Dietary Assessment: Practical, Evidence-Based Approaches For Researchers & Practitioners

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Objectives:

- Criteria to consider when selecting a dietary assessment tool?
- What simple, valid methods are available to assess intake of:
  - Beverages
  - Fruits and vegetables
  - Fat
Controversy….

- The validity of self-reported dietary assessment methods has been called into question.

- Why?
  - Under- and over-reporting error
  - Subgroups
  - Social desirability bias
Solutions?

- Dietary biomarkers – objective indicators of food and beverage intake.
  - Combine methods

- Select tools which are valid, reliable... *ideally* also sensitive enough to detect changes.

- Use a validated protocol (e.g., multiple-pass method).

- Recognize the strengths and limitations of the method.
Considerations:

• Target population
  • Adults, children, athletes, elderly, language, region, literacy....

• Feasibility
  • Available resources, setting, participant/client burden, staff, time available...

• Purpose
  • What is of interest?
  • Is a screener/brief FFQ sufficient?

• Validity (..etc) of the method...
More on Criteria – Briefly...

- **Validity**
  - Does the tool measure what it intends to measure?

- **Reliability**
  - Does the tool give the same results when administered repeatedly?

- **Sensitive to detect changes**
  - If intake is changing over time, is the tool able to capture that?

- ...Relevant to research & practice!

(for more...see Thompson, Gleason references)
Self-Reported Dietary Assessment – Options:

1. **24-hour dietary recall**
   - Generally considered the best method/validity
   - But, labor- & time-intensive, interviewer, software...

2. **Food intake records/diaries**
   - Less reliance on memory
   - Can change eating habits (i.e., reactivity), software, time....

3. **Food frequency questionnaires**
   - Assess usual intake over longer time periods
   - Self-administered
   - *Often* more feasible
   - Brief, rapid assessment tools available!

- More than one method can be used
24-hour Recall – to improve accuracy:

- Visual aids (food models, photos, 2-d portion size diagrams) and/or household utensils

- Often done for 3 days, within a 2-week period; include weekends and weekdays.

- Quality control procedures for minimizing errors and increasing the reliability of interviewing (ex. training sessions, taping, multiple-pass method).
  - In children, adolescents: add recording booklet

- Examples: USDA/WWEIA, NHANES use the 24-hour recall
24-hour Dietary Recall

USDA 5-Step Multiple-Pass Method

Step 1: Quick List
- The respondent: reports an uninterrupted listing of all foods and beverages consumed.

Step 2: Forgotten Foods List
- ... answers a series of 9 food category questions for additional foods.

Step 3: Time and Occasion
- ... answers the time they consumed foods and what they called eating occasions.

Step 4: Detail Cycle
- ... provides descriptions and amounts of each food reported.
- ... reviews each occasion and times between occasions.

Step 5: Final Review Probe
- ... a final probe for anything else consumed.
FFQ – Rapid, Low-Resource Options:

• Some are brief - <5 minute administration time
• Literacy level can be low – e.g., 5th grade reading level
• Reflect intake in past month, past year, etc
• Spanish language options
• Self-administered; paper/pencil, online
• Adults, children

May not be as precise as 24-hour recalls

• Limited response options—foods, portions, frequency
• Categorize individuals - low or high consumers
• Identify general areas for improvement
• Track changes over time
FFQ – Improving accuracy:

- Review, after completion (skipped rows, incomplete responses, etc)
- **Computer-based administration**
  - May reduce bias
- **Valid, reliable, etc... in your target population?**
- **Include visual aids → portion size estimation**
  - Food models, measuring cups, etc.
- **Clarifications needed?**
  - Children – milk, juice
- “Bogus pipeline” approach (research...), biomarkers
Validated, Rapid FFQ

• **Beverages - BEVQ-15**
  - Water, Sugar-sweetened beverages (SSB), milk, juice, alcohol, total beverages;
  - Kcal & fl oz

• **Fruit & Vegetable Screener, Dietary Fat Screener**
  - “Score” → Categories of intake (with interpretation, e.g., servings/day; % total calories from fat)
  - Also a Fruit-Vegetable-Fiber Version
  - Prediction equations:
    - Fat grams
    - Saturated fat grams
    - % Fat
    - Fruit/Veg servings
    - Vitamin C, Mg, K
Assessing Usual Beverage Intake: BEVQ-15

