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ABSTRACT

Background: Coffee and tea are traditional sources of caffeine in the diet, but other sources, such as energy drinks, are now available. Because risks and benefits of caffeine use are dose dependent, the public health consequences of caffeine consumption cannot be determined without data on amounts currently consumed by the US population.

Objective: The objective was to obtain an up-to-date, nationally representative estimate of caffeine consumption in adults.

Design: Dietary intake data from NHANES from 2001 to 2010 for adults ≥19 y of age were used (n = 24,808). Acute and usual intake of caffeine was estimated from all caffeine-containing foods and beverages. Trends in consumption and changes in sources of caffeine were also examined.

Results: Eighty-nine percent of the adult US population consumed caffeine, with equal prevalence in men and women. Usual mean ± SE per capita caffeine consumption when nonusers were included was 186 ± 4 mg/d, with men consuming more than women (211 ± 5 vs. 161 ± 3 mg/d, P < 0.05). Usual intake in consumers was 211 ± 3 mg/d, with 240 ± 4 mg/d in men and 183 ± 3 mg/d in women (P < 0.05; 46% was consumed in a single consumption event. In consumers, acute 90th and 99th percentiles of intake were 436 and 1066 mg/d, respectively. Consumption was highest in men aged 31–50 y and lowest in women aged 19–30 y. Beverages provided 98% of caffeine consumed, with coffee (~64%), tea (~16%), and soft drinks (~18%) predominant sources; energy drinks provided <1%, but their consumption increased substantially from 2001 to 2010.

Conclusions: Although new caffeine-containing products were introduced into the US food supply, total per capita intake was stable over the period examined. Am J Clin Nutr 2015;101:1081–7.

Keywords: NHANES, coffee, tea, energy drinks, usual intake, beverages

INTRODUCTION

Caffeine is a naturally occurring alkaloid substance found in numerous plant species worldwide and the most frequently consumed central nervous system stimulant in the world (1, 2). Coffee beans, tea leaves, cocoa beans, and kola nuts are the primary natural sources of this compound (1, 2), and caffeine is added to numerous foods and beverages (e.g., soft drinks and energy drinks). Chocolate and cocoa (3, 4) are also sources of caffeine, as are certain dietary supplements (5) and medications (3). Caffeine is generally regarded as a safe substance and has a very long history of use. A comprehensive review of the effects of caffeine consumption on human health, commissioned by Health Canada, concluded that for the healthy adult population, moderate chronic intakes of caffeine up to 400 mg/d are not associated with adverse effects on cardiovascular health, calcium balance and bone status, behavior, cancer risk, and male fertility (6). Several recent meta-analyses support these conclusions (7–9). However, it was suggested that women planning to become pregnant, as well as pregnant and lactating women, limit caffeine ingestion to ≤300 mg/d because of some evidence that caffeine consumption may adversely affect fertility and fetal growth (2, 6, 10, 11).

In response to a trend in which caffeine is being added to a growing number of foods, beverages, and dietary supplements, the US Food and Drug Administration reported that it will investigate the safety of caffeine in food products (12). At the request of the Food and Drug Administration, the Institute of Medicine of the National Academy of Sciences held a 2-d public workshop on caffeine. The workshop addressed potential health impacts of caffeine consumption in various products, including energy drinks and related products (13).

Despite substantial scientific, medical, regulatory, and lay interest in the effects of caffeine, limited data are available on caffeine intake and changes in sources of intake in the US population (14–17). Two recent publications report on caffeine intake in children and adolescents (18, 19), but the most recently reported intake data in adults are from a large beverage-only

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consumption survey that reported caffeine consumption was 122 mg/d in younger adults (18–24 y) and 226 mg/d in older adults (50–64 y) (17). Moreover, there are no recent data available on acute intake (i.e., intake on a particular day or at a particular consumption event), a specific concern of the Food and Drug Administration (12). Therefore, we assessed both acute and usual intakes and sources of caffeine in the diet of adults in a nationally representative sample of the US population by using data collected from What We Eat in America/NHANES from 2001 to 2010. Trends in intake and the sources of caffeine in the diet over this period were also determined.

