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## DEVELOPMENT OF TECHNOLOGY OF AYURVEDIC CULINARY PRODUCTS WITH NATURAL PLANT COMPONENTS

*Серед основних чинників профілактики зростаючої кількості неінфекційних захворювань є забезпечення здорового харчування, що підвищує опірність організму до несприятливих екзо- та ендогенних факторів, сприяє підтриманню належного гомеостазу та відновленню здоров'я. Перспективним для створення нової продукції є використання принципів Аюрведи, що передбачає харчування у відповідності до конституційних особливостей організму людини та враховує вплив факторів зовнішнього середовища. З цією метою запропоновано використання рослинної сировини – сухофруктів, сушеної овочевої сировини та прянощів, що є джерелом біологічно активних речовин – вітамінів, фенольних сполук, а також містить ефірні олії та комплекс мінеральних речовин. Об'єктом дослідження є технології напоїв на основі чаю, олійних екстрактів та цукерок у фруктових корпусах.*

*На основі аюрведичних принципів харчування розроблено рецептури нових видів напоїв на основі чаю з композицією прянощів, до складу якої входять кориця, імбир та гвоздика у співвідношенні 1:2:0,5.*

*Розроблено склад комбінаційної суміші рослинних олій – кунжутної, соєвої та конопляної у співвідношенні 1:2,5:1,5 та екстракту ароматичної суміші на її основі (кріп-нагідки-жора дуба у співвідношенні 1:3:2). Доведено ефективність отримання олійних екстрактів із використанням вакууматора Profi Cook 1080 (Нідерланди).*

*Розроблено рецептури аюрведичних цукерок у фруктових корпусах, до складу яких додатково вводиться мед, суха ламінарія та комбінація прянощів. Досліджено вуглеводний склад цукерок на основі сушених ягід журавлини: загальний вміст визначених вуглеводів становив 53,2 %, у тому числі сахарози – всього 12,3 %. Вживання таких цукерок дозволить знизити надходження до організму легкозасвоюваних вуглеводів, а застосування у якості вуглеводного компоненту натурального меду позбавить продукт рафінованих цукрів.*

*Застосування у технології кулінарної продукції аюрведичних принципів харчування дозволить гармонізувати всі системи організму, покращуючи самопочуття, фізичний та емоційний стан людини.*

**Ключові слова:** Аюрведа, аюрведичне харчування, напої на основі чаю, олійні екстракти рослинної сировини, композиції прянощів.

### 1. Introduction

The human body, being a self-regulating system, is able to respond to even minor changes due to a deficiency or excess of nutrients, and partially compensate for them using available reserves. But the reserve capacity of the organism is limited, and at constant negative effects, disturbances of homeostasis can occur, which can lead to disease.

To date, medicine has made significant progress in the diagnosis and treatment of diseases requiring radical intervention. But the problem of the modern world is the growth rate of growth in the number of non-communicable diseases. According to the results of statistical studies conducted by experts of the World Health Organization (WHO), with 38 million deaths from non-communicable diseases in 2012, 16 million or 42 % of premature deaths under the age of 70 from heart and lung diseases, stroke, cancer and diabetes were premature and they could have been prevented [1]. The WHO report states that in 2000 there were already 14.6 million such cases.

This tendency is explained, among other things, by the use of antibiotics and chemotherapeutic drugs for treatment, and they manifest negative complications on the human body. Destroying the bacteria that cause diseases, these drugs si-

multaneously affect the beneficial flora responsible for the synthesis of substances necessary for the growth and regeneration of tissues of a healthy organism. After long-term use of synthetic antibiotics, hormones, vaccines and steroids, sometimes serious side effects such as immunosuppression, gastrointestinal bleeding, ulcers, and much more occur.

Therefore, it is necessary to clearly understand the influence of adverse exogenous and endogenous factors on the state of human health. WHO notes the urgent steps taken by governments around the world to reduce non-infectious diseases. Among the main factors are early diagnostics, the provision of a healthy diet that meets the needs of the body in essential nutrients and energy, increased physical activity, reduced trans fat intake, and the like.

One of the oldest holistic medical systems of human health is Ayurveda, which appeared on the territory of modern India about 5,000 years ago and has not lost its relevance until today [2].

Contrary to the trends of modern medicine to the narrow specialization and treatment of each organ separately, Ayurveda is inclined to consider the human body as a single biological system, in which the disease is only an external manifestation of a deep imbalance. Its various parts are functionally interconnected, different diseases may be of the



same nature. Paying attention to the treatment of a specific organ, rather than eliminating the root cause, after a while the manifestation of the disease will be observed elsewhere. For example, an indispensable condition for good vision is the normal functioning of the intestines, and in case of impaired focusing of vision, besides eye treatment, it is necessary to ensure the nature of the work of the organs of the gastrointestinal tract.

