

HEALTH RISKS AND LEGAL ASPECTS OF NON-ALCOHOLIC DRINKS SAFE CONSUMPTION

T. Adamchuk, S. Kuzminsky, T. Shchutka

L.I. Medved's Research Center of Preventive Toxicology, Food and Chemical Safety,
Ministry of Health, Ukraine (State Enterprise), Kyiv, Ukraine

ABSTRACT. Objective of the Work. Conduct an analysis of the safety studies of the major energy drink components carried out by various international scientific institutions. Compare European and Ukrainian legislation on the regulation of safe energy drink consumption.

Methods and Materials. Analysis of scientific literature, as well as European and Ukrainian regulations on the safety and regulation of energy drinks.

Results and Discussion. Non-alcoholic beverage is one that, due to its special component, activates the physiological functions of the human body. Its main components are caffeine, taurine, glucuronolactone, ginseng extracts, guarana and vitamin B complex.

Caffeine safety assessment has been carried out by many scientific organizations. In 1991, the International Agency for Research on Cancer (IARC) concluded that caffeine was not classified as a human carcinogen. The European Food Safety Authority (EFSA) has conducted a comprehensive and in-depth study on the safety of caffeine. The main findings of this study are: single doses of caffeine up to 200 mg (about 3 mg / kg body weight for an adult weighing 70 kg) do not cause safety concerns, regular caffeine intake up to 400 mg per day does not cause safety concerns for nonpregnant adults, regular caffeine intake of up to 200 mg daily by pregnant women does not cause fetal safety concerns, breastfeeding women do not raise infant safety concerns; for adolescents, caffeine intake in amounts that do not cause fears for adult caffeine intake (3 mg / kg body weight per day) may serve as a basis for determining safe single doses of caffeine and its daily intake, other components of energy drinks in concentrations typical of such drinks (about 300-320, 4000 and 2400 mg / l of caffeine, taurine and D-glucuronyl- γ -lactone, respectively), and also alcohol at doses up to 0.65 g / kg body weight do not affect the safety of receiving single doses of caffeine (up to 200 mg).

Conclusions. The essential requirements governing the safe consumption of energy drinks relate to their labeling. In order to achieve a high level of consumer health protection, to guarantee their rights to obtain reliable information, to enable them to make a conscious choice of safe products for them, energy drink manufacturers should inform consumers about their products and the need to comply with the recommended consumption of these drinks.

Key Words: energy drinks, caffeine, safety, risks, marking.

Introduction. According to the definition given in Governmental Standard of Ukraine (GSTU) 2368: 2004 "Soft Drinks. Production. Terms and Definitions", energy non-alcoholic beverage is one that, due to its special component, activates the physiological functions of the human body.

The main components of energy drinks are caffeine, taurine, glucuronolactone, ginseng extracts, guarana and vitamin B complex, which are natural components of many foods.

Caffeine – 1,3,7-trimethyl-1H-purine-2,6-dione, is a class of substances known as methylxanthines. It is present in many foods – coffee, tea, chocolate, energy and tonic drinks. Purine alkaloid is widely used as a central nervous system stimulant that accelerates overall metabolism, enhances respiration and circula-

tion. All these effects contribute to enhancing the mental and physical performance of the body, such as accelerating the visual response, enhancing vigor, increasing muscle activity, reducing the feeling of fatigue and pain. At the same time, caffeine has side effects. When abused, it can deplete the nervous system like any other stimulant, and its prolonged use can cause caffeine addiction. Common side effects associated with excessive stimulation of the central nervous system include dizziness, palpitations, irritability, anxiety, tremor, insomnia. Gastrointestinal irritation can lead to diarrhea, nausea and vomiting.

