Research Article

Exploring the effects of caffeine content in energy drinks consumed by athletes in Katima Mulilo, Zambezi Region in Namibia

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Abstract

Energy drinks also known as (EDs) have become a well known staple beverage among nowadays generations, giving an instant increase in energy, enhanced alertness, and boosted physical endurance. Commonly consumed for athletic, social, and academic purposes, their availability and hostile marketing have influenced to rising dependence and abuse. The main objective of this study was to exploring the effects of caffeine content in energy drinks consumed by athletes in Katima Mulilo, Zambezi Region in Namibia. This employed a quantitative approach in it design to collect in-depth required data from participants. The population of this study consisted of n = 100 participants who were selected purposively on basis of their active participation in soccer, volleyball, netball, and basketball. Data was collected using questionnaires and analyzed using SPSS V21 software. Moreover, analyzed descriptive data was interpreted in percentages, frequencies, mean and standard deviation, and was presented into table. The results of this study revealed that the caffeine content in energy drinks above 150 milligrams have serious health implications such; heart rate increase, heart palpitations, stroke, cardiac arrest, heart rhythm problems, anxiety, restlessness, insomnia, headaches, dizziness, depression, sleep disruption and fatigue, nausea, diarrhea, stomach upset, dehydration, dental erosion and cavities, blood sugar spikes and it can lead to risks of developing Type 2 diabetes. There it can be concluded from this study that high content of caffeine in energy drinks have serious health implications if consumed at high doses, precautionary measures need to be taken into consideration prior to consumption.

Keywords: Effects, caffeine content, energy drinks, athletes, Katima Mulilo

Introduction

Energy drinks are alcohol free, sugary drinks that have variable volumes of taurine such as (amino acid), minerals, glucuronolactone, caffeine, herbal extracts, and vitamins in order to boost mental and physical endurance (Reissig et al, 2009). Research have shown that, the a large number of people who use energy drink usually participate in exhausting physical activity, and also those who wish to stay alert for a longer period of time, such as driver, students, and athletes (Kudema et al, 2023). Since energy drinks are promoted for their observed or actual advantages as stimulants, performance boosters, and energy enhancers, this is the rationale (Barbara et al, 2016). Numerous research outputs have shown that energy drinks were original introduced in Europe and Asia in the early 1960s (Reissig et al, 2009). Whilst in early 1987, the famous and well known energy drink brand Red Bull was launched, its use became very known worldwide (Miller, 2008).

Moreover, due to the extensive and long-term drinking of drinks comprising of caffeine naturally, like tea and coffee, the parameter of beverages having additional caffeine has been complex (The Center for Science and the Environment, 2011). However, a number of countries have sanctioned rules and regulations managing the branding, supply, and selling of energy drinks having substantial volumes of caffeine (Joo et al, 2014). Whereas, the European Food Safety Authority (EFSA) orders that energy drinks have caffeine content more than 150 (ppm) or else 150 milligram per liter must be categorized as having “High Caffeine Content” and the particular total must be specific (James, 2021). Some countries with stricter rulea and regulations like Australia has prohibited energy drinks that have more than 320 milligram of caffeine and wants to categorize them in the same cluster as drugs. Whereas, countries like Uruguay, Turkey and Denmark have prohibited the use of energy drinks completely, and countries such as Sweden has banned salling of energy drinks to children (Rashid, 2019). Scholars revealed that the upper limit advised daily caffeine consumption differs between 2.5 milligram and 6 milligram for kids, 100 milligram for teenagers, and 400 milligram for adults (Heckman et al, 2010). Likewise, the consumption towards caffeine differs

