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Food Pattern Group and Macronutrient Intakes of Adolescents 12 to 19 years: 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.
- Adolescents ate 5.6 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 adolescents 12-19, from 2003 to 2018?

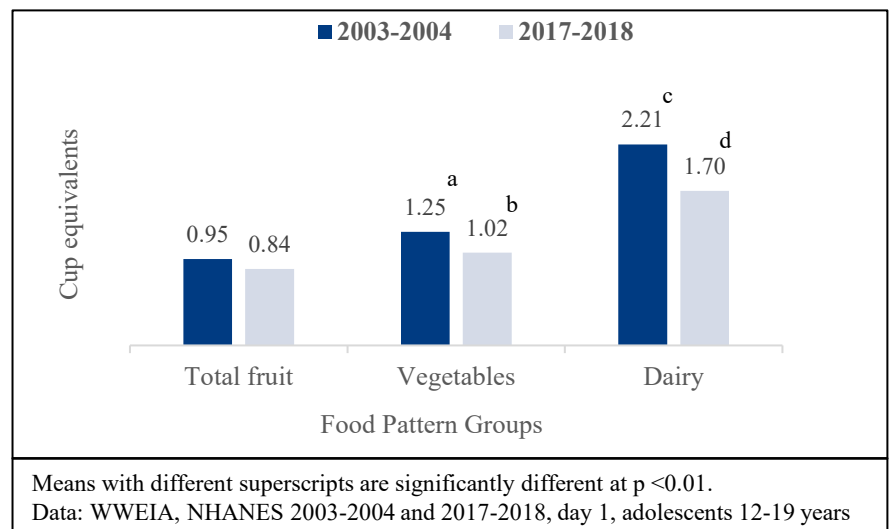
The Dietary Guidelines for Americans (DGA) [1] provide guidance on making healthful dietary choices. This study identifies changes in the macronutrient and food pattern group intakes of adolescents 12-19 years from What We Eat in America (WWEIA), NHANES, day 1 dietary data [2,3] between the survey periods 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?

Adolescents consumed 0.23 cup equivalent (cup eq.) less vegetables and 0.51 cup eq. less dairy in 2017-2018 than in 2003-2004 (p<0.01).

Figure 1. Estimated mean intakes of fruit, vegetables, and dairy by adolescents 12-19 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 ($p < 0.01$) decreased between 2005-2006 and 2017-2018 (figure 2). No significant differences were noted in the total fruit intakes between the surveys.

Figure 2. Estimated mean intakes of total fruit and fruit juice by adolescents 12 to 19 in 2005-2006 and 2017-2018, WWEIA, NHANES, day 1

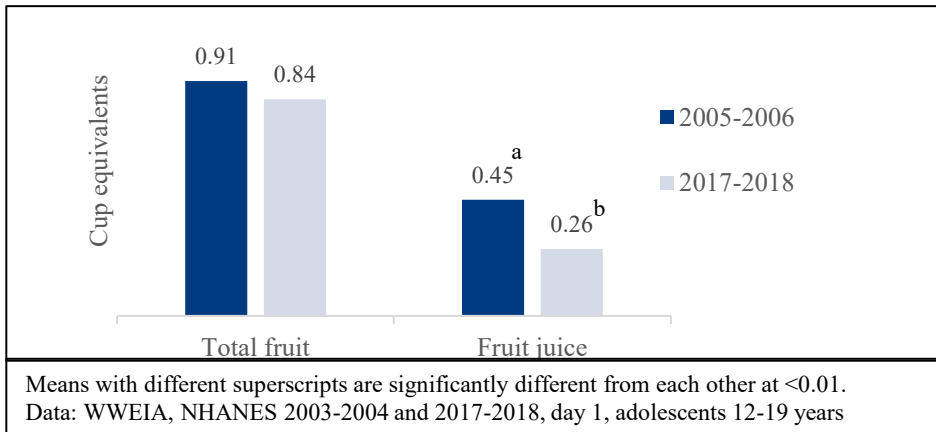
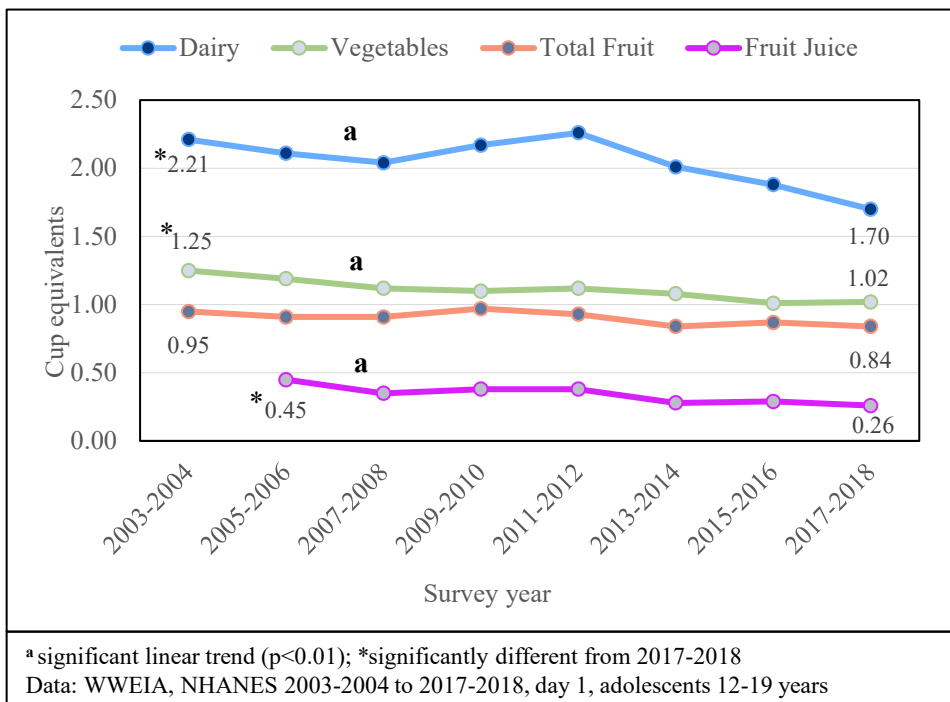