METHODS

NHANES is a continuous program designed to collect nationally representative information on the health and nutrition status of the civilian, noninstitutionalized US population (20). A complex, stratified, multistage probability cluster sampling design was used to collect these cross-sectional data. Survey participants were interviewed for demographic, socioeconomic, dietary, and general health information and participated in a comprehensive health examination conducted in a mobile examination center. Trained interviewers collect dietary intake data by conducting in-person 24-h dietary recalls by using USDA automated multipass methods during the mobile examination center examination (21). A second 24-h dietary recall was conducted via telephone 3–10 d after the first. To increase sample size and ensure reliable estimates for population subgroups, we used the data from adults age 19 y or older who participated in NHANES 2001–2002, 2003–2004, 2005–2006, 2007–2008, and 2009–2010. Only dietary records that were deemed reliable and complete by USDA’s Food Surveys Research Group were included; after pregnant and lactating women were excluded (because they may be limiting caffeine consumption based on a health professional’s recommendation), an evaluable sample of 24,808 adults remained. These secondary analyses of publicly available data were approved by the US Army Research Institute of Environmental Medicine institutional review board.

The amount of caffeine consumed was estimated from all caffeine-containing food and beverages, including energy drinks, but did not include dietary supplements and medicines. Interviewers specifically probed whether beverages consumed were caffeine free. Caffeine consumers were defined as individuals who had ingested some caffeine in foods or beverages on the first 24-h dietary recall. Acute caffeine intakes and the amount of caffeine consumed per consumption event were assessed by evaluating intake on the first 24-h dietary recall in those who consumed any nonzero amount of caffeine. The distribution of acute caffeine intake was estimated as percentiles of intake per day and intake per consumption event. Usual caffeine intake was determined by using the National Cancer Institute method (22) incorporating both days of dietary recall by using the 2-part model, first assessing person-specific probability of caffeine consumers.

### TABLE 1

<table>
<thead>
<tr>
<th>Age/sex</th>
<th>Total sample, n</th>
<th>Sample of caffeine consumers, n</th>
<th>% of total US population consuming caffeine</th>
<th>Acute caffeine intake in a day, mg/d</th>
<th>Acute caffeine intake in a consumption event, mg/consumption event</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean±</td>
<td>Median</td>
</tr>
<tr>
<td>≥19 y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>24,808</td>
<td>21,427</td>
<td>89</td>
<td>186 ± 4</td>
<td>123 ± 4</td>
</tr>
<tr>
<td>Men</td>
<td>12,561</td>
<td>10,874</td>
<td>89</td>
<td>211 ± 5</td>
<td>142 ± 3</td>
</tr>
<tr>
<td>Women</td>
<td>12,247</td>
<td>10,553</td>
<td>89</td>
<td>161 ± 3</td>
<td>104 ± 2</td>
</tr>
<tr>
<td>19–30 y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>5194</td>
<td>4051</td>
<td>81</td>
<td>121 ± 4</td>
<td>65 ± 4</td>
</tr>
<tr>
<td>Men</td>
<td>2762</td>
<td>2137</td>
<td>80</td>
<td>135 ± 6</td>
<td>75 ± 4</td>
</tr>
<tr>
<td>Women</td>
<td>2432</td>
<td>1914</td>
<td>82</td>
<td>106 ± 5</td>
<td>58 ± 4</td>
</tr>
<tr>
<td>31–50 y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>8073</td>
<td>7038</td>
<td>90</td>
<td>213 ± 5</td>
<td>144 ± 4</td>
</tr>
<tr>
<td>Men</td>
<td>4048</td>
<td>3556</td>
<td>90</td>
<td>239 ± 7</td>
<td>164 ± 7</td>
</tr>
<tr>
<td>Women</td>
<td>4025</td>
<td>3482</td>
<td>90</td>
<td>186 ± 5</td>
<td>127 ± 6</td>
</tr>
<tr>
<td>51–70 y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>7273</td>
<td>6496</td>
<td>92</td>
<td>251 ± 5</td>
<td>195 ± 5</td>
</tr>
<tr>
<td>Men</td>
<td>3639</td>
<td>3273</td>
<td>92</td>
<td>251 ± 7</td>
<td>195 ± 5</td>
</tr>
<tr>
<td>Women</td>
<td>3634</td>
<td>3223</td>
<td>91</td>
<td>181 ± 6</td>
<td>128 ± 6</td>
</tr>
<tr>
<td>≥71 y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>4268</td>
<td>3842</td>
<td>91</td>
<td>141 ± 4</td>
<td>97 ± 3</td>
</tr>
<tr>
<td>Men</td>
<td>2112</td>
<td>1908</td>
<td>91</td>
<td>161 ± 6</td>
<td>109 ± 5</td>
</tr>
<tr>
<td>Women</td>
<td>2156</td>
<td>1934</td>
<td>91</td>
<td>127 ± 5</td>
<td>86 ± 5</td>
</tr>
</tbody>
</table>