between people, with the mass of individuals developing toxic signs at doses of 200 milligram (McLellan et al, 2016). Numerous research conducted on energy drinks usage globally discovered that the health dangers linked with energy drinks consumption are predominantly regarded as being caused by caffeine content (Alsunni, 2015). In accordance with the study that was done by Pommerening et al (2015) revealed that an excessive overdose of caffeine can cause vomiting, nausea, dieresis, convulsions, hypertension, palpitations, stimulation of the central nervous system, metabolic acidosis, marked hypocalcemia, and few cases, cause death (Choudhury et al, 2017). In the study conducted by Hanif et al (2020) found that high caffeine energy drinks cause Type 2 diabetes, reduced insulin sensitivity and cause arterial hypertension in grownups adults (Mattioli et al, 2018). Additionally, research have found that caffeine intake rises the danger of stillbirths, late miscarriages, and small-for-gestational-age infants with pregnant women (Sattari et al, 2016). Repeated caffeine consumption can damage cognition in overall, learning in particular and long-term memory (Solomin et al., 2015). Consuming caffeine at a dose of 400 milligram raises anxiety levels, specifically when combined with a worrying task. Some studies propose that energy drinks can cause the start of the initial seizure and cause stroke (Ullah et al, 2018).

Statement problem

Energy drink consumption is related to numerous health dangers such as; blood pressure and increased heart rate, anxiety and sleep pattern disturbances, this is mostly due to high caffeine content. Extreme ingestion can lead to more dangerous issues such as dehydration, heart arrhythmias, and a higher probability of developing type 2 diabetes. There main aim of this study is to explore the effects of caffeine content in energy drinks consumed by athletes in Katima Mulilo, Zambezi Region in Namibia.

Research questions

What are the effects of caffeine content in energy drinks consumed when consumed by athletes?

Materials and methods

Design

This study employed a quantitative research approach in order to in-depth required data from respondents. According to Ghanad (2023) quantitative research design is a methodical plan to gather and evaluate mathematical figures to test assumptions, find patterns, and make projections

Population and sample

The population of this study were athletes participating in soccer, netball, basketball and volleyball within Katima Mulilo. Who were purposively selected to form part of the sample.

Data collection procedure and data analysis

Data was collected using questionnaires designed to by researcher and analyzed using SPSS V21 statistical software, descriptive data was interpreted in percentages, frequencies, mean and standard deviation and presented into tables.

Results

This section of this study shows the results of types of energy drinks, common ingredients, caffeine content, sugar content, calories and carbohydrates. 24 energy drinks were examined for their caffeine, sugar calories and carbs to which Monster energy drink used ingredients such as Taurine (2000 mg), gluconolactone N/S, carnitine N/S, inositol and guarana N/S, ginseng (400 mg) and vitamins B2, B3, B6 and B12 (40 mg) with 160 mg caffeine content. The second energy drink was Monster zero-sugar with ingredients such as; Taurine, carbonated water, citric acid, a sugar-free sweetener blend (erythritol, sucralose, and acesulfame potassium), natural flavors, caffeine, and B vitamins with 140 mg caffeine content. The third energy drink was Red bull with ingredients like; Taurine (2000 mg), gluconolactone (1200 mg), inositol N/S [not specified] and vitamins B3, B5, B6 and B12 N/S, 160 mg caffeine content. The fourth energy drink was Red bull sugar-free with ingredients like; Carbonated water, citric acid, taurine, caffeine,

B-group vitamins (niacin, pantothenic acid, B6, B12), and artificial sweeteners like sucralose and acesulfame K, 80 mg of caffeine content.

The fifth energy drink was Sting with ingredients such as; Taurine (148 mg), inositol (21 mg), ginseng (9.7 mg), vitamin B3 (10.2 mg), 290 mg of caffeine, 50 g sugar content, 28 calories and 7 g of carbs. The sixth energy drink was Full Throttle made with ingredients such as; Taurine (N/S), guarana (N/S), B3 (N/S), B6 (N/S), B8 (N/S), carnitine (N/S), 80 mg caffeine. The seventh energy drink was Fearless with ingredients such as; Taurine, water, sugar, carbon dioxide, caffeine, taurine, and B vitamins (B6 and B12), 160 caffeine content. The eighth energy examined was Cody with ingredients like; Water, taurine, caffeine, glucuronolactone, B vitamins (B6, B12), and various flavorings and colorants, 80 mg of caffeine.

