The Use Of Combined Composites Of Non-Traditional Raw Materials Of Plant Origin In The Production Of Functional Bakery Products

I D Konovalova¹, V N Orobinskaya,² E N Kholodova,² O N Pisarenko,² E V Galdin²

¹Pyatigorsk medical and pharmaceutical Institute (Affiliate), Volgograd state medical University, Russia, Pyatigorsk;
²Institute of Service, Tourism and Design (Affiliate), North-Caucasus Federal University, Pyatigorsk;

e-mail: orobinskaya.val@yandex.ru

Abstract: The development of new types of food products using non-traditional plant materials rich in useful substances necessary for the human body is an actual direction of the STI of the Russian Federation “FoodNet”. Bread and bakery products occupy a high share in the consumer basket of the population of the Russian Federation, research in the field of designing recipe compositions and technologies for new types of bakery products is of significant importance. The disadvantage of the main share of bakery products is the low biological and physiological value and high calorie content. Modern production of bread and bakery products is aimed at their enrichment with vitamins, minerals to increase biological value and reduce calorie content.

1. Introduction

Issues of a healthy lifestyle and nutrition in developed countries of the European community are elevated to the rank of state.

This issue is relevant for Russia. The Government, the State Duma of the Russian Federation, the Ministry of Health and Social Development, set modern scientists with tasks related to the organization of a healthy diet for the Russian population. For example, the “Fundamentals of State Policy in the Field of Healthy Nutrition of the Population of the Russian Federation for the Period Until 2020” define as a priority the increase in the production of nutrient-enriched mass-consumption foods, incl. wheat flour of the highest and first grades, bakery products [1,2,4].

The development of new types of food products using non-traditional plant materials rich in nutrients necessary for the human body is an actual direction of the STI of the Russian Federation “FoodNet”. Bread and bakery products occupy a high share in the consumer basket of the population of the Russian Federation, research in the field of designing recipe compositions and technologies for new types of bakery products is essential.

In 1995, a law was passed in China in charge of food quality and safety, on the basis of which administrative measures were developed to regulate food products, which included the concepts of “functional foods” and “nutraceuticals”. The main direction of improving the technology of functional products is the use of food components and biologically active additives, not only increasing their nutritional value, but also giving the products targeted therapeutic and preventive properties [1,2,4,7,14]. Functional food products are divided into 3 groups (Fig. 1).
In Russia, bakery products are traditional foods that are consumed daily. But recently, the assortment of bakery products has changed dramatically, the consumption of products from premium wheat flour has increased, where there are very few physiologically active substances - vitamins and minerals [1,2,4,7,11,14].

According to Intesco Research Group agency, bakery products are divided into 1) bakery products of long-term storage; 2) bakery products of non-durable storage% of the market ratio is presented in Fig. 3.
The disadvantage of the main share of bakery products is the low biological and physiological value and high calorie content. Modern production of bread and bakery products is aimed at their enrichment with vitamins, minerals to increase biological value and reduce calorie content.

One of the possible ways to obtain functional bread is the use of powder from the skin of grape pomace. This additive is a light brown powder with a moisture content of 9-10% sweet and sour taste, obtained from dried, crushed and sifted grapes, which are waste in the production of wines. The main components of the powder are carbohydrates in the form of mono- and disaccharides, pectin and fiber, as well as vitamins and minerals. An insignificant content of proteins and lipids was noted. The increased content of pectin and fiber in bread when using grape squeezed powder increases their quality and prolongs shelf life.

The use of powder helps to increase the gas and sugar-forming ability of the test and the quality of gluten with an increase in its hydrophilic properties, elasticity and increase in the compressive strain resistance of gluten.

The use of this additive helps to improve physical and chemical parameters in relation to bread from wheat flour without the use of grape squeezed powder. However, the use of non-standard raw materials in the recipe is a consequence of obtaining bread with a dark elastic crumb of a sour-sweet taste.

The use of powder from the skin of grape marc extracts also helps to slow down staling processes, increase the content of mineral and pectin substances in bread, and enrich it with dietary fiber.

2. Main part
In the socio-economic conditions of the Russian Federation at the moment, the formation of a state policy in the field of healthy nutrition is not only relevant, but also a vital task, based on a balanced combination of all the compounds necessary for the functioning of the body.

