Annals of the University of Oradea, Fascicle: Ecotoxicology, Animal Husbandry and Food Science and Technology, Vol. XIX/A 2020
Analele Universitatii din Oradea, Fascicula: Ecotoxicologie, Zootehnie si Tehnologii de Industrie Alimentara, Vol.XIX/A 2020

COMPARISON BETWEEN THE MAXIMUM INCLUSION OF ESSENTIAL FATTY ACIDS IN THE SANA COMPARED TO THE MATURE TELEME CHEESE

Hîlma Elena*

*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea, Romania, e-mail: hilma_elena@yahoo.com

Abstract

Two dairy products from two different categories were produced in the manufacturing system. The two products are: sana, from the category of acidic dairy products and matured teleme cheese, from the category of cheeses.

Because dairy products are low in essential fatty acids, their aim is to enrich them in these components. Given that milk fat is found in the form of globules wrapped in an elastic lyopoprotein membrane, it is proposed to incorporate fatty acids from fish oil into milk fat globule raw material used in the manufacture of products and protect them during the technological process.

They were obtained, three samples of jelly and matured Telemea cheese were obtained and the percentage of fish oil added in milk was progressive, respectively: 0.05%; 0.10% and 0.015%. Witness samples were also produced, without the addition of fish oil.

We analyzed the maximum limit of three essential fatty acids in fish oil that are representative of milk composition and fish oil composition.

For the three essential fatty acids studied, the maximum limit of fish oil added to milk in order to incorporate them into the fat globule of milk was for telemea cheese matured in the case of 0.0950% linoleic acid, in the case of 0.1050 γ – linolenic acid.

Also in the case dairy acid products sana these percentages are: in the case of linoleic acid it does not exist, in the case of linolenic acid of 1,3009% and in the case of γ-linolenic acid of 1,4090.

The statistical analysis shows a difference between sana and mature telemea of 1.047% in terms of concentration of fish oil added to milk at the maximum limit of incorporation of essential fatty acids in lactic fat.

Key words: sana, ripened teleme cheese, essential fatty acids.

INTRODUCTION

The fermentation of lactose into lactic acid by lactic acid bacteria is a safe and environmentally friendly technology that can alter the function of food ingredients (including proteins). These fermentations also reduce the content of free sulfhydryl (SH) (Liangjie Tian, 2020).

Two strains of lactic acid bacteria (LAB) (Lactobacillus rhamnosus and Lactococcus lactis) and one strain of yeast (Saccharomyces cerevisiae),

alone or in combination, reduce the levels of aflatoxin M1 (AFM1) in cheese during 30 days of storage (Bruna Leonel Gonçalves, 2020).

Lactic bacteria (LAB) (Lactococcus lactis FT27 and Carnobacteroim divergens SCA) but also their combination have antilisterial activity against four Listeria monocytogenes biotypes isolated from matured cheese (Stefano Morandi, 2020).

Lactococcus lactis subsp. Lactis are lactic acid bacteria capable of producing nisin, which is an effective antilisterial peptide that could be used to design active food packaging.

Packaging supplemented with protein hydrolysates or sodium caseinate inhibits the growth of the pathogen during the 21 days of storage at 4 ° C. This was due to the generation of organic acids by lactic acid bacteria. Therefore, packaging lined with nutrient-supplemented films can act as carriers of L. lactis and can contribute to increasing the safety of pasteurized drinking milk but also of refrigerated dairy products (Laura Settier-Ramírez, 2020).

Enterococcus fecalis 2/28, isolated from artisanal cheese, have the ability to release bioactive biopeptides from serum proteins.

These peptides may have inhibitory activity on the angiotensin I converting enzyme (ACE) and dipeptidyl peptidase IV (DPP-IV), with ACE inhibition being stronger than that of DPP-IV. (Paulina Worsztynowicz, 2019)

The interactions of exopolysaccharides and proteins are of great importance in food science.

This is favored by lactic acid bacteria in the binding of hetero-polysaccharides to various milk proteins (β-casein, K-casein, native and heat-treated, β-lactoglobulin) at pH 4.0–5.0 (Johnny Birch, 2017).

In addition to lactic acid bacteria and nutrients in milk and dairy products, the beneficial influence of essential fatty acids is known.

Essential fatty acids (EFAs) as food supplements are used in the treatment of dry eyes to reduce inflammation in the eye surface. EFAs can interact with tear lipids and affect tear stability (Poonam Mudgi, 2020).

