Nutrient Needs for Very Active People: An Update

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Agenda

• History lesson

• Nutrient needs of
  – not so active
  – very active people

• Dietary advice- needed by all on
  – Food
  – Supplements
Most of Human History

• Everyone active, nobody sedentary

• Food short for most people

• Obesity rarely a problem
Changing times:
Evolution or Devolution???
Today

- Many very sedentary
  few active

- Lots of food available

- Both intakes and activity need attention
Few people are very active physically

they confuse being busy with active

Not this

But this
Who is active?

Physical Activity Level Coefficient

- Very Active
- Active
- Low Activity
- Sedentary

PAL
What is usual?
In USA, most are sedentary or low/light activity.

![Physical Activity Level Coefficient](chart.png)
Regardless of physical activity level

• We need certain *nutrients*, not certain foods

• We all need same *kinds* of nutrients

• *Amounts* of nutrients we need vary

• *Timing* may be important in some situations
Nutrient Needs: Sedentary/Light activity
Most people in highly industrialized countries are sedentary

• So, reference person is sedentary/light activity
US Reference People

• Male
  – 5’ 10 inches, 154 lb BMI 22

• Female
  – 5’ 4”, 126 lb BMI 22

characteristic height, weight, sex, physical activity etc. of people in country.
Recommended energy Intakes vary by reference person and activity

<table>
<thead>
<tr>
<th>Age &amp; Sex</th>
<th>Singapore (sedentary to light activity)</th>
<th>USA Sedentary</th>
<th>USA Light activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-29</td>
<td>2550</td>
<td>2498</td>
<td>2726</td>
</tr>
<tr>
<td>30-59</td>
<td>2550</td>
<td>2309</td>
<td>2535</td>
</tr>
<tr>
<td>60+</td>
<td>2100</td>
<td>2164</td>
<td>2393</td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
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<tr>
<td>18-29</td>
<td>2000</td>
<td>1901</td>
<td>2102</td>
</tr>
<tr>
<td>30-59</td>
<td>2000</td>
<td>1762</td>
<td>1969</td>
</tr>
<tr>
<td>60+</td>
<td>1800</td>
<td>1659</td>
<td>1865</td>
</tr>
</tbody>
</table>
Nutrient Needs of Sedentary and Low Active People

- Very large part of the population
- Few adjustments in nutrient requirements necessary but need dietary advice
Good Advice

• Sit less
• Move more
• Play sports

• Eat well

But a little less
Dietary advice is needed in US physical activity guidelines
Need for our dogs, too!!!
Amounts of nutrients needed vary by

- Physiology
- Environment
- Genetics
Those with Sedentary and Light Activity Levels Need Dietary Advice

- Easy to eat too much since energy needs are so low

- Difficult to meet all nutrient needs with very low energy intakes, esp below 1600 Kcal

- US recommendations geared to them, but assume they are weight stable and PAL may be higher than actual
Energy: Estimated Energy Requirement (EER)

Average intake to maintain energy balance in a healthy adult of defined age, sex, height, weight and physical activity level (PAL)

- EER for sedentary people may be too high possibly reference person is even more sedentary than assumed
EER is recommendation for individuals

High

RISK of deficiency or excess

EER = RDA

Low

ENERGY INTAKE
Even small reductions in energy intake coupled with physical activity help speed weight loss.
Weight loss

- Old rule of 3500 KCal (15,000KJ) to lose 1 pound of fat overestimates losses

- Losses slower and smaller
  - Why: errors in estimating E intake and output

- Kevin Hall has better estimates of time and amount fat lost
  http://bwsimulator.niddk.nih.gov

Permanent 10 Kcal/d less causes weight loss of 1 lb at new body steady state
(but may take 1-3 yr to show up)
Overweight need dietary advice to lose and maintain loss

• Unhealthy reducing diets common

• Energy intakes must decrease
  ▪ During weight loss phase
  ▪ After weight loss
    o to cope with decreased weight and cost of physical activity
Other than food energy, needs change little
Exception: When intakes <500 Kcal, protein, water, electrolytes, and calcium needs increase

Macronutrient composition
short term shifts in water balance
but very small effects long term
Nutrient Needs of Very Active
Nutrient amount

Optimal diet composition

Intake timing & quality CHO, Protein

Nutrition pre, during and post extreme exertion

Much still to learn in developing requirements for very active individuals
Reference individual for very active deployed military different

- Younger 17-50 yr olds
  - Different height, weight, body fat, lean mass
  - Different, often much higher, levels of physical activity

Based on standard US reference person adjusted for very active people, used to develop menus
Very active individuals’ energy needs higher

- Resting energy expenditure (REE) higher
  - More muscle mass (actively metabolizing tissue)

- Physical activity higher
  - Cost of moving body

So estimated Energy Expenditure (EER) higher
Energy:
Estimated Energy Requirement (EER)

EER for “active” young adults:
- 3067 Males, 2403 Calories Females
- *May be too low for very active*
**Ideal Criterion**: Functional outcomes most relevant
- (muscle strength, immune function)

**Problem**: Difficult or impossible to measure functional outcomes, so little data available

**Solution**: Use measure along causal pathway to function such as
- **Protein (N) balance** (measure of adequacy)
- tracers
- Research with better measures and outcomes
Recommended Dietary Allowance
-covers requirement for nearly all healthy people

Adapted from the IOM/FNB: Dietary reference intakes applications in dietary assessment, 2000.