Figure 3 includes the estimated mean intakes for the eight survey periods. (trend analysis)

- 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 adolescents consumed a lower proportion of 100% fruit juice to total fruit from 2003-2004 to 2017-2018.
- Dairy and vegetable intakes declined over this time period, and the linear trends were significant.

Figure 3. Estimated mean intakes of total fruit, 100% fruit juice, vegetables, and dairy by adolescents 12 to 19, from 2003-2004 to 2017-2018, WWEIA, NHANES, day 1

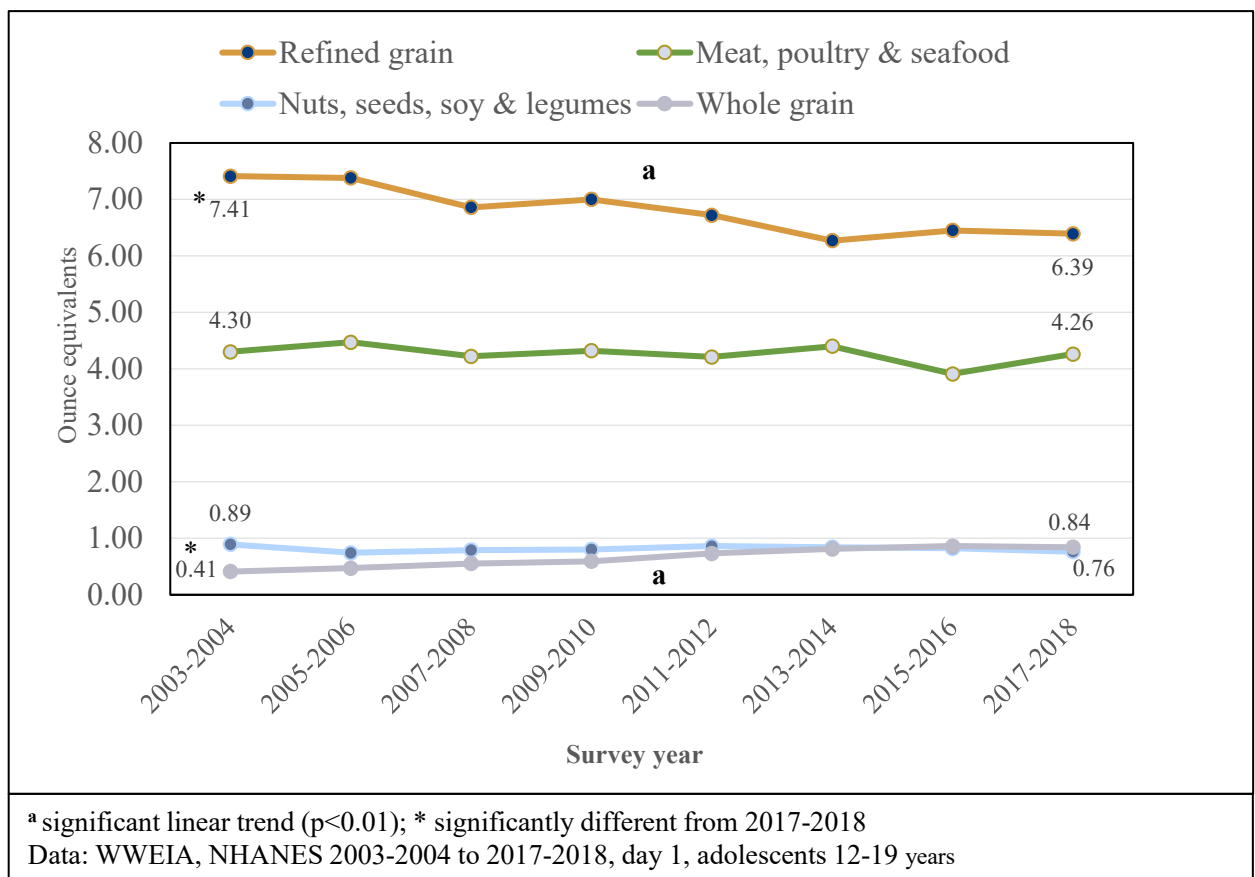


Did the grain and protein foods intakes change among adolescents 12-19 years?

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 0.43 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 about 1 oz. eq. from 2003-2004 to 2017-2018.
- The linear trends were significant for both whole and refined grains, during this period.
- The mean intakes of meat, poultry, and seafood in 2003-2004 was not significantly different from that in 2017-2018. The linear trend was not significant either.
- The mean intake of nuts, seeds, soy, and legumes in 2003-2004 was not significantly different from that in 2017-2018. The linear trend was not significant either.
- Adolescents 12-19 years, ate 5.6 times more protein foods of animal origin (meat, poultry, and seafood) than of plant origin, in 2017-2018.

Figure 4. Estimated mean intakes of grain and protein foods by adolescents 12 to 19 from 2003-2004 to 2017-2018, WWEIA, NHANES. day 1

