Produce Classification: Considerations for Improving Animal Diet Formulation

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Commercially available produce items differ nutritionally from the wild plant parts many exotic herbivorous and omnivorous animals would naturally consume; most commercial produce items, having been bred for human consumption, are much lower in fiber and higher in sugar than wild (un-cultivated) plant foods (Milton, 1999). These differences present a concern when formulating diets for captive exotic animals, as over-reliance on higher-sugar, higher-starch, and lower-fiber produce may contribute over time to the development of health issues and chronic disease in these animals (dental health issues in colobus and obesity in numerous primate species (Plowman 2013), social anxiety and undesirable behavior in lemurs and callitrichids (Britt et al 2015; Cabana and Plowman, 2014; Plowman 2015), reduced activity level and regurgitation and reingestion in great apes, and prediabetes and diabetes in orangutan and chimpanzee (Cabana et al. 2018); and other metabolic problems (Treiber presentation at workshop, Appendix I)). One significant challenge in using commercial produce in zoo diets is how to classify or categorize these foods to best mimic the types of plant foods naturally consumed by exotic species, to maximize the nutritional content of the diet and minimize adverse impacts on the health of these animals. As seen in Tables 1 and 2, there exist some significant differences between wild type foods and cultivated produce. However, using the known data to help make decisions based on nutrient similarities rather than nomenclature can help ensure the outcome is the most appropriate available. The information presented in these tables are pulled from several sources that can each provide additional insights into these food items. The authors encourage readers to explore these for a greater review of the available information, though caution drawing conclusions about the significance of an individual food item to a species (i.e. there may exist foods in the wild that contain higher sugar levels than some cultivated fruits, however, it would be irresponsible to conclude that that level is reflective of the diet as a whole, and vice versa).

The goal of the workshop was to devise a produce classification scheme that will enable keepers or commissary staff to rotate and substitute produce items as needed while maintaining the desired nutritional content of an animal's overall diet.

Before the conference, seven questions were sent out to the nutrition list serve. Twenty-one responses were received. Eighty-one percent formulate diets with sugar in mind while 91% consider starch concentration important and 100% factor in fiber. The objectives most important when formulating diets were reducing sugar, starch and energy, increasing fiber, and always considering food items used for training. An equal number of respondents were using culinary/common-use and 'other' categorizations systems for produce, while only 14% were using botanical categorization. Respondents varied in the rationales provided for the categorization systems they were using; examples included utilizing nutrient composition, 'it was how I was taught', using culinary or human food systems, and 'what is optimal for the animal's needs.' Finally, most respondents reported they had not made any changes to the way they categorized produce at their institutions.

Fruits and vegetables are defined and categorized in different ways, which has different implications for the resulting nutrient profiles of those categories. Botanically, a fruit is defined as the seeds and surrounding tissues of a plant, whereas the more common culinary use of the term 'fruit' refers to pulpy seeded tissues that have a sweet or tart taste. Thus, botanical fruits include foods like cucumber, eggplant, bell pepper, okra and squash that are commonly thought of as vegetables in a culinary framework. The botanical definition of vegetable is plant parts other than fruits (leaves, stems, stalks, flowers, roots, tubers, and bulbs), whereas the common culinary definition includes some fruits and seeds mentioned above that are considered less sweet or tart than fruits. The culinary (common-use) category of vegetables may distinguish between leafy and non-leafy vegetables, and/or starchy and non-starchy vegetables depending on the purpose (for example, dietetic categorization used in human nutrition for diabetes management distinguishes among starchy and non-starchy vegetables). The culinary vegetable category also includes mushrooms (a fungus) and corn (cereal grain) based on common use in human diets. Nutritionally, most commercially available fruits are higher in energy and sugar, and lower in fiber than most commercially available vegetables. Among vegetables, the different plant parts offer different nutrient profiles; leaves are considered the most nutritious part of plants (good source of fiber, folate, carotenoids, vitamin C, flavonoids and minerals), stems and stalks are high in fiber, roots and tubers tend to be high in starch, and seeds are good sources of protein, starch, some fats, vitamins B6 and folate, iron and other minerals.