2Weighted percentage of total US population.

3Acute intake of caffeine consumers was determined by using the first 24-h dietary recall.

4Values are means ± SEs, determined with adjustment for the complex sampling design of NHANES.

5Values are percentiles of intake ± SEs, determined with adjustment for the complex sampling design of NHANES.
consumption and then estimating the amount of caffeine consumed by the population sample, because a significant segment of the population had zero intakes. Usual intake was determined on a per capita basis, and a separate estimate was computed for individuals who consumed any nonzero amount of caffeine. The National Cancer Institute–supplied SAS programs, Mixtran v1.1 and Distrib v1.1, were used to generate parameter effects after covariate adjustment and estimate distribution of usual intake via the Monte Carlo method, respectively (23). Covariates in these regression analyses included age, sex, and race-ethnicity. The β coefficient computed across the NHANES release cycles provided direction and magnitude of any change over time.

RESULTS

Acute intake

About 89% of the adult US population is a caffeine consumer on any given day (Table 1). An equal percentage of men and women ingests caffeine. Individuals aged 19–30 y had the lowest rate of consumption, 81%. The mean acute (single-day) caffeine intake for all adult consumers was 186 mg/d; ~46% of this (85 mg) was consumed in one consumption event (Table 1). Men had about 30% higher acute intake per day and per consumption event. The highest mean acute intake per day and per consumption was noted in men aged 31–50 y (239 mg and 101 mg, respectively) and men aged 51–70 y (251 mg and 108 mg, respectively). For all adults, the 90th and 99th percentiles of acute caffeine intakes were 436 mg/d and 1066 mg/d, respectively, and 201 mg/consumption event and 636 mg/consumption event, respectively. The highest acute caffeine intake (99th percentile) was 1329 mg/d and 756 mg/consumption event in men aged 31–50 y and 1255 mg/d and 709 mg/consumption event in men aged 51–70 y. Women in these 2 age groups (31–50 and 51–70 y) also had higher acute caffeine intake (99th percentile) than did women in other age groups (Table 1).

