

## Секція 3. ПІДВИЩЕННЯ ЯКОСТІ ХАРЧОВИХ ПРОДУКТІВ

УДК 663.8.051

### ВИКОРИСТАННЯ ДИГІДРОКВЕРЦЕТИНУ В БЕЗАЛКОГОЛЬНИХ НАПОЯХ

**В.М. Михайлов, О.А. Маяк, А.М. Сардаров**

*Розглянуто сучасний ринок енергетичних напоїв. Описано основні компоненти, що входять до їх складу. Визначено можливі користь та шкоду для організму людини від уживання цієї продукції. Запропоновано в рецептурах напоїв використовувати як полівітамінний засіб дигідрокверцетин. Це дрібнокристалічний аморфний порошок від світло-жовтого до жовтого кольору, без запаху, із гіркуватим смаком, що виявляє якості антиоксиданту. Описано результати експериментів із розчинності дигідрокверцетину, надано рекомендації щодо введення цього компонента в безалкогольні напої.*

**Ключові слова:** енергетичні безалкогольні напої, дигідрокверцетин, антиоксидант, кофеїн, таурин, гуарана.

### ИСПОЛЬЗОВАНИЕ ДИГИДРОКВЕРЦЕТИНА В БЕЗАЛКОГОЛЬНЫХ НАПИТКАХ

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*Рассмотрен современный рынок энергетических напитков. Описаны основные компоненты, которые вводят в их состав. Определены возможные польза и вред для организма человека от употребления данной продукции. Предложено в рецептурах напитков использовать в качестве поливитаминного средства дигидрокверцетин. Это мелкокристаллический аморфный порошок от светло-желтого до желтого цвета, без запаха, с горьковатым вкусом, проявляет качества антиоксиданта. Описаны результаты экспериментов по растворимости дигидрокверцетина, предоставлены рекомендации относительно введения данного компонента в безалкогольные напитки.*

**Ключевые слова:** энергетические безалкогольные напитки, дигидрокверцетин, антиоксидант, кофеин, таурин, гуарана.

## USE OF DIHYDROQUERCETINE IN ALCOHOL-FREE BEVERAGES

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*In the article, the authors consider the modern market of energetic alcohol-free beverages – the products aimed at the increase in human mental and physical performance and endurance in general. The described main components are caffeine, taurine, guarana, ginseng, and others. The rules of drinking beverages with energetic components are to be carefully used. In the article the possibility to be useful or harmful for the organism depending on the application of the product is studied. It is recommended to use dihydroquercetine in the recipes of soft energetic beverages as poly-vitamin means – flavonoid received from the Siberian larch (*Larix sibirica* Ledeb) and Dahuric larch (*Larix dahurica* Turcz).*

*Dihydroquercetine is famous for its health-protective properties, possesses intense anti-fungal and microbicidal properties, and helps slowing down various inflammatory processes. It is natural hepato-protector due to fixation and removal of toxins and metabolic products out of the human body. This substance is fine-crystalline amorphous powder from light-yellow to yellow color, scentless, slightly bitter and acts as an antioxidant. The experiments showed that the powder was practically insoluble in water. Results of the experiments regarding solubility of dihydroquercetine in spirit, propylene glycol and glycerin are described; the recommendations concerning the amount of this component introduced to soft drinks are given. The investigations showed that dihydroquercetine could increase the terms of drinks storage 1,5-4 times. Besides, it can slow down the development of microorganisms in the products, where the processes of contamination have already begun. Quantitative determination of dihydroquercetine in the composition of beverages results in the following: with the increase of the term of the product's storage the amount of dihydroquercetine falls down by 10...15% for the first month, then the rate of decrease slows down and grows up by 20% to the six-months term of storage. Besides, dihydroquercetine possesses high technological qualities with low gustatory threshold in the beverage.*

**Keywords:** *energetic alcohol-free beverages, dihydroquercetine, antioxidant, caffeine, taurine, guarana.*

**Introduction.** Energy drinks are a comparatively recent humanity invention, though their constituents had been used for energy increase centuries before the invention of aluminum cans. It might seem that the invention of energy stimulating beverages is a panacea for students during the session, for top-managers and sportsmen, for tired drivers and visitors of night-clubs and in general for all, who got extremely tired, but must be provided with sustained energy, and reduce mental and physical fatigue. Producers assert that their drinks do no harm and continuously launch new varieties. But, if the safety of the product is well-proven, a question remains, why legislators try to issue a law that limits distribution of this sort of drinks.