Other categorization schemes include the USDA MyPyramid system (fruits and five categories of vegetables: dark green, orange, dry beans/peas, starchy and other), color (red/orange/yellow, green, blue/purple/black, and white/tan/brown based on vitamin and phytonutrient content) (IOM, 2014; IOM 2015), botanic family, and the Pennington and Fisher (2009) system based on nutrients of significance for human health (dark green leafy vegetables; cabbage family vegetables; lettuces; Allium family bulbs; legumes; deep orange/yellow fruits, roots and tubers; citrus family fruits; tomatoes and other red vegetables and fruits; red/blue/purple berries; and other). The number of different classification systems and the differences among them illustrate the challenges that nutritionists face in selecting a system that meets both nutritional/health and operational goals.

The above classification systems have their own advantages and disadvantages for use in captive animal diets. The botanical system is botanically accurate according to plant tissue function, so most items within a category share similar nutritional content. However, this system does not necessarily distinguish fruits and some vegetables by sugar, starch, or energy (i.e. low-sugar/low-calorie tomato categorized with high-sugar/high-calorie banana), which may result in unintended fluctuations in those parameters if items are freely substituted within categories. The botanical system may also be less familiar or intuitive to staff preparing or feeding diets. The common-use, or culinary systems, feature categories more familiar to most lay people, and items within categories also share similarity in nutrient content, depending on how vegetables are sub-categorized. This system features a narrower sugar and energy range among fruits, but does not necessarily distinguish vegetables by sugar, starch or energy content. The USDA MyPyramid system has categories familiar to most lay people and considers common nutrient content within categories (including energy content for vegetable categories). But this system considers human consumption patterns rather than those of animals. The Pennington and Fisher system similarly considers nutrients of significance in its category designation but is much more complicated with 10 categories and does not necessarily distinguish foods by sugar, starch or energy within some categories. The color system is easy to use visually and considers some micronutrients and phytonutrients but does not consider macronutrient or energy differences within groups.

Besides operational considerations for ease of use within an institution, the main consideration for which system to use should be how it affects the nutritional characteristics of diets prepared using the system. Table 3 features comparisons of the macronutrient content (dry-matter basis [DMB]) of average produce items for each category within the most commonly used systems (botanic, culinary/common-use, and USDA). Despite the differences in how certain foods are classified among systems, the average energy, sugar and fiber values for fruits under each system are very similar; the average sugar content of

botanic fruits is a little lower and average fiber content a little higher than for the other two systems, likely due to inclusion of low-sugar/higher-fiber foods like cucumbers, eggplant, peppers, and okra in that system. Comparing overall vegetables among these systems, they have very similar average energy, starch and fiber contents. When vegetables are broken down into the comparable sub-categories for each system, there are more noticeable differences among the systems. Leafy vegetables appear similar among the systems (using USDA 'dark green vegetables' as most representative of this category for that system) except for apparent lower average sugar content and slightly higher average starch using the USDA system. Root/tuber/bulb or starchy vegetables are similar across systems in average energy content but appear lower in average sugar and dietary fiber and higher in average starch content under the USDA system than the other two systems. The equivalent category of 'other' non-starchy vegetables is comparable among the systems in average energy, sugar, starch, and fiber contents, except for botanic flowers appearing much lower in sugar, botanic stalks/stems appearing lower in starch, and USDA orange vegetables appearing lower in NDF and dietary fiber. As expected, root or starchy vegetables have higher average energy and starch content than other vegetable categories using any of these systems, while leafy vegetables feature less sugar and more fiber using any of these systems. The category of "other" non-starchy vegetables is similar in average energy and fiber content to the overall average of all vegetables using any system.

When common commercially available produce items are ranked, regardless of classification system, by energy content (DMB), the ten highest-energy items are split between fruits and the equivalent of starchy vegetables (falling under different categories in each system) (e.g. seed/pod, other vegetable, starchy vegetable and dry beans/peas). The ten lowest-energy items are mostly leafy vegetables. When sorted by total sugar content (DMB), the ten highest-sugar items are all fruits using any of the above three systems, while the lowest-sugar items are a mix of leafy vegetables, beans and other items (avocado, alfalfa sprouts, plantain), spread among multiple categories using any system. When sorted by starch content (DMB), the ten highest-starch items are split among root or starchy vegetables (category name varies by system) and fruits (whole lemon, whole plum, whole lime, and plantain). The ten lowest-starch items are split among multiple categories using any of the above classification systems (leaf, flower, bulb, stem/stalk, root/tuber and fruit using botanical system; leafy vegetable, other vegetables and fruit using culinary system; dark green vegetable, other vegetable and fruit using USDA). When sorted by NDF as a measure of fiber (DMB), the ten highest-fiber items are split between the "other" vegetable and fruit categories using the culinary and USDA systems, and split

among more categories using the botanical system (fruit, stem/stalk, flower, seed/pod). The lowest-fiber foods are almost all fruits according to any of the systems.

