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# Morphological Features of the Human Body in Energy Drink Abuse

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A B S T R A C T
*The literature review examines the use of energy drinks, characterizes their main ingredients (caffeine, taurine, guarana, ginseng, sweeteners). The facts testifying to the negative impact on the human body of the systematic use of large amounts of energy drinks both independently and in combination with alcohol are presented.*

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Energy drinks are a special type of carbonated drinks, which are positioned by their manufacturers as such, which increase physical activity and improve performance when consumed. There are more than 500 trade names of energy drinks in the world, which differ significantly in their composition. At the same time, regardless of the specific brand, the unifying property of all such drinks is the content in them of high doses of substances and compounds with a stimulating / tonic effect (caffeine, guarana, taurine, ginseng, glucuronolactone, L-carnitine, B vitamins).

Caffeine is the most common psychoactive ingredient. In energy drinks, caffeine is in the form of

synthetic alkaloid. The amount of caffeine in energy drinks varies in different doses: from 32 mg to 130 mg per 100 ml of product. The caffeine content in one energy drink is 6-12 times higher than its concentration in one cup of coffee. The amount of caffeine in brewed or instant coffee varies widely from 48 to 317 mg per serving [1]. However, the negative effects of caffeine are offset by the fact that coffee is usually drunk hot, for a longer time and in smaller volumes than energy drinks. Coffee contains antioxidants that reduce the negative effects of caffeine on the cardiovascular and digestive systems of the body.

Taurine is a derivative compound of the amino acid cysteine. This compound is natural for the human body, because it is synthesized and contained in large quantities in muscles, liver. The body receives taurine from the outside when consuming meat, milk and seafood. There is evidence indicating side effects of using taurine in large quantities. There are also experimental data that suggest that taurine can reduce the negative effects of alcohol exposure [2].

Another common ingredient of energy drinks is guarana or guarana extract (its main active ingredient is guaranin). According to its pharmacological properties, guaranin is similar to caffeine. This fact may mean that energy drinks containing both guarana and caffeine may have a double stimulating effect. Such a dose of stimulants can increase the negative effects of taking energy drinks on the human body [3].

Ginseng is a natural adaptogen, its extract has a stimulating effect on metabolism and energy, cellular activity, as well as oxygen uptake by cells.

Sweeteners in energy drinks are represented by sucrose, fructose and glucose. A 250 ml can of energy

drink contains up to 35 g of sugar in the form of sucrose, glucose and fructose. The daily dose is the use of simple sugars (32 g per 2000 kcal), the amount of sugar in one can of an energy drink exceeds the recommended daily intake by 2-3 times. Manufacturers of energy drinks claim that their product contains natural ingredients that increase energy, attention, concentration and are harmless to health. According to the data of the Australian Toxicology Center for 2011-2018, the most common symptoms after the abuse of energy drinks were palpitations, nervous excitement, tremor of the extremities and disorders of the gastrointestinal tract [4].

The negative consequences for the cardiovascular system of the use of energy tonics are associated with the presence of caffeine in their composition. It is widely known that the use of caffeine, especially in large doses, increases blood pressure, accelerates cardiac activity and causes arrhythmia.

The literature has studied cases of atrial fibrillation in a patient with dilated cardiomyopathy who developed seizures after stopping excessive caffeine consumption; atrial fibrillation in a 16-year-old teenager after consuming an unknown amount of an energy drink mixed with vodka; atrial fibrillation in a 14-year-old athlete who drank energy after training (the volume is not known), while a similar situation occurred 5 days before, but at rest. In addition to arrhythmias, which are the most frequent violation of cardiac activity (in 35% of cases) with the use/abuse of energy drinks, cases of coronary spasm, cardiac arrest, postural orthostatic tachycardia syndrome, acute thrombosis of coronary vessels should also be noted [5, 7].

Studies conducted on volunteers have shown that the use of one can of energotonics causes an increase in systolic pressure by 10 mmHg and diastolic pressure by 7 mmHg, increases the heart rate by 20 beats per minute and slows down the speed of cerebral blood flow by 7 cm/s. [6]

For the most part, the authors of the cited publications point to caffeine and taurine as the most dangerous ingredients in the composition of energy tonics in relation to the cardiovascular system, and the main pathophysiological mechanisms are considered to be increased platelet aggregation and endothelial dysfunction.

Excessive consumption of energy drinks containing caffeine and taurine, which are potent psychoactive substances that can modify neurotransmission, affects the functioning of the nervous system. Numerous observations have shown that chronic abuse of energy tonics negatively affects the psycho-emotional state of a person. Disorders of the emotional sphere, the appearance of unmotivated fear, the development of depression, sleep disorders, appetite, and an increase in the frequency of antisocial behavior were noted. The appearance of aggressive behavior and insomnia in conscripts after taking energy drinks was noted. Mixing energy tonics with alcohol is also a health hazard. Such a mixture is a later moment of intoxication, which can lead to an increase in the amount of alcohol consumed and, as a consequence, the emergence of alcohol dependence. Numerous facts of exacerbation of psychiatric diseases in persons who have abused energy tonics have been recorded. In some cases, their reception by patients suffering from epilepsy provoked the development of seizures. The liver is the most sensitive organ of the digestive system to excessive consumption of energy drinks. The first cases of liver damage caused by the use of energy drinks were described in the scientific literature in 2011. A case of acute hepatitis has been described in a 22-year-old girl who consumed about 10 cans of drink a day every day for two weeks. In the same year, a case of cholestatic hepatitis was described in a patient with a transplanted liver who drank 15 cans of enegetics within three days. In both cases, the authors of the cited publications linked the hepatotoxicity of beverages with a high content of vitamin B3 in them. A 50-year-old man who consumed 4-5 cans of energy a day for 3 weeks. Signs of acute hepatitis were found: increased levels of aminotransferases and direct bilirubin in the blood; increased echogenicity of the liver and diffuse thickening of the gallbladder wall during ultrasound examination; bridge necrosis and pronounced cholestasis in the biopsy material [7]. The authors of publications associate the hepatotoxicity of energy drinks with vitamin PP (nicotinic acid) contained in them, which exhibits hepatoprotective properties in small doses, and in excess amounts has a direct toxic effect on liver tissue [8,9].

Another target organ for the action of energotonics is the kidneys, since cases of acute renal failure have been reported in individuals who often took energotonics in large quantities. Excessive consumption of energy drinks by people with low physical activity can lead to the development of obesity, due to the

content of large amounts of fructose and other sweeteners of a carbohydrate nature [10].

**Conclusions**

Analysis of the literature data indicates that excessive consumption of energy drinks can have an extremely adverse effect on human health and can lead to the development of multiple organ failure, with damage, first of all, to the cardiovascular, central nervous systems, as well as the liver and kidneys.

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