**Latest research and publications analysis.** In recent few years plenty of publications appeared concerning the use of dietary supplements in foodstuffs [1–3]. Specialists in different fields of industry and consumers actively discuss the possibilities of use and safety of such products in the Internet. However, the producers are not interested in distribution of the real information for different reasons.

**The aim of the article** is to suggest ideas on the use of dihydroquercetine antioxidant in soft drinks as a polyvitamin means.

Natural psychostimulants have been known for people all over the world since ancient times. The most widespread of them was caffeine. Its source in India and the countries of Middle East was coffee; in China, India and South-East Asia it was tea; in America it was yerba mate and kola nuts. Apart from this, history knows the examples of the usage of more potent stimulators, such as coca bush in South America, ephedra and kat in Asia. The people of Mongolia and Siberia used ginseng, eleutherococcus, aralia and other stimulant plants. In 1982 an Austrian Dietrich Mateschitz, being in Hong Kong, tried local restorative drink and brought this idea to the Occident. In 1984 he founded the first enterprise on the industrial production of energy drink "Red Bull", popular ever since. The product proved to be so successful, that ten more drinks with similar properties appeared on the market soon. Giants of beverage industry "Coca-cola" and "Pepsi-cola" did not remain aside as well, producing "Burn" and "Adrenaline Rush" correspondingly. But it should be noted that in many European countries, namely in Norway, Denmark and France energy drinks are considered dietary supplements and are allowed for sale only in pharmacies.

Beverages like this contain restorative substances, mostly caffeine (sometimes caffeine in beverage composition is substituted for the extracts of guarana, tea or yerba mate, that contain caffeine, or caffeine appears under other names: mathein, thein) and other stimulants: Theobrominum and Theophyllum (alkaloids of cacao), as well as vitamins, as an easily digestible energy source, carbohydrates (glucose, saccharose), different adaptogens and amino acids. Consider the main of these ingredients.

Caffeine is contained in all energy drinks without exception. It acts as a stimulator: 100 mg of caffeine stimulate mental performance, and 238 mg of it enhance cardiovascular endurance. To get such an effect one needs to drink at least 1250 ml of the beverage, though the producers recommend using no more than 500 ml per day. Content of caffeine in energy drinks varies from 150 to 320 mg/l with recommended upper bound of 150 mg per 24 hours. The phase of stimulation is replaced by fatigue that requires adequate rest [4].

Taurine is a derivative of cysteine amino acid (despite the widespread viewpoint, taurine itself is not an amino acid). 500 ml of drink generally contain from 400 to 1000 mg of taurine. This component is accumulated in muscular tissues. It is considered to improve the work of myocardium. In recent time, however, physicians tend to believe that taurine exerts no influence on human body.

Carnitine is a component in human body cells that contributes to the rapid oxidization of fatty acids. Carnitine intensifies metabolism and reduces muscle fatigue.

Guarana and ginseng are medical plants that have restorative properties. Leaves of guarana are used in medicine: they remove lactic acid from muscular tissues, diminishing pain at physical activities, prevent the occurrence of atherosclerosis and purify liver. Physicians, however, consider that stimulant properties that are attributed to guarana and ginseng are not confirmed by researches.

B vitamins are necessary for the normal work of the nervous system and cerebrum in particular. A human body can feel their deficit, but the increase of dose will not improve your performance, cognitive abilities or anything else, as it is claimed by the producers of energy drinks.

Melatonin is contained in human body and is involved in the entrainment of the circadian rhythms.

Malein is a substance present in the composition of Mate green tea in South America. The extract of *Ilex Paraguarensis* evergreen tree helps to still hunger and aids in weight loss.

