

Appendix E-3.4

Starchy Vegetables: Food Pattern Modeling Analysis

RESEARCH QUESTION

How do the nutrients provided by the starchy vegetable subgroup compare with those provided by grains and other vegetable subgroups? How would nutrient adequacy of the patterns be affected by considering starchy vegetables as a replacement for some grains rather than as a vegetable subgroup?

BACKGROUND

For more information on the development of the USDA food patterns, see Appendix E-3.1 *Adequacy of USDA Food Patterns*. In 2005, the USDA food patterns were updated to reflect the 2005 Dietary Guidelines. Recommended amounts of total vegetables and all vegetable subgroups were increased to meet new nutrient goals. The amounts of subgroups highest in potassium were increased the most to bring the patterns closer to the 2004 AI for potassium. The revised amounts, as weekly recommendations, were included in the 2005 Dietary Guidelines (p. 24):

“In the USDA Food Guide at the reference 2,000-calorie level, the following weekly amounts are recommended:

Dark green vegetables	3 cups/week
Orange vegetables	2 cups/week
Legumes (dry beans)	3 cups/week
Starchy vegetables	3 cups/week
Other vegetables	6 ½ cups/week”

These weekly amounts translate into 2 ½ cups of total vegetables per day, the recommended amount for the 2000 calorie pattern. These new amounts were compared to average intakes at the time, but usual intake ranges were not available at that time for comparison.

The starchy vegetable subgroup is composed of potatoes, yellow and white corn (not dried), green peas, immature (not dried) lima beans, cowpeas, field peas, blackeye peas, pigeon peas, water chestnuts, cassava, taro, burdock root, white yam, breadfruit, lotus root, and plantains. Starchy vegetable item clusters, ideal representative foods, and proportions of total consumption are shown in Table 1. By far the largest component of the subgroup is potatoes, and to better represent the forms of and nutrients in potatoes, they are broken into 5 item clusters, each of which is represented by an “ideal” food in nutrient-dense form. The “ideal” representative foods are used to calculate the nutrients that would be obtained from a standard amount (1 cup equivalent) of the subgroup. The nutrient calculations are weighted by proportionate consumption. Together, the potato item clusters make up over 80% of consumption from the starchy vegetable subgroup.

In 2009, realignment of the vegetable subgroups was undertaken for a number of reasons, including the desire to develop food intake patterns that are, where possible, similar to proportions selected by consumers and within the range of “best practices” of current consumption (95th percentile of current intakes). It was hoped that this would encourage increased vegetable consumption by providing guidance that may be more achievable by consumers. For more information about changes in vegetable subgroupings and vegetable intake recommendations over time, see Appendix E-3.2 *Realigning Vegetable Subgroups*.

Table 1: Starchy vegetable subgroup item clusters, representative foods, and percent of total consumption

Item Cluster	"Ideal" Representative Food (from NDB-SR22)	% Total Subgroup Consumption
Potatoes (boiled)	Potatoes, boiled, cooked without skin, flesh, without salt	27.3%
Potatoes (baked)	Potatoes, white, flesh and skin, baked	15.2%
French fries	Potatoes, French fried, salt not added in processing, frozen, oven heated	17.4%
Potato chips/puffs/sticks	Potato chips, fat free, salted	17.1%
Home fries/hash browns	Potatoes, hashed brown, frozen, plain, prepared	6.0%
Corn (yellow)	Corn, sweet, yellow, cooked, boiled, drained, without salt	8.8%
Corn (white) (includes hominy)	Corn, sweet, white, cooked, boiled, drained, without salt	1.2%
Green peas, cooked and raw	Peas, green, cooked, boiled, drained, without salt	4.0%
Lima beans, immature	Lima beans, immature seeds, cooked, boiled, drained, without salt	0.6%
Cowpeas, field peas, blackeye peas, pigeon peas, cooked (not dry forms)	Cowpeas, immature seeds, cooked, boiled, drained, without salt	0.4%
Water chestnuts	Water chestnuts, Chinese, canned, solids and liquids	0.4%
Cassava (includes taro, burdock root, and white yam)	Cassava, raw	0.1%
Vegetable starches and unknown starchy vegetables	Potato starch	0.2%
Plantains	Plantains, cooked	1.3%

The food patterns recommend consuming roughly double the current usual intake of total vegetables. Therefore, amounts recommended from all vegetable subgroups are an increase over the usual intake from that subgroup. Because starchy vegetables, and potatoes specifically, are well liked and commonly consumed, increased amounts from this subgroup, in comparison to previous recommendations, were proposed as a way to help reach total vegetable group intake goals and nutrient goals while staying within the "best practices" limits. However, these amounts also suggested increases in starchy vegetable consumption when some consumers actually eat too many potatoes, especially in the form of fried potatoes.

In addition, starchy vegetables are grouped with grains in a "starches" group in some other food grouping systems, notably the American Diabetes Association diet plan. Cooked dry beans and peas are also grouped with grains and starchy vegetables in this plan.

Therefore, this analysis was designed to compare the nutrient contributions of starchy vegetables with those of other vegetable subgroups and of grains, to investigate changes in the adequacy of the patterns if starchy vegetables were considered as grain replacements rather than as a vegetable, and to identify how recommended intakes compare to median intakes and the 95th percentile of intakes for various population groups.

METHODS

1. Compare the amounts of selected nutrients in a standard amount of each vegetable subgroup and grain subgroup.
2. Identify the nutrients in the patterns provided by the currently recommended amounts of starchy vegetables.
3. Calculate the increased amount of the dark green, red/orange, and other vegetable subgroups that would be needed to bring total vegetable recommendations to current levels if starchy vegetables were considered as a grain replacement rather than a vegetable.
4. Calculate the decreased amount of whole and refined grains that would be needed to maintain current recommended intake of grains with starchy vegetables "counted" as a grain replacement.
5. Test the impact on nutrient adequacy of potential modifications in the patterns with starchy vegetables replacing some grains and 3 vegetable subgroups increased proportionately.
6. Identify how the amounts of the vegetable subgroups compare to usual intake distributions with these potential modifications.

