CHANGES IN CONCENTRATIONS IN FATTY ACIDS IN SPUN PASTE CHEESE OF SHEEP'S MILK WITH FISH OIL DURING MATURATION

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Abstract

Spun fresh cheese paste is made from sheep's milk harvested in April, the first period of lactation when the milk solids concentration is minimal, but essential fatty acids content is maximum light and natural food, unripened raw pasture. Cheese ripening period is reduced to 15 days by increasing the ripening temperature from 14-16 to 16-18 , respectively about 2-3 , to protect against biochemical processes essential fatty acids and microbiological that occur during maturation. o avoid loss of fatty acids during the processes of sheep milk with added fish oil was homogenized for an inclusive fish oil globules of fat which is protective membrane and the stability of the product during the FOT pasteurize temperatures of 72-74 for 25 sec. They obtained three samples of cheese with the addition of 0% fish oil, blank, 0.05% and 0.15% fish oil added to raw milk. Fatty acids were analyzed by gas chromatography gas. Following results were obtained in samples aged cheese with added increasing percentage of fish oil: linoleic acid-2, 53%, 3.00%, 3.15% linolenic acid-0, 84%, 1.20 %, 1.39% γ-lonolenic acid-1.09%, 1.26%, 1.31%, and fresh cheese comparpativ: linoleic acid-2, 53%, 2.83%, 2.93%; linolenic acid-0, 89%, 1.08%, 1.15%, acid-γ-lonolenic 0.87%, 0.91%, 1.31%.

Key words: fresh and ripened cheese, essential fatty acids

INTRODUCTION

Maturation of cheese curd cheese heated to obtain partial distortion of the aims of the partial hydrolysis of proteins and their lipid which increases digestive capacity of the product in the body. Materials are also giving creamy consistency, taste and flavor ripened cheeses. razing sheep on areas rich in volatile flavor and aroma print their milk, characteristics that are transferred in cheese. Chrysanthemum coronarium pasture so the taste and aroma of fresh cheese prints of cheese matured (Cabiddu et all, 2006, Buchin et al., 2002, Addis et all, 2006). Cheese ripening cheese is cruel but necessary because fresh cheese components are hard to assimilate into the human body.

To avoid distortion of biologically-active substances are studied several techniques to accelerate ripening. Acceleration is obtained and cheese ripening characteristics between those obtained from raw milk and pasteurized milk (Li Juan Yuet et all, 2010). Increase temperature to 18 º C has been shown to accelerate cheese ripening process with increased lipolysis and increasing the percentage of free fatty acids without leading to their degradation. (Guillermo A.et all, 2007). K-carrageenan using enzyme resulted β-casein increased proteolysis, cheese characteristics thus obtained were not affected (K. Kailasapathyet all, 2005). To accelerate the cheese ripening was investigated β-cyclodextrin treatment (β-CD). Acceleration of maturation was achieved by obtaining short-chain fatty acids and amino acids. At the same time to reduce the cholesterol in cheese made with approximately 90%. They improved sensory characteristics while reducing the period of maturation avoiding risk of bitter and rancid taste. (K. H. Seon, and others, 2009). Recent research on aging cheese took place under the action of lactic bacteria was used to inoculate the Propionbacterium, Streptococcus thermophilus, Lactobacillus helveticus and Lactobacillus paracasei (Helen Falentin et all, 2010). Changes in ripening cheese essential fatty acids are minor resulting in preservation of their biological qualities. Prandini et all, 2011 had rapport higher values of fatty acids in cheese matured esnțiali nrânza than fresh. Dairy products of ruminants are the main dietary sources of conjugated linoleic acid, 80-90% of total fatty acids in milk fat (Parodi, 1999). More research on conjugated linoleic acid level in milk reported very high values, from 3 to 20 mg / g fat natural cheese and processed for different (Lavillonniere et all, 1998;. Moon et all, 2005;. Martin et all, 2007;. Prandin et all, 2001;. Prandini et all, 2007;. Shanti et all, 1992). Processing milk in cheese does not seem to have no effect on the final concentration of CLA in cheese, its content depends primarily on the concentration of CLA in milk unprocessed (Bisig et all, 2007; .. Collomb et all, 2006). Bisig et all (2007) concluded that processing and storage of dairy products in general, does not alter the concentration of essential fatty acids in milk fat.

