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THE INFLUENCE OF VEGETABLE ADDITIVES ON THE FORMATION OF CONSUMER PROPERTIES OF SUGAR COOKIES

WPŁYW DODATKÓW ROŚLINNYCH NA TWORZENIE WŁAŚCIWOŚCI KONSUMENCKICH CIASTEK

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Summary: The use of vegetable powders and oils in the production of sugar cookies, which promotes the vital nutrients needs' satisfaction for the human body has been scientifically justified on the basis of the conducted experimental studies. Summarizing the results of research and biscuit production in Ukraine and abroad, the authors have developed recipes of sugar cookies ("Dachne" and "Yantarne") with the use of vegetable powders from parsnips and carrots, as well as the replacement of 15% of margarine with walnut and grape oils. The properties of new consumer products with the use of unconventional raw materials and reduced energy value have been investigated. The organoleptic evaluation of new kinds of sugar biscuits using an especially developed 5-point scale taking into account significance of coefficients was conducted

Keywords: sugar cookies, vegetable powders, walnut oil, grape seed oil, quality, nutritional value.

Streszczenie: Zastosowanie składników roślinnych w produkcji ciastek sprzyja zwiększeniu wartości odżywczej, co zostało naukowo uzasadnione na podstawie przeprowadzonych badań eksperymentalnych. Opierając się na badaniach dotyczących produkcji herbatników na Ukrainie i poza jej granicami, autorzy opracowali przepisy ciastek cukrowych «Dachne» i «Yantarne» ze składnikiem roślinnym (pasteryk z pasternaku i marchewki), w produkcji których margarynę z margarynę (15%) zastąpiono orzechami i olejem z winogron. Zbadano także właściwości nowych produktów konsumenckich powstałych przy użyciu tych niekonwencjonalnych surowców. Ocenę organoleptyczną nowych rodzajów herbatników cukru przeprowadzono, stosując rozwiniętą 5-punktową skalę.

Słowa kluczowe: ciastka, składniki roślinne, orzech włoski, olej z winogron.

1. Introduction

Flour confectionery, including sugar cookies, occupies an important place in human nutrition and is in great demand among consumers, especially children.

The analysis of the assortment of sugar cookies available on the Ukrainian market, shows that these products are unbalanced in their composition of basic nutrients that contain significant amounts of digestible carbohydrates and fats. Therefore it is important to develop sugar cookies with various types of natural herbal supplements and create products with nutritional, biological and energy value.

A promising direction in the development of flour confectionery products of high biological value is the application of the fruit and vegetable processed products.

Scientists have developed flour confectionery products technology that contain powders of mill cake from carrots, beets, apples and hawthorn, obtained by production of juices [*Oatmeal*... 2012]. The technology of making oatmeal cookies with stevia and apple dietary fibers has been suggested. Their indicators of quality are not inferior to traditional oatmeal cookies technological and food properties [Perfilova 2009].

The method of making oatmeal cookies using dried whey and with the addition of vegetable powders (apple, Jerusalem artichoke and chokeberry) is proposed. These additives not only improve the quality of the finished product, but also have a positive effect on the human body. These cookies are rich in microelements, vitamins and other valuable substances [Mihailova 2011].

Scientists propose to use the berries of Schizandra chinensis and viburnum as the raw material for the production of flour confectionery products. The technology of obtaining extracts from the berries for the enrichment of the products has been worked out [Frolova 2011].

The future direction of products' development for medical purposes is the creation of sugar biscuits based on flour composite mixtures with the addition of semi-processed rosehip fruit, chokeberry and cranberry powder. Using the data powder berry semi-finished products in the production of sugar biscuits allows to reduce technological process of manufacture, increase the nutritional value of products, and improve their organoleptic and physical-chemical indicators [Matiushev 2016].

Shortbread dough was designed with the replacement of wheat flour by 4.5% detergent of bagasse sea buckthorn [Tipsina 2013], 7% – with grape marc blueberries powder [Velichko 2015] and sugar biscuits by 6% rose hip powder [Velichko 2015] and 10% by gooseberry powder [Tipsina 2015]. The usage of vegetable origin raw materials in the form of fruit powders promotes biological value, increases the range and improves nutritive properties of pastry products.

Today, confectionery developers and manufacturers reconsider their assortment policy. One of the important directions of improvement of the range of flour confectionery products is reducing their caloric content while maintaining or increasing the biological value.

That is why the problem of developing new types of sugar cookies with the use of nonconventional vegetable raw materials and their merchandising assessment is relevant.

2. Purpose

The aim of this work was to develop sugar cookies with an enhanced food value with optimal part replacement of wheat flour by vegetable powders and margarine with vegetable oils. We were to conduct:

- the study of food and biological value of alternative raw materials, which are included in the recipe of sugar cookies;
- the study of the organoleptic characteristics of developed cookies.

