Dietary Reference Intakes for Energy, Physical Activity, Protein, and Amino Acids

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Dietary Reference Intakes (DRIs)

- Estimated Average Requirement (EAR):
  - Average requirement for healthy people
  - used to estimate the prevalence of inadequate intakes within a group
- Recommended Dietary Allowance (RDA):
  - Sufficient to meet the daily needs of most people in a specific life stage and gender group
  - usual intakes at or above this level have a low probability of inadequacy.

Dietary Reference Intakes (DRIs)

- Adequate Intake (AI):
  - Based on observed or experimentally determined approximations of the nutrient intake by a defined population or subgroup that appear to sustain a defined nutritional state
  - mean usual intake at this level implies a low prevalence of inadequate intakes.

- Tolerable Upper Intake Level (UL):
  - The highest level of daily nutrient intake that is likely to pose no risks of adverse health effects to almost all people in the general population
  - intake above this level has a potential risk of adverse effects.
Dietary Reference Intakes

DRIs: New Concepts

- Recommendations for energy expenditure based on new method of determination (dlw)
- Physical activity levels to decrease risk of chronic disease & maintain weight
- Recommendations for indispensable amino acids
EER – Estimated Energy Requirement

- The average dietary energy intake that is predicted to maintain energy balance in a healthy adult of a defined age, gender weight, height, and level of physical activity consistent with good health.
- In children and pregnant and lactating women, the EER is taken to include the energy needs associated with the deposition of tissues or the secretion of milk at rates consistent with good health.

Estimated Energy Requirement

- The EER is based on regression equations from estimates of energy expenditure from doubly labeled water studies in over 1600 people (adults and children) from investigators around the world
  — specific for gender, age, weight, height, & physical activity
  — the EER is to be used for maintaining body weight

- Closer approximation to actual energy expenditure
Examples of EER Prediction Equations

- **Adult Male (\(>19\) years):**
  \[
  \text{EER} = 662 - (9.53 \times \text{Age in yrs}) + \text{PA} [(15.91 \times \text{Wt in kg} + (539.6 \times \text{Ht in m})]
  \]

- **Adult Woman:**
  \[
  \text{EER} = 354 - (6.91 \times \text{Age in yrs}) + \text{PA} [(9.36 \times \text{Wt in kg} + (726 \times \text{Ht in m})]
  \]

**PAL – Physical Activity Level**

- **PAL** = TEE/BEE
  - TEE = total energy expenditure
  - BEE = basal energy expenditure
Physical Activity Levels (PAL)

- Physical Activity Level (PAL) =
  total energy expenditure ÷ basal energy expenditure

  \[ PA = 1.0 \text{ if } \text{PAL} \geq 1.0 < 1.4 \text{ (sedentary)} \]
  \[ PA = 1.12 \text{ if } \text{PAL} \geq 1.4 < 1.6 \text{ (low active)} \]
  \[ PA = 1.27 \text{ if } \text{PAL} \geq 1.6 < 1.9 \text{ (active)} \]
  \[ PA = 1.45 \text{ if } \text{PAL} \geq 1.9 < 2.5 \text{ (very active)} \]

- Recommended PAL = \( \geq 1.6 < 1.9 \) (active)
  - to decrease risk of chronic disease (CVD)
  - to maintain ideal body weight (BMI = 18.5 to 25)

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### PAL Categories and Walking Equivalence

<table>
<thead>
<tr>
<th>PAL</th>
<th>PAL Values</th>
<th>Walking Equivalence (mi/d at 3-4 mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary</td>
<td>1.0–1.39</td>
<td></td>
</tr>
<tr>
<td>Low active</td>
<td>1.4–1.59</td>
<td>1.5, 2.2, 2.9 for PAL = 1.5</td>
</tr>
<tr>
<td>Active</td>
<td>1.6–1.89</td>
<td>3.0, 4.4, 5.8 for PAL = 1.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.3, 7.3, 9.9 for PAL = 1.75</td>
</tr>
<tr>
<td>Very active</td>
<td>1.9–2.5</td>
<td>7.5, 10.3, 14.0 for PAL = 1.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.3, 16.7, 22.5 for PAL = 2.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>17.0, 23.0, 31.0 for PAL = 2.5</td>
</tr>
</tbody>
</table>
Estimated Energy Requirements
at Recommended Level of Activity