## 2. The object of research and its technological audit

*The object of research* is the technology of drinks based on tea, olive oil and candies in fruit cases.

According to Ayurvedic science, the effect of nutrition on the human body is based on three fundamental principles:

1. Ensuring the availability of all six taste sensations in the consumed foods – sweet, sour, salty, spicy, bitter and tart, which in combination involve all body systems in the process of digestion and assimilation of nutrients.

2. Similar increases similar, and opposites reduce each other. That is, for a successful exit from the disease, an increase in the opposite qualities is necessary. For example, increasing the temperature of the grass with cooling properties will help reduce heat. There is no benefit from eating spicy food or visiting the sauna.

3. Restoring the balance of physical and psycho-emotional state, which strengthens the body's resistance.

Biologically active substances contained in food and medicinal raw materials and food products based on them are able to resist the destructive action of free radicals. This allows to restore impaired body functions, prevent cancer and cardiovascular diseases, slow down the aging process and prolong active longevity.

On the contrary, improperly cooked food and food consumed for adverse conditions – fast food, food «on the move» or that has been stored for a long time, causes a slowdown in the metabolic processes and, as a result, drowsiness, inertia, severity, accumulation of toxic substances – development of diseases [2–4].

The ability of the individual to self-healing is the basic concept of Ayurvedic science.

Today, the range of Ayurvedic food products is quite limited, and in Ukraine there is practically absent. Therefore, the development of technologies for new types of Ayurvedic culinary products is important and timely.

These tasks are met by the development in Ukraine of the practical implementation of the principles and provisions of Ayurveda on healthy nutrition involving the development of Ayurvedic dishes and products created by the masters of the educational program «Technology of Ayurvedic Food Products» of the National University of Food Technologies (Kyiv, Ukraine.).

## 3. The aim and objectives of research

*The aim of research* is justification of the composition of products in accordance with Ayurvedic nutrition principles.

To achieve this aim it is necessary to perform the following objectives:

1. To substantiate the expediency of the use and composition of combinational mixtures of herbal ingredients for Ayurvedic food products.

2. To develop formulations of new types of drinks based on tea, oil extracts and candies in fruit cases.

3. To determine the quality indicators of the developed Ayurvedic foods.

## 4. Research of existing solutions of the problem

The Ayurvedic system of human recovery is a complex holistic system. Food, according to Ayurveda, is classified according to consistency, taste, properties, qualities, compatibility and incompatibility [5, 6].

Tea is one of the most common drinks in Ukraine. With all the variety of types of tea: black, green, red, white – these are not different varieties, but only different ways of processing it [7]. An effectiveness of the use of black tea to reduce the effects of certain toxic compounds, in particular sodium fluoride, is proved [8]. The healing properties of tea are due to the content of valuable alkaloids (caffeine, theobromine, theophylline), phenolic compounds (tannins, catechins), essential oils, vitamins and minerals. Phenolic compounds (tannins) are the main, most important component of tea extractives. The main representatives of tannins in tea leaves are gallic acid and bioflavonoids, which are known to have P-vitamin activity [9]. The composition of herbs and spices are the main and additional components in creating ethnic tea and tea-based drinks.

The authors of [10] propose to enrich tea drinks with stevia, wild rose, melissa, hibiscus, blueberry fruits, citrus peel, cinnamon. Thus, the technology of the East note drink is developed using stevia, melissa leaves and cinnamon, Vitaminka with stevia, rosehips and orange peel, and Inspiration based on stevia with the addition of hibiscus flower petals and blueberries.

Sweets, in particular, candy is a traditional supplement to the diet of both adults and children. And, although the sweets of non-products of everyday food, candy or cake contributing to the improvement of mood, causing a feeling of pleasure, often become an addition not only to the main meal but also added to a cup of tea or coffee. But sweets are characterized by a high content of carbohydrates – from 40 to 70 %, which is mainly represented by sucrose, the energy value of sweets on average is 358/1498 kcal/kJ per 100 g [11]. Since the basis of most sweets is refined sugar, supplementing with easily digestible carbohydrates, an already overloaded insular apparatus of modern man and limits their consumption for all consumers, the use of sweets is especially dangerous for a child's body.

A worthy alternative is candy in fruit cases, produced on the basis of dried fruits – prunes, dried apricots, figs and the like. But in their production, dried fruits as a result of heat treatment have an increased moisture content and, as a result, a limited shelf life.

