

## PREPARATION OF THE CORE OF WALNUT FOR USE IN THE COMPOSITION OF SOFT DRINKS

A. Dyakonova, Doctor of Technical Sciences, Professor\*  
V. Stepanova, postgraduate student\*, E-mail: upiu@ukr.net  
Ye. Shtepa, Ph.D., Associate Professor\*\*, E-mail: stepa-evgen@ukr.net  
\*Department of technology of restaurant and health nutrition  
\*\*Department of Electromechanics and Mechatronics  
Odessa National Academy of Food Technologies, st. Kanatna, 112, Odessa, Ukraine, 65039

**Abstract.** In work it is considered conditions of preparation of a core of the Walnut for the following use as a prescrip-tion component of soft drinks of improvement. It is provided the analysis of patent and literary source in which are explained the existing productions technology of soft drinks on the basis of nut raw materials. It is considered influence on fatty acids compound of nucleus of Walnut by high temperatures, frying at 200 °C, damp-thermal treatment, by soaking in water and boiling during 60 seconds. It is scientifically argues that the most optimum method of preparation of a core of the Walnut which al-lows to inactivate an undesirable microflora and to raise physical and chemical indicators of nut is the method of damp-thermal processing of raw materials. It is designated influence of the long-lived soaking on durability of a core of nut and content of the free phosphorus in its structure which characterizes amount of phytin substances in raw materials. It is proved that the long-lived soaking destroys complexes of phytin acid with phosphorus release. After 10 clocks of soaking, the amount of the free phosphorus in the studied exemplars of the Walnut increases to 55 %. It is established technological parameters of preparation of nut extract by selection of its optimum hydro module. It is developed nut drink with the balanced composition of fatty acids. It was investigated chemical composition of nut drink which is characterized by content of 40 % of fats, 18 % – proteins and near 37 % of carbohydrates. It is analyzed possible influence of nut drink on the needs of a human body for biologically valu-able substances, and established that the developed drink satisfies the need of an organism for essence of fatty acids more than for 30 %. It is carried out the production approbation of the developed product that confirms practicality of the designed tech-nology and high organoleptic rates of nut drink.

**Keywords:** nut, extract, fatty acids, dispersion, proteins, fats, drink, technology.

## ПІДГОТОВКА ЯДРА ВОЛОСЬКОГО ГОРІХУ ДЛЯ ВИКОРИСТАННЯ У СКЛАДІ БЕЗАЛКОГОЛЬНИХ НАПОЇВ

A.K. Д'яконова, доктор технічних наук, професор\*  
В.С. Степанова, аспірант\*, E-mail: upiu@ukr.net  
Є.П. Штепа, кандидат технічних наук, доцент\*\*, E-mail: stepa-evgen@ukr.net  
\*Кафедра технології ресторанного та оздоровчого харчування  
\*\*Кафедра електромеханіки та мехатроніки  
Одеська національна академія харчових технологій, вул. Канатна, 112, м. Одеса, Україна, 65039

**Анотація.** У роботі розглянуто умови підготовки ядра волоського горіху для подальшого використання у якос-ті рецептурного компоненту безалкогольних напоїв оздоровчого призначення. Розглянуто вплив високотемпературної та волого-теплової обробки на жирнокислотний склад ядра волоського горіху. Визначено вплив довготривалого замо-чування на міцність ядра горіху та вміст вільного фосфору у його складі. Встановлено технологічні параметри приго-тування горіхового екстракту шляхом підбору його оптимального гідромодуля. Розроблено горіховий напій зі збалан-сованим складом жирних кислот. Проаналізовано можливий вплив горіхового напою на потреби організму людини в біологічно цінних речовинах. Встановлено, що розроблений напій задовольняє денну потребу в есенціальних жирних кислотах більш ніж на 30 %.