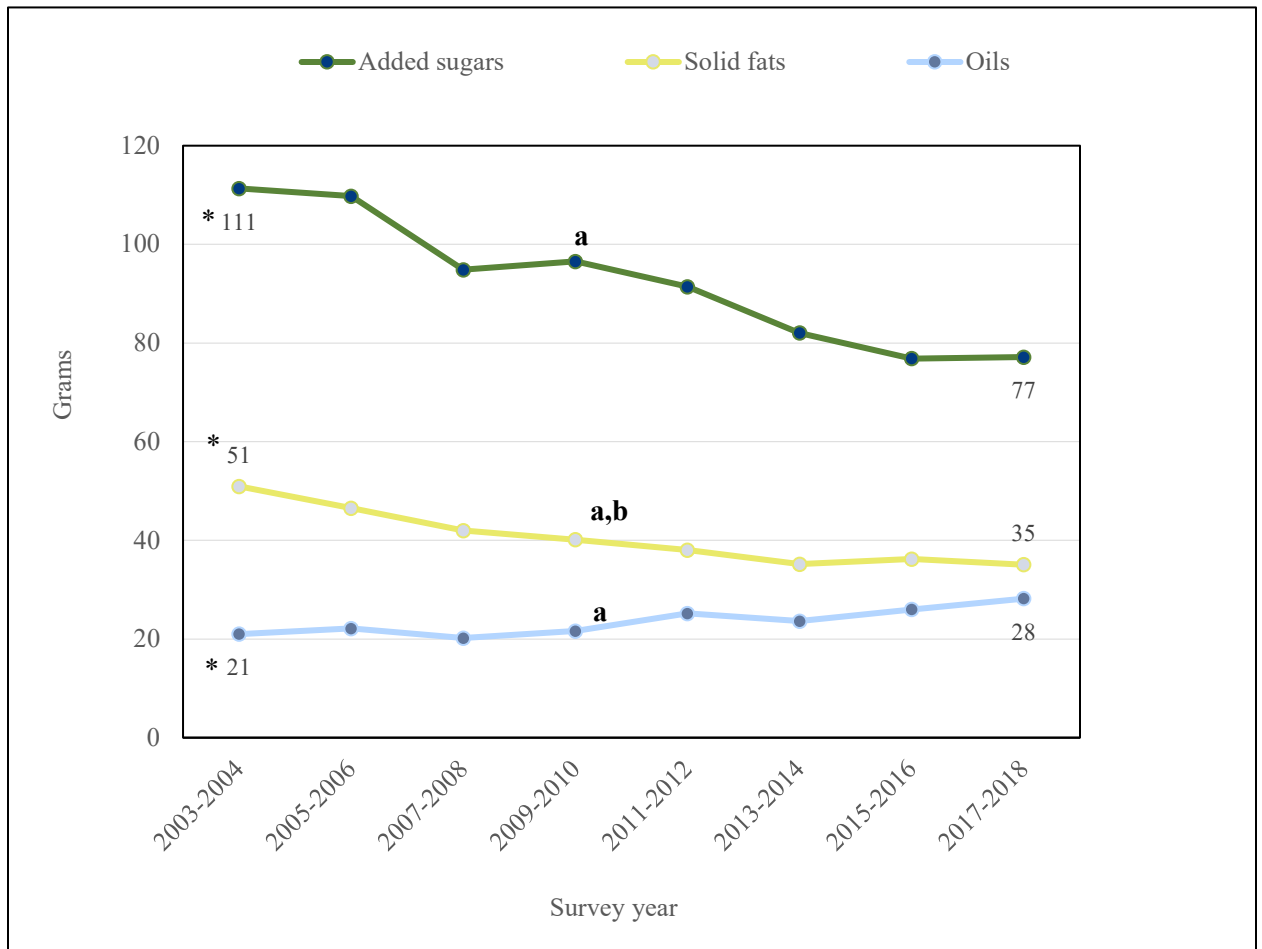


Did the added sugars, oils, and solid fats intakes change among adolescents?

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

- Adolescents 12 to 19 years, significantly ($p < 0.01$) decreased their added sugars intakes from 111 grams (26.4 tsp. eq.) in 2003-2004 to 77 grams (18.3 tsp. eq.) in 2017-2018, a difference of 34 grams or 8.1 tsp. eq.
- Solid fats intake significantly reduced by 16 grams
- Oils intake significantly increased by 7 grams.
- The linear trends from 2003-2004 to 2017-2018 were significant, and showed strong decline for added sugars and solid fats; and a significant increase for oils.
- Solid fats also had significant quadratic trend.

Figure 5. Estimated mean intakes of added sugars, oils, and solid fats by adolescents 12 to 19, from 2003-2004 to 2017-2018, WWEIA, NHANES. day 1



^a significant linear trend; ^b significant quadratic trend ($p < 0.01$); *significantly different from 2017-2018
Data: WWEIA, NHANES 2003-2004 to 2017-2018, day 1, adolescents 12-19 years

Did the estimated mean intakes of energy and macronutrients change from 2003-2004 to 2017-2018 among adolescents 12-19 years?

Table 1 includes the estimated mean intakes of energy and macronutrients.