High

RISK of deficiency or excess

Low

Adequate for ‘healthy’ individual

Intake

Adapted from the IOM/FNB: Dietary reference intakes applications in dietary assessment, 2000.
RDA protein 0.8 gm/kg/d

- Recommendation covers requirement for virtually all individuals (RDA)
  - Best single estimate of safe requirement for an individual is RDA – a single value (or AI if impossible to determine EAR)

- Range of healthy intakes above RDA (individual requirement) also reasonable
  - Intakes between “RDA” and “UL” safe & “optimal”
Protein

0.8 gm/kg/day RDA

*Is more protein needed for active individuals?*

- Maximize repair & replacement damaged protein?
- Remodel protein in muscle?
- Increase LBM?
- Increase immune response, plasma proteins?
- Maintain metabolic pathways for aa?
Protein Recommendations, gm/kg/d, US Military for very active individuals
Protein recommendations for active individuals vary from 1.2-2.0 gm/kg/d

• Vary by criteria used, body composition, type of exercise, purpose (normal or rehab)

• Research needed on
  - Requirements and effects of individual amino acids in actual exercise conditions & requirements
  - Amount, composition
  - Timing and recovery
Do certain amino acids enhance performance or recovery from exhaustion in very active adults?

No, for

Beta alanine

Ko et al Nutrition Reviews (Feb 2014)

Arginine (in press)
Composition of gain varies

- Energy 3500 Kcal/lb gain fat
- Less if more water, muscle
- Fluid shifts and gains in glycogen due to diet changes may obscure actual lean tissue gains

• *Do protein intakes need to increase?*
  • *Still debated; if yes, only a little*
Chicken soup doesn’t work either
Water needs increase for very active individuals

Very active individuals need more fluids

- Avoid dehydration, replace fluid loss
- Compensate for environment, weight, training
- Compensate for work intensity, sweat rates of 0.5-2.0 L/hr depending on temperature, humidity, exercise, individual factors

Disagreement is on how much
Upper safe level for sodium is likely higher for very active individuals because of losses.
Acceptable macronutrient ranges differ for very active people, at least pre, during and post exercise.
Acceptable macronutrient distribution ranges to decrease chronic disease risk may be wrong for very active

• Energy providing nutrients (not experimentally determined)
  – Carbohydrate 45-65% Calories, Fat 20-35% Calories
  – Protein 10-35% Calories (calculated as residual after CHO and Fat criteria set)
    – Lower limit at RDA
    – Upper based on complementing ranges for protein, CHO

• Very active individuals may need more carbohydrate than sedentary people (and possibly more protein)
  • Pre, during and post exercise recommendations provided by sports nutrition expert groups
Most vitamin & mineral needs do not change in very active individuals

*Exception:*
Electrolyte needs increased
Do dietary supplements improve performance?

• Food first:
  ▪ Varied, balance, nutrient dense foods and beverages

• Efficacy dietary supplements unproven
  ▪ Evidence weak for efficacy of most non-nutrient ergogenic and performance aids, antioxidants and other nutrient supplements
“Optimal Range” easy to exceed with high doses nutrient supplements
Optimal range of intakes is at or above RDA and below upper safe Level

* Adapted from the IOM/FNB: Dietary reference intakes applications in dietary assessment, 2000 and R Bailey.

High

UL easy to exceed with supplements

Low

RISK of deficiency or excess

Adequate and safe intakes for usual ‘healthy’ population

INTAKE
Mega-T Green Tea Dietary Supplement/Fat Burning Supplement

- Green tea is the primary ingredient (600mg)
- Does not include breakdowns of polyphenols, EGCG, or catechin
- Gotu Kola contains catechins
Proof lacking for green tea extract claims and harms possible