RESULTS

Macro- and micronutrients in standardized amounts of vegetable and grains subgroups

One cup equivalent of each vegetable subgroup was selected as the comparison amount. To provide a basis for comparison between vegetables and grains, a 2 ounce equivalent portion of grains was selected as the comparison amount. This amount of grains is close to the caloric value of 1 cup equivalent of starchy vegetables. Fruits were also included in the comparison, using 1 cup equivalent as the comparison portion. Since amounts and units for various nutrients are widely divergent, all amounts were converted to the percent of the RDA or AI for a 19- to 30-year-old female.

Nutrient content varies widely among the vegetable subgroups and fruits (Figures 1 and 2, and Table A1). In the standard amount selected of vegetables or fruits, cooked dry beans and peas and starchy vegetables have the most calories and carbohydrate. Cooked dry beans and peas have substantially more protein, fiber, iron, magnesium, phosphorus, zinc, selenium, thiamin, and folate than the other vegetable subgroups or fruits. While none of the compared groups is high in calcium, dark green vegetables and cooked dry beans and peas have more than other subgroups or fruits. Cooked dry beans and peas, starchy vegetables, and red/orange vegetables are highest in potassium. Vitamins A and E are highest in dark green and red/orange vegetables. Vitamin C is highest in fruits and dark green vegetables. While not high in any of the groups, cooked dry beans and peas and dark green vegetables have the most choline.

In comparison to fruits and most other vegetable subgroups (except for cooked dry beans and peas), starchy vegetables provide relatively high amounts of energy, carbohydrates, protein, fiber, magnesium, phosphorus, potassium, zinc, thiamin, niacin, and vitamin B-6. Starchy vegetables are also slightly higher in sodium than the other subgroups, due to the inclusion in the nutrient profile of hash brown potatoes and fat-free potato chips that contain added salt. The hash browns also contain some added fat as do the oven-heated French fries used to represent the French fries item cluster. No other vegetables are represented by a food with added fat, and only a few, all with low consumption levels, contain added salt: olives, low-sodium pickles, and horseradish.

The nutrient profile for 1 cup of starchy vegetables was also compared to 2 ounce equivalents of whole and refined grains (Figures 3 and 4, and Table A1). Grains and starchy vegetables are similar

in energy content, due to the design of the comparison to be for roughly equal caloric amounts. Starchy vegetables are also roughly similar to grains in a number of other nutrients and have amounts of these nutrients between the amount in whole and refined grains, for fiber, magnesium, phosphorus, and niacin. Starchy vegetables are somewhat lower than grains in protein, calcium, iron, and thiamin. Starchy vegetables are substantially lower than grains (whole or refined) in riboflavin, selenium and folate, and substantially higher in potassium, vitamin C, and choline.

Nutrients provided by starchy vegetables in USDA food patterns

Nutrients provided by starchy vegetables in the base USDA food pattern at 2000 calories, as a proportion of the total amount of the nutrient in the pattern, are shown in Table 2. In comparison to the percent of total calories provided (7%), starchy vegetables provide higher amounts of fiber (9%), magnesium (8%), potassium (13%), copper (9%), vitamin C (7%), thiamin (9%), niacin (8%), and vitamin B6 (10%). Starchy vegetables provide a smaller proportion of sodium (3%) than calories. See Table A2 for all nutrients.

Table 2: Percent of selected nutrients in 2000 calorie pattern provided by starchy vegetables (0.71 cup equivalents)

Nutrient	% of Nutrient in Pattern from Starchy Vegetables
Energy (kcal)	7%
Protein (g)	3%
Total fat (g)	3%
Carbohydrate (g)	10%
Dietary Fiber (g)	9%
Calcium (mg)	1%
Iron (mg)	5%
Magnesium (mg)	8%
Phosphorus (mg)	4%
Potassium (mg)	13%
Sodium (mg)	3%
Copper (mg)	9%
Vitamin C (mg)	7%
Thiamin (mg)	9%
Niacin (mg)	8%
Vitamin B-6 (mg)	10%
Choline (mg)	5%

Substitution of other vegetable subgroups for starchy vegetables:

Increased amounts from the other vegetable subgroups (except for cooked dry beans and peas) were calculated to compensate for starchy vegetables if they were not to be counted as a vegetable subgroup. Cooked dry beans and peas were excluded because of their high caloric value and nutrient differences from other vegetable subgroups, as shown in Figures 1 and 2. Therefore, the amount of starchy vegetables in each pattern was divided among dark green, red/orange, and other vegetables. Dark green vegetables were assigned a lower amount than the other 2 subgroups because intakes are much lower, and recommendations already much higher for dark green vegetables than for the other two subgroups, in proportion to intakes. Changes and resulting amounts in the reference 2000 calorie patterns are shown in Tables 3 and 4.

Table 3: Revisions to amounts of vegetable subgroups in the base USDA food pattern at the reference 2000 calorie level

Subgroup	Base Pattern— 2000 kcal level	Amount of Change	% of Starchy Vegetables Substitution	Revised Pattern
Dark Green	0.21 cup eq	+0.14 cup eq	20%	0.35 cup eq
Red/Orange	0.79 cup eq	+0.28 cup eq	40%	1.07 cup eq
Dry Beans & Peas	0.21 cup eq	0	0%	0.21 cup eq
Starchy	0.71 cup eq	-0.71 cup eq		Count as grain
Other	0.57 cup eq	+0.29 cup eq	40%	0.86 cup eq
TOTAL Vegetable	2.50 cup eq			2.50 cup eq

Table 4: Revisions to amounts of whole and refined grains subgroups in the base USDA food pattern at the reference 2000 calorie level*

Subgroup	Base Pattern -- 2000 kcal level	Amount of Change	% of Starchy Vegetables Substitution	Revised Pattern
Whole grains	3 ounce eq	-0.71 oz eq	50%	2.29 oz eq
Refined grains	3 ounce eq	-0.71 oz eq	50%	2.29 oz eq
Starchy	(0.71 cup eq veg)	+1.42 oz eq		1.42 oz eq
TOTAL grains	6.00 cup eq			6.00 cup eq

* Assuming that 1 cup equivalent of starchy vegetable is equal to 2 ounce equivalents of grains.