From the comparison of these three systems, there do not appear to be remarkable differences among them in their comparable categories; many of the foods highest and lowest in key parameters (energy, sugar, starch and fiber) are in similar categories using any of the above three systems. This suggests that any of these systems could be used for produce classification with similar outcomes in desired nutritional parameters of animal diets, which will allow for more weight to be given to operational considerations or preferences in choosing a system.

In addition to the above systems, one produce classification scheme currently in use at the Philadelphia Zoo, designed by their nutritionist as an example produce classification scheme for all diets containing produce, categorizes produce by sugar content (low-sugar = <5%; moderate-sugar = 6-8.5%; high-sugar = ≥ 9%) (Barbara Toddes, presented at workshop) (Table 4). This system also considers the sugar-to-fiber ratio of items, with a goal of the overall diet at no more than a 1:1 ratio, and items with a ratio of 5:1 considered equivalent to the high-sugar category. This system is reportedly working well, including achievement of buy-in from animal care staff.

Conclusions:

1) Wild and cultivated produce have some significant differences that suggest food choices for captive wild animals should be made based on their nutritional composition rather than their typical nomenclature or categorization.

2) Different systems may work for different institutions depending on their needs and focus/goals in diet formulation.

3) Produce categories can help simplify diet preparation through regular or temporary substitution of items within a category with variable impact on overall diet quality/content but should not take the place of formal diet assessment/evaluation, especially for animals being managed for weight or health conditions.

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Appendix I: Carbohydrate & Consequences (K Treiber, presentation at workshop)

Carbohydrates are critical to life as they are the primary energy source for the central nervous system and fetal development. Thus, life is adapted to seek out carbohydrates which are limited (or un-accessible) in nature. Insulin resistance is one adaptive strategy to conserve carbohydrates (Kronfeld et al., 2004). In captivity, the overabundance of nonstructural carbohydrates (NSC = sugar + starch) is mismatched to carbohydrate-sparing adaptations, and potentiates diabetes, inflammation, bone and joint dysfunction, reproductive failure and cardiovascular disease (FAO/WHO, 1997). The negative effects of NSC may derive from their high proportion in the diet (replacing other important macronutrients) or from their rapid intake and digestion, particularly in concentrated pelleted or grain meals. NSC can overwhelm the system metabolically (from high glycemic response) or digestively (causing inflammation, gas production and acidosis) (Hoffman et al., 2001). Even "high fiber" pelleted feeds may be rapidly consumed and have small particle size, resulting in rapid digestion and exaggerated metabolic responses compared to high-fiber items like forage or wild fruits which are consumed and processed slowly. Carbohydrates range in complexity from simple sugars to insoluble fibers, which require microbial fermentation (Englyst and Englyst, 2005). Captive species also range in their adaptations to consume and digest complex carbohydrates, thus the optimal complexity (i.e. fiber type) should be matched to the species to promote an optimal microbial environment and avoid gastrointestinal distress (Kienzle, 1994). NSC in diets may be managed by absolute amount (glycemic load), proportionally (e.g. sugar per kcal) or consumption time (e.g. mixing with higher fiber feeds). High NSC "treat" items should serve a behavioral purpose or be removed.

Table 1. Comparison of nutritional content of commercially available fruits from botanic, culinary and USDA classification systems with botanic fruits consumed by free-ranging animals (dry-matter basis).

