OPEN ACCESS Potravinarstvo® Scientific Journal for Food Industry

potravinárstvo®

*Potravinarstvo*, vol. 9, 2015, no. 1, p. 247-251
doi:10.5219/470
Received: 12 March 2015. Accepted: 3 June 2015.
Available online: 1 August 2015 at www.potravinarstvo.com

ISSN 1337-0960 (online)


# THE QUALITY OF PROCESSED CHEESES AND CHEESE ANALOGUES THE SAME BRAND DOMESTIC AND FOREIGN PRODUCTION

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## ABSTRACT

Processed cheeses belong to Slovakia favorite dairy products. Processed cheeses are made from natural cheeses. In recent years the trend is to replace natural cheeses with other raw materials of non-dairy nature. The composition of the processed cheese analogues is not in many countries defined by legislation. The objective of this study was to determine and compare chemical properties (fat, dry matter, fat in dry matter, NaCl) two samples of processed cheeses (C, D – Veselá krava) and two samples cheese analogues (A, B - Kiri) the same brand domestic and foreign production. The evaluated was taste of processed cheeses and cheese analogues, too. Chemical analysis and sensory analysis were repeated four times. The results of chemical analysis shows that all rated samples processed cheeses made on Slovakia fulfilled demands declared (dry matter and fat in dry matter) as producers provided on the label. The most commonly fluctuate content of NaCl from 1 to 1.24 g.100g$^{-1}$. The higher coefficient of variation in the determination of NaCl (3.88%) was found in processed cheeses made in France. Processed cheese and cheese analogues made in France had not specified parameters for dry matter and fat in dry matter on the label. For production cheese analogues Kiri made in Slovakia was used different raw material than Kiri made in France. The taste of products was determined by descriptors – salty, slightly sweet, milky, buttery-creamy, fatty, sour, bitter, and unknown. The interesting that Kiri made in Slovakia had stronger milky and buttery-creamy taste than cheese analogue Kiri made in France. Significant differences were found in the slighty sweet taste of processed cheeses, the most points won processed cheese Veselá krava made in Slovakia.

**Keywords:** processed cheese; cheese analogues

## INTRODUCTION

The term "processed cheese" describes a dairy product made by heating a mixture of various cheese types of different degrees of maturity in the presence of appropriate emulsifying salts (mostly sodium phosphate, polyphosphates, citrates and/or their combinations), usually under reduced pressure (vacuum) with constant stirring, commonly in the temperature range of 90 – 100 °C, until a smooth and homogenous compact mass is formed with desired textural properties **(Kapoor and Metzger, 2008; Sołowiej et al., 2014; Salek et al., 2015).**

Key components for the production of processed cheeses are emulsifying salts (ES). Application of ES has several functions in the creation of a stable emulsion (homogenous and not phase separated), until spray drying for cheese powder, or during cooling and storage for processed cheese, e.g., binding of $Ca^{2+}$, pH adjustment, casein dispersion and fat emulsification **(Nagyová et al. 2014; Hougaard et al., 2015)**.

The products from natural cheeses in that they are not made directly from milk (or dehydrated milk), but rather from various ingredients such as skim milk, natural cheese, water, butter oil, casein, caseinates, other dairy ingredients, vegetable oils, vegetable proteins and/or minor ingredients. The two main categories, namely pasteurized processed cheese products (PCPs) and analogue cheese products (ACPs) **(Guinee et al., 2004)**.

There are various types of PCPs (e.g., processed cheese, cheese spread, and cheese foods) defined by national legislation. Such legislation defines the composition, natural cheese content (ranging from 51 to about 96% of the final dry matter), and permitted ingredients for the different types. Optional ingredients may include dairy ingredients, condiments, flavors, colors, and preservatives **(Guinee, 2011)**. Cheese analogues are usually defined as products made by blending individual constituents, including non-dairy fats or proteins, to produce a cheese-like product to meet specific requirements. They are being used increasingly due to their cost-effectiveness, attributable to the simplicity of their manufacture and the replacement of selected milk ingredients by cheaper vegetable products **(Cunha et al., 2010)**.

