

The Genotoxicity and Health Effects of Stimulant (Energy) Drinks

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Abstract:

This research looked at energy drinks, and the key components of these beverages, which were shown to contain caffeine, which raises blood pressure and increases blood viscosity in the blood, the blood's proportions of sugar and fat increase heartbeat frequency and force of contractions, Taurine enter the bloodstream where it interacts with calcium, potassium, sodium, and d-water to protect the heart during physical exercise. Glucurono-lactone is thought to be a chemical that relieves depression. 50 from the control group and 50 from the addicted group were taken. There were findings, The mean and standard deviation of the percentage of DNA damage in groups were (4.48 ± 5.8) , and (6.58 ± 7.9) , respectively. A separate sample t-test revealed a statistically significant difference between the means of the two groups. Results that were statistically significant were observed for both addicts and controls.

Keywords: Energy drink, comet assay, cholesterol, uric acid

Introduction:

Energy drinks are stimulants, not actual energy sources. They rely on the body's high stimulation, including the herbs and stimulant compounds they contain. Many unidentified substances are present in energy drinks, and their proper application has not yet been established, mix Energy drink ingredients are combined without knowledge of the daily amounts permitted from each other and without consideration for how their components work together or in opposition to one another Energy drinks have a wide range of physiological effects and are highly addictive. Caffeine, which has been demonstrated to increase blood viscosity and boost the blood's proportion of fat and sugar, is the most crucial element present in these drinks⁽¹⁾. It was discovered that these drinks contain caffeine, which is the most crucial element present in these drinks, increases in heart rate and contraction power Taurine also modulates the heartbeat by allowing "water, potassium, sodium, and calcium to enter the cells, protecting the heart during vigorous activity". It is believed that glucurono-lactone is a substance that improves mental clarity and memory, works as a stimulant, and minimizes depression⁽²⁾. To produce energy, the body needs small amounts of vitamin B. Energy drinks are stimulants rather than an energy source because they rely on the body being attentive, including the stimulant substances and herbs they contain energy drinks include a number of substances whose effects are unclear or unknown, and their safety has not yet been shown⁽¹⁾. The ingredients in energy drinks were combined in an improper and comprehensible way in terms of the effects of synergy or antagonism between their constituent parts because they were added without knowledge of the maximum daily doses for some of them. Energy drinks have the potential to directly and indirectly damage many organs. Caffeine has never been discovered in an infant's urine who has been breastfed, not even⁽³⁾. when the mother consumed a lot of coffee. Studies on the effects of children's direct caffeine use in preschool and school have produced a number

of conclusions. There have either been no effects or very slight, irregular effects on psychological, behavioral, cognitive, and motor functioning—results that some could consider positive. A dose of 5 mg/kg bw of caffeine increased alertness, irritation, unease, or anxiety in some participants, especially if they were generally low caffeine consumers, according to several of these studies⁽⁴⁾. The person can consume energy drinks away from water through a multitude of ways. The appropriate fluid selection, timing of consumption, and integrative testing are crucial for overall health, particularly in young people. According to earlier researches, "Consumption has increased." Energy drinks are defined as beverages They also contain simple sugars like glucose and fructose, galactose, and sucrose, as well as acids, stimulants, plant guarana, and caffeine. Amino's exact composition is unknown, but the well-known caffeine in these beverages provides the energy.⁽⁵⁾ "It has been demonstrated that caffeine, a competitive antagonist of adenosine receptors, increases dopaminergic activity Caffeine's subjective and behavioral effects on people (improved sense of wellbeing, postponed sleep, and greater energy) are comparable to those of certain common psychomotor stimulant medications," whose effects may similarly be mediated by dopaminergic circuit interference⁽⁶⁾. DNA changes of various types, The comet test can detect strand breaks, including double-strand breaks, single-strand breaks, alkali-labile sites, incomplete repair sites, and cross-links. In this experiment, cells are embedded in agarose, lysed, and electrophoresed at low voltage, causing DNA that is relaxed and broken up to move more quickly than DNA that is intact or cross-linked, creating the impression of a comet. Increased DNA damage is correlated with the amount of comet "tail" migration. These pictures can be examined and contrasted cell by cell⁽⁷⁾.

Material and Method :

Study design :

In this study, 100 samples were used, 50 from healthy individuals and 50 from patients who drank energy drinks.

Methods :

Performing a glucose test: Involves drawing blood from the person's vein, whose blood sugar is being measured, placing it in a centrifuge tube, allowing it to clot, and then rotating the mechanism used to separate plasma without changing the sample's sugar concentration. Then, 10 microliters of the prepared solution (the regulator) is mixed with 1 mL of the prepared solution. Ten minutes are given for the patient's blood serum to stand at room temperature in an incubator set at 37 °C, and the colorimeter is calibrated to read the glucose level at a wavelength of 500 nm⁽⁸⁾.

