Original Article

# Use of Herbal Additives Products from Balm in the Production of Cakes

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**DOI:** 10.47750/pnr.2022.13.S08.291

## Abstract

As a rule, flour confectionery products, which include cakes, are in great demand among almost all age groups of the population. The purpose of research was to develop a recipe and technology for the preparation of cakes using herbal additives from balm. Research methods that common for laboratories of confectionery factories were used. An aqueous extract and powder from the aerial part of balm were prepared. The effect of these additives on the contaminating microflora of flour and other recipe components of cakes was studied. The results of organoleptic and physical-chemical indicators of the quality of finished products and changes in the process of its storage are presented. It has been established that the quality indicators of prototype cakes met the requirements of GOST 15052-2014 "Cakes. General technical conditions". The authors consider it possible to use herbal additives from balm in the production of cakes while maintaining the required organoleptic and physical-chemical indicators.

**Keywords:** Aerial Part, Prototype Cakes.

## INTRODUCTION

The demand for the flour confectionery among various segments of the population is growing year after year and is conditioned with high taste, affordability and a wide product range that meets the requirements of the most well versed consumers. At the same time, this type of product is characterized by high calorie content and a relatively short shelf life.

Concerning the problem under study, it becomes expedient to use various herbal additives from cultivated and wild-growing medicinal plants containing a unique complex of natural components and having volatile properties, the use of which provides many opportunities for creating new types of enriched flour confectionery products with a relatively long shelf life. Therefore, at present, developments on the enrichment of these products with physiologically significant and essential nutrients while maintaining sensory-adequate traditional consumer characteristics of products are especially relevant [1-3].

We have the data that the use of powder from earth apple and bird cherry flour in the recipe for shortcake cookies in a ratio with wheat flour of the highest grade, respectively, 20:5:75. will increase the mass fraction of organic acids relative to the reference sample (without additives) by 2.0 times, flavonoids - 1.1 times, dietary fiber - 1.6 times, iron - 1.13 times, potassium - 1.3 times, manganese - 5.0 times, zinc - 2.0 times, copper - 3.0 times, B vitamins - 0.6 times; reduce the energy value by 54.0 kcal. The antioxidant activity of cookies when bird cherry flour is added to its recipe increases by 0.04 mg per 100 g of weight, bird cherry flour and earth apple powder - by 0.02 mg per 100 g of weight of the relative reference sample. High quality indicators [4] characterize finished products.

The potential of using a combination of oatmeal, powdered leaves of leather bergenia (*Bergénia crassifólia*), sea girdle, raspberries, coltsfoot (*Tussilágo fárfara*), flowers and leaves of St. John's wort (*Hypéricum perforátum*), linden flowers in the production of cakes has been revealed. This allowed enriching new products with essential amino acids, macro- and microelements, and other biologically active substances, as well as to increase storage stability and reduce their cost [5].

The introduction of Siberian wild-growing pear powder into the production of cakes, prepared on chemical leavening agents, improves their consumer properties and increases the content of vitamins, microelements, and dietary fiber [6].

Flour from pumpkin seeds, flax and fruits of milk thistle are used as new types of raw materials; hawthorn is used as a source

of vegetable protein, vitamin C; flour from the seeds of watermelon, grapes and rose hips are used as an additional fiber in the production of flour confectionery to increase their nutritional value [7; 8].

As a source of an unconventional and promising biologically active plant polysaccharide, arabinogalactan from Siberian larch wood (*Lárix sibírica*) and gumhar (*Gmelina arborea*) was studied, which has biological activity, as part of a half-finished biscuit product, raw gingerbread and shortbread cookies. It is recommended as a prophylactic and technological additive that allows reducing the proportion of prescription components (sugar, molasses and egg products) and the caloric content of flour products [9].

Potential of using orange-ginseng syrup to fortify the functional and technological properties of cakes has been determined. The optimal dosage of syrup introduced at the whipping stage instead of sugar or egg-sugar mixture has been established, which is 10.0% [10].

