

**Institute of Medicine. 2014. *Caffeine in Food and Dietary Supplements: Examining Safety—Workshop Summary*. Washington, DC: The National Academies Press, 2014**



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### Background

Caffeine, chemically classified as a xanthine alkaloid and a component of commonly consumed foods and beverages, such as coffee, tea, and chocolate, has been part of the human diet for hundreds if not thousands of years. With an estimated annual consumption of nearly 120,000 tons in the United States and its well-described stimulatory effects, caffeine is considered the most popular psychoactive substance consumed around the world. Caffeine is generally believed to have no negative effects when consumed by adults in moderate amounts. Consequently, the FDA considers it safe. However, caffeine is finding its way into a variety of foods and beverages (such as “energy” drinks and jelly beans) in which it is not naturally occurring but instead is considered a “value-added” ingredient. This trend resulted in some serious and dangerous situations, such as the addition of caffeine to alcohol-containing beverages that are now banned because of numerous reports of increased risk of morbidity and mortality, especially among teens and young adults. In response to this rapidly changing landscape of caffeine in the American diet, the FDA asked the Institute of Medicine (IOM) to review the available science related to caffeine and human health.

### Objectives of the Workshop

In response, the IOM convened a group of caffeine experts who participated in an August 2013 workshop. The objectives of this workshop were as follows: 1) evaluate the epidemiologic, toxicologic, clinical, and other relevant literature describing important health hazards associated with caffeine consumption; 2) identify and describe vulnerable populations who may be at increased risk from caffeine exposure; and 3) explore what is safe in terms of caffeine consumption and identify gaps in knowledge in terms of how caffeine can influence health.

A summary of the presentations that were part of this workshop were published by the IOM and described here. (The opinions and conclusions made by the workshop’s speakers are not necessarily shared or endorsed by the IOM.)

### Selected Overarching Themes of the Report

In addition to an introductory chapter, the report comprises 6 focused reviews of the state of the science in terms of caffeine and human health. Selected overarching themes of these reviews are provided here.

*How much caffeine do we consume?* From 1999 to 2011, some data suggest that mean caffeine consumption increased from 120 to 165 mg/d in the United States. To put this in perspective, a typical cup of brewed coffee contains 75–150 mg of caffeine. Adults in their 50s and 60s consume the greatest amounts of caffeine. Most caffeine appears to come from coffee and, to a lesser extent, tea and soft drinks; energy drinks contribute very little to most people’s daily caffeine intake. However, it is noteworthy that other data suggest more stable intake trends over the past decade and increased intake from energy drinks among young adults.

### *Assessing caffeine intake and negative health outcomes.*

The U.S. National Poison Data System continuously monitors and records calls made to the 56 nationally dispersed poison centers, and these include those that are related to real or perceived excessive caffeine consumption. Data indicate that, from 1 January 2000 to 22 July 2014, 48,177 of these calls were related to caffeine; 6724 calls related specifically to “energy products” were registered from 18 June 2010 to 22 July 2013. In addition, industry stakeholders rely on the “generally regarded as safe” determination process of the FDA to assess upper limits of intake thought to be well tolerated. This approach suggests that intakes up to ~400 mg/d should be safe, regardless of whether the caffeine is naturally occurring or added by the manufacturer.

*Do especially vulnerable populations exist?* This question is difficult if not impossible to answer fully, because controlled clinical trials cannot be conducted. However, Health Canada identified children and women of reproductive age as being especially vulnerable to negative health consequences of excessive caffeine consumption. Children are advised to consume no more than 2.5 mg/d caffeine for each kilogram of body weight, whereas reproductive-age women should limit intake to 300 mg/d. The American College of Obstetrics and Gynecology recommends that pregnant women consume <200 mg/d caffeine. Because children with underlying cardiac conditions may be especially prone to the detrimental effects of caffeine, their consumption of energy drinks should likely be discouraged broadly.

*Caffeine and cardiovascular health.* Although health practitioners have long urged avoidance of caffeine among individuals with irregular cardiac function, the results of scientific studies in this realm are inconsistent. Indeed, caffeine may interact with genetic predisposition and a variety of environmental factors, such as exercise and the food/beverage matrix

(e.g., coffee vs. caffeinated energy drinks), such that some people are affected yet others are not.

***Caffeine, the central nervous system, and behavior.*** The effects of caffeine on neural responses and behavior are generally ascribed to its antagonism of adenosine receptors. Documented effects (mostly in adults) include increased “energy,” increased alertness, improved mood, and enhanced cognitive performance. Caffeine addition to a carbonated beverage may also increase its reinforcing properties, and this effect may be greater in boys than girls. Whether chronic caffeine intake can lead to addiction is a matter of debate.

***Interactions with other food components.*** Rigorous research related to the interaction of caffeine with other food/beverage components commonly added to energy drinks

(e.g., glucuronolactone and taurine) on health outcomes is rare. Additional clinical and animal studies (especially during vulnerable periods of the lifespan) are needed.

#### **For More Information**

Details concerning the workshop described in this report (including agendas and videos) can be accessed at <http://www.iom.edu/Activities/Nutrition/PotentialHazardsCaffeineSupplements/2013-AUG-05.aspx>. A free online version of this report can be found at [http://iom.edu/Reports/2014/Caffeine-in-Food-and-Dietary-Supplements-Examining-Safety.aspx?utm\\_term=](http://iom.edu/Reports/2014/Caffeine-in-Food-and-Dietary-Supplements-Examining-Safety.aspx?utm_term=)Detailed information related to the position of the FDA on caffeine-containing alcoholic beverages can be found at <http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm233987.htm>. The authors note that this does not reflect the views of the IOM.