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Impact of Fruit and Vegetable Intakes on Food and Nutrient Intakes of Adults: What We Eat in America, NHANES 2017-2018

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Highlights

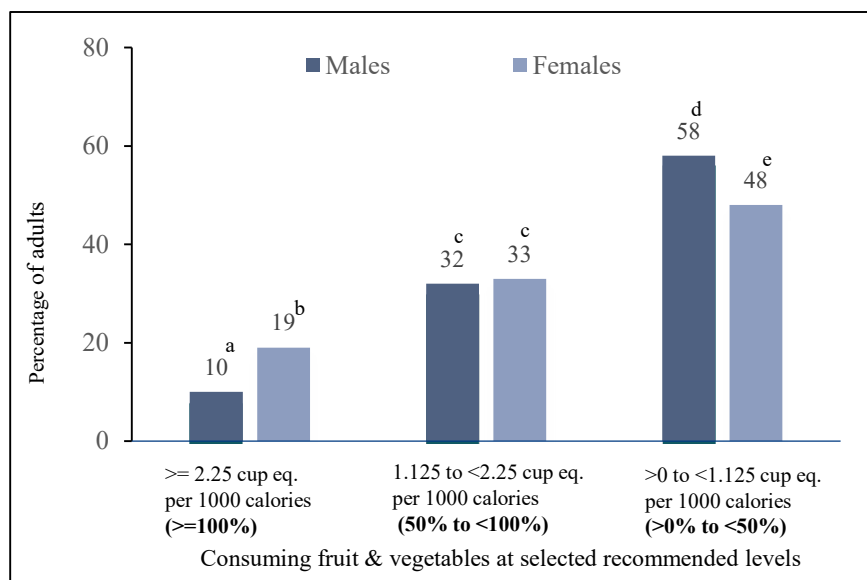
- Among adults 20+ years of age, more females than males ate at least 100% of the recommended level of fruit and vegetables (FV).
- More Asians and Hispanics than non-Hispanic white and non-Hispanic black met the FV recommendation.
- Meeting FV recommendation was associated with lower energy, macronutrient, saturated fat, and added sugars intakes.
- Meeting FV recommendation was associated with higher Vitamin A, C, and K and potassium intakes and lower Vitamin B12, phosphorus, zinc, and sodium intakes.
- Meeting FV recommendation was associated with lower total dairy and total meat, poultry, and seafood intakes.

The Dietary Guidelines for Americans 2020-2025 (DGA) recommend eating 4.5 cup equivalents (eq.) of fruit and vegetables (FV) per 2000 calories [1], which translates to 2.25 cup eq. per 1000 calories. This study used What We Eat in America (WWEIA), NHANES 2017-2018 Food Pattern and nutrient data [2, 3] and compared the dietary and nutrient intakes of adults 20+ years meeting FV recommendation at 3 different levels per 1000 calories of dietary intake: (1) ≥ 2.25 cup eq. or 100% (2) 1.125 to <2.25 cup eq. or 50% to $<100\%$, and (3) >0 to less than 1.125 cup eq. ($>0\%$ to $<50\%$). The adults (N=1117) who did not have any FV intake were excluded.

What percentage of adults met the recommendation?

Overall, 14% of adults fully met the recommendation, 32% between 50 to $<100\%$, and 53% between >0 to $<50\%$. One-tenth of males and about one-fifth of females fully met the recommendation (Fig. 1).

Figure 1. Estimated percentages of adults at selected levels of Dietary Guidelines for Americans recommendation for fruit and vegetables by sex, WWEIA, NHANES 2017-2018



Comparisons were made within the same FV recommendation levels. Percentages with different superscripts are different from each other at p-value <0.01 .

DATA SOURCE: (1) WWEIA, NHANES 2017-2018, day 1, adults 20+ years, Adults with no FV intakes were excluded. (2) Food Patterns Equivalents Databases and associated datasets 2017-2018.