Between 2003-2004 and 2017-2018:

- Energy intake significantly ($p < 0.01$) decreased by 311 calories.
- Carbohydrate significantly decreased by 56 grams.
- Saturated fat significantly decreased by 2.3 grams.
- No significant changes were noted in the estimated mean intakes of total fat and protein.

Trend analysis:

- Mean intakes of energy and all of the four macronutrients each had a significant ($p < 0.01$) linear decreasing trend during this time period.

Table 1. Estimated mean intakes of energy and macronutrients by adolescents 12 to 19 from 2003-2004 to 2017-2018, WWEIA, NHANES, day 1

Survey year	N	Energy (kcal)	Carbohydrate (g)	Protein (g)	Total fat (g)	Saturated fat (g)
2003-2004	2162	2341*	310*	81.4	87.2	29.8*
2005-2006	2115	2324	304	82.4	87.2	30.3
2007-2008	1156	2145	281	78.3	80.0	27.7
2009-2010	1265	2167	287	79.1	79.4	27.0
2011-2012	1152	2175	286	79.4	81.1	27.4
2013-2014	1296	2038	260	79.0	77.6	26.0
2015-2016	1196	2031	258	74.0	80.3	27.9
2017-2018	1045	2030	254	74.7	81.4	27.5

*Significantly different from 2017-2018.

The linear trends were significant at $p < 0.01$ for energy and all four macronutrients.

Quadratic trends were significant for total fat and saturated fat.

