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Food Pattern Group and Macronutrient Intakes of Adults: WWEIA, NHANES 2003-2004 to 2017-2018

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Highlights

- From 2003-2004 to 2017-2018, added sugars and solid fats intakes substantially decreased.
- The increase in the whole grain intake was significant, but very small.
- Total fruit intake remained the same, but the fruit juice intake significantly declined, showing the proportion of fruit juice to total fruit decreased during this period.
- Adults ate about 3.5 times more protein foods of animal origin (meat, poultry, and seafood) than of plant origin in 2017-2018.

What are the changes in energy, macronutrient, and food pattern group intakes of adults from 2003 to 2018?

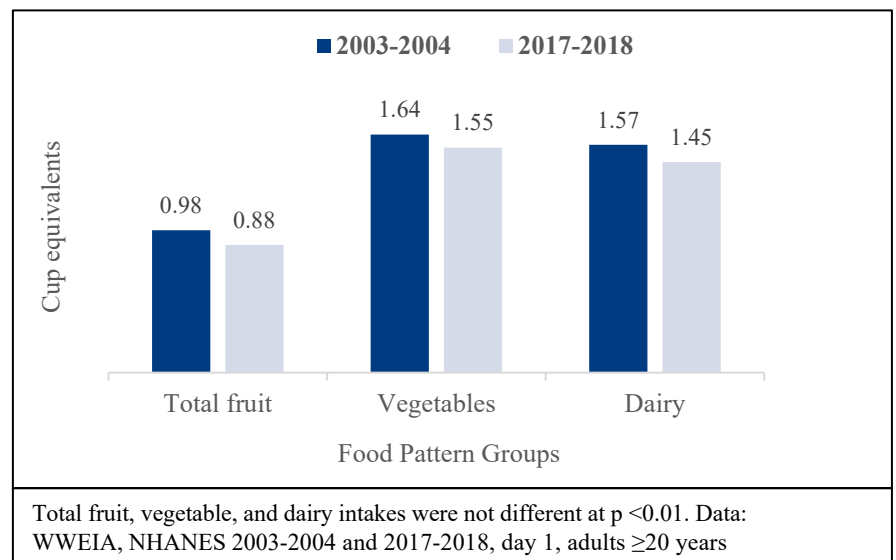
The Dietary Guidelines for Americans (DGA) [1] provide guidance on making healthful dietary choices. This study identifies changes in the macronutrient and food pattern group intakes of adults 20+ years from What We Eat in America (WWEIA), NHANES, day 1 dietary data [2,3] between the survey periods of 2003-2004 and 2017-2018; and examines the trends during this period.

Methodology is on page 7. A p-value < 0.01 was considered significantly different for all analyses.

Did the fruit, vegetable, and dairy intakes change?

The total fruit, vegetable, and dairy intakes between 2003-2004 and 2017-2018 were not different at $p < 0.01$.

Figure 1. Estimated mean intakes of fruit, vegetables, and dairy by adults in 2003-2004 and 2017-2018, WWEIA, NHANES, day 1



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Did the fruit, vegetable, and dairy intakes change? (continued)

Total fruit is composed of whole/intact fruit and fruit juice. Fruit juice data are available starting in 2005-2006. Fruit juice intakes significantly decreased between 2005-2006 and 2017-2018 (figure 2).

Figure 2. Estimated mean intakes of total fruit and fruit juice by adults in 2005-2006 and 2017-2018, WWEIA, NHANES, day 1

