

ASSESSMENT OF NITRATE AND NITRITE CONTENT OF ROMANIAN TRADITIONAL CHEESE

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Summary

The nitrate and nitrite levels were determined in 275 samples of traditional cheese or semi-processed cheese, which are produced in Romania by different type of raw milk: cow raw milk, sheep raw milk, combined cow and sheep raw milk (in different percent of combination). The analyzed samples were harvested from the most frequently assortments and type of cheese produced and commercialized in our country. Following the analyses the obtained results reveal a variation of nitrate level between 0.87 to 17.52 mg nitrate/kg (with an average of 3.29 mg/kg) and for nitrite was recorded a variation level between 0.28 to 21.16 mg nitrite/kg (with an average of 3.53 mg/kg). The highest level of nitrate and nitrite were revealed in green cheese (curds) obtained from sheep raw milk.

The nitrate and nitrite contents in analyzed samples of cheese or semi-processed products could be referable to different type of external source (like as contamination by fertilizers sources or the presence of this chemical substances in water which are used in technological process for cheese) but also can be attributed to addition of nitrate or nitrite in curds or green cheese like preservation additive.

Key words: nitrate, nitrite, green cheese, cheese, assortments.

The nitrates and nitrites are chemical compound frequently identified in different types or categories of food products, as a consequence of their presence in raw or auxiliary materials which are used to obtain different finite food products, or because of their use as additives in food technologies. The presence of nitrates in food products can be considered a major risk since they could be reduced in nitrites, either spontaneously in the food products or during the digestive process. The nitrites can be involved in chemical reaction with amides or secondary and tertiary amines which are synthesized in digestive tract, thus producing compounds with carcinogenic potential.

Generally, the nitrate (sodium or potassium salts) is using in cheese products to prevent the growth of different type of bacteria (especially gas-producing bacteria or coliforme bacteria) on maturation period, when these bacteria can produce the late blowing of cheese (Walstra et al., Goodhead et al.). The nitrate could be naturally present in raw milk and the level of it is directly in concordance with quality of feeding (the presence of nitrate in water and in feedstuff) of cattle or sheep. In many areas, water used in agriculture (for irrigation) has relatively high concentrations of nitrate because of pollution by fertilizers and different type of waste effluents. It has to be considered that the nitrate occurs in the range of 1 to 8 mg / kg in cheese made without the addition of nitrate.

The standard for cheese presenting in Codex alimentarius Rev. 4, considers as safe and possible to use the sodium nitrate or a combination of sodium and potassium nitrate, in different assortments of cheese, a maximum level of 50 mg / kg (determined in sodium nitrate) and The European Scientific Committee for Food was established an acceptable daily intake for nitrate of 3.7 mg nitrate by kg of body weight. The nitrite is a chemical compound with higher toxicity than nitrate and for that The European Scientific Committee for Food considering an acceptable daily intake lower of 0.06 mg nitrite by kg of body weight.

The most common assortments of cheese in Romania are salted matured cheese (telemea), fresh cow cheese (cottage cheese) and pressed cheese (cascaval). Many assortments of cheese are produced from combination of cow and sheep milk and they are produced both in traditional system (in small dairy organized in individual household) and in industrial system (milk factory). In generally, for production of cheese in traditional system, the production process has many failures in controlling of hygienic conditions and for that could appear different type of contamination which conduce to development of microorganism in finite products. For that, is frequently used nitrate to prevent possible taint and also to control as far as possible the development the bacteria of Clostridium or Escherichia genus.

In this study was investigate the nitrate and nitrite contents in different samples of traditional cheese or semi-processed cheese (green cheese) which was harvested directly on production places or market places and it was evaluate the potential hazard for consumers.

Materials and methods

For study was harvested and analyzed a total number of 275 samples: 56 samples of cow green cheese, 67 samples of sheep green cheese, 48 samples of salted matured cheese obtained by cow milk, 53 samples of salted matured cheese obtained by sheep milk and 51 samples of pressed cheese.

The method used for quantitative determination of nitrate and nitrite was Standardized Method approved by International Dairy Federation. This method consists in dissolution of samples in warm water (with continuous homogenization and using only deionized water); then is precipitating the protein and fats and quantitative filtration; the nitrate was reduced to nitrite in a part of the obtained filtrate by means off metallic cadmium into glass column; it was developed a red color in shares of both reduced solution and not reduced filtrate by the adding of sulfanilamide and N-1-naphtyl-ethylenediamide. The intensity of obtained color measured at spectrophotometer, using a wavelength of 538 nm and standardized solutions with nitrate. The nitrate content was calculated made the difference between two analytical results. All analyses were executed in duplicate to assure fairly results.

Results and discussions

It was analyzed and evaluated the nitrite and the nitrate content for all cheese samples. The nitrate content is presenting in table 1.

