Limitations of Food Composition Databases

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Revised Title

Considerations for Using Food Composition Databases
Outline

- Overview of databases and activities
- Data sources
- Data quality issues
- Food component variability
- Compiler decisions/issues
- Database needs
- Considerations for database use
Overview of Databases and Activities

- Many uses
  - Dietary evaluation/planning/counseling
  - Assess national food/food component adequacy
  - Guide nutrition policies
  - Food product development
- Always a work in progress (never complete)
US Databases and Activities

- USDA SR21
- USDA Special Interest Databases
- USDA FNDDS (software for assessment)
- NIH ODS Supplement Databases
- FDA Total Diet Study
- National Nutrient Databank Conference
- NNDC International Directory
International/European Databases/Activities

- INFOODS publications, database directory
- International Food Data Conference
- Journal of Food Composition and Analysis
- European Food Information Resource Network (EuroFIR)
Sources of Food Composition Data

- Scientific literature, e.g., JFCA
- Contract lab analysis, e.g., NFNAP
- Food industry (labeling data)
- US/non-US databases
- Calculated from ingredients
- Estimated based on similar foods
Issues of Data Quality

- **Timeliness** (when collected and analyzed)
- **Representativeness** (sampling based on region, season, cultivar/breed, etc.)
- **Number of individual/composited samples**
- **Accuracy** (sample prep, analytical methods, use of reference stds, QC)
- **Data summation** (mean/median/mode; market share; ranges; outliers; SDs, SEs)
Food Component Variability

- **Inherent** (cultivar/breed, maturity/age, color)
- **Environmental** (soil, water, weather, sunlight, feed)
- **Processing/preparation**
  - Transport and storage (time and temp)
  - Exposure to heat, light, air
  - Removal/addition of components, e.g., fat removal; nutrient fortification
  - Use of various recipes (if >1 ingredient)
Vitamin D Variability

Vitamin D in Milk (IU/quart)

- Nonfat milk – 423 ± 103 (24% CV)
- 1% fat milk – 507 ± 126 (25% CV)
- 2% fat milk – 406 ± 109 (27% CV)
## Calcium in Milk (FDA TDS) (mg/8 fl oz; n=51)

<table>
<thead>
<tr>
<th>Type</th>
<th>mean/med ± SD (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole</td>
<td>246/256 ± 39 (63-283)</td>
</tr>
<tr>
<td>2% fat</td>
<td>266/271 ± 34 (90-315)</td>
</tr>
<tr>
<td>Nonfat</td>
<td>278/281 ± 44 (117-427)</td>
</tr>
<tr>
<td>Chocolate</td>
<td>264/256 ± 49 (112-407)</td>
</tr>
</tbody>
</table>
## Iron in FDA TDS Foods
(mg/100 g; n=51)

<table>
<thead>
<tr>
<th>Food</th>
<th>mean ± SD</th>
<th>(range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef loin, ckd</td>
<td>2.6±0.4</td>
<td>(1.8-3.5)</td>
</tr>
<tr>
<td>Farina, ckd</td>
<td>4.9±2.0</td>
<td>(1.6-10.5)</td>
</tr>
<tr>
<td>Raisin bran</td>
<td>25.1±12.0</td>
<td>(10.9-56.0)</td>
</tr>
<tr>
<td>Spinach, ckd</td>
<td>2.5±2.4</td>
<td>(0.8-16.6)</td>
</tr>
<tr>
<td>Meatloaf, ckd</td>
<td>2.4±0.4</td>
<td>(1.3-3.4)</td>
</tr>
<tr>
<td>Chicken pot pie</td>
<td>1.2±0.6</td>
<td>(0.6-3.8)</td>
</tr>
</tbody>
</table>
Fat:  Time of Day

- Significant circadian variation in fat content of preterm breast milk; higher fat content in the evening (7.9±2.9%) than morning (6.6±2.8%)

Lubetzky et al., 2006. J Am Col Nutr 25, 151-154
Vitamin C decreased while carotenoids, chlorophylls, and polyphenols increase with height in dill plants:

<table>
<thead>
<tr>
<th>plant ht (cm)</th>
<th>vit C (mg/100g) in leaves</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>138±5</td>
</tr>
<tr>
<td>40</td>
<td>122±4</td>
</tr>
<tr>
<td>60</td>
<td>119±5</td>
</tr>
</tbody>
</table>

Lisiewska et al., 2006. J Food Comp Anal 19, 134-140
Antioxidant Capacity - Season

- Cherry tomatoes of same cultivar, conditions, & location showed marked differences in antioxidant capacity based on harvest time:

<table>
<thead>
<tr>
<th>Month</th>
<th>Trolox eq/100 g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr</td>
<td>0.191</td>
</tr>
<tr>
<td>Jun</td>
<td>0.263</td>
</tr>
<tr>
<td>Jan</td>
<td>0.170</td>
</tr>
<tr>
<td>Mar</td>
<td>0.420</td>
</tr>
</tbody>
</table>

