Supplement and Performance Drug Use in Youth Athletics

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LEARNING OBJECTIVES

• Discuss briefly the history of ergogenic aids.
• Discuss the current “hot” supplements.
• Provide information for informed discussion and counseling of athletes desiring supplements.
Brief History

- Supplements: $18 Billion in 2007
- Some studies estimate 25-30% adolescents use.
- Estimates of 30-40% use in 50+ active.
- Information available is often poor and biased.
Counseling Pitfalls

• Avoid: “All supplements are a rip-off.”
• Avoid: Supplements are not regulated.
  – FDA regulates safety and labeling.
  – FTC regulates advertising.
  – Has led to independent agencies.
• Be sure you have valid resources to supply to you patient.
SUBSTANCES TO BE DISCUSSED

- CREATINE MONOHYDRATE
- β-Hydroxy- β-Methylbutyrate (HMB)
- NEW SUPPLEMENTS
- PROTEIN SUPPLEMENTS
- ANABOLIC STEROIDS
CREATINE MONOHYDRATE

- Creatine is a substance made in our liver from arginine, methionine, and glycine.
- Creatine is ingested in fish and meat.
- Most of the body's creatine is stored in the muscles as creatine phosphate.
- Act as an intracellular buffer, replenishing ATP during short bursts of high intensity exercise. (Volek et al.)
Can Creatine Really Improve Exercise Performance?
Mechanism of Action

- Taken into cell by Na+ dependent and Insulin dependent pathways.
- Rephosphorylation of ATP.
- Energy transport within the cell.
- Prevents increase in intracellular ADP.
- Prevents intracellular acidosis.
- Maintains ATP/ADP ratio.
CREATINE MONOHYDRATE

- Numerous studies have shown that creatine loading yields performance enhancement in brief high-intensity work.
- Normal muscle creatine levels in skeletal muscle is between 90 and 150 mmole/kg.
  - People with lower baseline levels respond better to loading.
- 16oz beef, pork, fish yields 2 g of creatine.
CREATINE LOADING

• Ingestion of 25-30 grams per day in divided doses of 5g/dose for 7 days.
  – A maintenance dose of 2-3 g/day after loading phase to continue the 20% increase in intracellular phosphocreatine.
  – Hultman et al showed that loading with a carbohydrate load increased muscle uptake.
    • most likely due to up regulation of creatine transporter via insulin secretion.
• Many are now just using a maintenance regimen.
CREATINE LOADING

• Due to the increased uptake with carbohydrate the athlete will inject insulin while Creatine Loading.
  – Has been cases of death due to hypoglycemia in a bodybuilder using insulin to Carb Load.

• Some are using oral hypoglycemics.
  – Metformin is big because of the “safety profile”
Cycling

- May be a slow long-term decrease in muscle creatine over time.
- Loading Phase [5-7 days]
- Maintenance Phase [5-8 weeks]
- Off Cycle [2-10 weeks]
- Timing with season or competition.
Adverse Effects

• RENAL
  – No long term deleterious effects found. (5yrs)
  – Elevated serum creatine w/o ↓GFR.
  – Recent study showed rapid progression of renal disease. (Han: SPRD-cy Rats).
  – Case study of acute nephrotic syndrome.

• Do not use if renal disease or FHx.
Adverse Effects

• **Gastrointestinal**
  - Anecdotal reports with no scientific backing.
  - Probably due to the high glucose/fructose content in supplements.
  - Usually occurs during Loading Phase.
  - Lower incidence reported with dissolved powders.

• **Acute Compartment Syndrome**
  - Case of Athlete with ACS of thigh after workout.
  - Was using multiple other “supplements”
Adverse Effects

• Heat Intolerance
  – Several reports and ACSM Roundtable(2000)
    • No scientific evidence that this is true.

• Most noted side effect is water retention.
  – Increases total body water.
  – Lower CBT and HR compared to placebo group when exercising in heat.
  – Dehydrated individuals exercising heat show no difference in heat intolerance when compared to placebo.
Heat Intolerance

• Numerous studies show short term and long term supplementation may even be advantageous for athletes exercising in the heat.
  – Lower Core Body Temperature
  – May be due to increase total body water??
  – Exact mechanism unknown!
CREATINE MONOHYDRATE

- Has shown some promise in treating neuromuscular disorders.
  - Myasthenia Gravis patients.
  - Being studied in many muscle wasting disorders.
  - Has been used in HIV and cancer patients.
For whom does Creatine work?