Impact on nutrient adequacy of the patterns

While the modifications to the patterns of counting starchy vegetables as a grain did result in changes to the amounts of some nutrients in the patterns, the impact on nutrient adequacy was minimal. Nutrients in the base and revised patterns are shown in Table 5.

Table 5: Nutrients in base USDA food pattern at the reference 2000 calorie level and in the revised pattern with starchy vegetables counted as a grain replacement, and the change as a percent of the goal*

Nutrient	Base Pattern -- 2000 kcal % of goal*	Revised Pattern -- 2000 kcal % of goal*	Change as % of goal
Energy (kcal)	100%	95%	-4%
Protein (g)	198%	192%	-6%
Total fat (g)	32%**	33%**	+1%
Carbohydrate (g)	200%	187%	-12%
Dietary Fiber (g)	106%	105%	-2%
Calcium (mg)	124%	122%	-1%
Iron (mg)	94%	87%	-7%
Magnesium (mg)	113%	111%	-2%
Phosphorus (mg)	241%	234%	-8%
Potassium (mg)	74%	78%	+4%
Sodium (mg)	75%***	70%***	-5%
Zinc (mg)	179%	170%	-10%
Copper (mg)	161%	164%	+4%
Selenium (µg)	192%	176%	-16%
Vitamin A (µg RAE)	122%	134%	+13%
Vitamin E (mg AT)	55%	61%	+5%
Vitamin D (IU)	129%	124%	-4%
Vitamin C (mg)	168%	192%	+24%
Thiamin (mg)	164%	150%	-13%
Riboflavin (mg)	203%	196%	-7%
Niacin (mg)	163%	155%	-9%
Vitamin B-6 (mg)	180%	178%	-2%
Vitamin B12 (µg)	272%	259%	-13%
Choline (mg)	80%	81%	+1%
Vitamin K (µg)	156%	218%	+62%
Folate (µg DFE)	157%	144%	-13%

* Percent of the RDA or AI for a woman 19 to 30.

**Percent of calories.

***Percent of UL.

Amounts of protein, fiber, iron, magnesium, phosphorus, sodium, zinc, selenium, vitamin D, thiamin, niacin, riboflavin, vitamin B12, and folate were lower in the resulting patterns. Most changes were modest and did not affect adequacy. A decrease of about 7% in iron did result in the amount of iron in the 2000 calorie pattern going from 94% to 87% of the RDA for women 19-30, and from 91% to 84% of the RDA for women 31-50 in the 1800 calorie pattern. The amount of folate in the patterns decreased by 13% to 21%, but amounts remained adequate. The decrease in fiber was only about 2%. Calories in the resulting patterns were also somewhat lower than the original patterns (4 -5%). Given the need for patterns to remain at the target energy levels, these small differences would be compensated for by small increases in the allowance for added sugars and solid fats.

Other nutrients were higher in the resulting patterns, including potassium (up about 4%), vitamin A (up about 13%), vitamin E, vitamin C, vitamin K, and copper. The increase in potassium in the 2000 calorie pattern was from 74% to 78% of the AI.

Comparison of amounts of vegetable subgroups in revised patterns to median and 95th percentile of usual intakes

Amounts of each vegetable subgroup recommended in the base patterns, and in patterns revised to reflect starchy vegetables counting as grains, were compared to the median and 95th percentile of usual intakes for various age/sex groups. Vegetable intake varies widely among age/sex groups, so several divergent groups were selected to present in Tables 6 & 7. All age/sex groups and calorie levels of the patterns are shown in Tables A3, A4, and A5.

Table 6: Base pattern vegetable subgroup recommendations as percentages of usual median intakes and 95th percentile of intakes for selected population groups

Vegetable Subgroup	1600 kcal F 51-70 Median	1600 kcal F 51-70 95 th %ile	1800 kcal F 14-18 Median	1800 kcal F 14-18 95 th %ile	2000 kcal F 19-30 Median	2000 kcal F 19-30 95 th %ile	2200 kcal M 14-18 Median	2200 kcal M 14-18 95 th %ile	2400 kcal M 19-30 Median	2400 kcal M 19-30 95 th %ile
Dark Green	210%	53%	700%	140%	420%	81%	2900%	242%	967%	126%
Red/Orange	163%	71%	262%	103%	207%	94%	209%	95%	171%	89%
Dry Beans & Peas	286%	49%	714%	97%	357%	60%	714%	89%	408%	58%
Starchy	163%	71%	204%	94%	183%	85%	175%	95%	171%	89%
Other	89%	43%	190%	84%	133%	62%	197%	92%	137%	70%

Table 7: Revised pattern vegetable subgroup recommendations (starchy vegetables as grains) as percentages of usual median intakes and 95th percentile of intakes for selected population groups

Vegetable Subgroup	1600 kcal F 51-70 Median	1600 kcal F 51-70 95 th %ile	1800 kcal F 14-18 Median	1800 kcal F 14-18 95 th %ile	2000 kcal F 19-30 Median	2000 kcal F 19-30 95 th %ile	2200 kcal M 14-18 Median	2200 kcal M 14-18 95 th %ile	2400 kcal M 19-30 Median	2400 kcal M 19-30 95 th %ile
Dark Green	324%	81%	1176%	235%	706%	136%	4614%	385%	1538%	201%
Red/Orange	229%	100%	357%	141%	282%	128%	293%	133%	240%	125%
Dry Beans & Peas	286%	49%	714%	97%	357%	60%	714%	89%	408%	58%
Starchy	163%	71%	204%	94%	183%	85%	175%	95%	171%	89%
Other	130%	63%	285%	126%	199%	93%	292%	137%	202%	103%

Dark green vegetables: Of the age-sex groups shown, women over 50 consume the most dark green vegetables. Therefore, the recommendations for increased dark green vegetables fit within their 95th percentile of intake. For other age-sex groups shown, the increased amount of dark green vegetables exceeds the 95th percentile of their intakes. The revised recommendation is far above median intakes for these groups, ranging from 324% of median for women 51-70 to 4614% of median for boys 14-18.

