

HEALTH EFFECTS AND SIDE EFFECTS OF ENERGY DRINKS CONTAINING CAFFEINE ON ADOLESCENTS AND YOUNG ADULTS. STUDY CONDUCTED IN DIFFERENT AREAS OF KARACHI

¹*Dr. Saima Baig, ¹Dr. Lubna Bashir, ¹Dr. Shazia Naz, ²Dr. M. Ghias Uddin Siddiqui,
³Arshia Wamiq, ⁴Dr. Imran Khalid and ⁵S. M. Ali Mustafa

Pakistan.

ABSTRACT

Caffeine is most likely the most frequently ingested pharmacologically energetic substance in the world. Caffeine is a methylxanthine whose predominant organic effect is the aggressive antagonism of the adenosine receptor. Its presence in coffee, tea, soda beverages, chocolate and many prescription and over-the-counter tablets makes it a commonly used stimulant. Coffee and/or caffeine consumption has been linked to common human ailments in epidemiologic studies. Recent studies, displaying a vast effect over lengthy follow-up intervals

and with high espresso intake, have again raised the question of a function for espresso and/or caffeine consumption in the pathogenesis of atherosclerotic heart disease. Contrary to frequent belief, the present work provides little proof that coffee and/or caffeine in regular dosages will increase the risk of a number of diseases as well as surprising loss of life or arrhythmia. Results point out that caffeine can potentiate each cardiovascular and neuroendocrine stress reactivity and that the routine use of caffeine is now not always associated with the development of tolerance to these effects. Caffeine is one of the most regularly ingested alkaloids worldwide. It is existing in coffee, tea, gentle and strength drinks, chocolate, etc. Currently posted statistics has been stressed that the methylxanthine consumption increases the risk of coronary heart disease, arterial hypertension, arterial stiffness and an elevation of ldl cholesterol and homocysteine plasma concentration. The acute high consumption may also additionally modulate insulin sensitivity and glucose blood level. However, the long-term consumption reduces the incidence of the type 2 diabetes mellitus. When administered in excessive doses the substance may cause a range

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*Corresponding Author

Dr. Saima Baig

Pakistan.

of side effects, related to abnormal stimulation of the central nervous system, limit tonus of the lower esophageal sphincter, as properly as enlarge danger of miscarriage and intrauterine growth retardation.

KEYWORDS: behavior, caffeine, calcium balance, cardiovascular effects, children, coffee, congenital malformations, development, fertility, fetal growth, pregnancy, spontaneous abortion, tea.

INTRODUCTION

Caffeine is probably the most frequently ingested pharmacologically active substance in the world. It is found in common beverages (coffee, tea, soft drinks), in products containing cocoa or chocolate and in medications. Because of its wide consumption at different levels by most segments of the population, the public and the scientific community have expressed interest in the potential for caffeine to produce adverse effects on human health.^[1]

Coffee is a complex mixture of chemicals that provides significant amounts of chlorogenic acid and caffeine. The results of epidemiological research suggest that coffee consumption may help prevent several chronic diseases, including type 2 diabetes mellitus, Parkinson's disease and liver disease (cirrhosis and hepatocellular carcinoma). Most prospective cohort studies have not found coffee consumption to be associated with significantly increased cardiovascular disease risk. However, coffee consumption is associated with increases in several cardiovascular disease risk factors, including blood pressure and plasma homocysteine. At present, there is little evidence that coffee consumption increases the risk of cancer. For adults consuming moderate amounts of coffee (3-4 cups/d providing 300-400 mg/d of caffeine), there is little evidence of health risks and some evidence of health benefits. However, some groups, including people with hypertension, children, adolescents and the elderly, may be more vulnerable to the adverse effects of caffeine. In addition, currently available evidence suggests that it may be prudent for pregnant women to limit coffee consumption to 3 cups/d providing no more than 300 mg/d of caffeine to exclude any increased probability of spontaneous abortion or impaired fetal growth.^[2] Coffee is also a rich source of many other ingredients that may contribute to its biological activity, like heterocyclic compounds that exhibit strong antioxidant activity. Coffee has a significant antioxidant activity, and may have an inverse association with the risk of type 2 diabetes mellitus.^[3]

Excessive caffeine consumption can cause negative health consequences such as psychomotor agitation, insomnia, headache, gastrointestinal complaints. Metabolism of caffeine by pregnant woman is slowed down. Caffeine and its metabolites pass freely across the placenta into a fetus. For this reason pregnant women should limit caffeine intake. Children and adolescents should also limit daily caffeine consumption. It results from the influence of caffeine on the central nervous system in the period of rapid growth and the final stage of brain development, calcium balance and sleep duration. Smokers consume more caffeine than nonsmokers, similarly to persons with mental illnesses. With reference to the caffeine consumption it should be underline that caffeine content in coffee and tea beverages varies greatly depending on the method of brewing whereas the content of caffeine in many brands of energy drinks can much vary. This should be taken into account in the daily caffeine intake.^[4]