Developed energy bars for athletes «Mystery of Power» [12], containing:

- powdered sugar;
- natural honey;
- condensed whole milk with sugar;
- skimmed milk powder;
- dried apricots;
- dried grapes;
- peanuts;



- chocolate coating;
- functional composition «Mystery of Power», which includes hemovital, retinol, tocopherol, succinic acid, guarana, creatine monohydrate, ascorbic acid.

The surface of the product is covered with chocolate icing. The disadvantage of these products is the high content of sugar and chocolate, which limits their consumption to certain categories of the population.

In [13], the composition of the developed snack bars of energy bars with a high content of dietary fibers and polyphenols, the basis of which was formed by dietary apple fiber or inulin, is given.

The production of energy bars with the use of gluten-free flour *Prosopis alba* [14] together with amaranth, chia and quinoa flour allows to increase their nutritional value and is recommended for dietary foods, including for patients with whole potassium. Sugar and honey are used as a sweetener in the composition of these cold snacks.

In order to increase the nutritional value of snack bars, it has been proved that it is advisable to add shredded croutons, in particular, apples, to extruded dry cereal [15]. Their introduction will reduce the amount of sugar in the composition of the formulations and has a positive effect on the organoleptic characteristics.

Thus, the production of chocolates on the basis of crushed dried fruits will allow to obtain a product of high nutritional value, enriched with a complex of biologically active compounds, provide a gentle plastic consistency and provide it with original taste.

The use of spices is promising in the production of Ayurvedic products. According to Ayurveda, spices are a universal component that allows to purposefully shape the properties of food and regulate the effect of their effects on the human body [16].

The use of spices in the technology of sweets and tea-based drinks will further enrich them with a complex of biologically active compounds. This will help improve digestion, speed up metabolism and ensure the stability of food quality indicators during storage [17].

Thus, the results of the analysis allow to conclude that the development of culinary products with the use of Ayurvedic nutrition is a promising approach, since it will expand the range of health-improving products based on natural herbal ingredients.

## 5. Methods of research

In studies to create a composite tea drink used: dried cloves, cinnamon sticks and ginger root.

To obtain Ayurvedic oil extracts, vegetable oils are used – sesame, hemp, soybean, as well as vegetable dressers of fragrant dill, oak bark, calendula.

Ginger is probably the best of spices. The benefits of ginger in the treatment of diseases of the digestive and respiratory systems are widely known. It is also a good remedy for arthritis and tonic for the heart. Cinnamon is an effective means for strengthening and harmonizing blood circulation (*vyana-vayu*). It is an excellent diaphoretic and expectorant remedy for colds and flu. Cinnamon is the main component of the «three flavor» Ayurvedic composition, which also includes cardamom and bay leaf.

Clove is an effective stimulant for the lungs and stomach. It dispels the cold and disinfects the lymphatic system. As part of candy, it is effective for colds and coughs.

Clove essential oil is a powerful anesthetic. It has a strong warming effect, but this energy effect can be annoying due to its rajastic nature.

Turmeric shows antioxidant activity, has antimicrobial activity, and coloring matter curcumin, which is a part of it, has a stable color. Turmeric is widely used in cooking and homeopathic medicines, while improving digestion and helps normalize the intestinal microflora.

Black pepper is a powerful stimulator of digestion due to the content of piperine alkaloid in it, helps to eliminate toxins, reduce weight, reduces swelling and contributes to lower blood pressure, has powerful antioxidant activity and has antibacterial properties.

The production of candies is carried out on the basis of dried fruits and berries: cranberries and a banana with the addition of dried beets. They are the real storehouse of macro- and microelements (magnesium, sodium, potassium, iron, phosphorus, copper, zinc, selenium, manganese), vitamins (A, C, group B, in particular B1, B2, B5, B6),  $\beta$ -carotene, proteins, organic acids, fiber and the like. The content in food of these biologically active compounds has a positive effect on the gastrointestinal tract and contributes to the removal of toxins.

The addition is walnut and dried seaweed, which is an absolute record for the content of the deficient trace element – iodine, the concentration of which is on average 800–1000 mg/kg. In addition, they contain vitamins (A, B, including vitamin B5 or panthenol, C, D, K, PP) and carotenoids. Algae polysaccharides are represented by alginic acid, glucans, pectins, fucoidan and lignin), they contain dietary fiber, macro- and microelements and phenolic compounds. The value of a walnut is complemented by the presence of lipids with a high content of polyunsaturated fatty acids, including essential linoleic, linolenic and acids of the  $\omega$ -9 group, the antioxidant effect of walnut proteins is proved [18].

