

Herbs, Supplements and Athletes

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Athletes and Dietary Supplements

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Disclosures

- ▶ Dr. Neil Mathews has no conflict of interest, financial agreement, or working affiliation with any group or organization.
- ▶ I have nothing to disclose, but my wife does leave whole-food supplements out for me to take in morning, which I do.

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Creatine would most likely benefit which of the following athletes?

- A. Weight lifter-to improve strength
- B. Cross country runner-to improve endurance
- C. Track sprinter-to improve speed
- D. Ballerina-to help maintain healthy body weight

What percentage of patients did NOT reveal supplement use during a pre-operative clearance exams?

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- A. 25%
- B. 33%
- C. 50%
- D. 66%

What percentage of herbal products tested with DNA barcoding technology revealed product substitution (main ingredient not found AND unknown ingredient found)?

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- A. 10%
- B. 25%
- C. 67%
- D. 90%

Objectives

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- ▶ To be able to list reasons athletes use dietary supplements (DS)
- ▶ To understand the issues related to consumption of DS, including efficacy, purity, quality, and athlete testing
- ▶ To be able to list the DS that have shown to aid athletic performance and explain how they work

Epidemiology

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- ▶ \$60 Billion industry/\$20 B in US alone
- ▶ Since 1994, products from 4,000 to 55,000; 1,000 companies
- ▶ > 100,000,000 people take supplements
- ▶ 85% of elite track and field athletes take at least one DS (J of Sports Science, Apr 2009)
- ▶ Bailey, J of Nutrition 2011
 - ▶ 70% don't tell physicians
 - ▶ 44% think physician doesn't know much
 - ▶ 67% don't tell of use before surgery
 - ▶ 30% drug/supplement interaction



Why Take a Supplement?

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Correct nutritional deficiency-
sound evidence-Iron or B12
deficiency

Prevent medical disease or
condition-sound evidence-B2
and Magnesium for migraine
prevention

Improve health or optimize
performance-sound or poor
evidence

Less common-but common-athletes
take supplements



Reasons Athletes Take Supplements

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- ▶ "I can't get everything I need from my diet"
 - ▶ In few cases is this true: may need review c Nutritionist
- ▶ "I don't have time to prepare and cook meals"
 - ▶ Does take time: need to plan: help from Nutritionist
- ▶ "Everyone is using them and they will have an advantage over me"
 - ▶ Companies prey on fears: not true, but often slim margin from 1st to 4th place
- ▶ "Supplement recommended by my doctor"
 - ▶ Limited training for most physicians
- ▶ "Natural and organic way to enhance health"
 - ▶ More to come on this: not proven and often not natural
- ▶ Note: 50% of Olympic-caliber athletes would take a banned substance if they would win all competitions for 5 years, but die from adverse effects

Dietary Supplement Regulation

Dietary Supplement Health and Education Act of 1994 (DSHEA)
FDA regulates DS

Manufacturers responsible for product safety, quality, marketing and that labels are truthful and not misleading

Post-market, FDA responsible for monitoring safety and inspecting good manufacturing practices

National Trade Commission (FTC) responsible for truth in advertising - needs to be company specific, not disease oriented



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FDA Oversight

- ▶ 51% of Class 1 FDA recalls since 2004 are for supplements
- ▶ Food additives regulated more stringently than DS
- ▶ 2003- Ban on Kava (Nutraingredients)
- ▶ 2009- Warning placed on Hydroxycut products after number serious side effects and 1 death
- ▶ 2010- Voluntary recall of "Off Cycle II Hard Core"-contained aromatase inhibitor
- ▶ Emergen-C warned about untruthful advertising



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A Note on Quality

Consumer Grade DS:

Drug store/Health food store
Cheapest ingredients to max product shelf life

Artificial ingredients, colors, fillers, preservatives, binders
Minimum amount active ingredient

Professional Grade DS:

Full label disclosure
Standardization of herbal extracts
Third-party testing
IP party testing



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Testing

Depending on athlete, will have one or more governing body that oversees their participation

2.5.1.1. Substances

- All other substances, hormones
- Anabolic steroids, Steroids, THC
- Stimulants, beta-blockers, alcohol

2.5.1.2. Prohibited Methods (TUE)

- Approval for limited substance
- Approval for medical necessity
- Unassisted ascent
- Not used to enhance performance
- Used to provide support

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"But I swear I didn't cheat!"

Jessica Hardy set 2 world records in 2008, never made it to Beijing

Positive for clenbuterol, tested and found to be DS, one of her sponsors!

