

Caffeine Consumption:  
The Safety of Habitual Daily Use as Represented by Research Findings

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Your mother is on drugs. Your father is on drugs. Your neighbors are users as well. The postman is hopped up, your co-workers cannot quit, and even your physician is using. The thought of such widespread substance use is cause for alarm, unless, of course, the drug in question is caffeine. Caffeine has a long, international history and few people think twice before consuming this socially accepted substance. Nonetheless, caffeine remains a drug. The following investigation weighs the benefits and consequences of caffeine consumption. The research on the matter indicates that while a specific tolerance to caffeine can develop among regular users, its low abuse potential and negligible negative health consequences make it a safe drug for daily, regular consumption.

The present analysis will systematically investigate the most crucial aspects of caffeine consumption in modern society. Research ranging from individual-level medical consequences of caffeine use to macro-focused societal implications of consumption will be considered. To begin with, some background on caffeine as a drug is provided, including caffeine-containing products, the basic scientific functioning of caffeine in the body, and the practical interpretation of these functions (including its pharmacological effects). Next, concerns regarding caffeine and cardiovascular health are addressed and countered while acknowledging the unique tolerance that develops to caffeine in regular users. Then a brief investigation relates how athletes may benefit more than others from caffeine's endurance increasing effects. Studies that conclude that caffeine hinders sleep are then critiqued. The next section details the spurious relationship between caffeine use and health, and how it is important for studies to account for this discrepancy. Next, the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) is probed to conclude that caffeine is not a drug of abuse. This pivotal point leads into a discussion on the social

environment surrounding caffeine use, which includes non-pharmacological reasons for ingesting the drug as well as a brief comparison of “coffee cultures” in America and Hungary. The investigation is concluded with the application of social learning theory to caffeine consumption, specifically the relationship between expectations, perceptions, and actual effects. A final section summarizes the findings from the analysis on caffeine consumption.

Caffeine is widely available and largely unrestricted. The drug can be found in coffee, tea, energy drinks, chocolate, weight loss pills, cold medicines, other over-the-counter medications, and even gum (Goldberg 2008:263; Thornton 2004:266). As the demand for new and more convenient ways to self-administer energy boosts increases, consumers will inevitably be offered more ingeniously marketed mediums for ingesting the substance. Caffeine’s functional mechanics in the body operate opposite to how the term “stimulant” may imply. Caffeine does not so much “wake you up” as it does *prevent* one from falling asleep. Caffeine interferes with adenosine, neurotransmitters that normally sedate the central nervous system as well as dilate cerebral and coronary blood vessels (James 1997:19). Adenosine has the overall effect of making someone feel tired. Proper sleep is an effective way of “clearing out” adenosine neurotransmitters, but caffeine is able to hinder the sedating effects of adenosine (Thornton 2004:267). Caffeine has a similar molecular structure to the adenosine neuro-modulator and is able to block the adenosine receptor sites by effectively parking there in place of them (Daly and Fredholm 2004:2; James 1997:18). If adenosine transmitters cannot reach their receptor sites, their effectiveness in sedating the central nervous system is reduced, and the individual may feel less tired than they otherwise would have.

It is important to note that the impact caffeine has on the body can vary according to the individual consumer (this will be discussed in further detail later). Also, contradictory findings from different studies provide varying levels of support for some of caffeine's perceived benefits. Accounting for these two notes of precaution, a list of common effects can still be established. Pharmacological effects of caffeine consumption include increased vigilance, enhanced focus, and heightened alertness (Smith et al. 2004:36-41). Caffeine is also associated with an increase in heart rate, blood pressure, metabolism rates, and gastrointestinal activity (Faupel, Horitz and Weaver 2004:88). These latter physical effects, however, are generally not the primary reason a user seeks out caffeine. When someone indicates that they need a "pick-me-up", as they pop open a can of Red Bull, they are generally referring to the pharmacological results brought about by consumption.