- Weight loss
- Energy
- Antioxidant
- Thermogenesis/increased metabolism/Fat burning
- Immune system
<table>
<thead>
<tr>
<th>Green Zone</th>
<th>Yellow Zone</th>
<th>Red Zone</th>
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</thead>
<tbody>
<tr>
<td>Branched-Chain Amino Acids</td>
<td>Antioxidants</td>
<td>Ephedra</td>
</tr>
<tr>
<td>Fish Oil/Omega-3 Fatty Acids</td>
<td>Beta-Alanine (B-Alanine)</td>
<td>Melatonin (for flight personnel)</td>
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<tr>
<td>Melatonin</td>
<td>*Caffeine</td>
<td>Bitter Orange (Synephrine)</td>
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<tr>
<td>Multivitamins &amp; Minerals</td>
<td>Chromium</td>
<td>Testosterone Precursors/Boosters and Anabolic Compounds</td>
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<tr>
<td>Probiotics</td>
<td>Coenzyme Q10</td>
<td>Weight-loss Supplements</td>
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<tr>
<td>Tyrosine</td>
<td>Creatine</td>
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<tr>
<td>Vitamin B Complex</td>
<td>Glutamine</td>
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<tr>
<td></td>
<td>L-Arginine</td>
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<tr>
<td></td>
<td>L-Carnitine</td>
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<tr>
<td></td>
<td>Megavitamins &amp; Minerals</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quercetin</td>
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</tr>
</tbody>
</table>
Supplement Facts

Serving Size: 2 Liquid Soft-Gels
Servings per Container: 100

<table>
<thead>
<tr>
<th>Amount per Serving</th>
<th>% Daily Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Tea extract (50% EGCG)</td>
<td>480 mg</td>
</tr>
<tr>
<td>Caffeine</td>
<td>180 mg</td>
</tr>
<tr>
<td>Essential Oils: Cinnamon, Ginger, Black Pepper, Clove</td>
<td></td>
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</tbody>
</table>

*Daily Value not established*

**Other Ingredients:** Soybean oil, gelatin, glycerin, purified water, beeswax, soy lecithin, titanium dioxide and sodium copper chlorophyllate.

Contains: Soy

**Usage Warning:** Do not use if safety seal is broken. This product contains caffeine and may affect blood pressure and/or heart conditions. Check with your doctor before using this product if you are using medication for high blood pressure, including heart disease and/or high blood pressure. Do not use if you may become pregnant, are pregnant or nursing. Not intended for use by persons under 18. KEEP OUT OF REACH OF CHILDREN. Store in a cool, dry place.

**WARNING:** Caffeine is a stimulant and may affect sleep. Do not take within 12 hours of bedtime. Use of this product may produce a positive reaction for anabolic steroids in certain drug tests. See physician or other health care professional before and during use if you are pregnant, using thyroid hormone or are being treated with any medication. Not intended for use by persons under 18. KEEP OUT OF REACH OF CHILDREN. Store in a cool, dry place.

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Weak evidence health benefits of green tea /extracts

Epidemiological observational studies

In some studies, green tea consumption associated with reduced risk for decreasing excess weight, diabetes, heart disease:

Interventional studies: randomized controlled trials

Limited poor quality clinical trials claim potential preventive effects for weight loss and weight maintenance
Harms?? Hepatotoxicity caused by highly concentrated green tea extracts: conflicting reports

Major pharmacokinetic and safety studies of Green Tea extracts

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Dosage</th>
<th>Schedule</th>
<th>Reported effects</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy volunteers</td>
<td>Up to 846 mg catechins (incl. caffeine)</td>
<td>Single dosage</td>
<td>No apparent adverse effects</td>
<td>[32]</td>
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<tr>
<td>(n = 18)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Adult cancer patients</td>
<td>Up to 3500 mg catechins (incl. caffeine)</td>
<td>Distributed over 3 daily</td>
<td>GI, neurological and cardiovascular (&quot;caffeine related&quot;)</td>
<td>[33]</td>
</tr>
<tr>
<td>(n = 49)</td>
<td></td>
<td>dosages up to 6 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy volunteers</td>
<td>Up to 800 mg EGCG or Poly E</td>
<td>Daily for up to 4 wk</td>
<td>Mild adverse events (&quot;well tolerated&quot;)</td>
<td>[37]</td>
</tr>
<tr>
<td>(n = 40)</td>
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<tr>
<td>Healthy volunteers</td>
<td>Up to 800 mg EGCG (crystalline)</td>
<td>Daily for 10 days</td>
<td>&quot;Safe and very well tolerated&quot;</td>
<td>[39]</td>
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<td>(n = 36)</td>
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<tr>
<td>Healthy volunteers</td>
<td>Up to 1200 mg EGCG (as Poly E)</td>
<td>Single dose</td>
<td>Mild and transient nausea (&quot;generally well tolerated&quot;)</td>
<td>[40]</td>
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<td>(n = 30)</td>
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<td></td>
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<tr>
<td>Healthy volunteers</td>
<td>Up to 1600 mg EGCG (crystalline)</td>
<td>Single dose</td>
<td>No adverse events (&quot;safe and very well tolerated&quot;)</td>
<td>[41]</td>
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<td>(n = 60)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cancer patients</td>
<td>Up to 1800 mg catechins (as Poly E)</td>
<td>Daily for 1 month</td>
<td>Mostly well tolerated; 2 patients with grade 2</td>
<td>[43]</td>
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<tr>
<td>(n = 33)</td>
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<td></td>
<td>toxicities</td>
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<tr>
<td>Healthy volunteers</td>
<td>714 mg GTE (incl. caffeine)</td>
<td>Daily for 3 wk</td>
<td>No effects on risk biomarkers for liver, kidney or</td>
<td>[65]</td>
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<tr>
<td>(n = 17)</td>
<td></td>
<td></td>
<td>CVD</td>
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</table>
Sound advice on nutrition and dietary supplements for performance

