FLAVONOID CONTENT OF SELECTED FOODS – A COMPARISON OF FOUR INTERNATIONAL COMPOSITION TABLES

*Mulubirhan Assefa Alemayohu MPH [1,2,3]; M.Elisabetta Zanolin PhD[1]; Lucia Cazzoletti PhD[1]; Liliya Chamitava PhD[1]; Veronica Mattioli PhD[1]; Jenny Plumb[4]; Peter GJ Burney MD[5]; Vanessa Garcia-Larsen PhD[6]

[1]PhD student at the Epidemiology & Medical Statistics Unit, University of Verona mulubirhanassefa.alemayohu@univr.it; [2] Assistant Professor School Public Health, Mekelle University, Ethiopia; [3]Visiting Assistant Professor, Program in Human Nutrition, Department of International Health, The Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA; [4]Food Databanks National Capability, Quadram Institute Bioscience, Norwich, UK; [5]National Heart and Lung Institute, Imperial College London, UK; [6]Program in Human Nutrition, Department of International Health, The Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA

Mulubirhan A. Alemayohu's PhD is funded through programme agreement No 754345 – INVITE

*Program in Human Nutrition's *Richard & Barbara Hall Student Award for Excellence in Nutrition Science.*

*Emerging Leaders in Nutrition Science Finalist

BACKGROUND

Population-based studies often rely on food composition tables (FCTs) to estimate intake of nutrients and bio-compounds. The content of flavonoids, widely found in plant-based foods, might differ depending on which FCT is being used.

OBJECTIVE

As part of the multinational Burden of Lung Disease (BOLD) survey, this study investigated the variations in the content of flavonoids of foods included in BOLD's food frequency questionnaire (FFQ), and their comparability, using four international FCTs

METHODS

- Four FCTs were selected for their comparable data on five subclasses of flavonoids: 1) the USDA (American), 2) The BioActive Substances in Food Information System (eBASIS; European); 3) the Indian Food Composition (IFCT), and 4) Phenol-Explorer (European).
- Flavonoid estimates were derived for all foods available in each table, and comparisons were carried out for foods common between tables considering USDA and Phenol Explorer as reference tables. Bias percentage, 95% limits of agreement, and intra-class correlation coefficients (ICCs; 95% confidence intervals [95%CI]) were estimated. ICC was categorized as indicating low (<0.5), moderate (0.50-0.75), good (0.75-0.90), or excellent (>0.90) reliability.

RESULTS

- The USDA FCT had the largest No of foods available with flavonoid content (n=122), and there were 40 foods common to all four FCTs. The IFCT showed the lowest total flavonoid content (including common sub-classes) whilst eBASIS the highest (**Figure 1**)
- Phenol Explorer and eBASIS showed moderate-to-good reliability for total flavonoids and anthocyanins, and low reliability for other sub-classes, whilst the reliability with IFCT was good for flavanones only (**Table 1**). Compared to Phenol-Explorer, eBASIS and IFCT overestimated content of most flavonoid subclasses (**Table 1**).
- There was good-to-excellent reliability between USDA and Phenol-Explorer for proanthocyanidins and flavanones (ICC 0.89; 95%CI 0.80, 0.94; and ICC 0.94; 95%CI 0.86, 0.97, respectively). All three tables showed low-to-moderate reliability in total flavonoid estimates when compared to the USDA table (**Table 2**)

Figure 1. Total flavonoids content of 40 foods common to all the food composition tables studied