Table 1

The nitrate content in cheese samples

| Specifications | Cow green cheese | Sheep green cheese | Salted matured cow cheese | Salted matured sheep cheese | Pressed cheese |
|-------------------------------------------------|------------------|--------------------|---------------------------|-----------------------------|----------------|
| Total number of analyzed samples | 56 | 67 | 48 | 53 | 51 |
| Quota of samples with under 1 mg/kg nitrate (%) | 69.64 | 65.67 | 66.67 | 73.58 | 92.16 |
| Quota of samples with 1 - 5 mg/kg nitrate (%) | 8.93 | 11.94 | 14.58 | 9.43 | 5.88 |
| Quota of samples with 6 - 10 mg/kg nitrate (%) | 12.50 | 8.95 | 10.42 | 3.77 | 1.96 |
| Quota of samples with 11 - 15 mg/kg nitrate (%) | 3.57 | 5.97 | 6.25 | 7.55 | 0 |
| Quota of samples with 16 - 20 mg/kg nitrate (%) | 5.36 | 7.46 | 2.08 | 5.66 | 0 |
| Quota of samples with over 20 mg/kg nitrate (%) | 0 | 0 | 0 | 0 | 0 |
| Average value in nitrate (mg/kg) | 4.23 | 5.37 | 2.78 | 3.14 | 0.97 |

Nitrate content for analyzed samples was found between 0.87 to 17.52 mg/kg and the recorded variation was in directly dependence at age of cheese (in generally the nitrate decrease during the maturation and storage stages). The high recorded values of nitrate were found in green cheese obtained from sheep raw milk. This fact could be explained through particularly system of processing: in

generally the sheep green cheese are produced in small dairy farms, the production technique which are not used correctly and for that the failure in hygienic conditions cause defects in cheese. This is the reason to use small quantities of nitrate for preservation of cheese (to prevent eventually losses of cheese because of contamination with different bacterial species).

The level of nitrite content and percent of nitrite value from different analyzed samples are showing in table no. 2.

Table 2**The nitrite content in cheese samples**

| Specifications | Cow green cheese | Sheep green cheese | Salted matured cow cheese | Salted matured sheep cheese | Pressed cheese |
|-------------------------------------------------|------------------|--------------------|---------------------------|-----------------------------|----------------|
| Total number of analyzed samples | 56 | 67 | 48 | 53 | 51 |
| Quota of samples with under 1 mg/kg nitrite (%) | 73.21 | 56.72 | 72.92 | 75.47 | 88.23 |
| Quota of samples with 1 - 5 mg/kg nitrite (%) | 12.50 | 11.94 | 14.58 | 11.32 | 3.29 |
| Quota of samples with 6 - 10 mg/kg nitrite (%) | 5.36 | 8.95 | 4.17 | 5.66 | 5.88 |
| Quota of samples with 11 - 15 mg/kg nitrite (%) | 3.57 | 10.45 | 6.25 | 1.89 | 1.96 |
| Quota of samples with 16 - 20 mg/kg nitrite (%) | 1.78 | 7.46 | 2.08 | 3.77 | 0 |
| Quota of samples with over 20 mg/kg nitrite (%) | 3.57 | 4.48 | 0 | 1.89 | 0 |

| | | | | | |
|-----------------------------------------|-------------|-------------|-------------|-------------|-------------|
| Average value in nitrite (mg/kg) | 5.27 | 6.28 | 2.13 | 2.76 | 1.23 |
|-----------------------------------------|-------------|-------------|-------------|-------------|-------------|

The analyses for nitrite contents reveal a level of variation between 0.28 to 21.16 mg/kg. The high recorded values of nitrites was found in green cheese, both of sheep green cheese and cow green cheese, but the higher values was found for curds which are obtained from sheep raw milk. The presence of nitrite was found in a number of samples which was negative for nitrate. The average of nitrite value was 3.53 mg/kg and the higher level was recorded for green cheese obtained from sheep raw milk (6.28 mg/kg).

The nitrite and nitrate content of 73.27 % of all cheese samples were found lower than 1 mg/kg and it possible to be derived from the natural nitrate or nitrite content in water or feedstuff (with animal diet origin).

Conclusions

1. In total number of analyzed samples the average of nitrate and nitrite was found at 3.29 mg/kg and respectively at 3.53 mg/kg. This level could be considering lowest and non-dangerous for consumers.
2. The highest level of nitrate and nitrite was found in green cheese (17.52 mg/kg and respectively at 21.16 mg/kg) obtained from sheep milk. For nitrite contents a percent of 7.46 samples showed a level between 16 to 20 mg nitrite / kg and a percent of 4.48 samples revealed a higher level of nitrite (over 20 mg/kg).
3. The lowest level of nitrate and nitrite was found in pressed cheese, the average was 0.97 mg/kg for nitrate content and respectively 1.23 mg/kg for nitrite content.
4. The high recorded values could be attributed to addition of the nitrates and nitrites to the curds. For that, stricter control of the use of nitrate and nitrite in cheese is necessary because of possibility to disguise the hygienic conditions during the technological process.

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