Taurine (b-aminoethanesulfonic acid) is a biologically active substance. Some sources call it amino acid, others refer to it as a vitamin-like

substance. Taurine was first isolated from bovine bile in 1827 (lat. Taurus – bull). Taurine in the body is contained in the brain and spinal cord, peripheral nerves, muscles, liver, blood, milk. It is present in food, meat, fish, milk, shellfish, eggs, etc. It is an indispensable component of nutrition for newborns, and therefore is necessarily added to baby nutrition. Taurine promotes energy metabolism in the body, eliminates cholesterol, stimulates regeneration processes, leads to a decrease in blood sugar, participates in the detoxification of the body, binding harmful substances and accelerating their excretion. It allows you to maintain and restore muscles, nervous system, helps relieve stress. Taurine stimulates the energy of nerve cells, significantly improving memory, attention and mood. Regular taurine intake ranges from 40 to 400 mg per day. Taurine-rich foods include dark poultry (2000 mg/kg in ready-made chicken, 3000 mg/kg in ready-made turkey), white fish (1720 mg/kg), scallops (8720 mg/kg), squid (356 mg/kg) and shellfish (6550 mg/kg in mussels). An adequate level of taurine consumption is 400 mg per day.

Glucuronolactone – D-glucuronolactone is a derivative of glucose carbohydrate. It is present in the human body and participates in the process of detoxification, helping the removal of harmful substances from the body, prevents the development of fatigue and increases the performance of the body. This is because glucuronolactone is an effective nutrient that has antioxidant properties and eliminates toxic substances by binding them to glycosides. Glucuronolactone is found in many foods, such as cereals and red wine.

Guarana extract is used in the production of energy drinks as a source of caffeine. The seeds of the fruit contain guaranine, which is identical to caffeine, xanthine alkaloids (theophylline, theobromine), polyphenols (catechins, epicatechins), tannin, vitamins E, A and B. Guarana – an effective stimulant: contains twice as much caffeine (2-4.5% of caffeine in guarana seeds versus 1-2% in coffee beans). Guarana extracts tone the central nervous system, increase performance, improve cognitive function of the brain, intensify metabolism.

Ginseng extract contains terpene glycosides (panaxosides A, B, C, D, E, F, G), essential oil (0.05-0.25%), vitamins C, B1 and B2, pectin, starch, sucrose, fatty acids, macro- and trace elements (iron, phosphorus, sulfur, manganese,

aluminum, silicon, etc.). It is believed that the main effect of ginseng is due to the complex of glycosides. Ginseng acts as a synergist of stimulants. The experiment found that its extracts increase efficiency and reduce fatigue during exercise. In small doses, it increases the excitation and reduces the slowing processes, and in large doses, on the contrary, it enhances the slowing processes. Ginseng components stimulate the synthesis of nuclear ribonucleic acids and liver RNA polymerase, increase the synthesis of deoxyribonucleic acid and lipids in bone marrow cells, increase the level of oxycorticosteroids in blood plasma. Ginseng is a well-known herbal drug that is mostly used as an adaptogenic and tonic remedy. It is widely used for nervous and physical exhaustion, asthenic conditions associated with various somatic diseases.

Vitamin B complex plays an important role in normalizing metabolism, in particular in the synthesis and breakdown of carbohydrates, fats and proteins. Vitamin content in 100 ml of non-alcoholic energy drinks is usually about 15%-30% of their daily requirement.

The Aim of the Research. Conduct an analysis of the safety studies of the major components of energy drinks conducted by various international scientific institutions. Compare European and Ukrainian legislation on the regulation of safe consumption of energy drinks.

Methods and Materials. Analysis of scientific literature, as well as European and Ukrainian regulations on the safety and regulation of energy drinks.

Results and Discussion. Caffeine safety assessment has been carried out by many scientific organizations. In 1991, the International Agency for Research on Cancer (IARC) concluded that caffeine is not classified as a human carcinogen [3].

An Expert Working Group established by the Authority of Australia New Zealand Food Standards in 1999 reported the harmful effects of 95 mg of caffeine for children (3 mg/kg per day for children 5–12 years weighing 32 kg) and 210 mg of caffeine for adults (3 mg/kg per day for adults weighing 70 kg), which is due to high level of anxiety [14].