Energy drinks are divided into several groups for people with different needs: some contain more caffeine, others – more vitamins and carbohydrates. Caffeinated drinks suit for genuine workaholics and students that work night hours, and drinks enriched with vitamins and carbohydrates are best suited for active people who prefer to spend leisure time in a gymnasium.

Energy drinks contain vitamin complexes and glucose. One need not prove the benefits of vitamins. Glucose is rapidly absorbed in blood and is involved in oxidizing processes; it supplies energy to the muscles, brain and other vitally important organs. The effect from coffee intake lasts 1–2 hours, and from the intake of energy drinks – up to 3–4 hours. And, moreover, almost all energy drinks are carbonated, which accelerates their action – and that is what makes them substantially different from coffee. Furthermore, packing allows to use energy drinks in any situation (gymnasium, car), which is not always possible for coffee or tea.

Energy drinks should be used strictly dosed. Maximum is 1 litre per day. Excessive consumption of such drinks can result in considerable increase in blood pressure and in the level of blood sugar. Vitamins

contained in energy drinks cannot replace an ordinary multivitamin complex. People having cardiac problems should avoid consuming these drinks. The idea that energy drinks have high satiety value is absolutely wrong. Content of a can is like a key that opens doors to internal reserves of an organism. One uses his own resources, and, in other words, borrows them. The debt is to be paid back sooner or later in a form of fatigue, insomnia, irritability and depression. Caffeine contained in tonics just like any other stimulant exhausts the nervous system. Its effect generally lasts from three to five hours, whereupon an organism needs rest. And, besides, caffeine causes addiction. It should be remembered that caffeine is a good diuretic, which means that its intake after physical training with sufficient water losses must be avoided. Overdose may result in side effects like arrhythmia, anxiety, nervousness, depression [4].

Tonics contain taurine and glucuronolactone. Content of taurine is several times higher, than in all other products, the amount of glucuronolactone, contained in two cans, can almost 500 times (!) exceed the daily dose of this substance. How these components work in such doses in our organism remains unknown for scientists till now. There is no research on how they react with caffeine as well. For this reason the experts of European Committee on Food Safety officially declare, that safety of consumption of such doses of taurine and glucuronolactone is not ascertained and further researches are needed for this purpose.

Rules of consuming beverages with energy-enhancing ingredients suppose certain warnings. One cannot exceed the daily dose of caffeine, contained in approximately two cans of an average energy drink. Consumption more than two cans in succession can harm one's health: the inner body resources have been exhausted and the desirable effect may change into side effects instead. It should be kept in mind that by the end of the effect from an energy drink organism needs rest for recovery. Energy drinks cannot be used after athletics, since both actions increase blood pressure. Pregnant women, children and adolescents, elderly people with high blood pressure, people with health problems such as cardiac diseases, glaucoma, insomnia, increased anxiety and sensitiveness to caffeine must be banned from consuming energy drinks. Caffeine is half-eliminated from blood in approximately 3–5 hours. Therefore to mix tonics with other caffeinated drinks (coffee, tea) during this period of time is unacceptable – as it may considerably exceed the permitted dose. In addition, a large number of drinks have high-calorie content. Tonics cannot be mixed with alcohol (as visitors of night-clubs often do, for instance). Caffeine increases blood pressure, and in combination with alcohol this effect is multiplied. Hypertensive crisis may occur as a result. Specialists in health and medicine assert that tonics – are nothing but vitaminized substitutes of coffee, with

more possible harmful effects on health. That is why natural fruit and vegetable juices and drinks containing natural vegetable extracts should not be disregarded. Dihydroquercetine (DHQ) is one of such substances. This substance is antioxidant of natural origin. It was first obtained in 1959, but because of its high cost (about 1000 dollar per 1 gram) it did not find wide distribution. But no later than in year 2000 the research on extraction of this substance renewed. DHQ is extracted from the Siberian pine. Its positive influence on human body has been proved; and therapeutic and prophylactic properties have been researched by many scientists [5]. These research results make it possible to use DHQ as dietary supplements in foodstuffs, namely in soft drinks.