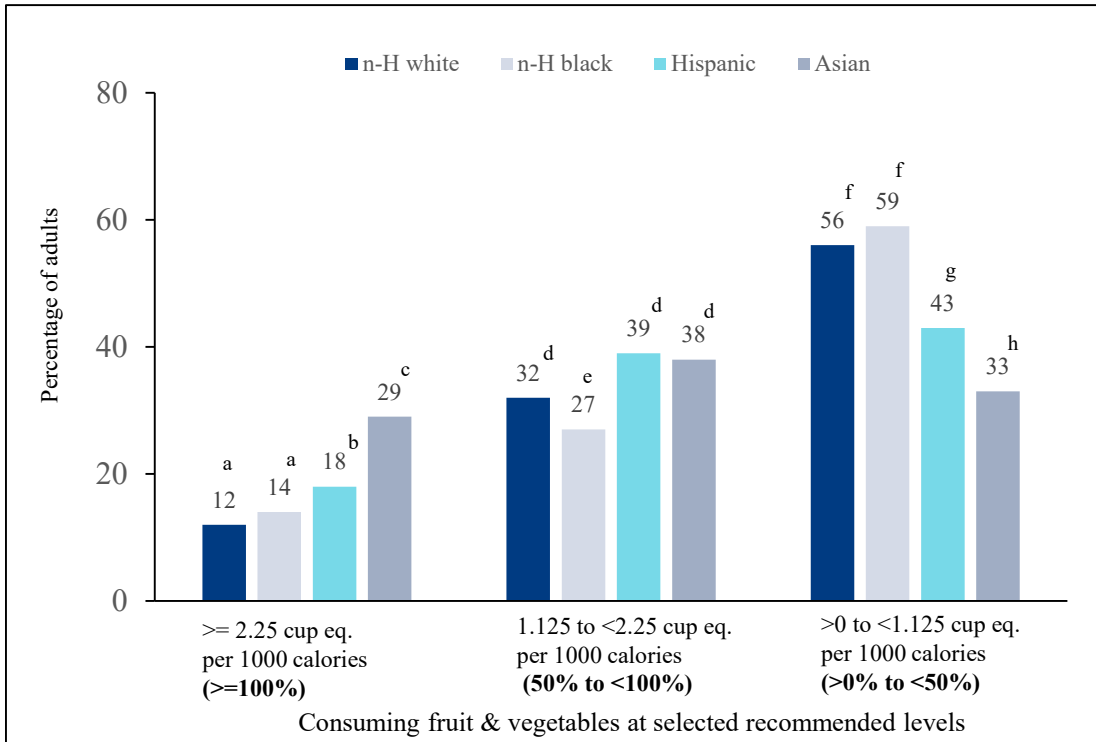
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Did meeting fruit and vegetables recommendation vary among race/ethnic groups?

A significantly higher percentage of Asian adults consumed at least 100% of the recommended amount of FV. More than one-half of non-Hispanic white and black adults consumed less than 50% of the recommended amounts (Figure 2).

Figure 2. Estimated percentage of adults eating at selected levels of Dietary Guidelines for Americans recommendation for fruit and vegetables by race/ethnicity WWEIA, NHANES 2017-2018



Comparisons were made within the same FV recommendation levels. Percentages with different superscripts are different from each other at p-value <0.01 .

DATA SOURCE: (1)WWEIA, NHANES 2017-2018, day 1, adults 20+ years, Adults with no FV intakes were excluded. (2) Food Patterns Equivalents Databases and associated datasets 2017-2018.

Did the day's energy intakes of the three groups vary?

Estimated energy intakes significantly decreased with an increase in FV intakes. Adults who consumed at least 100% of FV recommendation had 389 and 639 calories less than the adults who ate at 50% to $<100\%$ and 0% to $<50\%$ of recommendation, respectively (Table 1).

Table 1. Estimated mean daily energy intake of adults by fruit and vegetable intake status

	≥ 2.25 cup eq. per 1000 calories ($\geq 100\%$)	1.125 to <2.25 cup eq. per 1000 calories (50% to $<100\%$)	>0 to <1.125 cup eq. per 1000 calories (>0 to $<50\%$)
Energy (Calories)	1707 ^a	2096 ^b	2346 ^c

