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Production of Functional Cookies and Quality Research

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ABSTRACT

A technology for getting new assortment of functional cookies has been developed in the current work, which are intended for the use in special diets and for wide range of consumption. The quality indicators of these cookies were determined, and it turned out that the mentioned indices regulated per the standard fully meet the requirements set upon the Normative Documents. At the same time, it has been disclosed that the new cookies are enriched with iron, calcium, phosphorus, potassium, magnesium and vitamins *C, B*$_1$, *B*$_2$ and *B*$_6$.

Introduction

Currently, there are many definitions of functional food presented in the normative documents and in the professional literature (GOST R 52349-2005, GOST R 55577-2013, Decree of RF 379-2018, Loktev and Zonova, 2019). As a result of the study, the interpretation of Loktev and Zonova on "functional food" have been proved as the most acceptable. All products are functional to some extent, because they all have a certain nutritional value. Currently, food products are being intensively researched for additional physiological benefits that can reduce the risk of chronic diseases or optimize health otherwise. Due to such studies the global interest in the food types called "functional foods" has significantly increased.

Another term that is often used as a synonym for functional foods is "nutraceuticals". The term, introduced in 1991 by the Foundation for Innovations in Medicine, refers to almost any biologically active component that benefits health (Loktev and Zonova, 2019). At the present stage, some of the most important tasks in the confectionery industry are saving expensive raw materials, expanding the product range and improving technology. It is necessary to offer the consumer qualitatively new products using non-traditional raw materials with high consumer properties and low cost. Now it is relevant to develop food recipes for specialty foods, particularly for people suffering from diabetes and obesity (Matveeva and Koryachkina, 2012). There are more than 100 officially registered confectionery enterprises in Armenia; anyhow, almost none of them produce functional confectionery for the above-mentioned purposes. The largest cookie suppliers to Armenia are from Russia, Ukraine, Poland, Germany, Spain, 80 % being from Russia. To obtain functional cookies, the powder of red currant (Ribes rubrum), growing in the RA, has been used as a source of vitamins, minerals, organic acids and pectin substances and stevioside has been used as a sugar substitute. In cookies, sugar is completely replaced with stevioside, since it enables to get a product with close-to-sucrose sweetness but that is harmless for health. The

complete replacement of sugar with stevioside is due to the fact that new products can be regularly consumed by people with diabetes, overweight and those generally taking care of their health. In 2006, The World Health Organization made a clear conclusion: the plant of "Stevia rebaudiana Bertoni" is curative and absolutely safe. Currently, "Bertoni" candyleaf herbs are also grown in Armenia. Stevioside is the main active element of candyleaf, which is an extract refined therefrom. It is a water-soluble, white, crystalline, sweet natural herbal sweetener. Stevioside is not simply a sugar substitute, but it is also a substance rich in vitamins, minerals, polyunsaturated fatty acids and has a number of advantages such as low-calorie (10 kcal); so, it is fully fit for people preferring healthy diet.

In Armenia there are 6 types of natural currants: Eastern, Alpine, Biberstein, Armenian, Akhuryan and Common. In Armenia, the Common Red Currant is widespread, which is rich in pectin, mineral substances and vitamin *C* (the vitamin content is 30-60 mg%) that are vital for human organism. These nutrients are elements of functional significance, and cookies prepared via their addition will be considered as functional food products.

The aim of the current work is to develop a new technology for the production of new types of sacrose-free cookies that will have functional properties and contain vitamins, useful minerals, organic acids and will be fit for general consumption, children, diabetics and overweight people.

Materials and methods

The powder manufactured from the wild-growing Common Red Current through the well-known technologies was used as an additive for the new cookies (Antipov and Zhashkov, 2010). Stevioside powder "Stivia" of the "Stevilight Fitoe" trademark was used in the manufacture of functional cookies with red currant. In the current research work, 200 g of granulated sugar was replaced with 10 g stevioside. Based on numerous preliminary experiments, the optimal dose of red currant powder was determined guided by the averaged data obtained as a result of the 5-point system evaluation. The experimental options were:

Sample 1 - butter cookies (control)

Sample 2 – functional butter cookies with 10 % red currant powder and stevioside

Sample 3 - functional butter cookies with stevioside

Sample 4 - functional butter cookies with 15 % red currant jelly and stevioside.

Cookies with berry powder and stevioside were subjected to sensory examination, besides, berry powder was added in the butter cookie with the dose of 5 %, 10 % and 15 %. Then, expert examination on the sensory indicators for the produced cookies was carried out by a degustation committee consisting of 7 people. For further examinations, the cookie scoring high point (4.8) was selected. The physical and chemical properties, content of minerals and vitamins, as well as other indices regulated per the standard of functional cookies was determined (Skuratovskaya, 2003). Laboratory examinations were conducted in the Sanitary-Hygienic Laboratory of "National Institute of Health named after Academician S. Kh. Avdalbekyan" CJSC (Ministry of Health of the RA).

