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Dietary Supplements in the Pediatric Athlete

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SPORTS MEDICINE

CENTER



Children's Hospital Colorado



What is a Supplement?

Includes vitamins, minerals, herbs or other botanicals, amino acid, enzymes, dietary substance for use by man to supplement the diet by increasing the total dietary intake, or a concentrate, metabolite, constituent, extract, or combination of the preceding substances.

- NOT intended to treat, diagnose or prevent disease
- Health claims can not be legally made on labels

Forms:

tablets, capsules, softgels, gelcaps, gummies, powders, liquids



Big Industry

US Supplement industry profits \$55+ billion/yr

Sports Nutrition supplements are \$26 billion/year (sports, hydration, energy)

Supplements in Young People

1/3 of all children and teens take some supplement (up to 75% of athletes)

Vitamins/minerals are most common

In a national survey of about 21,000 U.S. college athletes:

- protein products (41.7%)
- energy drinks and shots (28.6%)
- creatine (14.0%)
- amino acids (12.1%)
- multivitamins with caffeine (5.7%)
- beta-hydroxy-beta-methylbutyrate (HMB; 0.2%)
- dehydroepiandrosterone (DHEA; 0.1%)
- mix of “testosterone boosters” (1.6%)



Supplements in Young People

Men use > women (except for energy drinks and energy shots)

Highest percentage of users:

- ice hockey, wrestling, and baseball among the men and volleyball, swimming, and ice hockey among the women.

Adolescents: protein, creatine, and caffeine were the most used ingredients which increased with age.

- Teens not involved in organized athletic activities often took supplements to enhance their appearance.



Who Needs a Supplement?

Chronic disease

- Celiac
- Eating disorder
- Cystic fibrosis

Vegan diet

Diagnosed deficiency

*Supplements should always be supervised by the child's healthcare provider

Food vs Supplement

Nutrition Facts	
Serving Size 2 tbsp. (33 g)	
Servings Per Container 7	
Amount Per Serving	
Calories 20	Calories from Fat 10
<hr/>	
% Daily Value*	
Total Fat 1 g	2%
Sodium 190 mg	8%
Total Carbohydrate 2 g	1%
Protein 1 g	
Vitamin A 2% • Vitamin C 15%	
Iron 10% • Vitamin B6 20%	
Vitamin B12 4%	
Not a significant source of saturated fat, trans fat, cholesterol, dietary fiber, sugars, and calcium.	
* Percent Daily Values are based on a 2,000 calorie diet.	

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Supplement Facts

Serving Size 1 scoop(s)
Servings Per Container 28

Amount Per Serving		% DV
Calories	200.00	
Calories from Fat	50.00	
Total Fat	6.00 g	9%
Saturated Fat	2.00 g	10%
Trans Fat	0.00 g	
Cholesterol	70.00 mg	23%
Sodium	220.00 mg	9%
Potassium	300.00 mg	9%
Total Carbohydrate	15.00 g	5%
Dietary Fiber	5.00 g	20%
Sugars	2.00 g	
Protein	22.00 g	44%
Vitamin A	0.00	0%
Vitamin C	0.00	0%
Calcium	0.00	15%
Iron	0.00	8%
Phosphorus	0.00	15%
Magnesium	0.00	6%

** Daily Value (DV) not established

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Dietary Supplement Health and Education Act of 1994 (DSHEA):

Individual manufacturers are responsible for evaluating the safety and labeling of their products. Misbranding is prohibited.

FDA is responsible for taking action against any adulterated or misbranded dietary supplement product AFTER it reaches the market.

The FDA must first establish that products are adulterated (e.g., that the product is unsafe) or misbranded (e.g., that the labeling is false or misleading) before legally being able to remove it from the market.



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Medical Food

“a food which is formulated to be consumed or administered enterally under the supervision of a physician and which is intended for the specific dietary management of a disease or condition for which distinctive nutritional requirements, based on recognized scientific principles, are established by medical evaluation.”