Red/orange vegetables: The revised recommendation is at or above the 95th percentile of intake for the age-sex groups shown above. However, since intake of this subgroup tends to be much higher than that for dark green vegetables, the revised recommendation is no more than 4 times the median intake for any group.

Cooked dry beans and peas: Amounts of cooked dry beans and peas recommended were not changed. The amounts recommended are from 3 to 7 times median intakes, and are within the 95th percentile of intake for the groups shown.

Starchy vegetables: Amounts of starchy vegetables were not changed, but would count as a grain alternative in this revision. For all but one group shown, the amounts recommended are less than 2 times the median intake, and all are within the 95th percentile of intake.

Other vegetables: The revised recommendation is above the 95th percentile of intake for 3 of the 5 age-sex groups presented. The revised recommendation is not more than 3 times the median intake for any group.

SUMMARY

In the USDA food patterns, it is possible to use starchy vegetables as an alternative to grains rather than as a subgroup within the vegetable group, with little impact on nutrient adequacy, as long as additional amounts of other vegetables are used to replace the starchy vegetables. If this modification is made, amounts of grains (whole and refined combined) should be decreased by 2 ounce equivalents for each 1 cup equivalent of starchy vegetables. Vegetables from other subgroups should be increased on a cup for cup substitution for the starchy vegetables. The increased amounts of other vegetable subgroups does create patterns that are further from usual intakes of these vegetables, and therefore may be considered by some consumers as more difficult to achieve. However, for consumers following another dietary plan that groups starchy vegetables with grains, such as the American Diabetes Association diet plan, this flexibility may help them to integrate the USDA food pattern recommendations with the other dietary pattern. In all cases, in order to meet nutrient adequacy goals within caloric limits, the vegetables and grains selected should be mostly in nutrient-dense forms, rather than in forms with added fats, sugars, or salt.

Figure 1: Macronutrients and minerals in 1 cup equivalent of each vegetable subgroup and the fruit group, as a percent of the daily goal for intake of that nutrient

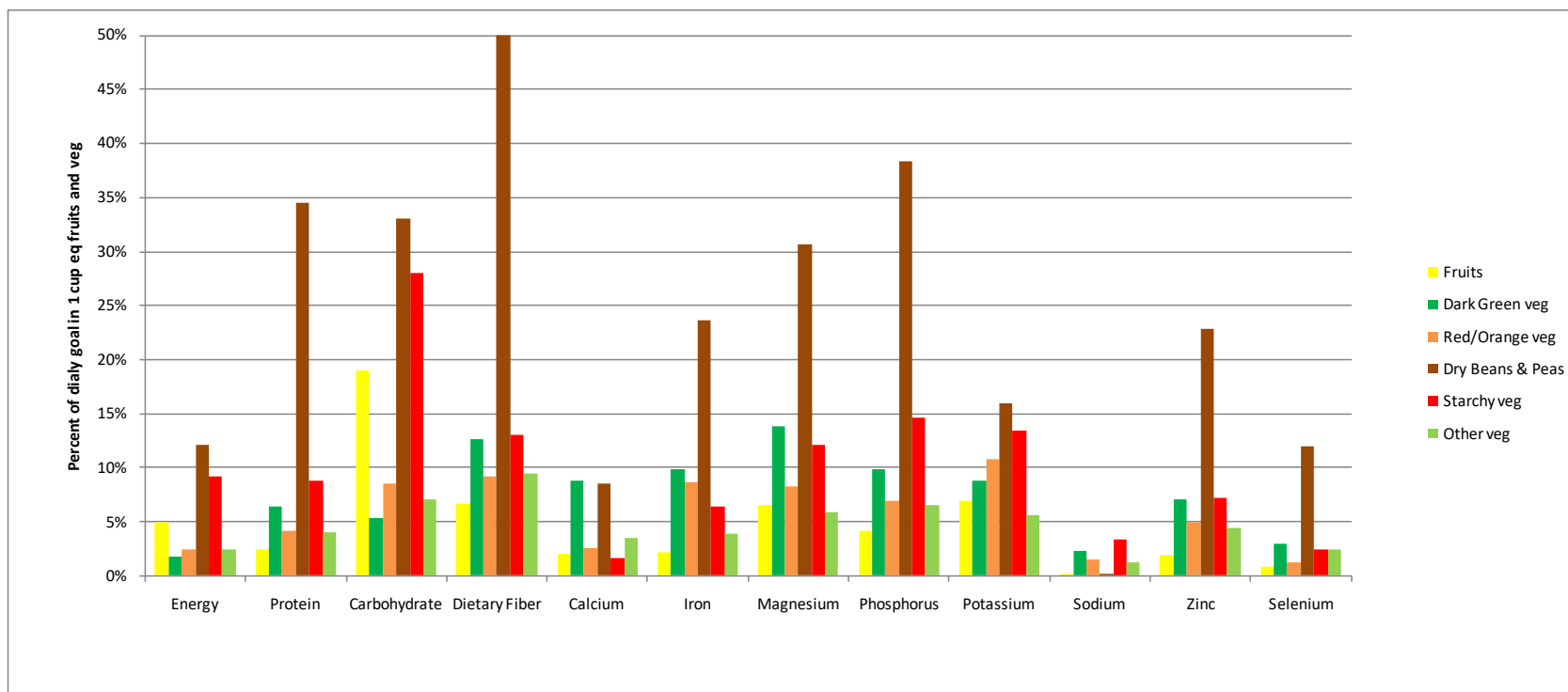


Table 8: Figure 1. Data points by food groups.