MATERIAL AND METODS

For cheese with spun paste is used sheep's milk, with no added fish oil and with added 0.05% to 0.155 added fish oil. Milk is homogenized homogenizer three steps and pasteurizzat at a temperature of 73 ☐ for 25 seconds. Maturation to obtain milk curd was carried out using culture containing Lactococcus lactis subsp. cremoris / lactis. Lactococcus lactis was used to enhance the acidity the milk that helps curdled milk and accelerating ripening curd of cheese to obtain. Lactococcus cremoris has role as flavor and creamy structure.

Description of technological process: Coagulation was performed at a temperature of 38 ☐, about 2 ☐ higher than normal to increase the elimination of the whey in the shortest possible time. Biochemical maturation of curd to the heat treatment was performed at 25 ☐ for 16 hours to obtain optimum acidity for scalding of 174-178 º T. Blanching was carried out manually curd scalding solution with 3% salt to 100 □. It eliminates the wet salting process. Blanching solution was used at 100 □ in contact with the curd as it crushed, the temperature drops to about 80-85 □, nominal temperature of scalding to obtain cheese spun. Training manual cheese was pressed to remove excess water scalding in cylindrical shapes. After training for cooling the cheese was immersed in water cooled to 10 □ for 30 min.

Analytical methods

Physical-Chemical milk:- Sampling media for cheese analysis- S.T.A.S. 9535/-74; Storing and preparing samples for analysis- S.T.A.S. 6343-81; Sensory analysis- S.T.A.S. 6345-74; Determination of moisture cheese- S.T.A.S. 6344/58; Determination of fat content of cheese- S.T.A.S. 6352/2-73; Determination of titratable acidity- S.R. ISO 6091/2008; Determination of the percentage of NaCl in cheese- S.T.A.S. 6354-70

Analysis of fatty acids by gas-chromatographic method:- Weigh 1 g of cheese sample and break it up with 10 ml distilled water. Take 1 ml of dilution obtained were mixed with 0,6 ml ammonia 25%, 2ml EtOH, 4ml Ethyl ether and 4 ml hexane and then agitated for 2-3min. After this process the lower layer (the ammonia layer) was discarded. Following this step the mixture was passed through a cellulose filter with Na2So4 and then brought to dryness.

Transesterification::Fatty acids were converted to methyl esters by reaction with boron trifluoride/methanol at 80ºC for two hours in a closed Pyrex glass tube. The content was transfered into a separatory funell. The methyl ester extraction:The extraction was made using 10 ml hexane. The hexanic fractions collected were dried using anhydrous sodium sulfate, filtered, concentrated under a nitrogen stream and finally re-eluted in 1 mL hexane. Fatty acids were analyzed by gas chromatography (GC) with flame ionization detection (FID). A 1µL sample was injected into the Shimadzu GC-17A series gas-chromatograph, equipped with a 30m polyethylene glycol coated column (Alltech AT-WAX, 0.25mm I.D., 0.25µm film thickness). Helium was used as the carrier gas at a pressure of 147 kPa. The injector and detector temperatures were set at 260ºC. For the oven temperature the following program was used: 70ºC for 2 min. then raised to 150ºC at 10ºC/ min. rate and held at 150ºC for 3min., then further raised up to 235ºC at a 4ºC/min. Fatty acids were analyzed by gas chromatography (GC) with flame ionization detection (FID). A 1µL sample was injected into the Shimadzu GC-17A series gas-chromatograph, equipped with a 30m polyethylene glycol coated column (Alltech AT-WAX, 0.25mm I.D., 0.25µm film thickness). Helium was used as the carrier gas at a pressure of 147 kPa. The injector and detector temperatures were set at 260ºC. For the oven temperature the following programe was used: 70ºC for 2 min. then raised to 150ºC at 10ºC/ min. rate and held at 150ºC for 3min., then further raised up to 235ºC at a 4ºC/min.

Coding samples: Were obtained and were analyzed three different samples of cheese made from sheep's milk. A sample without the addition of fish oil, considered and two blank samples with added fish oil increasing by 0.05% and 0.15%. Samples were coded as follows: CM-blank without fish oil, C0, 05 - with added 0.05% and C0, 15 - with added 0.15%.

RESULTS AND DISCUSSION

Sensory analysis of cheese samples with and without the addition of fish oil led to results in Table 1.

Table 1.

