Nutrition Supplements and Energy Drinks in Childhood:
The Good, The Bad and the Ugly

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Annual Primary Care Approach to Treating the Injured Athlete
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Conflict of Interest

- Alan M. Lake, M.D. has no conflict of interest nor disclosures relative to this presentation
Sports “Nutrition” in Childhood

- Basics: The “Good”
  - Fluids, Calories, Carbs, Protein, Vits

- Supplements: The “Mostly Bad”
  - The “PEDS” anabolic steroids
  - Fads, Protein shakes, Creatine

- Energy drinks: The “Ugly”
  - Energy “shots”, caffeine drinks, mixes with alcohol
# Fluid Guidelines for Children

<table>
<thead>
<tr>
<th>Age/Sex</th>
<th>Daily Fluid Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-8 yrs both</td>
<td>5 Cups/1.2L</td>
</tr>
<tr>
<td>9-13 yr boys</td>
<td>8 Cups/1.8L</td>
</tr>
<tr>
<td>9-13 yr girls</td>
<td>7 Cups/1.6L</td>
</tr>
<tr>
<td>14-18 yr boys</td>
<td>11 Cups/2.6L</td>
</tr>
<tr>
<td>14-18 yr girls</td>
<td>8 Cups/1.8L</td>
</tr>
</tbody>
</table>

For athletes, add 0.5 - 1.0L/day
Reducing Dehydration

- 2 hours before exercise, 18 – 24 oz of fluid, often with low protein, low glycemic snack (yogurt, nuts, cheese)
- 30 mins before exercise, 12 – 16 oz of fluid with complex CHO snack
- Every 20 -30 mins into exercise, 6 – 8 oz of fluid
- Sport drink (Gatorade etc) if exercise is high intensity and lasting longer than 90 min.
- Monitor athlete’s weight regularly
## DRI's for Calories in Youth

<table>
<thead>
<tr>
<th>Age/sex</th>
<th>Daily Calories</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 - 8 yo boys</td>
<td>1400 – 1600</td>
</tr>
<tr>
<td>9 – 13 yo boys</td>
<td>1800 – 2200</td>
</tr>
<tr>
<td>9 – 13 yo girls</td>
<td>1600 - 2200</td>
</tr>
<tr>
<td>14 – 18 yo boys</td>
<td>2200 – 2600</td>
</tr>
<tr>
<td>14 – 18 yo girls</td>
<td>2000</td>
</tr>
</tbody>
</table>

Baseline calories for normal growth and metabolism, tailor to sport & height (10kcal/min)

Many teen males at 4500 cal (“Rocky”=16,000)

[www.mypyramid.gov](http://www.mypyramid.gov)  [www.calorieking.com](http://www.calorieking.com)
Carbohydrate “Fuel”

- Best delivered as low-glycemic complex carbohydrates
- Baseline need of 130 gm/day in teen
- Additional need in athlete (up to 500g)
  - 1.5-2.5 g/lb for light training (2-3x/wk)
  - 2.5-4 g/lb for mod training (3-5x/wk)
  - 4.5-5 g/lb for pre-event loading
  - 0.8 gm/lb for post-event fueling
Protein:

- Teen athlete: 1.5 gm/kg/d vs 0.8 gm/kg/d for sedentary teen.
- Best met through normal diet and “mixed nutrient” shakes
- Males should avoid soy protein due to high estrogen content. Whey is ok.
- Training athlete: 0.5 – 0.8 gm/lb/day with max of 1.0 gm/lb/day
Vitamins and Minerals

- No value for “mega” doses of anything
- Calcium: 1500 mg/day
- Vit D: >60% of teens depleted, need 600-800 mg/day, twice the content of multivitamins
- Iron: Females 11-24 yo need 18 mg/d
  Males 11 – 24 yo need 12 mg/d
Strength Training in Children

- Assess readiness, ok after 7 years of age
- Strict supervision with experienced trainer
- Commitment to program: all gains are lost after 6 weeks of inactivity
- 10% rule for weekly increase in training
- Value in pre-adolescents even w/o androgen
The “PEDs”: Performance enhancing drugs

- Universally available
- Often “fad” products from peers
- Middle School: 5% tried steroids
- High School: 12% of boys, 3% girls have tried steroids repeatedly, 44% of senior males had tried creatine.
- Creatine danger greatest in wrestlers
- 60% of NCAA athletes used ephedrine
“Sport Drink” vs “Energy Drink”

- **Sport drinks** provide nutritive carbohydrate and electrolytes to re-hydrate and provide energy for carbohydrate oxidative metabolism.

