The Development and Evaluation of the Healthy Eating Index-2005

Patricia M. Guenther, PhD, RD
Center for Nutrition Policy and Promotion
US Department of Agriculture
Overview

• Background
• Purpose
• HEI-2005
  – Components and standards
    • Empty calories
  – Evaluations
• Recommendations
• Questions
From science to assessment
From science to assessment
From science to assessment

www.DietaryGuidelines.gov
From science to assessment
From science to assessment
From science to assessment
Applications

- Assess diet quality of populations
- Research on dietary patterns and health
- Nutrition interventions
Purposes of this project

• Revise HEI to conform to 2005 Dietary Guidelines
• Evaluate psychometric properties
  – Validity
  – Reliability

Original Healthy Eating Index

Adequacy:
• Total Fruit
• Total Vegetables
• Total Grains
• Milk
• Meat & Beans

Moderation:
• Total Fat
• Saturated Fat
• Cholesterol
• Sodium

Variety
Healthy Eating Index-2005

Adequacy:
• Total Fruit
• Whole Fruit
• Total Vegetables
• Dark Green/Orange/Legumes
• Total Grains
• Whole Grains

Moderation:
• Milk
• Meat & Beans
• Oils
• Saturated Fat
• Sodium
• Calories from Solid Fats, Alcohol, Added Sugars
Healthy Eating Index-2005

Adequacy:
• Total Fruit
• Whole Fruit
• Total Vegetables
• Dark Green/Orange/Legumes
• Total Grains
• Whole Grains

Moderation:
• Milk
• Meat & Beans
• Oils

Saturated Fat
• Sodium
• Calories from Solid Fats, Alcohol, Added Sugars ("empty calories")
Scoring

• **Fruit**
  - Total (5)
  - Whole (5)

• **Vegetables**
  - Total (5)
  - Dark Green/Orange/ Legumes (5)

• **Grains**
  - Total (5)
  - Whole (5)

• **Milk** (10)
• **Meat & Beans** (10)
• **Oils** (10)
• **Saturated Fat** (10)
• **Sodium** (10)
• **Calories from Solid Fats, Alcohol, Added Sugars** (20)
Density standards

• Density approach
  – Express recommended amounts per 1000 calories

• True to pattern intentions
  – Over time intake should have these proportions of food groups

• Assesses the mix of foods

• No need to determine an individual’s appropriate calorie level
Complementary measures

• Anthropometrics
  – Body Mass Index
  – Waist circumference
• Physical activity
Total Grains
Recommended amounts per 1000 calories
Total Grains

Recommended amounts per 1000 calories
Total Grains
Recommended amounts per 1000 calories

![Graph showing the recommended amounts of total grains per 1000 calories]
Scoring

• Adequacy components
  – Maximum points for meeting the standard
  – 0 points for none

• Moderation components
  – Scientific standards for maximum score
  – Population distributions examined to set minimum scores
Discretionary calories

- Introduced 2005 Dietary Guidelines Advisory Committee
  - “Difference between total energy requirements and energy consumed to meet recommended nutrient intakes”
  - Includes solid fats, alcohol and added sugars
  - Additional amounts of nutrient-rich foods
Discretionary calories

- Discretionary calories difficult to measure
- Desire a component to address over-consumption
Operational definition

• Calories from Solid Fats, Alcohol and Added Sugars
  – Represents a subset of all discretionary calories
  – Does not cover intake above recommended amounts of MyPyramid food groups
    • Total grains and meat
Evaluation

- **Content validity**
  - Check against Dietary Guidelines

- **Construct validity**
  - Exemplary menus
  - Smokers vs nonsmokers

- **Reliability**
  - Internal consistency
Content validity

- Extent to which the measure captures the variety of attributes that make up the construct
- Includes face validity
- Test
  - Check against Dietary Guidelines
Evaluation