Table 2

Usual caffeine intake of US consumers aged ≥19 y by age and sex, NHANES 2001–2010

<table>
<thead>
<tr>
<th>Age/sex</th>
<th>Usual caffeine per capita intake, mg/d</th>
<th>Usual caffeine intake in consumers only, mg/d</th>
<th>Percentiles of usual caffeine intake in consumers only, mg/d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>10th</td>
</tr>
<tr>
<td>≥19 y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>186 ± 2</td>
<td>211 ± 3</td>
<td>40 ± 1</td>
</tr>
<tr>
<td>Men</td>
<td>211 ± 4</td>
<td>240 ± 4</td>
<td>50 ± 2</td>
</tr>
<tr>
<td>Women</td>
<td>161 ± 3</td>
<td>183 ± 3</td>
<td>33 ± 1</td>
</tr>
<tr>
<td>19–30 y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>121 ± 3</td>
<td>152 ± 4</td>
<td>24 ± 1</td>
</tr>
<tr>
<td>Men</td>
<td>133 ± 4</td>
<td>170 ± 5</td>
<td>29 ± 2</td>
</tr>
<tr>
<td>Women</td>
<td>107 ± 4</td>
<td>132 ± 5</td>
<td>20 ± 2</td>
</tr>
<tr>
<td>31–50 y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>210 ± 4</td>
<td>236 ± 4</td>
<td>52 ± 2</td>
</tr>
<tr>
<td>Men</td>
<td>235 ± 7</td>
<td>263 ± 6</td>
<td>64 ± 3</td>
</tr>
<tr>
<td>Women</td>
<td>184 ± 4</td>
<td>207 ± 4</td>
<td>44 ± 2</td>
</tr>
<tr>
<td>51–70 y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>215 ± 3</td>
<td>235 ± 4</td>
<td>50 ± 2</td>
</tr>
<tr>
<td>Men</td>
<td>255 ± 6</td>
<td>275 ± 6</td>
<td>68 ± 3</td>
</tr>
<tr>
<td>Women</td>
<td>181 ± 4</td>
<td>197 ± 4</td>
<td>40 ± 2</td>
</tr>
<tr>
<td>≥71 y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>152 ± 3</td>
<td>164 ± 3</td>
<td>28 ± 1</td>
</tr>
<tr>
<td>Men</td>
<td>174 ± 6</td>
<td>188 ± 6</td>
<td>36 ± 3</td>
</tr>
<tr>
<td>Women</td>
<td>136 ± 4</td>
<td>147 ± 4</td>
<td>24 ± 2</td>
</tr>
</tbody>
</table>


2Values are means ± SEs, determined with adjustment for the complex sampling design of NHANES.

3Values are percentiles of intake ± SEs, determined with adjustment for the complex sampling design of NHANES.
usual caffeine intake over the past decade for adults overall or any age/sex group (Table 3).

Food/beverage sources of caffeine

Beverages provided 98% of caffeine consumed (Table 4), with coffee (~64%), tea (~16%), and soft drinks (~18%) predominant sources; energy drinks provided <1% of intake consumption, but their popularity increased dramatically from 2001 to 2010. Caffeine from regular soda has significantly decreased (~3 mg per each 2-y NHANES cycle, \( P < 0.0001 \)). Mean per capita caffeine intake from energy drinks increased by 0.5 mg for each 2-y NHANES cycle (\( P < 0.0001 \)) over the past decade, reaching 2.1 mg by 2009–2010, still a very small proportion of total caffeine intake.

### Discussion

This study presents comprehensive data on caffeine consumption in a very large, representative sample of the US adult population. To our knowledge, adult caffeine intake, including acute intake, has never been examined by using a large, comprehensive database such as NHANES 2001–2010. We estimate that 89% of the adult US population consumes some caffeine on any given day, similar to previous estimates, even though there appears to be greater availability of food and beverage products containing caffeine. Usual mean \( \pm \) SE per capita caffeine consumption of caffeine was 186 \( \pm \) 4 mg/d, with men consuming more than women (211 \( \pm \) 5 vs. 161 \( \pm \) 3 mg/d, \( P < 0.05 \)). Usual intake in caffeine consumers was 211 \( \pm \) 3 mg/d (240 \( \pm \) 4 in men

