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Trends in Caffeine Intake Among US Children and Adolescents

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Abstract

BACKGROUND AND OBJECTIVE—Physicians and policy makers are increasingly interested in caffeine intake among children and adolescents in the advent of increasing energy drink sales. However, there have been no recent descriptions of caffeine or energy drink intake in the United States. We aimed to describe trends in caffeine intake over the past decade among US children and adolescents.

METHODS—We assessed trends and demographic differences in mean caffeine intake among children and adolescents by using the 24-hour dietary recall data from the 1999–2010 NHANES. In addition, we described the proportion of caffeine consumption attributable to different beverages, including soda, energy drinks, and tea.

RESULTS—Approximately 73% of children consumed caffeine on a given day. From 1999 to 2010, there were no significant trends in mean caffeine intake overall; however, caffeine intake decreased among 2- to 11-year-olds ($P < .01$) and Mexican-American children ($P = .003$). Soda accounted for the majority of caffeine intake, but this contribution declined from 62% to 38% ($P < .001$). Coffee accounted for 10% of caffeine intake in 1999–2000 but increased to nearly 24% of intake in 2009–2010 ($P < .001$). Energy drinks did not exist in 1999–2000 but increased to nearly 6% of caffeine intake in 2009–2010.

CONCLUSIONS—Mean caffeine intake has not increased among children and adolescents in recent years. However, coffee and energy drinks represent a greater proportion of caffeine intake as soda intake has declined. These findings provide a baseline for caffeine intake among US children and young adults during a period of increasing energy drink use.

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Dr Branum codesigned the study, performed the literature review, and drafted the initial manuscript; Dr Rossen codesigned the study, performed the statistical analyses, and formatted the tables and figures; Dr Schoendorf conceptualized the study and critically reviewed the manuscript; and all authors approved the final manuscript as submitted.

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Keywords

diet; survey; children; adolescents; trends

The assessment of caffeine intake among children and adolescents is important to health professionals and policy makers. Historically, soda and tea have been the main sources of caffeine in the diets of children and adolescents[1]; however, the availability and sales of energy drinks, specialty coffee drinks, and food products containing caffeine, including candy bars, potato chips, and gum, have dramatically increased over the past decade and are often marketed toward children and adolescents.[2,3] Although caffeine is considered a "safe" substance by the US Food and Drug Administration (FDA), its potential adverse effects on children and adolescents are largely unknown because most research has been in adult populations.[3] In addition, the caffeine content of energy drinks, unlike that of cola, is not currently regulated by the FDA because the former are marketed as and considered dietary supplements.[2] Excess consumption of caffeine can result in tachycardia, arrhythmia, hypertension, hyperactivity, anxiety, and increased blood sugar concentrations because many energy drinks, specialty coffee drinks, and other drinks that contain large amounts of caffeine (eg, some brands of soda) often also contain high amounts of sugar.[4,5] Case reports of caffeine toxicity and deaths among adolescents and adults reflect the potential dangers of excess caffeine or energy drink consumption.[5,6] The American Academy of Pediatrics currently takes the position that "stimulant-containing energy drinks have no place in the diets of children and adolescents"[7]. In addition, neither the *Dietary Guidelines for Americans* nor the Institute of Medicine provides guidance for caffeine as a nutrient. With the exception of an analysis of Continuing Survey of Food Intakes by Individuals data from the mid-to-late 1990s,[1] which predate energy drink production in the United States, there have been no descriptions of caffeine or energy drink intake among adolescents in the United States using a nationally representative population. This analysis fills these important gaps by examining trends in caffeine intake over the past decade among US children, adolescents, and young adults and assessing caffeine intake from energy drinks and other beverages.

METHODS

Study Population

We analyzed data from the 1999–2000, 2001–2002, 2003–2004, 2005–2006, 2007–2008, and 2009–2010 NHANES, a nationally representative survey of the civilian noninstitutionalized population in the United States.[8] The NHANES comprises both a household interview and mobile examination center (MEC) component. Participants are administered a series of questionnaires during the household interview; those that consent to an MEC examination undergo selected medical and physiologic measurements and laboratory tests.[8] The overall response rates for NHANES MEC participants were 75% to 80% for the survey periods used in this analysis.[9]

Study Variables

Our main outcome was caffeine intake from all foods and beverages reported on the first 24-hour dietary recall among NHANES participants ages 2 through 22 years. This 24-hour dietary recall is conducted in person in the MEC by a trained interviewer by using the Automated Multi-Pass Method, which involves leading the respondent through a series of questions regarding all food and beverage intake in the previous 24 hours.[10] Since 2003, a second dietary recall has been conducted via telephone 3 to 10 days after the first; however, because we were making population-level mean estimates and only have 1 recall for 1999–2002, this analysis was limited to the first-day dietary recall. For children younger than 6 years, recalls were answered by a proxy respondent, typically a caregiver. Children between 6 and 11 years of age completed the dietary recalls with assistance from a proxy respondent, and children 12 and older reported intake unassisted. More information regarding the dietary recall methodology can be found elsewhere.[11] Data on caffeine were taken from the Total Nutrient file, which contains summed nutrients for an individual from all food and beverages reported on the dietary recall.[12] The nutrient information is derived from the US Department of Agriculture's Food and Nutrient Database for Dietary Studies, which contains food and beverage nutrient composition data and is used in conjunction with the NHANES dietary recall data to assign nutrient values to reported foods and beverages.[13]