Food Item	%DM	Protein (%)	Fat (%)	Sugar (%)	Starch (%)	NDF (%)	ADF (%)
AVERAGE FRUIT (BOTANIC)	16.6	7.6	4.1	49.2	15.0	14.4	9.9
AVERAGE FRUIT (CULINARY)	17.9	6.3	4.1	52.3	15.0	13.5	9.2
AVERAGE FRUIT (USDA)	18.3	6.2	4.1	51.4	16.3	13.4	9.0
BIRD, CIVET, FRUIT BAT, MACAQUE FRUITS (PULP) (KO ET AL.)[1,2]	-	-	-	34.9 (4.8-59.53)	-	-	-
HAWAIIAN CROW FRUITS (WHOLE)[2]	19.02 (5.95-38.07)	6.88 (1.95-16.32)	4.9 (0.58-15.8)	-	-	-	38 (17.27-55.26)
BLACK BEAR FRUITS (WHOLE)[2]	22.9 (8.63-31)	7.23 (2.99-14.82)	3.67 (0.52-55.04	33.4 (10.57-67.97)	-	-	-
ORANGUTAN FRUITS (WHOLE) (Knott)	-	4-12	0-4	-	-	50-65	-
ORANGUTAN FRUITS (PULP) (Knott)	-	5-13	0-18	-	-	9-77	-
GORILLA FRUITS (Popovich & Dierenfeld)	11.1-66	0.9-13.8	0.2-20.9	13.1-62.4	-	55.1-82.3	4.8-66.5
LT MACAQUE FRUITS (Dierenfeld & McCann)[3]	-	4.9-6.9	-	16.5-17.6	-	44.8-54.4	-
RINGTAIL LEMUR FRUITS (Dierenfeld & McCann)[3]	-	8.4-15.0	-	12.8-22.2	-	40.6-47.4	-

[1]Value is sum of measured glucose, fructose, and sucrose.

[2]Average followed by range in ( ).

[3]Range of means of data across multiple seasons

Table 2. Comparison of nutritional content of commercially available vegetables from botanic, culinary and USDA classification systems with botanic plant foods consumed by free-ranging primates (dry-matter basis)

Food Item	%DM	Protein (%)	Fat (%)	Sugar (%)	Starch (%)	NDF (%)	ADF (%)
AVERAGE FLOWER (BOTANIC)	11.2	24.1	2.7	15.5	14.1	21.7	17.5
ORANGUTAN FLOWERS (Knott)	-	13-Oct	3-Feb	-	-	46-57	-
RINGTAIL LEMUR BUDS (Dierenfeld & McCann)*	-	10.3-18.2	-	-		36.5-52.0	-
AVERAGE LEAF (BOTANIC)	13.7	23.1	3.7	16.7	13.7	18.1	13.5
AVERAGE LEAFY VEG (CULINARY)	8.3	24.4	4	17.8	12.8	18.1	13.8
AVERAGE DARK GREEN VEG (USDA)	15.9	23.2	4	12	14.8	18.3	14.3
ORANGUTAN LEAVES (Knott)	-	19-Dec	2-Jan	-	-	21-72	-
GORILLA LEAVES (Popovich & Dierenfeld)	11.5-50	10.6-32.2	0.6-13.5	0.2-8.0	-	21.3-72.6	16.5-58.0
GORILLA SHOOTS (Popovich & Dierenfeld)	7.6-14.3	8.4-13.8	2.1-3.8	-	-	63.3-80.4	48.4-54.1
LT MACAQUE LEAVES (Dierenfeld & McCann)*	-	6.9-9.8	-	-		61.7-64.6	-
RINGTAIL LEMUR LEAVES (Dierenfeld & McCann)*	-	11.6-15.3	-	-		38.1-47.2	-
AVERAGE STEM/STALK (BOTANIC)	7	33.7	4.2	28.3	8.2	19.8	14.7
AVERAGE ALL VEG (CULINARY)	12.3	19	3.3	26.2	17.2	18.5	18.5
AVERAGE OTHER VEG (CULINARY)	13.1	18.8	3.4	28.3	16.1	19.6	12.9
AVERAGE OTHER VEG (USDA)	8.7	19.5	3.1	33.9	10.9	18.4	12.8
GORILLA SHOOTS (Popovich & Dierenfeld)	7.6-14.3	8.4-13.8	2.1-3.8	-	-	63.3-80.4	48.4-54.1
GORILLA STEMS/BARK (Popovich & Dierenfeld)	5.1-45.6	2.6-17.1	0.4-5.7	0.5-31.0	-	34.7-81.9	34.8-61.8
ORANGUTAN PITH (Knott)	-	7-Mar	0-2	-	-	51-82	-
ORANGUTAN BARK (Knott)	-	17-Jun	0-8	-	-	53-73	-
LT MACAQUE WOOD (Dierenfeld & McCann)*	-	2.8-9.7	-	-		62.1-83.6	-
RINGTAIL LEMUR WOOD (Dierenfeld & McCann)	-	2.0-4.0	-	-		73.4-91.6	-
AVERAGE ROOT/TUBER (BOTANIC)	14.3	9.4	1.2	31.6	27	14	8.5
AVERAGE ROOT VEG (CULINARY)	16.1	9	1.1	32.3	31.5	13.7	7.6
AVERAGE ORANGE VEG (USDA)	10.9	11.8	3.7	32.5	10.2	15.6	13.4
AVERAGE STARCHY VEG (USDA)	21.9	12.2	1.7	18.9	41.7	20.7	7.5
AVERAGE SEED/POD (BOTANIC)	22.9	21.1	3.1	15.8	27.8	28.1	14.5
AVERAGE DRY BEAN/PEA (USDA)	29.9	23.9	3.5	7.4	-	30.1	9.6
ORANGUTAN SEEDS (Knott)	-	19-Feb	0-52	-	-	Sep-84	-
GORILLA SEEDS (Popovich & Dierenfeld)	21.4-56.9	4.1-18.4	0.3-12.0	2.3-25.7	-	-	43.1-78.6
LT MACAQUE SEEDS (Dierenfeld & McCann)*	-	3.0-11.1	12.4-23.8	6.3-21.3		8.9-53.7	-
RINGTAIL LEMUR SEEDS (Dierenfeld & McCann)*	-	3.0-5.5	18.8	11.1		8.9-32.5	-