• Short burst, anaerobic athletes.
  – Football players, throwers, weight lifters, sprint cyclist.

• Has not been shown to sprinters or swim sprint times.
  – Many think this is due to the weight gain.
HMB
(BETA-HYDROXY BETA-METHYLBUTYRATE)

• HMB is a natural metabolite of leucine.
  – Found in catfish, grapefruit, and mothers milk.
• HMB supplementation resulted in enhancement of muscle function in humans undergoing resistance training. (Nissen)
  – People receiving HMB showed increased muscle mass and strength and decreased muscle breakdown with weight training. (untrained)
  – Often combined with arginine and glutamine (Juven--Abbott) and Ensure: Muscle Health.
HMB
(BETA-HYDROXY BETA-METHYL BUTYRATE)

• Recent study at Ball State showed no ergogenic or deleterious effects.
• No adverse side-effects have been shown with HMB use.
• No good studies showing Positive effects in well trained athletes.
• Best used early in training
• Very expensive.
“NEW SUPPLEMENTS”

• As always there is some new hot supplement that is going to improve performance.
• A few of the latest wonder supplements on the scene, but of course this list will change with the next “great scientific discovery”
Choline

- **Essential nutrient**
  - Precursor for acetylcholine: a neurotransmitter for muscle contraction
- Supplementation may decrease muscle fatigue in endurance athletes and improve cognitive function.
- No improvement seen in studies.
  - Avoid with gout.
Glutamine

• A nonessential AA used for energy by immune cells.
  – Low levels have been implicated in over-training syndrome
  – Has shown promising effects with critical care patients.
  – No proof it helps athletic performance.
Methoxyisoflavone

- A natural flavanoid from soy beans.
- MAY ↑ bone density, ↓ hot flashes, ↓ cholesterol and improve cognition.
- No proven enhanced performance or increased lean body mass.
- Caution with E-responsive BCA or women at risk for BCA
Nitric Oxide

• A vasodilator used in treating ED and myocardial ischemia.
• May cause hypotension.
• May be of some benefit in hypoxic environments.
Quercetin

• Natural flavonoid: anti-inflammatory.
  – Found in onions, apples, cranberries and blueberries.

• Can enhance performance via psychomotor stimulation similar to caffeine in endurance activities.
CHROMIUM

• Touted to be lost in sweat during exercise.
• There is no proof chromium in any form is ergogenic
• Interferes with iron and zinc metabolism.
• May be needed in athletes with poor diets high in processed foods and high carbohydrates
CHROMIUM PICOLINATE

• Chromium is a trace element which is bound to picolinate to increase GI absorption.
  – Cr acts as a cofactor that enhances the action of insulin.
• Evans and Hasten found it to increase lean body mass and decrease percent body fat.
  – Poor studies which were never duplicated.
• Has been shown to cause dysplastic changes in hamster ovaries.
• Wasser et al report a case of chronic interstitial nephritis after chromium picolinate use.
Insulin-like Growth Factor

• Produced in liver
• Mediates hGH function.
• Stimulates protein synthesis.
• Mobilizes Free Fatty Acids
• Reduces the metabolism of glucose for energy.
Insulin-like Growth Factor

• Reasons Athletes use IGF.
  – Increase muscle strength.
  – Increase lean body mass.
  – Improved muscle function.

• Reasons Athletes Should Not use IGF
  – Acromegaly
  – Myalgias
  – Severe Hypoglycemia.
Whey Protein

• A supplement, not food replacement.
• One of the two main proteins found in milk
• It is really not one protein but a combination of many proteins and compounds.
• Well absorbed and highly useable
• Also high in branched chain amino acids.
• How much? 1.2-1.5 grams/kg daily
• Can be used after strength training-help recovery.
Anabolic Steroids

• Problem goes down into our middle schools
• Not only the athletes but also used for vanity.
• Have a high co-usage with other drugs.
• Taken at supra-physiological doses.
• Not always of the highest quality.
Main Effects

- Increase lean body mass.
- Increase muscle size and strength.
- Protein metabolism,
- Bone metabolism
- Collagen synthesis

- The most profound effects are noted when supra-physiologic doses accompany a training program and are used in conjunction with a diet adequate in protein and calories
Is it obvious?
Secondary Effects

• Glucocorticoid antagonism, which minimizes the catabolic actions of corticosteroids released during the stress of athletic activity.

• Stimulation of the growth hormone insulin-like growth factor-1 axis.