### TABLE 3

<table>
<thead>
<tr>
<th>Linear trend</th>
<th>Caffeine intake, mg/d</th>
<th>( \beta ) ( P ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \geq 19 ) y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>178 ( \pm ) 6</td>
<td>187 ( \pm ) 4</td>
</tr>
<tr>
<td>Men</td>
<td>201 ( \pm ) 7</td>
<td>215 ( \pm ) 7</td>
</tr>
<tr>
<td>Women</td>
<td>157 ( \pm ) 5</td>
<td>160 ( \pm ) 3</td>
</tr>
<tr>
<td>19–30 y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>120 ( \pm ) 5</td>
<td>121 ( \pm ) 3</td>
</tr>
<tr>
<td>Men</td>
<td>136 ( \pm ) 6</td>
<td>132 ( \pm ) 4</td>
</tr>
<tr>
<td>Women</td>
<td>102 ( \pm ) 7</td>
<td>109 ( \pm ) 4</td>
</tr>
<tr>
<td>31–50 y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>207 ( \pm ) 6</td>
<td>221 ( \pm ) 8</td>
</tr>
<tr>
<td>Men</td>
<td>227 ( \pm ) 9</td>
<td>255 ( \pm ) 11</td>
</tr>
<tr>
<td>Women</td>
<td>186 ( \pm ) 5</td>
<td>187 ( \pm ) 6</td>
</tr>
<tr>
<td>51–70 y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>196 ( \pm ) 6</td>
<td>210 ( \pm ) 5</td>
</tr>
<tr>
<td>Men</td>
<td>224 ( \pm ) 9</td>
<td>251 ( \pm ) 8</td>
</tr>
<tr>
<td>Women</td>
<td>171 ( \pm ) 9</td>
<td>173 ( \pm ) 4</td>
</tr>
<tr>
<td>( \geq 71 ) y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>137 ( \pm ) 5</td>
<td>145 ( \pm ) 7</td>
</tr>
<tr>
<td>Men</td>
<td>154 ( \pm ) 8</td>
<td>163 ( \pm ) 8</td>
</tr>
<tr>
<td>Women</td>
<td>125 ( \pm ) 4</td>
<td>133 ( \pm ) 8</td>
</tr>
</tbody>
</table>


\(^{b}\)Values are least squares means \( \pm \) SEs.

\(^{c}\)Regression coefficient examining \( P \)-trend over time.
The mean caffeine consumption was 193 mg/d in men and 149 mg/d in women. A large percentage (46%) of caffeine consumed per day was consumed in a single consumption event. In consumers, acute 90th and 99th percentiles of intake were 436, and 1066 mg/d, respectively. Consumption was highest in men aged 51–70 y and lowest in women aged 19–30 y. Beverages provided 98% of caffeine consumed, with coffee (≈64%), tea (≈16%), and soft drinks (≈18%) predominant sources; energy drinks provided <1%, but their consumption increased substantially from 2001 to 2010. Caffeine intake among consumers remained remarkably similar over the past decade for adults overall or any age/sex group examined.

A previous estimate of the proportion of the US adult population consuming caffeine from food and beverage sources, derived from the Continuing Survey of Food Intakes by Individuals data collected in 1994–1996 and 1998, was nearly 90% (3). A recent survey of beverage intake conducted by Mitchell and colleagues (17) reported that 85% of the total US population, including children, consumes at least one caffeinated beverage per day, a finding that is consistent with our results because we excluded children from our analyses and NHANES includes data from nonbeverage components of the diet. Given various methodologic differences between studies, it is remarkable the estimates are so consistent. Recent analyses of NHANES reported that ~73% of those 2–22 y of age consumed caffeine on any given day (18).

