Enrichment of milk ice cream with bee products

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Abstract. The article is devoted to the development of enriched diet ice cream technology for a wide range of consumers. The analysis of numerous literature on functional enrichment components determined the relevance of the use of products of biological origin. In this regard, organoleptic and physico-chemical studies of milk ice cream were obtained using the technology, which provides for the inclusion in the formulation of beekeeping products - bee pollen - pollen and water propolis extract. The choice of these components is explained by the high content of amino acids, vitamins, minerals, enzymes and other biologically active substances. The mass fraction of fat and sucrose solids in the product was controlled by traditional methods according to GOST, and organoleptic evaluation was carried out by consistency, structure and taste. The paper gives the rationale for the use of additives, and also determines the optimal dose for making milk ice cream. It was found that the introduction of propolis is recommended in an amount of 0.6%, bee pollen in an amount of 1.0%. These dosages did not impair organoleptic and physico-chemical parameters, but at the same time allowed enriching the product with biologically valuable components. In the future, it is planned to expand research on the use of food additives in dairy products for the functional enrichment of their composition.

1. Introduction

All over the world, a new trend in the food industry has become widespread - combinatorics, which means the use of various ingredients that, when used continuously, have a therapeutic and prophylactic effect on the body as a whole [1–9].

The list of dairy products is richly presented due to the introduction of additives of natural origin and technological processes in order to provide requirements for certain properties of products [10–19]. Replenishment of the assortment of dairy products implies the use of a considerable amount of additives, for example, biological components [20–26]. Absolutely each of them is obliged to pass checks and meet the expectations of consumers and the requirements of the law [26–29]. The use of beekeeping products in the dairy industry is a promising area. According to the results of numerous studies, the relationship between modern preservatives and additives used in the dairy industry, and various diseases - from hyperactivity to cancer, is direct.
One of the rich sources of biologically active substances, as well as potential raw materials for use in the food industry as an additive, including dairy products, is bee pollen. It is important to mention that pollen, when used correctly, helps to correct errors in modern nutrition, to increase the rate of tissue protein regeneration. Bonnet is a real find for modern man, as it is a complete collection of natural amino acids, as well as vitamins and minerals, do not forget to mention the high protein content. The content of these components depends on the timing of collection, the type of plant. Flavonoids of pollen grains are catechins, anthocyanins, flavones, flavonols, therefore it exhibits antioxidant properties.

Research was conducted with the aim of developing a technology for the production of milk ice cream with the addition of bee pollen and propolis water extract. To achieve this goal, the following tasks were set:

- to analyze the literature data on the use of bee propolis pollen in the dairy industry;
- to study the chemical composition, nutritional value, physico-chemical parameters and commodity-technological properties of bee pollen and propolis;
- scientifically substantiate the feasibility of using bee pollen and propolis in the production of ice cream;
- conduct a comparative analysis of the experimental and control samples of ice cream on organoleptic and physico-chemical indicators.

Ice cream is a product of processing milk and cream, unless of course we are talking about milk ice cream. In addition to milk itself, ice cream includes components such as sugar, cream, stabilizers and butter. Sometimes, chocolate, berries and others are used as aromatic components to give a specific taste.

In addition to milk, it contains sugar, cream, butter, stabilizers, and chocolate, berries and many others as flavoring, aromatic and nutritious components.

2. Material and methods

To determine the optimal dose of bee pollen as part of the ice cream formulation, it was added in an amount of 0.50 to 1.50%.

A visual and tasting evaluation of ice cream was carried out on the state of consistency, structure and taste. Setting the mass fraction of fat, sucrose, solids, acidity - according to current standards.

3. Results

According to the data given in table 1, the most rational dose was 1.0%.

| Bee pollen application rate, % | Characteristic |
|-------------------------------|----------------|
| Control                       | Taste and smell: pure, characteristic for this type of (milk) ice cream, without extraneous smacks and smells; Consistency: dense; Structure: homogeneous, without noticeable lumps of fat, stabilizer, particles of protein and lactose, ice crystals; Color: milky white, uniform throughout the mass. |
| 0.5                           | Taste and smell: pure, characteristic for this type of (milk) ice cream, with a faint taste and bee pollen smell; Consistency: dense; Structure: homogeneous, without noticeable lumps of fat, stabilizer, particles of protein and lactose, ice crystals; |
| 1.0                           | Taste and smell: pure, characteristic for this type of (milk) ice cream, with a light pleasant aftertaste and smell of bee pollen; |
Consistency: dense;
Structure: homogeneous, without noticeable lumps of fat, stabilizer, particles of protein and lactose, ice crystals;
Color: milky white with a light cream tint, uniform throughout the mass.