The main nutritional disorders are the high consumption of animal fats containing high-density lipoproteins (HDL), insufficient dietary fiber intake, and a lack of macro- and micro-minerals and vitamins. The development of new types of food products using non-traditional plant materials rich in useful substances necessary for the human body is an actual direction of the STI of the Russian
Federation “FoodNet”. Bread and bakery products occupy a high share in the consumer basket of the population of the Russian Federation, research in the field of designing recipe compositions and technologies for new types of bakery products, including those enriched with physiologically functional ingredients, is essential. [1,2,4,7,14].

Milk thistle and turmeric, Jerusalem artichoke powder with a leaf of lingonberry and carrot were selected as potentially useful additives of plant origin from non-traditional raw materials. In the production of bakery products, properly selected raw materials, an economically sound way of processing them on the principles of affordability, cheap raw materials and technological indicators are an important factor.

The use of raw materials growing in the Stavropol and Krasnodar Territory, reduces the cost of production. An increase in the number of diseases associated with adverse environmental effects necessitates the widespread use of biologically active compounds of hepatoprotective action, which protect the liver from damage of various kinds of external factors. The high concentration of flavolignan silymarin in the milk thistle fruits, which has an antioxidant effect and a pronounced hepatoprotective effect, allows the use of this unconventional raw material as a promising source for innovative selective products. The value of Jerusalem artichoke polysaccharide is inulin, which does not require insulin for biotransformation of substances. Carrot is a source of provitamin A - carotene. In humans and animals, carotene turns into retinol - vitamin A. The biological role of vitamin A, and therefore carotene, lies in the fact that it is part of the retina in the form of rhodopsin [3,2,5,6, 4,7,14].

Milk thistle is known as the most effective natural product for the restoration of liver cells. This is confirmed by many scientific studies. Grass is used in case of jaundice, cirrhosis, fatty degeneration or inflammation of the liver. Milk thistle is also used in case of mushroom poisoning, with psoriasis, gallstones, Alzheimer's disease and diabetes. This product is easily available and inexpensive. The composition of spotted milk thistle includes: silymarin (about 2-3%) - this is the name of the unique complex of flavolignans, consisting of silybin, isosilibine, silydianin, silychristine, taxifolin; phytosterols (campesterol, stigmasterol, beta-sitosterol); flavonoids (quercetin, apigenin, luteolin); oil (20-30%); protein (25-30%). Milk thistle owes its useful properties to the content of silymarin in it (or rather, silybin). This substance, as an effective antioxidant, stimulates protein synthesis and protects cells from various injuries and mutations, a feature of this non-traditional raw material is the absence of contraindications. The use of milk thistle herbs is possible at any age, as part of a separate or complex therapy. If it necessary, milk thistle is used for children.

Also, a rare class of phenolic compounds, flavolignans, is included in the spotted thistle. Almost all of the thistles are spotted thistle - flavonols; dehydrosilibinin and dihydroquercetin (Taxifolin) are flavonones.

The composition also includes essential fatty acids, fat-soluble vitamin K, hepatoprotector betaine, saponins, alkaloids, mucus, resins, as well as other substances that have a synergistic effect of silymarin.

Milk thistle processing products are oil, oilcake and meal and seed powder.

Milk thistle fruit is obtained after pressing the oil from them. It contains a large number of biologically active compounds: dietary fiber, flavonoids, vitamins, macro- and microelements (table 1).

| № | The name of indicators | Value       |
|---|------------------------|-------------|
| 1 | Moisture, %            | 6.9         |
| 2 | Protein, %             | 22.1        |
| 3 | Fat,%                  | 13.01       |
| 4 | Fatty acids, % of the total: | 62.0 |
6  oleic          21.9
7  arachidonic   1.99
8  linolenic      1.49
9  Water-soluble carbohydrates,%  0.79
10  Dietary fibre,%  27.4
11  Ash,%         6.0
12  Essential oils, %  0.39
13  Vitamins mg /  
14  E            47
15  B1           1.39
16  B2           1.33
17  β - carotene  0.84
18  Flavolignans (in terms of silybin) per 100 g  74 mg

Qualitative indicators of milk thistle powder are shown in table 4.