We also examined caffeine intake from specific food and beverages by using the Individual Foods files. Foods reported in the NHANES dietary recalls are assigned an 8-digit code beginning with the numbers 1 through 9, which distinguishes certain food groups from each other.[13] To examine food and beverage contributors to caffeine intake, we used these codes to create categories for specific beverages as follows: flavored dairy (eg, chocolate milk), coffee, soda, tea, and energy drinks. We also included 3 specific food categories, sweetened grains (eg, chocolate cake), sugars/sweets, and "other," due to the presence of caffeine in select items within these categories. We examined trends in caffeine intake by demographic characteristics including age (2–5, 6–11, 12–16, 17–18, and 19–22 years), race/ethnicity (non-Hispanic white, non-Hispanic black, and Mexican American), and poverty status. These age groups align with the differences in the way the dietary recall information was reported and also allowed a more detailed examination of caffeine intake among older adolescents and young adults. Although 19- to 22-year-olds are not typically included in analyses of children and adolescents, this age group was included due to concern about caffeine intake (and energy drink consumption, in particular) among college-aged youth. Race/ethnicity analysis was restricted to non-Hispanic white, non-Hispanic black, and Mexican American only because the relatively small sample sizes for children of "other Hispanic" and "other race/ethnicity" did not permit separate analyses. Poverty status was measured by using the poverty-income ratio (PIR), which accounts for household income according to household or family size, household age composition, and year.[14] We created ordinal categories of PIR expressed as a percentage of the federal poverty threshold (0%–99%, 100%–199%, 200%–299%, 300%–399%, and ≥400%).

Statistical Analysis

We estimated the mean caffeine intake (mg/day) by survey year and by demographic characteristics. Guidance from the online NHANES Dietary tutorial states that 1 day of

dietary recall is subject to random error, mainly in the form of intraindividual daily variability in food intake, and bias (eg, under-reporting of food intake based on weight or demographic characteristics).[15] Although it is assumed that the random errors will negate each other when intake is examined over an entire population, bias may still be present.[15] Therefore, the use of the first-day dietary recall to make population estimates of mean caffeine intake for a given day is sufficient for this analysis, although it may be limited by potential bias if certain demographic groups were more likely to misreport caffeine intake. Mean caffeine intake was not normally distributed because ~30% of respondents reported no caffeine intake on their first-day recall. Due to the large number of zero values, the distribution was also not easily transformable. Therefore, we estimated mean intake only among those reporting caffeine intake ("consumers") and examined the proportion reporting no caffeine intake ("nonconsumers") over time. We did this to determine whether the proportion of nonconsumers was different over time and therefore could bias the results of the mean analysis. The proportion of caffeine intake attributable to various food and beverage categories was assessed by multiplying caffeine intake in the Individual Foods file by the first-day dietary recall weight, as delineated in the NHANES analytic guidelines.[16] Using this value as the sample weight and tabulating the food and beverage categories subsequently produces the population-weighted proportion of caffeine intake attributable to each food and beverage category.

Trends over time were assessed overall and by demographic subgroups. Log-binomial models were used to model the proportion of youth reporting positive caffeine intake on a given day. Due to skewed distribution of caffeine intake among consumers, intake was log-transformed and linear regressions were used to examine associations between demographic characteristics, as well as to model trends over time. Statistical significance of trends was assessed by using orthogonal polynomial contrasts, which test a hypothesis of no linear or quadratic trend. Because of the large number of children with no caffeine intake, sensitivity analyses used zero-inflated negative binomial models to examine intake including nonconsumers. Analyses were performed by using Stata/SE (version 12.1; StataCorp, College Station, TX). Day 1 dietary recall weights and survey procedures were used in all analyses to account for the complex, stratified, multistage probability sample design of NHANES.

RESULTS

Approximately 73% of children consumed caffeine on a given day; this proportion did not change over time. However, there were some significant differences by age, race/ethnicity, and PIR (see Table 1). There was a significant quadratic trend for age; the percentage of consumers increased from 63% among 2- to 5-year-old children to ~75% among the older age groups. There was a linear trend for PIR where higher-income children were more likely to consume caffeine than children below the poverty threshold. Non-Hispanic white children were more likely to consume caffeine than non-Hispanic black or Mexican-American children. There were no differences over time in the proportion of youth consuming caffeine for any sociodemographic subgroup, except that youth in the lowest-income category (0%–99% of the federal poverty threshold) demonstrated a significant linear decrease in the likelihood of consuming caffeine across the study period ($P = .03$; data not shown).

Among caffeine consumers, there was an increase in caffeine intake with age ($P < .001$; Table 1). In addition, non- Hispanic white children consumed a greater amount of caffeine on a given day than non-Hispanic black or Mexican-American children ($P < .001$), and boys consumed a greater amount than girls ($P < .001$). There were no significant differences in mean caffeine intake by PIR.

There was no significant trend in mean caffeine intake (mg/day) among children with reported caffeine intake (Fig 1; $P = .104$). Similar results were found by using a zero-inflated negative binomial model to examine trends among all children, not just caffeine consumers (data not shown). Table 2 describes mean caffeine intake over the study period among consumers by sociodemographic characteristics. Sensitivity analyses using zero-inflated negative binomial models and including nonconsumers were consistent with results presented (Supplemental Table 4). There were significant linear decreases over the study period in the mean amount of caffeine consumed on a given day among 2- to 5-year-olds ($P < .001$), 6- to 11-year-olds ($P = .008$), and Mexican-American children ($P = .003$). There were no statistically significant linear or quadratic time trends in caffeine intake among other sociodemographic subgroups.