Replacing refined sugar with natural honey will reduce the intake of easily digestible carbohydrates.

Vacuum sealer Profi Cook1080 (Netherlands) are used for the extraction of vegetable raw materials. With this apparatus, at room temperature and a pressure of 2.5 bar, it is possible to achieve complete boiling of the oil at low temperatures, and an appropriate degree of extraction already at the first attempt. The product maintains long-term freshness in a vacuum environment. As a result of extraction, the oils are enriched with biologically active substances (BAS) and have a modified taste and smell.

Determination of moisture, ash, extractive, tannins and essential oils is carried out in accordance with the methods of [19].

The total content of phenolic compounds is determined using a KФК-2МП electrophotocolorimeter (Russia) at a wavelength of 640 nm using Folin-Ciocalteu reagent, consisting of a mixture of phosphorus-tungsten and phosphorus-molybdenic acids, which are reduced during the oxidation of phenols in an oxide mixture. This forms a blue color, the intensity of which is proportional to the amount of phenolic substances.

The amount of phenolic compounds is determined using a calibration graph constructed from standard solutions of gallic acid [20].

The content of tannin, rutin, catechin is determined by titration of the mixture with a  $\text{KMnO}_4$  solution with a concentration of 0.1 mol/dm<sup>3</sup>.



The total content of vitamin C in spices is determined by titration with an alkaline solution of 2,6-dichlorophenolindophenol in the presence of chloroform [21].

The content of vitamin C ( $m_c$ , mg %) in the samples is calculated by the formula:

$$m_c = \frac{100 \cdot a \cdot T \cdot V}{V_1 \cdot m_s}, \text{ mg \%}, \quad (1)$$

where  $a$  – the amount of 2,6-dichlorophenolindophenol spent on the titration of the extract,  $\text{cm}^3$ ;  $T$  – titer of 2,6-dichlorophenolindophenol for ascorbic acid;  $V$  – the total extraction volume,  $\text{cm}^3$ ;  $V_1$  – the volume of the extract for titration,  $\text{cm}^3$ ;  $m_s$  – spice weight, g.

The study of the carbohydrate composition of spices according to the content of sucrose, fructose and glucose is performed by liquid chromatography on a Shimadzu LC-20 A instrument (Japan) with a refractometric detector and an HC-75 column. Sample preparation is carried out as follows. A portion of the candy weighing 1 g is ground in a porcelain mortar in 50  $\text{cm}^3$  of distilled water and left for extraction at 12 hours. The obtained extract is filtered through a paper filter and studies are conducted without dilution, the sample mass is 50  $\mu\text{l}$ .

The mass fraction of individual carbohydrates is determined by the formula:

$$C = \frac{P \cdot M_e}{m}, \text{ \%}, \quad (2)$$

where  $C$  – the mass fraction of carbohydrate, %;  $P$  – instrument readings,  $\text{mg/ml}$ ;  $M_e$  – extract weight, taken for analysis, g;  $m$  – the sample weight, g.

Determination of taste, aroma, color and appearance of tea-based drinks is carried out organoleptic on a scale of 5 points.

## 6. Research results

At the first stage, the organoleptic characteristics of the investigated samples of tea and spices are determined and given (Table 1).

Table 1

Organoleptic characteristics of samples of the investigated raw materials

The name of the indicator	Tea black, long leaf	Cinnamon sticks	Dried cloves	Ginger root
Taste	Pleasant tart taste	Sweet spicy	Strongly spicy, hot	Hot spicy
Aroma	Gentle	Matching cinnamon	Corresponding to carnation	Peculiar to ginger
Colour	Brownish red, uniform	Brown	Light brown	Light gray
Appearance	Uniform, well twisted	Tubes with a thickness of not more than 3 mm, a length of 10 mm	Flower buds with finely wrinkled surface	Pieces of rhizomes of various sizes and shapes

The physico-chemical characteristics of the samples of used spices are determined (Table 2).

Table 2

Physico-chemical indicators of the quality of the investigated raw materials

The name of the indicator	Tea black	Cinnamon sticks	Dried cloves	Ginger root
Moisture mass fraction, %	7.04±0.15	12.6±0.10	10.8±0.10	11.0±0.10
Mass fraction of water-soluble extractive substances, %	37.5±0.1	7.15±0.08	7.02±0.2	8.1±0.1
Mass fraction of metal-magnetic impurities in coarse grinding, %	0.00048	–	0.00012	–
Mass fraction of essential oils, %	–	0.62	14.52	1.28
Mass fraction of ash, %	6.0±0.05	4.52±0.05	5.0±0.12	4.63±0.03

The research results, taking into account the statistical processing of the results, show compliance with the standards for the quality of spicy raw materials recorded in regulatory documents.