Biscuits, waffles, muffins, biscuits, gingerbread, etc. are traditionally in demand among consumers. Muffins are three-dimensional products prepared based on flour, sugar, fat and egg products, which may include large and / or small additions (raisins, nuts, candied fruits etc.), produced with filling, with or without surface finish. Sufficiently high consumption of muffins allows considering them as important products in the diet of the population, especially children and youth [11].

## METHODS

The purpose of research was to develop a recipe and technology for the preparation of cakes using herbal additives from balm.

The experimental part of the work was carried out in the laboratories of the Food Technology Department of the Bukhara Engineering-Technological Institute.

The following raw materials were used in the work: wheat flour of general purpose O'zDSt 313-2009. melange GOST 30363-2013. Granulated sugar GOST 31361-2008. Margarine ROST R ISO 9001-2015. Baking soda GOST 2156-76. Ammonium carbonate GOST 3770 -75. Vanillin flavor GOST 16599-71.

The objects of research were samples of ready-made cakes: a comparison sample (prototype) - a “Prazdnichniy” cake (Table 1), prototype cakes prepared with extracts, the dough was prepared with the appropriate adjustment of the recipe.

Table 1. Formulation for “Prazdnichniy” cake

| Raw material | Mass fraction of dry substances, % | Consumption of raw materials per 1000 kg of finished products, kg | |
|---|---|---|---|
| | | in test value | in dry substances |
| wheat flour of general purpose | 85.50 | 337.00 | 288.14 |
| Mélange | 27.00 | 471.00 | 127.17 |
| sugar | 99.85 | 239.00 | 238.64 |
| margarine | 84.00 | 176.00 | 147.84 |
| baking soda | - | 2.50 | - |
| ammonium carbonate | - | 2.50 | - |
| vanillin | - | 0.30 | - |
| ***Total*** | | **1228.30** | **801.79** |
| ***Yield*** | **78.00** | **1000.00** | **780.00** |

Experimental and control samples were prepared from the same batches of raw materials. All types of raw materials met the requirements of relevant standards. The balm powder was added to the emulsion, and the extract was added to the dough.

The emulsion and dough were prepared according to traditional technology in laboratory conditions. At the stage of preparing the emulsion, melange with granulated sugar and margarine was first whipped at a low speed, gradually increasing the speed of the working body, at a temperature of 20 °C for 15 minutes until a mass of a lush consistency of light cream color was obtained. At the stage of preparing the dough, general-purpose wheat flour M55-23. Mixed with chemical baking powder (baking soda and ammonium salt), was added to the whipped mass in 2–3 doses, and mixed for no more than 15 seconds.

The finished dough with a moisture content of 30.0 ± 1.0% was poured into molds previously greased. Forms were filled to 3/4 of the height of the sides, so that the dough did not spill out when lifting. Baking was carried out in a rotary oven at a

temperature of 175 - 180 °C for 16... 20 minutes. The baked cakes were cooled at room temperature.

The quality of finished products was assessed by modern generally accepted organoleptic (sensor) and physical-chemical (mass fraction of moisture, total sugar (according to sucrose) and fat; alkalinity, density, specific volume) methods described in the manual [13; 14]. Changes in the process of storing cakes were recorded by weight loss.

The calculation of the food and energy value of products was carried out in accordance with the methodology described in the manuals [12; 13]. Determination of contamination of the studied half-finished products with microorganisms was carried out using nutrient agar media. The substrates were incubated under conditions optimal for the growth of colonies of microorganisms, and then, by phase contrast microscopy, the species and quantitative composition of the microflora of the studied half-finished products was determined [14].

The effect of water extract and powder from lemon balm on the contaminating microflora of flour and other recipe components of cakes was studied.

To obtain the extract, the method of maceration (infusion) was used at the ratio of crushed raw materials and water, in 1:20 mass fraction; duration of extraction on a water bath with frequent stirring 30 min. Since the raw material contains easily volatile essential oils, the infusion was carried out with a tightly closed infuser at room temperature for 5 minutes, and then the mass was squeezed and filtered without waiting for complete cooling in accordance with the requirements of the State Pharmacopoeia. The mass fraction of solids in the extract varied from 7.0 to 8.0 ± 0.5%.