Proportion of Caffeine Intake Attributable to Food/Beverage Categories

Soda accounted for the majority of caffeine intake in 1999–2000 (62%) and remained the largest contributor to caffeine intake throughout the study period (Fig 2). However, the proportion of intake attributable to soda declined from 62% in 1999–2000 to 38% in 2009–2010 ($P < .001$). Tea was the second largest contributor to overall caffeine intake, and remained relatively stable from 1999–2000 to 2009–2010. Coffee accounted for only 10% of caffeine intake in 1999–2000, but increased significantly to nearly 24% of intake in 2009–2010 ($P < .001$). Energy drinks did not exist as a category in 1999–2000, but represented nearly 6% of caffeine intake in 2009–2010. This increase represented a significant linear trend ($P < .001$), even though the sample size of children reporting use of energy drinks was small (unweighted $n = 111$, survey-weighted proportion of children reporting = 0.7%).

Table 3 shows the proportions of caffeine intake attributable to various sources by age group. Across all age groups, soda represented the largest contributor to caffeine intake in 1999–2000. By 2009–2010, different patterns had emerged by age, although soda became a less predominant contributor to caffeine intakes across all groups. Among 2- to 5-year-olds, tea overtook soda as the largest contributor to caffeine intake. Among 19- to 22-year-olds, coffee emerged as the largest contributor to caffeine intake by 2009–2010. Energy drinks also increased from 0% of caffeine intake in 1999–2000 to just over 10% of caffeine intake among 19- to 22-year-olds in 2009–2010.Trends in the amount of caffeine attributable to different sources are presented in Supplemental Table 5 and are largely consistent with the trends in proportions described above. In addition, trends in caffeine intake attributable to sources by race/ethnicity are available in Supplemental Table 6.

DISCUSSION

Mean caffeine intake among the ~75% of children, adolescents, and young adults who consume caffeine in the United States has remained stable among adolescents and young

adults but decreased among young children over the past 10 years. Although the trend in mean caffeine intake among consumers has not significantly changed for adolescents and young adults, the proportion of caffeine intake from soda, which historically has accounted for the majority of caffeine intake, decreased whereas the proportion of intake from coffee and energy drinks increased.

There is concern that caffeine intake may be increasing among children and adolescents as a result of the growing popularity and use of energy drinks.[5,17] In addition, consumption of sweetened coffee drinks has also increased.[18] The increase in caffeine intake from energy drinks and coffee since 1999–2000 has been offset by decreases in soda consumption over the same period, resulting in no significant change over time for most groups; however, if current trends in energy drink and coffee consumption continue, especially among population groups who consume more caffeine, such as older adolescents, that may no longer hold true.

There have been 2 previous reports of caffeine intake using nationally representative data from the United States. Using the Continuing Survey of Food Intakes by Individuals data from 1994 to 1996 and from 1998, which also used a 24-hour dietary recall, Frary et al[1] reported a greater proportion of children and adolescents consuming caffeine (≥90% for most age and gender categories) compared with our results. Although our estimates of mean intake among children aged 2 to 5 years in 1999–2000 were similar to those reported by Frary et al, our estimates for older children were somewhat greater, although the use of different age groups and specific age and gender categories in their analysis make direct comparisons difficult. Similar proportions of caffeine intake from soda, tea, and coffee in 1999–2000 were observed in this study, compared with previous estimates.[1] A 2010 report from the FDA using NHANES data from same period as our study, which described caffeine intake among US children and adults, was also largely consistent with our results, although that report described per capita intake instead of intake among consumers only.[17] In addition, the FDA report used a consumer panel database to examine caffeine intake by food or beverage category, rather than NHANES; consequently, differences in methodology and age groups make findings not directly comparable.[19]

Our findings do compare with recently documented trends in beverage consumption. By using the NHANES data over the same time period, Kit et al,[18] found that soda consumption has declined in recent years whereas sweetened coffee and energy drink intake (combined with sports drinks) has increased among children and adolescents. The increasing trend in caffeine from energy drinks is temporally associated with sales data that show a sixfold increase in sales of energy drinks,[19,20] and with a doubling of visits to emergency departments related to energy drink consumption, mostly among 18- to 25-year-olds.[21]

Although there are currently no guidelines for daily maximum caffeine intake in individuals, the FDA sets tolerance limits on the amount of caffeine in cola-type beverages at ≤0.02% of the substance.[22] However, the FDA does set limits on caffeine-containing supplements at 200 mg per dose, a threshold at which acute caffeine toxicity is thought to occur.[22] Previous reports indicate that many caffeine-toxicity episodes occur among older teenagers and young

adults, largely as a result of ingesting large amounts of caffeine coupled with alcohol and other legal and illegal drugs.[21]

To our knowledge, this is the first detailed description of caffeine intake from energy drink consumption among children, adolescents, and young adults in the United States. Although energy drinks accounted for a relatively small proportion of caffeine intake in 2009–2010, intake increased rapidly in a short period of time. With the recent emphasis on reducing intake of soda and juice as an obesity-reduction strategy, more research is needed to determine if children and adolescents are substituting energy drinks or coffee for soda. On average, a 12-oz serving of energy drink contains 36 g of sugar and ~160 calories, nearly the same as a 12-oz can of soda.[23] However, the amount of caffeine in energy drinks varies between brands but can be as high as 130 mg in a 12-oz serving, equivalent to four 12-oz servings of caffeinated soda.[23] Although many energy drinks are sold in 8-oz sizes, sales of larger containers are increasing.[2] Similarly, sweetened coffee drinks can contain large amounts of sugar, nearly double the amount of calories of soda depending on size and flavoring and caffeine amounts similar to that of energy drinks.[23] Future research should continue to monitor trends in energy drink and coffee consumption among youth, as well as determine the potential impact of these beverages on health outcomes.

