Recipe and other calculations

U. Ruth Charrondiere

Calculation

1. Calculation procedures based on recipes for missing complex foods, e.g. cakes, sauces, or soups.
2. Calculation procedures based on algorithms for missing cooked foods
3. Calculation procedures to adapt to water and fat contents between foods
4. Calculation procedures to estimate NV of based on fat-free dry matter (USDA)

Steps for recipe calculations

- Collect recipes
- Decide on recipe calculation system
- Enter all necessary NVs of all ingredients into your system
- Run calculation programme
- Document

Yield and retention factors

- Yield factor (YF): % weight change in foods or recipes due to cooking.
- Nutrient retention factor (RF): % retention of nutrients, especially vitamins and minerals, in food or dish after, e.g. storage, preparation, processing, warm holding or reheating.
- Edible coefficient (ED): % weight loss when discarding inedible weight from a food

Published ED, RFs and YF not available for all foods. Best to measure ED and YF.

Sources for recipes

- Standard/most used recipe book
- From associations, e.g. bakery association
- Field work collecting ingredients quantitatively and qualitatively

=> accept variations between individuals
=> estimation better than no value

Transform into gram edible portion

Ingredients of omelette with onions and tomatoes
- 2 eggs
- 2 table spoons milk
- 1 tea spoon butter
- 1 big onion
- 2 small tomatoes
Transform into gram edible portion

- Do not use standard portions from other countries → source of error because weights and dimensions of portions are different between countries
- Better to sample ingredients and weight and take their dimensions → more accurate and can also be used in food consumption surveys
- Edible coefficients could be used from other sources but better to also weigh edible portions in one’s own country

Sources of error in recipe calculations

- Inappropriate weight of water or forgetting to add water
- Forget to add fat for frying
- Forget to apply edible coefficient
- Inappropriate use of yield and retention factors
- Apply nutrient values per 100g and forget to adjust for actual weight
- Missing nutrient values in ingredients (higher impact the higher content and/or amount in recipe)
- Introducing zero values in recipes (while ingredients had missing values)
- Wrong food match between ingredients and foods in FCDB

Recipe naming

- Put additional explanation into recipe name to distinguish different ingredients, e.g.
  - Between regions
  - Different main ingredient

Recipe calculation systems

1. Summing of raw ingredients (not recommended)
2. Ingredient method
3. Total recipe method
4. Mixed method (yield at recipe level and nutrient retention at ingredient level)

Summing of raw ingredients

- Sum weight of each raw ingredient
- Bring value to 100g

==⇒ not comparable with other 2 methods

Ingredient method

- Sum weight of each ingredient as in consumed recipe (edible, yield and retention factors applied at ingredient level)
- The nutrient values of the recipe will be calculated based on the weight of the relative proportion of each ingredient
- Check that yield factors are applied to fluids
Ingredient method

- **Advantages**
  - need to know weight loss at ingredient level (what is also needed to calculate value of cooked food)
  - no need to decide to which category recipe belongs
  - unequal weight loss of ingredients taken into account

- **Disadvantages**
  - only estimated weight loss of recipe (not measured for whole recipe)

Total recipe method

- **Advantages**
  - Sum weight of each raw ingredient as in recipe
  - Measure fat and water change
  - Apply yield and retention factors at recipe level based on food group of main ingredient

- **Disadvantages**
  - only estimated weight loss of recipe (not measured for whole recipe)

**Calculation methods for recipes**

<table>
<thead>
<tr>
<th>Ingredient Method</th>
<th>Ingredient 1: NV x 1/YF x RF</th>
<th>Ingredient 2: NV x 1/YF x RF</th>
<th>Ingredient 3: NV x 1/YF x RF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recipe</td>
<td>Recipe: Sum of above</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mixed Method</th>
<th>Ingredient 1: NV x RF</th>
<th>Ingredient 2: NV x RF</th>
<th>Ingredient 3: NV x RF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recipe</td>
<td>Recipe: Sum of above x 1/YF</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comparison of NVs of recipes due to different RF and calculation methods**

- Recipe and Mixed Method provide similar NVs except where differences in RF are big (low retention results in significant lower NVs with recipe method)
- Ingredient Method provides randomly significantly different results compared to other methods
- Bogner’s RF are available for many foods/food groups and cooking methods as compared to Bergstroem or McCance and Widdowson
- Verification through analytical determination are needed to determine which method and set of RF give correct results
- All results are relatively similar and close to analytical variation

**Cooked foods are single-ingredient recipes**

=> to calculate NVs of cooked foods based on same food (raw or other cooked method)

**Concept:**
- NV of raw/cooked food derived from national FCT
- apply yield factor linked to a specific cooking method (weight loss can be water and/or fat).
- apply retention factors
- for fatty meat and poultry (> 5% fat in raw food) used as foods, a fat loss (FL) coefficient will be applied as fat is leaking out of the food.
What about data documentation?