Means with different superscripts are different from each other at p-value <0.01

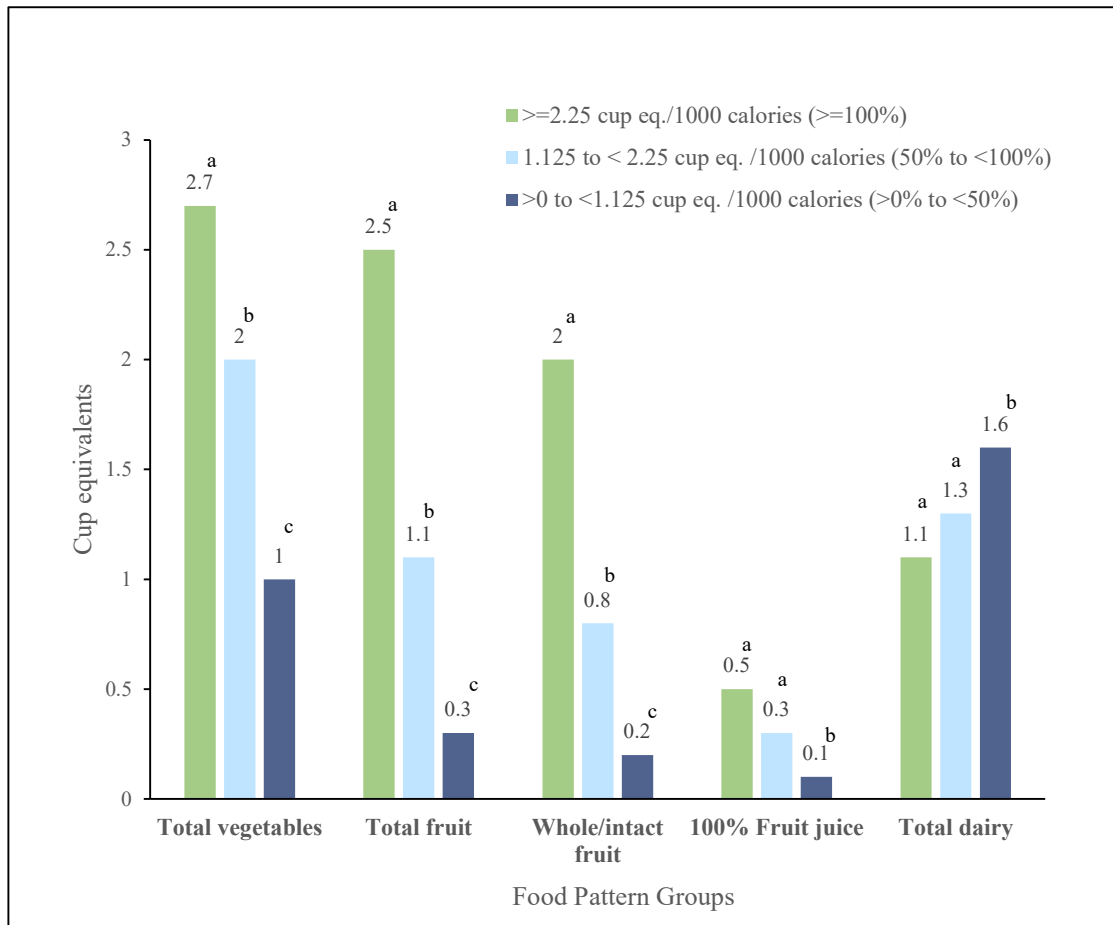
DATA SOURCE: (1) WWEIA, NHANES 2017-2018, day 1, adults 20+ years, Adults with no FV intakes were excluded. (2) Food Patterns Equivalents Databases and associated datasets 2017-2018.

How much vegetables, fruit, and dairy did the adults eat?

The estimated mean intakes of total vegetables and total fruit significantly increased as level of meeting FV recommendations increased (Figure 3.) A similar trend was seen with whole/intact fruit intakes. Adults meeting more than 50% of the recommendation, ate more than one-half of the total fruit as whole/intact fruit, as recommended by the Dietary Guidelines for Americans. Also, these adults had higher mean intakes of fruit juice than those who met less than 50% of the FV recommendation.

The adults who met less than 50% of FV recommendations had the highest mean intakes of total dairy.

Figure 3. Estimated mean intake of vegetables, fruit, and dairy by adults eating at selected levels of Dietary Guidelines for Americans recommendation for fruit and vegetables, WWEIA, NHANES 2017-2018



Comparisons were made within the same food pattern groups. Means with different superscripts are different from each other at p-value <0.01.

Total vegetables is composed of vegetables consumed separately or from multi-ingredient foods. Total fruit is composed of whole/intact fruit and 100% fruit juice consumed separately or from multi-ingredient foods and beverages. Total dairy is composed of fluid milk, yogurt, and cheese consumed alone or in a multi-ingredient foods and beverages. (See Reference 3 for details.)

DATA SOURCE: (1) WWEIA, NHANES 2017-2018, day 1, adults 20+ years, Adults with no FV intakes were excluded.