Caffeine increases alertness and reduces fatigue. This may be especially important in low arousal situations (e.g. working at night). Caffeine improves performance on vigilance tasks and simple tasks that require sustained response. Effects on more complex tasks are difficult to assess and probably involve interactions between the caffeine and other variables which increase alertness (e.g. personality and time of day). In contrast to the effects of caffeine consumption, withdrawal of caffeine has few effects on performance. There is often an increase in negative mood following withdrawal of caffeine, but such effects may largely reflect the expectancies of the volunteers and the failure to conduct "blind" studies. Regular caffeine usage appears to be beneficial, with higher users having better mental functioning. Most people are very good at controlling their caffeine consumption to maximize the above positive effects.^[5]

Caffeine stimulates the central nervous system first at the higher levels, resulting in increased alertness and wakefulness, faster and clearer flow of thought, increased focus and better general body coordination and later at the spinal cord level at higher doses.^[6] Once inside the body, it has a complex chemistry, and acts through several mechanisms including increased calcium uptake activating metabolic pathways and neural activity. activation of wake-promoting neurons, release of neurotransmitters producing excitation, release of glutamate producing anxiety. increased blood flow to smooth muscles and vasoconstriction, inhibition of dopamine reuptake, inhibition of gamma-amino butyric acid (GABA) and excitation of the CNS and inhibition of sleep promoting neurons.^[7]

Caffeine can increase blood pressure in non-habitual consumers. High blood pressure is associated with an increase in strokes and cerebral vascular disease, which in turn increase the risk of multi-infarct dementia.^[8] Caffeine may reduce control of fine motor movements (e.g. producing shaky hands). Caffeine can contribute to increased insomnia and sleep latency. Caffeine is addictive and caffeine withdrawal can produce headache, fatigue and decreased alertness. High doses of caffeine (300 mg or higher) can cause anxiety.^[9]

The database on caffeine's potential to adversely influence bone metabolism includes epidemiological studies investigating the relationship between caffeine and/or coffee intake and the risk of osteoporosis as characterized by low bone mineral density and increased susceptibility to fractures, as well as metabolic studies examining the effect of caffeine on calcium homeostasis. Scientific studies have shown a variety of effects of caffeine consumption in children. At low doses, an increased performance in attention tests has been noted in children. Anxiety, measured both subjectively and objectively, has also been associated with the administration of low doses of caffeine in children in a number of studies.^[10]

Caffeine easily crosses the blood brain barrier and enters every organ, tissue and bodily fluid. It contains a large amount of chemicals, including polycyclic aromatic hydrocarbons (carcinogens). It is broken down into 25 by-products that all have detrimental effects on the body. It contains aldehydes, alcohols and sulfides. All of which have to be removed by your poor liver. Caffeine disrupts your normal adenosine receptors, which control the brain, kidneys, gastrointestinal system, cardiovascular system and respiratory system. Caffeine's by-products are reabsorbed into the blood stream. Living in the gastrointestinal tract and causing putrefaction, maldigestion, gas, bloating and increasing your risk of gastrointestinal disease. Caffeine causes your body to be less metabolically efficient. Less oxygen gets to the cells, therefore less waste is removed from the cells, increasing your risk of every type of cancer. Caffeine causes the blood vessels in the brain to constrict and blood flow to your brain is literally reduced. Caffeine reduces the quality and quantity of sleep. It fights against your immune system and can turn it against you, causing auto-immune disease. This condition, known as immune dysregulation, is responsible for Lupus, Rheumatoid Arthritis and Muscular Dystrophy and Fibromyalgia. Caffeine raises dopamine levels and interacts with opiate receptors in exactly the same way the amphetamines and cocaine do, making it a highly addictive drug! Caffeine has horrible long-term effects on the adrenal glands, affecting

every one of the 150 hormones produced and metabolized by these glands. Caffeine decreases your ability to deal with stress by lowering the GABA levels in your blood, at the same time increasing the amount of stress hormones flowing through your bloodstream. This equals big anxiety and stress! Caffeine causes increases loss of thiamin and other B-vitamins. Caffeine also decreases the ability to absorb these nutrients from food or supplements. Vitamin B deficiency is one major cause of neurological damage. Caffeine decreases your ability to absorb calcium, magnesium, sodium, zinc and chloride. This increases your risk of a whole host of illnesses including osteoporosis. Caffeine directly affects the neurotransmitters involved with memory and learning, decreasing mental acuity and causing brain fog. Caffeine raises blood sugar levels and disrupts the blood sugar-regulating effect of insulin. Caffeine raises fatty acid levels in the blood. Caffeine lowers sperm count as well as decreasing the virility and mobility of existing sperm. Caffeine causes uric acid crystals to be deposited in the cartilage & joints (gout) feet (bone spurs) and kidneys (kidney stones). Caffeine significantly increases intra-ocular pressure in the eyes, contributing to glaucoma and macular degeneration.^[11]