The nineth energy drink was XXL Energy made with ingredients such as; Carbonated water, sugar, caffeine, taurine, inositol, glucuronolactone, B vitamins (niacin, pantothenic acid, B6, and B12), with 100 mg caffeine content. The tenth energy drink was 3D with ingredients like; Carbonated water, citric acid, erythritol, and flavorings, along with energy-boosting components like caffeine (200 mg per can), taurine, L-carnitine tartrate, and B vitamins (B-3, B-5, B-6, B-12), with 200 mg of caffeine content. The eleventh energy was 5 Hour energy shot with ingredients such as; Caffeine (200-230 mg, depending on strength), B vitamins (\(B_{3}\), \(B_{6}\), \(B_{12}\) amino acids like taurine, N-acetyl-L-tyrosine, and phenylalanine. The twelfth energy drink was Alani Nu made with ingredients such as; taurine, L-theanine, ginseng, L-carnitine, inositol with 200 mg caffeine content.

The thirteenth energy drink evaluated was Beyond Raw Lit with ingredients such as; Carbonated water, B vitamins (\(B_{3},B_{5},B_{6},B_{12}\)), with 250 mg of caffeine content. The fourteenth energy drink was C4 energy made out of ingredients such as; Carbonated water, a caffeine source, vitamins (Niacin and B12), amino acids like L-arginine and taurine, and sweeteners such as sucralose with 200 mg of caffeine content. The fifteenth energy drink was Celsius with these ingredients' Carbonated filtered water, essential vitamins (B vitamins, vitamin C), and a proprietary blend of ingredients including taurine, guarana seed extract, green tea extract, and ginger root extract with 200 mg caffeine content.

The sixteenth energy was Ghost with ingredients such as Carbonated water, natural caffeine (from coffee bean), taurine, and a mix of vitamins and nootropics like Acetyl-L-Carnitine HCl, Alpha-Gpc, and Neuroeffector Coffee Fruit Extract with 200 mg caffeine. The seventeenth energy drink was MTN Dew Rise with ingredients such as Carbonated water, a blend of sweeteners like aspartame, acesulfame potassium, and sucralose, and is flavored with fruit juice concentrates and natural flavors. Key energy and vitamin ingredients include 180 mg of caffeine content, citicoline, vitamins A, C, and B3, B5, and B6, along with minerals like zinc and sodium. The eighteenth energy was Nocco with ingredients such as; Carbonated water, branched-chain amino acids (BCAAs), caffeine, B vitamins (niacin, \(B_{6}\), biotin, \(B_{12}\)), and sweeteners like sucralose, with 180 mg caffeine content.

The nineteenth energy drink was Nos with ingredients like; Carbonated water, high fructose corn syrup (or sugar substitutes in zero-sugar versions), citric acid, sodium citrate, and 160 caffeine content. The twentieth energy drink was Reign with ingredients such as; Carbonated water, natural flavors, and sweeteners like sucralose and erythritol with 300 mg of caffeine content. The twenty first energy drink was Rockstar with ingredients such as; Carbonated water, sugar (or artificial sweeteners), dextrose/glucose, citric acid, taurine, sodium citrate, 160 mg caffeine content, and a blend of vitamins like B3 (niacinamide), B5 (pantothenic acid), and B6 (pyridoxine hydrochloride).

The twenty second energy drink was Rockstar sugar-free with ingredients such as; A blend of carbonated water, 160 mg caffeine, B-vitamins, taurine, guarana seed extract, and Panax ginseng root extract. The twenty third energy drink was Zevia with these ingredients; Carbonated water, 120 mg organic caffeine, and organic stevia leaf extract, along with natural flavors, citric acid, and tartaric acid. The last energy at number 24 was Zoa with common ingredients such as; Carbonated water, 160 mg natural caffeine, amino acids (like L-leucine, L-valine, and L-isoleucine), a blend of vitamins (such as Vitamin C, B3, B6, B12), and other components like green tea extract, turmeric extract, choline bitartrate, and sucralose for sweetness.

