tbcausp 5.0 Tabela Brasileira de Composição de Alimentos

BRASILFOODS

Information on Flavonoids in the Brazilian Food Composition Database (TBCA-USP): Application of Quality Evaluation System

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8th IFDC
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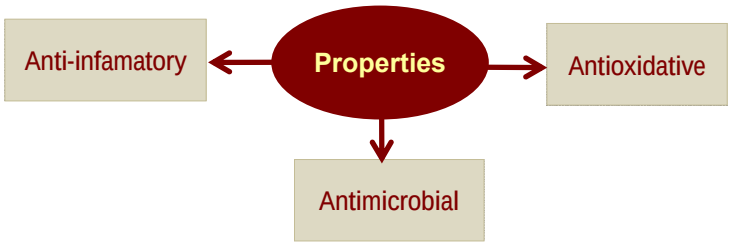
Brazilian Food Composition Database (TCBA-USP)
(www.fcf.usp.br/tabela)

- Created in 1998 by BRASILFOODS/ USP
- Centralizes the information on food composition of Brazil
- The main goal of TBCA-USP: to provide tools to help lower the risk for non-transmissible chronic diseases (NTCD)

Version 5.0, 2008

- Information on flavonoids 773 data - 197 foods
- Information on carbohydrates (individually analyzed) (112) and glycemic response (41)
- Information of 1800 Brazilian foods (1200 - with proximal composition + 600 - compilation concluded)

Bioactive compounds – Flavonoids



Flavonoids may contribute to reduce the risk for cancer and cardiovascular diseases

Subclasses of flavonoids and selected compounds

Flavonoids

Total of 28 compounds

- **Flavonols** (Isorhamnetin, Kaempferol, Myricetin, Quercetin)
- **Flavones** (Apigenin, Luteolin)
- **Isoflavones** (Genistein, Daidzein)
- **Flavanones** (Eriodictyol, Hesperetin, Naringenin)
- **Flavan-3-ols** (Catechins and gallic acid esters of catechins, Epicatechins and gallic acid esters of epicatechins, Theaflavins and gallic acid esters of theaflavins,Thearubigins)
- **Anthocyanidins** (Cyanidin, Delphinidin, Malvidin, Pelargonidin, Peonidin, Petunidin

8th IFDC International Food Data Conference 2009

Compilation of flavonoid data

A) Compilation

Information of literature and labs of USP

The analysis of the compounds by HPLC was adopted as criteria for data inclusion

B) BRASILFOODS form

					Flavonóis (mg/100g)							
	<NAME>	n	<WATER>		<ISOR-I>		<KAEM>		<MYR>		<QUE>	
			Umidade		Isoramnetina		Caempferol		Miricetina		Quercetina	
ID	descrição curta	n	valor médio	desvio/ variação	valor médio	desvio/ variação	valor médio	desvio/ variação	valor médio	desvio/ variação	valor médio	desvio/ variação

	Flavonas (mg/100g)				Flavanonas (mg/100g)						Isoflavonas (mg/100g)					
	<LUTE>		<APIGE>		<ERIOD>		<HESP>		<NARIN>		<GLYCTEIN>		<GNISTEIN>		<DIDEIN>	
	Luteolina		Apigenina		Eriodictiol		Hesperitina		Naringenina		Glicitena		Genisteína		Daidzeína	
	valor médio	desvio/ variação	valor médio	desvio/ variação	valor médio	desvio/ variação	valor médio	desvio/ variação	valor médio	desvio/ variação	valor médio	desvio/ variação	valor médio	desvio/ variação	valor médio	desvio/ variação

Tagnames of INFOODS

Systems for data quality evaluation

Created and updated

- USDA - Selenium (Bigwood et al., 1987; Holden et al., 1987; Schubert et al.,1987)
  - Copper (Lurie et al., 1989)
  - Carotenoids (Mangels et al., 1993, Holden et al.,1999)
  - Multi-nutrient Data Quality (Holden et al., 2002)
  - Flavonoids (Holden et al., 2005)
- BRASILFOODS - Dietary fiber (Menezes et al., 2000),
  - Flavonoids (finished)
  - Antioxidant capacity (in preparation)
- EuroFir
  (*European Food Infomation Resource Network) project*
  - Multi-nutrient

The application of these systems aims to express the quality and reliability of the mean (Confidence Code)