On the department of processes, devices and automation of food production at Kharkiv State University of Food Technology and Trade investigations were carried out to reveal antioxidant properties of DHQ, its solubility and ability to slow the processes of spoilage in foodstuffs.

Researches showed that DHQ is able to increase the product's storage life by 1,5–4 times, as well as to slow down the development of microorganisms in the product.

Table

**Microbiological indices of water solution with DHQ  
and of control sample**

Index	Norm	Solution with DHQ	Control sample
1. Number of mesophilic aerobic and facultative anaerobic microorganisms in 1 g of the product	$< 5 \cdot 10^3$	$2 \cdot 10^2$	$3 \cdot 10^3$
2. Coliform bacteria in 1 g of the product	–	not found	
3. Pathogenic microorganisms, including salmonella	–	not found	not found
4. Coagulase-positive staphylococci in 1 g of the product	–	not found	not found
5. Yeast CFU/g	< 50	not found	10
6. Mould CFU/g	< 50	not found	70

Aiming to study the influence of DHQ on viability of microorganisms the preparation was added into water solution of sugar with lemon acid in the amount of 50 mg/dm<sup>3</sup>. Control solution was prepared without addition of DHQ. The solutions were not exposed to heat treatment. The samples were kept in a refrigerator at a temperature 4...5°C throughout 7 days. The results of research of microbiological indices are given in the table below.

Quantitative determination of dihydroquercetine in the composition of beverages results in the following: with the increase of the term of the product's storage the amount of dihydroquercetine falls down by 10...15% for the first month, then the rate of decrease slows down and grows up by 20% to the six-months term of storage.

The methods of DHQ introduction into soft drinks were investigated.

Experiments showed that DHQ as powder is practically insoluble in water, however dissolves in alcohols – ethyl, propylene glycol and glycerin. Thus, DHQ must be introduced into soft drinks in final product before passing it to the filling equipment in the following way: to dissolve constantly stirring in 1–2 litres volume of the prepared product a certain amount of DHQ, which was preliminary dissolved in alcohol, and then infuse the obtained mixture with GHQ into the reservoir with prepared drink.

**Conclusions.** The research results allowed suggesting using dihydroquercetine antioxidant in the recipes of soft energy beverages as poly-vitamin means. Its positive influence on the microbiological indexes of obtained drinks was discovered; its solubility in water and alcohols was studied, proving that DHQ is insoluble in water, however dissolves in ethyl, propylene glycol and glycerine, which determines the features of the process of DHQ introduction into final product.

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*Рекомендовано до публікації д-ром техн. наук, проф. О.І. Черевком.  
Отримано 1.08.2015. ХДУХТ, Харків.*

УДК 637.5.04/.07:637.52

## **ДОСЛІДЖЕННЯ ВЛАСТИВОСТЕЙ БІЛКОВО-ЖИРОВИХ ЕМУЛЬСІЙ ДЛЯ М'ЯСОВІСНИХ НАПІВФАБРИКАТІВ ОЗДОРОВЧОГО СПРЯМУВАННЯ**

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*Перспективним напрямом у виробництві м'ясних продуктів на сьогодні є використання багатокомпонентних емульсій. Нами запропоновано введення каротиновмісної сировини до складу білково-жирових емульсій, які є найефективнішою формою збагачувачів для продуктів оздоровчого спрямування. Наведено результати дослідження реологічних властивостей каротиновмісних білково-жирових емульсій та доведено доцільність використання їх у технології січених кулінарних напівфабрикатів із м'яса птиці, оскільки це дозволить покращити фізико-хімічні та технологічні показники виробів, підвищити харчову та біологічну цінність, знизити собівартість та розширити асортимент оздоровчих продуктів для закладів ресторанного господарства та мережі роздрібної торгівлі.*

**Ключові слова:** білково-жирові емульсії, м'ясовісні кулінарні напівфабрикати, каротиноїди, реологічні властивості.