On the basis of data collected by the Continuing Survey of Food Intakes by Individuals in 1994–1996 and 1998, and by using food composition data that were updated in 2004 to increase their accuracy, Ahuja and colleagues (15) reported that mean caffeine consumption was 193 mg/d in men and 149 mg/d in women. It therefore appears that caffeine consumption has been relatively stable in the adult population not only for the 10 y examined in this study but for nearly 20 y. In fact, estimates of US adult caffeine consumption in the 1970s and 1980s are also in this same range (25). This stability suggests that individuals may be titrating their individual caffeine intake to achieve a particular psychological state, such as increased alertness, because caffeine’s behavioral effects are detectable by individuals and are dose dependent (26, 27). Over time or across different demographic groups, consumers appear to be exchanging one caffeinated beverage for another in their diet or diversifying the types of beverages they consume, but this has little effect on their aggregate caffeine intake. In addition, analyses of NHANES of children and adolescents also indicated relatively stable intakes of caffeine over the past decade (18, 19).

Although the mean 1-d caffeine intake among US adults was 186 mg/d, an amount well within the moderate chronic intakes of 400 mg/d identified by Health Canada as safe (6), the 90th and 99th percentiles of intake were more than 2.3 times and 5.7 times higher (436 mg/d and 1066 mg/d, respectively), and 50%–60% of this was being consumed in a single consumption event. We estimate from usual intake in consumers that 14% of the adult population aged ≥19 y exceeded 400 mg caffeine/d. In those aged 31–50 y, 17% of this group exceeded 400 mg caffeine/d (22% of men and 11% of women).

It is interesting to note that the highest caffeine intake (99th percentile) in a single consumption event was 756 mg for men aged 31–50 y and 709 mg/d for men aged 51–70 y, suggesting that these high-end consumers may be consuming more than one

### Table 4

| Caffeine intake, mg/d | Linear trend |  |  |  |  |  |  |  |
|-----------------------|-------------|---|---|---|---|---|---|
| All                   |             |           |           |           |           |
| All foods             | 180 ± 9     | 191 ± 9   | 192 ± 6   | 186 ± 9   | 180 ± 8   |
| Sodas, regular        | 27 ± 2      | 24 ± 2    | 18 ± 1    | 18 ± 2    | 16 ± 1    |
| Soda, reduced and no calorie | 13 ± 1   | 13 ± 2    | 15 ± 1    | 14 ± 1    | 12 ± 1    |
| Coffee                | 110 ± 7     | 122 ± 8   | 124 ± 4   | 118 ± 7   | 120 ± 7   |
| Tea                   | 27 ± 2      | 29 ± 3    | 32 ± 4    | 32 ± 3    | 27 ± 2    |
| Energy drinks         | 0.2 ± 0.1   | 0.3 ± 0.1 | 1.1 ± 0.3 | 1.8 ± 0.3 | 2.1 ± 0.2 |

| Men                   |             |           |           |           |           |
| All foods             | 201 ± 11    | 224 ± 13  | 214 ± 8   | 210 ± 11  | 207 ± 11  |
| Sodas, regular        | 34 ± 3      | 33 ± 3    | 24 ± 1    | 24 ± 3    | 21 ± 1    |
| Soda, reduced and no calorie | 13 ± 1   | 13 ± 3    | 14 ± 2    | 14 ± 1    | 12 ± 2    |
| Coffee                | 122 ± 9     | 144 ± 12  | 138 ± 6   | 131 ± 9   | 138 ± 10  |
| Tea                   | 30 ± 3      | 31 ± 4    | 33 ± 5    | 34 ± 3    | 29 ± 3    |
| Energy drinks         | 0.3 ± 0.1   | 0.3 ± 0.1 | 1.9 ± 0.6 | 2.6 ± 0.5 | 3.2 ± 0.4 |

| Women                 |             |           |           |           |           |
| All foods             | 158 ± 9     | 158 ± 7   | 170 ± 5   | 164 ± 9   | 154 ± 8   |
| Sodas, regular        | 19 ± 2      | 15 ± 1    | 11 ± 1    | 12 ± 2    | 11 ± 1    |
| Soda, reduced and no calorie | 14 ± 2   | 12 ± 1    | 15 ± 2    | 14 ± 2    | 11 ± 1    |
| Coffee                | 98 ± 7      | 101 ± 6   | 110 ± 5   | 105 ± 6   | 102 ± 6   |
| Tea                   | 24 ± 1      | 28 ± 2    | 31 ± 5    | 30 ± 2    | 24 ± 2    |
| Energy drinks         | 0.1 ± 0.1   | 0.3 ± 0.2 | 0.3 ± 0.1 | 1.0 ± 0.3 | 0.9 ± 0.1 |


2Values are least squares means ± SEs.