* Range of means of data across multiple seasons

Table 3. Comparison of nutritional content of commercially available produce according to botanic, culinary and USDA classification systems (DM basis).

Food Item	%DM	Energy (kcal/kg)	Protein (%)	Fat (%)	CHO (%)	Sugar (%)	Starch (%)	NDF (%)	ADF (%)	Dietary Fiber (%)
AVERAGE FRUIT (BOTANIC)	16.6	3552.9	7.6	4.1	84.9	49.2	15.0	14.4	9.9	18.2
AVERAGE FRUIT (CULINARY)	17.9	3623.3	6.3	4.1	87.6	52.3	15.0	13.5	9.2	18.0
AVERAGE FRUIT (USDA)	18.3	3620.7	6.2	4.1	87.7	51.4	16.3	13.4	9.0	17.8

Food Item	%DM	Energy (kcal/kg)	Protein (%)	Fat (%)	CHO (%)	Sugar (%)	Starch (%)	NDF (%)	ADF (%)	Dietary Fiber (%)
AVERAGE ALL VEG (BOTANIC)	12.1	3341.3	21.4	3.9	67.7	22.0	20.5	18.3	12.5	25.0
AVERAGE ALL VEG (CULINARY)	11.0	3319.5	20.6	4.2	68.3	24.2	18.6	18.5	12.7	23.7
AVERAGE ALL VEG (USDA)	11.0	3319.5	20.6	4.2	68.3	24.2	18.6	18.5	12.7	23.7
AVERAGE LEAF (BOTANIC)	13.7	2817.1	23.1	3.7	54.7	16.7	13.7	18.1	13.5	27.2
AVERAGE LEAFY VEG (CULINARY)	8.3	2987.3	24.4	4.0	57.7	17.8	12.8	18.1	13.8	28.9
AVERAGE DARK GREEN VEG (USDA)	15.9	2753.6	23.2	4.0	51.9	12.0	14.8	18.3	14.3	26.7
AVERAGE BULB (BOTANIC)	11.2	3509.9	12.3	2.3	81.8	39.6	7.9	11.1	7.3	15.5
AVERAGE ROOT/TUBER (BOTANIC)	14.3	3604.6	9.4	1.2	82.7	31.6	27.0	14.0	8.5	23.7
AVERAGE ROOT VEG (CULINARY)	16.1	3604.5	9.0	1.1	83.3	32.3	31.5	13.7	7.6	19.3
AVERAGE STARCHY VEG (USDA)	21.9	3721.2	12.2	1.7	82.0	18.9	41.7	20.7	7.5	14.1
AVERAGE FLOWER (BOTANIC)	11.2	3150.3	24.1	2.7	64.8	15.5	14.1	21.7	17.5	28.5
AVERAGE STEM/STALK (BOTANIC)	7.0	3195.1	33.7	4.2	53.3	28.3	8.2	19.8	14.7	27.8
AVERAGE OTHER VEG (CULINARY)	13.1	3400.0	18.8	3.4	70.3	28.3	16.1	19.6	12.9	21.8
AVERAGE ORANGE VEG (USDA)	10.9	3302.0	11.8	3.7	82.6	32.5	10.2	15.6	13.4	14.2
AVERAGE OTHER VEG (USDA)	8.7	3329.0	19.5	3.1	69.6	33.9	10.9	18.4	12.8	25.0
AVERAGE SEED/POD (BOTANIC)	22.9	3764.8	21.1	3.1	70.4	15.8	27.8	28.1	14.5	19.6
AVERAGE DRY BEAN/PEA (USDA)	29.9	3896.7	23.9	3.5	68.2	7.4	-	30.1	9.6	17.2