**Ключові слова:** горіх, екстракт, жирні кислоти, дисперсія, білки, жири, напій, технологія.

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### Introduction. Problem statement

Under the influence of adverse environmental factors on a human body is noted decrease in duration and quality of life. For fight and prophylaxis of diseases of different type the modern person tries to follow the rules of a healthy lifestyle, especially healthy nutrition. In the market of food products every year increases the quantity of production for healthy and treatment-and-prophylactic appointment which are directed not

only to satisfaction of needs of the person for nutrients and energy, but also have the optimized structure and contain the increased amount of biologically valuable substances. Taking in an attention promoting of the alternate types of a delivery – vegetarianism and veganism, development and expansion of technologies and the range of foodstuff on the basis of vegetable raw materials are relevant and appropriate [1]. Vegetable products are recommended to nutrition for people, who are sensitive to proteins of animal origin, cannot digest

lactose, from religious or private judgments do not eat animal products. One of the most valuable types of vegetable products is nut raw materials. Today on the basis of nuts cook a large number of foodstuffs, one of which is drinks which use as substitute of milk of animal origin. The industry and institutions of restaurant business release nut drinks on the basis of almonds, hazel and a cedar, this is why it should be investigating a possibility of use a core of the Walnut for manufacture drinks such kind for what it is necessary to study in detail paths of its preparation and processing.

### Analysis of Literature

According to literary and patent data, manufacture of nut drinks happens by a refinement of nuts in an aqueous medium by hydromodule (HM) 1:3 – 1:10. Then the received weight is maintained for infusion of biological and valuable substances, and carry out filtration. Extraction is carried out in several ways:

- Without the forced influence (extraction takes place at environment temperature);
- Under the influence of temperature (by heating or continuous heating);
- Under pressure (due to forcing of pressure and formation of vacuum).

For use of nuts as extractive drinks carrying out their preparation by frying, germinations, activations or lacquerization [2,3].

It is known the processing way of the Walnut or peanut for receiving the milk tableted vegetable powder [4], by use of the low-temperature vacuum drying with addition of enzymes, with receiving a product with humidity of 3 %. The way of receiving cedar milk from whole nut [5], is known for what use the cleaned cores of pine nut which crush at 5 – 10 the multiple amount of water and extract for 1 – 2 hours at a temperature of 40 – 70 °C. The received heterogeneous system is cleaned from insoluble particles with filtration or a centrifugation, and the purified liquid is homogenize, and receive drink.

There is a way of receiving vegetable milk described in the patent [6]. This way expects clarification of a core of pine nut, their refinement in water at a temperature of 0 – 60 °C to particle sizes no more than  $10^{-3}$  m and simultaneous extraction at ratio water: cores of pine nuts 1:3 – 1:10, carry out homogenization of the received emulsion with a pressure not lower than 5 mPa. It is developed a way of receiving cedar milk from whole nut which expects the common refinement of a core and an envelope of pine nut, extraction in an aqueous medium at ratio nut: water 1: (3 – 10) at a temperature of 0 – 10 °C, homogenization and stabilization [7].

The Italian scientists studied a possibility of using the almond powdered milk drink as milk substitute of a cow in baby nutrition. The scientists in details learned chemical composition of a product and carried out clinical trials which finished a possibility of use of

this product in diets of children aged from 5 months, especially those which are sensitive to components of milk by animal origin [8].

Scientists from the USA investigated a possibility of use of nut drink as a source for receiving qualitative protein. It is studied influence of pressure upon solubility of protein with receiving almond milk also its immunoreactivity [9].

By Chinese scientists it is developed almond drink with carob tree gum use as the stabilizing agent. The developed product is stated as drink with healthy action with high organoleptic rates [10]. By the Ukrainian scientists it is developed drink of dispersible type on the basis of a core of the Walnut that represents suspension and is produced by method of water-salt extraction at ratio of a solid and liquid phase as 1:10. Scientists position half-scientific drink as a source of biologically valuable protein of a phytogenesis [11].

The structure of all drinks, from this kind, includes solid part of a feed stock in the form of fine-grained particles, irrespective of prescription structure. On the basis of scientific researches of the Ukrainian scientists [12] is argued that fine-grained food systems contain a large amount of biologically valuable nutrients, which containment much more, than with not crushed exemplars. It is important to investigate conditions of preparation and technological processing the core of the Walnut for receiving fine-grained system, on its basis, with high-performance stability and biological value.