Food Group	Energy	Protein	Carbohydrate	Dietary Fiber	Calcium	Iron	Magnesium	Phosphorus	Potassium	Sodium	Zinc	Selenium
Fruits	5%	2%	19%	7%	2%	2%	7%	4%	7%	0%	2%	1%
Dark Green Vegetable	2%	6%	5%	13%	9%	10%	14%	10%	9%	2%	7%	3%
Red/Orange Vegetable	2%	4%	9%	9%	3%	9%	8%	7%	11%	2%	5%	1%
Dry Beans & Peas	12%	34%	33%	54%	8%	24%	31%	38%	16%	0%	23%	12%
Starchy Vegetable	9%	9%	28%	13%	2%	6%	12%	15%	13%	3%	7%	2%
Other Vegetable	2%	4%	7%	9%	4%	4%	6%	6%	6%	1%	4%	2%

Figure 2: Vitamins in 1 cup equivalent of each vegetable subgroup and the fruit group, as a percent of the daily goal for intake of that nutrient

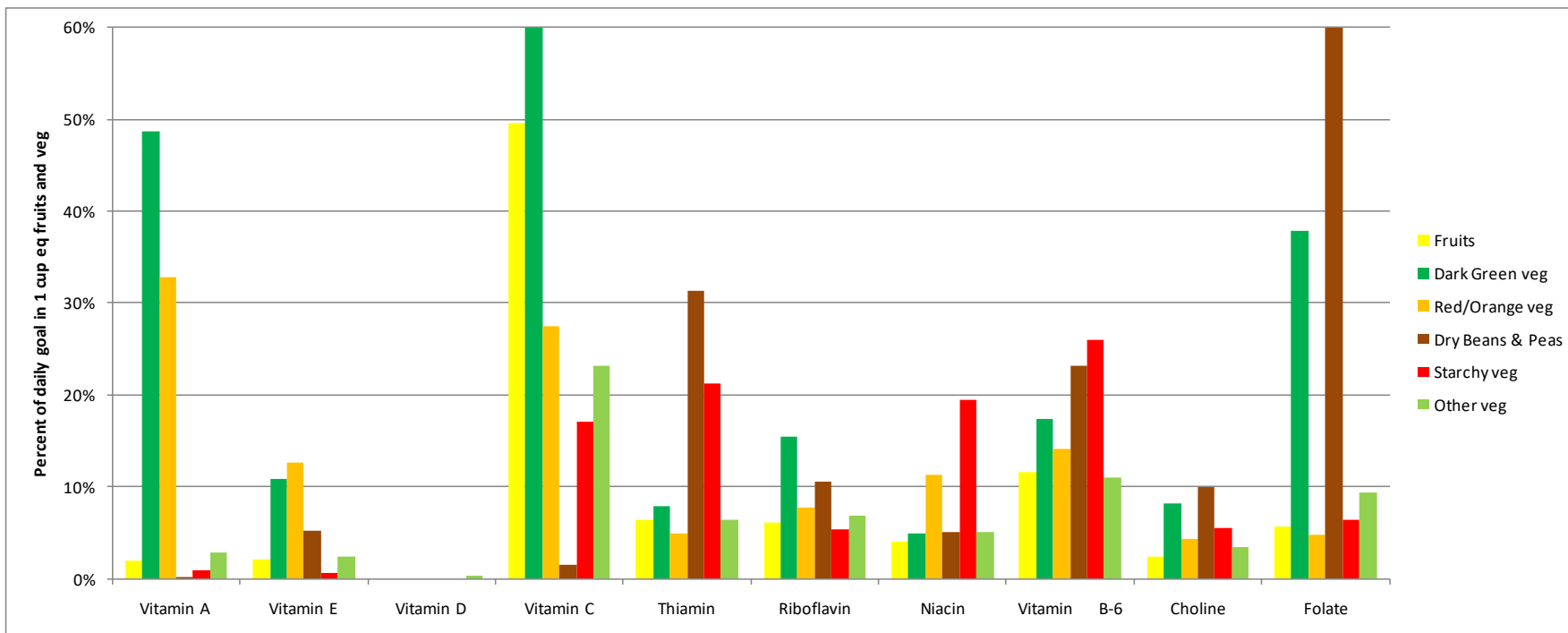


Table 9: Figure 2. Data points by Food Group.

Food Group	Vitamin A	Vitamin E	Vitamin D	Vitamin C	Thiamin	Riboflavin	Niacin	Vitamin B-6	Choline	Folate
Fruits	2%	2%	0%	50%	6%	6%	4%	12%	2%	6%
Dark Green vegetable	49%	11%	0%	76%	8%	15%	5%	17%	8%	38%
Red/Orange vegetable	33%	13%	0%	27%	5%	8%	11%	14%	4%	5%
Dry Beans & Peas	0%	5%	0%	2%	31%	11%	5%	23%	10%	66%
Starchy vegetable	1%	1%	0%	17%	21%	5%	19%	26%	6%	6%
Other vegetable	3%	2%	0%	23%	6%	7%	5%	11%	3%	9%

Figure 3: Macronutrients and minerals in 1 cup equivalent of starchy vegetables in comparison to the amount in 2 ounce equivalents of whole and non-whole grains, as a percent of the daily goal for intake of that nutrient