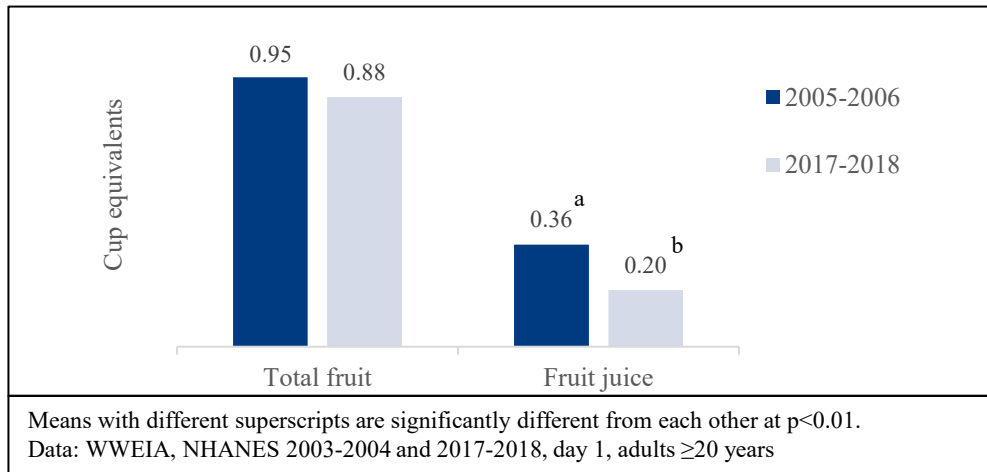
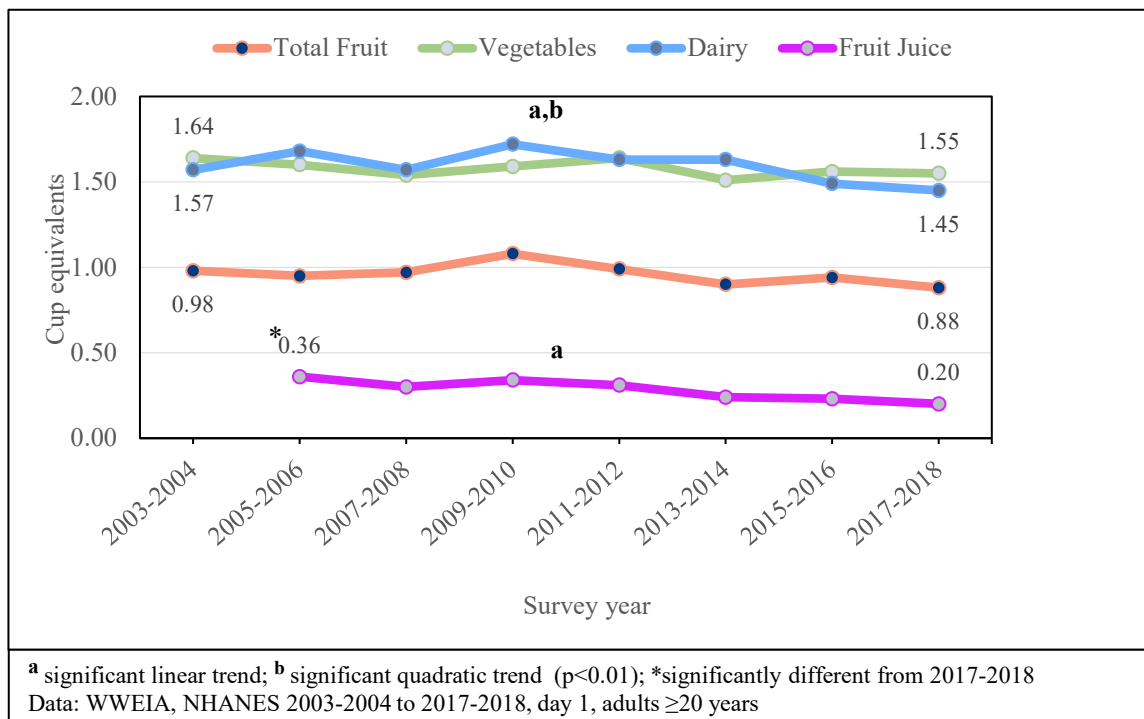


Figure 3 includes the estimated mean intakes for the eight survey periods. (trend analysis)

- Whereas the linear trend for total fruit was not significant ($p < 0.01$), the linear trend for fruit juice had a significant decline showing that adults consumed a lower proportion of 100% fruit juice to total fruit from 2003-2004 to 2017-2018.
- The linear trend for vegetables was not significant.
- Both linear and quadratic trends were significant at for dairy.