The main part. An object of researches of this work is the core of the Walnut its technological preparation for manufacture of soft drinks with expressed healthy effect. The Walnut is highly biologically valuable raw materials that is actively grown up in territory of Ukraine. That's why the core of the Walnut has the low price of realization, compared with the majority of nut bearing. About 60 % of fats are included in core of the Walnut, 85 % is presented by polysaturated fatty acids (PUFAs) which composition is characterized by mix of linoleic and linolenic fatty acids, which provide ratio of  $\omega$ -3 and  $\omega$ -6 fatty acids at the level of 1:4 as it is recommended nutrition specialists and specialists in alimentation [13].

However, the core of the Walnut has high microbiological dissemination and has in structure anti-nutrients in the form of phytin substances that demands a previous preparation.

**Purposes and tasks.** The purpose of work is selection the optimum modes of preparation a core of the Walnut for manufacture extraction of dispersible drinks nonalcoholic segment. It was exposed the following tasks for achievement of a purpose:

- to investigate influence of a previous preparation on aliphatic and acid structure a core of the Walnut;
- to define influence preparation of the Walnut on indicators of microbiological safety;

- to investigate influence of the long-lived soaking on durability core of the Walnut and content of phytin substances in it's structure;
- to investigate stabilization conditions of nut extracts;
- to develop the production technology of nut drink.

#### Methods of researches

During work used a complex of the standard traditional and special physical and chemical, microbiological methods of the analysis in the corresponding standards and the guides to technical and chemical and microbiological monitoring. Content of fatty acids determined by a gas-liquid chromatography method, according to ISO 5508-2001. Researches were conducted on a gas chromatograph of Shimadzu GC-14A with the fiery ionizing detector. Acid, iodine, peroxide numbers which characterize hydrolytic and oxidizing spoilage of fat defined behind reference techniques [14].

Researches of mesophilic aerobic and facultative and anaerobic microorganisms determined in compliance to instructions by health microbiological control in institutions of restaurant business and trade [15].

Phosphorus content in the studied exemplars defined for DSTU ISO 2294:2005. The quantitative content of phytin acid was estimated for content of the

common phosphorus. For this purpose phytin acid is hydrolyzed at first before formation of plain phosphates, by oxidation in mix of nitric and chloric acids, and the gained solution analyze by method of a photometry of a complex of molybdenumdetonate heteropoly acids at a wavelength  $\lambda_{\max} = 425$  nanometers [16].

For definition of removable durability core of the Walnut as a result of soaking investigated a step of its swelling, and the obtained data displayed in integral dependence [17].

Determination of emulsion firmness depending on duration and the power of a refinement of raw materials in aqueous medium carried out by means of the centrifuge by Gurov's technique [18].

#### Results and their discussion

For definition of the most rational way of preparation of nut raw materials for the subsequent technological processing, it is carried out the analysis of action of a way of thermal treatment on content and quality of aliphatic and acid composition of raw materials. In work used two types of thermal treatment of raw materials – high-temperature short-term (temperature 200 °C for 120 s) and damp-thermal (activation by soaking) – in aqueous medium at boiling point of water ( $t = 98 - 100$  °C) for 120 s. The received results it is shown in the figure 1.

