

# 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
- $\beta$ -Hydroxy-  $\beta$ -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 bodies 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.)





# Mechanism of Action

- Taken into cell by  $\text{Na}^+$  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 [2-10weeks]
- 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-METHYLBUTYRATE)

- 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 flavanoid: anti-inflammatory.
  - Found in onions, apples, cranberries and blueberries.
- Can enhance performance via psychomotor stimulation similar to caffeine in endurance activities.



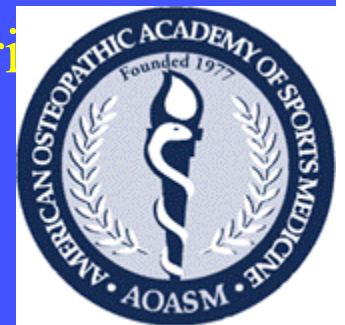
# CHROMIUM

- 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 8<sup>th</sup> 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?



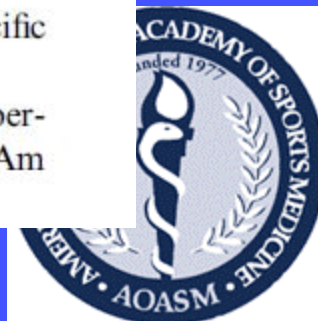
Table 1  
More commonly abused anabolic steroids

| Generic name   | How supplied               | Recommended dosage | Abused dosage <sup>a</sup>  |
|--|----------------------------|--------------------|-----------------------------|
| Oxymetholone (O)   | 50 mg                      | 1–5 mg/kg/d        | 50–100 mg/d                 |
| Oxandrolone (O)  | 2.5 mg                     | 5–10 mg/d          | 15 mg/d                     |
| Nandrolone decanoate (I)   | 25 mg/mL, 5 mL             | 100–200 mg/wk      | 200–400 mg/wk               |
| Methandrostenolone (O & I)   | 5 mg, 10 mg/mL             | —                  | 15–30 mg/d,<br>50–100 mg/wk |
| Boldenone undecyclenate (I)  | 50 mg/mL                   | —                  | 5 mL/wk                     |
| Methenolone (O & I)  | 50 mg/mL; 50,<br>100 mg/mL | —                  | 50–100 mg/d,<br>200 mg/wk   |
| Testosterone propionate,<br>phenyl propionate,<br>isocaproate, decanoate (I) | 250 mg/mL                  | —                  | 250 mg/wk                   |
| Testosterone cypionate (I)   | 200 mg/mL                  | 25–200 mg/wk       | 1–3 mL/wk                   |
| Testosterone enanthate (I)   | 200 mg/mL                  | 25–200 mg/wk       | 1–3 mL/wk                   |
| Testosterone propionate (I)  | 100 mg/10 mL               | 50–150 mg/wk       | 200–400 mg/wk               |
| Testosterone suspension (I)  | 100 mg/10 mL               | —                  | 50 mg/d                     |
| Stanozolol (O & I)   | 2 mg, 50 mg/mL             | 6 mg/d,            | 16–30 mg/d,<br>3–5 mL/wk    |

*Abbreviations:* O, oral; I, injectable.

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

*Data from* Bahrke MS, Yesalis CE, Brower KJ. Anabolic-androgenic steroid abuse and performance-enhancing drugs among adolescents. *Child Adolesc Psychiatr Clin N Am* 1998;7(4):826.



# 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
- Psyche: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