According to a researcher from the Harvard School of Public Health in Boston, people who drink coffee or consume caffeine regularly have a lower risk of developing Parkinson's disease. The research put forth that the mice that had first been given caffeine equivalent to moderate amounts of coffee in humans lost fewer neurons than those not given caffeine.

Caffeine also seems to protect human brain cells. In a meta-analysis that pooled 13 studies, drinkers of regular coffee - but not decaf - had a 30 percent lower risk of Parkinson's disease than non-drinkers. There are at least six studies indicating that people who drink coffee on a regular basis are up to 80% less likely to develop Parkinson's, with three showing the more they drink, the lower the risk.

The theory is that caffeine reduces the amount of neurotransmitters produced by the brain, transmitters that may cause damage to surrounding brain tissue. The actual action of caffeine in the brain is not known. It may also interfere with uptake of other transmitters, allowing the levels of dopamine to increase. The Nurses' Health Study and the Health Professionals Follow-up Study put forth that those who drank two to three cups of regular coffee a day had about a 20 percent lower risk of gallstones than non-drinkers. Another research showed that compared to not drinking coffee, at least two cups daily can result in a 25% reduced risk of colon cancer, an 80% drop in liver cirrhosis risk, and nearly half the risk of gallstones.

Caffeine has several metabolic effects that reduce the risk of gallstones. One probable explanation is that caffeine may stimulate the gallbladder to contract, which helps empty it of stone-forming cholesterol and bile pigments.

Caffeine improves alertness and reaction time in people, whether they are habitual consumers of caffeine or not. The caffeine in a cup of coffee stimulates the central system as it simultaneously lowers the blood sugar and increases the brain's demand for sugar. The mood altering effects of caffeine depend on the amount of caffeine consumed and whether the individual is physically dependent on or tolerant to caffeine. In caffeine non-users or intermittent users, low doses of caffeine (20-200 mg) generally produce positive mood effects such as increased well-being, happiness, energetic arousal, alertness and sociability. Among daily caffeine users, much of the positive mood effect experienced with consumption of caffeine in the morning after overnight abstinence is due to suppression of low grade withdrawal symptoms such as sleepiness and lethargy. Large caffeine doses (200 mg or greater) may produce negative mood effects. Although generally mild and brief, these effects include increased anxiety, nervousness, jitteriness and upset stomach. There is evidence that caffeine can improve physical performance. In a study on recreational athletes, the consumption of about five cups of coffee significantly increased muscle endurance during brief, intense exercise. Prior to a maximum effort run, caffeine consumption of about three cups of coffee resulted in significantly greater anaerobic metabolism and improved athletic performance among recreational runners.

During a headache, the blood vessels in brain dilate, or become wider. Caffeine causes blood vessels to constrict, thus it can help relieve headache pain. It is also a mild analgesic. Caffeine makes pain relievers 40% more effective in relieving headaches and helps the body absorb headache medications more quickly, bringing faster relief. For this reason, many over-the-counter headache drugs include caffeine in their formula. It is also used with ergotamine in the treatment of migraine and cluster headaches as well as to overcome the drowsiness caused by antihistamines.

Results of a study published in *The Journal of Clinical Nutrition* put forth that moderate coffee intake can help prevent some cardiovascular problems. Coffee is full of antioxidants which are good for both the heart and the body. Coffee can also reduce inflammation and this too helps prevent certain heart related illnesses. Another study published in the *Annals of International Medicine* found that women who drink two to three cups of coffee a day have a

25% lower risk of heart disease and an 18% lower risk of developing diseases other than cancer than non-coffee drinkers.^[12]

METHODOLOGY

A cross-sectional study was conducted in different areas of Karachi included 150 students and 150 adults of age more than 40 years who have a career in medicine, sports and arts. Only fourth-year students were approached. Data were collected using a self-administered standard questionnaire.