- **Energy drinks** provide non-nutritive stimulant (ergogenic) such as caffeine, guarana, and taurine. NO role in the athletic diet.

- **Vitamin waters**: No evidence of benefit.
“Energy Drinks”

- The FDA limits caffeine in sodas (<71mg/12 oz), as a “food”, does not limit caffeine or other stimulants in energy drinks which are “dietary supplements”

- The caffeine content in energy drinks is more than 80 mg/8oz, 3 times that of colas, in energy “shots”, is 5 times higher than colas. Guarana has 80 mg of caffeine per gram. Caffeine content not listed on product With “supercaffeinated”, up to 19,200 mg
“Energy” Drinks

- Non-Nutritive Stimulant Drink
- Not to be confused with re-hydration, electrolyte and glucose fluids
- Fastest growing beverage in sales
  - $27 billion in sales in 2014 world wide
- 55% of market for those less than 19 years old
Market Impact

- “Regular” consumption by teens defined as more than 3/week
  - 2003: 16%
  - 2008: 35%
  - 2014: 48%

- 8% of teens drink daily, 80% > weekly
- College: 60% more than weekly and >50% of intake is combined with alcohol
“Mystery” Drink

- No FDA regulation
- No content acknowledgement
- Unsubstantiated health claims
- Supersized: average 16 oz can
- Advertising Target: Teens and Athlete
- pH 2.4
- Sold cheaply with high alcohol content
“Usual” Ingredients

- Sugar
- Caffeine (from 100mg to 19,000 mg)
- Guarana (Brazilian cocoa)
- Ginseng
- Taurine / mixed amino acids
- “B vitamins”
Carbohydrate/Sugar

- Glucose, sucrose, high fructose corn syrup
- Avg content: 42 – 68 grams/16 oz
- Thus 2-3 drinks is intake >4 – 6 times dietary guidelines for teens
- Issue with dental health (with pH 2.4), diabetes, and obesity
Guarana / Brazilian Cocoa

- Active ingredient: Guaranine
- 1 gram = 40 – 80 mg of caffeine
- Not listed as part of caffeine source
- Also theobromine, theophylline, tannin
- Reduces blood sugar
- Prolongs bleeding time
Ginseng

- East Asian Nut
- No proven health value
- No proven immune benefit
- Side effects: insomnia, headache, hypertension, cardiac arrhythmia
- Toxicity: estrogen effect, amenorrhea,
- Breast tenderness
Taurine

- Common amino acid
- Critical to brain development
- Critical to normal fluid and mineral balance
- Daily RDI 40 - 400 mg
- Drink content in 16 oz is 2000 mg
  - But “more is not better”
Caffeine

- No adolescent data on value or risk
- Adult: safe intake less than 400 mg/d
- Potential value in adults:
  - At intakes of 3 – 6 mg/kg
  - Increases aerobic endurance
  - Increases reaction time
  - 10% decline in rate of fatigue
Caffeine: Risk Issues

- Acute Toxicity at > 1 gm
- Lethal Toxicity at > 4 gm/ >200mg/kg
- Increases anxiety, increases heart rate, increases blood pressure
- Vasoconstricts coronary arteries
- Vasodilates cerebral blood flow
- Reduces placental blood flow
- Binds adenosine receptors in all tissue
Specific Risks for Caffeine

- Women of child bearing age
  - Loss of fetus, premature birth, fetal growth retardation

- Children
  - Withdrawal symptoms at 100 mg/day
  - In Middle School, use more than 3 x a week increases inattention/poor behavior by 66%

- Athletes
  - Palpitations, hypotension, diuretic effect
Specific Risks in Child

- Increases cardiac events with cardiomyopathy and prolonged QT
- Increases stimulant effect in ADD
- Increases electrolyte imbalance in anorexia
- Increases post-prandial blood sugar
- Reduces GI absorption of calcium
## Caffeine Content by Brand

(> 200 products)

<table>
<thead>
<tr>
<th>Brand</th>
<th>oz/can</th>
<th>Caffeine/mg/can</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Hour Energy</td>
<td>2</td>
<td>220</td>
</tr>
<tr>
<td>Red Bull</td>
<td>16</td>
<td>154</td>
</tr>
<tr>
<td>Monster Energy</td>
<td>24</td>
<td>240</td>
</tr>
<tr>
<td>Rockstar</td>
<td>16</td>
<td>160</td>
</tr>
<tr>
<td>Amp Energy</td>
<td>16</td>
<td>160</td>
</tr>
<tr>
<td>Full Throttle</td>
<td>16</td>
<td>144</td>
</tr>
<tr>
<td>Wired X505</td>
<td>24</td>
<td>505</td>
</tr>
<tr>
<td>Cocaine</td>
<td>8.4</td>
<td>280</td>
</tr>
</tbody>
</table>
# Caffeine Content “Others”

