Global Recommendations for Macronutrient Requirements & Acceptable Macronutrient Distribution Ranges

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Underlying Theme

Diet and Health: Thoughts and Applications Beyond Calories

Current Goal for Setting Nutrient Recommendations

Meet nutrient needs AND reduce chronic disease risk

Outline

1. Brief overview of nutrient and diet recommendations
2. Establishing recommendations to meet nutrient requirements
3. Establishing nutrient recommendations to reduce chronic disease
4. Why and how to set reference intakes for reducing chronic disease

Current Nutrient Recommendations by Lead Agencies:

Similarities and Differences
### Macronutrient Distribution of Energy

<table>
<thead>
<tr>
<th></th>
<th>WHO, 2015</th>
<th>EFSA, 2010/2012 DRVs</th>
<th>USA/Canada DRIs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total fat</strong></td>
<td>≤30% of total energy</td>
<td>Total carbohydrate: 45-60% energy</td>
<td>Acceptable Macronutrient Distribution Ranges</td>
</tr>
<tr>
<td></td>
<td>Free sugars: ≤10% of total energy</td>
<td>Total fat: 20-35% of total energy</td>
<td>Carbohydrate: 45-60% energy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dietary fiber: 25 g/d</td>
<td>Fat: 20-35% energy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Added sugar: Insufficient data for an upper limit</td>
<td>Protein: 10-35% energy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Saturated &amp; trans fat: as low as possible</td>
<td>Dietary fiber: 14 g/1000 kcal/d</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Al: linoleic acid (4% energy), alpha linolenic acid (0.5% energy)</td>
<td>Added sugar: &lt; 25% of total energy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Linoleic acid: 5-10% of energy</td>
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<td></td>
<td></td>
<td></td>
<td>Alpha Linolenic acid: 0.6-1.2% energy</td>
</tr>
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### SEA Macronutrient Recommendations: Underlying Questions

1. What are the current macronutrient intakes? How do they vary among the SEA countries?
2. Are ‘healthy’ alternative sources of carbohydrate and fat readily available?
3. What is the need to set standards for nutrients to inform programs and policies?
4. Can nutrient recommendations be made to reduce under-nutrition and diet-related chronic disease?

### Dietary Recommendations for Nutrition & Health: A Long Tradition

1894—Dr. Atwater recommended **variety, proportionality and moderation**, measuring calories, and an **affordable** diet focused on nutrient-rich foods, less fat, sugar and starch.

1916—Food guide for children **grouped foods** into milk & meat, cereals, vegetables and fruits, fatty foods and fats, sugar and sugary foods. 1917: same food groups recommended for adults. **Goal**: nutrient adequacy.

1933—USDA developed **food plans of different cost** in response to the Great Depression. 12 food groups; potatoes were one group.

1943—Food and Nutrition Board released the first edition of the RDAs to **meet nutrient needs of practically all healthy persons**.

### 1950-80: Emphasis Shifted Towards Reducing Chronic Disease

1952: Dietary fat and heart disease. Ancel Keys

1967: Congressional trip to Mississippi; observed emaciated children.

1968: McGovern Committee established

- 1969: White House Conference: focus—Hunger in the USA
- 1974: Expanded focus: eating too much of the wrong foods
- 1977: Dietary Goals released (eat less fat, cholesterol & sugar)

1980: First set of dietary guidelines: two lines of reasoning

- Replace empty calories with nutritious food
- Reduce saturated fat & cholesterol to prevent heart disease
- Published every 5 years thereafter
1980-2015

**Nutrient Recommendations**

World Health Organization, September, 2015

“**A healthy diet helps protect against malnutrition in all its forms, as well as noncommunicable diseases, including diabetes, heart disease, stroke and cancer.**”

21st Century:
Macro and micronutrient recommendations to meet nutrient requirements and reduce the risk of chronic disease

**Two Endpoints:**
1. Nutrient Requirements
2. Chronic Disease

**Pathways Differ:**
1. Diet ➔ nutrient biomarker change
2. Diet & other factors ➔ Multiple metabolic changes ➔ Chronic disease
Both Macro and Micro Nutrients are Linked to Chronic Disease

Process for setting recommendations to meet nutrient needs differs from that for reducing CD risk

Nutrient-Disease Associations

<table>
<thead>
<tr>
<th>Dietary factors decreasing/increasing risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
</tr>
<tr>
<td>↓ Sodium, potassium, calcium</td>
</tr>
<tr>
<td>↑ Calories, saturated fat</td>
</tr>
<tr>
<td>Cardiovascular Disease</td>
</tr>
<tr>
<td>↓ Omega-3 fatty acids, fiber, folate, B12, vitamin D, vitamin E, polyphenols</td>
</tr>
<tr>
<td>↑ Saturated fats, added sugars, trans fats</td>
</tr>
<tr>
<td>Diabetes</td>
</tr>
<tr>
<td>↓ Fiber/whole grains, unsaturated fatty acids Magnesium, vitamin D, folate, B12, vitamin E and vitamin C, polyphenols</td>
</tr>
<tr>
<td>↑ Calories, added sugars, saturated fat</td>
</tr>
</tbody>
</table>