Rx is not needed

Includes:

- Oral rehydration solutions
- Specialty infant formulas
- Phenylalanine free beverages



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Supplement Safety

2007 - 2016:

776 dietary supplements contained unapproved ingredients

Common categories of supplement for adulteration:

- weight loss (sibutramine)
- muscle building (synthetic steroids, steroid-like ingredients)
- sexual enhancement



Supplement Safety

- 977 supplement related injury cases over 11 years (in ages 0-25)
- 40 percent of which involved trips to an emergency room, hospitalization, disability or death
- Remaining cases involved trips to a doctor's office
- Supplements sold for muscle building, energy and weight loss were 3x the risk for severe medical events compared with vitamins

Third Party Verification



Live safer.®



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Types of supplements: Energy

Includes: sports drinks, energy drinks, sports gels, electrolyte replacement, protein, liquid meal replacements, sports bars and protein enhanced foods

Performance - Based

Good research in adults on:

- caffeine
- creatine
- nitrate
- beta alanine
- sodium bicarb

Significantly less evidence in adolescents.

Types of Supplements: Training Capacity and Injury Management

Substance	Proposed Mechanism of Action
Creatine Monohydrate	Enhanced adaptive response to exercise via increased growth factor/gene expression and increased intracellular water. Reduced symptoms of, or enhanced recovery from, muscle damaging exercise (eg, DOMS). Enhanced recovery from disuse or immobilization/extreme inactivity. Improved cognitive processing Decreased risk/enhanced recovery from concussion
Beta-hydroxy beta-methylbutyrate (HMB)	Enhanced adaptive response to exercise via decreased protein breakdown, increased protein synthesis, increased cholesterol synthesis, increased growth hormone and IGF-I mRNA, increased proliferation and differentiation of satellite cells and inhibited apoptosis
Omega-3 FA	Improved cognitive processing Decreased risk/enhanced recovery from concussion Increased muscle protein synthesis Reduced symptoms of, or enhanced recovery from, muscle damaging exercise (eg, DOMS)
Vitamin D	Enhanced adaptive response to exercise Decreased stress fractures
Gelatin with vit C/collagen	Increased collagen production; Thickened cartilage; Decreased joint pain
Anti-inflammatory supps (curcumin/tart cherry)	Anti-inflammatory effects; Reduced symptoms of, or enhanced recovery, from muscle damaging exercise (eg, DOMS)



Popular Supplements

Protein powder

- Unnecessary
- Convenient
- 3rd party certification
- Simple ingredient list
- Risk of heavy metal contamination

Athlete protein needs: 1.5-2g/kg body weight

- Easily met with food and adequate nutrition intake

Popular Supplements

Caffeine/Stimulants

<12y/o: none recommended

12-18y/o: <100mg/day

Tall coffee Starbucks: 235mg caffeine

Grande Frappuccino: 105mg caffeine

Energy drinks: 80-400mg caffeine

Side effects

- Sleep disturbances
- Jitteriness, anxiety, heart palpitations, increased blood pressure, heart attack

Amount Per Serving	%
Vitamin B12 (as Cyanocobalamin)	60 mcg
Chromium (as Chromium Polynicotinate)	50 mcg
Proprietary Blend	640.5 mg
Ginkgo Leaf Powder, Cabbage Palm Fruit Powder, Raspberry Ketone, Cola Nut Seed Powder, Eleuthero Root Powder, Green Tea Leaf Extract, White Willow Bark Powder, Guarana Seed Extract, Mate Leaf Powder, Bee Pollen Powder, Fo-Ti Root Powder, Ginger Root Powder, Bitter Orange Fruit Powder, Asian Ginseng Root Powder, American Ginseng Root Powder.	
Caffeine Anhydrous	100 mg
†Daily Value not established.	
Other Ingredients: Gelatin (Capsule), Microcrystalline Cellulose, Magnesium Stearate, Titanium Dioxide (Color), FD&C #1	

Contains 0% Juice

Nutrition Facts

Servings Per Container 1
Serving Size 12 fl. oz (355mL)

Amount Per Serving
Calories 10

	% Daily Value
Total Fat 0mg	0%
Sodium 5mg	0%
Total Carbohydrate 0mg	0%
Protein 0mg	
Calcium 50mg	4%
Vitamin C 60mg	70%
Riboflavin 1.7mg	130%
Niacin 20mg	130%
Vitamin B6 2mg	120%
Vitamin B12 6mcg	250%
Biotin 300mcg	1000%
Pantothenic Acid 10mg	200%
Chromium 50mcg	140%

Not a significant source of sat fat, trans fat, cholesterol, dietary fiber, total sugar, added sugars, vitamin D, iron, and potassium.