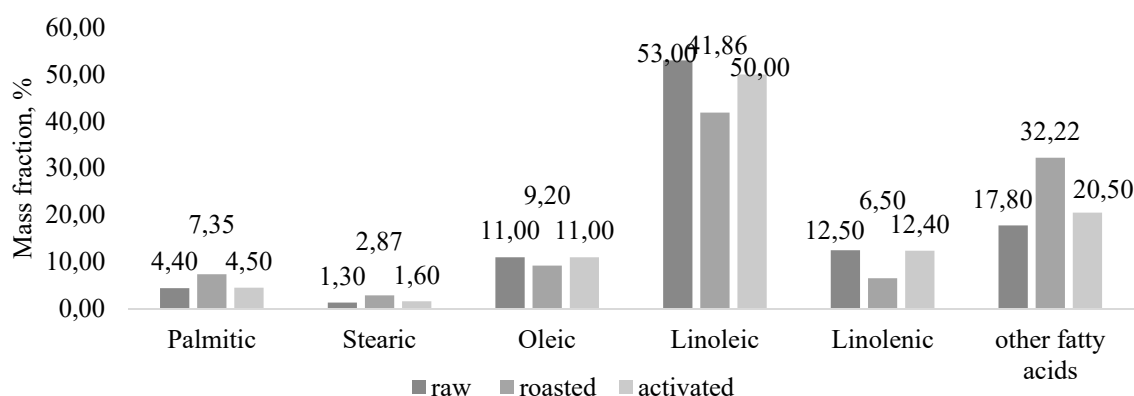


Fig. 1. Effect of preparation of raw materials on the content of fatty acids

It is observed that high-temperature processing of raw materials decrease content of unsaturated fatty acids. At damp-thermal processing after the long-lived soaking in water at environment temperature, change in amount of unsaturated fatty acids does not happen.

The important characteristic of fat quality core of the Walnut is their resistance to oxidation and as result - spoilage. It is carried out the analysis of fat quality core of the Walnut depending on a way of preparation them before processing according to indications which characterize content of unsaturated fatty acids (iodine number), a step of fats oxidation (acid number) and a step of fats burn-out (peroxide number). Results are shown in table 1.

The obtained data show that after high-temperature processing there is an essential deterioration of fat in cores of the Walnut Iodine number shows that there is a decrease of amount of unsaturated fatty acids that testifies about fat deterioration. Acid number which indicates accumulation of the free fatty acids in a corollary of fat hydrolysis under the influence of high temperatures increases practically by 1,5 times. Peroxide value demonstrates that in fat there are processes of oxidation and there is already particular amount of peroxide substances which were formed under the influence of high temperatures in corollary of oxidation of saturated and unsaturated fatty acids by the fissile oxygen also increases.

Physical and chemical indexes of fat quality after the long-lived soaking and damp-thermal processing, compared with raw materials without thermal processing, practically did not change that testifies about maintaining fat quality and relevance of use the way damp-thermal processing after the long-lived soaking for a receiving high-quality biologically and physically valuable products.

Microbiological safety belongs to one of keys indicators of fitness raw materials for production of food. For definition of influence microbiological safety on processes of a previous preparation of raw materials, also it was investigated microflora of kernels of the Walnut before processes high-temperature damp-thermal processing after the long-lived soaking. Results of a research are shown in table 2.

**Table 1 – Fat quality characteristics of walnut core (n = 3; P ≤ 0,05)**

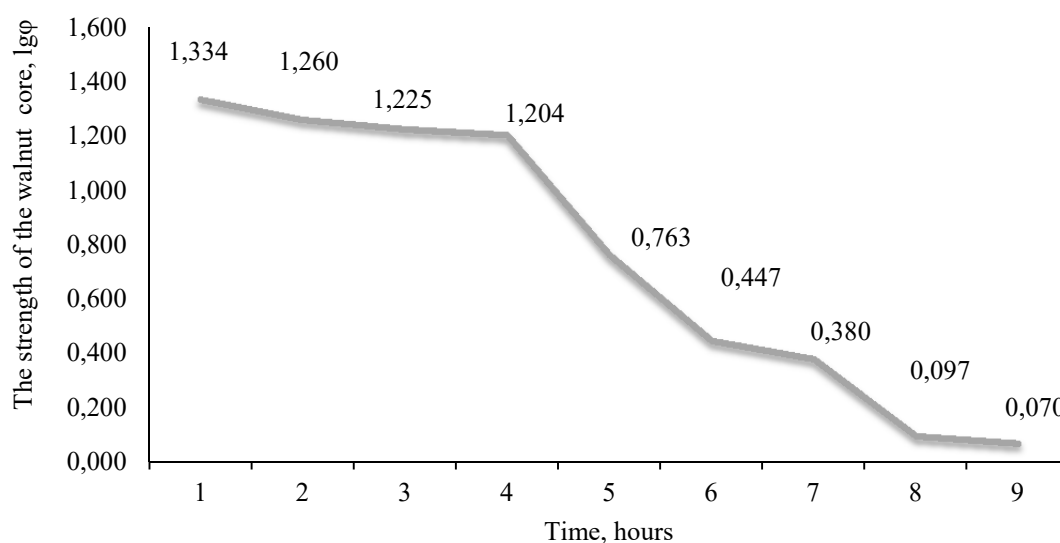
Quality Score	Fat of walnut kernel		
	without processing	after wet-heat treatment	After heat treatment
Iodine number, g I <sub>2</sub> / 100 g	162,04	159,8	135,41
Acid number, mg KOH / g	1,26	1,27	1,95
Peroxide number, mmol O <sub>2</sub> / kg	4,5	4,57	6,3