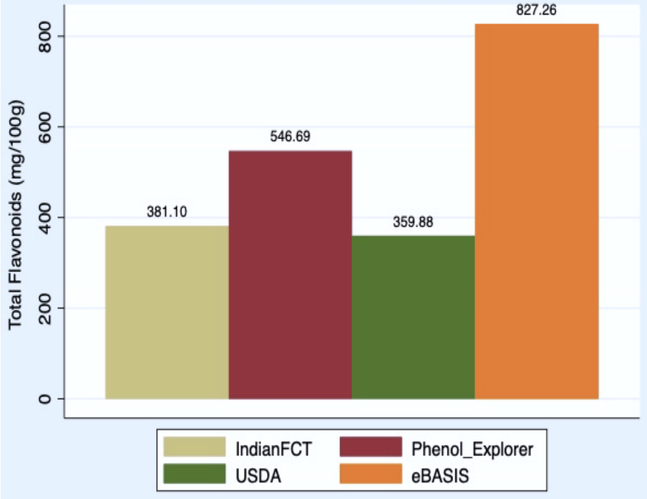

Table 1. Percentage of Bias and intra-class correlation coefficients (95%CI) estimated for flavonoid contents of selected foods among composition tables under study (Phenol Explorer as reference)

Flavonoids	% bias		Intraclass correlation coefficients (95%CI)	
	eBASIS	IFCT	eBASIS (n=60)	IFCT (n=51)
Total Flavonoids	9.4	54.9	0.67(0.51, 0.79)	0.35(0.12, 0.54)
Anthocyanidins	55.3	-	0.83 (0.63, 0.93)	-
Flavanols	31.6	17.8	-0.01 (-0.12, 0.10)	0.07(-0.27, 0.39)
Flavanones	11.1	14.1	0.31(-0.24, 0.71)	0.82(0.19, 0.97)
Flavones	89.8	87.3	0.41(0.22, 0.57)	0.16 (-0.22, 0.49)
Flavonols	77.9	63.1	0.24 (0.05, 0.41)	0.03(-0.10, 0.16)
Proanthocyanidins	-117.1	-	0.04(-0.04, 0.11)	-

% bias- Flavonoid estimate difference divided by the mean of estimates
n- number of food items common for Total Flavonoid. This can vary among subclasses.
Note: Isoflavones have been removed for insufficient data for this comparison

Table 2 Percentage of Bias and intra-class correlation coefficients (95%CI) estimated for flavonoid content of selected foods across composition tables under study (USDA as reference)

Flavonoids	% bias			Intraclass correlation coefficients (95%CI)		
	eBASIS	IFCT	Phenol Explorer	eBASIS (n=76)	IFCT (n=61)	Phenol Explorer (n=88)
Total Flavonoids	9.6	48.8	-0.39	0.42 (0.27, 0.55)	0.48 (0.36, 0.59)	0.50 (0.34, 0.62)
Anthocyanidins	63.4	-	32.2	0.26 (0.13, 0.39)	-	0.12 (-0.38, 0.56)
Flavanols	26.4	12.6	-4.6	-0.02 (-0.16, 0.13)	0.65 (0.32, 0.85)	0.03 (-0.04, 0.10)
Flavanones	15.1	65.4	-27.9	0.35 (-0.10, 0.68)	0.82 (0.56, 0.93)	0.94 (0.87, 0.97)
Flavones	61.6	102.1	2.0	0.33 (0.29, 0.37)	0.37 (0.20, 0.52)	0.59 (0.47, 0.69)
Flavonols	51.6	27.3	3.8	0.003 (-0.07, 0.08)	0.26 (0.08, 0.43)	0.21(0.001, 0.41)
Isoflavones	78.9	-81.9	-0.57	0.71(0.66, 0.76)	0.44 (0.26, 0.58)	0.17 (-0.22, 0.51)
Proanthocyanidins	-133.2	-	-0.23	0.03 (-0.05, 0.10)	-	0.89 (0.80, 0.94)

% bias- Flavonoid estimate absolute difference divided by the mean of estimates
n- number of food items common for Total Flavonoid. This can vary among subclasses

CONCLUSIONS

Food content of flavonoids varied considerably across international tables. There was a high heterogeneity in the levels of agreement (%bias and ICC) across flavonoid sub-classes. These differences should be taken into consideration when deriving flavonoid intake estimates in population-based surveys.