Study on some characteristics of fresh cheese with selenium

Camelia Moldovan\(^a\), Eugeniu Crăiniceanu\(^b\), Slavița Jivanov\(^a\), Mihai Drugă\(^a\), Mărioara Drugă\(^a\), Boltea Florin\(^c\), Ramona Clep\(^d\)

\(^a\) Banat’s University of Agricultural Sciences and Veterinary Medicine, Faculty of Food Processing Technology, 300645-Timisoara, C. Aradului 119, Romania
\(^b\) University of Agricultural Sciences and Veterinary Medicine Timișoara, Faculty of Veterinary Medicine Timișoara, Calea Aradului 119 A, RO-300645, Timișoara, Romania
\(^c\) University of Baia Mare, Sciences Faculty, Victoriei 76, RO-430122, Baia Mare, Romania
\(^d\) National Sanitar-Veterinary Authority, Negustori 1B, RO-023951, Romania

Abstract

Being known the selenium request for human, in the conditions of a severe carence of selenium in Romania [1, 2], the aim of this paper was to propose a new product for romanian market – fresh cheese with selenium, as „functional food” (this term does not exist in romanian legislation, the sinonim of this is „food reached with...”). It is well-known in the specialized literature the enrichment with good results of animal origin food with Se [3, 4, 5, 6]. In the majority of cases they proceeded to the enrichment of fodder with Se, finally obtaining enriched animal products (milk, eggs, meat). We added various doses of selenium in the primary matter (cow milk) used to obtain fresh cheese, strictly following the specific technological stages of cheese manufactoring. We made several requested tests in order to homologate and launch this product on the romanian market. We efectuated only some of the tests for this purpose, not all tests. Until now we determined: acidity, pH, humidity, fats, major of mineral elements from cheese and from whey. The „fresh cheese with selenium” presented sensorial (didn’t remark major differences between basic product and the product with selenium, excepting smell) and physical-chemical characteristics similar with the product without selenium, the analized products framed within the legal limits of romanian commercial legislation. It was remarked a higher acidity of cheese samples with selenium supplement but not in whey samples.

Keywords: cheese, selenium

1. Introduction

Selenium is the major component of glutatione-peroxidase enzyme. It is an antioxidant microelement and may be anticancregen. In human body the essential selenium role resides in cell breathing, in hemoglobin protect, and in favour of vitamine E absorbtion and in growing of vitamine E efficiency. Selenium is known as antiaterogene and antiageing. This element contributes to mentaining of tissues elasticity, diminish specific symptoms of menopause, helps in the cardiovascular treatment and to reproduction processes [7].

From the experimental point of view, the enrichment of the food with selenium prooved to be very positive, being observed the reducing of somatical cells in the milk [6]; the decrease of incidence and severity for clinical mastitis [8]; the decrease for number of cases from retained placenta [9]; the improvement of reproduction parameters [10].

Although the daily recommended doses for microelements in the human and animal food are evidently small, however their importance - in zootechnical production for instance - is well documented. By fortune, the difference between deficieny and toxicity is enough significant in order to be handled. This issue allows a lot of adds

Corresponding author: e-mail address: camelia.clep@gmail.com
administration practices to be implemented without major problems.

Like any other microelement, selenium is necessary to sustain life and also essential for basic physiological functions. On the other hand, selenium was identified as a toxic mineral before being recognized as an essential element. In 1957 selenium was irrevocably defined as a microelement essential in nutrition, when a German chemist demonstrated that hepatic necroses on rats fed with beer yeast sedimentary could be prevented by simply adding selenium in the same yeast [11].

This was the beginning of a long battle for the validation of selenium as a dietary additive in the conditions of a thin border between carelessness and toxicity, combined with the suspicion that selenium can be a toxic agent for the environment. These hesitation brought more 30 years lost in debates, supplementary research and political confrontations before the validation by FDA of 0.3 ppm selenium doses in the complete fodders for the majority of animals in zootecnical farms.

Through analogy, in human, selenium is also necessary like in the animals. An increasing number of proofs indicate that selenium is very important for human health. In human, the symptoms of selenium careness may be: high cholesterol level, slow growing and development, frequent infections, reduced hepatic functions, masculine sterility etc. [12].