This study is subject to some limitations. First, we used only the first day of dietary recall in documenting trends in intake, which does not account for intraindividual variation. Therefore, results do not necessarily represent usual intake of caffeine. Second, although increasing, energy drink intake remains relatively low, precluding reliable estimates for some groups (eg, children <12 years). Finally data on caffeine intake may be subject to recall and social desirability biases as well as misreporting, because caregivers/proxies complete the recall or assist younger children in the sample. This study is the first detailed analysis of trends in, and sources of, caffeine intake among children and adolescents in the United States using 10 years of nationally representative data. This analysis of caffeine intake among youth provides valuable data in the context of the recent and rapid increase in the development and marketing of highly caffeinated food and beverage products. Moreover, this study is among the first to examine sociodemographic patterns in caffeine intake.

CONCLUSIONS

Mean caffeine intake has not increased among children and adolescents in recent years. However, coffee and energy drinks represent a greater proportion of caffeine intake as soda intake has declined, and generally have higher concentrations and amounts of caffeine than soda.[23] These findings provide a baseline for caffeine intake among US children and young adults in the advent of increasing energy drink sales and availability. Additional research will be needed to continue to monitor these trends and to determine the role of increasing energy drink and coffee consumption on child and adolescent health.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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ABBREVIATIONS

FDA	US Food and Drug Administration
MEC	mobile examination center
PIR	poverty-income ratio

REFERENCES

1. Frary CD, Johnson RK, Wang MQ. Food sources and intakes of caffeine in the diets of persons in the United States. J Am Diet Assoc. 2005; 105(1):110–113. [PubMed: 15635355]
2. Heckman MA, Sherry K, Gonzalez de Mejia E. Energy drinks: an assessment of their market size, consumer demographics, ingredient profile, functionality, and regulations in the United States. Comprehensive Reviews in Food Science and Food Safety. 2010; 9(3):303–317.
3. Temple JL. Caffeine use in children: what we know, what we have left to learn, and why we should worry. Neurosci Biobehav Rev. 2009; 33(6):793–806. [PubMed: 19428492]
4. Torpy JM, Livingston EH. JAMA patient page. Energy drinks. JAMA. 2013; 309(3):297. [PubMed: 23330173]
5. Seifert SM, Schaechter JL, Hershorin ER, Lipshultz SE. Health effects of energy drinks on children, adolescents, and young adults. Pediatrics. 2011; 127(3):511–528. [PubMed: 21321035]
6. Meier B. Caffeinated drink cited in reports of 13 deaths. Available at: www.nytimes.com/2012/11/15/business/5-hour-energy-is-cited-in-13-death-reports.html?_r=1&.
7. Committee on Nutrition and the Council on Sports Medicine and Fitness. Sports drinks and energy drinks for children and adolescents: are they appropriate? Pediatrics. 2011; 127(6):1182–1189. [PubMed: 21624882]
8. National Center for Health Statistics. [Accessed December 17, 2013] National Health and Nutrition Examination Survey. About the National Health and Nutrition Examination Survey. Available at: www.cdc.gov/nchs/nhanes/about_nhanes.htm
9. National Center for Health Statistics. [Accessed December 17, 2013] National Health and Nutrition Examination Survey. NHANES response rates and CPS totals. Available at: www.cdc.gov/nchs/nhanes/response_rates_CPS.htm
10. Agricultural Research Service. Beltsville, MD: Beltsville Human Nutrition Research Center, Food Surveys Research Group; USDA Automated multiple-pass method for dietary recalls. Available at: www.ars.usda.gov/Services/docs.htm?docid=7710 [Accessed December 17, 2013]
11. National Center for Health Statistics. [Accessed December 17, 2013] National Health and Nutrition Examination Survey. Survey questionnaires, examination components and laboratory components 2009–2010. Dietary recall component. Available at: www.cdc.gov/nchs/data/nhanes/nhanes_09_10/dietaryrecall_f.pdf
12. National Center for Health Statistics. [Accessed December 17, 2013] National Health and Nutrition Examination Survey. 2009–2010 Data documentation, codebook, and frequencies. Dietary interview: total nutrient intakes - first day. Available at: http://www.cdc.gov/nchs/nhanes/nhanes2009–2010/DR1TOT_F.htm
13. US Department of Agriculture, Agriculture Research Service, Food Surveys Group. USDA Food and Nutrient Database for Dietary Studies. 4.1. Beltsville, MD: US Department of Agriculture; 2010.
14. US Census Bureau. [Accessed December 17, 2013] Poverty. Available at: www.census.gov/hhes/www/poverty/data/threshld/index.html