2.1. The recipes for sugar cookies improved composition

Sugar cookies is a large group of high-calorie food products popular both among children and adults in Ukraine. Data analysis of the level of consumption of confectionery in Ukraine, confirms that almost all groups of the population prefer confectionery products, and include them in their daily diet and in the diet of children.

To improve the consumer properties of flour confectionery products it is necessary to constantly search for various kinds of raw materials in a harmonious way, especially for by-products in various forms. It is necessary to take into account complex food, its biological value, protective properties and other aspects not only of raw materials, but also of its components. Therefore we are searching for the rational use of relevant raw materials.

One of the important directions of improving biscuits technology is reducing their caloric content while maintaining or increasing the biological value. Reduced calorie cookies can be achieved by replacing energomash nutrients with natural components of plant origin, including fruit and vegetable powders.

Scientists of the Foodstuff Commodity and Technology Sciences Department of Lviv University of Trade and Economics are constantly searching for new types of unconventional valuable raw materials for the enrichment of flour confectionery products with biologically valuable active substances. In this respectt in recent years we developed a significant range of flour confectionery products with nonconventional vegetable raw materials.

That is why we have developed new types of sugar cookies called “Dachne” and “Yantarne” with fruit and vegetable powders and unconventional types of oils. As a control sample we used sugar cookies “Ternopilske molochne”, the main raw material of which was 1st grade wheat flour, powdered sugar, invert syrup, corn starch, skimmed milk powder, whole eggs and margarine (Table 1).

As biologically active additives to sugar cookies, we replaced 5% of the main raw material (1st grade wheat flour) with carrot and parsnip powders, and 15% of

Table 1. Recipe for new types of sugar cookies
Tabela 1. Receptury testowanych wyrobów ciastkarskich

Main and alternative raw materials	The raw materials amount in the biscuit recipe, kg/t		
	«Ternopilske» molochne (control sample)	«Dachne»	«Yantarne»
Flour 1st grade	635.47	603.70	603.70
Powdered sugar	212.17	212.17	212.17
Invert syrup	29.86	29.86	29.86
Corn starch	49.10	49.10	49.10
Parsnip powder	–	31.77	–
Carrot powder	–	–	31.77
Skimmed milk powder	3.71	3.71	3.71
Melange	18.59	18.59	18.59
Salt	4.91	4.91	4.91
Baking soda	4.92	4.92	4.92
Ammonium salt	0.50	0.50	0.50
Margarine	152.40	129.54	129.54
Grapeseed oil	–	–	22.86
Walnut oil	–	22.86	–
Flavor vanilla	0.7	0.7	0.7
Emulsifier	2.70	2.70	2.70
Total	1115.03	1115.03	1115.03

Source: own study.
Źródło: opracowanie własne

margarine with walnut or grapeseed oil, which not only improved the organoleptic characteristics of biscuits, but also increased their biological value.

2.2. Food and biological value of vegetable powders and vegetable oils

Vegetable powders are fruit pulp and juice concentrates, which contains proteins, cell protoplasm, monosaccharides, colloidal, mineral and pectin. The chemical composition of the powders is listed in Table 2.

As we can see from the data Table 2, vegetable powders contain carbohydrates, which are present in the form of glucose and fructose, allowing easy absorption in the human body and are the main carrier of the energy value. Food powders from carrots and parsnips also contain a significant amount of micro and macro elements that affect the growth and development of the human body, blood circulation and tissue respiration. The carotenoid powder from carrots eliminates free radicals and inhibitors of chain reactions. A characteristic feature of the carrot

Table 2. The chemical composition of vegetable powders
Tabela 2. Skład chemiczny dodatków roślinnych

Chemical composition, %	Powders	
	Parsnip	Carrot
Carbohydrates	55.4-59.5	48.0-58.0
Pectin	1.4-2.0	3.5-5.0
Organic acids	0.6-0.8	1.5-2.5
Ash	8.2-9.5	5.6-8.0
Nitrogenous compounds	7.5-8.7	10.4-14.0
Fiber	13.0-14.5	10.3-12.0
Fats	–	0.8-1.6
β-carotene, mg %	–	86-120
Energy value, kcal	270	285

Source: [Sniezhkin 2003].
Źródło: [Sniezhkin 2003].

Table 3. Fatty acid composition of grape seed and walnut oil
Tabela 3. Profil kwasów tłuszczowych dla oleju z pestek winogron oraz orzechów

The name of fatty acids	Mass fraction, % to the sum of fatty acids	
	Grapeseed oil	Walnut oil
Palmitic acid	7.5	
Stearic acid	3.4	7.0
Linoleic acid	19.3 65.8	24.0 47.0
Linolenic acid	1.1	15.8
Other acids and components of the lipid fraction	2.9	6.2

Source: [Kozin 1968].
Źródło: [Kozin 1968].

powder is the presence of pectin. These factors contribute to their use against malignant diseases, atherosclerosis and cardiovascular diseases [Lipkan 1988].