The selenium level in food depends on the natural differences between the essential foods and selenium availability in environment, availability which can be influenced by human activities.

A great number of works reported values of selenium content in food. Some examples of these are presented below (as mg/kg):

- 0.4 to 1.5 in liver, kidney and seafood;
- 0.1 to 0.4 in muscles;
- 0.1 to 0.8 in cereals and cereal products;
- 0.1 to 0.3 dairy products;

These values vary from a country to another, partially because they may be influenced by analytical methods and the procedures of preparing the samples [3].

Organs like kidney and liver contain the highest selenium level, but seafood is also rich in selenium, approaching to the same levels. Muscles are significant sources for selenium, although they do not approach to the same selenium levels like in muscles or seafood.

Certainly, the cereal products may improve significantly the selenium presence in the food ratio.

Milk, cheese and eggs have a lower content of selenium but the reported results vary in large limits, because the food is produced and provided by different countries [3].

Fruits and vegetables, generally, contain lower levels of selenium, for all that mushroom and garlic present moderate selenium contents.

2. Materials and method

Our product was obtained with classical methods, in “homemade” conditions, from non-pasteurized milk. This milk was produced in a village area and supplemented with selenium from Pharmasel. Supplementation doses were different: 50, 37.5, 25 și 12.5 µg Se/L milk. The selenium adding was implemented in coagulation phase of milk. Each selenium tablet contained 50 µg Se, 100 mg C vitamine and 20 mg E vitamine. This association of Se with E and C vitamins is very beneficial, because they are in a synergism relation [1, 2, 5].

First, we mention that Se recommended dose for an adult is between 50 and 200 µg Se/day. The highest supplement dose of Se was established at minimum recommended
dose, on the reason that a consumer may ingest also Se from a higher quantity of cheese or from other sources, and the outrun of the maximum dose can be toxic.

The product obtained in according with the technological scheme was sensorial examined in comparison with the product from control sample.

The determinations made until now at the our proposed product were:
- cheese and whey acidity determination - by Torner method [13, 14, 15]
- pH determination of the cheese and whey – by potentiometric method [16];
- mineral content determination from cheese and whey – by spectroscopy method;
- humidity determination – by etuve drying [16].

3. Results and discussion

After the determinations made for whey and cheese with selenium, we obtained the results presented in table 1. This value are the mean between three simultaneous determinations.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>P0 (0 µg Se/L milk)</th>
<th>P1 (12.5 µg Se/L milk)</th>
<th>P2 (25 µg Se/L milk)</th>
<th>P3 (37.5 µg Se/L milk)</th>
<th>P4 (50 µg Se/L milk)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acidity °T</strong></td>
<td>Cheese</td>
<td>40.6</td>
<td>46.0</td>
<td>48.3</td>
<td>48.5</td>
</tr>
<tr>
<td></td>
<td>Whey</td>
<td>48.5</td>
<td>53.0</td>
<td>52.5</td>
<td>52.0</td>
</tr>
<tr>
<td><strong>pH</strong></td>
<td>Cheese</td>
<td>5.5</td>
<td>5.0</td>
<td>5.1</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>Whey</td>
<td>4.5</td>
<td>3.9</td>
<td>3.6</td>
<td>3.6</td>
</tr>
<tr>
<td><strong>Calcium (mg/100 g)</strong></td>
<td>Cheese</td>
<td>624.6</td>
<td>619.8</td>
<td>625.2</td>
<td>615.9</td>
</tr>
<tr>
<td></td>
<td>Whey</td>
<td>39.3</td>
<td>39.4</td>
<td>39.2</td>
<td>39.3</td>
</tr>
<tr>
<td><strong>Magnesium (mg/100 g)</strong></td>
<td>Cheese</td>
<td>32.4</td>
<td>31.6</td>
<td>32.2</td>
<td>30.1</td>
</tr>
<tr>
<td></td>
<td>Whey</td>
<td>7.0</td>
<td>6.8</td>
<td>6.9</td>
<td>7.2</td>
</tr>
<tr>
<td><strong>Sodium (mg/100 g)</strong></td>
<td>Cheese</td>
<td>359.2</td>
<td>584.9</td>
<td>587.0</td>
<td>590.3</td>
</tr>
<tr>
<td></td>
<td>Whey</td>
<td>35.3</td>
<td>35.3</td>
<td>34.6</td>
<td>35.5</td>
</tr>
<tr>
<td><strong>Kalium (mg/100 g)</strong></td>
<td>Cheese</td>
<td>53.0</td>
<td>50.7</td>
<td>55.4</td>
<td>52.8</td>
</tr>
<tr>
<td></td>
<td>Whey</td>
<td>102.8</td>
<td>100.4</td>
<td>103.5</td>
<td>102.0</td>
</tr>
<tr>
<td><strong>Humidity %</strong></td>
<td>Cheese</td>
<td>53.62</td>
<td>50.14</td>
<td>48.06</td>
<td>49.68</td>
</tr>
</tbody>
</table>