The content of biologically active substances in samples of black Indian and Ceylon long leaf tea and selected spices is studied (Table 3).

Table 3

Content of biologically active substances in samples of black Indian and Ceylon long leaf tea and selected spices

Tea samples	Content, mg/100 g (±ε)				The total content of phenolic compounds, mg/100 g
	Vitamin C	Rutin	Catechin	Tannin	
Ceylon	8.8±1.25	1225±1.7	688±1.5	520±1.25	2619±1.3
Indian	7.9±1.42	1107±1.7	622±1.5	470±1.25	2090±2.4
Dry ginger (w=11.8 %)	21.1±0.8	294.3±1.4	165±1.5	130±1.1	3089.95±5.0
Fresh ginger root (w=86.1 %)	32.6±0.8	120±1.4	66.0±1.5	50.0±1.1	1949.17±5.0
Cinnamon sticks	13.2±0.8	1176±1.4	660±1.5	499.2±1.1	14497.7±5.0
Dried cloves	24.6±0.8	3530±1.4	1980±1.5	1500±1.1	16208.9±5.0

To the samples of tea was added a decoction of combinations of dry crushed to 0.4 mm particles (0.25 mm – 60 %; 0.5 mm – 40 %) spices, set by organoleptic priorities and compensatory content of biologically active substances, in particular, cloves: cinnamon: ginger – 0.5:1.0:2.0.

Decoctions are prepared according to the general rule – one part of a combination of spices per 16 parts of water, that is, about 15 g of spices per cup (250  $\text{cm}^3$ ). The solution is boiled over low heat until the water is evaporated to 1/4 of the original volume. 4 glasses of water with spices are evaporated to one. This procedure lasts for several hours, but the decoctions has a pleasant, delicate, but well noticeable aroma of oriental spices, a wonderful color of milk chocolate.

Strong broth can be diluted with water, immediately after boiling, eat with honey, or other beekeeping products.

The determination of organoleptic characteristics is carried out in concentrated decoctions. Table 4 shows the organoleptic properties of decoctions of individual spices, the selected composition and a sample of tea with a composition of spices.



**Table 4**

Organoleptic properties of the samples

Sample	Colour	Aroma	Taste
Water (control)	Transparent	Absent	Absent
Cloves decoction	Ruby-rich	Carnations	Sweet and sour
Ginger decoction	Cloudy, light yellow	Pronounced ginger	Bitter, burning, saturated
Cinnamon decoction	Ruby brown	Cinnamon	Tart, oak
Spice composition	Milk chocolate color	Thin, but well noticeable aroma of oriental spices	Sour-sweet, rich
Indian tea with spices composition	Dark brown with a ruby shade	Pleasant, fragrant with spicy notes	Tart, saturated, harmonious

As a research result, the determination of the quality characteristics of the composite tea drink with cloves, cinnamon, ginger root, it has been established that this method of preparing a tea drink is promising for use in Ayurvedic cooking, in restaurant menus. The optimal dose of the composition of decoctions in this case does not exceed 3...5 %.

The approbation of the aromatic properties of the tea drink in the Vedic cafe has a positive assessment by both visitors and guest tasters.

How many traditions – so much fat. In the indigenous peoples of the north, the rendered animals are still valued; in Tibet, yak's milk oil is valued; the civilized West, striving for a balanced diet, has long used fatty mixtures with a predominance of vegetable oils.

The world of vegetable oils is very diverse. Flax, cedar, mustard, sunflower, olive, pumpkin, sesame, soybean are recognized as the most valuable vegetable oils. They are characterized by a high content of essential polyunsaturated fatty acids, the presence of a wide range of biologically active compounds, a pleasant taste and smell. It is also necessary to mention vegetable oils obtained from the seeds of medicinal plants (rosehip, sea buckthorn, viburnum, black currant, borage, evening primrose), which are used as pharmacological preparations or administered in combination with traditional edible oils to enhance their biological value and functionality [22].

Ayurveda considers vegetable oils to be a powerful source for self-renewal, self-reproduction, self-regulation of the human body. They contribute to the lubrication of the lungs and intestines – the main locations of Vata-dosha in the body, the imbalance of which is often the cause of the development of diseases. Vegetable oils also nourish the deeper tissue levels of the body, such as bones, bone marrow, nerve tissues, and reproductive fluids. Oils contribute to the implementation of the secretory functions of the body [2, 3].