RESULTS

In bivariate analyses, frequency of energy-drink consumption was higher in students of arts and sports and in those who did not have breakfast on a regular basis, ever smoked cigarettes, drank alcoholic beverages and regularly engaged in sports compared with their counterparts. Many students who had “ever” tried an energy drink did so the first time because they wondered about its taste. Of regular users of energy drinks, reasons for using such drinks varied across the three selected groups of students and included obtaining getting energy, staying awake, boosting performance while doing sports, or mixing with alcoholic beverages. About 40% of all current users of energy drinks reported that they mixed those with alcoholic beverages. Most students could not correctly define the ingredients of energy drinks or their potential hazardous health effects, and they could not distinguish energy and sports drinks when they were requested to select them from a list of commercial names of various drinks.

Frequencies

Statistics												
		AGE OF PARTICIPIENT	GENDER OF PARTICIPIANT	Would you like energy drinks?	Do you have knowledge about the composition of energy drinks and their effects?	Which type of energy drink you consumed?	What is your frequency of drinking such beverages ?	How much you drank daily, in terms of the number of 250-mL cans/bottles ?	What is the place of purchase of energy drinks?	Which time of day when you usually consumed an energy drink?	What is the reason for drinking energy drinks	How you felt after having an energy drink
N	Valid	109	109	109	109	109	109	109	109	109	109	109
	Missing	0	0	0	0	0	0	0	0	0	0	0
	Mean	21.89										

Frequency Table AGE OF PARTICIPIENT					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15	2	1.8	1.8	1.8
	16	6	5.5	5.5	7.3
	17	4	3.7	3.7	11.0
	18	5	4.6	4.6	15.6
	19	5	4.6	4.6	20.2
	20	12	11.0	11.0	31.2
	21	18	16.5	16.5	47.7
	22	13	11.9	11.9	59.6
	23	5	4.6	4.6	64.2
	24	16	14.7	14.7	78.9
	25	11	10.1	10.1	89.0
	26	7	6.4	6.4	95.4
	27	2	1.8	1.8	97.2
	28	1	.9	.9	98.2
	30	1	.9	.9	99.1
35	1	.9	.9	100.0	
Total		109	100.0	100.0	

GENDER OF PARTICIPIANT					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	FEMALE	50	45.9	45.9	45.9
	MALE	59	54.1	54.1	100.0
	Total	109	100.0	100.0	

Would you like energy drinks?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	33	30.3	30.3	30.3
	Yes	76	69.7	69.7	100.0
	Total	109	100.0	100.0	

Do you have knowledge about the composition of energy drinks and their effects?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	76	69.7	69.7	69.7
	Yes	33	30.3	30.3	100.0
	Total	109	100.0	100.0	

Which type of energy drink you consumed?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	7up	24	22.0	22.0	22.0
	coke	18	16.5	16.5	38.5

	pepsi	27	24.8	24.8	63.3
	Sting	40	36.7	36.7	100.0
	Total	109	100.0	100.0	

What is your frequency of drinking such beverages ?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	every day	13	11.9	11.9	11.9
	every day few	64	58.7	58.7	70.6
	once a week	8	7.3	7.3	78.0
	once a year	24	22.0	22.0	100.0
	Total	109	100.0	100.0	

How much you drank daily, in terms of the number of 250-mL cans/bottles ?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 cans/bottles	1	.9	.9	.9
	2 cans/bottles cans/bottles	104	95.4	95.4	96.3
	4 cans/bottel	3	2.8	2.8	99.1
	6 cans/bottles	1	.9	.9	100.0
	Total	109	100.0	100.0	

What is the place of purchase of energy drinks?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	corner shop	20	18.3	18.3	18.3
	hypermarket/supermarket	20	18.3	18.3	36.7
	on the way to school	1	.9	.9	37.6
	restaurant	53	48.6	48.6	86.2
	school shop/cafeteria	15	13.8	13.8	100.0
	Total	109	100.0	100.0	