Table 1: Most popular energy drinks' ingredients, caffeine content, sugar content, calories and carbs

Types of energy drinks	Common ingredients	Caffeine (mg)
1. Monster	Taurine (2000 mg), gluconolactone N/S, carnitine N/S, inositol and guarana N/S, ginseng (400 mg) and vitamins B2, B3, B6 and B12 (40 mg)	160mg
2. Monster Zero Sugar	Taurine, carbonated water, citric acid, a sugar-free sweetener blend (erythritol, sucralose, and acesulfame potassium), natural flavors, caffeine, and B vitamins.	140mg
3. Red Bull	Taurine (2000 mg), gluconolactone (1200 mg), inositol N/S [not specified] and vitamins B3, B5, B6 and B12 N/S	160mg
4. Red bull Sugar-free	Carbonated water, citric acid, taurine, caffeine, B-group vitamins (niacin, pantothenic acid, B6, B12), and artificial sweeteners like sucralose and acesulfame K.	80mg
5. Sting	Taurine (148 mg), inositol (21 mg), ginseng (9.7 mg), vitamin B3 (10.2 mg)	290mg
6. Full Throttle	Taurine (N/S), guarana (N/S), B3 (N/S), B6 (N/S), B8 (N/S), carnitine (N/S)	141mg
7. Fearless	Taurine, water, sugar, carbon dioxide, caffeine, taurine, and B vitamins (B6 and B12)	160mg
8. Cody	Water, taurine, caffeine, glucuronolactone, B vitamins (B6, B12), and various flavorings and colorants.	80mg
9. XXL Energy	Carbonated water, sugar, caffeine, taurine, inositol, glucuronolactone, B vitamins (niacin, pantothenic acid, B6, and B12),	100mg
10. 3D	Carbonated water, citric acid, erythritol, and flavorings, along with energy-boosting components like caffeine (200 mg per can), taurine, L-carnitine tartrate, and B vitamins (B-3, B-5, B-6, B-12)	200mg
11. 5 Hour energy shot	Caffeine (200-230 mg, depending on strength), B vitamins (\(B_{3}\), \(B_{6}\), \(B_{12}\) amino acids like taurine, N-acetyl-L-tyrosine, and phenylalanine	200mg
12. Alani Nu	taurine, L-theanine, ginseng, L-carnitine, inositol,	200mg
13. Beyond Raw Lit	Carbonated water, B vitamins (\(B_{3},B_{5},B_{6},B_{12}\)), caffeine,	250mg
14. C4 energy	Carbonated water, a caffeine source, vitamins (Niacin and B12), amino acids like L-arginine and taurine, and sweeteners such as sucralose.	200mg

15. Celsius	Carbonated filtered water, essential vitamins (B vitamins, vitamin C), and a proprietary blend of ingredients including taurine, guarana seed extract, green tea extract, and ginger root extract.	200mg
16. Ghost	Carbonated water, natural caffeine (from coffee bean), taurine, and a mix of vitamins and nootropics like Acetyl-L-Carnitine HCl, Alpha-Gpc, and Neuroeffector Coffee Fruit Extract.	200mg
17. MTN Dew Rise	Carbonated water, a blend of sweeteners like aspartame, acesulfame potassium, and sucralose, and is flavored with fruit juice concentrates and natural flavors. Key energy and vitamin ingredients include caffeine, citicoline, vitamins A, C, and B3, B5, and B6, along with minerals like zinc and sodium	180mg
18. Nocco	Carbonated water, branched-chain amino acids (BCAAs), caffeine, B vitamins (niacin, \(B_{6}\), biotin, \(B_{12}\)), and sweeteners like sucralose.	180mg
19. Nos	Carbonated water, high fructose corn syrup (or sugar substitutes in zero-sugar versions), citric acid, sodium citrate, and caffeine.	160mg
20. Reign	Carbonated water, natural flavors, and sweeteners like sucralose and erythritol.	300mg
21. Rockstar	Carbonated water, sugar (or artificial sweeteners), dextrose/glucose, citric acid, taurine, sodium citrate, caffeine, and a blend of vitamins like B3 (niacinamide), B5 (pantothenic acid), and B6 (pyridoxine hydrochloride)	160mg
22. Rockstar sugar-free	A blend of carbonated water, caffeine, B-vitamins, taurine, guarana seed extract, and Panax ginseng root extract.	160mg
23. Zevia	Carbonated water, organic caffeine, and organic stevia leaf extract, along with natural flavors, citric acid, and tartaric acid	120mg
24. Zoa	Carbonated water, natural caffeine, amino acids (like L-leucine, L-valine, and L-isoleucine), a blend of vitamins (such as Vitamin C, B3, B6, B12), and other components like green tea extract, turmeric extract, choline bitartrate, and sucralose for sweetness.	160mg