15. National Center for Health Statistics. [Accessed December 17, 2013] National Health and Nutrition Examination Survey. Dietary tutorial: estimate population mean intakes. Task 2: Estimate mean nutrient intakes from foods and beverages. Available at: www.cdc.gov/nchs/tutorials/Dietary/Basic/PopulationMeanIntakes/intro.htm
16. National Center for Health Statistics. [Accessed December 17, 2013] Dietary tutorial: estimate ratios and identify important food group sources of nutrients: National Health and Nutrition Examination Survey. Available at: www.cdc.gov/nchs/tutorials/dietary/Basic/Ratios/intro.htm
17. Reissig CJ, Strain EC, Griffiths RR. Caffeinated energy drinks—a growing problem. Drug Alcohol Depend. 2009; 99(1–3):1–10. [PubMed: 18809264]
18. Kit BK, Fakhouri TH, Park S, Nielsen SJ, Ogden CL. Trends in sugar-sweetened beverage consumption among youth and adults in the United States: 1999–2010. Am J Clin Nutr. 2013; 98(1):180–188. [PubMed: 23676424]
19. Laszlo, SP. [Accessed December 17, 2013] Caffeine intake by the U.S. population. US Food and Drug Administration. Available at: www.fda.gov/downloads/AboutFDA/CentersOffices/OfficeofFoods/CFSAN/CFSANFOIAElectronicReadingRoom/UCM333191.pdf
20. Kleiman S, Ng SW, Popkin B. Drinking to our health: can beverage companies cut calories while maintaining profits? Obes Rev. 2012; 13(3):258–274. [PubMed: 22070346]
21. Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality. A continuing public health concern. Rockville, MD: 2013 Jan 10. The DAWN report: update on emergency department visits involving energy drinks. Available at: www.samhsa.gov/data/2k13/DAWN126/sr126-energy-drinks-use.pdf [Accessed December 17, 2013]
22. US National Archives and Records Administration. [Accessed December 17, 2013] Code of Federal Regulations. Title 21. Caffeine. 2011. Available at: www.gpo.gov/fdsys/granule/CFR-2011-title21-vol3/CFR-2011-title21-vol3-sec182-1180/content-detail.html
23. US Department of Agriculture. [Accessed December 17, 2013] What's in the foods you eat online database. 2013. Available at: www.ars.usda.gov/services/docs.htm?docid=17032

WHAT'S KNOWN ON THIS SUBJECT

The majority of caffeine intake among children and adolescents is due to soda and tea consumption. Energy drinks, which provide a potent source of caffeine, have increased in availability in the United States in recent years.

WHAT THIS STUDY ADDS

This analysis presents trends in caffeine intake between 1999 and 2010, which have previously not been described in the United States, and reveals the impact of increasing energy drink use, also previously not described, on these trends among children and adolescents.

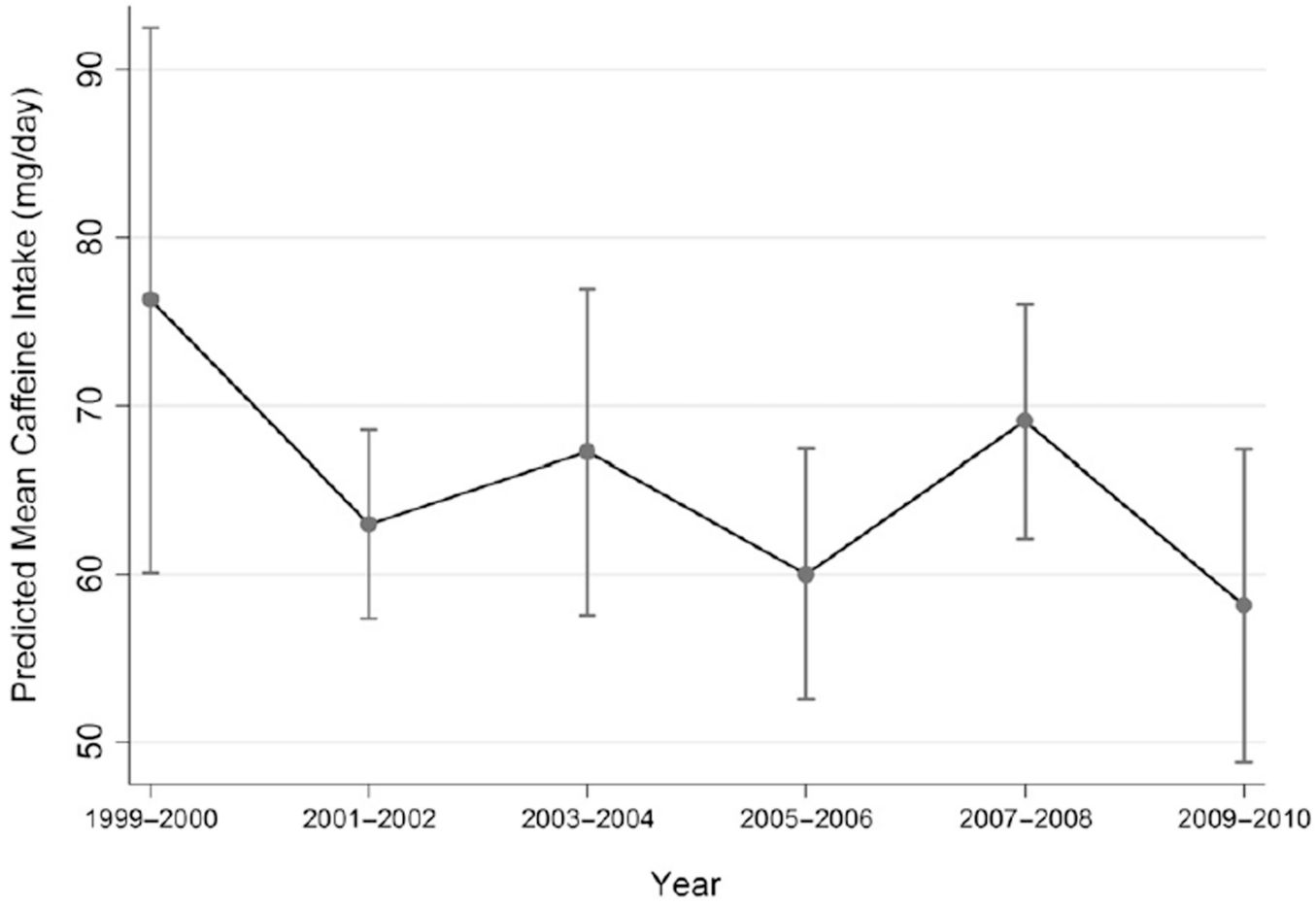

FIGURE 1.

Mean caffeine intake (mg/day) and 95% confidence intervals among consumers of caffeine aged 2 to 22 years: NHANES 1999–2010.