**Table 2 – Microbiological indicators of the quality of nuts**

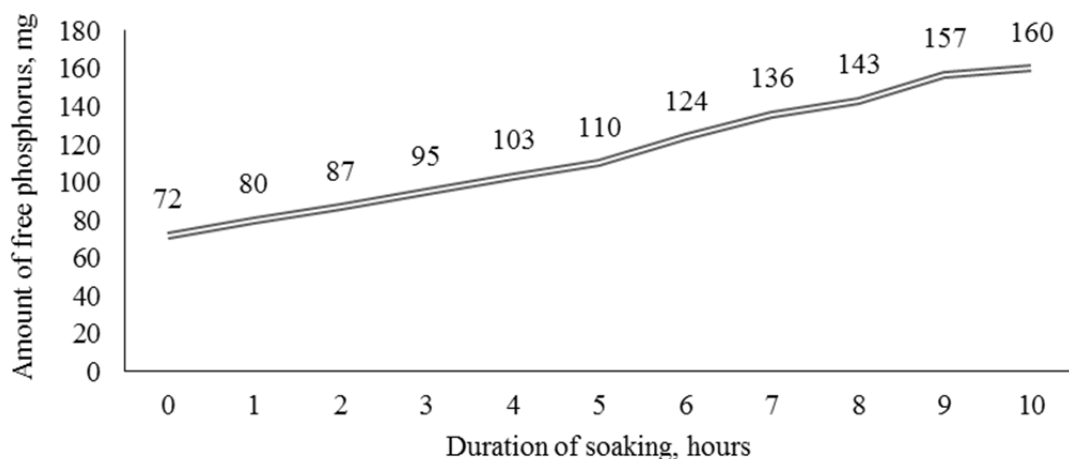
Indicators	Maximum permissible values	The core of the walnut		
		without pre-processing	after high-temperature processing	after wet-heat treatment
NMAFAM, CFU/ g	No more 1 · 10 <sup>3</sup>	32·10 <sup>2</sup>	3·10 <sup>1</sup>	17·10 <sup>1</sup>
Mold fungi and yeast, CFU/ g	No more 10	5	Not found	Not found

It is established what near-term high-temperature and damp-thermal procession nucleus of the Walnut allows to destroy completely undesirable microflora in the form of mesophilic aerobic and facultative microorganisms, and completely destroys fungi of a mold and yeast. Thus, the long-lived soaking

in water and the subsequent damp-thermal processing kernels of the Walnut provide maintaining quality of a fatty component raw materials on physical and chemical indexes and also microbiological safety, without change of structure and ratio of fatty acids.



**Fig. 2. Kinetics change the strength of walnut core depending on the duration of soaking.**



**Fig. 3. Kinetic changes in the content of free phosphorus in walnut kernels between soaking in the water.**

It is necessary to designate that the long-lived soaking have positively influence rheological, including durability structure of a core of the Walnut on which the refinement step, quality and biological value of the crushed product depends. The kinetics of durability changes of a core of the Walnut depending on duration of soaking is shown in the figure 2. The obtained data demonstrate that at increase duration of soaking in water, the durability of structure of a core of the Walnut decreases. Therefore for manufacture products from a core of the Walnut, before the subsequent refinement, it is necessary to carry out raw materials preparation, namely to steep in water that allows to receive products on the basis of nut raw materials of the best structure and quality, with the best biological, physiological and rheological indexes.