Table 2 below shows results derived from the effects of energy drinks, their frequencies, mean and standard deviation scores. 20 item questions were asked to participants with intentions to collect data on their energy drink usage and experiences. The results shows that 75% (.750±.435) of participants indicated by saying yes they felt heart rate increase when they consumed energy drinks. 68% (.680±.468) agreed that they felt heart palpitations when they consumed energy drinks. Whereas, 58% (.580±.496) agreed that indeed energy drinks lead to serious issues like stroke. 64% (.640±.482) said yes energy drinks lead to cardiac arrest, 72% (720±.451) said yes energy drinks lead to

heart rhythm problems. 78% (.780±.416) agreed with the statement that energy drinks somehow lead to anxiety. 80% (.800±402) of participants said energy drinks caffeine content lead to restlessness. While, 90% (.900±.301) of participants said caffeine content in energy drinks lead to insomnia. 87% (.870±.338) participants said energy drinks caused headaches and 92% (.920±.272) said it also causes dizziness. Moreover, participant further said yes energy drinks caused; 86% (.860±.348) confusion and even seizures, 60% (.600±.492) led to depression, 95% (.950±.219) said it led to sleep disruption and fatigue. 83% (.830±.377) of participants said energy drink consumption led to upset stomach, 83% (.830± believe it causes nausea, 59% (.590±.494) said it causes diarrhea, 83% (.830±.377) said it causes dehydration, 57% (.570±.497) said it causes blood sugar spikes, 53% (.530±.501) said it increase the risk of developing type 2 diabetes, and 71% (.710±.456) said it causes dental erosion and cavities.

Table 2: Effects of energy drinks, frequence, mean and standard deviation results

Effects of energy drinks to the body	Frequence %		mean	Standard Deviation
	yes	no		
1. Do you feel heart rate increase when you drink energy drinks? (Cardiovascular)	75**	25	.750**	.435
2. Do you somehow feel heart palpitations when you consume energy drinks? (Cardiovascular)	68*	32	.680*	.468
3. Does energy drinks lead to serious issues like stroke? (Cardiovascular)	58*	42	.580*	.496
4. Does energy drinks lead to serious issues like cardiac arrest? (Cardiovascular)	64*	36	.640*	.482
5. Do energy drinks lead to heart rhythm problems? (cardiovascular)	72**	28	.720**	.451
6. Do energy drinks somehow lead to anxiety? (Neurological)	78**	22	.780**	.416
7. Do energy drinks somehow lead to restlessness? (Neurological)	80**	20	.800**	.402
8. Do energy drinks somehow lead to insomnia? (Neurological)	90**	10	.900**	.301
9. Do energy drinks somehow causes headaches? (Neurological)	87**	13	.870**	.338
10. Do energy somehow drinks cause dizziness? (Neurological)	92**	8	.920**	.272
11. Do energy drinks somehow lead to confusion and even seizures?(Neurological)	86**	14	.860**	.348
12. Do energy drinks lead to depression? (Neurological)	60*	40	.600*	.492
13. Do energy drinks lead to lead to sleep disruption and fatigue? (Neurological)	95**	5	.950**	.219