Table 2 - Qualitative indicators of milk thistle powder

| №  | The name of indicators                  | Value                                      |
|-----|----------------------------------------|--------------------------------------------|
| 1   | Color                                  | Grey-brown                                |
| 2   | Smell                                  | Inherent to milk thistle seed powder, oily, odorless |
| 3   | Taste                                  | Inherent to milk thistle seed powder, without extraneous flavors, not sour, not bitter |
| 4   | Moisture content,%                     | 8.3                                       |
| 5   | Degree of acidity                      | 2.6                                       |
| 6   | Presence of signs of mold, insects, pests | Are absent                                |

According to the research of V.S. Agibalova "... the fruits of milk thistle and their processed products are used in the food industry, namely, in the production of butter, soft drinks and coffee drinks, dietary products for therapeutic and preventive purposes ...".

The introduction of milk thistle in the form of a powder composite with the addition of 1% turmeric will enrich the resulting product with biologically active compounds of hepatoprotective, hypoglycemic and antioxidant effects [4,7,8,9,10,11,12,13].

Jerusalem artichoke tubers contain food acids (malic, citric, succinic, etc.), of which citric is predominant. Jerusalem artichoke is characterized by a wide range of physiologically active components, such as macro-, microelements, ascorbic acid, B vitamins and polyphenolic compounds. The biochemical composition of Jerusalem artichoke gives reason to recommend tubers as a raw material for creating functional products.

We propose to use a powdery composite, which includes inulin powder from Jerusalem artichoke and a sheet of lingonberry. The content of lingonberry leaves of arbutin, flavonoids, tannins and tannins causes an anti-inflammatory and immunomodulating effect. The tiritenoids contained in the lingonberry leaf ursolic and oleanic acids have antitumor activity; their content ranges from 100 - 150 mg%. The main constituent in the composition of the powder composite is inulin (the content of 0.5% nanodispersion powder of lingonberry leaf in 100 g of powder enhances the hypoglycemic and diuretic effect). This composite, when used in the formulation of antidiabetic products, will expand the range of therapeutic and prophylactic products. The special value of carrots is explained by its high content of provitamin A - carotene. In humans and animals, carotene is converted into β-from one molecule of...
β-carotene, two molecules of vitamin A are formed in the body. A person’s need for vitamin A is 1 mg of pure vitamin or 2 g of carotene.

Scientists at the Kuban State Technological University have developed a technology for the production of carrot-based sauces, using a composite multifunctional food supplement of a polysaccharide nature, which allows controlling the quality of the resulting products.

In the work of O.V.Perfilova, the rationale for the use of fruit and vegetable powders (carrot, beetroot, etc.) in the production of muffins is given. The resulting products were characterized by low calorie content and a high content (10% or more) of pectin substances, vitamin E, β-carotene, P-active substances, hematopoietic trace element of iron, which allows us to attribute ready-made muffins to functional products [4,7,8,9,10,11,12,13].

D.L. Azin studied the nutritional value of new types of bakery products prepared with the addition of vegetable powders (a combination of apple and carrot powder). [13,14,15,16].

The main biologically active component is (curcumin). Curcumin (Fig. 5), Long’s most active component of turmeric (“Zardchoubeh”), is from the ginger family (Zingiberaceae), which is a mixture of 3 different compounds known as curcuminoids (C3 curcumin complex) Fig. 6.

Curcuminoids with respect to oxidative stress radicals: O2 • -, HO •, ROO • and NO • exhibit an antiradical effect similar to quercetin, the most common plant-based flavonoids [13,14,15,16].
Curcuminoids are able to activate antioxidant enzymes and phase II enzymes of xenobiotic metabolism.

Results and discussion
The effect of powders (milk thistle and turmeric powder; Jerusalem artichoke powder with lingonberry leaf and carrots) on the physicochemical parameters of raw materials, semi-finished products of table. 3

Table 3 - Organoleptic characteristics of flour with non-traditional vegetable dressing

