NEGATIVE EFFECTS OF ENERGY DRINKS ON THE CARDIOVASCULAR SYSTEM AND MUSCLE ACTIVITY

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Abstract: This article discusses energy drinks and their negative effects on the body. Interviews were conducted with people who drink energy drinks. Among them, changes in blood pressure and changes in heart rate were studied in young, middle-aged and older people.

Key words: Energy drinks, cardiovascular system. [1,2,5,8]

Energy drinks are popular foods that contain high doses of caffeine, sugar, B vitamins, and other stimulants. They are positioned as tools for improving performance, alertness and improving physical activity. However, despite their appeal, regular consumption of these beverages can have harmful effects on the cardiovascular system and muscle activity.

Impact on the cardiovascular system

1. **Increased blood pressure** Caffeine, which is the main active ingredient in energy drinks, contributes to narrowing of blood vessels, which can lead to increased blood pressure. This is especially dangerous for people with pre-existing heart disease or hypertension. In the short term, this increase in blood pressure can cause rapid heartbeat, headaches, and general malaise.
2. **Increased heart rate (tachycardia)** Caffeine stimulates the central nervous system, which can lead to tachycardia — a rapid heartbeat. In healthy people, this may be a temporary effect, but in people with heart rhythm disorders, such as arrhythmias, the use of energy drinks can cause more serious complications, including stroke or heart attack.
3. **Heart failure** Excessive consumption of energy drinks can lead to stress on the heart muscle, which is especially dangerous in conditions of physical exertion. Energy drinks can cause increased heart function, which increases the risk of heart disease, especially when combined with intense training.[4,16,18,26]
4. **Риск сердечно-сосудистых заболеваний**Long-term exposure to high doses of caffeine and other stimulants can increase the risk of developing cardiovascular diseases, such as coronary heart disease, and also increase the likelihood of having a myocardial infarction in people with a predisposition to these diseases.[6,10]

Effect on muscle activity

1. **Tremors and muscle spasms** The effect of caffeine on the nervous system can manifest itself not only in an increase in heart rate, but also in an increase in

muscle excitability. This can cause tremors in some peoplehands and muscle spasms, especially after consuming large amounts of energy drinks.

2. **Dehydration** Caffeine and other stimulants have a diuretic effect, which can lead to dehydration of the body. This is extremely important for maintaining normal muscle function, since water is the main component of cells that ensure their functioning. Lack of fluids can lead to poor physical activity, as well as an increased risk of injuries and sprains.[14,19,20]
3. **Reduced stamina** HEven though energy drinks can temporarily increase energy levels, their prolonged use leads to exhaustion of the body. As a result, the muscles lose their ability to maintain long-term exercise, which can reduce overall endurance.
4. **Muscle pain and fatigue** Excessive consumption of energy drinks can increase stress levels in the body, which in turn affects muscle recovery after exercise. This leads to increased pain in the muscles, slowing down their recovery and an increased feeling of fatigue.

Materials and methods for studying the effect of energy drinks on the cardiovascular system and muscle activity

1. Purpose of the study

The aim of the study is to assess the impact of energy drinks on the cardiovascular system and muscle activity in healthy volunteers, as well as to analyze the possible risks associated with their use.

2. Hypothesis

It is suggested that regular consumption of energy drinks has a negative impact on the cardiovascular system (for example, increased blood pressure, increased heart rate) and reduces the effectiveness of muscle activity (for example, reduces endurance, increases the risk of muscle spasms and dehydration).

3. Research materials

3.1. Energy drinks

Several popular brands of energy drinks containing caffeine, sugar, B vitamins, taurine, and other active ingredients were selected for the experiment. Approximate composition of drinks:

Caffeine — 50-150 mg per serving (250-500 ml)

Taurine — 500-1000 mg

B Vitamins (B3, B6, B12)

Sugar (20 to 50 g per serving)

The beverage brands used in the study include Red Bull, Monster, and other beverages widely available in the region.

3.2. **Test subjects**

The study involved 30 healthy volunteers aged 18 to 30 years (15 men and 15 women). All participants had normal blood pressure and did not suffer from cardiovascular or chronic diseases. The subjects were divided into two groups:

Group 1 (experimental) - consumed an energy drink (250 ml) daily for 5 days.

Group 2 (control) - did not consume energy drinks, but monitored their lifestyle and diet.

3.3. **Research conditions**

All participants underwent a preliminary medical examination to exclude the presence of contraindications for participation in the experiment (for example, hypertension, heart or kidney disease). The subjects were instructed about the specifics of the study and signed an informed consent form.

4. **Research methods**

4.1. **Assessment of cardiovascular activity**

The following methods were used to monitor the effects of energy drinks on the cardiovascular system:

Measurement of blood pressure and pulse. Participants had their blood pressure measured twice a day (morning and evening) using an automatic blood pressure monitor and their pulse recorded.

Electrocardiogram (ECG). All participants underwent an ECG at the beginning and end of the experiment to detect changes in their heart rate.

Test with physical activity. 4 days after the start of the study, a physical activity test (treadmilltest) was performed to assess the response of the cardiovascular system to exercise.

4.2. **Assessment of muscle activity**

The following methods were used to assess muscle activity:

Endurance test. Participants completed an endurance test, including running on a simulator or outside for 10 minutes at maximum speed. Maximum heart rate, fatigue and recovery levels were measured.

Measurement of muscle tone and spasms. During the training, the participants were given exercises with a load on large muscle groups. Attention was paid to the appearance of spasms or pain, as well as the time required for recovery.

Hydration assessment. The level of dehydration was recorded by measuring body weight before and after training, as well as by analyzing the level of sweating.

4.3. **Collection of biological data**

Blood and urine. To analyze their electrolyte levels and other biochemical parameters, such as glucose and creatinine, participants took blood and urine tests before and after 5 days of drinking an energy drink.

Surveyresults. During the study, participants filled out questionnaires that recorded their state of health, fatigue, stress levels, and other subjective indicators.

5. Statistical analysis

The obtained data were processed using the SPSS statistical package. To assess the differences between the groups, the methods of t-test for independent samples and analysis of variance (ANOVA) were used. The significance of differences was assessed at the significance level $p < 0.05$.

6. Ethical considerations

All participants were informed about the purpose of the study, methods of conducting it, possible risks, and gave their voluntary consent to participate. The confidentiality of all data was strictly observed.[26]

Thus, the use of scientific methods and tools, such as blood pressure measurement, ECG, blood and urine analysis, as well as endurance tests, allowed us to obtain an objective picture of the impact of energy drinks on the cardiovascular system and muscle activity. [26]

Conclusion

Energy drinks can have a significant impact on the cardiovascular system and muscle activity. Despite their ability to temporarily boost alertness and improve physical performance, their abuse can lead to a variety of negative consequences, including increased blood pressure, tachycardia, muscle spasms, and dehydration. It is important to remember that the safe use of energy drinks is possible only with moderate consumption and awareness of possible health risks.

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