14. Do energy drinks somehow lead to upset stomach? (Gastrointestinal)	66*	34	.660*	.476
15. Do energy drinks somehow lead to nausea?	83**	17	.830**	.377
16. Do energy drinks somehow lead to diarrhea? (Gastrointestinal)	59*	41	.590*	.494
17. Does the diuretic effects of caffeine in energy drinks lead to dehydration which can be worsened by exercise? (Dehydration)	83**	17	.830**	.377
18. Does high sugar content in energy drinks cause blood sugar spikes? (Blood sugar)	57*	43	.570*	.497
19. Do energy drinks high sugar content increase the risk of developing type 2 diabetes? (Metabolic)	53*	47	.530*	.501
20. Do energy drinks high sugar and acid contents lead to dental erosion and cavities? (Dental)	71**	29	.710**	.456

** high score * low score

Table 3 below shows the results of caffeine doses levels in milligrams, examples of drinks with such caffeine, side effects, and health summary. The results shows that the can of soda, small green tea, single espresso shot and small energy drink (8 oz) falls in a range of 100 milligrams dose, and the usual side effect are; mild stimulation, improved mood, increased alertness, reduced perception of fatigue and can improve reaction time. 8 oz brewed coffee, standard energy shot, 16 oz energy drink, pre-workout (low-end) are in a range of 100 – 200 milligrams dose of caffeine and they usual have these side effects' optimal performance or alertness, heightened focus, significant increase in vigilance, and enhanced endurance for physical performance. This is often the therapeutic range for cognitive and physical enhancement. Single doses up to 200 milligrams are generally safe for most healthy adults. Large brewed coffee, high caffeine energy drinks, 16 oz, pre-workouts usually have 200 - 400 milligrams of caffeine doses with side effects such as; strong stimulation & onset of side effects. Jittering, restlessness, nervousness, and stomach upset become likely, especially for non-habitual users. May cause heart palpitations. Whilst, 400 milligrams is the recommended maximum daily limit for healthy adults. Does in this range are common in concentrated products and should be approached with caution. Specialty coffee shop drink (venti/large), high-end pre-workout (max scoop) fall in 400 milligrams dose of caffeine with side effects such as; Severe side effects. rapid or irregular heart (tachycardia), Pronounced anxiety, significant gastrointestinal distress, and headache, may cause temporary hypertension. This dose start to cross into the zone of acute intoxication, carrying a higher risk of adverse cardiovascular and central nervous system effects. The 1,200 milligrams (toxic level) extreme danger, this level is typically associated with consuming concentrated caffeine powders or pills. It can cause seizures, severe cardiac arrhythmias, and is potentially life-threatening. The side effects are; Seek immediate medical attention. The estimated lethal dose of caffeine is generally 10 g to 14 g (or 150 mg/kg of body weight), but severe toxicity occurs much lower.

Table 3: Caffeine doses levels and their side effects

Range of doses in milligrams (mg)	Examples	Usual side effects	Health summary
< 100 milligrams (mg)	Can of soda, Small green tea, single espresso shot, small energy drink (8.4 oz)	Mild stimulation. improved mood, Increase alertness, reduced perception of fatigue. Can improve	General considered a low-risk, functional dose. A single dose of 100 mg may affect sleep if consumed close to