It is possible to increase the power of oils by creating specially designed compositions of various herbs, spices, which can very effectively feed different levels of the body. Typically, Ayurvedic oil contains extracts of 20–50 medicinal herbs, which makes these products a powerful therapeutic agent. In addition, the skillful selection of a combination of spices helps to reveal the hidden flavors of vegetable oils.

The studied oils are obtained as a result of the first cold-pressed, fresh. The research reveals that the selected

oils are rich in omega 9 and 6 classes, and only hemp oil, which was common in the life of the Slavs, is completely rich in all three classes of fatty acids. Various compositions of combining selected vegetable oils are studied (Table 5).

**Table 5**

Combination of vegetable oils, %

Variants of compositions	Soybean oil	Hemp oil	Sesame oil
No. 1	50	40	10
No. 2	30	40	30
No. 3	50	10	40
No. 4	50	30	20

All investigated oils have a pleasant color and taste. At the same time, sesame oil has more pronounced flavor characteristics. Therefore, according to the composition of fatty acids, their ratio and taste, let's consider it expedient to choose the 4th version of the composition.

Herbal raw materials are selected spicy grass – common dill and medicinal plants – oak bark and marigold. Raw materials dried under conditions of sterile dehydration do not contain impurities and toxic substances.

Vegetable raw materials are mixed in the proportions of dill: marigold: oak bark=1:3:2 and extracted with oil composition in Profi Cook1080. The process takes place under pressure in a closed environment to a noticeable boiling of the sample. After extraction (single, double boiling), a change in the organoleptic characteristics of the mixture is observed (Table 6).

**Table 6**

Characteristic and scoring organoleptic characteristics of oilseeds compositions

Sample	Taste	Aroma	Colour	Consistency	Score
The composition of oils without spices	Herbal, spicy	Intrinsic to oils, with a sesame accent	Amber	Liquid	5
Vegetable composition	Herbal, spicy	Difficult with dill accent	Dried greens	Dry	5
Disposable vacuum	Herbal, spicy, slightly astringent	Sesame with dill accent	Amber yellow	Liquid	5
Double vacuum	Herbal, spicy, astringent	Sesame with dill accent	Amber yellow	Liquid	5
Four times vacuum	Herbal, spicy, astringent, bitter	Sesame with dill accent	Amber dark	Viscous	3

Summing up, it is possible to say that the best quality indicators are samples that are subjected to single and double vacuum. These samples receive a high score, have good organoleptic characteristics. By definition, the shelf life of the mixture is set to a maximum period of not more than 7 days.

According to the principles of Ayurvedic nutrition [3, 5], a prescription composition of candies in fruit cases is developed. Dried fruits are the basis. As an example, Table 7



shows the prescription composition of candy based on cranberries.

**Table 7**

Candy composition in the fruit case based on dry cranberries

No.	Component	Mass, g
1	Cranberries	45.5
2	Honey	20.8
3	Dried banana	10.0
4	Hazelnut	9.5
5	Dried beetroot	4.1
6	Walnut	4.4
7	Seaweed (dry kelp)	3.5
8	Turmeric	0.7
9	Ginger	0.7
10	Black pepper	0.4
11	Carnation	0.4
Total		100.0

For this, dry cranberries, banana dry and beetroots are ground to a particle size of no more than 2 mm, hazelnuts and walnuts are ground to a particle size of not more than 1 mm and mixed.

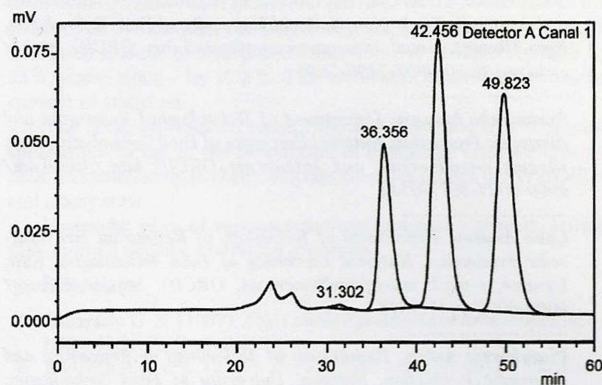
Crushed to a particle size of not more than 0.4 mm, spices and kelp are added to the calculated amount of honey, mixed until a homogeneous mass is obtained and added to the main mixture of components.

Kneading is carried out to obtain a mass with evenly distributed components.

The mass is subjected to formation and remained at 2 hours for the final formation of the structure.