The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used as a general nutrition advice.

Caffeine Content: 200mg

Ingredients: Carbonated Filtered Water, Citric Acid, Taurine, Guarana Seed Extract, Caffeine, Green Tea Extract, Sucralose, Calcium Carbonate, Ascorbic Acid, Gluconolactone, Ginger Root Extract, Calcium Pantothenate, Nicotinamide, Natural Flavor, Pyridoxine Hydrochloride, Riboflavin, Vitamin B12, Biotin, Beta-Carotene (color), Cyanocobalamin.

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CA CRV ME-VT-CT-MA-NY WA HI SD MI-OR-ND
NOT RECOMMENDED FOR PEOPLE WHO ARE
PREGNANT OR BREASTFEEDING
OR MORE SENSITIVE CHILDREN UNDER 18.
DO NOT EXCEED
STATED SERVINGS
PER DAY

Energy Drink



Popular Supplements

Vitamins/minerals

- Most used supplement
- Lowest risk, products vary
- Look at the label—can contain caffeine, botanicals
- USP verification

SUGGESTED USE:

Adults, take 1 tablet daily with water and a meal.
Store tightly closed, in a cool, dry place, out of reach of children.
Do not use if imprinted seal under cap is broken or missing.

Supplement Facts

Serving Size 1 Tablet

Amount Per Tablet	% Daily Value	Amount Per Tablet	% Daily Value
Vitamin A 750 mcg (as Retinyl Acetate and 60% as Beta Carotene)	83%	Pantothenic Acid 10 mg (as d-Calcium Pantothenate)	200%
Vitamin C (as Ascorbic Acid) 180 mg	200%	Calcium (as Calcium Carbonate) 160 mg	12%
Vitamin D ₃ (as Cholecalciferol) 25 mcg (1000 IU)	125%	Iron (as Ferrous Fumarate) 18 mg	100%
Vitamin E (as dl-Alpha Tocopheryl Acetate) 22.5 mg	150%	Iodine (as Potassium Iodide) 150 mcg	100%
Vitamin K (as Phytonadione) 80 mcg	67%	Magnesium (as Magnesium Oxide) 100 mg	24%
Thiamin (as Thiamine Mononitrate) 1.5 mg	125%	Zinc (as Zinc Oxide) 15 mg	136%
Riboflavin 1.7 mg	131%	Selenium (as Sodium Selenate) 70 mcg	127%
Niacin (as Niacinamide) 20 mg	125%	Copper (as Cupric Sulfate) 2 mg	222%
Vitamin B ₆ (as Pyridoxine Hydrochloride) 2 mg	118%	Manganese (as Manganese Sulfate) 4 mg	174%
Folate 665 mcg DFE (400 mcg Folic Acid)	167%	Chromium (as Chromium Chloride) 120 mcg	343%
Vitamin B ₁₂ (as Cyanocobalamin) 6 mcg	250%	Molybdenum (as Sodium Molybdate) 75 mcg	167%
Biotin 30 mcg	100%		

USP has tested and verified ingredients, potency and manufacturing process.
USP sets official standards for dietary supplements. www.uspverified.org

- ✓ No Color Added
- ✓ No Artificial Flavors
- ✓ Gluten Free

CAUTION:

If you are taking medication or have blood clotting issues, consult your physician before use.

WARNING: Accidental overdose of iron-containing products is a leading cause of fatal poisoning in children under 6. Keep this product out of reach of children. In case of accidental overdose, call a doctor or poison control center immediately.

OTHER INGREDIENTS:

Cellulose Gel, Modified Food Starch, Maltodextrin, Croscarmellose Sodium, Hypromellose, Silicon Dioxide, Magnesium Stearate, Gelatin, Polyethylene Glycol.