Sales of cheese analogues are closely linked to developments in the convenience food sector, where they extend the supply and lower the cost. Moreover, there is an ever-increasing interest among consumers in food products which contain less total fat, saturated fat, cholesterol, and calories. Development of cheese analogues involves the use of fat and/or protein sources other than those native to milk, together with a flavour system simulating as closely as possible that of the natural product. It is also necessary to develop a suitable processing regime capable of

combining these elements to provide the required textural and functional properties **(Bachmann, 2001)**.

Regarding processed cheese, several studies have been carried out on sensory characterization in relation to processing factors and chemical composition. Their effects on structure, texture and rheological properties have been studied in order to improve our understanding and obtain acceptable products **(Hanaei et al., 2015)**.

The objective of this study was to determine and compare chemical properties (fat, dry matter, fat in dry matter, NaCl) two samples of processed cheeses (C, D – Veselá krava) and two samples cheese analogues (A, B - Kiri) the same brand domestic and foreign production.

## MATERIAL AND METHODOLOGY

### *Material*

For evaluation were used 2 samples of processed cheeses – C, D and 2 samples of cheese analogues – A, B the same brand. Composition of cheeses showed Table 1.

### *Chemical analysis*

Dry matter was determined by drying at 102 ±2 °C according to **ISO 5534:2004**.

Fat content was measured by the method of van Gulik according to **ISO 3433:2008**.

Fat in dry mater was determined by mathematical calculation.

NaCl content in cheeses was determined by methodology described by **Cvak et al. (1992)**.

### *Sensory evaluation*

Sensory analysis was attended by five lay tasters. The taste of products was determined by descriptors – salty, slightly sweet, milky, buttery-creamy, fatty, sour, bitter and unknown. The rating was done by assigning points of 0 to 5. The descriptors were described by **Horčin (2002)**.

Chemical analysis and sensory analysis were repeated four times.

## RESULTS AND DISCUSSION

### *Chemical analysis*

The results of the selected chemical parameters of cheeses showen Tables 2.

As shown in Table 2 the composition of cheese analogue Kiri produced in Slovakia was almost unchanged. The evaluated product has declared on the package label the fat content in the dry matter of 65% and 41.5% dry matter. Our results confirm (given the accuracy of the methods) declare content of the fat in dry mater. The dry matter of the analyzed products was even higher than the goverment requirements. Unchanging salt content in these products probably related with the fact, that the base formula of the product was formed by a curd and not by the sweet natural cheeses. Especially for sweet natural cheeses contain higher amount of salt, which is influenced by more factors. From that reason content of salt in sweet cheeses fluctuates, which of course must also be reflected in variouse salt content in processed cheeses.

On the package label of the Kiri product (made in France) were not declared content of dry matter and content of fat in dry matter, except content of salt. Consequently, it was not possible to determine whether it satisfies the quality. Since it is the same brand name of one company (sample A was produced in Slovakia and sample B in France), so the values could be compare with each other. In the comparison of these two products was detected the same content of NaCl, while in the products from the French production, salt content fluctuated significantly. Non significantly higher content of fat and fat in dry matter were determined in the Kiri product, which was made in France. The interesting point of this comparison was that both products were manufactured from different raw materials – Table 1.

In the product Veselá krava (made in Slovakia) often fluctuated fat in dry matter and NaCl content. The evaluated product has declared on the package label fat content in the dry matter 45% and dry matter content 40%. Our results confirm these declared parameters.

**Table 1** Composition samples of processed cheeses and cheese analogues declared on the label

| Sample | Materials | Composition |
|---|---|---|
| **A** | curd 76% (50% cream), water, butter, milk proteins, emulsifying salts: E452, E341, E331, E330, salt, milk protein concentrate, thickener: E407 | fat in dry matter 65%, dry matter 41.5% |
| **B** | cream cheese (50%), cream (27%), water, milk protein, emulsifying salts: E341, E452, E339, E331, sodium chloride, mineral substances, milk, stabilizers: E407. The salt content of at least: 0.7%. | not specified |
| **C** | skimmed milk, cheese, butter, emulsifying salts: E452, E341, E450, E330, milk protein, salt | fat in dry matter 45%, dry matter 40% |
| **D** | skimmed milk, cheese, butter, emulsifying salts: E452, E341, E450, E330, milk protein, salt | not specified |

A – Kiri, Slovakia; B – Kiri, France; C – Veselá krava, Slovakia; D – Veselá krava, France;

