WHI Dietary Nutrient Data

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Focus on

- Importance of nutrition in WHI
- Nutrition data collected in WHI
- What data are available on the website
- Miscellaneous tips/guides
- How to get involved
Heart disease and cancer are leading causes of death in the US.
Importance of Nutrition

- Improved nutrition could be one of the most cost-effective approaches to address societal, environmental, [health] and economic challenges across the globe today
  NIH Interagency Committee on Human Nutrition Research 2016

- A healthy lifestyle is the foundation for cardiovascular health
  AHA/ACC Ann Int Med 2014

- 35% of cancers may have a diet-related etiology
  National Cancer Institute
Dietary data collected in WHI

- Observational Study
- Dietary Modification Trial
- Long Life Study
Observational Study

- Food Frequency Questionnaire (FFQ) at baseline (SV1) & year 3 (Form 60)
  - Created specifically for WHI
  - English and Spanish, plus Hawaii version
  - 122 line items, 19 adjustment questions, 4 summary questions

- Current Supplements at baseline (SV1) & year 3 (Form 45)
  - Multivitamins (w/or w/o minerals), stress supplements, other supplement mixtures, selected single supplements
Dietary Modification CT

- FFQ (Form 60) at baseline (SV1)
- FFQ at Year 1
- FFQ at Years 3, 6, and 9 in rotating 1/3
- 4 Day Food Records (4DFR) at SV1
- 4DFR in 4.6% sample in Yr 1; ->two 24 Hr Recalls Yrs 3, 6 and 9 and extension
- 24-HR Recalls on 1% sample during the intervention
- Current Supplements (Form 45) at SV1, Yrs 1, 3, 6, 9
How Was Diet Measured (DM)?

Study Start

- Food Frequency Questionnaire All
- 4-day food records

Year 1

- Food Frequency Questionnaire All
- 4-day food records
  - 4.6% of participants

Year 2 → Close-out

- Food Frequency Questionnaire Rotating 1/3 of participants
- Repeat (x2) 24 hr Recalls
  - 4.6% of participants

Year 3, 6, 9

- 24 hour recalls
  - 1% of participants
Important point!

- To be eligible for the Dietary Modification CT (which was a low fat dietary pattern), potential participants were excluded if their screening FFQ showed <32% kcals from fat.
- This results in a truncated % energy from fat at baseline.
- Therefore use caution!
Baseline for All DM Participants (N=48,836)
An FFQ was completed by Long Life Study participants. LLS was conducted during the 2010-2015 Extension.

This FFQ is slightly different than the WHI FFQ:
- Reflects more contemporary food items.
Form 60 (WHI FFQ)

- The supporting food and nutrient database is the Nutrition Data Systems for Research (University of MN), v. 2005
- Yields per person/day intake of over 140 vitamins, minerals, plant compounds (i.e., carotenoids), macronutrients and other compounds (i.e., caffeine, alcohol)
- Line items (coffee) and food groups (i.e., red meat, dairy)
- Data dictionaries & documentation on website
Caveats

- Not all available nutrients in the output are considered reliable or valid.
- For example, some nutrients are imputed.
- Please read document called:
  - “WHI FFQ Nutrient Database Estimations”
  - This document provides guidance in the interpretation of the FFQ nutrient variables.
Nutrition Data Available

- **Form 45 (Current Supplements)**
  - Vitamin and mineral values for supplements reported (values from labels were directly data entered)
  - Types of supplements used (i.e., multivitamin with minerals)
  - “Total” nutrient (food + supplement) variables must be constructed by each analyst. Most units should match the FFQ units (i.e., mg/day), but check carefully
  - Data dictionaries & documentation on website
Other Nutrient Data

- Four Day Food Record Data (DM only)
  - Some but not all are coded and data entered
  - Could possibly be made available on special request for approved manuscript proposals and/or ancillary studies

- 24 Hour Recall Data (DM only)
  - Could be made available on special request as above

- LLS FFQ – not posted, but results may be available for use as above
Much interest in dietary patterns and disease outcomes in WHI

What are dietary patterns?
- “The quantities, proportions, variety, or combination of different foods, drinks and nutrients (when available) in diets and the frequency with which they are habitually consumed”

NIH 2016 National Nutrition Research Roadmap has identified a need for research on dietary patterns
Commonly applied methods to identify dietary patterns (slide courtesy of NCI Dietary Patterns Methods Project)