Canadian scientists have concluded that for healthy adults, moderate caffeine intake of 400 mg/day (5.7 mg/kg per day for adults weighing 70 kg) is not associated with adverse effects, including overall toxicity, cardiovascular effects,

changes in behavior, increasing cancer incidence. Northern working group on toxicology and risk assessment within the Council of Ministers of the Nordic countries in 2006 and 2007 assessed the toxicity of caffeine for children and adolescents. Available data from studies of children (12 years and under) suggest that caffeine causes the same pharmacokinetic and pharmacodynamic effects in young people as in adults [7]. The effect of caffeine depends more on body weight rather than age. The Ministry of Health of Canada has suggested limiting caffeine intake for children by no more than 2.5 mg/kg body weight per day [9, 12].

As for the metabolism and pharmacokinetics of caffeine, its high daily intake (up to 1 g per day) does not lead to cumulating [6].

The Committee on Toxicity of Chemicals in Food (COT), which evaluated the reproductive effects of caffeine in 2008, concluded that caffeine consumption during pregnancy may be associated with an increased risk of fetal growth retardation. Based on available data, it is not possible to determine a maximum level of caffeine intake below which there would be no increase in risk, although the likelihood of risk increases when consumed more than 200 mg of caffeine per day [5].

Studies of cardiovascular disease in humans have shown that although caffeine causes a small but brief rise in blood pressure, other parameters of the electrocardiogram do not change. Several reports, including recent analyzes of prospective studies, have concluded that the effects of caffeine on cardiovascular function are not clinically relevant [8, 10].

In 2015, at the initiative of the European Commission, the European Food Safety Authority (EFSA) conducted a comprehensive and in-depth study on caffeine safety again (after 2011) (13). The main findings of this study are:

- single doses of caffeine up to 200 mg (about 3 mg / kg body weight for an adult weighing 70 kg) do not cause safety concerns;
- receiving the same amount of caffeine does not cause safety concerns when consumed less than 2 hours before intense exercise under normal environmental conditions;
- regular caffeine intake of up to 400 mg per day does not raise safety concerns for pregnant adults;
- regular caffeine intake of up to 200 mg per day for pregnant women does not raise concerns about fetal safety;

- single doses of caffeine and regular caffeine intake of up to 200 mg by breastfeeding women do not cause infant safety concerns;
- as for children and adolescents, the information available to determine the safe level of caffeine intake is insufficient. The Committee considers that for these subgroups, caffeine intake and its daily intake may be the basis for caffeine intake in quantities that do not cause adult caffeine intake (3 mg/kg body weight per day);
- other components of energy drinks in concentrations typical of such drinks (about 300-320, 4000 and 2400 mg/l of caffeine, taurine and D-glucuronyl- γ -lactone, respectively), and alcohol at doses up to 0.65 g / kg body weight does not affect the safety of receiving single doses of caffeine (up to 200 mg).

This assessment is in line with the findings of other authorities, such as the Department of Health of Canada or the Food and Drug Administration (FDA). The European Food Safety Authority (EFSA) has also recognized that current European legislation on the regulation of energy drinks is sufficient and adequate to ensure the protection of consumers' health.

It is important to note that the average consumption of energy drinks in Ukraine does not exceed 2 liters per year per person. This number is sometimes several times lower, then in EU and US countries (Austria – 10.87 liters per year per person, UK – 11 liters, US – 7 liters, Poland – 4.91 liters).

According to data from different countries, the contribution of energy drinks to the total consumption of caffeine by the population is less than 10%. Depending on the country where the sources of caffeine consumption have been investigated, its lion's share goes to the body with coffee, tea, chocolates and other non-alcoholic beverages, with only a percentage difference.

According to available statistics from independent studies, the main sources of caffeine in the diet are tea, coffee, chocolate and other non-alcoholic beverages such as Cola (total contribution over 90% for individuals over 18 years of age, and for the younger population almost 100%) [4].