Nutrient reference intakes reflect a U-shaped curve & are based on statistical risk

- Estimated average requirement (EAR): amount required by half of healthy individuals.
- Upper intake level (UL): highest average daily intake level likely to pose no risk of adverse health effects for nearly all people.
- Assumes an inflection point
  - Intakes above the UL increases the risk of adverse effects
Defined evidence for setting diet recommendations for nutrient adequacy

Criteria: Evidence of causality and/or dose response
- RCT
- Intervention trials
- Metabolic/balance studies
- Depletion/repletion
- ≥3 doses (dose/response)

Biomarkers of nutrient adequacy are on a causal pathway

- Direct observations of a clinical symptom or endpoint due to low (EAR/RDA) or high (UL) intake of nutrient
- Examples:
  - Serum folate—macrocytic anemia
  - Serum 25(OH)D—rickets
  - Serum ferritin—anemia
  - Omega-3 fatty acids—reduced platelet aggregation

For nutrient deficiencies, risk is absolute and affects all persons, all life-stage groups

Setting Nutrient Recommendations to Reduce Chronic Disease Risk

Example: Vitamin D and bone health
Nutrient Recommendations to Reduce Chronic Disease Risk

Why establish DRIs to reduce CD:
- An increase in the proportion of elderly citizens
- Increased prevalence of CD
- The high prevalence of overweight and obesity

Challenges:
- Risk varies among individuals
- Relative risk or benefit never reaches 100%
- Multiple causes; diet is only one of many
- Several nutrients or dietary components may contribute to the CD risk

The evidence linking diet and CDs differs from evidence for nutrient requirements
- Nutrient-Chronic Disease evidence is mostly observational or associational
- Causality and/or dose response must be established without randomized controlled trials
- Inherent errors/bias are associated with the studies
  - Confounding and selection bias
  - Self-reported intake

Multiple biomarkers are on the causal pathway

- Food substance-CD risk are often associated by surrogate or intermediate outcomes (e.g., saturated fat, LDL-c, waist circumference, sedentary lifestyle AND cardiovascular disease)
  - Higher uncertainty
  - Lack of a quantitative relationship
  - Very few validated biomarkers (including intake)

Relative risk of chronic disease usually does not affect all persons & all life-stage groups
Often <50% of population affected by the CD
Relative risk of chronic disease

- No one in a population is at 0 or 100% risk—they are at higher or lower risk compared to a baseline risk.
- Intake of food substances often alter disease risk by <10%

Overlap of benefit and harm

A food substance can be related to multiple chronic diseases with different risk relationship shapes

Absence of an inflection point

- Food substance-CD relationships often lack an inflection point
  - Example: Saturated fats and LDL cholesterol
  - Also no “benefit”: Keep intakes as low as possible while consuming a nutritionally adequate diet

Summary

- Nutrient Requirements Criteria:
  - “Essentiality” of the substance
  - Evidence of causality and dose response
  - Threshold for adequacy and adverse effects
  - Relevant population
  - Applicability of U-shaped risk curve
- Recommendations to reduce chronic disease
  - More than one nutrient or food substance involved
  - Risk curve varies with disease, biomarker, nutrient, and population
  - Usually <50% of population is at risk
Time to Merge Nutrient Recommendations for Nutrition & Health

Why?
- Chronic disease is an increasing problem globally
- Nutrition researchers are the best qualified to set these standards
- Need to begin linking classical symptoms of nutrient deficiencies with biomarkers of chronic disease risk
- Enhanced understanding of the link between food intakes and chronic disease risk will lead to new ways to reduce the disease burden.

Future Plans for DRIs

- Consider chronic disease risk for each DRI nutrient review
  - $\text{DRI}_{\text{nutr}}$
  - $\text{DRI}_{\text{CD}}$
- Address associations for macro and micro nutrients
- Will not replace Dietary Guidelines
- Food ≠ Nutrition
  - Food is a source of nutrients
  - Nutrition is a biological indicator of diet and health

How?

- Assess the strength of the evidence for a chronic disease endpoint in a systematic review prior to revising the nutrient recommendations.
- Include investigators of nutrition and chronic disease on nutrient recommendations committees.
- Macronutrient issues possibly related to CD:
  - Simple carbohydrates and sugars versus whole grains/fiber
  - Saturated versus unsaturated fat
  - Omega-6 versus omega-3 fatty acids

Thank you!