Table combines USDA database values with Schmidt (2005) values (DM sugars, starch, NDF, ADF added to USDA data & converted to DM basis)

Table 4. Common commercially available produce items categorized by sugar content and sugar-to-fiber ratio (as-fed basis)

Food Item	Source	Energy (kcal/g)	Total Sugar	Total Dietary Fiber	Sugar:Fiber Ratio	Total Carbohydrate	Estimated Starch
High Sugar (> 9%)							
Grapes (red or green)	NDB #09132	1	15.50%	0.90%	15:01	18.10%	1.70%
Mango	NDB#09176	0.5	13.70%	1.60%	8.5:1	14.98%	-0.30%
Bananas	NDB #09040	1	12.20%	2.60%	4.7:1	22.84%	8.00%
Apples	NDB #09003	0.5	10.40%	2.40%	4.3:1	13.81%	1.00%
Pears	NDB #09252	0.5	9.80%	3.10%	3.2:1	15.23%	2.30%
Oranges	NDB #09203	0.5	9.10%	2.40%	3.8:1	11.54%	0.00%
Kiwi	NDB#09148	0.5	9.00%	3.00%	3:01	14.66%	2.70%
Moderate Sugar (6 - 8.5%)							
Blueberries	NDB #09054	0.3	8.50%	2.70%	3.1:1	12.17%	1.00%
Yellow Peaches	NDB#09236	0.5	8.40%	1.50%	5.6:1	9.54%	-0.40%
Feijoa	NDB#09334	1	8.20%	6.40%	1.2:1	15.21%	0.60%
Mulberries	NDB#09190	0.5	8.10%	1.70%	5:01	9.80%	0.00%
Honeydew Melon	NBD#09184	0.5	8.10%	0.80%	10.2:1	9.09%	0.20%
Papaya	NBD #09226	0.5	7.80%	1.70%	4.6:1	10.82%	1.30%
Grapefruit	NDB #09116	0.5	7.30%	1.10%	6.7:1	8.41%	0.00%
Beets	NDB #11080	0.5	6.80%	2.80%	2.4:1	9.56%	0.00%
Water Melon	NBD #09326	0.25	6.20%	0.40%	15.5:1	7.55%	1.00%
Peas, Cooked	NDB#11305		5.93%	5.50%	1.2:1	15.63%	4.20%
Low Sugar (<5%)							
Peas	NDB #11312	1	5.00%	4.50%	1.1:1	13.62%	4.10%
Carrots	NDB #11124	0.5	4.70%	2.80%	1.7:1	9.58%	2.00%
Carrots, Cooked	NDB#11125		3.40%	3.00%	1.2:1	8.22%	1.70%
Rutabaga	NDB#11435	0.3	4.50%	3.20%	1.4:1	8.62%	1.00%
Red Peppers	NBD#11821	0.3	4.20%	2.10%	2:01	6.03%	-0.30%
Carambola (Starfruit)	NBD#09060	0.5	4.00%	2.80%	1.4:1	6.73%	-0.10%
Green Peppers	NBD#11333	0.2	2.40%	1.70%	1.4:1	4.64%	0.50%
Canned Pumpkin	NBD#11424	0.34	3.30%	2.90%	1.1:1	8.09%	1.90%
Green Cauliflower	NDB#11965	0.3	3.00%	3.20%	0.94:1	6.09%	-0.10%
Kohlrabi	NDB#11241	0.27	2.60%	3.60%	0.72:1	6.20%	0.00%
Tomato	NDB #11529	0.2	2.60%	1.20%	2.2:1	3.89%	0.10%
Eggplant	NDB #11209	0.25	2.40%	3.40%	0.7:1	5.88%	0.10%
Summer Squash Scallop	NDB# 11475	0.2	2.40%	1.20%	2:01	3.84%	0.30%
Brussels Sprouts	NDB #11098	0.5	2.20%	3.80%	0.58:1	8.95%	3.00%
Summer Squash	NDB# 11641	0.2	2.20%	1.10%	2:01	3.35%	0.10%
Green Beans	NDB #11060	0.3	2.20%	2.60%	0.85:1	7.54%	2.70%
Butternut squash, Raw	NDB#11485		2.20%	2.00%	1.1:1	11.69%	7.49%

