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USDA develops a database for flavonoids to assess dietary intakes

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Abstract

The Nutrient Data Laboratory (NDL) of ARS/USDA issued "USDA Database for the Flavonoid Content of Selected Foods, Release 3.1" in 2012. A complementary database for the "USDA Database for the Isoflavone Content of Selected Foods, Release 2" was issued in 2008. To support the assessment of the flavonoids intake these two databases were expanded to comprise approximately 2900 foods from USDA's National Nutrient Database for Standard Reference (SR). Various estimation techniques, long established for calculating unavailable values in SR, were used to complete this expanded flavonoids database for a total of 30 compounds for each of 2900 foods.

Keywords: monomeric flavonoids; calculation techniques; database expansion

1. Introduction

There is a considerable interest in the scientific community about the potential benefits of flavonoids in reducing the risk of chronic diseases including cardiovascular diseases [1]. Evidence supporting cancer prevention effects of flavonoids is limited and conflicting, but some organ-specific associations have been reported. Lam et al. [2] observed an inverse relationship between quercetin-rich food intake and lung cancer in Italy, while Ekström et al., [3], observed protection against stomach cancer with high intakes of quercetin in a population study in Sweden. Flavonoids, including isoflavones, are secondary plant metabolites and are found mainly in fruits, vegetables, soybeans and some grains. The USDA database for the flavonoid content of selected foods, Release 3.1 (FDB 3.1) [4], contains values for up to 27 monomeric flavonoid compounds in five subclasses of flavonoids for 500 foods. The isoflavones database released by the USDA in 2008 (IDB 2) [5] contains values for three prominent compounds (daidzein, genistein, and glycitein) for 557 foods. The Nutrient Data Laboratory (NDL) developed a new

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database by expanding these two databases to include approximately 2900 food items in the subset of USDA's National Nutrient Database for Standard Reference (SR) used as the foundation to develop USDA Food and Nutrient Database for Dietary Studies (FNDDS).

Fruits and vegetables are the main sources of dietary flavonoids. Some grains like barley and buckwheat contain some catechins and flavonols. Isoflavones are mainly present in soybeans and soybean products such as soy flour, soymilk, tofu etc. Animal products such as meat/poultry do not contain flavonoids, unless flavonoid containing ingredients are added. Every food (fruit or vegetable) does not contain every compound from all subclasses. Quercetin, a flavonol, is the most ubiquitous flavonoid. Most of the foods contain compounds predominantly from one or two subclasses only. For example: citrus fruits contain mainly flavanones, while tea contains mainly flavan 3-ols. The six subclasses of flavonoids and the compounds in the subclasses included in the two USDA databases and some of their food sources are presented below in Table 1.

Table 1.Flavonoid subclasses and major food sources

Subclass	Compounds	Color	Food Sources
Anthocyanidins	Cyanidin, Delphinidin, Malvidin, Pelargonidin, Peonidin, Petunidin	Blue, Red, Violet	Berries (blueberries, Red grapes, Strawberries)
Flavanols (Flavan 3-ols)	Catechin, Epicatechin, Gallocatechin, Epicatechin gallate, Epigallocatechin gallate, Theaflavins, Thearubigins	Colorless	Apples, Tea, Beer
		Yellow	
Flavanones	Hesperetin,	Colorless	Citrus fruits
	Naringenin, Eriodictyol,	Pale Yellow	Oranges, Grapefruit
Flavonols	Quercetin, Kaempferol, Myricetin, Isorhamnetin	Pale Yellow	Onions, Broccoli, Kale, Apple, Tea, Buckwheat
Flavones	Apigenin, Luteolin	Pale Yellow	Herbs, Parsley, Thyme, Celery
Isoflavones	Daidzein, Genistein, Glycitein	Colorless	Legumes (soybeans), soybean products (tofu, soymilk)

Yao et al., Plant Foods for Human Nutrition, 2004, 59:113-122.

2. Method

There are approximately 500 and 550 foods in FDB 3.1 and IDB 2 respectively. The available analytical values for the compounds for each food from these databases were matched by using the Nutrient Data Bank (NDB) number, a five digit numerical code used in the SR for a unique food item. These two databases were used as the foundation to calculate all the unavailable values. The FNDDS requires complete profile for all 30 compounds for each food in the subset of SR. It was, therefore, necessary to calculate values for many flavonoid compounds for which analytical values were not available.