Varying estimates identify approximately 90% of the world's population as regular caffeine users (Weinberg and Bealer 2001:198). This tremendous prevalence is evidence of caffeine's well-accepted social status around the world. It is not common to accuse even heavy users of caffeine of being drug "abusers" or "addicts"; many people would even disregard caffeine's status as a drug. But, as with other drugs, suspicions regarding health concerns are reasonable.

As indicated earlier, caffeine ingestion causes an increase in heart rate and blood pressure. It would logically follow that consistent consumption of caffeine could lead to consistently high heart rate and blood pressure. This is the primary reason that concerns associating caffeine with cardiovascular disease arise. Those opposing the idea of any possible healthy habitual caffeine intake propose the argument that regular consumption

can lead to cardiovascular disease. However, many findings have been inconsistent and there is disagreement among experts (James 1997:80-81; Weinberg and Bealer 2001:271). Methodological issues have also plagued a large number of studies trying to identify correlates between caffeine use and cardiovascular disease (James 1991:181). Some of these problems include small sample sizes, inability to preserve the “blind” nature of tests due to participants’ abilities to differentiate between caffeinated and decaffeinated beverages, and misrepresentation of “average” caffeine consumption in studies (Satel 2006:275-276). However, the cumulative recent research does lean towards caffeine having no adverse relation to cardiovascular health (James 1991:272). This is attributed to a tolerance developed in caffeine users to the acute physical effects of consumption, such as increased heart rate and high blood pressure (Weinberg and Bealer 2001:270-271).

Habitual users of a variety of drugs tend to develop a tolerance to the effects of that particular substance. Tolerance is cause for concern and puts users at risk for abuse since they oftentimes will increase their dosage in order to achieve the desired effects (Faupel, Horowitz and Weaver 2004:17-18). From here, it is easy to assume that caffeine has the potential to become a drug of abuse. Indeed, regular users of caffeine *do* establish a tolerance to the drug. However, the tolerance that is developed is not a full or complete tolerance. Instead, as mentioned above, research has shown that a tolerance to the *negative* aspects of caffeine use is developed (Nehlig 2004:137; Satel 2008:272-275; James 1997:30). This stays inline with the notion that daily, regular consumption does not produce serious adverse effects; daily users will still derive the benefits, such as

warding off sleepiness, without the effects of over-agitation or the risk for long-term health consequences.

Caffeine use is generally safe, with any significant negative health exceptions usually attributable to individual traits. But caffeine can be more than just safe; it can be beneficial as well, especially for athletes. Research has consistently found endurance to be significantly improved by caffeine consumption. This is particularly useful in distance-related sports such as cross-country skiing, cycling, and running (James 1997:141-144). With the goal of increased endurance in mind, methods of ingestion have also been reconsidered. Studies for the Canadian military found a particularly effective medium to be gum. Caffeinated gum can be chewed, with the blood vessels under the tongue absorbing the drug. This delivers the desired effects more quickly to the user (approximately five to ten minutes) when compared with drinking coffee (Thornton 2004:265-270). If the use-specific benefits of caffeine, like increased physical endurance, are considered, those who profit the most from the drug are athletes and other individuals who *require* maximum stamina to best perform their job.

Caffeine is obviously consumed by many with the intent of feeling less tired or trying to stay awake longer during routine activities. This leads to concerns regarding the effects of caffeine on users when they no longer desire or need the stimulating effects of the substance, such as when it's time to go to bed. Thornton recounts a hellish personal struggle going "Caffeine Cold Turkey" after being a heavy daily user for many years; he concludes that caffeine consumption is not conducive to proper sleep (2004:263,265-270). The research, however, does not fully back this anecdotal experience. Again, varying methodologies deliver inconsistent findings, but the general consensus indicates