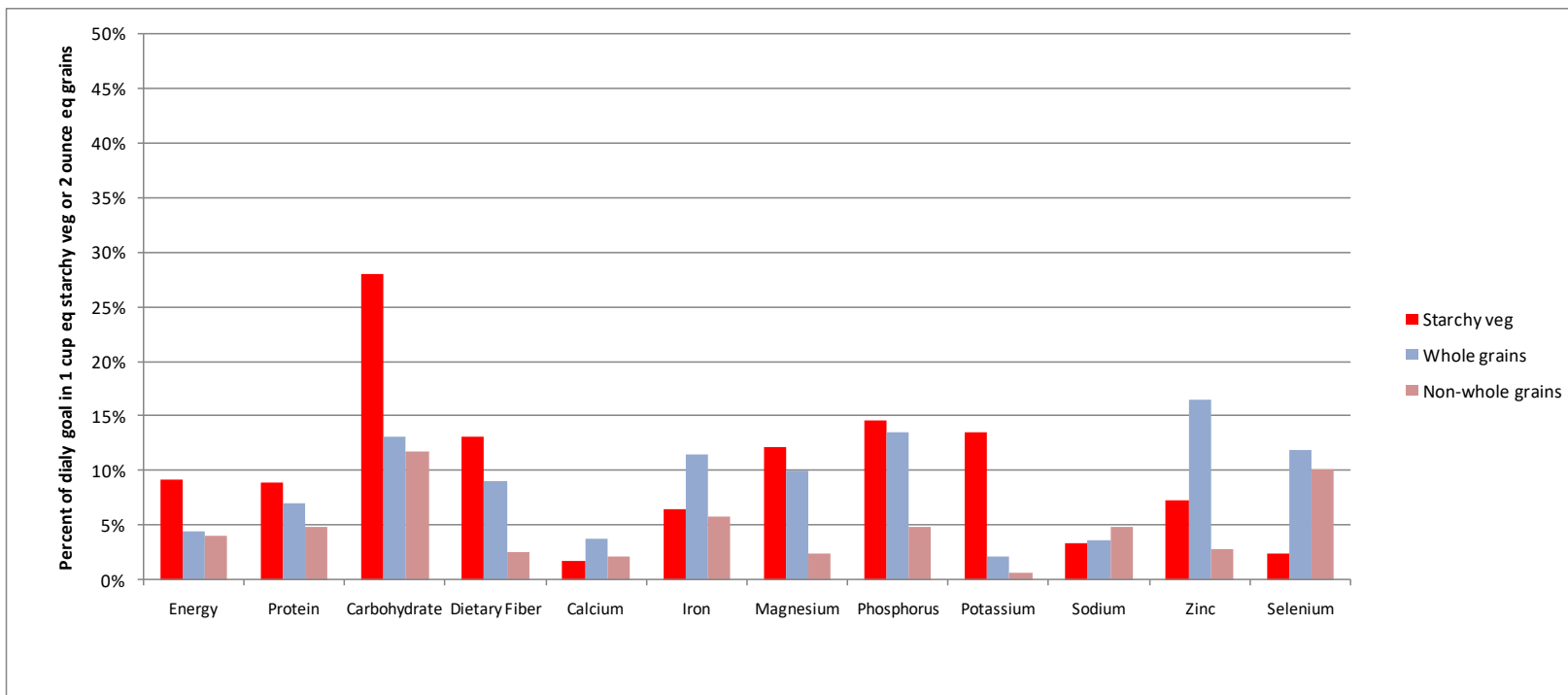


Table 10: Figure 3. Data points for Food Groups.

Food Group	Energy	Protein	Carbohydrate	Dietary Fiber	Calcium	Iron	Magnesium	Phosphorus	Potassium	Sodium	Zinc	Selenium
Starchy vegetable	9%	9%	28%	13%	2%	6%	12%	15%	13%	3%	7%	2%
Whole grains	9%	14%	26%	18%	7%	23%	20%	27%	4%	7%	33%	24%
Non-whole grains	8%	10%	23%	5%	4%	12%	5%	10%	1%	10%	6%	20%

Figure 4: Vitamins in 1 cup equivalent of starchy vegetables in comparison to the amount in 2 ounce equivalents of whole and non-whole grains, as a percent of the daily goal for intake of that nutrient

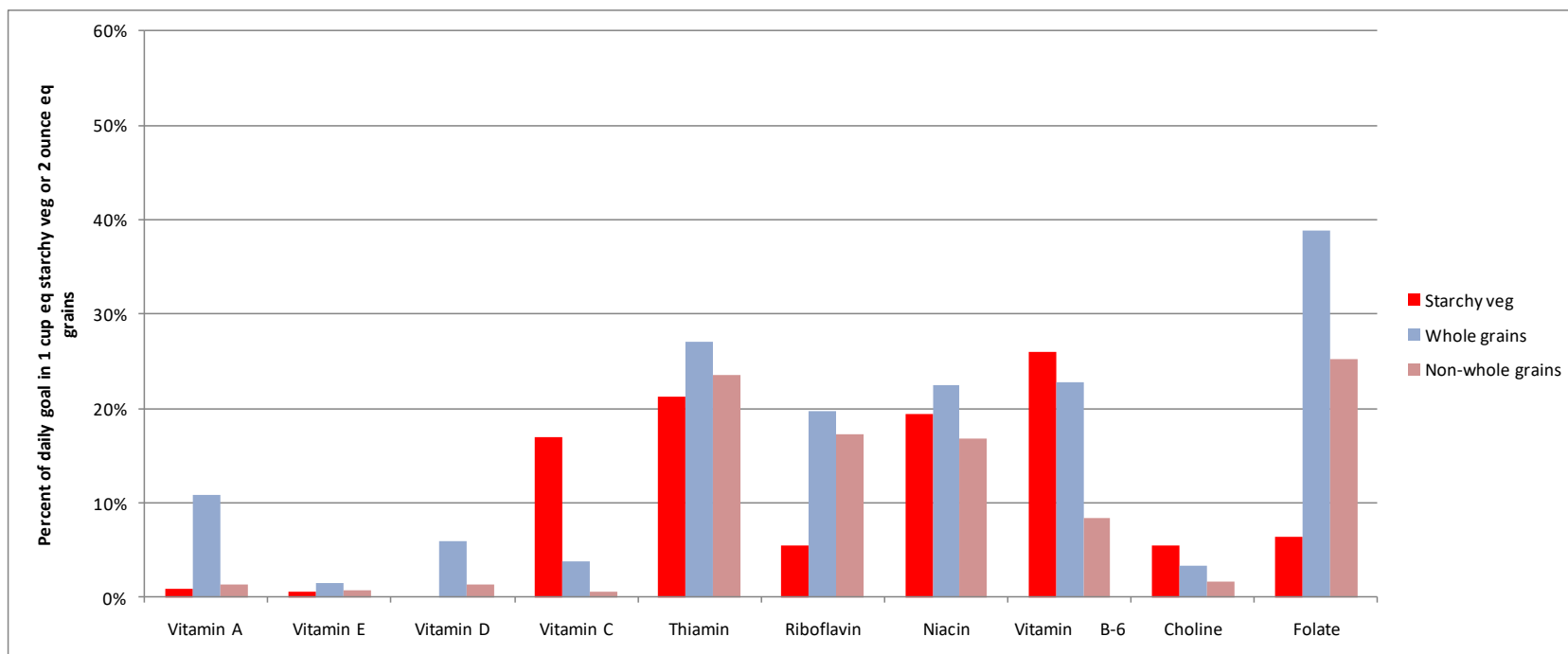


Table 11: Figure 4. Data points.