Figure 3. Estimated mean intakes of total fruit, fruit juice, vegetables, and dairy by adults from 2003-2004 to 2017-2018, WWEIA, NHANES, day 1

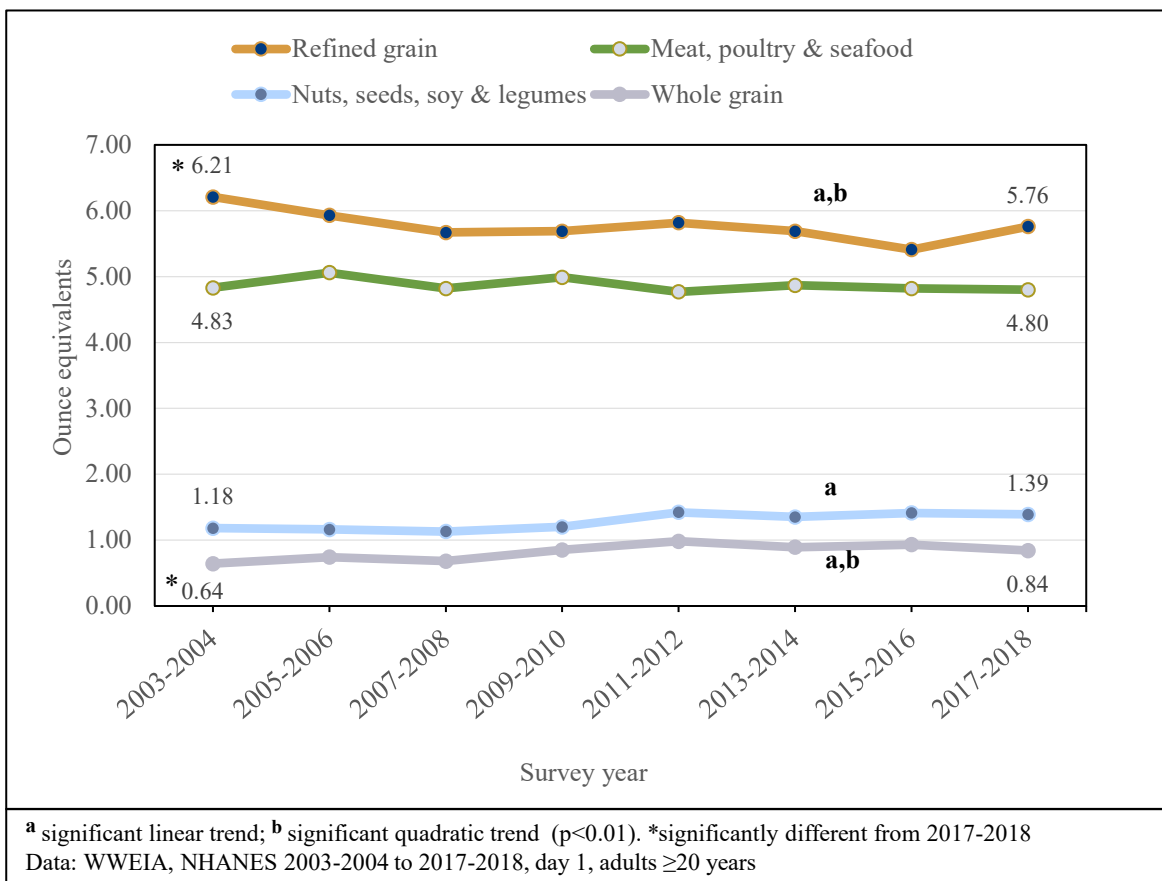


Did the grain and protein foods intakes change among adults?

Figure 4 includes the estimated mean intakes of whole and refined grains; meat, poultry, and seafood; and nuts, seeds, soy, and legumes.