- Total beverage, water, SSB (fl oz, kcal)
- Validated in adults (print, online)
- Included USG in validation study to validate (biomarker)
- Valid, Reliable, Sensitive to ▲
- 4-5th grade reading level
- Completion time 2-3 min.
- Stay tuned!
  - Children and adolescents
  - Hispanic preschoolers
  - Healthy Beverage Index (pattern)

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**Beverage Questionnaire**

In the past month, please indicate your response for each beverage type by marking an “X” in the bubble for “how often” and “how much each time”

1. Indicate how often you drank the following beverages, for example, you drank 5 glasses of water per week, therefore mark 4-6 times per week
2. Indicate the approximate amount of beverage you drank each time, for example, you drank 1 cup of water each time, therefore mark 1 cup under “how much each time”
3. Do not count beverages used in cooking or other preparations, such as milk in cereal
4. Count milk added to tea and coffee in the tea/coffee with cream beverage category NOT in the milk categories

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<table>
<thead>
<tr>
<th>Type of Beverage</th>
<th>HOW OFTEN (MARK ONE)</th>
<th>HOW MUCH EACH TIME (MARK ONE)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never or less than 1</td>
<td>Less than 6 fl oz (3/4 cup)</td>
</tr>
<tr>
<td></td>
<td>time per week (go to</td>
<td>8 fl oz (1 cup)</td>
</tr>
<tr>
<td></td>
<td>next beverage)</td>
<td>12 fl oz (1 1/2 cups)</td>
</tr>
<tr>
<td></td>
<td>1 time per week</td>
<td>16 fl oz (2 cups)</td>
</tr>
<tr>
<td></td>
<td>2-3 times per week</td>
<td>More than 20 fl oz (2 1/2 cups)</td>
</tr>
<tr>
<td></td>
<td>4-6 times per week</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 time per day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2+ times per day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3+ times per day</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>0 0 0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>100% Fruit Juice</td>
<td>0 0 0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Sweetened Juice Beverage/Drink (fruit aces, lemonade, punch, Sunny Delight)</td>
<td>0 0 0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Whole Milk</td>
<td>0 0 0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Reduced Fat Milk (2%)</td>
<td>0 0 0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Low Fat/Fat Free Milk (Skin, 1%, Buttermilk,</td>
<td>0 0 0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Soft Drinks, Regular</td>
<td>0 0 0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Diet Soft Drinks/Artificially Sweetened Drinks (Crystal Light)</td>
<td>0 0 0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Sweetened Tea</td>
<td>0 0 0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Tea or Coffee, with cream and/or sugar (includes non-dairy creamer)</td>
<td>0 0 0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Tea or Coffee, black, with/without artificial sweetener (no cream or sugar)</td>
<td>0 0 0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Beer, Ales, Wine Coolers, Non-alcoholic or Light Beer</td>
<td>0 0 0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Hard Liquor (shots, rum, tequila, etc.)</td>
<td>0 0 0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Wine (red or white)</td>
<td>0 0 0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Energy &amp; Sports Drinks (Red Bull, Rockstar, Gatorade, Powerade, etc.)</td>
<td>0 0 0 0 0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Other (list)</td>
<td>0 0 0 0 0 0 0 0</td>
<td></td>
</tr>
</tbody>
</table>

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Virginia Polytechnic Institute and State University, 2016
Description of the Healthy Beverage Index (HBI) score components