		reaction time	bedtime
100 milligrams – 200 milligrams (mg)	8 oz brewed coffee, standard energy shot, 16 oz energy drink, pre-workout (low-end)	Optimal performance/alertness. Heightened focus, significant increase in vigilance, and enhanced endurance for physical performance	This is often the therapeutic range for cognitive and physical enhancement. Single doses up to 200 mg are generally safe for most healthy adults
200 milligrams – 400 milligrams (mg)	Large brewed coffee, high-caffeine energy drink, (16 oz), Pre-workout (standard)	Strong stimulation & onset of side effects. Jittering, restlessness, nervousness, and stomach upset become likely, especially for non-habitual users. May cause heart palpitations	400 mg is the recommended maximum daily limit for healthy adults. Does in this range are common in concentrated products and should be approached with caution
> 400 milligrams (1 dose)	Specialty coffee shop drink (venti/large), high-end pre-workout (max scoop)	Severe side effects. rapid or irregular heart (tachycardia), Pronounced anxiety, significant gastrointestinal distress, and headache. May cause temporary hypertension	This dose start to cross into the zone of acute intoxication, carrying a higher risk of adverse cardiovascular and central nervous system effects.
> 1,200 milligrams (toxic level)	Extreme danger. This level is typically associated with consuming concentrated caffeine powders or pills. It can cause seizures, severe cardiac arrhythmias, and is potentially life-threatening	Seek immediate medical attention. The estimated lethal dose of caffeine is generally 10 g to 14 g (or 150 mg/kg of body weight), but severe toxicity occurs much lower.	

Discussions

This section of this research discusses the results of this study in association with literature linked to topic. In table 1: 24 energy drinks were closely examined for ingredients and caffeine content levels. The study results shows that taurine, caffeine and glucuronolactone were the commonly used ingredients in all energy drinks inspected. These results are also found in Alsunni (2015) study which revealed that energy drinks are made out of common ingredients that have side effects such as; taurine, glucuronolactone, caffeine, inositol, amino acids and carbonated water. The study results further shows that 22 (91%) of energy drinks have caffeine content levels above 100 (mg) to 300 (mg) and only 2 (8.3%) energy drinks under scrutiny were found to be below 100 (mg). These results are supported by Mental Health Commision (2016) findings which discovered that most energy drinks have caffeine content which is way more higher than 100 milligram and only a few energy drinks have lesser caffeine content below 100 milligrams. These results may imply that most energy drinks have high caffeine contels levels that maybe be associated with

some side effects.

Moreover, the study result in table 2, shows participants' responses to 20 item questions which featured their experiences after the consumption of energy drinks. The results of this study shows that 58% - 75% of participants pointed out that caffeine content found in energy drinks caused vascular health problems such as, heart rate increase, heart palpitations, stroke, cardiac arrest and heart rhythm problems. The results concur with Chami and Di Primio (2024) study outcome which found that high doses of caffeine leads to heart rhythm problems and incresed heart rate especially if engage in physical activity. Furthermore, the results are also supported by Wassef et al (2017) research which reported that energy drinks-related cardiovascular adversative impacts has helped to foster raise skepticism of these drinks. It is commonly alleged that caffeine, especially at high doses, is linked with numerous cardiac health issues including heart palpitations, stroke, cardiac arrest, heart rhythm issues and heart rate increase.

The study results shows that 78% - 95% of participants in this study said yes energy drinks caffeine contents caused neurological health problems such as; anxiety, restlessness, insomnia, headaches, dizziness, confusion and seizures, depression, sleep disruption and fatigue. These results correspond to Persad (2011) study outcomes which found that high doses of caffeine has neurological health impacts on the body like; severe headaches and dizziness, depression and anxiety, confusion and seizures, disrupted sleeping patterns and fatigue, insomnia and restlessness. Basht et al (2025) found that energy drinks has neurological effects such as; severe heads, parkinson disease, anxiety, celebellar dysfunction, insomnia, hyperkinesia or hypokinesia, depression and Alzeheimer's disease.

The results of this study further shows that 59% - 83% of participants agreed that energy drink consumption caused gastrointestinal health problems such as; dehydration, nausea, diarrhea and stomach upset when consumed in high doses. These results aligns with De Sanctis et al (2017) study which found that approximately 6% of athletes who consume energy drinks, usually complain of dehydration, stomach upset, diarrhea, and nausea. Whereas, the study outcomes by Kanorewala and Suryawanshi (2025) coincide with the results above as they found that abuse of energy drink intake can cause liver dysfunctions, leading to too much production of jaundice, liver enzymes and leading to abdominal pain. Moreover, their research outcome further support and shows that caffeine in energy drinks cause gostrointestinal health complication such as stomarch upset, nausea and dehydration.