Taste and smell: pure, characteristic for this type of (milk) ice cream, with a pronounced taste and aroma of bee pollen;
Consistency: dense;
Structure: homogeneous, without noticeable lumps of fat, stabilizer, particles of protein and lactose, ice crystals;
Color: milky white with a cream tint, uniform throughout the mass.

Physico-chemical indicators of the quality of ice cream were studied, which are shown in table 2.

| Index                                      | The amount of additives - bee pollen, % |
|--------------------------------------------|----------------------------------------|
| Mass fraction of fat, %                   | control      | 0.5 | 1.0 | 1.5 |
| Mass fraction of sucrose, %               | 3.5          | 3.5 | 3.5 | 3.5 |
| Mass fraction of SOMO (dry skim milk residue), % | 15.5        | 15.5| 15.5| 15.5|
| Mass fraction of solids, %                | 10.25        | 10.29| 10.31| 10.33|
| Acidity, T                                | 22           | 23  | 24  | 25  |

The composition of pollen enriched with bee pollen was slightly different from the control samples. At the same time, with and without additives, ice cream samples met the requirements of regulatory documents. However, in the samples in which bee pollen was added, there was a noticeable increase in solids compared to the control sample.

Propolis, it is also called bee glue, is a rather solid mass of brown color with a barely noticeable green undertone. It is highly soluble in ethanol and practically insoluble in ordinary water. Let's pay attention to the composition of propolis, which includes:
- a mixture of organic acids and balms - 55%;
- wax - 30%;
- essential oil - 10%;
- flower pollen - 5%;

As well as vitamins A, C, group B and some other trace elements. It is worth noting that more than twenty compounds were found in propolis, which we can designate into three groups of biologically active substances, namely acids, compounds of the isoprenoid group and polyphenols. Propolis in its composition, like the aforementioned pollen, may differ from the generalized structure given by us due to different collection times, climatic conditions of the region (republic, territory), the breed of the bees themselves, and many others.

Medicine has long known about the beneficial properties of propolis and uses it for prophylactic and even therapeutic purposes; it was found that propolis productively copes with certain bacteria, for example pyogen. It should be emphasized that propolis is not addictive, but it very well stimulates the body's defense mechanisms. It is used in the treatment of not only people, but also animals, as well as in the control of pests of crops. But first of all, propolis is known for its ability to enhance immunity and strengthen tooth enamel, which many could hear about even in advertising.

To determine the optimal dose of bee propolis as part of the ice cream formulation, it was added in an amount of 0.3 to 1.0%.

According to the data given in Table 3, the most rational dose was 0.6%.
Table 3. Organoleptic characteristics of milk ice cream with the addition of propolis.

| The rate of propolis, % | Characteristic |
|------------------------|---------------|
| control                | Taste and smell: unadulterated, property for this type of (milk) ice cream, without external smells; Consistency: close; Structure: similar, without noticeable fragments of fat, stabilizer, suspension of protein and lactose, piece of ice; Color: white like milk, the mass of uniform. |
| 0.3                    | Same like control group, with a faint taste and smell of propolis; Consistency: dense; Structure: same like control group; Color: milky white, uniform throughout the mass. |
| 0.6                    | Taste and smell: same like control group but with a light pleasant aftertaste and smell of propolis; Consistency: same like control group; Structure: same like control group; Color: white with a light cream tint, the mass of uniform. |
| 0.9                    | Taste and smell: same like control group but with a pronounced taste and aroma of propolis; Consistency: same like control group; Structure: same like control group; Color: white with a cream tint, the mass of uniform. |

Physico-chemical indicators of the quality of ice cream were also investigated, which are shown in table 4.

Table 4. Physico-chemical characteristics of ice cream with the addition of propolis.

| Index                               | control | The amount of additives – propolis, % |
|-------------------------------------|---------|---------------------------------------|
|                                     |         | 0.3  | 0.6  | 0.9  |
| Mass fraction of fat, %             | 3.5     | 3.5  | 3.5  | 3.5  |
| Mass fraction of sucrose, %         | 15.5    | 15.5 | 15.5 | 15.5 |
| Mass fraction of SOMO (dry skim milk residue), % | 10.25  | 10.26 | 10.26 | 10.28 |
| Mass fraction of solids, %          | 29.25   | 29.26 | 29.26 | 29.28 |
| Acidity, T                          | 22      | 22   | 22   | 22   |

The composition of propolis-enriched product samples practically did not differ from the control samples. However, in the samples in which propolis was added, there was a slight increase in solids compared to the control sample.

4. Conclusion
Thus, the introduction of propolis in the amount of 0.6% and bee pollen in the amount of 1.0% does not enrich the organoleptic properties and does not reduce the physico-chemical parameters of milk ice cream. In addition, the functional properties of propolis increase the biological value of the product.
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