Dry eye is a common condition that can severely affect your quality of life. Systemic and topical omega-3 fatty acids and omega-6 fatty acids may have been used as a treatment for patients with dry eye disease and have shown promising results (Ammar M. Al Mahmood, 2014).

Fish is an important source of essential fatty acids. Fish is also a pure protein resource. For a balanced diet, romanians should eat about two fish or seafood meals a week.

According to statistics, at the moment in Romania we consume, on average, a fish meal every three weeks, which is extremely low (Morna Anamaria, 2017).

It is therefore beneficial to enrich dairy products in essential fatty acids by adding fish oil.

Unsaturated fats also improves the rheological qualities of the prosus (Morna Anamaria, 2018).

MATERIAL AND METHOD

The two dairy products that were analyzed were obtained in the manufacturing system. Sheep milk was used harvested in April period which is characterized by a lower concentration of milk components, including fat.

The raw milk was added fish oil, liver tone.

The mixture of milk and fish oil was homogenized in order to incorporate the fatty acids from fish oil into the fat globule of sheep's milk.

The process of obtaining the products has been modified in order to protect both the fatty acids and the quality of the finished products.

For this purpose, the maturation period of the cheese samples was reduced to two thirds of the nominal one by increasing the temperature by about 2-3 ° C.

The acidity of the milk and by-products was monitored using the method for determining titratable acidity. The areometric method was used to analyze the milk density.

The fat percentage of raw milk and finished products was determined using the acid-butyrometric method.

Organoleptic analysis of the cheese samples was performed by three unauthorized persons. It has been appreciated, in particular, the flavor and aroma of the products which can be affected by the fish taste of fish oil added.

The total dry matter of the cheese samples was analyzed by the oven drying method and the salt content was determined by the Mohr method.

The fatty acids in the samples were analyzed by gas chromatography. 19 saturated and unsaturated fatty acids were analyzed, of which 3 essential fatty acids were analyzed.

For analysis of the results staticstică methods were used for comparison between the samples and the control sample compared to the ANOVA.

The maximum point of incorporation of fatty acids from fish oil into the milk fat globule with the Receiver Operator Characteristic (R.O.C.) curves has been established.

RESULTS AND DISSCUSIONS

In this study we were made two dairy where it tried incorporation of essential fatty acids in fish oil added to raw milk sheep. Fish oil was added in progressive concentrations as follows: 0.05%; 0.10%; 0.15%. There was also a control sample without the addition of fish oil.

The coding of the samples is presented in table no. 1

Table 1

Coding of samples

No. cr.	Add fish oil %	Sample code	
		Sana	matured teleme cheese
1	0	S_0	Tm_0
2	0,0,5	$S_{0,05}$	$Tm_{0,05}$
3	0,10	$S_{0,10}$	$Tm_{0,10}$
4	0,15	$S_{0,15}$	$Tm_{0,15}$

In the presented analysis, 19 fatty acids from the composition of the 4 samples of sana and 4 samples of matured teleme cheese were determined by gas chromatography.

The evolution of saturated fatty acids (SFA), monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA) was analyzed. It can be seen that the addition of fish oil in sheep's milk raw material used to obtain samples decreases the concentration in SFA and increases the concentration in MUFA.

The decrease in SFA occurs by 1.89 percent in the samples of sana and by 2.49 in the samples of matured teleme. Therefore the superior evolution in the case of the samples of matured teleme.

The increase in MUFA occurs by 2.49 percent in the samples of sana and by 0.6 in the samples of matured teleme. These results are not conclusive because they do not depend on the addition of fish oil.

The concentration of PUFA is clearly increasing by increasing the concentration of fish oil added to milk.

This demonstrates that the polyunsaturated fatty acids in the composition of fish oil are found in samples of manufactured dairy products.

Evolution of unsaturated fatty acids in samples of matured teleme compared to those of sana: it is observed that in the cheese samples the increase is by 0.9 percent and in the case of the sana samples it is 1.22. In conclusion, sana samples more effectively incorporate essential fatty acids from fish oil added to raw milk.