3Regression coefficient examining P-trend over time.
typical serving of highly caffeinated products in a single consumption event. The acute intake results also indicate that some individuals may be experiencing symptoms of very high caffeine intake, such as elevated blood pressure and heart rate, and these will be more pronounced in caffeine-naive consumers (28–30). Some individuals may require emergency medical treatment when they experience caffeine-induced cardiovascular symptoms (13).

The Continuing Survey of Food Intakes by Individuals 1994–1996 and 1998 survey reported that coffee, tea, and soft drinks provided 71%, 12%, and 16% of caffeine in adults, respectively (14). Our data are similar to these, except the contribution from coffee was slightly lower, and tea was slightly higher in our study. Caffeine intake from energy drinks was low (<1%) in the total population in our study; in those 19–30 y of age, energy drinks provided ~3% of caffeine consumed (data not shown) and have increased for each data release examined. However, individuals aged 19–30 y consume substantially less caffeine than their middle-aged peers and consume less caffeine on average relative to all other age groups. This suggests that the availability of energy drinks may have less of an impact on the overall intake of caffeine by this age group than has been suggested (31). This is consistent with the recent beverage intake study, which reported that average caffeine intake from energy drinks was minimal, even in young males (17). Caffeine intake in one subpopulation, US Army soldiers, who have unique and intense occupational demands placed on them, is similar to middle-aged subjects but more likely to be derived from energy drinks than their civilian counterparts (32). Given the recent reduction in caffeine from carbonated soft drinks, the rapid rise in use of energy drinks by some individuals, and uncertainty whether energy drinks combined with other beverages (i.e., alcohol) are adequately captured in NHANES, continued monitoring of caffeine consumption from these beverages is warranted.

A limitation of our study and others that use 24-h dietary recalls is possible underreporting of intake. Our estimate of caffeine intake is likely to be an underestimate as a consequence of this potential bias and because caffeine intake from dietary supplements and medications was not included. Another limitation is that the most recent NHANES data available for these analyses were for 2009–2010, and thus increases in energy drinks or other caffeine-containing food and beverages in the past few years were not captured. A major strength of our study is the use of a large nationally representative population-based sample of adults to assess acute and usual intake, including intakes among high consumers.

In conclusion, most US adults consume caffeine in moderate quantities, whereas some adults consume higher amounts. Middle-aged and older individuals consume more caffeine than do their younger counterparts. An equal number of men and women consume caffeine, but men consume greater quantities of caffeine than do women. Beverages are the main source of caffeine from food, with coffee being the predominant source (~65%), with tea and soft drinks, including soda, each providing an additional 15%–17%. Energy drinks currently make a small contribution on a population basis, but their popularity is growing quickly, and they may make a much larger contribution to caffeine intake of certain age groups and heavy consumers of these products.

The authors’ contributions were as follows—VLF, DRK, and HRL: designed the research; DRK and VLF: performed the statistical analysis; VLF and HRL: wrote the manuscript and had primary responsibility for its final content; and all authors: read and approved the final manuscript. HRL and DRK declare no conflicts of interest. VLF works as a food and nutrition consultant, helping members of the food industry create science-based messages about their products and services, and conducts analyses of national databases such as NHANES for various clients, including members of the food industry. The investigators have adhered to policies for protection of human subjects as described in Department of Defense Instruction 3216.02, and the research was conducted in adherence with the provisions of 32 CFR Part 219.

REFERENCES