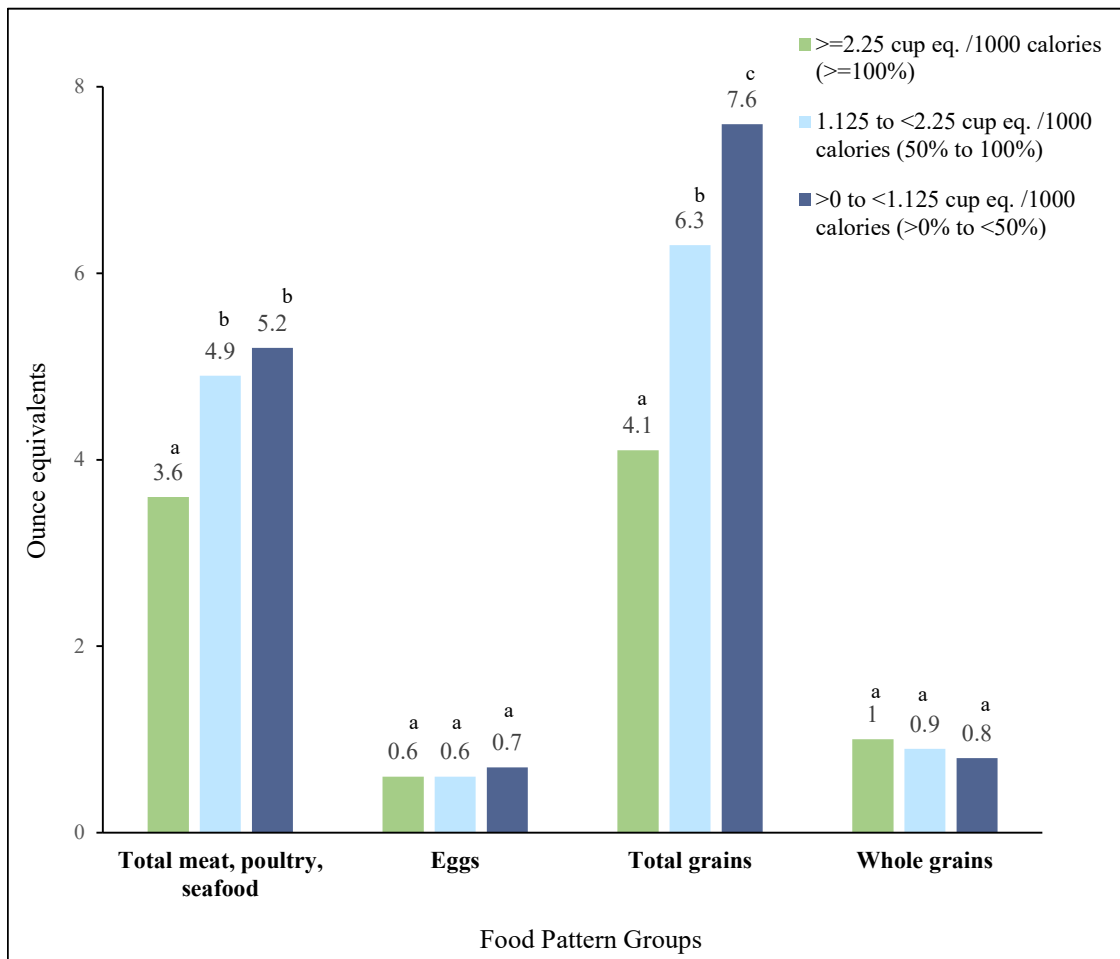
(2) Food Patterns Equivalents Databases and associated datasets 2017-2018.

What were the animal protein foods and grain intakes?

Adults eating at least 100% of FV recommendation ate significantly lower amount of total meat, poultry, and seafood (MPS). There was no difference in the total MPS intakes of the other two groups. No differences were noted in the mean intakes of eggs of the three groups of adults.

The total grain group includes whole grains and refined grains. Total grain and refined grain (not shown in figure 4) intakes increased as FV intake decreased. However, no differences were noted in the whole grain intakes among the three groups of adults.

Figure 4. Estimated mean intake of animal protein foods and grains by adults eating at selected levels of Dietary Guidelines for Americans recommendation for fruit and vegetables, WWEIA, NHANES 2017-2018



Comparisons were made within the same food pattern groups. Means with different superscripts are different from each other at p-value <0.01.

Total meat, poultry, and seafood ; eggs; and grains include that consumed alone or in a multi-ingredient foods (See Reference 3 for details.)

DATA SOURCE: (1)WWEIA, NHANES 2017-2018, day 1, adults 20+ years, Adults with no FV intakes were excluded.