Evaluation of quality of flavonoid data

Available online at www.sciencedirect.com
SCIENCE DIRECT
Journal of Food Composition and Analysis 18 (2005) 829–844
JOURNAL OF FOOD COMPOSITION AND ANALYSIS
www.elsevier.com/locate/jfca
ELSEVIER

Original Article

Development of a database of critically evaluated flavonoids data: application of USDA's data quality evaluation system

Joanne M. Holden[a,*], Seema A. Bhagwat[a], David B. Haytowitz[a], Susan E. Gebhardt[a], Johanna T. Dwyer[b], Julia Peterson[b], Gary R. Beecher[a], Alison L. Eldridge[c], Douglas Balentine[d]

2005

2009

Contents lists available at ScienceDirect
Journal of Food Composition and Analysis
journal homepage: www.elsevier.com/locate/jfca
ELSEVIER

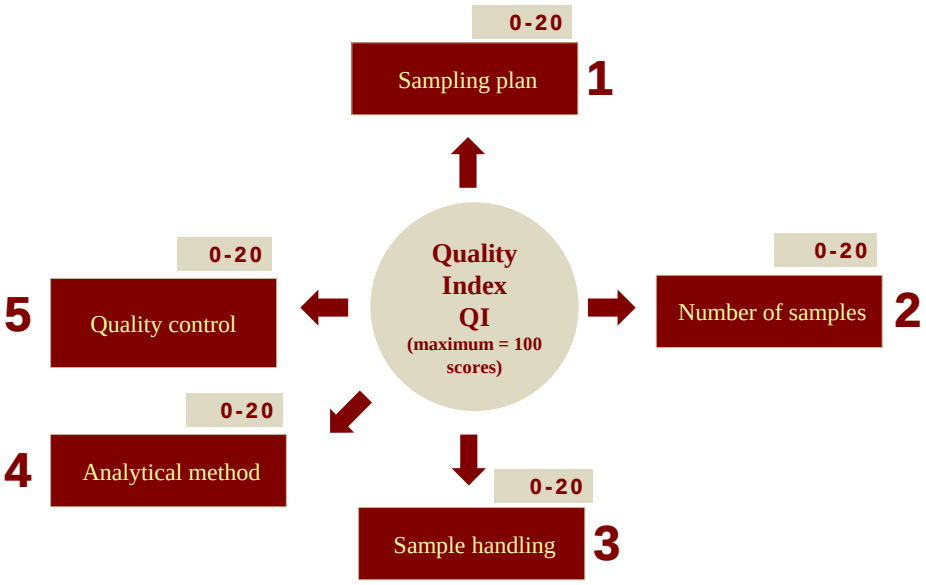
Original Article

Validation study of the USDA's Data Quality Evaluation System

Seema A. Bhagwat*, Kristine Y. Patterson, Joanne M. Holden

- ► Evaluated according to USDA's data quality evaluation system (Holden et al. JFCA, 2005)
- ► Considering 5 categories: number of samples, sampling plan, sample handling, analytical method and analytical quality control
- ► The information was scored: 0-20 scores per each category
- ► Quality Index (QI) - sum of scores of the 5 categories per compound
- ► Confidence Codes (A, B, C, and D) were assigned to every value

Scores assigned per evaluated categories



Steps accomplished for the quality evaluation of Brazilian flavonoid data

1- We elaborated questions according to critical points of all the process

2- We gave the score to each critical points per category

3- We evaluated the compiled data - Application of quality evaluation system

Graviola

Mulberry

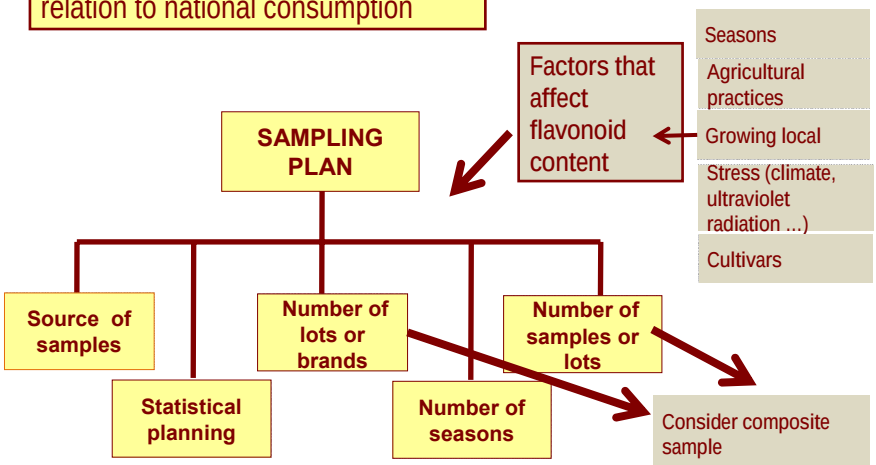
Red passion

Sweet passion

Strawberry

Sampling plan

► Consider the representativeness of analytical result of a food in relation to national consumption