For determination of dependence the content of phytate from soaking duration, rate of decay of phytate was controlled for content phosphorus in a core of the Walnut before soaking and in process of soaking at a temperature of 20 °C each hour for 10 hours (fig. 3). According to data of the pilot studies conducted by us in 100 g of a core of the Walnut to content about 330 mg of phosphorus, 80 % of this microcell are in structure of phytate, in the bound form and are not acquired by a human body.

Researches of the influence of soaking of a core of the Walnut on amount of the free phosphorus in raw materials demonstrates that soaking of kernels in the water at temperature (20 ± 3 °C) for 1 – 10 hours gives increase content of the free phosphorus in raw materials to 55 %. Before soaking in a core of the Walnut content of free phosphorus approximately 70 mg/100 g, with increase in duration of soaking of raw materials content the free phosphorus in it increases and after 10 hours makes approximately 160 mg/100 g.

Further cores of the Walnut are prepared by damp-thermal procession struck to a fine-grained re-

finement in aqueous medium for receiving nut extract of dispersible type. Exemplars of nut extract were prepared by a path two stage reduction of nuts in an aqueous medium on HM 1:5 – 1:10, by means of blenders with power not less than 900 W, the stationary and plunging type. The refinement was carried out for 180 s. After the first refinement the received mix was infused on an extent of 30 min for extraction of biologically valuable substances. After the second refinement carried out filtration with separation of solid fraction. For definition the most suitable hydromodule (HM) of process of a refinement in an aqueous medium with simultaneous extraction of solvents, investigated stability of half-scientific disperse systems at storage. The graphic dependence of stability of extract on shelf-life and the hydromodule of manufacture is shown in the figure 4.

The obtained data demonstrate that the extracts made by hydromodules 1:8, 1:9, 1:10 lose the stability for 30 min of storage, at the same time from 3 to 5 % of a deposit appears. The exemplars of extracts that are prepared by hydromodule 1:7, 1:6, 1:5 do not lose the stability for 30 minutes of storage, but after 300 min in all exemplars of drinks formation is observed a slight spalling of white color which disappears during stirring. For preparation of quality extracts it is necessary to use the hydromodule of manufacture 1:7 as stability of nut extract on this module is at the level of 94 %, after 24 clocks of storage.

It is developed technology of complex processing of a core of the Walnut which allows receiving two fractions of biologically valuable semi-finished products what appropriate to use as a part of foodstuff for institutions of restaurant business, on the basis of the studied data. Fluid fraction in the form of nut extract it is used in technology of nut drink, compounding of which is shown in table 3. It is recommended to use solid fraction in the form of a nut fine-grained constrictor as a part of production of sauces [19].

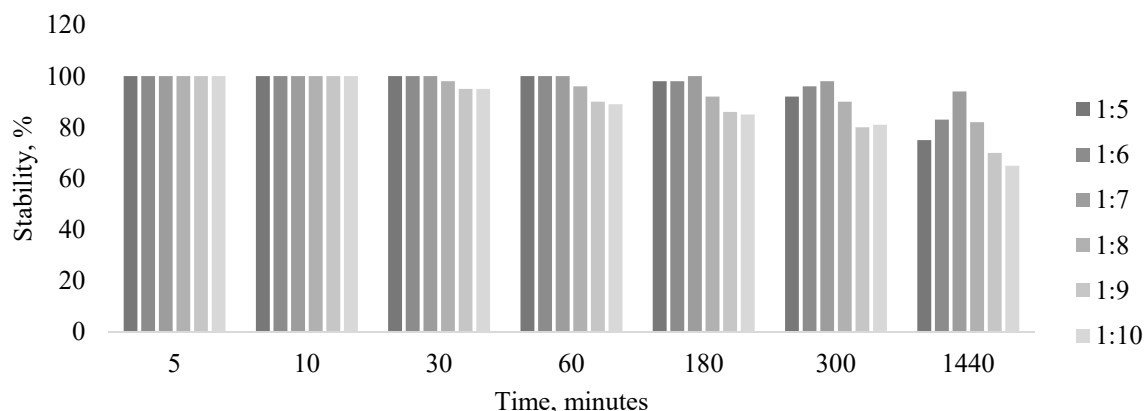


Fig. 4. Indicators of extracts stability depending on the storage duration and the production module.