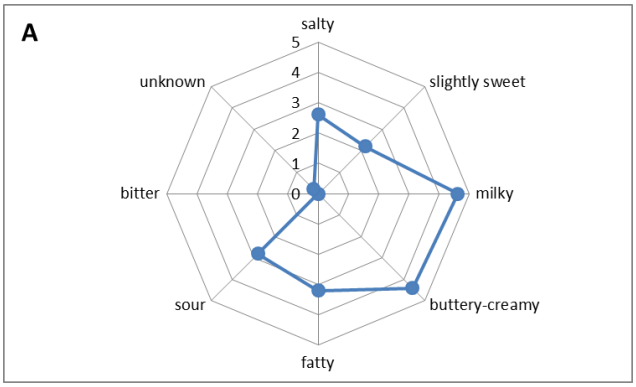


**Figure 1** The taste of „Kiri“ samples manufactured in Slovakia.

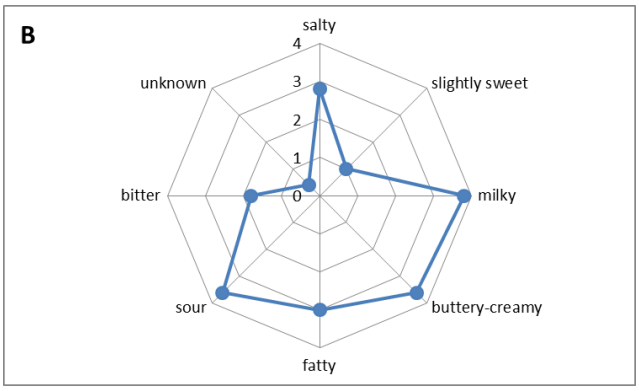


**Figure 2** The taste of „Kiri“ samples manufactured in France.

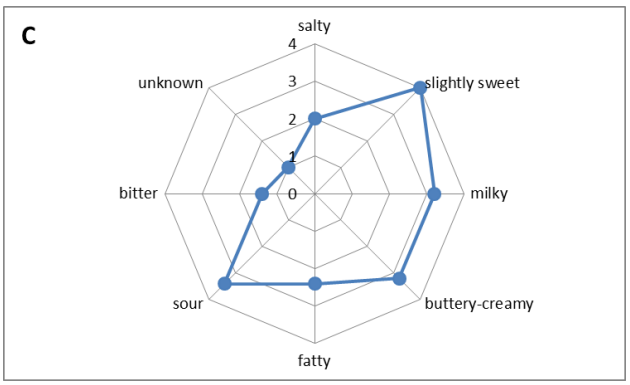


**Figure 3** The taste of „Veselá krava“ samples manufactured in Slovakia.

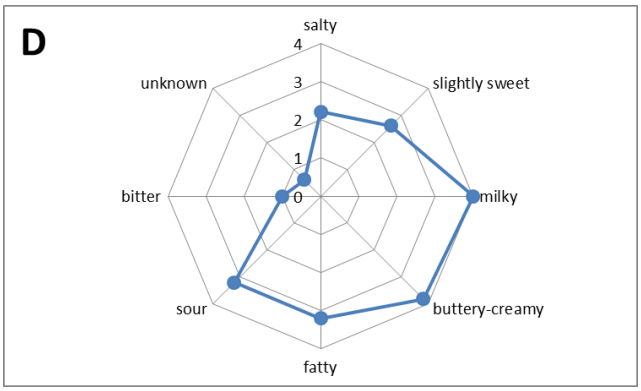


**Figure 4** The taste of „Veselá krava“ samples manufactured in France.

The dry matter content and content of NaCl most commonly fluctuated in the products of Veselá krava manufactured in France (D). On the package label of this product were not declared contents of these parameters. Since it is the same brand name of one company (sample C was produced in Slovakia and sample D in France), so the values could be compare with each other. The processed cheese Veselá krava manufactured in Slovakia has higher salt content and the value of fat in dry matter. However, on the package label of both products were declared the same raw materials.

From the results can be concluded that most frequently fluctuated content of salt. The determination of salt content is not assessed by statutes. The average sodium content in the processed cheese reported by **Vojtaššáková et al. (2000)** is 751 – 1347 mg.100 $g^{-1}$. According to **Dostálová (2005)** many products contains a higher amount of sodium than 1000 mg.100$g^{-1}$, which is in accordance with our results.