Distribution of scores in sampling plan category

I: Bulk from producing regions (3), Native from producing reg., Industrialized with national distribution

II: Bulk from producing reg. (2), Native producing reg. different than principal Ind. with local distribution

III: Bulk from provider (1) Specific cultivar Ind. without brand...

Characteristics of sample		Statistical planning	
		Yes	No
Source of sample (classes)	I	12	10
	II	7	3
	III	1	1
Number of lots or products	≥3	6	5
	2	4	3
	1	2	1
Number of samples/ lot	≥2	1	1
	1	0	0
Number of seasons	≥2	1	1
	1	0	0

Holden et al., 2005 modified

When statistical planning was done, the highest score was assigned

Sample handling

It considers the whole trajectory of the sample, since its acquisition until analysis

It aims to ensure that the stability of the food and nutrient content were preserved

- Storage conditions
- Part of food analyzed
- Homogenization
- Moisture content

Distribution of scores in the sample handling category

Question related to sample treatment	Answers	Score
1. Is homogenization of samples necessary?	Yes (go to 2) No or unknown (go to 5)	- 10
2. Was homogenization performed?	Yes	5
3.Was homogenization validated?	Yes	3
4. Was information about equipment given?	Yes	2
5. Was only edible portion analyzed?	Yes No	3 0
6. Was moisture information given?	Yes No	3 0
7. Were samples stored properly?	Yes No	4 0

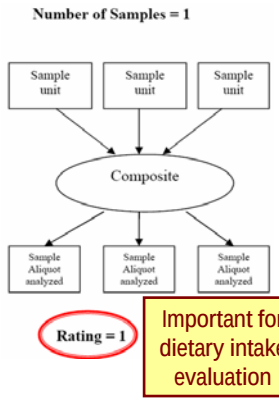
Holden et al., 2005 modified

Number of samples

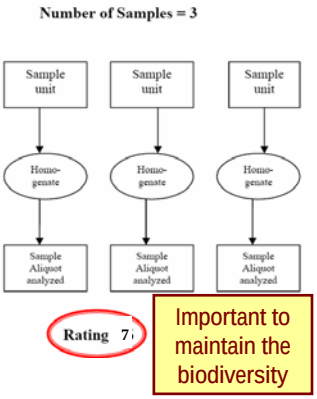
It evaluates the adequacy of the number of individual samples analyzed (sample-to-sample variability)

Replicate = 1 sample

Composite sample = 1 sample



Important for dietary intake evaluation



Important to maintain the biodiversity

Distribution of scores in the number of samples category

Number of samples	Score	Number of samples	Score
1	1	7	15
2	4	8	16
3	7	9	17
4	9	10	18
5	11	11	19
6	13	≥12	20

Holden et al., 2005 modified

More than 12 individual samples received the maximum score (20)

Analytical method

It considers the performance of the technique for flavonoid analysis and method validation

The analysis by HPLC was adopted as criteria for data inclusion

Critical steps of sample processing, analysis and quantitation → **1st Part**

Critical steps of method execution by the laboratory (validation) → **2nd Part**

Distribution of scores in the analytical method category (part 1)

Critical steps of sample processing, analysis and quantitation	Yes	No or Unknown
1. Were analyte peaks **identified by more than one method**?	0,5	0
2. If **external standardization** was used for quantitation, was the purity of standard verified?	0,5	0
3. If **internal standardization** was used for quantitation, was the standard similar in stability, chemical and spectral properties?	0,5	0
4. Were ≥ 3 concentrations used for the **standard curve**?	1,0	0
5. Was the **linearity of the standard curve** demonstrated?	0,5	0
6. Was the **calibration curve coefficient** (r) ≥ 0.99?	0,5	0
7. Was the **instrument response** checked frequently?	0,5	0