Cholesterol test: The test is performed by simply taking a patient's blood, often in the morning after a night of fasting. Following the collection of the blood sample for the required laboratory tests, 1 ml of the prepared solution (controlled) cholesterol analysis is added to the patient's blood serum and kept at room temperature before being read by a wave spectrometer at 500 nm. setting the gadget to 0.⁽⁹⁾

Uric acid test: We put 1 cc of the regulator and 20 microliters of the patient's blood serum in an empty test tube and let them sit at room temperature for 5 or 10 minutes. A 520nm wavelength spectrometer is used to take the reading in order for the interaction to occur after the instrument has been reset to zero⁽¹⁰⁾.

Test for protein: The procedure for performing a protein analysis in the blood involves drawing blood from the patient's vein by using a rubber band to secure the patient's hand, which quickens the blood flow and makes the vein more noticeable, allowing for the easy drawing of blood. The area on the patient's hand where the needle will be inserted is then sterilized. The tube linked to the end of the needle is then filled with blood once it has been placed into the patient's vein. Then, for this test, 1 ml

of the organized solution and 20 microliters of the patient's blood serum are added, and a technician completes the reading.⁽¹¹⁾

Assay of a comet: Cybergreen was used to stain the dried microscope slides, which were then immediately examined at a magnification of 200 in a fluorescence microscope with green illumination. DNA damage was identified using a system for visual analysis (Comet Assay 2.2; Perceptive Instruments, Suffolk, UK). DNA fragment migration in the agarose gel served as a visual representation of DNA damage. It was once thought that two criteria that directly linked to one another—the distance from the head's center to the tail's end and the distance from the head's end to the tail's end—reflected DNA movement. In addition, “the system offered the mean tail moment (the ratio of the tail DNA to the total DNA divided by the tail center of gravity)”⁽¹²⁾.

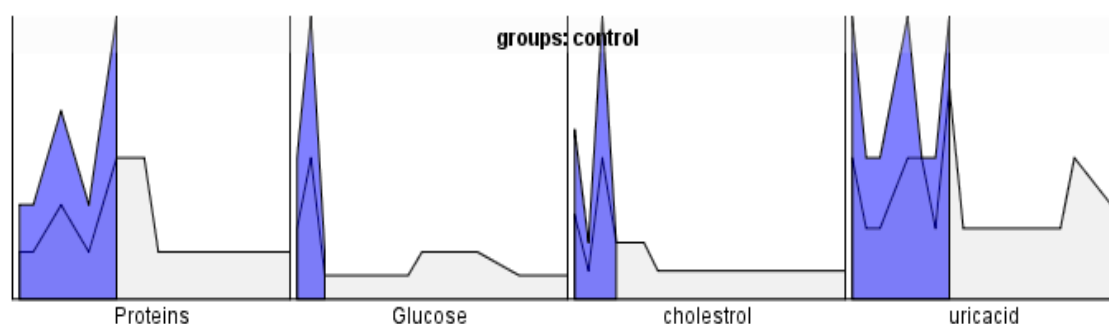
Result and Discussion

The investigation reveals a considerable rise in cholesterol, triglycerides, protein, and uric acid. The following table and figure illustrates how most energy drink users' bodily functions compare to those of healthy individuals after using energy drink.

Table (1):demonstrates the rise in the characteristics under study

Groups	Proteins	Glucose	cholesterol	uricacid
Control	5.90 ± 0.67	119.1 ± 7.75	141.30 ± 5.68	6.50 ± 0.34
Patients	11.88 ± 0.921	63.52 ± 1.05	271.6 ± 29.7	9.69 ± 0.59

According to studies, the blood sugar level does slightly change, and it was shown that most addicts had lower blood sugar levels than healthy people. This is due to the energy drink's components, such as taurine, which, depending on how long a person has consumed it, drop blood sugar levels⁽¹³⁾. The second component is a rise in blood sugar levels, “which calls for a large amount of the hormone insulin, which transports sugar to the cells”. When insulin levels are high and too much glucose is consumed, more sugar is transported from the blood to the cells, which lowers blood sugar levels and causes inactivity⁽¹⁴⁾.