Dietary Supplements Classification System

Click on the links below to jump to each section.
Supplements by Class
Supplements by Zone

Dietary Supplements Classification System—Risks and Benefits

Before using any dietary supplement, a Warfighter—or anyone—should ask: “What are the potential benefits?” and “What are the risks associated?” And finally, “Are the potential benefits worth the risks?” This Dietary Supplements Classification Table was developed to assist healthy military personnel in making informed decisions about supplements. Benefit was ranked on a scale of low, moderate, or high potential benefit. Safety concern was similarly ranked on a scale of minimal, low, moderate, or high concern.

For an alphabetical list of supplements, see here.

Dietary Supplements Classification Table
Supplement Facts

Serving Size: 1 Tablet
Servings Per Container: 60

- Green Tea Leaf Extract 252.5 mg*
  Providing EGCG and 50 mg Caffeine
- Raspberry Ketone 125 mg*
- Concentrated Berry Extracts 50 mg*
  Acai Fruit 5:1 Extract (Euterpe Oleracea), Litchi Fruit 10:1 Extract
- Blueberry Fruit 4:1 Extract
  Raspberry Fruit 20:1 Extract, Mulberry Leaf 4:1 Extract

Note: Daily Value not established.

Recommendation: Take 1 capsule one to two times daily, preferably with food.
Two capsules contain the same amount of EGCG as of three cups of Green Tea.

Caution: Not for use during pregnancy.

Supplement Facts

Serving Size: 1 ml (1 full dropper)
Servings Per Bottle: 60

<table>
<thead>
<tr>
<th>Amount Per Serving</th>
<th>%DV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Tea extract (leaf)</td>
<td>100 mg †</td>
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<tr>
<td>(minimum 90% polyphenols, 50% EGCG)</td>
<td></td>
</tr>
<tr>
<td>Proprietary blend of Lo Han extract (fruit) and Stevia extract (leaf)</td>
<td>25 mg †</td>
</tr>
<tr>
<td>Lotus extract (leaf)</td>
<td>25 mg †</td>
</tr>
<tr>
<td>Kudzu extract (root)</td>
<td>10 mg †</td>
</tr>
<tr>
<td>Ural Licorice extract (root)</td>
<td>2 mg †</td>
</tr>
</tbody>
</table>

† Daily Value (DV) not established

Other Ingredients: purified water, vegetable glycerin, natural flavor.
Energy shots and drinks

Possible effects attention

Little evidence positive effects on physical performance

Concerns about safety of very high total doses, esp with alcohol
CAFFEINATED

YOU CAN SLEEP WHEN YOU'RE DEAD
. Label Statement 5-hour ENERGY Grape: “Contains caffeine comparable to a cup of the leading premium coffee”.
How can people make sure their intakes are appropriate?

• Be realistic about how active they really are

• Adjust for clearly altered calorie and nutrients needs

• Focus on total nutrient intake

  Food, beverages, nutrient containing supplements & over the counter medications containing nutrients

• Use reliable sources for guidance
How can very active people make sure their intakes are adequate?

Remember diet alone is not nutritional status: consider body composition, biochemical indices, clinical signs and symptoms as well.

Consult reliable sources.
Good web-based nutrition advice for very active people

• Human Performance Resource Center:
  – http://hprc-online.org/nutrition

• Australian Government Sports Commission

• Singapore:
• Nutrition Module

- Nutrient timing
  - exercise
  - refueling
  - recovery
  - maintenance
- Fatigue and glycogen depletion
- Carbohydrates and glycemic index
- Protein
- Water
- Dietary supplements
Take Homes

• Address dietary intake and physical activity together

• Food and drink, not supplements, best to maximize health and performance
Take Homes

• Sedentary /light physically active need to watch dietary intakes to
  – maintain and avoid gaining weight
  – lose weight
  – stay healthy

Sit less, move more, play sports, and eat well but a bit less
Take Homes

• Very physically active have altered needs for a few nutrients, and no proven needs for dietary supplements to enhance performance