<table>
<thead>
<tr>
<th>Beverage Component</th>
<th>Description</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Water</td>
<td>Water comprises at least 20% of fluid requirements</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>No water consumption</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Water &lt;20% of fluid requirements</td>
<td>Proportional points for intake</td>
</tr>
<tr>
<td></td>
<td>&gt; 0% - &lt; 20%</td>
<td></td>
</tr>
<tr>
<td>2. Coffee &amp; Tea</td>
<td>Unsweetened coffee and tea comprise 0-40% of fluid requirements</td>
<td>5</td>
</tr>
<tr>
<td>3. Low Fat Milk</td>
<td>&lt;1.5%, skim, and/or soy milk comprises 0-16% of fluid requirements</td>
<td>5</td>
</tr>
<tr>
<td>4. Diet Drinks</td>
<td>Artificially sweetened beverages, including coffee &amp; tea, comprise 0-16% of fluid requirements</td>
<td>5</td>
</tr>
<tr>
<td>5. 100% Fruit Juice</td>
<td>100% fruit juice comprises 0-8% of fluid requirements</td>
<td>5</td>
</tr>
<tr>
<td>6. Alcohol</td>
<td>Between 0-1 drinks[^2] for women, 0-2 drinks for men</td>
<td>5</td>
</tr>
<tr>
<td>7. 2% or Whole Fat Milk</td>
<td>0% of fluid requirements come from 2% or whole fat milk</td>
<td>5</td>
</tr>
<tr>
<td>8. Sugar-sweetened beverages</td>
<td>0-8% of fluid requirements come from sugar-sweetened Soda, Fruit Drinks, Sweetened Coffee or Tea, Other Sweetened Beverages[^3], Other Beverages[^4]</td>
<td>15</td>
</tr>
<tr>
<td>9. Total Beverage Energy</td>
<td>Energy from beverages &lt;10% of total energy</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Energy from beverages ≥10% but &lt;15% of total energy</td>
<td>proportional points based on reported intake[^1]</td>
</tr>
<tr>
<td>10. Met Fluid Requirements</td>
<td>Amount (mL) of beverages consumed was ≥ fluid requirements</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Amount (mL) of beverages consumed was &lt; fluid requirements</td>
<td>proportional points based on reported intake[^1]</td>
</tr>
</tbody>
</table>

[^1]Proportional points were assigned as follows: Proportional Score for Water = 
((mL of Water * 15) / (0.20 * Total Fluid Requirements)); Proportional Score for Total Beverage Energy, energy from beverages = 
((15 – Percent energy from beverages)*3.333333) where energy from beverages is ≥10% - ≤14%; Proportional score for Met Fluid requirements = 
((mL of Water * 15) / (0.20 * Total Fluid Requirements)) where total fluid requirements = 1 mL per 1 kcal of food consumed.

[^2]One drink is defined as the following: beer - 12 oz, 354.84 grams/mL; wine - 5 oz, 147.85 grams/mL; liquor - 1.5 oz, 44.355 grams/mL.

[^3]Includes beverages like sweetened coffee and tea, and Horchata (a Mexican/Spanish sugar-sweetened beverage).

Block Rapid Screeners – Fruit & Vegetable, Dietary Fat

- Assesses usual intake in past year
- Older versions are freely available, newer versions must be purchased through NutritionQuest
- Validity testing – Adults, wide age range, multi-ethnic population
- Self-administered
- ~ 1 minute
- Sensitivity to change - Fruit & Vegetable Screener
  - Hedrick, Eat Beh, 2013
  - 2 servings/d increase
Think about your eating habits over the past year or so. About how often do you eat each of the following foods? Remember breakfast, lunch, dinner, snacks and eating out. Mark one bubble for each food.

<table>
<thead>
<tr>
<th>Fruits and Vegetables</th>
<th>(0) Less than 1/WEEK</th>
<th>(1) Once a WEEK</th>
<th>(2) 2-3 times a WEEK</th>
<th>(3) 4-6 times a WEEK</th>
<th>(4) Once a DAY</th>
<th>(5) 2+ a DAY</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit juice, like orange, apple, grape, fresh, frozen or canned. (Not sodas or other drinks)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>______</td>
</tr>
<tr>
<td>How often do you eat any fruit, fresh or canned (not counting juice?)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>______</td>
</tr>
<tr>
<td>Vegetable juice, like tomato juice, V-8, carrot</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>______</td>
</tr>
<tr>
<td>Green salad</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>______</td>
</tr>
<tr>
<td>Potatoes, any kind, including baked, mashed or french fried</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>______</td>
</tr>
<tr>
<td>Vegetable soup, or stew with vegetables</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>______</td>
</tr>
<tr>
<td>Any other vegetables, including string beans, peas, corn, broccoli or any other kind</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>______</td>
</tr>
</tbody>
</table>

Fruit Vegetable Score = ______
Block Fruit & Vegetable Screener

Scoring key:

If your score is:

0-10: You are not eating enough fruits and vegetables! You are probably eating fewer than 3 servings a day, but experts recommend 5 or more. You may be low in important vitamins, and fiber. Pick a few fruits or vegetables you like, and eat more of them. Green salad counts, too, and fruit juice or vegetable juice.

11-12: Your diet is like most Americans -- low in fruits and vegetables! You’re eating fewer than 4 servings, but experts recommend 5 or more. Pick some you like, and eat them more often. Green salad counts, and fruit juice or vegetable juice.