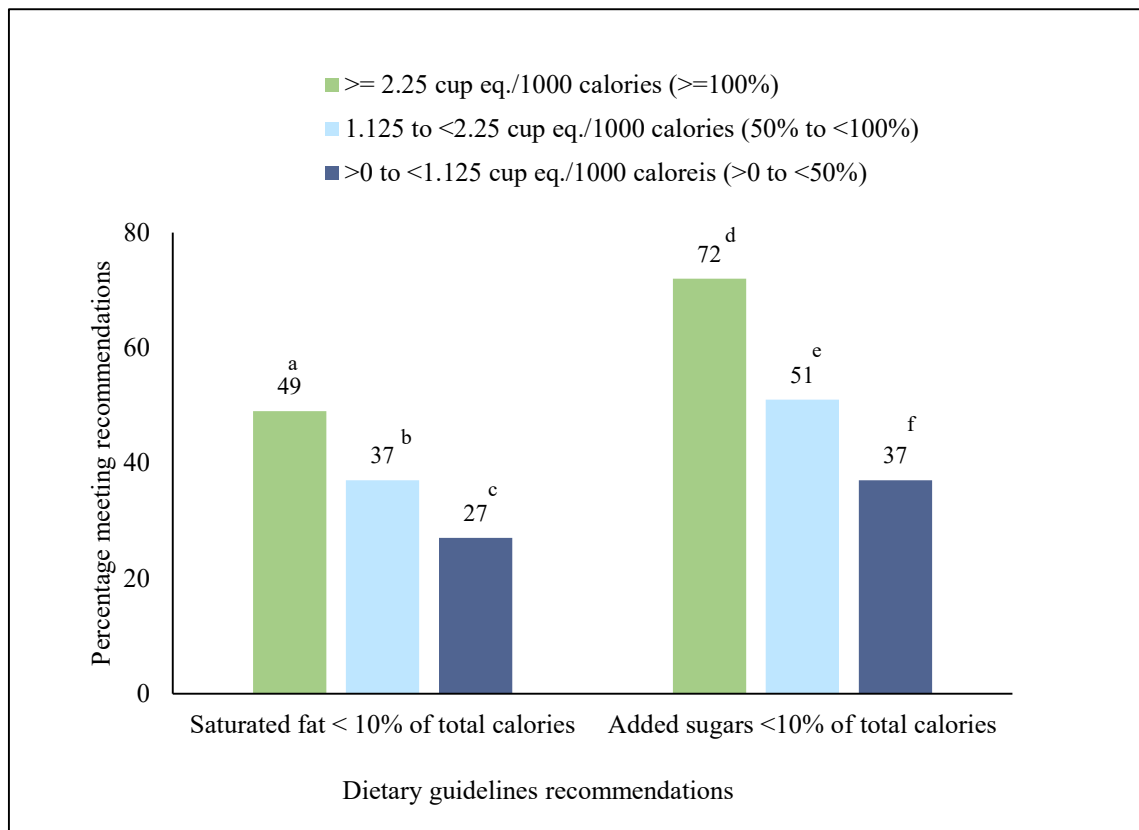
(2) Food Patterns Equivalents Databases and associated datasets 2017-2018.

What was the relationship between meeting Dietary Guidelines FV, saturated fat, and added sugars recommendations?

Meeting FV recommendation was associated with significantly more adults meeting the Dietary Guidelines recommendations for saturated fat and added sugars, and vice versa.

- About one-half of the adults eating at least 100% of recommended amount of FV met the saturated fat recommendation, and about three-fourth of these adults met added sugars recommendation.
- About one-third of the adults eating 50% to 100% of recommended amount of FV met the saturated fat recommendation, and about one-half of these adults met added sugars recommendation.
- About one-fifth of the adults eating 0% to <50% of recommended amount of FV met the saturated fat recommendation, and about one-third of these adults met added sugars recommendation.

Figure 5. Estimated percentage of adults meeting the Dietary Guidelines for Americans recommendations for saturated fat and added sugars by selected fruit and vegetables intake status WWEIA, NHANES 2017-2018



Comparisons were made within the same dietary guidelines recommendation.

Means with different superscripts are different from each other at p-value <0.01.

DATA SOURCE: (1)WWEIA, NHANES 2017-2018, day 1, adults 20+ years, Adults with no FV intakes were excluded.

(2) Food Patterns Equivalents Databases and associated datasets 2017-2018.

How did the nutrient intakes compare?