DISTRIBUTED BY:

Nature Made
Nutritional Products
West Hills, CA 91309-9903
USA
1-800-276-2878
www.NatureMade.com

Lot:
Exp.:

Supplement Facts

Serving Size: 1 Capsule Servings Per Container: 60

Amount Per Serving	% Daily Value**	
Vitamin A (as 50% Retinyl Acetate, 50% Mixed Carotenoids)	1,050 mcg	117%
Vitamin C (as Ascorbic Acid)	150 mg	167%
Vitamin D3 (as Cholecalciferol)	50 mcg	250%
Vitamin E (as d-alpha Tocopheryl Succinate)	20 mg	134%
Vitamin K2 (as Menaquinone-7)	50 mcg	42%
Thiamine (as Thiamine HCl)	5 mg	417%
Riboflavin (as Riboflavin 5-Phosphate)	3.5 mg	269%
Niacin (as Niacinamide)	20 mg	125%
Vitamin B6 (as Pyridoxal 5-Phosphate)	5 mg	254%
Folate (as [6s]-5-Methyltetrahydrofolic Acid)	400 mcg	100%
Vitamin B12 (as Methylcobalamin)	500 mcg	20,833%
Biotin (as Methylcobalamin)	300 mcg	1,000%
Pantothenic Acid (as Ca Pantothenate)	10 mg	200%
Choline (as Choline Bitartrate)	25 mg	5%
Iodine (as K Iodide)	150 mcg	100%
Zinc (as Zn Citrate)	25 mg	227%
Selenium (as Selenomethionine)	50 mcg	91%
Manganese (as Mn Citrate)	2 mg	87%
Chromium (as Cr Polynicotinate)	200 mcg	571%
Molybdenum (as Molybdenum Glycinate Chelate)	75 mcg	167%
Coenzyme Q10	50 mg	†
Alpha Lipoic Acid	50 mg	†
Inositol	25 mg	†
Lutein	3 mg	†
Boron (as B Amino Acid Chelate)	1 mg	†
Lycopene	500 mcg	†
Zeaxanthin	500 mcg	†

** Percent Daily Values are based on a 2,000 calorie diet.

† Daily Value not established.

Other Ingredients: Vegetarian Cellulose (Capsule), Microcrystalline Cellulose, Vegetarian Leucine.

Free of: Gluten



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Popular Supplements

Weight gainer/muscle gain

- Huge variety in nutrition content
- Some with excessive protein
- Added carbohydrate/fat to increase calories
- Not as valuable as high calorie foods
 - Phytochemicals, antioxidants, fiber, etc.



Popular Supplements

Preworkout / Branched Chain Amino Acids (BCAA)

- Unnecessary
- Stimulants, amino acids, sugar (sometimes), herbals
- Dry scooping- dangerous trend on social media

Pre-workout

SUPPLEMENT FACTS		
Serving Size: One Scoop (5.11 g)		Servings Per Container: 24
One Scoop (5.11 g) Contains:		%DV
Calories	15	
Total Carbohydrate	2 g	<1%*
PeakO ₂ ® Proprietary Blend†	1,000 mg	**
Caterpillar Mushroom (<i>Cordyceps militaris</i>), Reishi Mushroom (<i>Ganoderma lucidum</i>), King Trumpet (<i>Pleurotus eryngii</i>), Shiitake Mushroom (<i>Lentinula edodes</i>), Lion's Mane Mushroom (<i>Hericium erinaceus</i>), Turkey Tail Mushroom (<i>Trametes versicolor</i>)		
Alpha GPC (L-alpha-Glycerylphosphorylcholine)	600 mg	**
Peak ATP® (Adenosine 5-Triphosphate Disodium)††	450 mg	**
Guayusa extract (leaf) (<i>Ilex guayusa</i>)	350 mg	**
Mango extract (leaf) (<i>Mangifera indica</i>)†††	140 mg	**
Quercetin Phytosome (<i>Sophora japonica</i> extract (flower) / Phospholipid complex from Sunflower)	35 mg	**
*Percent Daily Values are based on a 2,000 calorie diet.		**Daily Value (DV) not established

Other Ingredients: Flavor, Maltodextrin, Medium Chain Triglyceride Oil, Stevia extract (leaf), Citric Acid.