- Accepted one year ban, not usual 2
- Clenbuterol banned, world champion 400 m
- Positive for clenbuterol, offense
- Did not serve actual 2 year ban
- World Manager multiple victories in road cycling
- Positive for testosterone from OTC DS, he bought it convenience store
- One year ban

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World Anti-Doping Agency (WADA)

WADA aims to distinguish between athletes cheating and medication doping
WADA is responsible for everything that enters their body



What's in There?

50% of 33 brands creatine in Europe exceed limits for one contaminant

Non-medicine contaminants include pesticides, bugs, animal feces, lead, broken glass

Chemical contaminants include phenols, antibiotics, steroids, pesticides, parabens, fragrance releasing agents, BPA, growth promoter

WADA says: "Banned substances: wheat, milk, etc."

WADA's World Anti-Doping Agency, 2009 and 2010 reports led to in 2009 and 2010 WADA resulted positive contamination violation



DNA Barcoding Study

Newmaster SG et al, BMC Medicine 2013

DNA barcodes for 44 herbal products: detect contamination and adulteration

Results

100% contamination or filler (Most were not listed)

99% adulteration

100% adulteration

21% companies sell authentic products and include contamination notices



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NSF Certified for Sport

Recognized by NFL, MLB, PGA, NHL
Participating manufacturers

Label content, quality inspections, ongoing monitoring of manufacturing and product changes

NSF will do not guarantee any product is safe or pure, therefore it is not a seal of approval

Does not assure efficacy

App available for smartphones-lists companies and quality products



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Types of Athletes and Exercise

Endurance athlete-long bouts of exercise (run, swim, cycle, team soccer)

Team sports-short bouts (track, tennis, team handball, volleyball)

Strength athletes-power exercises (weight lifting, football, tennis)

Many athletes in our athletes and sports participated in all three

Some may actually help the overall body participate in exercise



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A Good Diet

Need to have first

If well balanced diet, no vitamin or mineral supplement are required

"Eat the Rainbow"

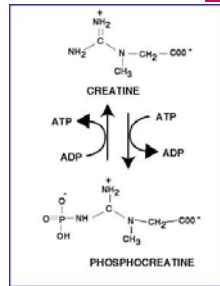
Better to get nutrients in natural state instead of all from

vegetation, and especially vitamins, which also has in energy, protein, fat, iron, calcium, Vit D, Biotin, Zinc, etc.



Creatine

Most well studied DS ever
Naturally occurs in body (mostly in muscles) and in many foods (meat and fish)
Complex organic acid
Can only build up to 150g; reach saturation in few days
90% consumed; 100 mg creatine/year
Absorbed by SGLT, NaCM, into sports
ACSM recommends NOT use if < 18 yo
2011 report on 100 adolescents on creatine; need to control use



Creatine

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- ▶ Effects: increase strength, increase free fat mass, increase performance in short repetitive bouts of high intensity exercise (30-90 seconds), faster regeneration of ATP between bouts, increased muscle mass
 - ▶ NOT proven benefit aerobic training or performance
 - ▶ Can be taken as loading dose 20-30 gm/d for 5-7 days, then maintenance 2-4 gm/day; extra cannot be stored or used
 - ▶ Responders and non-responders: vegetarians at risk
 - ▶ Side effects-most common: weight gain (fluid), GI upset, diarrhea, muscle cramping
 - ▶ Caution in patients with kidney disease, liver disease, diabetes
 - ▶ Excellent safety profile, especially if taken as recommended
 - ▶ Now, 20+ new novel creatine preparations-pitch better absorbed-no research to prove

Vitamin D- "The Sunshine Vitamin"

Steroid hormone affecting calcium metabolism, bone health, muscle strength, immune function, and hormones
75% general population with low levels
60-70% kids
Better absorbed with poor diet, breast-feeding, low sun
In all children (indoor, indoor recess, high school, vegetarians, those who sweat a lot, etc.)
20-30% of blood indicator of status



Vitamin D

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- ▶ Emerging evidence to support direct impact on athletic performance via enhancement muscle function (Close GL, J Sports Sci 2013)
- ▶ NFL players released for injury or poor performance had significantly lower levels Vit D compared to other players (Maroon JC, Am J Sports Med 2015)
- ▶ Indirectly affects performance via immunity-higher number URI in deficient group
- ▶ General accepted levels
 - ▶ Adequate: 30-100 ng/ml
 - ▶ Borderline: 20-30 ng/ml
 - ▶ Deficient: <20 ng/ml
 - ▶ Many believe current RDA is not adequate
- ▶ Peak neuromuscular performance at levels near 50 ng/ml
- ▶ Toxicity rare with supplementation
- ▶ Screen: Stress fx, recurrent infection, MSK pains, everyone???