In addition, in the cookie recipes “Dachne” and “Yantarne”, we replaced 15% of the margarine with walnut and grapeseed oils. The fatty acid composition of these oils is listed in Table 3.

As can be seen from Table 3, grapeseed oil and walnut oil can be considered a valuable dietary supplement because they contain lipids with a balanced fatty acid composition.

Linoleic, linolenic, arachidonic fatty acids are biologically valuable, and indispensable linoleic and linolenic acids are non-replaceable (not synthesized by the body and must be obtained from food). Arachidonic acid can be formed in the body from linoleic acid with the presence of vitamin B and Biotin. These acids are essential for the growth and metabolism of living organisms and the elasticity of blood vessels. Polyunsaturated fatty acids, which form a significant part of vegetable oils, play an important role in the synthesis of prostaglandins – hormone-like substances which are important in the regulation of many processes in the body. In the absence of PUFA in the diet the cessation of growth, skin lesions, changes in capillary permeability are observed. Unlike saturated fatty acids, polyunsaturated acids promote the excretion of excess cholesterol from the body.

According to the modern theory, the following fatty acid composition of triacylglycerols is balanced: fatty acid – 10%, monounsaturated – 60% saturated to 30%. The daily requirement for linoleic acid – 4-10g, which corresponds to 20-30 grams of vegetable oils.

Therefore, due to the grape and walnut oils we can increase the valuable content of these acids in the new sugar cookie.

2.3. The results of organoleptic evaluation of sugar cookies

The organoleptic estimation of thequality of the developed kinds of biscuits was conducted at the Foodstuff Commodity and Technology Sciences Department of Lviv University of Trade and Economics by a taste panel of 18 professional tasters. The quality level according to the specially developed 5-scale table and eventual coefficients (maximum score 50 points) was estimated.

The substantiation of the scales was based on standard organoleptic indices regulated by DSTU 3781-98 «Cookie. Common technical conditions», namely: appearance, surface and finishing, color, appearance for breaking, taste and smell. According to the applicable standard. The organoleptic estimation of quality of biscuits does not provide the index definition that characterizes the influence of new additives on the quality of the products. We have developed a system that includes, besides the standard indicators – appearance, surface, finishing, color, view on breaking, taste and odor, and new – severity and harmony of taste additives.

Each indicator was assessed on a five-point scale: 5 – excellent quality, 4 – good, 3 – satisfactory, 2 – poor, 1 – bad quality.

In the 50-point system: excellent quality – 50-45, very good – 44-40, good – 39--35, the average – 34-27, satisfactory – 26-20, unsatisfactory – less than 20.

According to the results of the Taste Testing Committee at the Foodstuff Commodity and Technology Sciences Department of Lviv University of Trade and Economics, the new types of biscuits were evaluated as excellent (Table 4).

The cookie “Yantarne” obtained the highest points of meaningfulness coefficient (49.15).

Table 4. Summary of the tasting evaluation of the quality of sugar cookies in points
Tabela 4. Wyniki analizy sensorycznej

No.	Quality indexes	Meaningfulness Coefficient	Name of cookie		
			«Ternopilske» molochne (control sample)	«Dachne»	«Yantarne»
1.	Exterior appearance	1	4.5	4.8	5.0
2.	Surface and finishing	1	4.6	4.8	4.9
3.	Color	1	4.8	4.8	5.0
4.	View on breaking	1.5	6.9	7.2	7.35
5.	Smell	2	9.0	10.0	10.0
6.	Taste	1,5	6.9	7.35	7.2
6.1	Impression of taste addition	1	–	4.8	4.8
6.2	Harmoniousness	1	–	4.9	4.9
Points with the coefficient of significance			38.7	48.65	49.15
General, middle estimation with significance			4.83	4.87	4.91

Source: own study.
Źródło: opracowanie własne.

An important argument in the evaluation of quality of new products was the more attractive color of cookie “Yantarne”, due to the additional colouring, especially with carrot powder, apart for this, cookie “Dachne” differed in its pleasant nutty taste and aroma.

Thus the oils added to the recipe of the new kinds of sugar biscuits improved their appearance on breaking and gave the products a more tender and melting consistency.

3. Conclusion

We have developed the recipes of new types of sugar biscuits called “Yantarne” and “Dachne”, which quite successfully blend ingredients of vegetable origin. The main criteria which the consumer focuses on, are the products’ organoleptic characteristics; their composition significantly affects the raw materials used in the production of food products.

The research of the quality characteristics of the sugar biscuits shows that the use of vegetable powders and vegetable oils allows to improve their organoleptic characteristics and extend the range of flour confectionery products.

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