Never forget to document

For recipes:
- method of calculation
- source of recipes (e.g. cooking book)
- retention and yield factors
- ingredients quantification and qualification

Argue about analyzing or calculating recipes

Analyse or calculate NVs of recipes

Inter-and intraindividual variation in recipe preparation

Variation of NV in analytical determination

Variation of NV when calculating recipes using yield and retention factors

Arguments against analysis of recipes

- Precise measure of one single combination of ingredients prepared (in general) by one person
- Often ingredients are not representative of the foods consumed in the country but taken from shop around the corner
- Any variation in cooking method or ingredient makes the NVs of the analysed recipe not transformable to a similar recipe

Æ better to analyse raw ingredients representative of the food supply and calculate recipes. Variation still smaller than that of inter-individual variation.

Conclusion

From a user perspective: Better to have values for important foods and components (including cooked foods and recipes) than none at all.

But: Always document your data

Missing data and their calculation
**Which data can be missing?**

- Specific nutrients for all foods  
  = missing nutrient
- One nutrient value (NV) for a given food  
  = missing value
- All NVs for a given food  
  = missing food
- (documentation)
- density/ specific gravity
- edible part/ refuse/ waste

**Do FCTs have missing data?**

Most FCTs/FCDBs have missing data

including those of developed countries

**Are missing data harmful?**

- Missing data can be treated as zero in data use (nutrient intake estimation)
- If not treated as zero, missing data are estimated by user on personal basis
  
  ==> Diminished and/or incomparable nutrient intake estimates

**Why missing data?**

- Not comfortable to assign value of sufficient quality
- Not considered important
- unknown that these missing foods are important in food intake
- tradition ==> only raw foods in FCT
- policy ==> better no value as unsure value
- no data for manufactured foods
- cost and capacity

**Determine important foods**

- Compare with food consumption data
- Conduct rapid assessment
- Key food approach
- Investigate about potential foods to be exported

**Determine important components**

- Proximates / macronutrients are always needed to determine energy
- Interest in country, e.g. programmes, research, etc
- Interest for trade, e.g. label requirements of import countries
- Food safety requirements
**Complete missing data**

- Analyse foods
- Estimate from similar food within or outside FCT
- Calculate
- Presume as zero

**Caution when borrowing values into FCDB**

1. Check that it is the same food
   - taxonomic name, species
   - meat cut
   - description
   - fat, water, protein content
   - composition of brandname (esp. between countries)
   - fortification??

2. Check that it is the same nutrient
   - comparable definition
   - comparable analytical method
   - same expression (CHO as monosach. or sum of fraction, unit etc)

**Calculation**

1. Calculation procedures based on recipes for missing complex foods (e.g. cakes, sauces, or soups) or of cooked foods (= simple one ingredient recipe calculation)
2. Calculation procedures to adapt to water and fat contents between foods
3. Calculation procedures to estimate NV of dairy products based on fat-free dry matter

**FAT LOSS COEFFICIENTS (FLC)**

<table>
<thead>
<tr>
<th></th>
<th>Non-fatty foods, ingredients, lean meat and poultry (&lt;5% fat)</th>
<th>Fatty meat and poultry (6-15% fat)</th>
<th>Very fatty meat and poultry (%fat&gt;15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat loss coeff. (FLC)</td>
<td>0%</td>
<td>7%</td>
<td>13-15%</td>
</tr>
<tr>
<td>Water loss</td>
<td>100%</td>
<td>93%</td>
<td>85-87%</td>
</tr>
</tbody>
</table>

Source: EPIC

**Adapt to water and fat contents between foods**

- Fat-soluble vitamins depend on fat content
- Water-soluble vitamins and minerals depend on water content

--> if fat/water content between copied and to be copied food is e.g. >10% different, adapt

**Example:**

Food with missing vitamin E value has 10 g fat/100g food and the food, from which value should be copied, has 30g fat and 30mg Vitamin E (TE)

30mg VitE x 10g fat/30g fat = 10mg VitE
Impute on a non-fat solid basis (USDA)

- reference nutrient per 100 g \(\frac{(new \text{ food item } H20 + new \text{ food item fat})}{(100 - (\text{reference item } H20 + \text{reference item fat})} = \text{new nutrient per 100 g}\)

Example: calculate Ca content of Brie cheese based on blue cheese.
- \(528 \times (100 - 17.68 - 48.42) / (100 - 28.74 - 42.41) = 445 \text{ mg Ca (in USDA table there is 184 mg Ca for brie cheese)}\)

→ better analytical data than calculated

Estimate some nutrients

- estimate zero values: e.g. fibre in meat, alcohol in most foods, vitamin C in cereals, vitamin B_{12} in plant foods
- Tryptophan contribution to niacin equivalent can be estimated as about 1% of protein value

Conclusion about missing foods

From a user perspective: Better to have values for important foods and components than none at all.

But: Always document your data