13-15: You are doing better than most people, but you are still not eating 5 servings of fruits and vegetables every day. Try adding fruit or vegetable juice, or salad -- or just any fruit or vegetable you like.

16+: Congratulations! You’re doing very well in fruits/vegetables, probably around 5 servings a day! Go for it!
### Block Dietary Fat Screener

Think about your eating habits over the past year or so. About how often do you eat each of the following foods? Remember breakfast, lunch, dinner, snacks and eating out. Mark one bubble for each food.

<table>
<thead>
<tr>
<th>Meats and Snacks</th>
<th>(0)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamburgers, ground beef, meat burritos, tacos</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Beef or pork, such as steaks, roasts, ribs, or in sandwiches</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Fried chicken</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Hot dogs, or Polish or Italian sausage</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Cold cuts, lunch meats, ham (not low-fat)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Bacon or breakfast sausage</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Salad dressings (not low-fat)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Margarine, butter or mayo on bread or potatoes</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Margarine, butter or oil in cooking</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Eggs (not Egg Beaters or just egg whites)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Pizza</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Cheese, cheese spread (not low-fat)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Whole milk</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>French fries, fried potatoes</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Corn chips, potato chips, popcorn, crackers</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Doughnuts, pastries, cake, cookies (not low-fat)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Ice cream (not sherbet or non-fat)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
</tbody>
</table>

Fat Score = ________
Block Dietary Fat Screener

Scoring key:

If your score is:

0-7: Your fat intake is very low, probably less than 25% of calories. Congratulations!

8-14: Your fat intake is about like most Americans, probably between 30% and 35% of calories. Experts recommend that it be less than 30%. Try eating some of your high-scoring foods less often, and eat more fruits and vegetables.

15-22: Your diet is quite high in fat, probably higher than the U.S. average of 35% of calories. Look at the foods you scored highest on. You don’t have to give up your favorites, just eat them less often or in smaller portions. Try lower-fat milk, low-fat salad dressing. And fill up on grains, fruits and vegetables!

23+: Your diet is very high in fat, probably 40-50% of calories! Look at the foods you scored highest on, and eat them less often. Switch to 2% milk, and low-fat lunch meats and salad dressing. Most of the food you eat should come from bread, rice, cereals, fruits and vegetables.
Other Block Rapid Screeners

- **Calcium/Vitamin D Screener**
  - 19 food items, 7-8 min.
  - Original validation study ➔ older women.

- **Sodium Screener**
  - 25 food items, 5-7 min.
  - Has not been validated – but is being used in clinical settings.

- **Kids Food Screener (aged 2-17 yrs)**
  - 41 items, 10-12 min., Spanish version
  - Fruits, vegetables, diary, whole grains, protein, saturated fat, added sugars, GI
  - Self-administered, or parent/caregiver
  - Validation study ➔ youth aged 10-17 yrs
Other Rapid Screeners (cont)

- **NCI Dietary Screener Questionnaire (DSQ)**
  - Publicly available, can be processed with SAS, scannable version possible
  - 30 items, Spanish version available
  - Fiber, calcium, added sugar, whole grains, dairy, fruits/vegetables, sugar-sweetened beverages
  - Validity testing – summarized on website; also Yaroch, JAND 2012.

- **2-item Fruit/Vegetable assessment tools**
  - Servings
  - Cups
  - 16-item screener also evaluated - see Yaroch, 2012.
  - Validity and reliability tested
  - (...longer screener performed better than 2-item ones)
Other Rapid Screeners (cont)

- **NCI Five Factor Screener**
  - Publicly available, scoring instructions are posted online
  - 18 categories of foods
  - Fruits/vegetables, fiber, added sugar, calcium, and dairy foods

- **Percentage Energy from Fat Screener (total fat)**
  - Publicly available, scoring instructions are posted online
Other Rapid Screeners (cont)

- Register of validated short screeners:
  - Can narrow search by food/nutrient of interest, population, number of items, etc.
Not just for researchers....

- Outcomes tracking (Extension, clinical practice)
- Evidence-based practice (and assessment!)
- Community, worksite, school-based programs – effective?
Final Thoughts......

- In some situations, short screeners may be appropriate.
- Recognize the pros/cons of the tool selected.
- Many have NOT been evaluated for sensitivity to change.
- There is a great need for valid short screeners!
  - Develop a rapid assessment tool,
  - Make it publicly available to researchers and clinicians.
  - Update existing screeners?
  - Technology!


