [www.consumerlab.com](http://www.consumerlab.com)
  - ✓ Athletic Banned Substances Screening Program

## Quality Concerns

- ◆ Products eligible for ConsumerLab seal of approval:
  - ✓ [www.consumerlab.com](http://www.consumerlab.com)
- ◆ Products that have USP (United States Pharmacopeia) on the supplement label:
  - ✓ [www.usp.org](http://www.usp.org)
- ◆ Products that are NSF certified:
  - ✓ [www.nsf.org](http://www.nsf.org)
- ◆ Nationally known food and drug companies with tight manufacturing controls

When evaluating supplements, try to keep an open mind, but not so open that your brain falls out

Thank you!  
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