## RESULTS AND DISCUSSION

Balm, lemon mint, honeydew, queen cell, swarm, apiary (*Melissa officinalis L.*) - a genus of perennial essential oil herbaceous plants is included in the mint tribe (*Mentheae*), Kotovnikov's subfamily (*Nepetoideae*), Lamiaceae's family of the order Lamiales [15;. 16].

The chemical analysis of the extract (abbr. EM) and powder (abbr. PM) from balm investigated (table 1).

Table 1. Chemical composition of extract and powder from balm

| Indicator | EM | PM |
|---|---|---|
| Mass fraction of the nutrients | | |
| Dry substances, % | 7.52±0.30 | 90. 10±0.10 |
| Nitrogen compounds, % | 0.34±0.25 | 4.07±0.13 |
| Carbohydrates, % | 4.20±0.10 | 50.32±0.50 |
| Essential oil, % | 0.18±0.02 | 2.15±0.25 |
| Minerals, % | 0.91±0.18 | 10.90±0.10 |
| Extractive substances, %, including: | 1.89±0.11 | 22.66±0.34 |
| tannins and dyes, mg% | 14.50±0.50 | 173.70±0.30 |
| polyphenolic compounds, mg% | 437.2±8.4 | 5238.3±7.7 |

The fractional composition of PM is relatively homogeneous, the average particle size of the dominant fraction (70.0-75.0%) does not exceed 300 micron, and the bulk density is 589.3 kg/m3. water-retaining capacity - 8.2 g of water / 1 g of product.

Cakes were evaluated according to organoleptic (sensory) and physical-chemical indicators for compliance with the requirements of GOST 15052-2014 "Cakes. General technical conditions". The results of research of the quality of cakes are presented in Table 2.

Table 2. Quality indicators of cakes with herbal additives from balm

| Name of indicator | Requirements GOST 15052-2014 | Value of cake indicators | | |
|---|---|---|---|---|
| | | *Control* | *with 30.0% EM* | *with 5.0% PM* |
| Taste and smell | Rich taste and characteristic aroma of prescription ingredients, additives or flavors, without foreign tastes and odors | Sweet taste and vanilla aroma, without foreign tastes and odors | Slightly pronounced taste and aroma characteristic of the additive, without foreign tastes and odors | Pronounced taste and aroma of mint and lemon, without foreign tastes and odors |
| Surface | With characteristic cracks, with a pronounced lateral surface, without voids, burns, ruptures and irregularities | | | |
| View at a break | The product is baked without lumps, traces of non-mixing, with uniform porosity, without voids and hardening | | | |
| Structure | Soft, bound, loosened, porous, without voids and seals | | | |

| | | | | |
|---|---|---|---|---|
| The form | Correct, with a convex upper surface, without voids and shells | | | |
| Moisture content, % | 12.0…24.0 | 21.4±0.2 | 21.8±0.2 | 21.6±0.2 |
| Alkalinity, degree | No more 2.0 | 0.5±50.1 | 0.3±0.2 | 0.5±0.1 |

Analysis of the obtained results (Table 2) showed that the addition of herbal additives from balm would allow excluding flavoring agents (in this case, vanillin) from the recipe and provide cakes with a pleasant aroma and flavor.

One of the indicators of the quality of cakes is its shelf life, during which the secondary microbial contamination of the product occurs. Determination of microbiological contamination of cakes after 30 days of storage was carried out using nutrient agar media. The substrates were incubated under conditions optimal for the growth of colonies of microorganisms, and then, by phase-contrast microscopy, the species and quantitative composition of the microflora of the studied half-finished products was determined (Table 3).