• Enhanced collagen synthesis and bone mineral density.
Getting the Goods

• Gyms and Health Clubs
• Black Market through magazines and the internet.
• Online pharmacies.
• Anti-Aging Clinics.
• Veterinarians.
Prevalence

- Estimates of 4-11% high school senior males and 3.3% females.
- Monitoring the future study in 2004 estimated 1.7% of 8th grade boys had tried AA.
- Studies in other parts of the world have shown similar numbers.
Risk Factors

• No clear cut prevalence according to race or geographic location
• Varied results looking at academic performance.
• More prevalent in strength sports athletes but CDC study shows 30-40% of users were non-athletes.
• Misperception of body image
  – Young boys with later onset of puberty are at risk.

• Also have a higher rate of using cigarettes, smokeless tobacco, marijuana, alcohol, cocaine and narcotics.

• More likely to carry a gun, DUI, unprotected sex and promiscuity, fighting and unsafe driving behaviors. Middleman and colleagues
Modes of Administration

- Injectables: Class I (testosterone esters) and Class II (nortestosterone derivatives)
- Orals: Alkylated at C17 which slows the hepatic clearance.
- Transdermal is also now available.
- Reasons for each?
<table>
<thead>
<tr>
<th>Generic name</th>
<th>How supplied</th>
<th>Recommended dosage</th>
<th>Abused dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxymetholone (O)</td>
<td>50 mg</td>
<td>1–5 mg/kg/d</td>
<td>50–100 mg/d</td>
</tr>
<tr>
<td>Oxandrolone (O)</td>
<td>2.5 mg</td>
<td>5–10 mg/d</td>
<td>15 mg/d</td>
</tr>
<tr>
<td>Nandrolone decanoate (I)</td>
<td>25 mg/mL, 5 mL</td>
<td>100–200 mg/wk</td>
<td>200–400 mg/wk</td>
</tr>
<tr>
<td>Methandrostanolone (O &amp; I)</td>
<td>5 mg, 10 mg/mL</td>
<td>—</td>
<td>15–30 mg/d, 50–100 mg/wk</td>
</tr>
<tr>
<td>Boldenone undecylenate (I)</td>
<td>50 mg/mL</td>
<td>—</td>
<td>5 mL/wk</td>
</tr>
<tr>
<td>Methenolone (O &amp; I)</td>
<td>50 mg/ml; 50, 100 mg/mL</td>
<td>—</td>
<td>50–100 mg/d, 200 mg/wk</td>
</tr>
<tr>
<td>Testosterone propionate, phenyl propionate, isocaproate, decanoate (I)</td>
<td>250 mg/mL</td>
<td>—</td>
<td>250 mg/wk</td>
</tr>
<tr>
<td>Testosterone cypionate (I)</td>
<td>200 mg/mL</td>
<td>25–200 mg/wk</td>
<td>1–3 mL/wk</td>
</tr>
<tr>
<td>Testosterone enanthate (I)</td>
<td>200 mg/mL</td>
<td>25–200 mg/mL</td>
<td>1–3 mL/wk</td>
</tr>
<tr>
<td>Testosterone propionate (I)</td>
<td>100 mg/10 mL</td>
<td>50–150 mg/wk</td>
<td>200–400 mg/wk</td>
</tr>
<tr>
<td>Testosterone suspension (I)</td>
<td>100 mg/10 mL</td>
<td>—</td>
<td>50 mg/d</td>
</tr>
<tr>
<td>Stanozolol (O &amp; I)</td>
<td>2 mg, 50 mg/mL</td>
<td>6 mg/d,</td>
<td>16–30 mg/d, 3–5 mL/wk</td>
</tr>
</tbody>
</table>

Abbreviations: O, oral; I, injectable.

Abused dosages may vary greatly by gender, personal experience, availability of specific steroids, performance and appearance goals, and the simultaneous use of several steroids.

Adverse Effects

- Hepatic: ↑ LFT’s and hepatocellular adenomas.
- CV: ↑ LDL ↓ HDL and HTN.
- Endocrine: ↓ LH and FSH – testicular atrophy, gynecomastia and hirsutism
- MS: tendon rupture.
- Derm: Acne
- Physche: roid rage, euphoria, and severe depression when coming off.
Prevention

• Education and legislation is the way to go.
• Scare tactics do not work.
• My personal opinion is that level playing field and morals is garbage and does not work!!!
• Thoughtful Discouragement.
• START AT A YOUNGER AGE
• Taylor Hooten Foundation
Thank you
See you in Colorado Springs
March 6-9, 2013