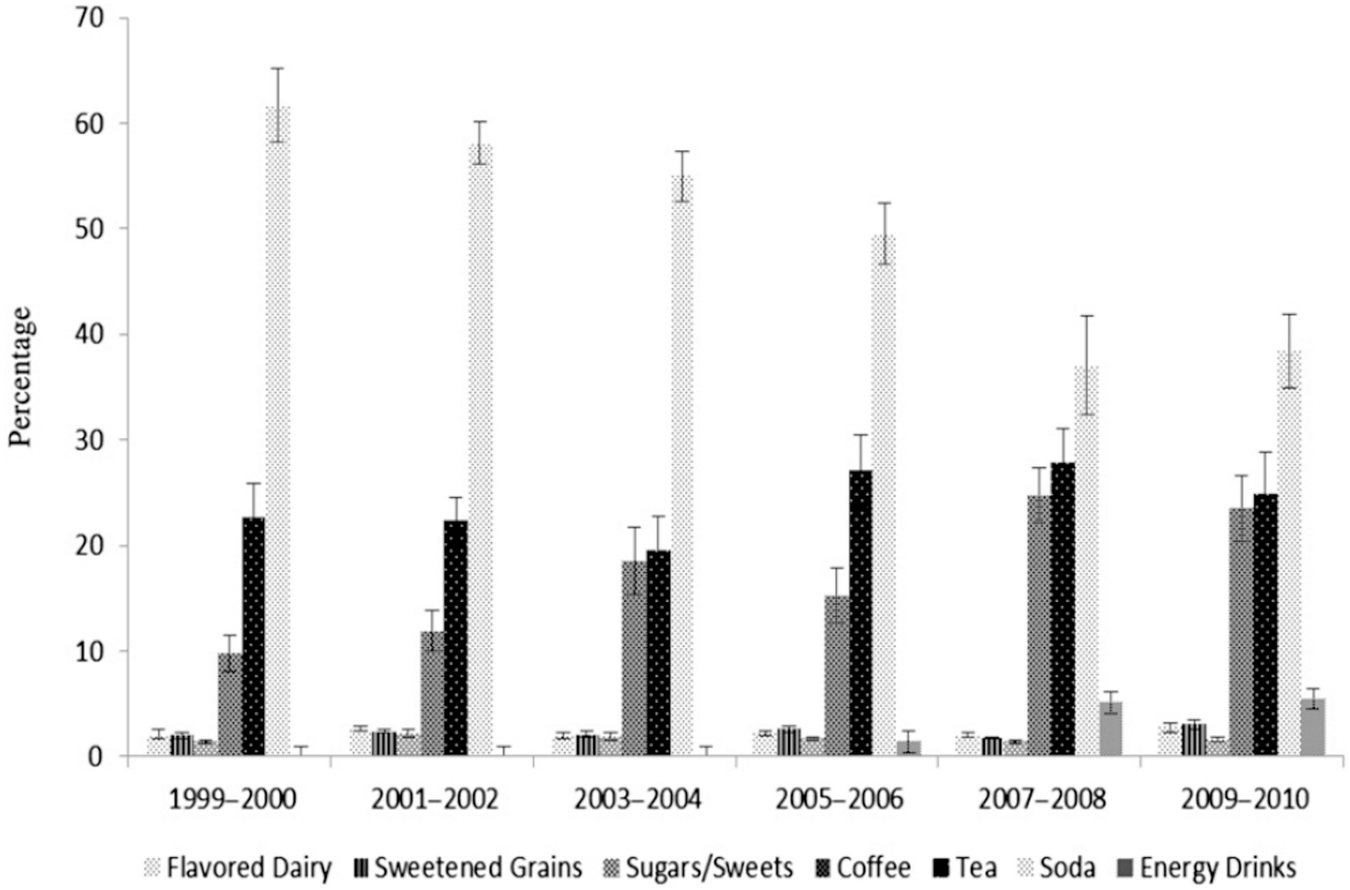

FIGURE 2.

Percentages and SEs of total caffeine intake from different sources among 2- to 22-year-olds: NHANES 1999–2010. Linear trends for soda, coffee, and energy drinks were significant at $P < .001$.

TABLE 1

Percentage of US Children and Adolescents (2–22 Years Old) Consuming Caffeine and Intake Among Consumers: NHANES 1999–2010

	Percentage Consuming Caffeine	Mean Intake Among Consumers, mg
Year		
1999–2000	73.7 ± 1.3	77.4 ± 8.3
2001–2002	73.4 ± 1.1	63.3 ± 3.1
2003–2004	75.5 ± 1.4	67.3 ± 4.9
2005–2006	72.4 ± 1.3	60.0 ± 3.8
2007–2008	72.1 ± 1.1	69.1 ± 3.5
2009–2010	72.1 ± 0.9	58.1 ± 4.8
Gender		
Male	73.3 ± 0.7	73.1 ± 3.3
Female	73.1 ± 0.7	57.7 ± 1.7[a]
Age[a,b]		
2–5 years	62.7 ± 1.1	15.9 ± 1.2
6–11 years	74.8 ± 0.9	31.8 ± 1.6
12–16 years	75.3 ± 0.9	67.5 ± 2.4
17–18 years	75.8 ± 1.2	109.9 ± 7.1
19–22 years	76.8 ± 1.6	125.5 ± 6.0
Race/ethnicity		
Non-Hispanic white	77.5 ± 0.7	74.2 ± 2.6
Non-Hispanic black	58.7 ± 0.9[c]	39.4 ± 1.7[c]
Mexican American	73.3 ± 0.9[d]	46.0 ± 1.6[c]
PIR[e,f]		
0%–99% of FPT	71.9 ± 0.9	66.8 ± 4.0
100%–199% of FPT	72.4 ± 1.2	70.9 ± 5.3
200%–299% of FPT	73.9 ± 1.7	58.1 ± 3.1
300%–399% of FPT	74.6 ± 1.1	68.6 ± 5.7
≥400% of FPT	75.1 ± 1.2	61.6 ± 3.1

Data are presented as percentages or means ± SEs. FPT, federal poverty threshold.