Supplement Facts

Serving Size: 1 Scoop (10.5 g)

Servings Per Container: 30

Supplement Facts		
Serving Size: 1 Scoop (10.5 g)		Servings Per Container: 30
Amount Per Scoop Serving		%DV†
Vitamin B12 (as Methylcobalamin)	100mcg	4,170%
Sodium	39mg	2%
Citrulline Malate 2:1	6,000mg	*
Beta-Alanine	2,000mg	*
Caffeine Anhydrous	200mg	*
AlphaSize® Alpha GPC	200mg	*
Taurine	100mg	*
Himalayan Rock Salt – with Trace Minerals	100mg	*
Deer Antler Velvet Extract	50mg	*
AstraGin® (Astragalus, Panax Notoginseng)	25mg	*
Senactiv® (Panax Notoginseng, Rosa Roxburghii)	25mg	*

† Percent Daily Value (DV) is based on a 2,000 calorie diet

* Daily Value not established

Other Ingredients: Natural Flavors, Malic Acid (used as a flavor enhancer), Silicon Dioxide, Calcium Silicate, Sucralose, Beta-Carotene (for color).



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Operation Supplement Safety: Supplement Scorecard

- Is any one of these **third-party certification seals** on the product label?
- Are there **less than six ingredients** on the Supplement Facts label?
- Is the label free of the words **proprietary, blend, matrix, or complex**?
- Can you **easily pronounce** the name of each ingredient on the Supplement Facts label?
- Is the amount of caffeine listed on the label **200 mg or less** per serving? (If caffeine is not listed, mark “Yes”)
- Is the label free of **questionable claims or statements**?
- Are all the % Daily Values (% DV) on the Supplement Facts label **less than 200%**? (If % DV is not listed, mark “No”)



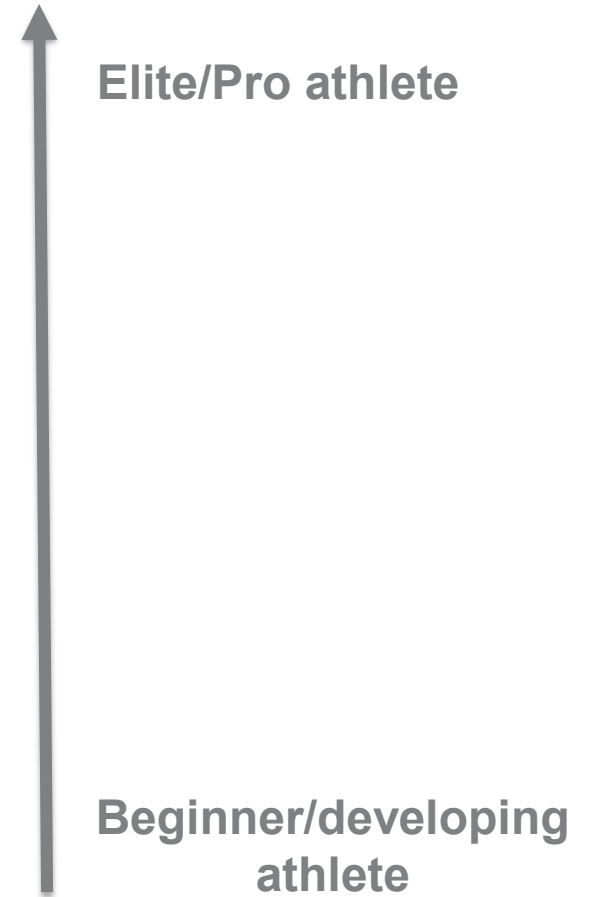
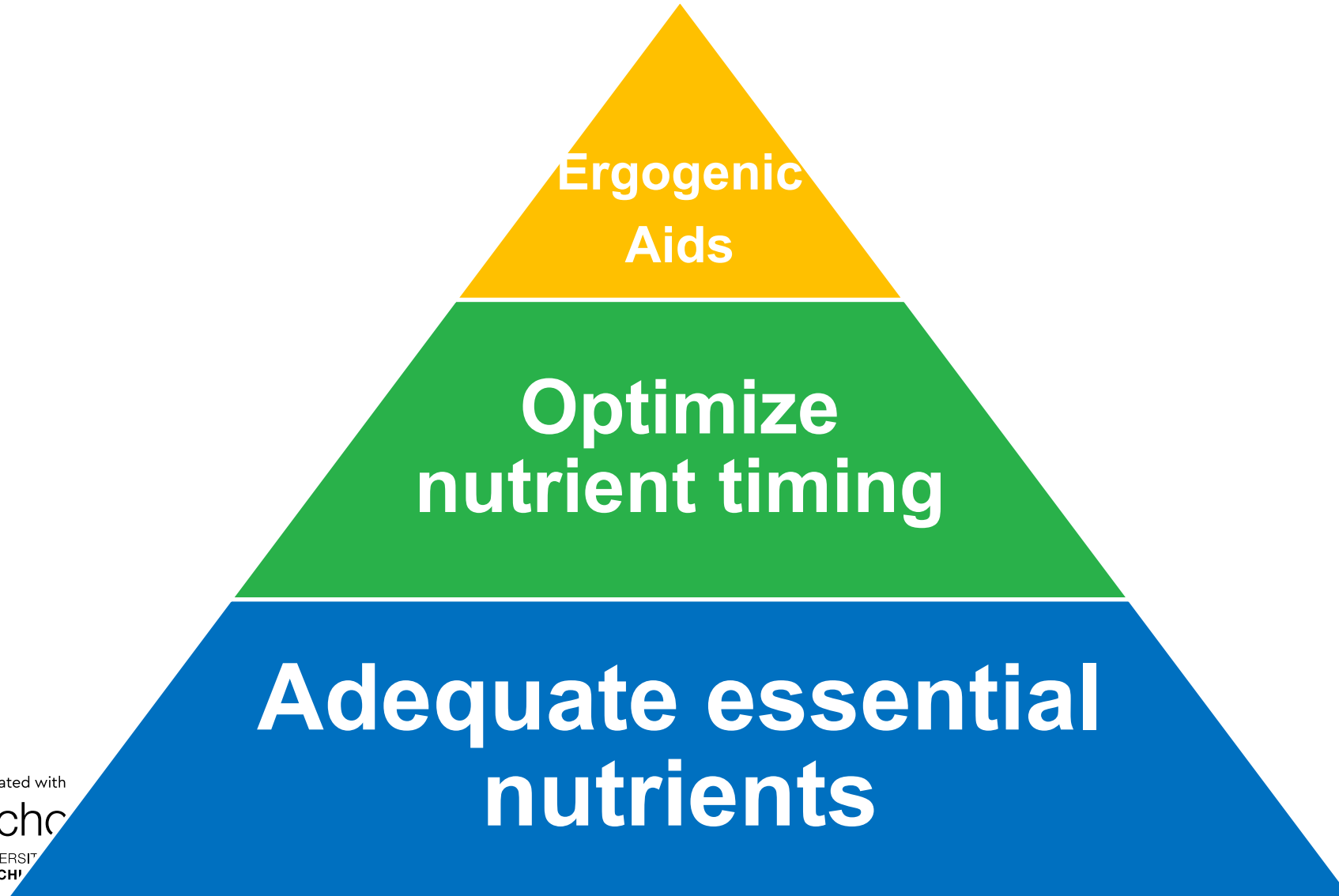
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The Full Picture