The taste and aroma of sheep's milk cheese with fish oil

Sample cheese	Spun paste cheese fresh, unripened	Spun paste cheese ripened 15 days
C_M	Specific flavor of scalded cheese from sheep's milk, sweet taste.	No charge fishy aroma and taste bitter or.
$C_{0,05}$	Taste and flavor of fish unobtrusive	
$C_{0,15}$	Taste and flavor of fish marked	

The physico-chemical properties of fresh cheese compared to aged cheese are presented in Table 2

Table 2.

Physicochemical characteristics of sheep's milk spun paste cheese enriched in essential fatty acids.

Sample cheese	Spun paste cheese fresh, unripened			Spun paste cheese ripened 15 days					
	Aciditaty ºT	Umidity %	Salt %	Aciditaty ºT	Umidity %	Dry %	Fat %	Fat/Dry %	Salt %
C_M	150	58,0	2,2	142	45,3	54,7	24,5	44,9	2,3
$C_{0,05}$	154	58,6	2,0	146	44,8	55,2	25	45,3	2,0
$C_{0,15}$	156	58,5	2,2	150	44,7	55,3	25	45,2	2,1

During maturation of cheese dry matter concentration increased slightly due to lower humidity by evaporating water and acidity decreases slightly due to lactic acid conversion.

Fatty acid composition of sheep's milk cheese with good fresh fish oil compared with aged cheese is presented in Table 3. The maturation process occurring chemical processes, biochemical and biophysical complex. Proteolysis occurs at the level of protein substances, less advanced lipolysis of fat, lactose fermentation continues, oxidation reactions, decarboxylation and deamination of amino acids.

With the changes that occur in the aging changes in fatty acid concentration and the percentage of cheese to total fatty acids. Compared tospun fresh cheese to the percentage of fatty acids C_{4-10} does not change significantly. Following the changes taking place in this process is the increasing proportion caproate acid detected in mature cheese samples from 1.08% (the C_M) to 1.96% (at $C_{0,\ 15}$), of total fatty acids. Saturated fatty acids have lower values in ripened cheese containing 0.15% fish oil compared with fresh cheese by the same percentage of fish oil added to raw milk. The proportion of total fatty acids lauric acid decreased by 5.5%, 7.5% myristic, pentadecanoic 10%, 7.5% heptadecanoic, and stearic 17.5%.

Table 3.

Fatty acids in fresh spun paste cheese comparative than ripened cheese

Nr. Crt	Fatty acids	Abrev	Spun paste cheese					
			Fresh			Ripened		
			0 %	0,05 %	0,15 %	C_M	$C_{0,05}$	$C_{0,15}$
1.	Butyric	4:0	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
2.	Caproic	6:0	n.d.	n.d.	n.d.	1,08	1,37	1,96
3.	Caprilic	8:0	0,85	2,10	1,44	1,55	2,30	2,55
4.	Capric	10:0	5,83	10,97	10,48	5,89	10,27	10,81
5.	Lauric	12:0	5,40	7,43	7,65	5,13	6,76	7,23
6.	Miristic	14:0	12,90	13,82	14,51	12,02	13,25	13,41
7.	Miristoleic	14:1	0,60	0,32	0,28	0,57	0,26	0,30
8.	Pentadecanoic	15:0	1,34	1,20	1,29	1,27	1,19	1,16
9.	Cis-10-pentadecanoic	15:1	n.d.	0,15	n.d.	n.d.	n.d.	0,17
10.	Palmitic	16:0	28,72	25,77	26,52	27,04	25,83	24,70
11.	Palmitoleic	16:1	1,69	1,81	1,68	0,30	1,62	0,22
12.	Heptadecanoic	17:0	0,68	0,51	0,53	1,52	0,52	0,49
13.	Cis-10-heptadecanoic	17:1	0,38	0,35	0,35	0,53	0,34	0,33
14.	Stearic	18:0	7,93	2,15	2,75	7,94	2,97	2,27
15.	Oleic	18:1	23,26	17,62	17,44	21,50	17,64	16,84
16.	Elaidic	18:1	1,27	2,23	2,12	1,20	2,16	2,11
17.	Linoleic	18:2	2,53	2,83	2,93	2,53	3,00	3,15
18.	Linolenic	18:3	0,89	1,08	1,15	0,84	1,20	1,39
19.	γ-Linolenic	18:3	0,87	0,91	1,05	1,09	1,26	1,31

Also in the maturation process have significant transformation essential fatty acids in cheese matured their share is 4.47% for CM, 5.47% from C0, 05 and 5.85% from C0, 15 of the total fatty acids . The evolution of essential fatty acids in cheese finished product is shown in Figure 1, to total ω-3 fatty acids and ω-6.