Table 3. Microbiological indicators of the quality of cakes

| Indicator | Indicator value | | | |
|---|---|---|---|---|
| | According to ND*, no more | *Control* | *EM* | *PM* |
| Number of mesophilic aerobic and facultative anaerobic microorganisms, CFU/g, no more | $5\times10^3$ | $7.3\times10^2$ | $6.8\times10^2$ | $6.2\times10^2$ |
| Bacteria of the Escherichia coli group (coliforms), in 1 g | Not allowed | Not found | | |
| Staphylococcus.aureus in 0.1 g | Not allowed | Not found | | |
| Pathogenic, including salmonella in 25 g | Not allowed | Not found | | |
| Yeast, CFU/g, no more | 50 | 36 | 32 | 29 |
| Mold, CFU/g, no more | 50 | 28 | 27 | 23 |

*Note: *ND is normative documents*

It was established that the studied control and test samples of cakes after 30 days of storage in the package in terms of microbiological parameters met the requirements of Sanitary Regulations and Standards No. 0366-19 (5.5.7. Cakes and rolls in sealed packaging). At the same time, samples with additives had the best microbiological quality indicators, which will increase their shelf life.

At present, retail chains require from manufacturers a product with a delivery time of 30-90 days. However, often the products become unsalable even before the expiration of this period. The reason is microbiological processes that cause spoilage of foodstuffs of food enterprises, mainly mold.

The fungistatic properties of herbal additives for test-cultures of micromycetes of the genus Aspergillus, Penicillium, Mucor were studied by the method of wells in the thickness of a dense agar nutrient medium with the measurement of growth inhibition zones of these test-cultures.

Results of research of the antimicrobial activity of an aqueous extract and powder from balm in experiments with "pure" cultures of microorganisms are shown in Table 4.

Table 4. Antimicrobial activity of herbal additives from balm officinal

| Microorganism strain | The color of plaque (mold) on the surface of the product | Diameter of growth retardation zones of test-cultures of microorganisms under the influence of herbal additives, mm | | | |
|---|---|---|---|---|---|
| | | extract | powder, в % | | |
| | | | 1.0 | 3.0 | 5.0 |
| Aspergillus candidus | Whitish yellow | 10.5±0.5 | 17.2±0.1 | 20.2±0.3 | 23.5±0.5 |
| Aspergillus flavus | Yellow - green | 10.4±0.6 | 16.8±0.3 | 19.1±0.1 | 22.8±0.2 |
| Aspergillus brasiliensis F-879 (previous *Aspergillus niger)* | Black | 8.2±0.3 | 11.5±0.5 | 16.4±0.1 | 18.2±0.1 |

| | | | | | |
|---|---|---|---|---|---|
| Penicillium olivaceum GKPM 190155 | Brown - yellow | 10.0±0.1 | 12.4±0.3 | 17.8±0.2 | 21.0±0.1 |
| Mucor mucedo | Light gray | 10.2±0.1 | 13.4±0.1 | 19.9±0.1 | 23.2±0.1 |

It has been revealed that the aqueous extract of balm, in contrast to the powder, has an unstable effect of inhibition of the growth of the above-mentioned strains of microorganisms. With an increase in the dosage of PM to 5.0%, its antimicrobial effect increased, especially against mold fungi Aspergillus brasiliensis.

We have a data that the aerial part (grass) of balm exhibits high antimicrobial and antifungal activity against various microorganisms, including Candida albicans, Shigella sone, Trichophyton fungi. Powerful antioxidants were found in this plant: flavonoids (quercetin, rutin), rosmarinic and gallic acids, etc., which also help to increase the shelf life of flour confectionery products [17-21].

## CONCLUSION

Thereby, the involvement of non-traditional types of vegetable raw materials in the production of flour confectionery products is a promising and relevant scientific area of research, which has practical significance from the point of view of providing the population with enriched products. This determines the implementation of the priority directions of the state development strategy in the field of healthy nutrition of the population and food security, the economic component in terms of reducing the cost of production by replacing imported and expensive raw materials with local non-traditional resources or additional products of complex processing of raw materials. Most food producers do not use enough reserves for the processing of local raw materials (berries, fruits and vegetables) and secondary raw materials of the processing industries of the food industry, the use of which in the production of confectionery products will reduce production costs and dependence on suppliers of imported prescription ingredients.

The use of natural additives allows avoiding the use of food additives of a non-alimentary nature and, consequently, to increase the level of product safety.

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