- Whole grain intake significantly ($p < 0.01$) increased by 0.2 ounce equivalent (oz. eq.) from 2003-2004 to 2017-2018. However, this increase was very small and far below the DGA recommendation of eating 50 percent of total grains as whole grains.
- Refined grain intake significantly decreased by 0.45 oz. eq. from 2003-2004 to 2017-2018.
- The linear and quadratic trends during this time period were significant for refined and whole grains.
- The mean intakes of meat, poultry, and seafood were not significantly different between 2003-2004 and 2017-2018. The linear trend was not significant either.
- The mean intakes of nuts, seeds, soy, and legumes were not significantly different between 2003-2004 and 2017-2018. However, the linear trend was significant.
- Adults ate about 3.5 times more protein foods of animal origin (meat, poultry, and seafood) than of plant origin, in 2017-2018.

Figure 4. Estimated mean intakes of grains and protein foods by adults from 2003-2004 to 2017-2018, WWEIA, NHANES, day 1

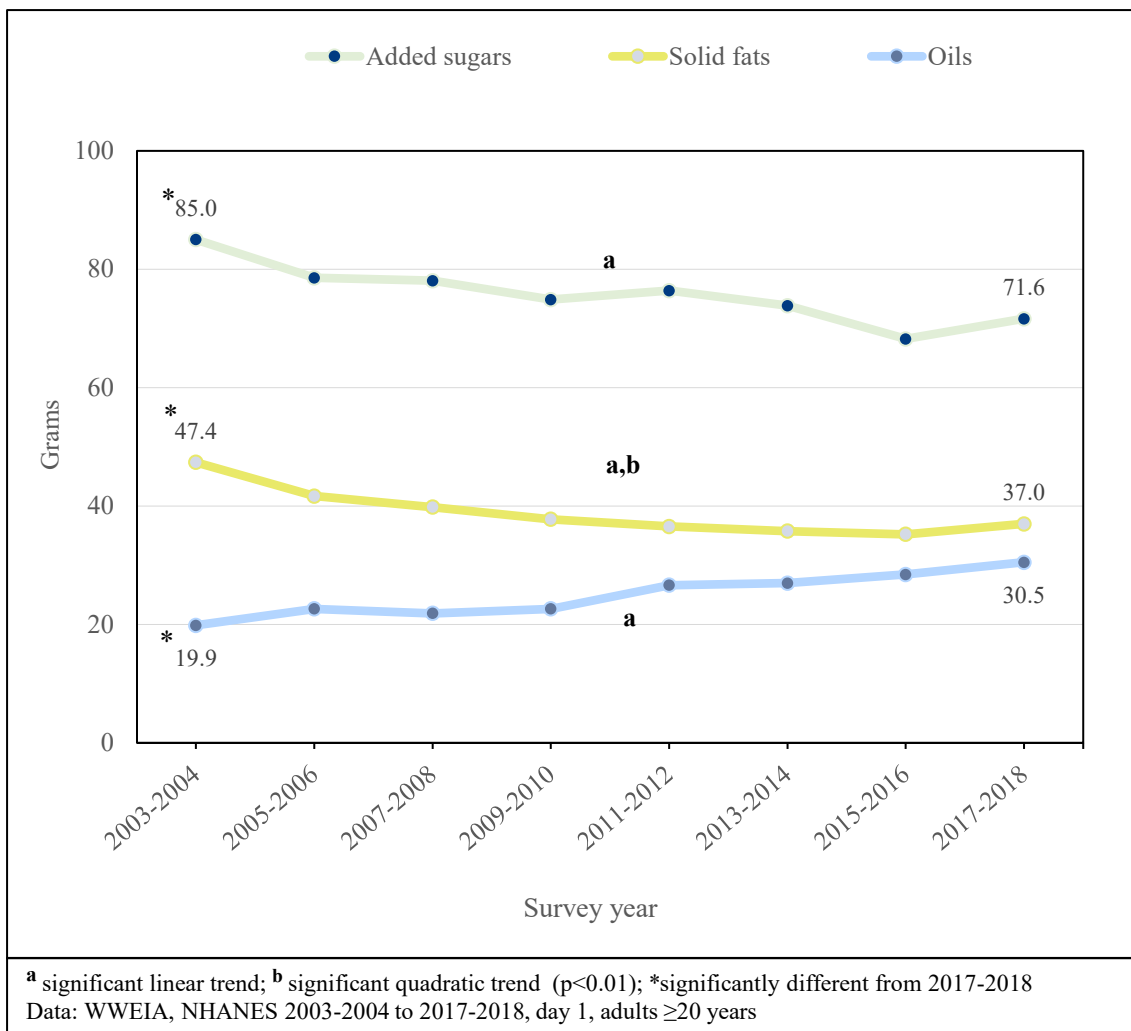


Did the added sugars, oils, and solid fats intakes change among adults?

Figure 5 includes the estimated mean intakes of added sugars, oils, and solid fats (see page 8 for definitions).

- Added sugars intake significantly ($p < 0.01$) reduced from 85 grams (20.2 tsp. eq.) in 2003-2004 to 71.6 grams (17 tsp. eq.) in 2017-2018, a difference of 13.4 grams (3.2 tsp. eq.)
- Solid fats intake significantly reduced by 10.4 grams from 2003-2004 to 2017-2018.
- Oils intake significantly increased by 10.6 grams in 2003-2004 to 2017-2018.