that *realistic* typical consumption of caffeine does not result in any significant sleep disorders (Snel, Tieges and Lorist 2004:15-16). Most studies that reported an unhealthy correlation between caffeine and sleep did so under highly artificial settings. “Effects [of caffeine on sleep] are likely to be most obvious when caffeine is consumed shortly before bedtime by persons whose habitual use of the drug is comparatively low” (James 1991:306). It is unlikely that people most frequently consume caffeine right before bed or otherwise try to use it as a sleep aid. One study, claiming that “administration of caffeine... leads to sleep disruption”, saw caffeine administered intravenously *during* sleep to a select group of only 14 male volunteers that excluded any “habitual coffee drinkers” (Lin et al. 1997:22,25). Unstable research regarding the caffeine-sleep relationship tends to neglect the possibility of a spurious correlation between the two.

Different drugs affect different people in different ways. Caffeine is no exception. While caffeine is generally safe for most, some people may experience exaggerated negative health consequences. In these situations, attention must be paid to any biological bases that may factor in (Alsene et al. 2003:1694,1699). Research does indicate that, “Both the extent of habitual caffeine consumption and the magnitude of response to single doses appear to be subject to a hereditary predisposition” (Smith et al. 2004:36). Studies which have concluded that caffeine use negatively affects sleep or other healthy functions may be inadvertently picking up on the effects of a third factor (Snel, Tieges and Lorist 2004:16-17).

Spurious relationships between caffeine use and health merit a serious degree of attention, as they can sometimes be easily overlooked. Under an evaluative section entitled “Methodological Pitfalls”, Weinberg and Bealer note that individuals who

consume less caffeine are also less likely to use alcohol and tobacco when compared to heavier caffeine users (2001:342-344). Other reports have shown a positive correlation between caffeine use and tobacco use as well (Fillmore 1999:216). Caffeine users who smoke and drink are exposed to both the potential health consequences of caffeine *and* the health consequences of tobacco and alcohol. If studies do not aim to tease out the proportional effects of each of these substances in test subjects then proper causality cannot be established between caffeine and health.

Lifestyle associations also have potential for being the causal factors behind negative health aspects related to use. Individuals that use the drug frequently and consume caffeinated beverages for their pharmacological effects tend to lead higher-stress lifestyles than non-users. For example, a university student staying up late and consuming large amounts of caffeine while studying for an important exam has much more than just caffeine taxing their body. He or she is subscribing to an irregular sleep pattern and is also under unusual amounts of stress and pressure to perform. With such a multitude of factors straining the body, it is difficult to pinpoint only one culprit (such as caffeine use) as the cause of negative health experiences.

As with other drugs, it is important to establish any potential for abuse and dependence. The American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), is the standard for measuring these parameters. However, it must be noted that these diagnoses of substance abuse are not explicitly recommended by the DSM-IV to be applied to caffeine (James 1997:63-64). The measures are useful nonetheless, especially considering that social impacts of drug use are also taken into account by the DSM-IV criteria.

According to the Manual, the criteria for abuse have been met if one or more of the following is true. (1) Recurrent use of the substance has resulted in a failure to fulfill major role obligations at work, school, or home. (2) Recurrent use of the substance has been conducted in situations in which it is physically hazardous to do so. (3) Use of the substance results in recurrent substance-related legal problems. (4) Effects resulting from continued use of the substance has led to or exacerbated interpersonal problems (American Psychiatric Association 1994). None of the above-mentioned criteria qualify average, or even heavy, use of caffeine as abuse. The very nature of caffeine consumption is contradictory to all four criteria. Users very frequently use caffeine before or during their undertaking of “major role obligations”, such as school and work, with insignificant (if any) measurable interference. Quite the contrary may be true, as users sometimes consume in order to *help fulfill* these obligations. Since the majority of caffeine is consumed in coffees, teas, and soft drinks, all of which are legal, socially accepted substances, there is no reason to hide one’s use from view by consuming in potentially “hazardous” situations. The opposite environment is a typical harbor for use, as we see caffeine most often ingested either at home, at work, or at legal vending establishments. The legal status of caffeine averts any potential legal problems that could arise from its use. Finally, the widely accepted social nature of caffeine makes it difficult for interpersonal problems to develop around the substance. Any exceptions must be well scrutinized, as a spurious relationship will likely be present. Caffeine is not a drug of abuse.