Sports Nutrition Pyramid



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Habits of Teen Athletes

- Inconsistent breakfast  
- Inadequate hydration 
- Poorly timed snacking  
- Low fruit/veggie intake 
- Inadequate calcium/D 
- Inadequate fueling  



Support sound
physiological,
physical and
psychosocial
development



Summary

- Most athletes have room for improvement in nutrition and hydration
- If a supplement is indicated, must be monitored by a trained healthcare provider
- Weight loss and muscle gain supplements are highest risk and most unnecessary



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Food Resources

- Nutrient recommendations and general diet guidance: dietary reference intakes and recommended dietary allowances: http://ods.od.nih.gov/health_information/Dietary_Reference_Intakes.aspx <http://www.choosemyplate.gov>
- Sports, Cardiovascular, and Wellness Nutrition practice group of the American Dietetic Association: <http://www.scandpg.org> and <http://www.scandpg.org/sports-nutrition/sports-nutrition-fact-sheets>
- Professionals in Nutrition for Exercise and Sport (PINES): <http://www.pinesnutrition.org>
- International Olympic Committee Medical Commission 2010 consensus statement <http://www.olympic.org/Documents/Reports/EN/CONSENSUS-FINAL-v8-en.pdf>
- Australian Institute of Sport: <http://www.ausport.gov.au/ais/nutrition>
- Food and Nutrition Information Center of the U.S. Department of Agriculture: http://fnic.nal.usda.gov/nal_display/index.php?info_center=4&tax_level=1
- Sportsoracle Web site, particularly the International Association of Athletics Federations document: <http://www.sportsoracle.com/resources?id=2039>
- Select food and supplement companies develop and maintain educational Web sites for public access, but it is not the intention of this paper to promote companies or products