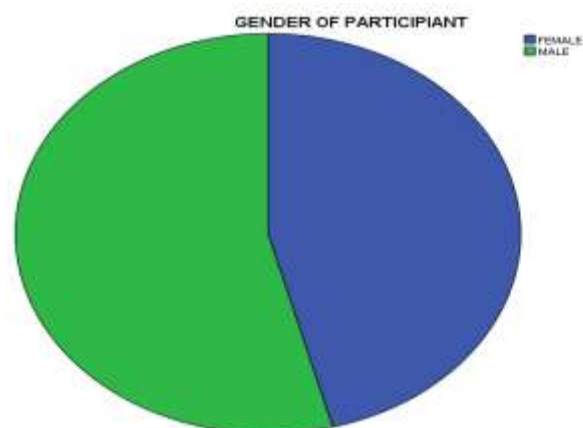
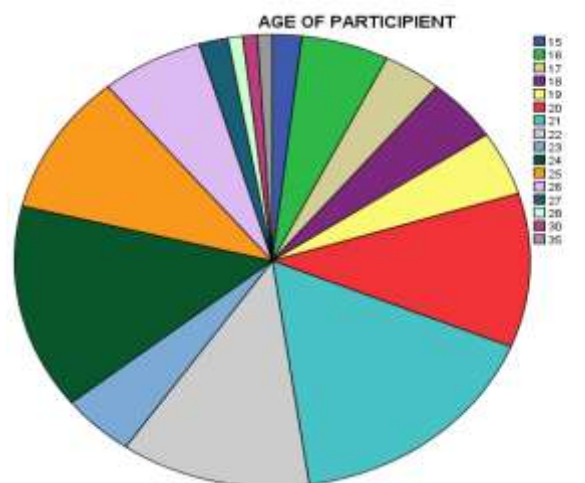
Which time of day when you usually consumed an energy drink?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Afternoon	16	14.7	14.7	14.7
	Evening	44	40.4	40.4	55.0
	Morning	3	2.8	2.8	57.8
	Night	46	42.2	42.2	100.0
	Total	109	100.0	100.0	

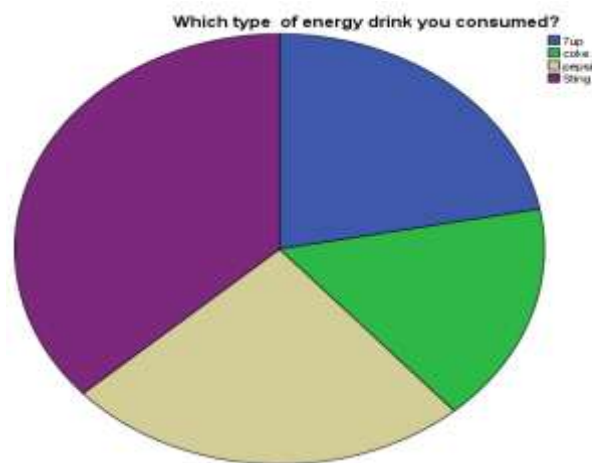
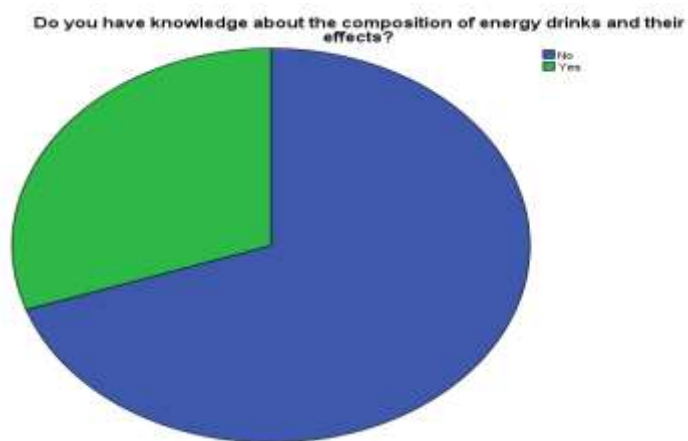
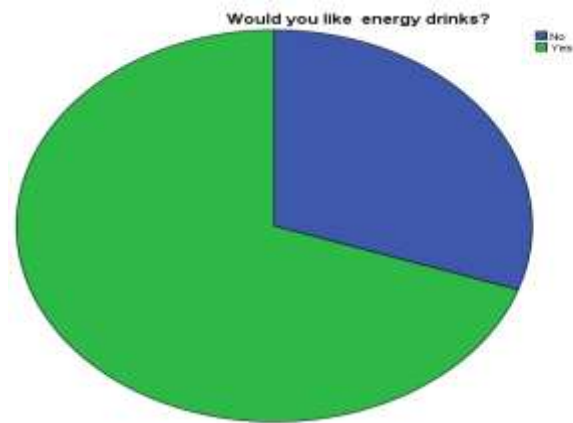
What is the reason for drinking energy drinks					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no particular reason	16	14.7	14.7	14.7
	before and after physical or mental effort	14	12.8	12.8	27.5
	in a party	27	24.8	24.8	52.3