- The reduction in solid fats intake was almost equal to the increase in oils intake.
- The linear trends from 2003-2004 to 2017-2018 were significant for added sugars, solid fats, and oils.
- The quadratic trend was significant for solid fats.

Figure 5. Estimated mean intakes of added sugars, oils, and solid fats by adults from 2003-2004 to 2017-2018, WWEIA, NHANES. day 1



Did the estimated mean intakes of energy and macronutrients change from 2003-2018?

Table 1 includes estimated mean intakes of energy and macronutrients.

Between 2003-2004 and 2017-2018:

- Energy intake did not change significantly.
- Carbohydrate significantly decreased by 21 grams.
- Total fat significantly increased by 4 grams.
- Saturated fat and protein did not change significantly.

Trend analysis:

- Linear trends were significant for carbohydrate and total fat only.
- Quadratic trends were significant for total fat and saturated fat.

Table 1. Estimated mean intakes of energy and macronutrients by adults 20 years and over, WWEIA, NHANES 2003-2004 to 2017-2018, day 1

Survey year	N	Energy (kcal)	Carbo-hydrate (g)	Protein (g)	Total fat (g)	Saturated fat (g)
2003-2004	4448	2216	269*	83	84*	28
2005-2006	4520	2195	262	85	84	28
2007-2008	5420	2115	256	81	81	27
2009-2010	5762	2132	259	83	79	26
2011-2012	4801	2191	266	83	82	27
2013-2014	5047	2141	253	84	83	27
2015-2016	5017	2105	244	83	84	28
2017-2018	4742	2155	248	82	88	29

Means were rounded to integers.

*significantly different at $p < 0.01$ between 2003-2004 and 2017-2018

Linear trends were significant for carbohydrate and total fat.

Quadratic trends were significant for total fat and saturated fat.