Whey Protein

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Includes all amino acids, good source BCAA

Easier to absorb than soy or casein

ADA average protein needs:

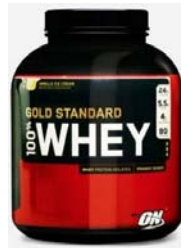
Men: 0.8-1.0 g/kg/d

Women: 0.7-1.0 g/kg/d

Children: 1.4-1.7 g/kg/d

Caution with athletes with renal disorders, diabetes, lactose intolerance, dairy allergy

Whey adds effects up to 2 g/kg/day



Whey Protein/BCAA

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- ▶ Prevent negative Nitrogen balance, aid protein synthesis especially during high intensity exercise: synthesize, repair, and maintain skeletal muscle proteins: prevent fatigue and overtraining
- ▶ Important source of energy in prolonged endurance exercise (soccer, tennis, running, swimming, cycling)
- ▶ Good in post-exercise smoothie-take within 20-30 minutes of bout, mix with CHO 3:1 protein

Caffeine

Stimulant, methylxanthine similar to theophylline

Claims-decreased level of exertion, increase mobilization of FFA and rate lipid metabolism, decrease glycogen

Peaks 1-2 hours after intake

Average American 2 cups coffee per day

40% athletes reported improved performance

70% believe it helps

Approved by FDA, WHO, and IAAF

WADA limit 12 mg/ml urine, have to drink 6 cups coffee after urine activity



Caffeine

- ▶ ACSM-may be effective, ?ethics if ergogenic
- ▶ Side effects-jitteriness, palpitations, anxiety, insomnia, arrhythmias
- ▶ Caution with energy drinks and caffeine powder
 - ▶ Next to MVL most popular DS c teens and young adults
 - ▶ 24 oz drink contains 500 mg caffeine (4-5 c/coffee); Guarana
 - ▶ 2007-2011: ER visits doubled for caffeine intoxic, most > 40 yo
 - ▶ FDA advisory-pure caffeine powder c 2 deaths young men
- ▶ Powder 1 tsp=25 cups/coffee
- ▶ Available on internet
- ▶ Drinks often combined with alcohol use



Others with some good evidence...

- ▶ Alkalinizing agents (Sodium Bicarbonate)-improves anaerobic endurance performance through increased pre-exercise pH and increased buffering ability
- ▶ L-arginine-improves aerobic endurance exercise performance through increased plasma nitrite levels and reduced O2 consumption during submaximal exercise
- ▶ Beta-alanine-Improves aerobic and anaerobic endurance performance through increased carnosine content and improves intracellular buffer capacity
- ▶ Nitrate-Improves aerobic endurance exercise performance-increases plasma nitrate levels, reduces O2 consumption, reduces ATP cost of muscle force production, and inhibits fall in muscle Phosphorylcreatine content during contractions
- ▶ "Dietary Supplements for Athletes: Emerging Trends and Recurring Themes": Maughan RJ et al, J of Sp Sciences, 2011.



As for the rest of them...

No convincing evidence for most other DS

• Creatine: poorly studied, mixed studies

• Beta-alanine, branched amino acids, steroid enhancers, testosterone boosters

• Some do work: Study found AAS supplementation increases lean muscle mass in males (25.8%), females (22.7%), & 12-17 y.o. (18.8) - [Bryant et al., 2004](#)



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Helpful Resources

- ▶ American College of Sports Medicine (acsm.org)
- ▶ National Center for CAM (www.nccam.nih.gov)
- ▶ Food and Drug Administration (fda.gov)
- ▶ Office of Dietary Supplements (ods.od.nih.gov)
- ▶ US Anti-Doping Agency (www.usada.org)
- ▶ GlobalDRO.org-website for Olympics/International
- ▶ National Center for Drug Free Sport (www.drugfreesport.com)
- ▶ "Position of American Dietetics Assoc., Dieticians of Canada, and ACSM: Nutrition and Athletic Performance" J. of ADA 2009
- ▶ Academy of Nutrition and Dietetics (eatright.org)
- ▶ Local Sports Nutritionist/Registered Dietician (RD)

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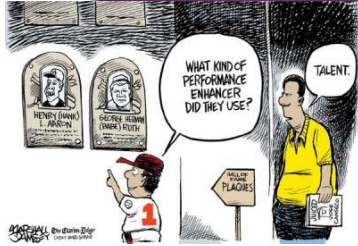
Summary for Family Physicians 36

- ▶ Athletes, and many others, are using DS and many are not aware of the risks and limited benefits
- ▶ Ask about use in non-judgmental way when covering meds and vitamins
- ▶ Few have proven beneficial effects
- ▶ Be aware of special circumstances regarding elite, competitive athletes (restrictions and testing)
- ▶ Start with improving diet first before recommending DS; consider referral to Sports Nutritionist
- ▶ Use abundant, reputable resources to educate athlete and yourself



Thank You!

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