Candy is characterized by a pleasant harmonious sweet-sour taste and aroma with a spicy note, the consistency is homogeneous with inclusions of crushed vegetable components, dense enough to maintain a given shape. Color is dark cherry, uniform throughout the mass.

The carbohydrate composition of the candy in the fruit case is determined by high performance liquid chromatography (Fig. 1).



**Fig. 1.** Chromatogram of carbohydrate composition of candies in the fruit case on the basis of cranberries (Table 8)

Mass fraction of individual carbohydrate components are given in Table 9.

Peak table

Peak No.	Retention time	Area	Height	Concentration	Measurement unit	Label	Name
1	31.302	99091	974	0.000	mg/ml	—	—
2	36.356	4782237	46740	2.469	mg/ml	—	sucrose
3	42.456	8860735	76111	4.224	mg/ml	—	glucose
4	49.823	8019909	61733	3.818	mg/ml	—	fructose
Total		21761971	185558	—	—	—	—

**Table 8****Table 9**

The carbohydrate composition of candy in the fruit case on the basis of dry berries of cranberries

No.	Carbohydrate name	Quantitative content, %
1	sucrose	12.3
2	fructose	19.0
3	glucose	21.0
Total		52.3

Thus, the main carbohydrates of candy are fructose and glucose, which are practically contained in equal quantities. The sucrose content is almost 1.5 times lower compared to glucose and fructose.

Thus, candies in a sugar package based on dry fruits and berries with honey can be a worthy alternative to candies based on refined sugar, and their production in accordance with the principles of Ayurveda will provide preventive properties and help preserve health.

## 7. SWOT analysis of research results

**Strengths.** The advantage of the developed products is that they not only provide the body with nutrients and energy, but also harmonize all body systems, improving the well-being, physical and emotional state of a person.

**Weaknesses.** The introduction of technology on the basis of establishments of the restaurant industry will require the involvement of additional technological equipment and a slight increase in production space and storage space for packaging materials and finished products.

**Opportunities.** Ayurvedic cooking meets today's urgent requirements for providing consumers with «healthy» food. Such products should not only provide the body with nutrients and energy, but also help to improve health, help prevent the onset of diseases, awaken the body's potential for self-healing and self-renewal. The problem of increasing the number of chronic non-communicable diseases among the population of all ages today has become characteristic of the whole world, including countries with a high standard of living. Therefore, the development of technologies for a wide range of culinary products according to Ayurvedic nutrition principles is a promising direction for further research.

**Threats.** At present, catering establishments offer a rather limited range of Ayurvedic food products, mainly represented by dishes of traditional Indian cuisine.



## 8. Conclusions

1. It is shown that today, when it is possible to combine the latest technologies and ancient wisdom, it is necessary to create products that will meet the technological standards, the needs of the individual consumer and preserve the nutritional value. Dried fruits, vegetables, berries, seaweed, nuts, seeds, honey and spices are natural products, making Ayurvedic products tasty, nutritious and healthy.

2. Based on the established organoleptic priorities and compensatory for the content of biologically active substances, a composition of spices in the composition of cloves: cinnamon: ginger in a ratio of 0.5:1.0:2.0 is developed. The technology of decoction has been developed using the composition by bringing; the recommended amount of decoction for making tea is determined to be 3...5 %.

A technology has been developed for the preparation of oil extracts of spices: dill: marigold: oak bark at a ratio of 1:3:2. A mixture of natural oils: soybean: hemp: sesame at a ratio of 2.5:1.5:1 is justified as a fat base.

Based on the Ayurvedic principles of nutrition, a prescription composition of candy in a fruit case based on dried cranberries with the addition of honey, nuts: walnuts and hazelnuts, dried beets, bananas and spice composition has been developed.

3. It is determined that the organoleptic quality indicators of the developed Ayurvedic food products meet consumer requirements for this group of products. The carbohydrate composition of candies in the fruit case on the basis of cranberries is investigated. The total content of certain carbohydrates is 53.2 %, including sucrose – only 12.3 %. The use of such candies will reduce the intake of easily digestible carbohydrates, and the use of natural honey as a carbohydrate component will relieve the product of refined sugars.