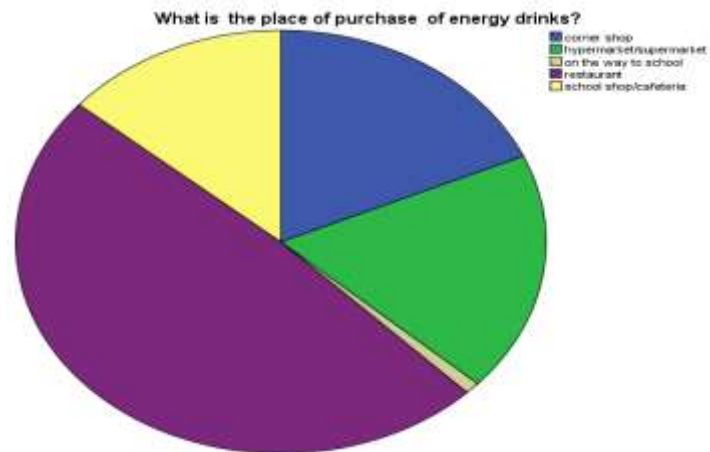
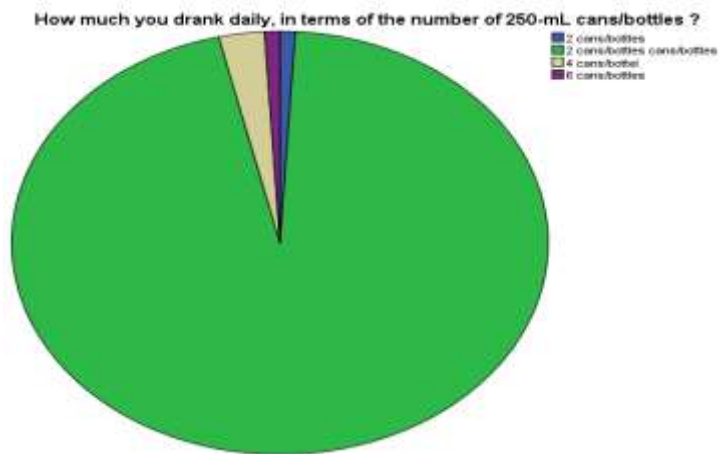
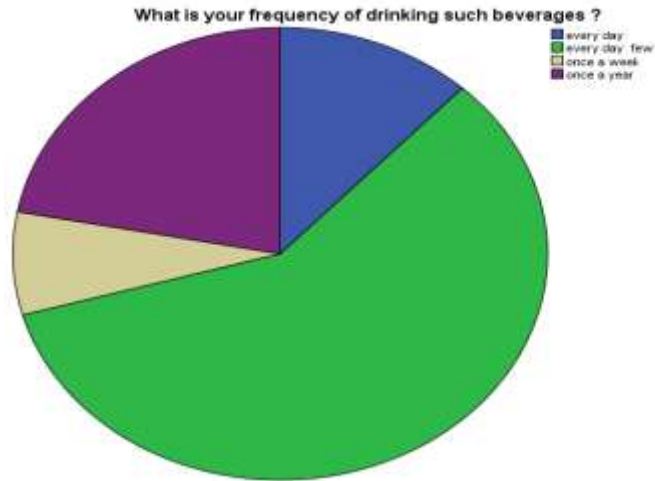
when I feel like having something to drink	29	26.6	26.6	78.9
when I feel tired	23	21.1	21.1	100.0
Total	109	100.0	100.0	

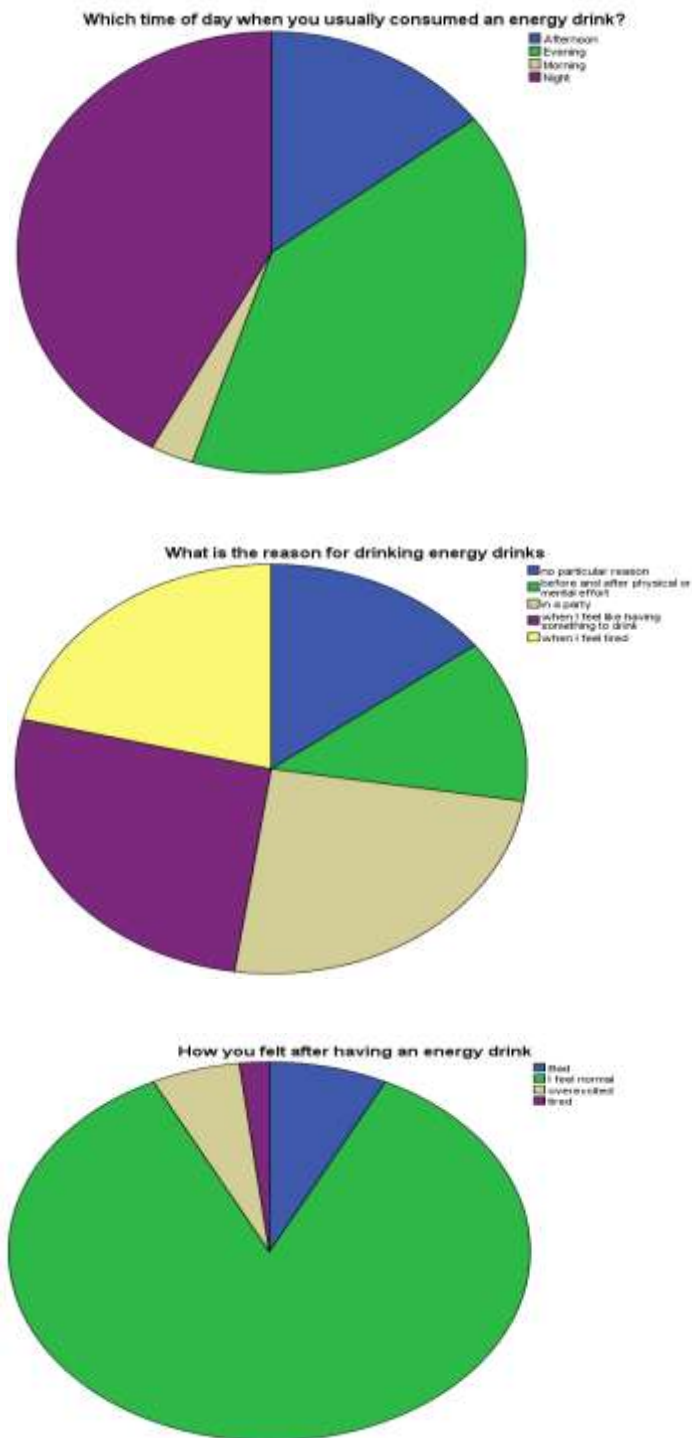
How you felt after having an energy drink					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bad	8	7.3	7.3	7.3
	I feel normal	93	85.3	85.3	92.7
	overexcited	6	5.5	5.5	98.2
	tired	2	1.8	1.8	100.0
	Total	109	100.0	100.0	