- Theoretically or index driven:
  - Healthy Eating Index (HEI)
  - DASH Score

- Data driven by predictor(s):
  - Factor analysis, principal component analysis (PCA), cluster analysis

- Data driven by response(s):
  - Reduced rank regression (RRR)
Dietary Patterns from Indices
<table>
<thead>
<tr>
<th>Components</th>
<th>HEI-2010</th>
<th>AHEI-2010</th>
<th>aMED</th>
<th>DASH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Fruit</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Nuts</td>
<td>+</td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Legumes</td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Fish</td>
<td>+</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Whole grains</td>
<td>+</td>
<td>+</td>
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<td>+</td>
</tr>
<tr>
<td>Total protein foods</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dairy</td>
<td>+</td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Oils/fats</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Alcohol</td>
<td></td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Red &amp; processed meat</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
</tr>
<tr>
<td>Refined grains</td>
<td>(+)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empty calories</td>
<td>(+)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>SSB &amp; fruit juice</td>
<td>(+)</td>
<td></td>
<td></td>
<td>(+)</td>
</tr>
<tr>
<td>Sodium</td>
<td>(+)</td>
<td>(+)</td>
<td></td>
<td>(+)</td>
</tr>
</tbody>
</table>
The WHI website now provides the 32 food groupings called MPEDs (for MyPyramidEquivalents)

HEI-2005 components are available, computed from the MPEDs

Guidance and documentation is provided for using MPEDs to create the AHEI-2010, aMed, DASH and HEI-2010

Read the detailed documentation
Special Analysis Tools

- Two major WHI Ancillary Study (the Nutritional Biomarkers Study and the Nutrition and Physical Activity) have used recovery biomarkers to better understand the measurement properties of the self-report data in WHI (FFQs, 4DFR and 24 Hr recalls).

- We have good and consistent data to show systematic mis-reporting of energy, protein, sodium and potassium (references on website).
Dr. Ross Prentice & the NBS/NPAAS Teams developed regression calibration equations to correct for systematic misreporting.

WHI manuscripts where the primary dietary exposure is energy (kcals/d), protein (g/d), protein density (%energy from protein), sodium, or potassium, should construct and use the calibrated measures.

Documentation/guides on website.
APPENDIX TABLE. Estimates of energy intake (kcal/day) obtained by self-reported food frequency questionnaire, a biomarker (total energy expenditure), and a calibrated food frequency questionnaire, according to body mass index category, Women’s Health Initiative Nutritional Biomarkers Study, 2004–2005*

<table>
<thead>
<tr>
<th>Body mass index† category</th>
<th>Self-reported FFQ‡</th>
<th>Total energy expenditure</th>
<th>Calibrated FFQ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Geometric mean</td>
<td>IQR‡</td>
<td>Geometric mean</td>
</tr>
<tr>
<td>Normal (&lt;25.0)</td>
<td>1,407</td>
<td>1,157–1,759</td>
<td>1,894</td>
</tr>
<tr>
<td>Overweight (25.0–29.9)</td>
<td>1,462</td>
<td>1,196–1,837</td>
<td>2,043</td>
</tr>
<tr>
<td>Obese (≥30)</td>
<td>1,454</td>
<td>1,161–1,897</td>
<td>2,213</td>
</tr>
</tbody>
</table>

* Note that the difference between FFQ energy intake (self-report) and total energy expenditure (biomarker) increases as body mass index increases. The biomarker-calibrated estimates, for the same women, correct for the measurement error using the model shown in table 4.

† Weight (kg)/height (m)².
‡ FFQ, food frequency questionnaire; IQR, interquartile range (25th–75th percentiles).
Figure 1. Estimated hazard ratios and 95% confidence intervals for a 20% increase in energy consumption (kcal/day), from combined analysis of data from the Women's Health Initiative dietary modification trial comparison group and observational study, without and with biomarker calibration of consumption, 1993–2005. Unfilled square, uncalibrated; filled circle, calibrated.
How to get involved

- Nutrition/Energy Balance Scientific Interest Group (SIG)
- Meets first Friday of each month at 10 am Pacific Time; contact Marian Neuhouser if interested in joining
- Priority is to discuss ideas/topics for manuscripts and ancillary studies
- Check out the WHI website!
Questions?