Food Group	Vitamin A	Vitamin E	Vitamin D	Vitamin C	Thiamin	Riboflavin	Niacin	Vitamin B-6	Choline	Folate
Starchy vegetable	1%	1%	0%	17%	21%	5%	19%	26%	6%	6%
Whole grains	11%	1%	6%	4%	27%	20%	23%	23%	3%	39%
Non-whole grains	1%	1%	1%	1%	24%	17%	17%	8%	2%	25%

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Appendix 1: Table A1 Nutrients in standard amount of fruits, and vegetable and grain subgroups

Nutrient	Fruits	Vegetables Dark Green	Vegetables Red/Orange	Vegetables Dry Beans & Peas	Vegetables Starchy	Vegetables Other	Grains Whole	Grains Refined
Percent of goal for nutrient (RDA or AI) for female 19-30, in 1 cup equivalent or 2 ounce equivalents								
Energy (% of 2000 kcal)	5%	2%	2%	12%	9%	2%	9%	8%
Protein	2%	6%	4%	34%	9%	4%	14%	10%
Carbohydrate	19%	5%	9%	33%	28%	7%	26%	23%
Dietary Fiber	7%	13%	9%	54%	13%	9%	18%	5%
Calcium	2%	9%	3%	8%	2%	4%	7%	4%
Iron	2%	10%	9%	24%	6%	4%	23%	12%
Magnesium	7%	14%	8%	31%	12%	6%	20%	5%
Phosphorus	4%	10%	7%	38%	15%	6%	27%	10%
Potassium	7%	9%	11%	16%	13%	6%	4%	1%
Sodium	0%	2%	2%	0%	3%	1%	7%	10%
Zinc	2%	7%	5%	23%	7%	4%	33%	6%
Selenium	1%	3%	1%	12%	2%	2%	24%	20%
Vitamin A	2%	49%	33%	0%	1%	3%	11%	1%
Vitamin E	2%	11%	13%	5%	1%	2%	1%	1%
Vitamin D	0%	0%	0%	0%	0%	0%	6%	1%
Vitamin C	49%	76%	27%	2%	17%	23%	4%	1%
Thiamin	6%	8%	5%	31%	21%	6%	27%	24%
Riboflavin	6%	15%	8%	11%	5%	7%	20%	17%
Niacin	4%	5%	11%	5%	19%	5%	23%	17%
Vitamin B-6	12%	17%	14%	23%	26%	11%	23%	8%
Choline	2%	8%	4%	10%	6%	3%	3%	2%
Folate	6%	38%	5%	66%	6%	9%	39%	25%

Appendix 2: Table A2. Nutrients provided by starchy vegetables in the reference 2000 calorie pattern

Nutrient	Amount in 2000 calorie pattern	Amount in 0.71 cups of starchy vegetables	% of nutrient in pattern from starchy vegetables*
Energy (kcal)	1997	130	7%
Protein (g)	91	3	3%
Total lipid (fat) (g)	71	2	3%
Carbohydrate (g)	260	26	10%
Fiber, total dietary (g)	30	3	9%
Water (g)	1220	64	5%
Calcium (mg)	1235	12	1%
Iron (mg)	17	1	5%
Magnesium (mg)	351	27	8%
Phosphorus (mg)	1690	73	4%
Potassium (mg)	3478	452	13%
Sodium (mg)	1722	56	3%
Zinc (mg)	14	0.41	3%
Copper (mg)	1.446	0.133	9%
Fluoride (µg)	126	0	0%
Manganese (mg)	4	0	5%
Selenium (µg)	106	1	1%
Vitamin A (µg RAE)	851	4	1%
Vitamin E (mg α-tocopherol)	8.3	0.1	1%
Vitamin D (IU)	258	0	0%
Vitamin C (mg)	126	9	7%
Thiamin (mg)	1.8	0.2	9%
Riboflavin (mg)	2.2	0.0	2%
Niacin (mg)	22.9	1.9	8%
Vitamin B-6 (mg)	2.3	0.2	10%
Vitamin B-12 (µg)	6.5	0.0	0%
Choline (mg)	340	17	5%
Vitamin K (µg)	140	4	3%
Folate (µg DFE)	628	18	3%
Cholesterol (mg)	229	0	0%
Trans fatty acids (g)	1.4	0.0	0%
Saturated fatty acids (g)	18.7	0.5	3%
Monounsaturated fatty acids (g)	26.1	1.0	4%
Polyunsaturated fatty acids (g)	20.9	0.3	1%
18:2 linoleic (g)	18.7	0.2	1%
18:3 linolenic (g)	1.85	0.02	1%
20:4 arachidonic (g)	0.14	0.00	0%
20:5 n-3 EPA (g)	0.040	0.000	0%
22:5 n-3 DPA (g)	0.012	0.000	0%
22:6 n-3 DHA (g)	0.086	0.000	0%
18:0 stearic (g)	5.0	0.2	4%

*Percentages rounded to nearest whole number.