• Content validity
  – Check against Dietary Guidelines

• Construct validity
  – Exemplary menus
  – Smokers vs nonsmokers

• Reliability
  – Internal consistency
Construct validity

- Indicates theoretical construct and is consistent with theoretical hypotheses
- Tests
  - Scored exemplary menus
  - Smokers vs nonsmokers
Menu data

• MyPyramid.gov
• Your Guide to Lowering Your Blood Pressure With DASH
• Eat, Drink, and Be Healthy: The Harvard Medical School Guide to Healthy Eating
• AmericanHeart.org
# Exemplary Menus

<table>
<thead>
<tr>
<th></th>
<th>MyPyramid</th>
<th>DASH</th>
<th>Harvard</th>
<th>AHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Grains</td>
<td>5</td>
<td>4.8</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Whole Grains</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Total Vegetables</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Dark Green, etc.</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4.9</td>
</tr>
<tr>
<td>Fruit</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Whole Fruit</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Milk</td>
<td>10</td>
<td>10</td>
<td>0.9</td>
<td>8.7</td>
</tr>
<tr>
<td>Meat &amp; Beans</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Oils</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Sodium</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Empty Calories</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>99.8</strong></td>
<td><strong>90.9</strong></td>
<td><strong>98.6</strong></td>
</tr>
</tbody>
</table>
Food intake data

- NHANES 2001-2002
- N = 8650
- One 24-hour recall per respondent
Evaluation

• Content validity
  – Check against Dietary Guidelines

• Construct validity
  – Exemplary menus
  – Smokers vs nonsmokers

• Reliability
  – Internal consistency
Concurrent criterion validity

- Distinguishes between groups in the present time
- Test
  - Smokers vs nonsmokers
Smokers vs nonsmokers

• Different component scores
  – Original HEI  5 of 10
  – HEI-2005  9 of 12

• Different total score
  – Original HEI  5.5 points
  – HEI-2005  8.6 points
Evaluation

• Content validity
  – Check against Dietary Guidelines

• Construct validity
  – Exemplary menus
  – Smokers vs nonsmokers

• Reliability
  – Internal consistency
Types of reliability

• Test-retest
  – Respondent recall
  – Data collection and coding

• Inter-rater
  – No judgment required

• Internal consistency
Internal consistency

- Cronbach’s alpha = 0.43
- Anticipated to be low
- Components
  - Not measuring same thing
  - Relationships vary
- HEI as a set of profile scores
HEI-2005

• Reflects the 2005 Dietary Guidelines
• Uncouples diet quality and diet quantity
  – Density approach
• Provides a valid set of profile scores
  – Monitoring diet quality
  – Research on dietary patterns and health
  – Nutrition interventions
Assessing usual intake

- Institute of Medicine (IOM) dietary assessment report
- IOM and Dietary Guidelines
  - Recommendations to be met over time
  - Assess usual intake
- 1-day means estimate group usual intake

IOM, DRIs: Applications in Dietary Assessment, 2002
Population HEI-2005 score

$$\sum (\text{Food Group})_{\text{individual}}$$

$$\sum (\text{Energy})_{\text{individual}}$$

Population HEI-2005 score

\[ \sum (\text{Food Group})_{\text{individual}} \]
\[ \sum (\text{Energy})_{\text{individual}} \]

→ Assign score

Freedman et al, J Nutr, Sept, 2008
HEI-2005 population scores
as a percent of the standard
Total score = 57.5%

National Health and Nutrition Examination Survey, 2003-2004
Application to EFNEP

• Evaluate the effectiveness of the program
  – Collect one 24-hour recall from a sample
    • Before the intervention
  – Collect one 24-hour recall from the sample
    • After the intervention
  – Calculate and compare pre- and post-HEI scores at the group (state) level
From science to assessment

HEI-2005
Resources

www.cnpp.usda.gov/HealthyEatingIndex

www.DietaryGuidelines.gov

Patricia.Guenther@cnpp.usda.gov