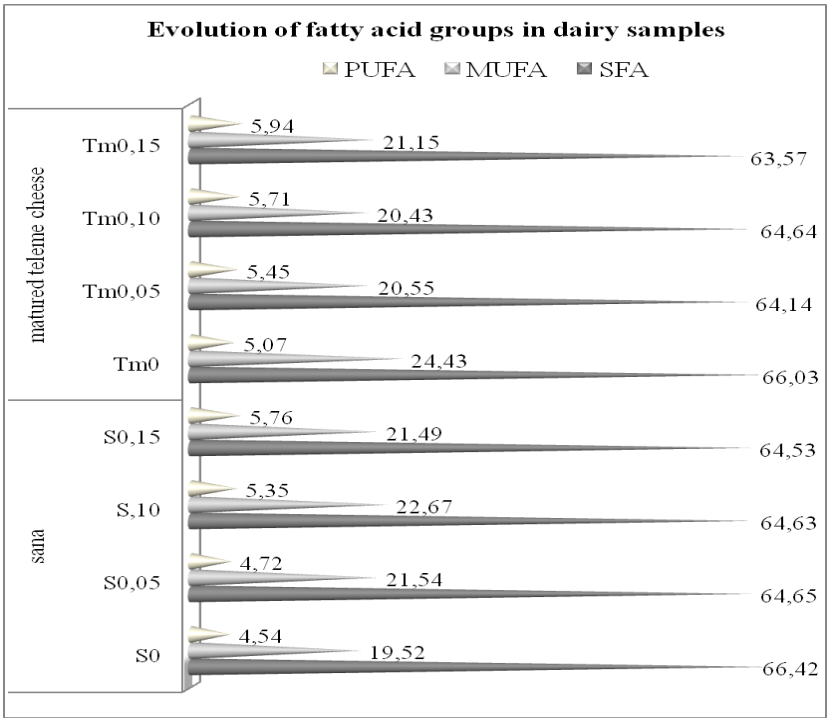

Figure 1 Evolution of fatty acid groups in dairy samples

Among the PUFAs, three essential fatty acids were analyzed, which are specific for both the composition of sheep's milk and fish oil: linoleic acid, linolenic acid and **γ** -linolenic acid. The concentrations of fish oil at the maximum incorporation limit of those three essential fatty acids analyzed are shown in figure 2.

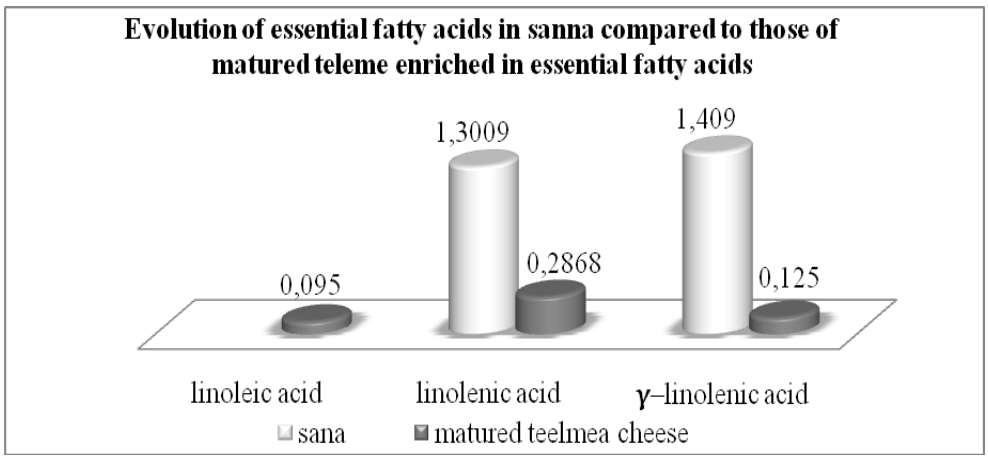

Figure 2 Evolution of essential fatty acids in sanna samples compared to those of matured teleme enriched in essential fatty acids

In figure 2 it is seen that the samples of linoleic acid buttermilk if there is no maximum limit for embedding. This is due to the pasteurization of milk at high temperature which can cause thermal breakdown of the fat globule membrane. Linoleic acid has an embedding limit of about 4 times higher in matured teleme and **γ**-linolenic acid more than 10 times.

CONCLUSIONS

The addition of fish oil in the raw material milk used in the manufacture of sana and matured teleme cheese increases the concentration of essential fatty acids in the two products obtained in the manufacturing system and analyzed.

The study showed that dairy products enriched in essential fatty acids can be obtained by adding fish oil.

Analyzing the concentration of added fish oil, at the maximum incorporation limit, it can be seen that those studied are appropriate. It should be considered in this regard, that under industrial conditions occurring biochemical changes that can determine variations in the evolution of essential fatty acids.