1st Part

Distribution of scores in the analytical method category

Critical steps of sample processing, analysis and quantitation	Yes	No or Unknown
8. Were the samples **protected from oxidation** (use of TBHQ, BHT, N_2, BHA etc.)?	0.5	0
9. Was **optimization of extraction** reported?	1.25	0
10. Were the **samples protected from UV** light?	0.25	0
11. Was the **sample size** 5g (anthocyanidins) or 1g (other flavonoids)?	0.5	0
12. Were **samples hydrolyzed**?	0.5	0.5
13. Were **losses by hydrolysis minimized**?	1.5	0.1
14. If samples were not hydrolyzed, **was adequate resolution** of peaks demonstrated?	1.5	0.1

Holden et al., 2005 modified

1st Part - total = 10

Distribution of scores for evaluation of execution of the analytical method by the laboratory

Questions related to method execution	Answers	Scores
1. Reference material (**RM**) was used?	**Yes** **No**	
2. What was the range observed according to the Reference Material used ?		
Certified Reference Material (**CRMs**)	**Values within expected range**	**4**
	Values within extended range (±15%)	**3**
Standard Reference Materials (**SRMs**)	**Values within expected range**	**3**
	Values within extended range (±15%)	**2**
In-house quality control material	**Go to 3?**	

2nd Part - total = 10

Distribution of scores for evaluation of execution of the analytical method by the laboratory

Questions related to method execution	Answers	Scores
In-house quality control material 3. What was the range of % of standard recoveries?	**95% - 100%** **90% - 110%** **85% - 115%** **80% - 120%** **<80% or >120% or unknown**	**2** **1.5** **1** **0.5** **0**
4. What was the % of difference in results when compared to another laboratory or method?	**≤10%** **≤15%** **≤20%** **>20% or unknown**	**2** **1.5** **1** **0**
5. What is the % of coefficient of variation (CV) observed? (repeatability studies – precision)	**≤10%** **≤15%** **≤20%** **>20% or unknown**	**2** **1.5** **1** **0**

Holden et al., 2005 modificado

2nd Part - total = 10

Evaluates accuracy and precision in the day-to-day execution of the analytical method by the laboratory

Analytical quality control and assigned scores

Was Reference Material (RM) or In-house quality control material used?

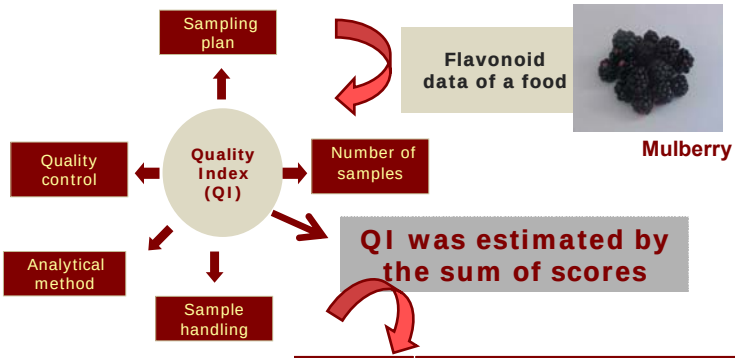
- **Yes** → RM ou *In-house?*
  - → **Values within expected or extended range?** (0-9)
  - → **Frequency of use?** (0-3)
  - → **% CV of material?** (0-4)
  - → **% Recovery of nutrient?** (0-4)
- **No** → (0)

Examples of scores assigned

= 20

Holden et al., 2005 modified

Confidence Code according to the Quality Index of each food data



Flavonoid data of a food

Mulberry

QI was estimated by the sum of scores

QI	Confidence Code (CC)	
75-100	A	Exceptional
50-74	B	Above average
25-49	C	Average
<25	D	Below average

Example of flavonoid data to be disseminated through the TBCA-USP

Values are reported as mg/100g of fresh weight of edible portion of food
Expressed as aglycons

Number Samples | Sampling plan | Sample Handling | Anal. Method | Quality Control