- For adults

EER [19 y, 70 kg, 177 cm] man = 2,550-3,543 kcal/day
EER [19 y, 54 kg, 163 cm] woman = 1,912-2,672 kcal/day

- Subtract 10 kcal/day for men and 7 kcal/day for women for each year above 19 y

Pregnancy Estimated Energy Requirement

1st Trimester Prepregnant EER
2nd through 3rd Trimester
Prepregnant EER + Change in TEE (8 kcal/wk)
+ Energy Deposition (180a kcal)

a Based on a meta-analysis indicating total pregnancy energy deposition of 38,900 kcal
Lactation Estimated Energy Requirement

Prepregnant EER + Milk Energy Output – Weight Loss

1\textsuperscript{st} 6 mo \quad \text{Prepregnant EER} + 500\textsuperscript{a} – 170\textsuperscript{b}

2\textsuperscript{nd} 6 mo \quad \text{Prepregnant EER} + 400\textsuperscript{c}

\begin{itemize}
  \item a. 0.67 kcal/ml x 780ml
  \item b. Weight Loss of 0.8kg/mo
  \item c. 0.67 kcal/ml x 600ml
\end{itemize}

No UL for Energy

- An energy intake that exceeds the EER could result in weight gain - depends on how
  - accurate the estimate is of the individual’s PAL
  - close the prediction equations are to actual requirements
Recommendation for Physical Activity

To prevent weight gain and accrue additional weight-independent health benefits of physical activity, the equivalent of 60 minutes of daily moderate intensity physical activity above sedentary is recommended for both children and adults in addition to activities required by a sedentary lifestyle.

This level of activity corresponds to an “active” lifestyle.

Body Weight and Time to increase PAL by 0.10
Distribution of Protein Requirements of Individuals in Meta-analysis
Protein Recommendations

- RDA = 0.8 g/kg body weight/day using meta-analysis of nitrogen balance studies
  - Same for men and women based on body weight
  - No differentiation for animal versus vegetable protein, assumes complementary protein consumption
  - No differentiation for age based on body weight (thus declining LBM)

Criteria and RDAs for Protein (g/day)

<table>
<thead>
<tr>
<th>Life Stage</th>
<th>Criterion</th>
<th>RDA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>0-6 m</td>
<td>human milk content</td>
<td>9.1 (AI)</td>
</tr>
<tr>
<td>7-12 m</td>
<td>Extrapolated N balance + protein deposition</td>
<td>13.5</td>
</tr>
<tr>
<td>1-3 y</td>
<td>&quot;</td>
<td>13</td>
</tr>
<tr>
<td>4-8 y</td>
<td>N balance + deposition</td>
<td>19</td>
</tr>
<tr>
<td>9-13 y</td>
<td>“</td>
<td>34</td>
</tr>
<tr>
<td>14-18 y</td>
<td>Extrapolated N balance + protein deposition</td>
<td>52</td>
</tr>
<tr>
<td>19+ y</td>
<td>N balance meta-analysis</td>
<td>56</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>Deposition corrected for efficiency</td>
<td>+25</td>
</tr>
<tr>
<td>Lactation</td>
<td>Milk content corrected for efficiency</td>
<td>+25</td>
</tr>
</tbody>
</table>
No UL for Protein and Amino Acids

- Food - Insufficient dose-response data
- Supplements - Lack of data; caution warranted when consuming high protein and amino acid intakes from supplements

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1-800-624-6242
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