Data: WWEIA, NHANES 2003-2004 to 2017-2018, day 1, adults ≥ 20 years

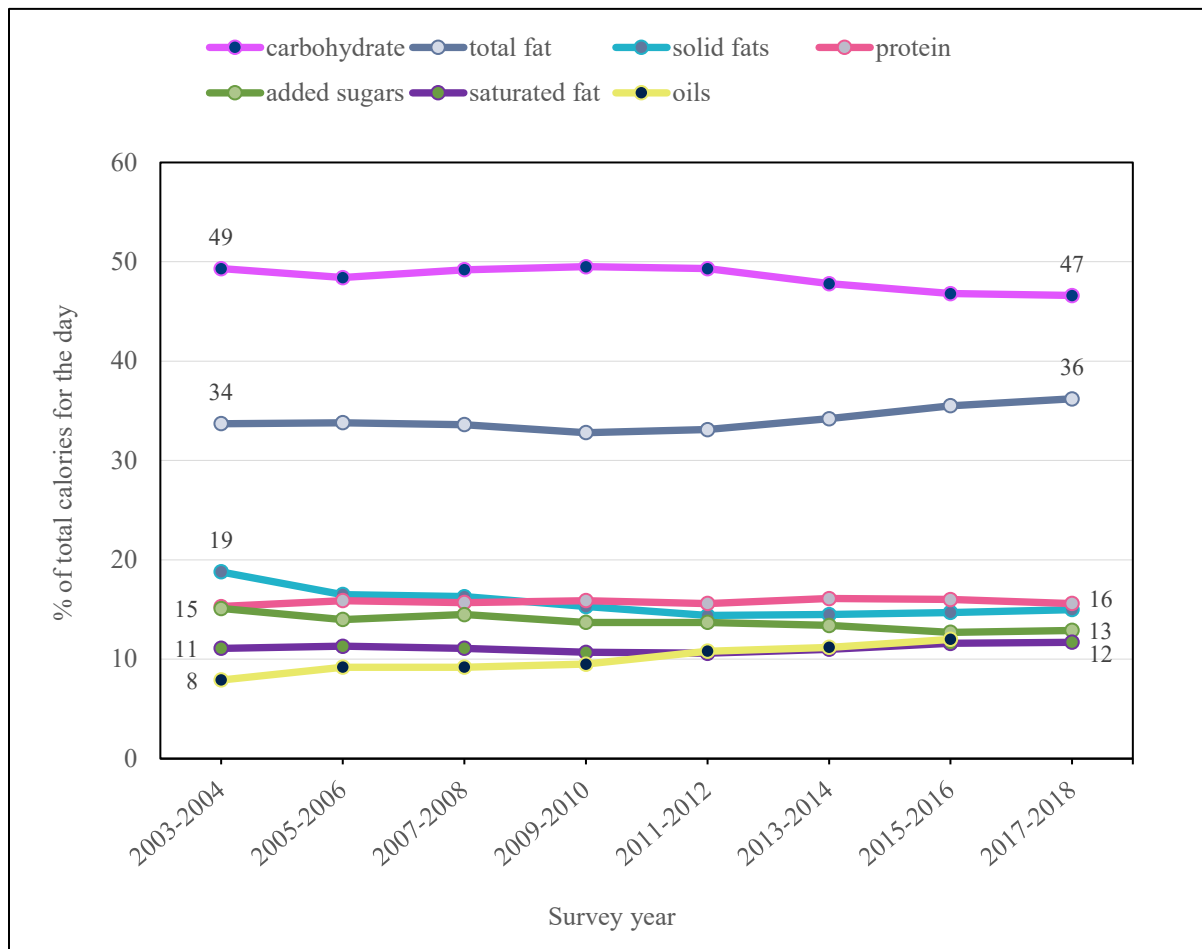
Did the estimated mean percentage of calories from macronutrients, added sugars, solid fats, and oils change?

The estimated mean percentage of calories are shown in Figure 6. Solid fats and oils are two different Food Pattern representations of fat present in food (see page 8 for definitions.) Solid fats and oils are 100% fat, and added sugars are 100% sugar and hence, the energy (calories) provided by them can be estimated.

The percentages below are rounded to integers.

- Carbohydrate significantly decreased from 49% to 47%.
- Total fat significantly increased from 34% to 36% and saturated fat increased from 11% to 12%.
- Solid fats significantly decreased from 19% to 15%, and oils increased from 8% to 13%.
- Added sugars significantly decreased from 15% to 13%.
- The linear trends were significant at $p < 0.01$ for all of the above listed variables.
- The linear trend was not significant for protein, and the percentage of calories from protein remained unchanged (about 16%).

