

Caffeine - Is it good or bad for health - A Review

Miloni Suresh Shah

I BDS Physiology Department
Saveetha Dental College Chennai – 600 007

Mrs. Jothi Priya (Co-Author) MSc (Physiology)
Department of Physiology Saveetha Dental College
Chennai 77

Abstract: The aim of this review is to make people aware about the advantages and disadvantages of consuming caffeine. Caffeine is the most widely consumed psychoactive substance in the world. The main objective is to examine its effectiveness and assess people's knowledge about its advantages and disadvantages causing our body. With caffeine consumption being so common, it is vital to know the impact caffeine has on the body, as its effects can influence cardio-respiratory, endocrine, and perhaps most importantly neurological systems. Coffee is beneficial to our health but caffeine is a chemical compound that affects our nervous system and other systems of our body. Anything excess can damage our body. Caffeine has properties of psychoactive activities. There are a million of people whose biological clock starts with coffee but without them knowing its positive and negative effects. This study is to make people are about its advantages and disadvantages to our human body.

Keywords: caffeine, psychoactive, advantages, disadvantages, biological clock, positive, negative.

Introduction:

Depression is a leading cause of disability worldwide. Caffeine is a psychoactive and central nervous system stimulant of the methyl-xanthine class that unlike many other psychoactive, is legal all around the world. (1) Overall, incidence of depressive disorders is progressively increasing, ranking among the leading conditions contributing to the global burden of disease. Caffeine can cause anxiety, insomnia, nervousness, and hypertension. Caffeine is a diuretic and increases urination. Caffeine can help to relieve headaches, so a number of over-the-counter and prescription pain relievers include it as an ingredient, usually with aspirin or another analgesic. (2) These days Energy drinks are a growing problem. Significance of caffeine and mental performance; caffeine and coronary heart disease; cardiovascular effects of antidepressants in children and adolescents; caffeine consumption and eating disorders; caffeine and bone gain in children and adolescents. (1) Although consumption of low to moderate doses of caffeine is generally safe, an increasing number of clinical studies are showing that some caffeine users become dependent on the drug and are unable to reduce consumption despite knowledge of recurrent health problems associated with continued use. (3) Thus, the World Health Organisation and some health care professionals recognise caffeine dependence as a clinical disorder. High doses of caffeine may exacerbate cardiac conditions for which stimulants are contraindicated. The most prevalent genetic cardiomyopathy in children and young adults, because of the risk of hypertension.

Caffeine and coffee:

Because caffeine is well known as an ingredient in coffee, there is much confusion, even in research literature, between the effects of caffeine and those of coffee. Coffee contains many other constituents that may also carry health benefits too. (4)

Most of the pharmacologic effects of adenosine in the brain can be suppressed by relatively low concentrations of circulating caffeine (the equivalent of 1-3 cups of coffee). Adenosine decreases the neuronal firing rate and inhibits both synaptic transmission and the release of most neurotransmitters. (6) Caffeine also increases the turnover of many neurotransmitters, including monoamines and acetylcholine.

Caffeine wakes people up but also disrupts the quality of sleep. Consuming caffeine in the evening—the equivalent of a double espresso—delays the human endogenous circadian clock by antagonising receptors for the endogenous sleep factor adenosine in the brain. Mistimed caffeine consumption may contribute to the growing incidence of sleep problems in society. (2)

Physiological effects:

Caffeine is a pharmacologically active substance and, depending on the amount consumed, can be a mild stimulant to the central nervous system. (7)

Caffeine is not alone in this respect. It is one of several ingredients in foods capable of exerting pharmacological and physiological effects. For example, capsaicin in hot peppers causes the familiar burning sensation that often evokes sweating.

When caffeine is consumed orally, it is rapidly absorbed into body fluids and distributed throughout the body in its “water phase” (i.e. blood, urine etc.).

Clinical studies of central nervous system arousal:

Caffeine has appeared to be associated with a higher overall arousal level, better processing of attended and unattended information, and more rapid motor processes. In addition, there is a growing body of evidence that caffeine has a significant effect on the sleep-wake cycle and on circadian rhythm. (9)

Cardiovascular and respiratory effects:

Caffeine induces various Cardiovascular and respiratory effects. Arterial stiffness and endothelium dependent vasodilatation also result, leading to increases in systolic and diastolic blood pressure. (10) An increase in the respiration rate is the prime effect

dependent on the plasma caffeine value.(5)High doses of caffeine could potentially exacerbate cardiac conditions for which stimulants are contraindicated, including ion channelopathies and hypertrophic cardiomyopathy in children and young adults, due to the risk of hypertension, syncope, arrhythmias and sudden death .