It is worth paying attention to the caffeine content of some foods that we consume daily, but do not consider harmful:

- 90-200 mg – in one cup of espresso coffee;
- 150-300 mg – in one cup of «American» coffee;

- 40-100 mg – in one cup of instant coffee;
- 40-50 mg – in one cup of tea;
- about 80 mg – in 100 g of dark chocolate;
- 50-100 mg – 1 liter of other soft drink, which contains caffeine.

At the same time, 1 liter of energy drink contains 100-350 mg of caffeine.

Conclusions. The essential requirements governing the safe consumption of energy drinks relate to their labeling. In EU legislation, these requirements are reflected in Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the “Provision of Information to Consumers on Foodstuffs” [11].

In Ukraine, the Law of Ukraine “On Consumer Information on Food Products” came into force [2], which 100% complied with the European requirement of national legislation on energy drinks. This Law of Ukraine stipulates that the labeling of energy drinks should include warnings about high caffeine content, and that the use of such drinks is not recommended for children, pregnant women or women during lactation. In addition, it is stipulated that the amount of caffeine in mg per 100 ml beverage should be indicated on the package of the energy drink.

Annex 2 to the Law of Ukraine “On Consumer Information on Food” states: “Drinks (except beverages based on coffee, tea or coffee or tea extracts, the name of which includes the word “coffee” or “tea”), which are: intended for consumption without modification and containing caffeine from any source in excess of 150 milligrams per liter or in concentrated or dry form and after reconstitution containing caffeine from any source in excess of 150 milligrams per liter, the label shall read: “High in caffeine. Not recommended for children, pregnant women or women during lactation” (in the same field of vision as the name of the drink, followed by 100 milliliters of caffeine in brackets).”

In order to achieve a high level of consumer health protection, to guarantee their rights to obtain reliable information and to enable them to make a conscious choice of food products safe for them, energy drink manufacturers must give due notice to consumers about their products. Responsible manufacturers should not only label these beverages in full compliance with the law, but also seek to provide consumers with additional information on the need for compliance with recommended beverages based on risk assessment research.

REFERENCES

1. DSTU 2368:2004 «Napoi bezalkoholni. Vyrobnictvo. Terminy ta vyznachennia poniat».
2. Zakon Ukrainy «Pro informaciiu dlia spozhyvachiv shchodo kharchovykh produktiv» № 2639-VIII.
3. IARC. (1991) Caffeine. In: IARC (eds). IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Volume 51. Coffee, Tea, Mate, Methylxanthines and Methylglyoxal. Lyon, France: IARC.
4. Mitchell C. Diane. Beverage caffeine intakes in the U.S. / Diane C. Mitchell, Carol A. Knight, Jon Hockenberry, Robyn Teplansky, Terry J. Hartman // Food and Chemical Toxicology. – January 2014. – V. 63. – P. 136–142.
5. COT. (2008) Committee on toxicity of chemicals in food, consumer products and the environment. Statement of reproductive effects of caffeine. 16 December 2009.
6. Effects of coffee consumption on subclinical inflammation and other risk factors for type 2 diabetes: A clinical trial / K. Kempf, C. Herder, I. Erlund, H. Kolb, S. Martin, M. Carstensen [et al.] // American Journal of Clinical Nutrition. – 2010. – № 91. – R. 950–957.
7. Risk assessment of caffeine among children and adolescents in the Nordic countries / H.M. Meltzer, T.O. Fotland, J. Alexander [et al.] // Copenhagen, Denmark: Nordic Council of Ministers, TemaNord; 2008.
8. Mostofsky E. Habitual coffee consumption and risk of heart failure: A dose-response metaanalysis / M.S. Rice, E.V. Levitan, M.A. Mittleman // Circulatory Heart Failure. – 2012. – № 5(4). – R.401–405.
9. Effects of caffeine on human health / P. Nawrot, S. Jordan, J. Eastwood, J. Rotstein [et al.] // Food Additive and Contaminants. – 2003. – № 20. – R.1–30.
10. Pelchovitz D.J. Caffeine and cardiac arrhythmias: A review of the evidence / D.J. Pelchovitz, J.J. Goldberger // American Journal of Medicine. – 2011. – № 124(4). – R.284–289.
11. Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers, amending Regulations (EC) No 1924/2006 and (EC) No 1925/2006 of the European Parliament and of the Council, and repealing Commission Directive 87/250/EEC, Council Directive 90/496/EEC, Commission Directive 1999/10/EC, Directive 2000/13/EC of the European Parliament and of the Council, Commission Directives 2002/67/EC and 2008/5/EC and Commission Regulation (EC) No 608/2004.