ID	Descrição curta/ <NAME>	Ref.	Subclasses dos flavonóides	Flavonóides	Umi-dade	Média (mg/100g)	DP	CV (%)						IQ	CC
B1106	Pimentão, verde,cru, 2º semestre 2001	365	**Flavonol**	Caempferol	93,6	n.d		n.d	1	4	20	9	4	38	C
				Quercetina		4,10	± 0,50	12,20	1	4	20	9	2	36	C
			Flavona	Luteolina		2,10	± 0,20	9,52	1	4	20	9	3	37	C
				Apigenina		n.d		n.d	1	4	20	9	4	38	C
			Antocianidinas	Cianidina		n.d		n.d	1	4	20	9	4	38	C
C797	Morango, *in natura* , Camp Dover	371	**Flavonol**	Caempferol	92	0,77	± 0,02	2,60	1	4	20	9	4	38	C
				Quercetina		3,10	± 0,10	3,23	1	4	20	9	4	38	C
			Antocianidinas	Cianidina		0,54	± 0,03	5,56	1	4	20	9	3	37	C
				Pelargonidina		11,90	± 0,20	1,68	1	4	20	9	4	38	C
			Flavanol	Catequina		5,70	± 0,10	1,75	1	4	20	9	4	38	C
				Epicatequina		2,00	± 0,20	10,00	1	4	20	9	3	37	C

197 foods | 773 compounds | 99% = C (average)

Mean scores of flavonoid data per subclasses and total of different categories

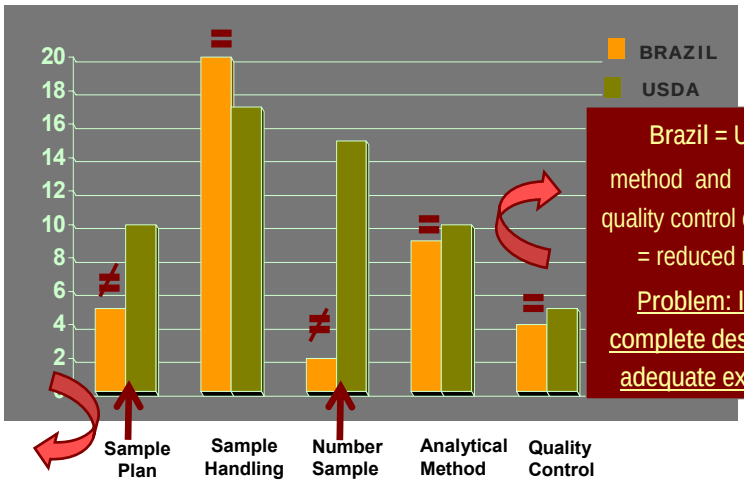
Categories/ Subclasses	Number of samples	Sampling plan	Sample handling	Analytical method	Quality control
	Mean (minimum - maximum)				
Flavonols	1 (1-9)	4 (2-11)	20 (17-20)	9 (9)	3 (0-4)
Flavones	1 (1-4)	4 (4-7)	20 (20)	9 (9)	4 (2-4)
Flavanones	1 (1)	4 (4)	20 (20)	9 (9)	3 (2-4)
Flavan-3-ols	1 (1-9)	5 (2-11)	20 (20)	9 (9)	4 (0-4)
Isoflavones	3 (1-20)	10 (6-11)	18 (17-20)	9 (9)	5 (0-8)
Anthocyanidins	2 (1-7)	5 (2-11)	20 (17-20)	9 (9)	3 (0-4)
Total	2 (1-20)	5 (2-11)	20 (17-20)	9 (9)	4 (0-8)

Maximum of 20 points

Validation?

Critical categories = with insufficient data or unknown information

Comparison of mean scores of flavonoid data from Brazil and from the USDA database



Brazil = USDA method and analytical quality control categories = reduced means

Problem: lack of complete description/ adequate execution

Critical categories in relation to USDA = insufficient or unknown data

Results of evaluation of quality of flavonoid data

► Total of foods = 197 (773 data of 28 compounds)

	Brazil	USDA
A	0 %	3 %
B	1 %	61 %
C	99 %	31 %
D	0 %	5 %
	773	1469

► Confidence Code B (above average) – 1% of data
C (average) – 99% of data
CC A (exceptional) and D (below average) were not assigned

► Main categories that received lower average marks were number of samples, sampling plan and quality control (2, 5 and 4, respectively).
The most part of the papers did not describe the methodology validation

► These results show that researchers need to be conscious about the importance of:

1. the number of samples and sampling plan
2. the complete description of all the process of methodology validation and analytical quality control

Flavonoid data of Brazilian foods to be included in TBCA-USP

Confidence Code (CC)		Number of flavonoids data
A	Exceptional	0
B	Above average	9 (1%)
C	Average	764 (99%)
D	Below average	0
	Total of data	773

Thank you!

Thank you!