Despite the influences that caffeine has on the body and mind, experiencing pharmacological effects is not *always* the goal of the consumer. In enjoying their favorite

food, chocolate lovers are unlikely to state that they eat it for the caffeine high or they need a Hershey bar to stay awake at work. Tea's reputation is similar; it is a beverage enjoyed for its wonderful aroma in its many varieties, oftentimes in relaxing settings. Even coffee is not necessarily consumed as a "drug". In an article evaluating the relative harmlessness of caffeine use, Satel noted, "An important question about the reinforcing properties of caffeine is whether ongoing use is a function of a drinker's enjoyment of caffeine containing beverages – in which case, it is more like a loyal, pleasurable habit than a compulsion..." (2008:272). The distinction between caffeine and coffee (as well as other caffeine-containing foods and beverages) is important. The idea of caffeine "abuse" or "addiction" loses weight when the presence of the drug in someone's diet is more coincidental than intentional.

Any need-based association that people do share with coffee in the United States may be the result of a lifestyle unique to Americans. The entire consumption ritual of coffee in some European countries is indicative of their different perception towards coffee and caffeine. For example, the tradition of coffee consumption in Hungary is steeped in rich history and born from the country's great intellectuals who used to use coffeehouses as meeting places. Budapest, Hungary's capital, is home to renowned establishments like the Central and New York Coffeehouses, both of which offer elaborate gold-trimmed décor and recreate an atmosphere of high-brow living and prosperity pulled straight from a century past. Many Americans might be shocked to discover that these and other cafés and coffeehouses in Hungary do not serve anything "to-go". Instead, a hot beverage is usually enjoyed in the company of friends, over

several hours, *at* the café; waiters never pester clients to “buy or leave”, and the purchase of a single cappuccino is enough to secure your welcome for the rest of the afternoon.

It is interesting to note the contradiction that arises between the relaxed nature of coffee consumption in some European countries and the opposing pharmacological effects it provides. Social factors can impose on both the perceived and actual effects of a drug and the entire cultural context surrounding certain caffeine-containing products can vary greatly from place to place. This more global perspective on caffeine use further demonstrates how specific substance consumption oftentimes comes second to the enjoyment of the vehicle in which it is carried.

Sociological perspectives are useful for analyzing caffeine consumption. Social learning theory would suggest that caffeine consumption and its perceived effects in different persons are the result of individually learned experiences related to the drug. These social “lessons” include how to use the drug, the acceptability of the drug, and even the desirability of drug use (Faupel, Horowitz and Weaver 2004:118-120). The structure of this theory is also behind research that has looked at the relationship between the perceived effects and the realized effects of alcohol. Applying the theory to caffeine use would mean that behavioral reactions to consumption would be based on the socialized expectations of the user. If the user has learned that caffeine will make them hyper and jittery, these will be the results of consumption. If the user is under the impression that they are not much affected by caffeine or otherwise do not even know they are ingesting caffeine, consumption may have a much more subtle or even nonexistent effect on behavior (Fillmore 1999:207-219). In their study investigating the relationship between expectancy and pharmacological effects, Fillmore and Vogel-Sprott

concluded that, “The research presented shows that the expectancies about caffeine effects can predict behavioral responses to the drug” (1994:2,319). Theories and findings such as this play an important role in caffeine research, since it helps further account for a great deal of the discrepancies present on the matter.