For healthier population is necessary to ensure consumption of safety foods. However, permits of these foods on the market are often not possible, because the foods contain higher amount of salt which is responsible for various health problems such as the cardiovascular disease **(Zachar, 2008)**.

Among cheeses made in Slovakia and France were not determined significant differences.

***Sensory analysis***

Results of the sensory evaluation showen Fig. 1 – 4.

Panelists most often detected milky flavor and buttery-creamy taste after evaluation of Kiri samples manufactured in Slovakia. The bitter taste was not detected.

The milky flavor and creamy-buttery flavor were most intensive in Kiri samples manufactured in France. Interested is that Kiri produced in Slovakia has strong milky and buttery-creamy taste than the cheese of same brand manufactured in France.

**Panovská et al. (2001)** reported that the cheeses with low fat contents are perceive as more salty but less creamy and

In the product „Veselá krava“ manufactured in Slovakia, panelist most often detected slightly sweet taste and sour taste. Salty taste of processed cheese Veselá krava manufactured by Slovakia to obtain less points than Veselá krava manufactured by France.

The same milky flavor and creamy-buttery flavor which were detected in Kiri samples manufactured in France were also most intensive in Veselá krava samples manufactured in same country. From the evaluation of taste Panelists found that among samples manufactured in Slovakia and France were significant differences. It is probably due to with cheeses used for production of these products.

**Table 2** Chemical composition of processed cheeses and cheese analogues.

| Sample | Parameter | Fat (g.100g$^{-1}$) | Dry matter (g.100g$^{-1}$) | Fat in dry matter (%) | NaCl (g.100g$^{-1}$) |
|---|---|---|---|---|---|
| **A** | $\bar{x}$ | 28.13 | 43.66 | 64.42 | 1.03 |
| | $x_{min}$ | 27.75 | 4.64 | 63.59 | 1.03 |
| | $x_{max}$ | 28.25 | 43.70 | 64.73 | 1.03 |
| | $s_x$ | 0.25 | 0.03 | 0.55 | 0 |
| | v (%) | 0.89 | 0.06 | 0.85 | 0 |
| **B** | $\bar{x}$ | 29.68 | 44.50 | 66.71 | 1.03 |
| | $x_{min}$ | 28.75 | 44.42 | 64.56 | 1.00 |
| | $x_{max}$ | 30.25 | 44.63 | 68.08 | 1.07 |
| | $s_x$ | 0.66 | 0.10 | 1.58 | 0.04 |
| | v (%) | 2.22 | 0.20 | 2.26 | 3.88 |
| **C** | $\bar{x}$ | 19.13 | 41.36 | 46.24 | 1.20 |
| | $x_{min}$ | 18.75 | 41.26 | 45.13 | 1.16 |
| | $x_{max}$ | 19.50 | 41.55 | 47.26 | 1.24 |
| | $s_x$ | 0.32 | 0.13 | 0.91 | 0.03 |
| | v (%) | 1.67 | 0.31 | 1.97 | 2.49 |
| **D** | $\bar{x}$ | 18.75 | 41.73 | 43.59 | 1.03 |
| | $x_{min}$ | 18.00 | 41.28 | 42.57 | 1.00 |
| | $x_{max}$ | 18.25 | 42.87 | 44.14 | 1.06 |
| | $s_x$ | 0.13 | 0.77 | 0.73 | 0.03 |
| | v (%) | 0.66 | 1.82 | 1.65 | 2.91 |

A – Kiri, Slovakia; B – Kiri, France; C – Veselá krava, Slovakia; D – Veselá krava, France;
$s_x$ – standard deviation, v – coefficient of variation

## CONCLUSION

Based on these results it can be concluded that the products from Slovakia contains declared composition, which is labeled on package and in conformity with legislative requirements. The quality of evaluated processed cheeses produced in Slovakia and abroad is very good. Efforts of manufacturers should be a tendency of going back to the original recipe and not the substitution by cheeses and milk commodities, various stabilizers and emulsifiers, which also leads to the use of a wider range of melting salts. From the observed results can be concluded that it should be aware to consumption of processed cheese and processed cheese products with relatively high content of salt in high amount.

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**Acknowledgments:**

This work was co-funded by European Community under project no 26220220180: Building Research Centre „AgroBioTech".

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