Cancer:

Most of the research on possible links between cancer and caffeine has been conducted on coffee and tea. . Consequently, research on caffeine and its effects on cancer, if any, is sparse. There are however, references in coffee and tea research relating to caffeine that are generally positive.(11)

Caffeine has not been shown in animal or human studies to be carcinogenic. [WHO IARC, 1991] In addition, Nawrot et al. (2003) concluded in his review of the research that caffeine is unlikely to be a human carcinogen at levels below cups of coffee per day (or less than 500 mg caffeine per day). (14)Furthermore, the overall evidence indicates that caffeine, as present in coffee, does not cause breast or bowel cancer. Moreover, although early case control studies appeared to link caffeine intake to pancreatic, bladder and ovarian cancers, more recent, better designed studies have not supported these conclusions. [Leviton, 1998; Tavani and La Vecchia, 2000; Zeegers, et al., 2004] A number of case control studies have demonstrated reduced risk of colorectal cancer with coffee consumption. [Tavani and La Vecchia, 2004; Higdon and Frei.

Reproductive system:

Christian and Brent (2001) conducted a very systematic review on the relationship between caffeine consumption by both pregnant women and women of child-bearing age and the occurrence of congenital malformations, fetal growth retardation, small-for-date babies, miscarriages, behavioral effects, maternal infertility and genetic effects. The only statistically significant results were teratogenic (birth defect) effects in rats administered extremely high levels of caffeine intravenously, which do not necessarily translate to humans and also could never be attained merely by drinking beverages containing caffeine.(15)

Gastrointestinal and urinary effects:

Caffeine excites the small intestine, causing secretion of water and sodium. (9) Caffeine has been seen to promote apoptosis in, and even serves as a psychoactive drug in the treatment of Parkinson's disease. With its potential utilization in medicine, the safety and effects of caffeine are important issues.

Energy drink use among adolescents and children:

Children and adolescents with eating disorders, especially anorexia nervosa, may regularly consume high amounts of caffeine to counter caloric-restriction-associated fatigue, suppress appetite, and produce looser stools and some diuresis.97–100 Given that children and adolescents with eating disorders have a propensity for cardiac morbidity/mortality and electrolyte disorders, consumption of high-caffeine energy drinks may put them at further risk for cardiac dysrhythmias and intracardiac conduction abnormalities.97–99

Effects of caffeine among different person:

Caffeine metabolism is slower among infants, pregnant women and individuals with liver disease. In addition, some medications slow caffeine metabolism, which may increase the risk for caffeine intoxication. But the effects of caffeine also vary simply because we're all different.

Benefits of caffeine to human body:

Besides the mental and physical performance benefits of caffeine, several areas are emerging in which consumption of caffeine could be beneficial to health. Such areas include reduced risk of diabetes, reduced risk of Parkinson's Disease Some studies investigate pure caffeine, while the others not pointing out the other components in coffee and their potential confounding effects .High caffeine intakes for reduced risk of certain health conditions and improvement of athletic performance should be taken in the context of the overall health implications. Caffeine levels observed to have beneficial effects for some conditions could have adverse effects for other health conditions, and individuals should consult a physician about safe caffeine intake levels when faced with multiple health concerns.

Despite these limitations, extensive explorations of caffeine have been carried out and have provided a great deal of information regarding the effects of caffeine. Caffeine consumption has also been associated with positive effects on the brain.

Last year, a study from the Harvard School of Public Health suggested that drinking between two and four cups of coffee a day may reduce suicide risk in adults, while more recent research found that ingesting 200 mg of caffeine each day may boost long-term memory.[13]

Disadvantages to the human body:

Caffeine could have detrimental effects on a hypertensive that is stressed and consumes caffeine as ultimately caffeine is a stimulant and as with as all stimulants and substance's abuse or overuse has negative effects. This review looks at some of the detriments of caffeine on the nervous system. Heavy daily caffeine use — more than 500 to 600 mg a day — may cause side effects such as:(16) Insomnia, Nervousness, Restlessness, Irritability, Stomach upset, Fast heartbeat, Muscle tremors.

Adverse health effects of caffeine intake in specific population groups Relevant population groups are:

- Breast-fed infants consuming caffeine via mother's milk
- Children possibly divided by age group
- Pregnant women
- Lactating women
- Adults and adolescents
- Adults and adolescents performing endurance exercise

Conclusion:

Caffeine consumption at varying levels may help reduce the risk of several chronic diseases. In addition, most prospective cohort studies have found that caffeine consumption does not significantly increase the risk of coronary heart disease (CHD), stroke, cancer or many women's health issues. On the basis of this review, we conclude that energy drinks have only a few therapeutic benefits, and both the known and unknown pharmacology of various ingredients, combined with reports of toxicity, suggest that these drinks may put some children at risk for serious adverse health effects; typically, energy drinks contain high levels of caffeine, taurine, which have stimulant properties and cardiac activity, but manufacturers claim that energy drinks are nutritional supplements. [3]

References:

- 1] Coffee, tea, caffeine and risk of depression: A systematic review and dose–response meta-analysis of observational studies Giuseppe Grosso¹, Agnieszka Micek², Sabrina Castellano³, Andzrej Pajak² and Fabio Galvano³
- 2] Caffeine, the circadian clock, and sleep Hans Peter Landolt Vol. 349, Issue 6254, pp. 1289 DOI: 10.1126/science.aad2958
- 3] Health Effects of Energy Drinks on Children, Adolescents, and Young Adults. Sara M. Seifert, BS, Judith L. Schaechter, MD, Eugene R. Hershorin, MD, and Steven E. Lipshultz, MD Department of Pediatrics and the Pediatric Integrative Medicine Program, University of Miami, Leonard M. Miller School of Medicine, Miami, Florida.
- 4] Relation of caffeine intake and blood caffeine concentrations during pregnancy to fetal growth: prospective population based study. D. G. Cook, J. L. Peacock, C. Feyerabend, I. M. Carey, M. J. Jarvis, H. R. Anderson, and J. M. Bland Department of Public Health Sciences, St George's Hospital Medical School, London.
- 5] Energy Drinks and the Neurophysiological Impact of Caffeine Leeana Aarathi Bagwath
- 6] IFIC REVIEW
International Food Information Council Foundation Caffeine & Health: Clarifying The Controversies
- 7] Neurologic Effects of Caffeine
Author: Jasvinder Chawla, MD, MBA; Chief Editor: Nicholas Lorenzo, MD, MHA, CPE more... Updated: Nov 11, 2015
- 8] The Role of Caffeine in Pain Management: A Brief Literature Review
Alireza Baratloo,¹ Alaleh Rouhipour,² Mohammad Mehdi Forouzanfar,¹ Saeed Safari,¹ Marzieh Amiri,³ and Ahmed Negida^{4,*}
¹Department of Emergency Medicine, Shohadaye Tajrish Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran
²Pediatric Specialist, Tehran, Iran ³Department of Emergency Medicine, Shahid Beheshti Hospital, Guilan University of Medical Sciences, Anzali, Iran ⁴Student Research Unit, Zagazig University, Zagazig, Egypt
- 9] Guo, X., Park, Y., Freedman, N. D., Sinha, R. et al., Sweetened beverages, coffee, and tea and depression risk among older US adults. *PloS One* 2014, 9, e94715.
- 10] Godos, J., Pluchinotta, F. R., Marventano, S., Buscemi, S. et al., Coffee components and cardiovascular risk: beneficial and detrimental effects. *Int. J. Food Sci. Nutr.* 2014, 65, 925–936.
- 11] Hintikka, J., Tolmunen, T., Honkalampi, K., Haatainen, K. et al., Daily tea drinking is associated with a low level of depressive symptoms in the Finnish general population. *Eur. J. Epidemiol.* 2005, 20, 359–363.
- 12] Nutrition / Diet Neurology / Neuroscience Public Health Pediatrics / Children's Health Caffeine: how does it affect our health? Honor Whiteman
- 13] 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
- 14] Walker, J., Rohm, B., Lang, R., Pariza, M. W. et al., Identification of coffee components that stimulate dopamine release from pheochromocytoma cells (PC-12). *Food Chem. Toxicol.* 2012, 50, 390–398.
- 15] Godos, J., Pluchinotta, F. R., Marventano, S., Buscemi, S. et al., Coffee components and cardiovascular risk: beneficial and detrimental effects. *Int. J. Food Sci. Nutr.* 2014, 65, 925–936.
- 16] Lucas, M., O'Reilly, E. J., Pan, A., Mirzaei, F. et al., Coffee, caffeine, and risk of completed suicide: results from three prospective cohorts of American adults. *World J. Biol. Psychiatry* 2014, 15, 377–386.
- 17] Ritchie, K., Ancelin, M. L., Amieva, H., Rouaud, O. et al., The association between caffeine and cognitive decline: examining alternative causal hypotheses. *Int. Psychoger.* 2014, 26, 581–590.
- 18] Carlsson, S., Hammar, N., Grill, V., and Kaprio, J. Coffee consumption and risk of type 2 diabetes in Finnish twins. *Int. J. Epidemiol.* 2004; 33:616–617.
- 19] Castellanos, F.X., Rapoport, J.L., Effects of Caffeine on development and behaviour in infancy and childhood: a review of the published literature. *Food Chem. Toxicol.* 2002; 40:1235-1242.
- 20] Chen, J.F., Xu, K., Petzer, J.P., Staal, R., Xu, Y.H., Beilstein, M., Sonsalla, P.K., Castagnoli, K., Castagnoli, N. Jr, Schwarzschild, M.A. Neuroprotection by caffeine and A(2A) adenosine receptor inactivation in a model of Parkinson'