Furthermore, this study results shows that 53% - 71% of the respondents were in agreement that caffeine found in energy drinks caused health problems such dental erosion and cavities, metabolic health problems associated with the risk of developing Type 2 diabetes and causing blood sugar spikes. These results are linked to Pinto and Zempleni (2016) report which revealed that energy drinks have been strongly linked with teeth damage. The high caffeine and sugar content level and Ph acidic levels in these drinks erode enamel of teeth, casuing to dental sensitivity. Scholar have reported that the smear layer of teeth is eroded, showing sensitive parts and rising up the danger of decay (Pinto and Zempleni, 2016). The results above are also supported by Pote and Suryawanshi (2022) study outcomes which found that high doses of caffeine found in energy drinks led to blood suagr spikes and increased the risk of developing Type 2 Diabetes.

Lastly the results of this study shows that drinks such as Can of soda, Small green tea, single espresso shot, small energy drink (8.4 oz) contain below < 100 mg of caffeine content and have these side effects on the body; Mild stimulation. improved mood, Increase alertness, reduced perception of fatigue. Can improve reaction time. These results correspond with Reddy et al, (2024) caffeine content levels below 100 mg have less impact on thr body, such as; improved reaction time and reduced tiredness. The results also shows drinks such as 8 oz brewed coffee, standard energy shot, 16 oz energy drink, pre-workout (low-end) beverages to have 100 mg – 200 mg of caffeine content levels with health effects to the body such as; Optimal performance/alertness. Heightened focus, significant increase in vigilance, and enhanced endurance for physical performance. These results goes hand in hand with Alperet et al (2020) research outcome which mentioned that beverages that contain 100 mg to 200 mg have side effects such as best performance and readiness, high sports focus, vital increase in awareness.

The results shows that large brewed coffee, high-caffeine energy drink, (16 oz), Pre-workout (standard) has caffeine content of 200 mg to 400 mg with sided heallth effects such; strong stimulation & onset of side effects. Jittering,

restlessness, nervousness, and stomach upset become likely, especially for non-habitual users. May cause heart palpitations. The results harmonize with Mitchell et al (2020) study outcomes which alluded that energy drinks that contains caffeine contents between 200 mg and 400 mg have serious health problems such as stomarch upset, jittering and result in heart palpitation if extreme doses are used. The results show that specialty coffee shop drink (venti/large), high-end pre-workout (max scoop) has caffeine content of more than 400 mg with health implications such as; Severe side effects. rapid or irregular heart (tachycardia), Pronounced anxiety, significant gastrointestinal distress, and headache. May cause temporary hypertension. These results are supported by Andrs et al (2016) survey which find that energy with morethan 400 mg caffeine content cause serious health problems such as hypertension, headache, anxiety, irregular heart and gastrointestinal distress. Lastly, the study results shows that extreme danger in energy drinks that have caffeine content levels of above 1,200 mg. This level is typically associated with consuming concentrated caffeine powders or pills. It can cause seizures, severe cardiac arrhythmias, and is potentially life-threatening. These related results are shown in a study by Michael et al (2018) which reported that energy drinks that contains caffeine content level of > above 1,200 mg lead to seizure and even cardiac problemsit seek immediate medical attention. The estimated lethal dose of caffeine is generally 10 g to 14 g (or 150 mg/kg of body weight), but severe toxicity occurs much lower.

Conclusion

Research have shown that caffeine, in whatever form either naturally or man made, is being commonly used in and around the globe, even though the focal source and the extent it consumed differs in distinctive countries. Though, the safety of caffeine has been a topic of much discussion in previous years. Still, both human and animal experiments done defend that caffeine is safe as long as it is consumed in reasonably. Therefore, it can be concluded from this study that they should be regulation put in place to ban energy drinks that have a caffeine content of morethan 100 mg , due to numerous studies that have revealed that negative effects outweighed positive impacts on human body.

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