From these data may be observed a higher acidity in samples with selenium supplement. While in cheese samples the acidity increase is almost linear, in whey samples was no remark of a significant acidity growing. In according with this parameter, we infered that selenium stimulates development of lactic bacteria – evident issue in cheese samples, where the lactic bacteria are in abundance. For whey case, we may suppose the same issue and a logical explaination (empirical) for the lower acidity growing comparing with cheese can be the selenium bonding at proteins from cheese, while in whey the protein content is significant lower in comparison with cheese. This bonding of selenium may be similar to calcium bonding in casein:

\[
\text{caseine} \left\{ \begin{array}{c}
\text{COO} \\
\text{COO} \\
\end{array} \right\} \text{Ca}^n
\]

\[
\text{caseine} \left\{ \begin{array}{c}
\text{COO} \\
\text{COO} \\
\end{array} \right\} \text{Se}^n
\]
Lowest pH values were remarked in samples with the highest selenium content and reverse. The content of major mineral elements in both kinds of samples is presented in figures 4, 5 and 6. The mineral content from whey makes from it a precious subproduct for zootechnical area, where whey can be administered in fodder of some animals.
The water content from cheese was situated between 48 and 54%; this values frame in maximum legal limits (60-70%) for this product. We have to mention that this parameter didn’t correlate with selenium added in cheese.

![Fig. 7 - Humidity of the cheese.](image)

### 4. Conclusions

The protein from dairy products can be an precious source of selenoprotein in human nourishment.

Selenium supplementation through fresh cheese is a newly product on the romanian market. This issue is very benefical for romanian consumer, because first the fresh cheese is considered a dietetical food, and on the other hand cheese by selenium adding may be considered a „functional food”, while the romanian soil is very poor in selenium.

The selenium benefit can be demonstrated for all consumer (children or adults, health or with health problems), selenium beeing known as a strong antioxidant. In asosiation with C and E vitamins, the antioxidant capacity grows. Included in fresh cheese, selenium is easier to asimilate by the consumer’s organism, having in view that the „support” – fresh cheese – beeing „light” is recommended in each nourishment regime.

Through the advantages of fresh cow cheese, we have to remark that cheese can be prepared in various kinds: cheese creams with diverses vegetables or spices (pepper, dill, ketchup, cumin, onion, garlic, paprika, etc.), appetizers (liptauer, tomato fill with cheese, etc.) all being savoury an healthy.

The major disadvantage of selenium supplementation in cheese is the disagreably (pungent) smell which the product gets after obtaining. This inconvenience is diminished in time (in 24 hour it entirely dissappears). For the camouflage of this smell is recommended adding of some anterior mentioned ingredients. In the case of patisery products preparation with fresh cheese (including selenium) we recomend the adding of vanilla or other specific food flavour or esences.

Our new product „fresh cheese with selenium” presents sensorial and physical-chemical characteristics similar with the basic product (without selenium). However, we observed a light growing of acidity in concordance with selenium growing doses. This fact requests an increasing concerning about packing, preservation and valability terms of this product in comparison with the basic product.

The sensorial exam didn’t remark major differences between basic product and the product with selenium, excepting smell.

The whey remaining after the cheese production is very valuable for zootechnical area due to its mineral content.

The physical-chemical parameters for the analized products framed within the legal limits of romanian commercial legislation.
The necessary tests for introducing this product on the market will continue. We included in this paper only a few of them; other testing works will be soon accomplished.

References
16. *** - Colecția de standarde