Pie Chart









SUMMARY AND CONCLUSIONS

Caffeine is part of modern life. Regular coffee drinkers include the majority of U.S. adults and a growing number of children. The recommendation for most people is to enjoy one or two cups of coffee a day, which will allow you to capitalize on its health benefits without incurring health drawbacks. Extensive recent research has put forth that coffee is far more healthful than it is harmful. Very little bad and a lot of good come from drinking it. Caffeine

is widely consumed at different levels by most segments of the population. Both the public and the scientific community have expressed concern about the potential for caffeine to produce adverse effects on human health. The possibility that caffeine ingestion adversely affects human health was investigated based on reviews of published (primarily) human studies obtained through a comprehensive literature search. The following potential adverse effects of caffeine on human health were investigated: general toxicity, cardiovascular effects, effects on calcium balance and bone status, behavioural effects in adults and children, carcinogenic potential, genotoxic potential, and reproductive effects, including pre- and postnatal development. It should be pointed out that review of some of the epidemiological studies was complicated by one or more methodological issues, such as inadequate measurement of caffeine intake; a lack of consideration of all sources of caffeine intake; a lack of consideration of caffeine intake before study; the lack of distinction made between different types of preparation and different strengths of coffee in most studies; inadequate control for the possible confounding effects of variables such as smoking, alcohol consumption, age, nutrition and lifestyle factors in some studies; the low response rates in several studies; biased selection of adequate controls because of self-selection into groups of drinkers and non-drinkers of coffee; recall bias in retrospective studies; and insufficient statistical power in some of the studies. Despite these issues, the majority of the reviewed studies provided important and useful data with which to assess the potential effects of caffeine on human health. Based on the data reviewed, it can be concluded that there is sample evidence indicating that for the general population of healthy adults, moderate caffeine in-take at a dose level of 400 mg day is not associated with adverse effects such as general toxicity, cardio-vascular effects, changes in adult behavior, increased incidence of cancer and effects on male fertility. Nor are moderate intakes of caffeine associated with adverse effects on bone status and/or calcium balance if adequate intakes of calcium are being consumed. On the basis of this review, we conclude that (1) energy drinks have no therapeutic benefit 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 which have stimulant properties and cardiac and hematologic activity but manufacturers claim that energy drinks are nutritional supplements, which shields them from the caffeine limits imposed on sodas and the safety testing and labeling required of pharmaceuticals. In the short-term, pediatric health care providers need to be aware of energy drink consumption by children, adolescents, and young adults and the potentially dangerous consequences of

