Evaluation of Quality Control Information on Food Composition Data from Journal Publications

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Abstract

The Nutrient Data Laboratory (NDL), Beltsville Human Nutrition Research Center, provides USDA's Nutrient Data Base for Standard Reference (SR), the foundation of most other food composition databases and includes information on about 130 components in approximately 7100 foods. Assessing the validity of analytical data to be used in SR is important to maintaining the quality of the information contained in the database. Journal publications on food composition are one important source of analytical data. The NDL has developed a series of modules for data quality evaluation. Each module evaluates the quality of data by rating important documentation concerning the analytical method, analytical quality control (QC), number of samples, sampling plan and sample handling. The pertinent information is culled from the published articles to answer specific questions. A set of general questions was developed for each module to objectively assess the information in nutrient data publications. A preliminary study of the variability of responses between individuals answering these questions about the same publications was assessed to evaluate whether the information on these topics was expressed clearly. Twelve individuals from 11 different countries who work with nutrition data completed evaluation of two research articles. Three individuals at the NDL also evaluated the same articles. Sample handling and analytical quality control modules gave the greatest variability reflecting uncertainty in the subjects' understanding of the documentation for these categories. Analytical QC as described in manuscripts documenting nutrient data for foods may be incomplete or ambiguous. Even when reference materials (RM), either certified or in-house, are used as analytical controls when determining the composition of foods, the details may not be clearly described in subsequent publications. It is important that journal editors and reviewers insist that information on RM, procedures and QC results be included, be complete and clearly written to allow for accurate evaluation of the data quality.

Why do we evaluate data?

- Determine reliability of existing data
- Provide documentation of data reliability to users / document reliability in the database
- Establish priorities for new research

Nutrient Data Evaluation

5 Elements of Evaluating Nutrient Data on Foods from Journal Articles

Sampling	Determining if the food samples have been collected from a broad enough area of the country to be representative of the food supply
Handling	Determining if the food has been handled appropriately to maintain the integrity of the composition
Number of samples	Determining how many independent samples were analyzed
Methodology	Determining if the method is capable of producing accurate results
Quality control	Determining if the data reported are valid

Pilot Validation Study

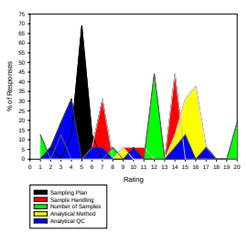
Objectives

To measure the variability of responses between individuals
To test the robustness of the rating scale
To assess the objectivity of the system categories

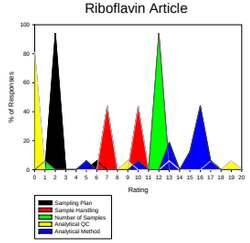
Methods

- Total of 16 participants (13 who participated in the graduate course on Food Composition and 3 from NDL)
- Evaluated two research articles: vitamin K and Riboflavin
- Rated the articles for 5 categories (Sampling Plan, Sample Handling, Number of Samples, Analytical Method, Analytical Quality control)

Vitamin K Article



Riboflavin Article



Results

Consistency in rating Analytical Method and Sampling Plan categories
Variability in rating Sample Handling and Analytical Quality Control
Number of Samples concept confusing

Validation Questions for Methodology and QC

Method Validation

Use of commercial CRM/SRM reported?

Nature of nutrient value described (cert., ref., inform.)?

Range of the values analyzed reported ?

CV or %RSD reported for precision?

Was the recovery of the nutrient reported?
Was the method validated by comparing with another laboratory or method?

Analytical QC

Was control material analyzed with the analytical samples?

Nature of nutrient value described (cert., ref., inform.)?

Was the frequency of the QC material analyzed reported?

What was the CV of the QC material?

Methodology/QC Review of Publications

Objectives

To examine additional articles for descriptions of methodology and QC
To review the use of reference materials and the description of the use
To determine the completeness of the descriptions

Methods

- Total of 19 articles were randomly selected to review method validation and use of reference materials
- Four articles on zinc, 9 on selenium, 4 on thiamin/riboflavin and 3 on vitamin K
- Articles were carefully examined for information regarding the questions listed for methodology
- Answers were tabulated to review the results

Method Validation	Zinc (4 articles)		Selenium (8 articles)		Thiamin/ Riboflavin (4 articles)		Vitamin K (3 articles)	
	Y	N	Y	N	Y	N	Y	N
Use of commercial CRM/SRM reported?	4	0	6	2	1	3	1	2
Nutrient value (cert., ref. Info) reported?	4	0	6	-	1	-	1	-
Range of the values analyzed reported?	3	1	6	-	1	-	1	-
CV or %RSD for precision reported?	3	1	6	2	2	2	3	0
Was the recovery of the nutrient reported?	2	2	4	4	3	1	3	0
Was the method validated by comparing it to another laboratory or another method?	2	2	8	0	3	1	1	2
Analytical QC								
Was the control material analyzed with the analytical samples?	1	3	2	5	0	4	1	2
Was the nature of the control material (ref. In-house) reported?	1	3	2	5	0	4	1	2
Was the frequency of the QC material analyzed reported?	1	3	2	5	0	4	1	2
Was the CV of the QC material reported?	1	3	2	5	0	4	1	2

Issues in description of QC

- Description of the analytical method in sufficient detail is necessary for evaluation of data quality.
- The details should include the use of CRM/SRM if available, and if no CRM is available, validation by comparison with another laboratory or independent method, and information on accuracy (closeness to the range of expected values), precision (CV, %RSD), % recoveries of the nutrient.
- There is a need for additional reference materials for some nutrients such as vitamins D and K, as well as for new emerging bioactive components (flavonoids, isoflavonoids)
- Use of in-house control materials, cross-validated to CRM, should be used to monitor precision and accuracy of routine analyses over an extended period of time.