Appendix 3: Table A3 Actual recommended amounts in cup equivalents per day

Calorie level	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200
Base Patterns												
cup equivalents per day												
Total Vegetables	1	1.5	1.5	2	2.5	2.5	3	3	3.5	3.5	4	4
Dark Green	0.07	0.14	0.14	0.21	0.21	0.21	0.29	0.29	0.36	0.36	0.36	0.36
Red/Orange	0.36	0.43	0.43	0.57	0.79	0.79	0.86	0.86	1.00	1.00	1.07	1.07
Dry Beans & Peas	0.07	0.07	0.07	0.14	0.21	0.21	0.29	0.29	0.36	0.36	0.43	0.43
Starchy	0.29	0.50	0.50	0.57	0.71	0.71	0.86	0.86	1.00	1.00	1.14	1.14
Other	0.21	0.36	0.36	0.50	0.57	0.57	0.71	0.71	0.79	0.79	1.00	1.00
Proposed Amounts*												
Total Vegetables*	1	1.5	1.5	2	2.5	2.5	3	3	3.5	3.5	4	4
Dark Green	0.13	0.24	0.24	0.32	0.35	0.35	0.46	0.46	0.56	0.56	0.59	0.59
Red/Orange	0.47	0.63	0.63	0.80	1.07	1.07	1.20	1.20	1.40	1.40	1.53	1.53
Dry Beans & Peas	0.07	0.07	0.07	0.14	0.21	0.21	0.29	0.29	0.36	0.36	0.43	0.43
Starchy*	0.29	0.50	0.50	0.57	0.71	0.71	0.86	0.86	1.00	1.00	1.14	1.14
Other	0.33	0.56	0.56	0.73	0.86	0.86	1.05	1.05	1.19	1.19	1.46	1.46

*Dark green, red/orange, and other vegetables increased and starchy vegetables counted as a grain alternative and not included in the total vegetables amount.

Appendix 4: Table A4. Amounts as a percent of median usual intakes by age-sex groups

Calorie level	1000	1200	1400	1600	1600	1800	1800	1800	2000	2000	2200	2200	2400	2600	2800	3000	3200
Age-sex group	1 to 3	4 to 8	4 to 8	F 51-70	F 9-13	M 9-13	F 31-50	F 14-18	F 19-30	M 51-70	M 14-18	M 31-50	M 19-30	M 19-30	M 14-18	M 19-30	M 14-18
Base Patterns	Percent of Usual Median intakes																
Dark Green	714%	1400%	1400%	210%	1050%	2100%	210%	700%	420%	300%	2900%	580%	967%	1200%	3600%	1200%	3600%
Red/Orange	198%	179%	179%	163%	212%	201%	231%	262%	207%	196%	209%	186%	171%	200%	244%	214%	261%
Dry Beans & Peas	357%	238%	238%	286%	357%	536%	536%	714%	357%	306%	714%	260%	408%	510%	893%	612%	1071%
Starchy	119%	161%	161%	163%	100%	183%	198%	204%	183%	135%	175%	162%	171%	200%	204%	229%	233%
Other	179%	212%	212%	89%	200%	219%	108%	190%	133%	95%	197%	118%	137%	152%	219%	192%	278%
Proposed Amounts*																	
Dark Green	1286%	2400%	2400%	324%	1621%	3529%	353%	1176%	706%	504%	4614%	923%	1538%	1867%	5600%	1962%	5886%
Red/Orange	262%	262%	262%	229%	296%	275%	315%	357%	282%	268%	293%	261%	240%	280%	341%	306%	373%
Dry Beans & Peas	357%	238%	238%	286%	357%	536%	536%	714%	357%	306%	714%	260%	408%	510%	893%	612%	1071%
Starchy*	119%	161%	161%	163%	100%	183%	198%	204%	183%	135%	175%	162%	171%	200%	204%	229%	233%
Other	274%	329%	329%	130%	291%	329%	161%	285%	199%	143%	292%	175%	202%	229%	331%	280%	405%

*Dark green, red-orange, and other vegetables increased and starchy vegetables counted as a grain alternative.

Appendix 5: Table A5. Amounts as a percent of 95th percentile of usual intakes by age-sex groups

Calorie level	1000	1200	1400	1600	1600	1800	1800	1800	2000	2000	2200	2200	2400	2600	2800	3000	3200
Age-sex group	1 to 3	4 to 8	4 to 8	F 51-70	F 9-13	M 9-13	F 31-50	F 14-18	F 19-30	M 51-70	M 14-18	M 31-50	M 19-30	M 19-30	M 14-18	M 19-30	M 14-18
Base Patterns	Percent of Usual 95th Percentile Intakes																
Dark green	71%	127%	127%	53%	191%	175%	51%	140%	81%	48%	242%	83%	126%	157%	300%	157%	300%
Red/Orange	51%	49%	49%	71%	71%	99%	97%	103%	94%	73%	95%	83%	89%	104%	111%	112%	119%
Dry Beans & Peas	45%	42%	42%	49%	55%	65%	79%	97%	60%	51%	89%	48%	58%	73%	112%	87%	134%
Starchy	41%	57%	57%	71%	71%	90%	88%	94%	85%	66%	95%	83%	89%	104%	111%	119%	127%
Other	55%	72%	72%	43%	88%	98%	52%	84%	62%	49%	92%	58%	70%	77%	103%	98%	130%
Proposed Amounts*																	
Dark Green	129%	218%	218%	81%	295%	294%	86%	235%	136%	80%	385%	132%	201%	243%	467%	256%	490%
Red/Orange	67%	72%	72%	100%	100%	136%	132%	141%	128%	99%	133%	117%	125%	146%	156%	159%	170%
Dry Beans & Peas	45%	42%	42%	49%	55%	65%	79%	97%	60%	51%	89%	48%	58%	73%	112%	87%	134%
Starchy*	41%	57%	57%	71%	71%	90%	88%	94%	85%	66%	95%	83%	89%	104%	111%	119%	127%
Other	84%	112%	112%	63%	128%	148%	78%	126%	93%	74%	137%	86%	103%	117%	155%	143%	189%

*Dark green, red-orange, and other vegetables increased and starchy vegetables counted as a grain alternative.