The way of production of nut drink is carried out in the following order. Raw materials are weighed and steeped in water for 10 hours at HM 1:1 and temperature  $20 \pm 3$  °C. Then cores of the Walnut carefully washed out under running water for 180 s, filled in with the boiling water and carried out damp-thermal procession at a temperature of 98 – 100 °C for 60 s, then merged the water, and cores of nuts filled in with water volume in 7 times more. The mix was

carefully crushed by means of the blender with power 900 W, for 180 s. Then infused the crushed mix for 1800 s, repeatedly crushed by the blender with power 900 W for 180 s. Further the received mix was filtered through cotton cloth, either a kapron sieve, or a colander with a diameter of openings of 0,4 – 0,5 mm. For manufacture of nut drink the received extract was mixed with fructose and stored in compliance to specified to the technological modes.

Table 3 – Prescription beverage composition of walnut core

Type of raw material	Content of prescription components	
	g / 100 g	g / l
Drinking water	100	1000
Core of walnut	14,3	143
Fructose	4,0	40

Half-scientific drink has white or beige color, the homogeneous consistence, has nut taste and aroma. It is conducted researches to a content of the main

nutritive and biologically valuable substances in ready nut drink (table 4).

Table 4 – The content of nutrients in nut walnut beverage

Indicator	Mass fraction of components	
	g / 100 g	on dry weight, g / 100 g
Proteins	2,275	18,05
Fats	5,0	39,68
Carbohydrates	4,71	37,38
Ash	0,65	5,16

The results demonstrate that a majority of nutrients that make 39,4 % is fats, about 18 % is proteins and 37 % – carbohydrates. But it should be noted, that the content of biologically valuable substances as a part of ready drink fluctuates depending on the period of use of mother substance and conditions of its storage. The cores of the Walnut during the autumn and winter periods content larger amount of biologically valuable substances, in comparison with the spring and summer periods, therefore drinks that receive with short lines of storage after collecting, contents larger quantity the nutritive substances.

It was investigated aliphatic and acid structure of nut drink by the method of a stratographic analysis. The received results demonstrate that 50 % of linoleic, 23,8 % of oleic and 12,7 % linolenic fatty acids are a part of fatty acids of nut drink that testifies about the uniform extraction of the lipid part from a core of Walnut in a dispersion medium of nut drink. The ratio of fatty acids  $\omega$ -3 and  $\omega$ -6 remains at the level of 1:4.

For determination of nutrition value of the developed production we counted the content of proteins, fats and carbohydrates and also the content of omega-3 and an omega-6 fatty acids in the made exemplars of nut drink. The obtained data in comparison with recommended to World Health Or-

ganization to amount of these substances for the healthy adult at the age of 30 – 40 years with average body weight about 70 kg. According to norms of the use to the person of this age which conducts the moderately fissile image of life without large exercise stresses, with keeping of ground rules of a healthy delivery and considering its balances on the content of the main nutrients, it is necessary to eat 150 g of proteins, 60 g of fats and 210 g of carbohydrates [20]. In that case energy which is released as a result of

digestion of proteins, fats and carbohydrates makes 1:1:4. Also the person should get not less than 2 g an omega-3 and 8 g an omega-6 of fatty acids which ratio will remain at the level of 1:4. The chart of comparison of satisfaction indication of requirements of an organism from the use of the developed production it is shown in the figure 5. Indexes to the content of proteins, fats, carbohydrates and PUFAs are calculated on 100 cm<sup>3</sup> ready drink.