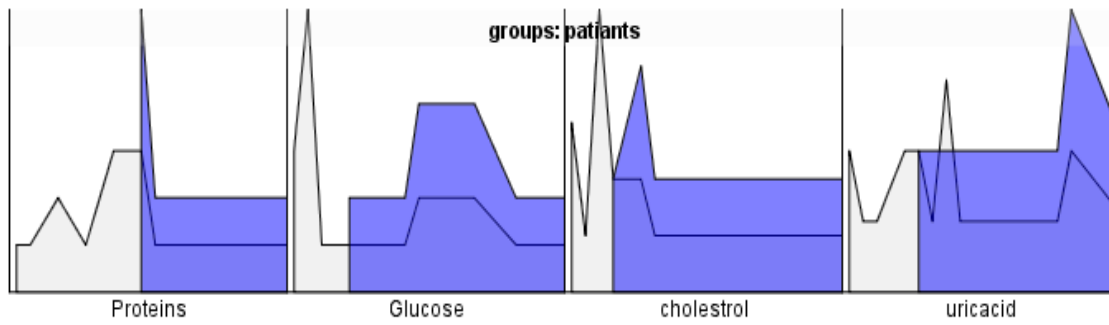


Figure 1: illustrates the rise in the characteristics under study

Additionally, when compared to healthy people, the amount of cholesterol was higher in those who were addicted. “Because the ginseng in one of the energy drink's ingredients is in charge of controlling cholesterol”⁽¹⁵⁾. One of the ingredients in the energy drink is taurine. Additionally, it is a non-essential amino acid that the body can produce, and those who are addicted to it will have more proteins in their bodies due to taurine levels that are higher than the body's natural upper limit. Additionally, it was discovered that due to an increase in one of the body's salts, uric acid levels are higher in addicts. According to study “ taurine, a substance present in energy components, transports water, potassium, sodium, and calcium to cells. When these salts surpass the normal limit, depending on how long the energy drink is consumed, especially sodium salts, this can be dangerous”⁽¹⁶⁾.

The Comet test is used to assess chemicals or agents that have the potential to be mutagenic . It aids in the detection of DNA damage and picks up a variety of DNA damage type that are undetectable by other assays. Any sort of tissue or tissue can be used for this test. Due to its sensitivity to even little DNA damage, cytology only needs a minimal number of cells per sample and can be finished quickly, The comet assay used to assess genotoxic stress revealed that patients had more DNA damage than controls. The metric use to measure this damage was the comet tail moment. we use in this study epithelial cells in urine in this test as observe in table2 and figure 2:

Table 2: Mean difference values for cells with damage DNA

Groups	anomalies	average of the affected cells
Control	.85 4.48 ±	51.66 ± 15.19
Patients	9.75 ± 8.6	57.01± 18. 68

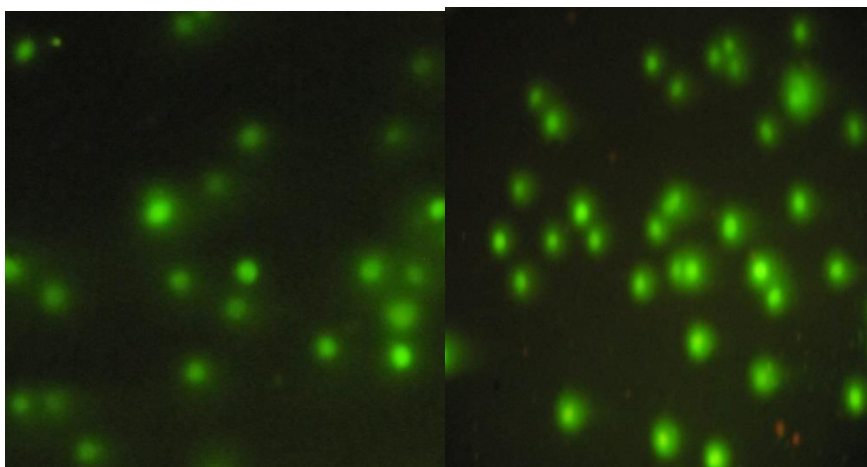


Figure2: Different degrees of DNA damage in the urinary system's epithelial cells

According to test results, energy drink ingredients cause cytotoxicity or simple chromosomal damage in the alkaline comet assay. The alkaline comet test, which can immediately identify degrees of damage in all cells, is a highly sensitive tool for assessing DNA damage and repair at the level of the individual cell. This assay's objective is to in vivo map DNA damage in human cells for scientific, environmental, and occupational surveillance. The comet assay's considerable adaptability allows for the research of the use of different cell types, like epithelial cells, to assess DNA damage. It may also be used to evaluate genotoxicity and be a biomarker of effect early. These uses range from therapeutic to tissue engineering, pre-transplant storage, and in vivo experimental tests⁽¹⁷⁾. Because the capacity of the DNA to migrate depends on the size of the fractions and their number due to their influence on a particular substance, the DNA in the damaged cells exhibits greater migration from the nucleus, generating a comet-like appearance⁽¹⁸⁾.

Conclusions:

Manufacturers should properly label the components concentration on their energy drink products in order to prevent any adverse health effects that may result from using energy drinks. In addition, users should avoid energy drinks.

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