12. Rotstein J. Energy drinks: An assessment of the potential health risks in the Canadian context / J. Rotstein, J. Barber, C. Stowbridge, H. Hayward, R. Huang, S. Benrejeb Godefroy // International Food Risk Analysis Journal. – 2013. – № 3(4). – Р. 1–29.
13. Scientific Opinion on the safety of caffeine. EFSA Panel on Dietetic Products, Nutrition, and Allergies (NDA). European Food Safety Authority (EFSA), Parma, Italy, 2015.
14. Smith P.F., Smith A, Miners J, McNeil J, Proudfoot A. (2000) Report of the Expert Working Group on the Safety Aspects of Dietary Caffeine. Canberra: Australia New Zealand Food Authority.

РИЗИКИ ДЛЯ ЗДОРОВ'Я ТА ПРАВОВІ АСПЕКТИ БЕЗПЕЧНОГО СПОЖИВАННЯ БЕЗАЛКОГОЛЬНИХ ЕНЕРГЕТИЧНИХ НАПОЇВ

Т.В. Адамчук, С.М. Кузьминський, Т.О. Щуцька

ДП «Науковий центр превентивної токсикології, харчової та хімічної безпеки
імені академіка Л.І.Медведя Міністерства охорони здоров'я України», м. Київ, Україна

РЕЗЮМЕ. Мета роботи. Провести аналіз досліджень з безпеки основних складових енергетичних напоїв, здійснених різними міжнародними науковими установами. Порівняти європейське та українське законодавство щодо регулювання безпечного споживання енергетичних напоїв.

Матеріали і методи. Аналіз наукової літератури, а також європейських та українських нормативних актів щодо безпечності та регламентації енергетичних напоїв.

Результати. Енергетичний безалкогольний напій – це такий, який завдяки спеціальним інгредієнтам активізує фізіологічні функції організму людини. Основними його складовими є кофеїн, таурин, глюко-ронолактон, екстракти женьшеню, гуарани та вітаміни групи В.

Оцінка безпечності кофеїну проводилась багатьма науковими організаціями. Міжнародне агентство з вивчення раку (IARC) у 1991 році дійшло висновку, що кофеїн не класифікується як канцероген для людини. Європейський орган з питань безпечності харчових продуктів (EFSA) провів всеохоплююче і поглиблене дослідження щодо безпечності кофеїну. Основні висновки цього дослідження: разові дози кофеїну до 200 мг (близько 3 мг/кг маси тіла для дорослого вагою 70 кг) не викликають побоювань з безпеки, регулярне споживання кофеїну в дозі до 400 мг на день не викликає побоювань щодо безпечності для невагітних дорослих, регулярне споживання кофеїну в дозі до 200 мг на день вагітними жінками не викликає побоювань щодо безпеки плода, жінками, що годують, не викликають побоювань з безпеки немовлят на грудному вигодовуванні; для підлітків підставою для визначення безпечних разових доз кофеїну і його добового надходження може служити надходження кофеїну в кількостях, що не викликають побоювань для споживання кофеїну дорослими (3 мг/кг маси тіла в день), інші компоненти енергетичних напоїв у типових для таких напоїв концентраціях (близько 300-320, 4000 і 2400 мг/л кофеїну, таурину і D-глюкуроноіл-γ-лактону відповідно), а також алкоголь у дозах до 0,65 г/кг маси тіла не впливають на безпечність надходження разових доз кофеїну (до 200 мг).