Canned Butternut Squash	Label FM	0.39	2.00%	3.00%	0.5:1	16.00%	11.00%
Cauliflower	NBD#11135	0.25	2.00%	2.10%	1:01	4.97%	0.80%
Asparagus	NDB#11011	0.2	1.90%	2.10%	0.9:1	3.88%	-0.10%
Celery	NDB #11143	0.2	1.80%	1.60%	1.1:1	2.97%	-0.50%
Jicama	NDB#11603	0.38	1.80%	4.90%	0.37:1	8.82%	2.10%
Cucumber	NBD#11205	0.15	1.70%	0.50%	3.4:1	3.63%	1.50%
Nopalitos Cactus	NDB#45201340	0.15	1.00%	2.00%	0.5:1	3.00%	0.00%
Broccoli	NDB #11740	0.3	1.50%	2.30%	0.65:1	5.06%	1.30%
Tree Mulberries	DairyOne S21758750	0.94	1.20%	6.10%	0.2:1		
Rhubarb	NDB#09307	0.2	1.10%	1.80%	0.61:1	4.54%	1.60%
Canned Beans	NDB #16316	1	0.20%	6.90%	0.03:1	16.55%	9.40%
Starch > 3%							
Winter Squash (4.89% SE)	NBD#11643	0.3	2.20%	1.50%	1.5:1	8.59%	4.90%
Parsnips (8.29% SE)	NDB#11298	1	4.80%	4.90%	1:01	17.99%	8.30%
Leeks (8.4% SE)	NDB #11246	0.61	3.90%	1.80%	2.2:1	12.59%	6.90%
Potatoes, white (12.16% SE)	NDB #11354	1	1.20%	2.40%	0.48:1	15.71%	12.20%
Sweet Corn (bagged) (13.1% SE)	NDB #11900	1	3.20%	2.70%	1.2:1	19.02%	13.10%
Yam (23.28% SE)	NDB #11601	1	0.50%	4.10%	0.12:1	27.88%	23.30%
Greens							
Kale	NDB #11233	0.5	2.30%	3.60%	0.63:1	4.42%	-1.40%
Lettuce (iceberg)	NDB #11252	0.15	2.00%	1.20%	1.6:1	2.97%	-0.20%
Mustard Greens	NDB11270	0.25	1.30%	3.20%	0.41:1	4.67%	0.20%
Lettuce (cos or romaine)	NDB #11251	0.15	1.20%	2.10%	0.57:1	3.29%	0.00%
Swiss Chard	NDB#11147	0.2	1.10%	1.60%	0.68:1	3.74%	1.00%
Turnip Greens	NDB#11568	0.3	0.80%	3.20%	0.2:1	7.13%	3.10%
Lettuce (green leaf)	NDB #11253	0.15	0.80%	1.30%	0.6:1	2.87%	0.80%
Dandelion Greens	NDB#11207	0.5	0.70%	3.50%	0.2:1	9.20%	5.00%
Chicory Greens	NBD#11152	0.25	0.70%	4.00%	0.18:1	4.70%	0.00%
Lettuce (red leaf)	NDB #11257	0.15	0.50%	0.90%	0.53:1	2.26%	0.90%
Beet Greens	NDB#11086	0.2	0.50%	3.00%	0.16:1	4.33%	0.80%
Endive	NBD#11213	0.2	0.30%	3.10%	0.08:1	3.35%	0.00%
Miscellaneous							
Enriched Pasta, dry	NDB#20120		2.60%	3.20%	0.8:1	67.95%	62.10%
Enriched Pasta, Cooked	NDB#20121		0.50%	1.85	0.3:1	30.86%	28.50%

https://ndb.nal.usda.gov/ndb/foods