If we consider the sana dairy product and the matured telemea cheese, it can be stated that the incorporation of fatty acids from fish oil into lactic fat is superior in the case of sana compared to that of cheese.

REFERENCES

1. Bruna Leonel Gonçalves, Khurram Muaz, Carolina Fernanda Sengling Cebin Coppa, Carlos Humberto Corassin, 2020, Aflatoxin M1 absorption by non-viable cells of lactic acid bacteria and Saccharomyces cerevisiae strains in Frescal cheese, Food Research InternationalOctober 2020...First available on 28 July 2020;
2. Laura Settier-Ramírez, Gracia López-Carballo, Rafael Gavara, Pilar Hernández-Muñoz, 2020, PVOH/*protein* blend films embedded with *lactic* acid bacteria and their antilisterial activity in pasteurized milk, International Journal of Food Microbiology2 June 2020...First available on 30 January 2020;
3. Paulina Worsztynowicz, Wojciech Białas, Włodzimierz Grajek, Integrated approach for obtaining bioactive peptides from whey *proteins* hydrolysed using a new proteolytic *lactic* acid bacteria, Food Chemistry, 15 May 2020...First available on 17 December 2019;
4. Johnny Birch, Hörður Kári Harðarson, Sanaullah Khan, Birte Svensson, 2017,
5. Effect of repeat unit structure and molecular mass of *lactic* acid bacteria hetero-exopolysaccharides on binding to milk *proteins*, Carbohydrate Polymers1 December 2017...First available on 18 August 2017;
6. Liangjie Tian,Shuting Hu, Jie Jia,Xiang Duan,2020, Effects of short-term fermentation with lactic acid bacteria on the characterization, rheological and emulsifying properties of egg yolk, Food Chemistry30 March 2021...First available on 24 September 2020;
7. Stefano Morandi, Tiziana Silvetti, Vito Vezzini, Milena Brasca, 2020, How we can improve the antimicrobial performances of lactic acid bacteria? A new strategy to control Listeria monocytogenes in Gorgonzola cheese, Food MicrobiologySeptember 2020...First available on 18 March 2020;
8. Ammar M. Al Mahmood, Samar A. Al-Swailem, 2014, *Essential fatty acids* in the treatment of dry eye syndrome: A myth or reality?, Saudi Journal of OphthalmologyJuly–September 2014...First available on 24 June 2014;
9. Merliţă D., C. Maerescu, St. Daraban, F. Lup. 2009. Effects of energy and protein content in the diet on milk yield and milk fatty acid profile in dairy ewes. Bulletin USAMV Cluj-Napoca, Animal Science and Biotechnologies, 66(1-2), ISSN 1843-5262, p: 67-73;
10. Mierliţă D., F. Lup, C. Maerescu. 2009. Nutritional and technological factors inorder to obtain functional food enriched with PUFA Omega 3 and CLA at sheep: a review. Analele Univ. din Oradea, Fascicula: Ecotoxicologie, Zootehnie şi Tehnologii de Industrie Alimentară, ISSN 1583-4301;
11. Morna Anamaria, 2017, RESEARCH ON CONSUMPTION AND PURCHASING OF FISH AND FISHERY PRODUCTS IN BIHOR COUNTRY, Annals of the University of Oradea, Fascicle: Ecotoxicology, Animal Husbandry and Food Science and Technology, Vol. XVI/B 2017;
12. Morna Anamaria, 2018, RHEOLOGICAL BEHAVIOR AND SENSORY EVALUATION OF COMMERCIAL MAYONNAISE, Annals of the University of Oradea, Fascicle: Ecotoxicology, Animal Husbandry and Food Science and Technology, Vol. XVII/B 2018;

13. Poonam Mudgi, 2020, Evaluation of use of *essential fatty acids* in topical ophthalmic preparations for dry eye 9, The Ocular Surface January 2020...First available on 4 October 2019;
14. Teuşdea, A. C., Modog, T., Mancia A., Drăgan Dan. 2008. Deformations analisys with fourier correlation. Annals of DAAAM for 2008 & Proceedins of the 19th International DAAAM Symposium, "Intelligent Manufacturing & Automation: Focus on Next Generation of Intelligent Systems and Solutions", 22-25th October, ISBN 978-3-90150-958-X (ISI Proceedings M/IT);
15. Teuşdea, A.; Modog, T.. 2008. Fourier correlations of dam horizontal movements time series. Journal of Electrical and Electronics Engineering, ISSN 1844 – 6035, Editura Universităţii din Oradea, Oradea, pg. 267-270.