<table>
<thead>
<tr>
<th>Product</th>
<th>Caffeine Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Doz</td>
<td>200 mg/tab</td>
</tr>
<tr>
<td>Excedrine</td>
<td>65 mg/tab</td>
</tr>
<tr>
<td>Coffee</td>
<td>100 mg/8 oz</td>
</tr>
<tr>
<td>Starbucks Tall</td>
<td>174 mg/8 oz</td>
</tr>
<tr>
<td>CocaCola</td>
<td>35 mg/8 oz</td>
</tr>
<tr>
<td>Mt Dew</td>
<td>28 mg/8 oz</td>
</tr>
<tr>
<td>Diet Pepsi Max</td>
<td>47 mg/8 oz</td>
</tr>
<tr>
<td>Hershey’s Kiss</td>
<td>1 mg/kiss</td>
</tr>
</tbody>
</table>
## Caffeine Intake in Children

Intake average for 8 of 10 days

<table>
<thead>
<tr>
<th>Age</th>
<th>Intake</th>
<th>Max/Canada</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 – 6 yrs</td>
<td>50 mg</td>
<td>45 mg</td>
</tr>
<tr>
<td>7 – 9 yrs</td>
<td>82 mg</td>
<td>62 mg</td>
</tr>
<tr>
<td>10 – 12 yrs</td>
<td>110 mg</td>
<td>85 mg</td>
</tr>
</tbody>
</table>

US “consensus” less than 100 mg OK
## Poison Control Data: Caffeine Concern by Age

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>6-10</th>
<th>10-18</th>
<th>&gt;19</th>
<th>Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>5896</td>
<td>1247</td>
<td>3045</td>
<td>1604</td>
<td>11</td>
</tr>
<tr>
<td>2008</td>
<td>4852</td>
<td>1208</td>
<td>1944</td>
<td>1700</td>
<td>18</td>
</tr>
<tr>
<td>2012</td>
<td>6012</td>
<td>1410</td>
<td>2692</td>
<td>1910</td>
<td>22</td>
</tr>
<tr>
<td>2014</td>
<td>7206</td>
<td>1565</td>
<td>2975</td>
<td>2450</td>
<td>28</td>
</tr>
</tbody>
</table>

Note: >50% of deaths are from 5 Hour Energy
ER Visits after Energy Drinks

From 2007 to 2011
- Increase from 10,000 to 21,000
- Males increase 7,000 to 15,000
- Females increase 3000 to 6000
- 58% energy drinks alone
- 42% energy drinks with alcohol
- 10% energy drinks with Adderall
- Average college campus: 15 – 20 Hosp/mo
Fruity/Energy Alcohol

Cheap: often less than energy drink alone
Large: 24 oz bottles
Banned Four Loko and Josse/FDA warning
One serving = 500 mg caffeine, ETOH content equal to one bottle of wine
Underestimate intoxication: wide awake drunk
Average “Party intake” 3.5 bottles
25% of college students take more than twice a week
Active Duty Military in Combat Zones
44.8% use energy drinks daily
With intake of > 32 ounces daily....
More likely to have less than 4 hrs sleep
400% more accidents that affect mission
500% more likely to fall asleep on guard
National Agenda

NCAA 2010

Illegal if urine content suggests intake in excess of 500 mg in past hour

Recommendation

No energy or caffeine containing drinks are to be sold or offered in schools

2008: National Fed of State High School Associations
2011: Institute of Medicine, American Academy of Pediatrics

FDA: Limits for coffee and colas: less than 71 mg/8 ounces
“Relaxation” “Chill-out” Anti-energy Drinks

- Introduced in 2000, doubling sales yearly
- Caffeine free
- Contain theonine and melatonin
- Relax by Rockstar, Slow Cow, Chill, Marley’s Mellow Mood. Lava Cola
References:

Pediatrics in Review 34: 2010; 55 – 61


AAP Committee on Nutrition: Clinical Report: Sports Drinks and energy Drinks for Children and Adolescents: Are they appropriate?
Pediatrics 127, 2011: 1182-1189