[a] Indicates different from reference group of males, $P < .05$.

[b] Indicates significant linear trend, $P < .001$.

[c] Indicates different from reference group of non-Hispanic whites, $P < .001$.

[d] Indicates different from reference group of non-Hispanic whites, $P < .05$.

[e] Indicates significant linear trend, $P < .01$.

[f] Indicates significant quadratic trend, $P < .01$.

TABLE 2

Mean Caffeine Intake Among Consumers Only Aged 2 to 22 Years Old: NHANES 1999–2010

	1999–2000	2001–2002	2003–2004	2005–2006	2007–2008	2009–2010
Gender, mg/d						
Male	86.3 ± 14.5	72.7 ± 4.4	73.9 ± 6.5	71.2 ± 6.8	71.3 ± 5.2	65.2 ± 7.2
Female	68.7 ± 3.7	53.8 ± 4.1	60.0 ± 4.2	48.3 ± 3.1	66.9 ± 4.6	50.9 ± 4.5
Age, mg/d						
2–5 years[a]	17.4 ± 1.9	20.6 ± 3.6	21.9 ± 5.6	12.2 ± 0.7	13.0 ± 1.6	10.0 ± 1.0
6–11 years[a]	39.4 ± 8.0	31.4 ± 2.1	38.3 ± 3.8	24.6 ± 2.1	33.7 ± 3.4	23.0 ± 1.4
12–16 years	80.6 ± 4.6	61.2 ± 4.9	68.7 ± 4.4	59.6 ± 3.9	72.0 ± 5.2	64.3 ± 9.8
17–18 years	124.4 ± 16.1	105 ± 6.8	92.8 ± 12.0	117.3 ± 19.2	130.9 ± 30.9	96.1 ± 7.2
19–22 years	142.9 ± 15.7	123.7 ± 13.2	126.3 ± 13.5	118.2 ± 14.8	127.5 ± 19	116.4 ± 8.4
Race/ethnicity, mg/d						
Non-Hispanic white	81.5 ± 8.8	68.8 ± 4.7	75.9 ± 6.1	69.4 ± 6.0	84.2 ± 5.1	67.4 ± 7.2
Non-Hispanic black	38.9 ± 2.6	37.1 ± 2.9	38.4 ± 3.5	42.1 ± 4.1	37.7 ± 5.3	42.2 ± 5.2
Mexican American[b]	52.9 ± 2.3	47.4 ± 3.4	50.7 ± 5.1	39.5 ± 3.7	41.8 ± 4.0	42.4 ± 3.3
PIR, mg/d						
0%–99% of FPT	86.1 ± 11.2	52.9 ± 4.5	61.2 ± 6.5	68.1 ± 15.9	75.7 ± 12.8	60.6 ± 5.0
100%–199% of FPT	98.1 ± 22.3	65.8 ± 6.9	62.3 ± 8.6	61.8 ± 9.3	79.5 ± 12.5	60.5 ± 7.0
200%–299% of FPT	63.3 ± 7.1	60.5 ± 7.8	59.3 ± 9.3	54.5 ± 6.8	62.2 ± 6.2	51.2 ± 7.3
300%–399% of FPT	62.9 ± 8.4	83.9 ± 18.4	81.8 ± 12.7	54.1 ± 5.9	62.3 ± 14.2	68.8 ± 21.3
≥400% of FPT	69.4 ± 7.0	59.7 ± 5.7	74.1 ± 9.7	58.6 ± 8.9	60.8 ± 6.2	49.8 ± 6.7

Data are presented as means ± SEs. FPT, federal poverty threshold.

[a] Indicates significant linear trend, $P < .001$.

[b] Indicates significant linear trend, $P < .01$.

TABLE 3

Proportion of Total Caffeine Intake From Different Sources, by Age Group: NHANES 1999–2010