Results and discussions

For the production of functional cookies, the following ingredients were used: high-grade wheat flour, red currant powder, stevioside, butter, melange, water and the mixture of $(NH_4)_2\ CO_3$ and $NaHCO_3$ as baking powder. To prepare the dough, the butter and stevioside was mixed for $t=10\text{-}15$ minutes, then the other raw products fixed upon the recipe were gradually added. Currant powder is added prior to flour, so as the powder is homogeneously mixed throughout the entire dough mass. The moisture content of the dough at $T=19\text{-}22\ ^{\circ}C$ made 15-24 %, after which the dough forming process was implemented. Baking lasted $t=5\text{-}12$ minutes in the oven chambers at $T=180\text{-}200\ ^{\circ}C$, then the baked products were cooled and moved to the production tare with the help of a scraper. The degustation committee assessed functional cookies supplemented with various portions of red currant and stevioside through 5-point assessment system (per the organoleptic indicators) (Table 1).

As a result of the organoleptic examination (Table 1) the maximum rating was awarded to the functional cookie containing 10 % red currant powder. The results obtained indicate that the functional cookies with berry powders and stevioside are of high quality per their organoleptic indices and the latter are, if not always, a priority for the consumers.

The results of the physicochemical indicators of functional cookies were compared with the standard indices (GOST 24901-2014. (2019)) and it was proved that they fully meet the requirements of Normative Documents (Table 2). The chemical composition of the produced cookies was also determined: mass fractions of protein substances, carbohydrates, sucrose, fat, total ash (Table 3).

The mass fractions of minerals and vitamins *C,* B_1, B_2, B_6 of the studied cookies were also estimated (Table 4).

Table 1. Evaluation of functional cookies with red currant and stevioside*

Organoleptic indicators	Cookies with stevioside and different doses of red currant powder			
	control sample	5 % red currant powder	10 % red currant powder	15 % red currant powder
Appearance	1.0	1.0	1.2	1.2
Colour	0.6	0.6	1.0	1.1
Taste and flavor	1.6	1.9	2.2	1.5
Appearance in the fracture	0.4	0.4	0.4	0.5
Total	3.6	3.9	4.8	4.3

Table 2. The results of physicochemical examinations of cookies*

Samples / Indicators	Cookies				
	N1	N2	N3	N4	According to GOST-24901-2014 (2019)
Humidity, %	4.3	5.8	3.7	19.3	no more than 15.5
Mass fraction of fat in terms of dry matters, %	12.0	15.0	12.0	12.0	no less than 2.3
10% *HCL* insoluble mass of ash fraction, %	0.045	0.02	0.03	0.05	no more than 0.1
Wettability, %	160	165	160	165	no less than 150
Alkalinity, degree	2.0	1.9	2.0	1.85	no more than 2.0

Table 3. The examination results of the chemical composition of cookies*

Indicators	Cookies			
	N1	N2	N3	N4
Mass fraction of moisture, %	4.3	5.8	3.7	19.3
Mass fraction of protein, %	8.14	8.70	8.90	8.70
Mass fraction of carbohydrates, %	57.20	69.96	75.00	59.45
Mass fraction of sucrose, %	18.0	-	-	-
Mass fraction of fat in terms of dry matters, %	12.0	15.0	12.0	12.0
Total ash, %	0.40	0.55	0.40	0.50

Table 4. The content of minerals and vitamins of functional red currant cookies*

Minerals and vitamins, mg%	Cookies			
	N1	N2	N3	N4
K	106.7	212	135.6	186.3
Na	13.3	15.0	15.7	18.0
Ca	8.0	15.4	6.8	7.0
Mg	8.7	9.85	7.2	8.0
P	79.3	91.3	80.3	60
Fe	0.97	1.27	0.65	0.7
Vitamin *C*	0.0	0.1	0.0	7.0
Vitamin B_1	0.20	0.22	0.20	0.25
Vitamin B_2	0.08	0.08	0.09	0.11
Vitamin B_6	0.18	0.19	0.18	0.28
Energy value. kcal	441.4	449.7	441.6	441.4

*Composed by the authors.

The results of the examination show that functional cookies supplemented with 10 % of red currant powder and red currant jelly are richer in minerals necessary for the human body as compared to those found in standard cookies. Thus, the content of *Fe* increased by 0.3 mg%, *Na* - by 1.7 mg%, *K* - by 105.3 mg%, *Ca* - by 7.4 mg%, *P* - by 12 mg% and *Mg* - by 1.15 mg%. At the same time, they were enriched with vitamins, particularly with vitamin *C*. The content of vitamin *C* is rather high in the jelly containing samples with 15 % red currant powder. Functional cookies do not contain sucrose and the calorie content is lower compared to the standard samples (Table 4). Minerals are not only important for human food diet, but they also have a favorable effect on the bioactivities of microorganisms in the cookie dough. Interacting with the dough ingredients *Ca* and *Mg* improve the dough rheological properties.

Conclusion

As a result of the conducted experiments, sweet dough (butter), high-quality functional cookies supplemented with red currant powder and stevioside rich in minerals and vitamins have been produced.

So, functional cookies do not contain sucrose and are intended for a wide-range consumption, including children, diabetics and overweight people.

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