Data: WWEIA, NHANES 2003-2004 to 2017-2018, day 1, adolescents 12-19 years

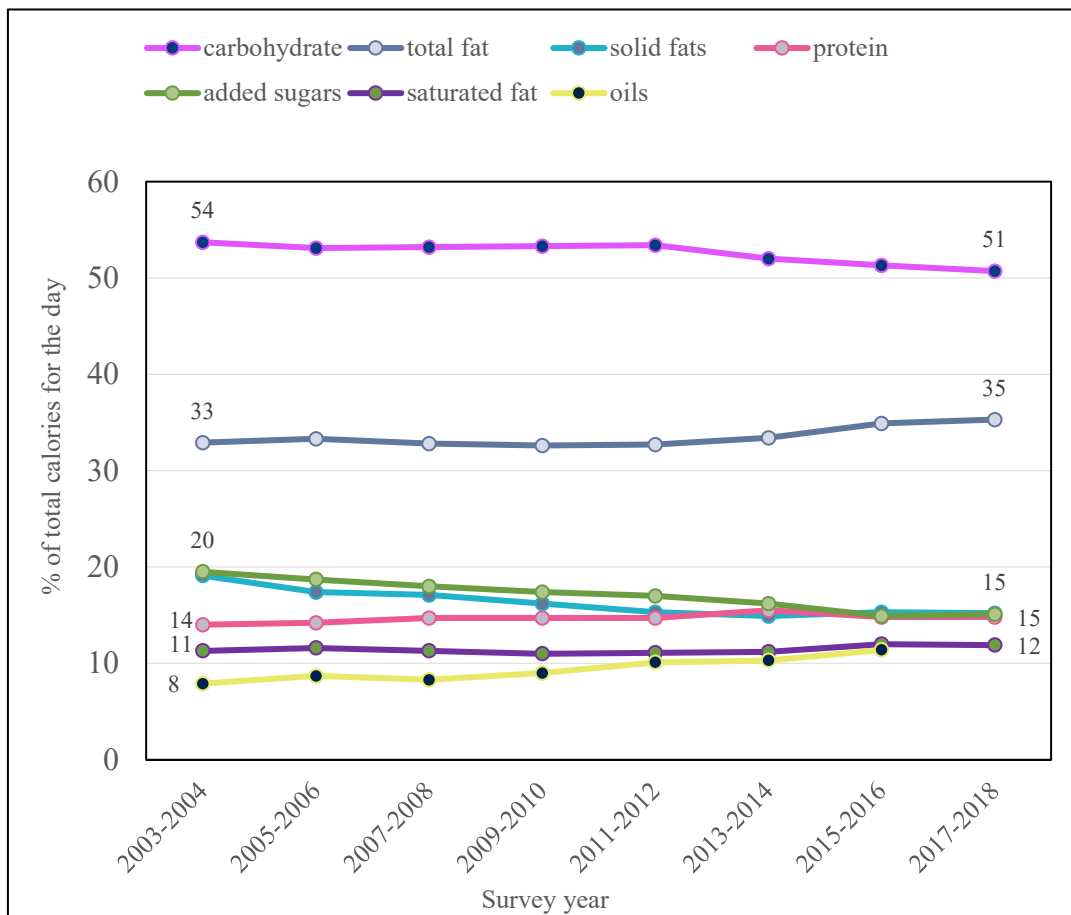
Did the estimated mean percentage of calories from macronutrients, added sugars, solid fats, and oils change among adolescents 12-19 years?

The estimated mean percentage of calories are shown in Figure 6. Solid fats and oils are two different Food Patterns 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 provided by them can be estimated.

The percentages below are rounded to integers.

- Carbohydrate intake significantly reduced from 54% to 51%.
- Total fat significantly increased from 33% to 35%, and saturated fat increased from 11% to 12%.
- Added sugars significantly decreased from 20% to 15%.
- Solid fats significantly decreased from 19% to 15%.
- Oils significantly increased from 8% to 12%.
- Protein was not significantly different.
- The linear trends were significant at $p < 0.01$ for all of the variables, except protein.

Figure 6. Estimated mean percentage of calories obtained from macronutrients, added sugars, solid fats, and oils by adolescents 12 to 19, 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, adolescents 12-19 years

What are the main findings of the study?

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

- Estimated mean intakes of vegetable and dairy decreased.
- Estimated total fruit intake did not change over the 8 survey periods, but fruit juice intakes decreased, showing a reduction in the proportion of fruit consumed as fruit juice.
- Estimated whole grain intake increased by a small amount, and refined grain intake decreased.
- Estimated added sugars and solid fats intakes substantially decreased, and oils intake increased
- Estimated mean percentage of calories from added sugars and solid fats decreased.
- Estimated mean intakes of energy, carbohydrate, and saturated fat decreased.

What are the implications of the study?

- The study showed an urgent need for nutrition intervention to increase fruit, vegetables, and low-fat or non-fat dairy intakes among adolescents 12 to 19 years.
- Adolescents 12-19 years 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
- Adolescents 12-19 years may choose nonfat or low-fat dairy food and lean protein food to further control solid fats intakes.

Methodology

The study included adolescents 12-19 years of age 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 amount of each of the variables analyzed between the two survey periods.
2. The second set of analysis examined the overall linear 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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