Age Group	1999–2000	2001–2002	2003–2004	2005–2006	2007–2008	2009–2010
2–5 years						
Flavored dairy[a]	10.5 ± 1.9	10.0 ± 2.3	9.2 ± 2.6	12.6 ± 1.2	15.2 ± 2.6	17.0 ± 2.3
Sweetened grains[b]	7.9 ± 1.9	6.2 ± 1.5	6.6 ± 2.1	9.7 ± 1.7	7.9 ± 1.2	14.8 ± 2.8
Sugars/sweets[a,c]	5.0 ± 1.3	2.4 ± 0.8	2.4 ± 0.6	6.1 ± 1.3	5.3 ± 1.0	7.0 ± 1.3
Coffee[b]	2.1 ± 1.5	0.9 ± 0.6	3.8 ± 3.1	5.5 ± 2.5	6.1 ± 3.5	4.6 ± 1.8
Tea	27.1 ± 8	36.2 ± 6.6	46.1 ± 8.9	23.4 ± 3.7	32.0 ± 5.1	29.4 ± 5.0
Soda[a]	47.2 ± 5.8	44.1 ± 5.1	31.3 ± 3.3	42.6 ± 4.2	33.4 ± 3.9	26.8 ± 3.7
Energy drinks	0.0 ± 0.0	0.0 ± 0.0	0.5 ± 0.6	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
6–11 years						
Flavored dairy	4.9 ± 1.3	7.4 ± 1.1	5.5 ± 1.0	8.9 ± 0.7	5.9 ± 0.7	9.6 ± 0.9
Sweetened grains[a]	4.3 ± 1.1	4.7 ± 0.5	4.4 ± 0.7	9.2 ± 1.3	4.1 ± 0.5	8.8 ± 0.7
Sugars/sweets	3.0 ± 0.5	4.3 ± 0.6	2.2 ± 0.4	3.9 ± 0.6	2.7 ± 0.5	4.3 ± 0.6
Coffee[b]	2.2 ± 1.1	5.4 ± 3.4	1.5 ± 0.6	4.5 ± 2.1	8.0 ± 2.3	8.5 ± 2.6
Tea	25.1 ± 8.0	21.1 ± 3.2	19.9 ± 4.5	21.9 ± 3.5	29.7 ± 5.6	29.7 ± 5.9
Soda[d]	60.4 ± 5.2	57.1 ± 3.7	65.2 ± 4.7	50.5 ± 3.8	44.3 ± 7.4	39.1 ± 3.8
Energy drinks	0.0 ± 0.0	0.0 ± 0.0	1.5 ± 1.3	0.1 ± 0.1	5.3 ± 2.8	0.0 ± 0.0
12–16 years						
Flavored dairy[b]	2.3 ± 0.3	2.8 ± 0.4	1.4 ± 0.3	1.7 ± 0.4	1.5 ± 0.3	2.5 ± 0.5
Sweetened grains	2.2 ± 0.5	2.8 ± 0.3	2.1 ± 0.3	2.9 ± 0.4	2.0 ± 0.2	3.4 ± 0.9
Sugars/sweets	1.5 ± 0.1	1.7 ± 0.3	1.9 ± 0.3	2.0 ± 0.3	1.5 ± 0.3	1.3 ± 0.3
Coffee[d]	5.1 ± 1.9	4.0 ± 0.8	10.3 ± 2.7	11.4 ± 1.8	21.3 ± 3.3	12.2 ± 3.8
Tea	24.2 ± 3.4	22.8 ± 2.4	22.5 ± 4.5	21.4 ± 2.1	24.4 ± 3.7	31.8 ± 9.1
Soda[d]	64.6 ± 4.1	65.3 ± 2.3	61.5 ± 3.5	58.9 ± 2.1	44.1 ± 6	45.8 ± 7.7
Energy drinks[a]	0.0 ± 0.0	0.6 ± 0.5	0.3 ± 0.3	1.7 ± 1.0	5.2 ± 2.3	3.0 ± 1.2
17–18 years						
Flavored dairy	0.8 ± 0.2	0.8 ± 0.1	1.0 ± 0.2	0.6 ± 0.2	0.9 ± 0.4	1.3 ± 0.3

Age Group	1999–2000	2001–2002	2003–2004	2005–2006	2007–2008	2009–2010
Sweetened grains	1.1 ± 0.4	1.6 ± 0.4	1.2 ± 0.3	1.0 ± 0.2	0.8 ± 0.2	1.1 ± 0.2
Sugars/sweets	0.9 ± 0.2	1.1 ± 0.2	1.4 ± 0.4	0.8 ± 0.1	1.0 ± 0.4	1.5 ± 0.4
Coffee[b]	15.0 ± 4.7	12.7 ± 4.0	24.9 ± 7.6	17.3 ± 6.9	27.1 ± 4.5	28.6 ± 4.8
Tea	19.9 ± 4.4	20.2 ± 3.6	16.9 ± 6.3	24.2 ± 6.8	32.2 ± 4.8	25.4 ± 5.8
Soda[d]	62.3 ± 3.8	63.5 ± 4.2	53.9 ± 6.2	52.2 ± 7.8	29.4 ± 7.9	39.9 ± 4.9
Energy drinks[c,d]	0.0 ± 0.0	0.1 ± 0.1	0.3 ± 0.3	4.0 ± 2.3	8.4 ± 3.1	2.2 ± 1.2
19–22 years						
Flavored dairy	0.8 ± 0.3	0.5 ± 0.1	0.4 ± 0.1	0.5 ± 0.1	0.5 ± 0.2	0.6 ± 0.1
Sweetened grains	0.8 ± 0.2	1 ± 0.5	0.8 ± 0.3	0.8 ± 0.2	0.9 ± 0.1	1.1 ± 0.3
Sugars/sweets[b]	0.7 ± 0.2	2.2 ± 0.7	1.9 ± 0.7	0.9 ± 0.2	0.8 ± 0.3	0.8 ± 0.2
Coffee[d]	14.1 ± 3.3	20.9 ± 4.1	30.1 ± 6.4	20.5 ± 4.1	33.2 ± 5.2	34.2 ± 4.2
Tea	21.3 ± 4.1	21.5 ± 5.7	15.5 ± 5.3	33.7 ± 7.2	26.9 ± 3.2	18.7 ± 2.9
Soda[d]	61.5 ± 5.9	53.3 ± 4.9	50.1 ± 3.9	42.7 ± 4.8	34 ± 4.7	33.5 ± 4.4
Energy drinks[d]	0.0 ± 0.0	0.2 ± 0.1	0.5 ± 0.5	0.6 ± 0.3	3.6 ± 1.1	10.3 ± 3

Data are presented as proportions +/− SEs.

[a] Indicates significant linear trend, $P < .01$.

[b] Indicates significant linear trend, $P < .05$.

[c] Indicates significant quadratic trend, $P < .05$.

[d] Indicates significant linear trend, $P < .001$.