Total phenolic acid of 15 varieties of dry beans:

- cranberry beans: 19.1 mg/100 g
- kidney beans, dark: 20.9
- pink beans: 34.4
- navy beans: 48.3

Luthria and Pastor-Corrales. 2006. J Food Comp Anal 19, 205-211
Database Compiler Decisions

- Foods/food components
- Merging data from various sources
- Documentation of data
- Food component names/units
- Food groups/subgroups
- Food descriptors (Languual, INFOODS)
- Food names (examples of issues)
Langual Food Description Factors (retrieval system)

- Product type
- Food source
- Part of plant/animal
- Physical state
- Heat treatment
- Cooking method
- Treatments applied
- Preservation
- Packing medium
- Container/wrapping
- Food contact surface
- Consumer group/dietary use
- Geographic place/region
- Cuisine
INFOODS Food Descriptors

- Scientific name
- Variety/breed/strain
- Part of plant/animal
- Area of origin
- Manufacturer
- Ingredients
- Processing/prep
- Preservation
- Cooking method
- Agricultural issues
- Maturity/ripeness
- Storage conditions
- Grade
- Container
- Physical state
- Color
Food Name Synonyms

- Balsam pear (bitter melon, bitter gourd)
- Celeriac (celery root)
- Jerusalem artichoke (sunchoke)
- Kiwi fruit (Chinese gooseberry)
- Ocean perch (redfish)
- Rutabaga (Swede)
- Sub (grinder, hero, hoagie, torpedo)
Same Name – Different Foods

- Biscuit: dinner roll vs. British cookie
- Half & half: milk & cream vs. porter & ale
- Lady finger: sponge cake vs. okra
- Marrow: bone tissue vs. summer squash
- Snowball: shaved ice vs. snack cake
- Sweetbread: calf/lamb pancreas vs. pastry
- Truffle: fungus vs. chocolate cream
- Tuna: fish vs. prickly pear (cactus fruit)
- Twister: Tropicana drink vs. KFC entree
Foods with Geographic Names (not know in named country)

- Brussels sprouts
- Canadian bacon
- Danish/Danish pastry
- French fries
- German chocolate cake
- Scotch broth
- Swede
- Swiss steak
Food names that may not be useful outside the US

- Baby Ruth/Twizzler
- Buffalo wings
- Chicken fried steak
- Chicken/hen of the woods; cloudear
- Dirty rice
- Hush puppy; cornpone
- Pebbles/Froot Loops
- Pig-in-a-blanket
- Old fashioned; rusty nail; screwdriver
- Succotash
- Whopper
Complexity of Beef Cuts in SR21

- Bottom sirloin, tri-tip (11)
- Brisket (27)
- Chuck (69)
- Composite cuts (14)
- Flank (13)
- Ground (31)
- Loin (3)

- Plate (4)
- Rib (64)
- Round (119)
- Short loin (44)
- Tenderloin (24)
- Top sirloin (19)
69 Beef Chuck Cuts in SR21

- arm pot roast (16 listings)
- blade roast (17 listings)
- clod steak (6 listings)
- mock tender steak (6 listings)
- shoulder clod (18 listings)
- top blade (6 listings)
31 Ground Beef Listings in SR21

- 70, 75, 80, 85, 90, 95% lean
- Crumbles, loaf, patty
- Pan-browned, baked, broiled, frozen, raw
16 Tuna Listings in SR21

- Fresh, raw (3): blue/yellowfin, skipjack
- Fresh, ckd (3): blue/yellowfin, skipjack
- Light, canned in oil (2)
- Light, canned in water (2)
- White, canned in oil (2)
- White, canned water (2)
- Tuna salad (1)
- Fast food sub with tuna salad (1)
StarKist (22 products)

- Flavor Fresh Pouch (albacore white/chunk light)
- StarKist Creations in pouches (5 flavors)
- StarKist Tuna Fillets (3 types)
- Lunch-To-Go (2 flavors snack packs)
- Gourmet Choice (low-sodium chunk light/albacore)
Bumble Bee (19 products)

- Easy Peel Boxes (spicy Thai chili; lemon & cracked pepper, sundried tomato & basil)
- Prime fillet solid white in vegetable broth
- Prime fillet albacore in pouches
- Solid white albacore in oil/water
- Premium albacore in pouch
Database Areas in Need of Improvement

- Documentation of sources
- Information on variability & # of samples
- Common and consistent terminology for food names/descriptors
- Data for cultural/ethnic foods
- Data for fast foods/restaurant foods
- Keep up with the food industry
- Data for bioactive components
Considerations for Using Databases

- They require continuous/considerable upkeep to reflect food supply
- Data are uneven in quality, reliability, representativeness, accuracy
- Usually means without clear indications of variability
- No way to control for variability
Considerations for Using Databases (contd.)

- Nationally-representative data may not be useful for individuals.
- Often don’t have the exact food needed, i.e., must pick closest match.
- Not reliable enough for clinical/individual studies where intakes are compared with biological measures.