| Sample Name | Ash content, % | Smell, Taste | Crunch | Color                  | Point grade |
|-------------|----------------|--------------|--------|------------------------|-------------|
| Control (MAKFA flour, premium) | 0.52±0.1 | a characteristic crunch for a premium flour | a characteristic crunch for a flour | white | 5 5 5 |
| Sample No. 1 (milk thistle 5% + 1% turmeric powder) | 0.78±0.2 | pronounced aroma, turmeric | a characteristic crunch for a flour | with a yellowish tint | 4 5 5 |
| Sample No. 2 (milk thistle 7% + 0.5% turmeric powder) | 0.88±0.3 | slightly noticeable turmeric flavor | a characteristic crunch for a flour | grayish yellow | 4 4 4 |
| Sample No. 3 (milk thistle 10% + 0.5% turmeric powder) | 0.95±0.1 | slightly noticeable turmeric flavor | a characteristic crunch for a flour | grayish yellow | 4 3 3 |
| Sample No. 4 (powder-like composite 5% Jerusalem artichoke + lingonberry leaf 1% carrot powder) | 0.76±0.3 | slightly noticeable grassy smell | non-characteristic crunch for a flour | taupe | 4 5 4 |
| Sample No. 5 (powder-like composite 7% Jerusalem artichoke + lingonberry leaf 1% carrot powder) | 0.91±0.3 | pronounced grassy odor | non-characteristic crunch for a flour | taupe with orange blotches | 3 2 3 |
| Sample No. 6 (powder-like composite 10% Jerusalem artichoke + lingonberry leaf 1% carrot powder) | 1.25±0.2 | pronounced grassy odor | non-characteristic crunch for a flour | taupe with orange blotches | 3 2 3 |
An analysis of the experimental data showed that when phyto-enrichment agents from non-traditional plant materials are introduced, the organoleptic characteristics of flour change. The most acceptable according to experts were samples No. 1 and No. 4.

The effect of phyto-enrichment agents on titratable acidity of flour is investigated. The acidity of flour shows the ability of protein compounds of flour to bind a certain amount of alkali. With the breakdown of compounds: phytin, lipids, etc., rancidity of flour occurs and an increased content of organic acids occurs in it.

The results of the influence of phytochemicals on acidity are presented in table 4.

| A portion of flour, g | Name of sample | Amount of 0.1 N alkali used for titration, ml | Degree of acidity | Conclusion |
|-----------------------|----------------|---------------------------------|-----------------|------------|
| 5                     | Control        | 1.5                             | 3.0             | Meets the standard requirements for flour quality |
| 5                     | Sample №1      | 1.6                             | 3.2             | With the introduction of powder with milk thistle, a slight increase |
| 5                     | Sample №2      | 1.7                             | 3.4             | With the introduction of powder with milk thistle, a slight increase |
| 5                     | Sample №3      | 1.9                             | 3.8             | With the introduction of milk thistle powder, an increase in acidity occurs due to the presence of organic acids in the feed |
| 5                     | Sample №4      | 2.0                             | 4.0             | With the introduction of powder from Jerusalem artichoke, a significant increase |
| 5                     | Sample №5      | 2.1                             | 4.2             | With the introduction of powder from Jerusalem artichoke, a significant increase |
| 5                     | Sample №6      | 2.2                             | 4.4             | With the introduction of powder from Jerusalem artichoke, a significant increase |

The analysis of experimental data showed that in sample No. 1 there is a slight increase in the acidity of flour, in samples No. 3-4 the acidity is higher, which must be taken into account in the production of bakery products.

The effect of phytochemicals on the quality of flour was studied using the method of swelling in a solution of acetic acid, the so-called flour strength.

The "strength" of flour affects the quality of bakery products. The results of the analysis are presented in table 5.
Table 5 - “Strength” of flour, depending on the size of sedimentation sediment in experimental samples

| Name of sample | V (sediment volume), cm$^3$ | Analysis results, cm$^3$ | Flour class by “strength” |
|----------------|-----------------------------|--------------------------|---------------------------|
| Control        | More than 60                | 50.9                     | High protein, excellent gluten, strong |
| Sample №1      | 40-59                       | 47.8                     | High protein, good quality gluten, strong |
| Sample №2      | 40                          | 42.4                     | With medium protein and low gluten quality |
| Sample №3      | 31-39                       | 39.1                     | With medium protein and low gluten quality |
| Sample №4      | 31-39                       | 48.6                     | High protein, good quality gluten, strong |
| Sample №5      | 31-39                       | 37.7                     | With medium protein and low gluten quality |
| Sample №6      | Less than 30                | 30.3                     | Low-protein mealy with reduced quality gluten |

Thus, the most suitable for the production of bakery products are sample No.1, No.2, No.4.

3. Conclusions

In connection with the above, conducted comprehensive studies on the development of bakery product formulations using non-traditional plant materials, namely flour from powder of the seeds of milk thistle, Jerusalem artichoke and carrots, is relevant, as it will contribute to the expansion of the range of preventive bakery products.

Phyto-fortifiers not only improve the quality of the flour used for the production of bakery products, but also enrich them with biologically active compounds of a functional orientation of selective action: hepatoprotective, antioxidant, contributing to a decrease in blood glucose, expanding the range.

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