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Regulatory Resources

- Codex Alimentarius: http://www.codexalimentarius.net/web/index_en.jsp
- American Botanical Council access to Commission E monographs for herbal therapies: <http://cms.herbalgram.org/commissione/index.html>
- Consumer information from the Federal Trade Commission: <http://www.ftc.gov/bcp/menus/consumer/health/drugs.shtm>
- Council for Responsible Nutrition (leading trade association represents ingredient suppliers and manufacturers): <http://www.crnusa.org>
- World Anti-Doping Agency, *The Guide*, 4th edition: <http://www.wada-ama.org>; Adopted code: <http://www.wada-ama.org/en/World-Anti-Doping-Program/Sports-and-Anti-Doping-Organizations/The-Code/Code-Acceptance>
- United States Anti-Doping Agency: <http://www.usantidoping.org>
- National Collegiate Athletic Association Drug-Testing Program and exceptions procedures: <http://www.ncaa.org/health-safety> and banned substance list <http://www.ncaa.org/wps/wcm/connect/public/NCAA/Student-Athlete+Experience/NCAA+banned+drugs+list>
- National Association of Intercollegiate Athletics: <http://naia.cstv.com>
- National Federation of State High Schools Associations Sports Medicine Advisory Committee position statements: <http://www.nfhs.org/content.aspx?id=5786&terms=position%20statements>
- The International Olympic Committee: <http://www.olympic.org>
- The National Center for Drug Free Sport and Resource Exchange Center: <http://www.drugfreesport.com>



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Safety Resources

- MedWatch: <http://www.fda.gov/Safety/MedWatch/default.htm>
- Quackwatch: <http://quackwatch.org>
- Dietary warnings and safety information from the US Food and Drug Administration: <http://www.fda.gov/Food/DietarySupplements/Alerts/default.htm>
- Recall of products: <http://www.fda.gov/Safety/Recalls/default.htm>
- Center for Drug Evaluation and Research: <http://www.fda.gov/Drugs/default.htm>
- United States Anti-Doping Agency: <http://www.supplementsafetynow.com>
- Reporting of dietary supplements: <http://www.oig.hhs.gov/oei/reports/oei-01-00-00180.pdf>
- US Department of Agriculture Food and Nutrition Information Center, dietary supplements (regulations, reports, and warnings): http://fnic.nal.usda.gov/nal_display/index.php?info_center=4&tax_level=2&tax_subject=274&topic_id=1328



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Efficacy and Fact Sheets

- National Institutes of Health Fact sheets on dietary supplements: <http://ods.od.nih.gov/factsheets/list-all>
- Nutrient Recommendations: Dietary Reference Intakes (DRI), and Recommended Dietary Allowances (RDA): http://ods.od.nih.gov/health_information/Dietary_Reference_Intakes.aspx
- National Institutes of Health, Office of Dietary Supplements fact sheets: http://ods.od.nih.gov/Research/PubMed_Dietary_Supplement_Subset.aspx
- Natural Medicines database: <http://naturaldatabase.therapeuticresearch.com/home.aspx?cs=osu&s=ND>
- The Natural Pharmacist partners with ConsumerLab: <http://www.consumerlab.com/tnp.asp>
- Sports, Cardiovascular, and Wellness Nutritionists Practice Group of the American Dietetic Association: <http://www.scandpg.org>, <http://www.scandpg.org/sports-nutrition/sports-nutrition-fact-sheets>
- Professionals in Nutrition for Exercise and Sport (PINES): <http://www.sportsoracle.com/pines/pines-home>
- Australian Institute of Sport: <http://www.ausport.gov.au/ais/nutrition>
- *British Journal of Sports Medicine* series “A-Z of Nutritional Supplements: Dietary Supplements, Sports Nutrition Foods and Ergogenic Aids for Health and Performance” as published by sports nutrition experts⁴⁴: bjsm.bmj.com/content



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- Department of Defense Operation Supplement Safety; <https://www.opss.org/screen-your-supplement-safety-read-label-your-supplement-and-answer-these-questions>