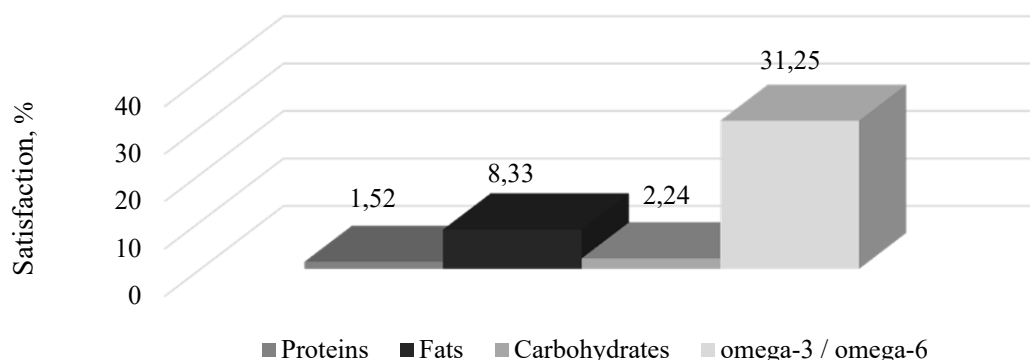


Fig. 5. The degree of satisfaction of daily needs in nutrients, depending on the use of walnut beverage.

#### Approbation of results of a research

For confirmation of processibility and a possibility of use of the developed production in network of institutions of restaurant business, it is carried out approbation of its introduction to technological process in cafes and restaurants of the city of Odessa. Production of nut drink happened on the basis of the Center of a healthy food of student's youth, in cafe Puzata Hata, the El' Decameron restaurant and the restaurant Palace Del Mar that is confirmed with the relevant acts of approbation. Development of production on the basis of different profile institutions allows make a conclusion about processibility of development and a possibility of use of the existing stock in institutions for preparation of nut drink. All developed exemplars of a product used in institutions as substitutes of cow's milk in a compounding of coffee drinks, muzzy and milkshakes.

#### Conclusions

It is investigated the optimum conditions of preparation of a core of the Walnut, for its further processing in coffee drink. It is established that by the long-lived soaking with the subsequent boiling of a core of the Walnut in water it is possible to reduce microbiological dissemination of nut raw materials. To reduce the content of phytate and a durability of a core of the Walnut, without essential change of aliphatic and acid structure of a lipid part.

It is picked up the optimum hydromodule of manufacture of nut extract which owns high organoleptic properties and high stability during storage. It is developed technology of nut drink on the basis of previous prepared core of the Greek drink, potable water and fructose. It is investigated organoleptic indexes and chemical composition of ready drink. It is analysed degree of satisfaction of day need of the person in macronutrients and PUFAs from consumption of nut drink. According to half-scientific data nut drink satisfies requirement in omega-3 and omega-6 fatty acids not less than for 30 %.

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## ПОДГОТОВКА ЯДРА ГРЕЦКИХ ОРЕХОВ ДЛЯ ИСПОЛЬЗОВАНИЯ В СОСТАВЕ БЕЗАЛКОГОЛЬНЫХ НАПИТКОВ

А.К. Дьяконова, доктор технических наук, профессор\*

В.С. Степанова, аспирант\*, E-mail: upri@ukr.net

Е.П. Штепа, кандидат технических наук, доцент\*\*, E-mail: stepa-evgen@ukr.net

\*Кафедра технологии ресторанного и оздоровительного питания

\*\*Кафедра электромеханики и мехатроники

Одесская национальная академия пищевых технологий, ул. Канатная, 112, г. Одесса, Украина, 65039

**Аннотация:** в работе рассмотрены условия подготовки ядра грецкого ореха для дальнейшего использования в качестве рецептурного компонента безалкогольных напитков оздоровительного назначения. Рассмотрено влияние высокотемпературной и влажно-тепловой обработки на жирнокислотный состав ядра грецкого ореха. Определено влияние длительного замачивания на прочность ядра ореха и содержание свободного фосфора в его составе. Установлены технологические параметры приготовления орехового экстракта путем подбора его оптимального гидромодуля. Разработан ореховый напиток со сбалансированным составом жирных кислот. Проанализировано возможное влияние орехового напитка на потребности организма человека в биологически ценных веществах. Установлено, что разработанный напиток удовлетворяет суточную потребность в эссенциальных жирных кислотах на более чем 30 %.

**Ключевые слова:** орех, экстракт, жирные кислоты, дисперсия, белки, жиры, напиток, технология.

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