The estimated mean intakes of selected nutrients are in Table 2. The adults who consumed $\geq 100\%$ of FV recommendation had the highest intake of dietary fiber and the lowest intakes of carbohydrate, protein, total fat, and saturated fat resulting in lowest energy intake. These adults had higher Vitamin A, C, and K and potassium intakes and lower Vitamin B12, phosphorus, zinc, and sodium than the other two groups of adults.

Table 2. Estimated mean daily intakes of selected nutrients of adults eating at selected levels of Dietary Guidelines for Americans recommendation for fruit and vegetables

Nutrients	Fruit and vegetable intake status		
	≥ 2.25 cup eq. per 1000 calories ($\geq 100\%$)	1.125 to <2.25 cup eq. per 1000 calories (50% to $<100\%$)	>0 to <1.125 cup eq. per 1000 calories ($>0\%$ to $<50\%$)
Carbohydrate (g)	213 ^a	244 ^b	264 ^c
Dietary fiber (g)	23 ^a	19 ^b	14 ^c
Protein (g)	69 ^a	83 ^b	86 ^b
Total fat (g)	66 ^a	85 ^b	98 ^c
Saturated fat (g)	20 ^a	27 ^b	33 ^c
Vitamin A, RAE (mcg)	860 ^a	713 ^b	565 ^c
Vitamin B12 (mcg)	3.4 ^a	4.7 ^b	5.4 ^b
Vitamin C (mg)	155 ^a	99 ^b	44 ^c
Vitamin K (mcg)	241 ^a	156 ^b	84 ^c
Calcium (mg)	880 ^a	962 ^{ab}	1005 ^b
Phosphorus (mg)	1204 ^a	1394 ^b	1461 ^b
Potassium (mg)	3163 ^a	2878 ^a	2367 ^b
Sodium (mg)	2851 ^a	3581 ^b	3741 ^b
Magnesium (mg)	336 ^a	325 ^a	291 ^b
Zinc (mg)	9.3 ^a	11.0 ^b	11.8 ^c
Added sugars (tsp. eq.*)	7.9 ^a	13.9 ^b	21.5 ^c

Means with different superscripts are different from each other at p value <0.01 .

*tsp. eq. = teaspoon equivalents. 1 tsp. eq. = 4.2 grams total sugars. Added sugars is a food patterns group. For the definition of added sugars see reference #3.

DATA SOURCE: (1)WWEIA, NHANES 2017-2018, day 1, adults 20+ years, Adults with no FV intakes were excluded. (2) Food Patterns Equivalents Databases and associated datasets 2017-2018.

What are the implications of the study?

The Dietary Guidelines for Americans (DGA) recommend individuals aim to reduce saturated fat, sodium, and added sugar intakes and increase dietary fiber intake. Meeting DGA FV recommendation may help to control intakes of these nutrients.

Definitions Used in the Food Patterns Equivalents Database 2017-2018

USDA food patterns include the five food groups- vegetables, fruit, grains, dairy, and protein foods; and other components such as oils, solid fats, added sugars, and alcoholic drinks. Reference No. 3 includes definitions, foods assigned to the food pattern groups, and the computation of cup and ounce equivalents.

Data source

- (1) What We Eat in America, NHANES 2017-2018, day 1 dietary data were used to estimate Food Patterns equivalents intakes[ref #2]. Study sample included 4624 adults, ages 20 years and over, with complete and reliable intake records the surveys and who reported eating fruit and vegetables. The 117 adults who did not eat FV intake were excluded in the study. Sample weights were applied in the analyses to produce nationally representative estimates.

The sample sizes were as below:

- >= 2.25 cup eq. of FV/1000 calories, or 100% (N=750)
- 1.125 to <2.25 cup eq. of FV/1000 calories, or 50% to <100% (N=1502),
- >0 to <1.125 cup eq. of FV/1000 calories, or >0% to <50%, (N=2372).

- (2) Food Patterns Equivalent dietary intakes were computed using the Food Patterns Equivalents Database 2017-2018 Methodology and User Guide[3].

References

1. U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans, 2020-2025. 9th Edition. December 2020. Available at: [Home | Dietary Guidelines for Americans](#). Accessed date September 9, 2022.
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3. Bowman SA, Clemens JC, Friday JE, and Moshfegh AJ. 2020. Food Patterns Equivalents Database 2017-2018: Methodology and User Guide [Online]. Food Surveys Research Group, Beltsville Human Nutrition Research Center, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland. October 2020. Available at: [Food Patterns Equivalents Database 2017-2018 Methodology and User Guide \(usda.gov\)](#). Accessed date September 9, 2022.

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