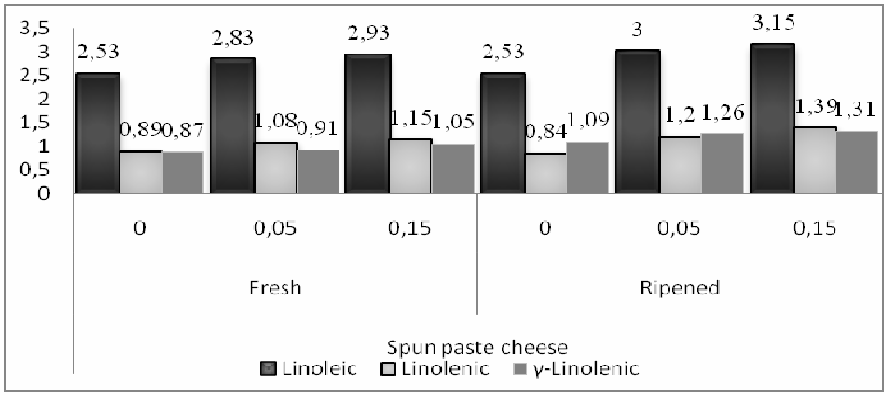

Fig.1. The evolution of essential fatty acids in sheep milk cheese enriched in essential fatty acids, freshly compared to matured cheese

Maturation does not affect the concentration of saturated fatty acids (SFA) in total fatty acids. Share monounsaturated fatty acids (MUFA) decreased by up to 10% compared with fresh samples. MUFA proportion in the finished product has decreased by 8% $C_{0,\ 05}$, and 17% $C_{0,\ 15}$, compared with C_M. Decrease the proportion of monounsaturated fatty acids is due to the addition of polyunsaturated fatty acids (fish oil). Also there is a faster growth of PUFA in mature cheese samples than in Spun fresh cheese, which can be attributed to changes in the overall total proportion of fatty acids in the process of maturation, but signifies the fact that transformations do not happen to bring loss of polyunsaturated fatty acids in this process. Fatty acid composition of the groups is shown in Figure 2.

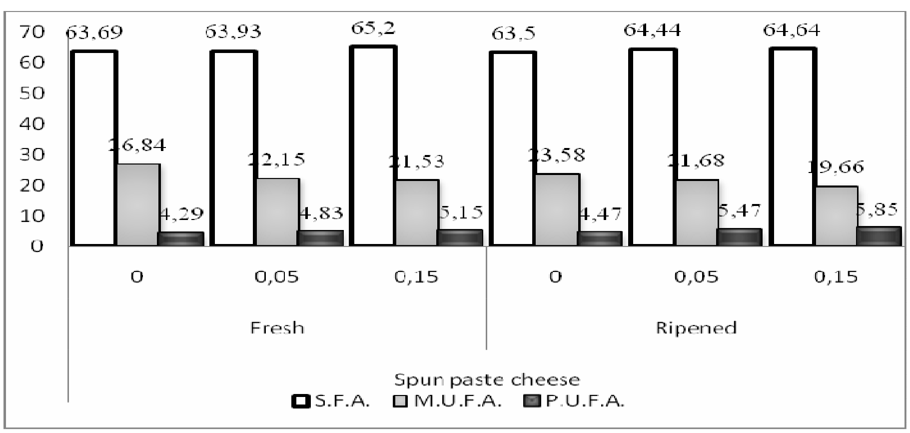

Fig. 2. Fatty acid composition in groups of spun paste from cheese sheep's milk rich in essential fatty acids.

CONCLUSIONS

Finally after maturing fish taste disappears and all cheese samples were heated specific flavor of cheese from sheep's milk. Addition of fish oil has the effect of lowering saturated and monounsaturated fatty acids and increasing the proportion of essential fatty acids in spun paste cheese.

Cheese ripening also causes a decrease saturated and monounsaturated fatty acids and essential fatty acids increase the share of fatty acids in the picture. This fact indicates that during maturation of cheese rich in essential fatty acids have chemical and biochemical changes occur that affect these ω-3 and ω-6.

ACKNOWLEDGEMENTS

This work was supported by CNCSIS–UEFISCSU, project number PNII–IDEI, ID-679/2008, number 1082/2009.

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