Висновки. Основні вимоги, які регулюють безпечне споживання енергетичних напоїв, стосуються їхнього маркування. З метою досягнення високого рівня захисту здоров'я споживачів, гарантування їхніх прав на одержання достовірної інформації для забезпечення можливості зробити свідомий вибір безпечних для них продуктів, виробники енергетичних напоїв повинні інформувати споживачів про свою продукцію і про необхідність дотримання рекомендованих норм споживання цих напоїв.

Ключові слова: енергетичні напої, кофеїн, безпечність, ризики, маркування.

РИСКИ ДЛЯ ЗДОРОВЬЯ И ПРАВОВЫЕ АСПЕКТЫ БЕЗОПАСНОГО ПОТРЕБЛЕНИЯ БЕЗАЛКОГОЛЬНЫХ ЭНЕРГЕТИЧЕСКИХ НАПИТКОВ

Т.В. Адамчук, С.Н. Кузьминский, Т.А. Щуцкая

ГП «Научный центр превентивной токсикологии, пищевой и химической безопасности
имени академика Л. И. Медведя Министерства здравоохранения Украины, г. Киев, Украина

РЕЗЮМЕ. Цель работы. Провести анализ исследований по безопасности основных ингредиентов энергетических напитков, которые проводились различными международными научными учреждениями. Сравнить европейское и украинское законодательство по регулированию безопасного потребления энергетических напитков.

Материалы и методы. Анализ научной литературы, а также европейских и украинских нормативных актов, касающихся безопасности и регламентации энергетических напитков.

Результаты. Энергетический безалкогольный напиток – это такой, который благодаря специальному составу активизирует физиологические функции организма человека. Основные его составляющие – кофеин, таурин, глюкоуронолактон, экстракты женьшеня, гуараны и витамины группы В.

Оценка безопасности кофеина проводились многими научными организациями. Международное Агентство по изучению рака (IARC) в 1991 году пришло к выводу, что кофеин не классифицируется как канцероген для человека. Европейский орган по вопросам безопасности пищевых продуктов (EFSA)

провел наиболее всеобъемлющее и углубленное исследование по безопасности кофеина. Основные выводы этого исследования: разовые дозы кофеина до 200 мг (около 3 мг / кг массы тела для взрослого весом 70 кг) не вызывают опасений по безопасности, регулярное потребление кофеина в дозе до 400 мг в день не вызывает опасений относительно безопасности для небеременных взрослых, регулярное потребление кофеина в дозе до 200 мг в день беременными женщинами не вызывает опасений безопасности плода, а в период кормления не вызывают опасений по безопасности младенцев на грудном вскармливании, для подростков основанием для определения безопасных разовых доз кофеина и его суточного поступления может служить поступление кофеина в количествах, не вызывающих опасений для потребления кофеина взрослыми (3 мг / кг массы тела в день); другие компоненты энергетических напитков в типичных для таких напитков концентрациях (около 300-320, 4000 и 2400 мг/л кофеина, таурин и D-глюкуронил-γ-лактона соответственно), а также алкоголь в дозах до 0,65 г/кг массы тела не влияют на безопасность поступления разовых доз кофеина (до 200 мг).

Выводы. Основные требования, которые регулируют безопасное потребление энергетических напитков, касаются их маркировки. С целью достижения высокого уровня защиты здоровья потребителей, обеспечение их прав на получение достоверной информации для возможности сделать осознанный выбор безопасных для них продуктов, производители энергетических напитков должны информировать потребителей о своей продукции и о необходимости соблюдения рекомендуемых норм потребления этих напитков.

Ключевые слова: энергетические напитки, кофеин, безопасность, риски, маркировка.

Received 12/19/2019