inappropriate use. The use of caffeine may lead with high-risk behaviors, certain health conditions (eg, seizures, diabetes, hypertension, cardiac abnormalities) and children with behavioral changes, anxiety, poor nutrition, or sleep disturbances. For most children, adolescents and young adults, safe levels of consumption have not been established. Yet, heavy use may be harmful or interact with medications and cause untoward adverse effects. Health care providers should educate families and children at risk for the potential adverse effect of use of caffeine in the form of energy drinks. Children and adults with cardiac conditions should be counseled regarding the risks of caffeine-containing products, including irregular heart rhythms, syncope, dysrhythmias and sudden death. Community partners, including schools, athletic groups and regulatory bodies, also need to promote risk awareness. Long-term research objectives should aim to better define maximum safe doses, the effects of chronic use and effects in at-risk populations (eg, those with preexisting medical conditions, those who consume energy drinks during and after exercise, or those who consume them in combination with alcohol), and better documentation and tracking of adverse health effects. At present, there is little evidence that coffee consumption increases the risk of cancer. Although most studies have not found coffee or caffeine consumption to be inversely associated with bone mineral density in women who consume adequate calcium, positive associations between caffeine consumption and hip fracture risk in three prospective cohort studies suggest that limiting coffee consumption to 3 cups/d (300 mg/d of caffeine) may help prevent osteoporotic fractures in older adults. 201–203 Although epidemiological data on the effects of caffeine during pregnancy are conflicting, they raise concern regarding the potential for high intakes of coffee or caffeine to increase the risk of spontaneous abortion and impair fetal growth. Serious adverse effects from caffeine at the levels consumed from coffee are uncommon, but there is a potential for adverse interactions with a number of medications. Regular consumers of coffee and other caffeinated beverages may experience withdrawal symptoms, particularly if caffeine cessation is abrupt. Overall, there is little evidence of health risks and some evidence of health benefits for adults consuming moderate amounts of coffee (3–4 cups/d providing 300–400 mg/d of caffeine). Limited data from short-term clinical trials suggest that daily caffeine intakes of 3 mg/kg of body weight or more may have adverse effects in children and adolescents. These findings are the basis for Health Canada should not consume more than 2.5 mg/d of caffeine per kg of body weight. Clearly, more research is needed to determine whether long-term caffeine consumption has adverse effects on the health of children and adolescents.

REFERENCES

1. Food Addit Contam. 2003 Jan; 20(1): 1-30. Effects of caffeine on human health.
2. Nawrot P, Jordan S, Eastwood J, Rotstein J, Hugenholtz A, Feeley M. 2006; 46(2): 1 Crit Rev Food Sci Nutr. 01-23. Coffee and health: a review of recent human research. Higdon JV, Frei B.
3. Mol Nutr Food Res. 2005 Mar; 49(3): 274-84. Coffee consumption and human health--beneficial or detrimental?--Mechanisms for effects of coffee consumption on different risk factors for cardiovascular disease and type 2 diabetes mellitus.
4. Ranheim T, Halvorsen B.
5. Rocznik Państw Zakł Hig. 2012; 63(2): 141-7. [Caffeine--common ingredient in a diet and its influence on human health].
6. Food Chem Toxicol. 2002 Sep; 40(9): 1243-55. Effects of caffeine on human behavior.
7. Smith A.
8. Karau, M, Kihunyu, J, Kathenya, N, Wangai, L, Kariuki, D, Kibet, R (2010). "Determination of Caffeine Content in Non-Alcoholic Beverages and Energy Drinks Using Hplc-Uv Method". *African Journal of Drug and Alcohol Studies* (Centre for Research and Information on Substance Abuse) 9(1): 15–21. doi:10.4314/ajdas.v9i1.61754.
9. Huang, ZL, Qu, WM, Eguchi, N, Chen, JF, Schwarzschild, MA, Fredholm, BB, Urade, Y, Hayaishi, O (2005). "Adenosine A2A, but not A1, receptors mediate the arousal effect of caffeine". *Nature Neuroscience*, 8(7): 858–9. doi:10.1038/nn1491. PMID 15965471.
10. ^ Jump up to: *abc* Cornelis, MC, El-Sohemy, A (2007). "Coffee, caffeine and coronary heart disease". *Current Opinion in Clinical Nutrition and Metabolic Care*, 10(6): 745–51. doi:10.1097/MCO.0b013e3282f05d81. PMID 18089957.
11. ^ Jump up to: *abcdefghi* Smith, A (2002). "Effects of caffeine on human behavior". *Food and Chemical Toxicology*, 40(9): 1243–55. doi:10.1016/S0278-6915(02)00096-0. PMID 12204388.
12. Food Additives and Contaminants, 2003; 20(1): 1–30 Effects of caffeine on human health.
13. 50 Ways Caffeine Effects the Human Body March 20, 2012 at 6:00 AM (Health, Non Toxic) Tags: addiction, caffeine, coffee, diet, Health, Nutrition, pop, soda, soft drink.
14. Positive And Negative Health Effects Of Caffeine by dr. Shelley Narula over a year ago. Healthy Living.