Figure 6. Estimated mean percentage of calories obtained from macronutrients, added sugars, solid fats, and oils by adults from 2003-2004 to 2017- 2018, WWEIA, NHANES, day 1



All percentages of calories, except protein, were significantly different at $p < 0.01$ between 2003-2004 and 2017-2018.

The linear trends were significant at $p < 0.01$ for all, except protein.

Values rounded to integers

Data: WWEIA, NHANES 2003-2004 to 2017-2018, day 1, adults ≥ 20 years

What are the main findings of the study?

Between the two survey periods, 2003-2004 and 2017-2018, at $p < 0.01$ level of significance:

- Estimated mean intakes of whole grain increased and that of refined grain decreased.
- No changes were noted in the estimated mean intakes of total fruit, vegetables, and dairy.
- Estimated mean intakes of added sugars decreased.
- Estimated mean intakes of solid fats decreased and that of oils increased.
- No changes were noted in the estimated mean intakes of energy and protein.
- Estimated mean percentage of calories from carbohydrate decreased.
- Estimated mean percentage of calories from total fat increased.

What are the implications of the study?

- Adults need to increase their fruit, vegetables, low fat or non-fat dairy, and whole grain intakes.
- Adults may further reduce their added sugars intake by choosing food and beverages that do not contain added sugars or low in added sugars, to keep their added sugars intake below 10% of total calories, as recommended by the DGA.
- Adults may choose nonfat or low-fat dairy food and lean protein food to control solid fats intakes.

Methodology

The study included adults, 20 years and over, who had complete dietary intake data on day 1 of What We Eat in America (WWEIA), NHANES survey cycles from 2003-2004 to 2017-2018. Eight survey cycles were included in the study. Day 1 dietary data [2, 3] were analyzed and mean intakes of energy, macronutrients, and food pattern groups were estimated. Survey sample weights were used in the analyses. Fruit juice data were available starting in 2005-2006. Sample sizes are in Table 1.

Two types of statistical analyses were conducted.

1. The first set of analysis compared mean intakes in 2003-2004 with that in 2017-2018. The purpose was to know whether adults ate more, less, or the same amounts of each of the variables analyzed between the two survey periods.
2. The second set of analysis examined the overall linear trends and quadratic trends during the 8 survey periods, starting from 2003 to 2018. Linear and quadratic trends were analyzed for macronutrients and food pattern groups; and linear trends were analyzed for percentage of calories from macronutrients.

A p -value < 0.01 was considered significantly different for all analyses.

Definitions

USDA Food Patterns [4] include the five food groups, vegetables, fruits, grains, dairy, and protein foods; and components such as oils, solid fats, added sugars, and alcoholic drinks.

Added sugars are defined as caloric sweeteners such as sugars and syrups that are added to foods as ingredients during food preparation, processing, or at the table. Added sugars do not include naturally occurring sugars such as lactose present in milk and fructose present in fruit and 100% fruit juice.

Oils include fats that are naturally present in nuts, seeds, avocado, olives, and seafood; and all unhydrogenated vegetable oils, except tropical oils such as palm oil, palm kernel oil, and coconut oil.

Solid fats are high in saturated fat. Solid fats include fat that are naturally present in dairy products such as milk, cheese, butter, cream, cream cheese, and sour cream; fat naturally present in meat, poultry, and eggs; lard; hydrogenated fats and shortenings; cocoa butter; coconut oil; palm oil; and other tropical oils.

Oils and solid fats are two different ways used to represent the fat present in foods. Foods in oils group are relatively lower in saturated fat as compared with foods in the solid fats group.

Data sources

Eight survey cycles of What We Eat in America, NHANES 2003-2018, day 1 dietary data were used to estimate nutrient and Food Patterns equivalents intakes. Sample sizes are in Table 1 on page 5.

References

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