## References

1. WHO. Global action plan for the prevention and control of noncommunicable diseases 2013–2020. Report of a WHO. WHO, 2013. 55 p. URL: <https://www.who.int/nmh/publications/ncd-action-plan/en/>
2. Agnivas A. Vvedenie v Ayurvedu. Moscow: Profit-Stayl, 2011. 160 p.
3. Morningstar A. Ayurvedic Cooking for Westerners: Familiar Western Food Prepared with Ayurvedic Principles Kindle. Lotus Press, 1995. 395 p.
4. Lad V., Frouli D. Travy i spetsii. Moscow: Sattva, Profil', 2015. 320 p.
5. Syal K. The Concept of Diet in Ayurveda and Its Implications for the Modern World // Ayurvedic Science of Food and Nutrition. New York: Springer-Verlag, 2013. P. 25–38. doi: [http://doi.org/10.1007/978-1-4614-9628-1\\_3](http://doi.org/10.1007/978-1-4614-9628-1_3)
6. Simakhina H. O., Ukrainets A. I. Innovatsiini tekhnologii ta produkty. Ozdorovche kharchuvannia. Kyiv, 2010. 294 p.
7. Kistanova S. Chaii variatsii na Tseilonskykh plantatsiakh // Napytky plius. 2010. Issue 8. P. 30–35.
8. Oyewopo A. O., Olaniyi S. K., Oyeleke O. M. Black Tea Extract Attenuates Sodium Fluoride-Induced Neurotoxicity in Adult Male Rats // Journal of Natural & Ayurvedic Medicine. 2018. Vol. 2, Issue 1. doi: <http://doi.org/10.23880/jonam-16000117>
9. Prirodnye flavonoidy / Korul'kin D. Yu. et. al. Novosibirsk: Akademicheskoe izdatel'stvo «Geo», 2007. 232 p.
10. Havrylyshyn V. V. Doslidzhennia mozhlyvosti polipshennia spozhyvnykh vlastyvosti chainykh napoiv // Prohresy vni tekhnika ta tekhnologii kharchovykh vyrobnytstv restorannoho hospodarstva i torhivli. 2008. Issue 1. P. 138–141.

11. Blagodarina L. M. Assortiment konditerskikh izdeliy // Nauka v sovremennykh usloviyakh: ot idei do vnedreniya. 2015. Issue 1. P. 35–40.
12. Sposib vyrobnytstva enerhetychnykh hatonchykiv: Pat. No. 78251 UA. MPK: A23G 3/00, A23G 1/48 / Voitiuk M. K. No. u201211083; declared: 24.12.2012; published: 11.03.2013. Bul. No. 5. URL: <http://base.uipv.org/searchINV/search.php?action=viewdetails&IdClaim=184391&chapte>
13. Comparative analysis of fruit-based functional snack bars / Sun-Waterhouse D. et. al. // Food Chemistry. 2010. Vol. 119, Issue 4. P. 1369–1379. doi: <http://doi.org/10.1016/j.foodchem.2009.09.016>
14. Sciammaro L., Ferrero C., Puppo C. Physicochemical and nutritional characterization of sweet snacks formulated with Prosopis alba flour // LWT. 2018. Vol. 93. P. 24–31. doi: <http://doi.org/10.1016/j.lwt.2018.03.019>
15. Potter R., Stojceska V., Plunkett A. The use of fruit powders in extruded snacks suitable for Children's diets // LWT – Food Science and Technology. 2013. Vol. 51, Issue 2. P. 537–544. doi: <http://doi.org/10.1016/j.lwt.2012.11.015>
16. Charles D. J. Antioxidant properties of spices, herbs and other sources. New York: Springer, 2013. doi: <http://doi.org/10.1007/978-1-4614-4310-0>
17. Goots V., Yushchenko N., Kuzmyk U. Development of mathematic model of spiced sour-milk pastas quality // Food and Environment Safety. 2018. Issue 2. P. 224–232. URL: <http://dspace.nuft.edu.ua/jspui/handle/123456789/28547>
18. Identification and characterization of antioxidative peptides derived from simulated in vitro gastrointestinal digestion of walnut meal proteins / Feng L. et. al. // Food Research International. 2018. doi: <http://doi.org/10.1016/j.foodres.2018.08.068>
19. GOST 24027.2. Syr'e lekarstvennoe rastitel'noe. Metody opredeleniya vlazhnosti, soderzhaniya zoly, ekstraktyvnykh i dubil'nykh veshchestv, efirnogo masla. 1980. 13 p.
20. Ainsworth E. A., Gillespie K. M. Estimation of total phenolic content and other oxidation substrates in plant tissues using Folin–Ciocalteu reagent // Nature Protocols. 2007. Vol. 2, Issue 4. P. 875–877. doi: <http://doi.org/10.1038/nprot.2007.102>
21. GOST 24556. Produkty pererabotki plodov i ovoshhey. Metody opredeleniya vitamina S. 1989. 19 p.
22. Nauchnye osnovy proizvodstva emul'sionnykh produktov / Voskanyan O. C. et. al. Moscow: Pishhepromizdat, 2003. 48 p.

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