The review of competent, comprehensive literature on the subject reveals that while caffeine is a drug and has the common characteristics of a drug, such as tolerance development, it is generally safe to use on a regular, even daily, basis. Concerns regarding caffeine’s relation to cardiovascular disease and sleep loss are placed in the minority when represented by actual research studies, although many of these efforts still yield conflicting results. Even unfavorable findings are usually attributed to spurious relationships, with individual traits and characteristics accounting for any discrepancies. Future research should focus on solidifying consistent methodologies and minimizing the amount of inconsistency presently abound. In light of modern-day research, the longstanding tradition of caffeine consumption has been deemed safe to continue.

## References

- Alsene, Karen and Deckert Jürgen and Sand, Philipp and de Wit, Harriet. 2003. "Association Between A<sub>2a</sub> Receptor Gene Polymorphisms and Caffeine-Induced Anxiety". *Neuropsychopharmacology*. 1694-1702.
- American Psychiatric Association. *Diagnostic and Statistical Manual*. 4<sup>th</sup> ed. 197.
- Braun, Stephen. 1996. *Buzz: The Science and Lore of Alcohol and Caffeine*. Oxford University Press. New York, NY.
- Daly, John W. and Fredholm, Bertil B. 2004. "Mechanisms of Action of Caffeine on the Nervous System". *Coffee, Tea, Chocolate, and the Brain*. 1-11.
- Faupel, Charles, E. and Horowitz, Alam M. and Weaver, Greg S. 2004. *The Sociology of American Drug Use*. McGraw-Hill. New York, NY.
- Fillmore, Mark T. 1999. "Behavioral effects of caffeine: the role of drug-related expectancies". *Caffeine and Behavior*. 207-219.
- Fillmore, M.T. and Vogel-Sprott, M. 1994. "Psychomotor performances under alcohol and under caffeine: Expectancy and pharmacological effects". *Exp. Clin. Psychopharmacology*. 2, 319.
- Goldberg, Raymond. 2008. *Taking Sides: Clashing Views in Drugs and Society*. 8<sup>th</sup> ed. McGraw-Hill. New York, NY.
- Gupta, B.S. and Gupta, Uma. 1999. *Caffeine and Behavior: Current Views and Research Trends*. CRC Press. Boca Raton, FL.
- James, Jack E. 1991. *Caffeine and Health*. US ed. San Diego, CA. Academic Press.

- James, Jack E. 1997. *Understanding Caffeine: A Biobehavioral Analysis*. Thousand Oaks, CA. SAGE Publications.
- Lin, Albert Shi-Kwang and Uhde, Thomas W. and Slate, Shiyoko O. and McCann, Una D. 1997. "Effects of Intravenous Caffeine Administered to Healthy Males During Sleep" *Depression and Anxiety*. Vol. 5, issue 1. 21-28.
- Nehlig, Astrid. 2004. "Dependence upon Coffee and Caffeine: An Update". *Coffee, Tea, Chocolate, and the Brain*. 133-146.
- Nehlig, Astrid. 2004. *Nutrition, Brain, and Behavior: Coffee, Tea, Chocolate, and the Brain*. v. 2. CRC Press. Boca Raton, FL.
- Satel, Sally. 2006. "Is Caffeine Addictive? – A Review of the Literature". *American Journal of Drug and Alcohol Abuse*. 32:493-502.
- Smith, Barry D. and Osborne, Amanda and Mann, Mark and Jones, Heather and White, Tom. 2004. "Arousal and Behavior: Biopsychological Effects of Caffeine". *Coffee, Tea, Chocolate, and the Brain*. 35-52.
- Snel, Jan and Tiegels, Zoë and Lorist, Monique M. 2004. "Effects of Caffeine on Sleep and Wakefulness: An Update". *Coffee, Tea, Chocolate, and the Brain*. 13-33.
- Thornton, James. 2004. "Start Me Up". *Men's Health*, October, pp. 172. Vol. 19, issue 8.
- Weinberg, Bennett Alan and Bealer, Bonnie K. 2001. *The World of Caffeine: The Science and Culture of the World's Most Popular Drug*. New York, NY.