FATTY ACID COMPOSITION OF SPUN PASTE CHEESE RICH IN *ESSENTIAL* FATTY ACIDS COMPARED WITH RAW SHEEP'S MILK

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Abstract

For making the paste is heated using rich sheep's milk casein protein curd entering the structure and fat cells formed small, easily digested in the human body. To obtain a functional product improves the quality of milk by adding fish oil rich in essential fatty acids. Order to obtain cheese with boiled pulp trough technology uses a process to reduce losses in essential fatty acids and their protection during the technological process. Fatty acid analysis was performed by gas chromatography and the following results were obtained for raw milk with added fish oil progressively (0%, 0.05, 0.10% and 0.15%) linoleic acid (ω-6) -2.55% 2.68% 3.01% linolenic acid (ω-3) -0.97% 1.00% 1.10% γ-linolenic acid (ω-6) -0.72% 0.84% 0.96%. For spun paste cheese matured for the same percentage of fish oil were obtained the following values for essential fatty acids: linoleic acid-2, 53%, 3.00%, 3.15% linolenic acid-0, 84% , 1.20%, 1.39% γ-linolenic acid, 1.09%, 1.26%, 1.31%.

Key words: sheep milk, ripened cheese, essential fatty acids

INTRODUCTION

Cheese consumption is beneficial to human body due to their content of protein containing all essential aminaocizi (Mallatou et all. 2004) and are digested in the human body (Hayaloglou et all, 2004). Free amino acids in cheese produced using lactic cultures of microorganisms (Papp, 2008), and bioactive peptides (Niels et all, 2008) that increase the nutritional and biological value cheese. Sheep's milk are made which is considered healthy and because of the high content of orotic acid. Orotic acid compounds have antitumour (JL Butouret all, 1997). Also, orotic acid has a role in lowering body fat (Adaliene Versiani Matos Ferreira et all, 2008). It is known that people who practice pasture in several regions of the world have a higher life expectancy (Lotte Hanreichet all, 2008). Essential fatty acids are long-chain polyunsaturated fatty acids that can not be synthesized by humans but it is indispensable. They affect many body functions. Thus, fatty acid composition of human immune cells influence their function in the cell membrane content of arachidonic acid, EPA and DHA are important. Fatty acids may affect immune cell functions through a variety of complex mechanisms and these mechanisms now beginning to be revealed (Philip C. Calder, 2008). High levels of ω-3 fatty acids and ω-6 in heart tissues are

associated with reduced mortality due to heart disease (Nipon Chattipakorn et all, 2009). Demonstrated the influence of essential fatty acids in neurological disorders like schizophrenia (Ravinder Det all, 2004), Parkinson's disease (M. Bousquet, 2009), in the case of Alzheimer's disease and mild cognitive decline and dementia prevention (Vincenzo Solfrizzi et all, 2010). The best source of fatty acids is fish oil. Fish oil added to animal diets increases the concentration of essential fatty acids in milk (Palmquist DL and others 2006). Multipelele benefits of fish oil, the effect of hyperlipidemia (Balk EM et all, 2006), reduce cholesterol levels and trigiceridelor (Hartweg J et all, 2007), efcte beneficial in diseases of the pancreas, diabetes (Hokanson et all, 1996), cardiovascular (PE McBride et all, 2007), antihypertensives (Howe et all, 2004), determined to carry out studies to enrich food in this product. Enrichment cheese fish oil was achieved by adding cheese in paste form encapsulated in milk proteins (A. Ye, 2009).

MATERIAL AND METODS

For cheese with spun paste is used sheep's milk. It is made from sheep's milk cheese 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:- lactostar device; 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: They made 3 types of samples without fish oil, with 0.05% and 0.15% by fish oil added to the raw sheep's milk, in order to determine the optimum amount of fish oil not influence the sensory qualities of the product to be accepted by the consumer. 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 increasing addition of fish oil. 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

Characteristics of ewe's milk used in the manufacture cheese enriched in essential fatty acids are presented in table 1.

Table 1

Characteristics sheep's milk used in production spun paste cheese enriched with essential fatty acids

No.	Sample	Density20□ g/l	Acidity ºT	Non-fat dry %	Fat %	Protein %	Lactose %
1	CM	1036,5	20	11,3	6,3	4,5	6,3
2	C0,05	1036,3	21	11,3	6,4	4,5	6,3
3	C0,15	1036,5	22	11,35	6,5	4,5	6,4

Sensory characteristics of cheese obtained: Spun ripened cheese samples were assessed organoleptic regarding paste design, appearance and texture, drawing section, taste and aroma. After 15 days of cheese ripening all samples have a fine texture, buttery, which peel off easily without pressing or fermentation goals. In the samples spun paste cheese cured for 15 days no longer simpte fish taste and aroma to any percentage of fish oil added to the raw sheep's milk. Finally after maturing fish taste disappears and all samples of cheese were to paste specific flavor of scalded cheese from sheep's milk.

Physicochemical characteristics of spun paste cheese from sheep with added fish oil: They determined the percentage of fat, protein, moisture, salt, acidity, degree of maturation. Physico-chemical results are presented in table 2.

Table 2

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

Sample	Umidity %	Fat		Protein %	NaCl %	Acidity ºT	Degree of maturity $\frac{NS}{NT}x100$
		%	%/ Non-fat dry				
CM	55,2	22,5	50,22	20,8	2,7	142	15,09
C0,05	54,9	23	50,90	21,4	2,5	146	15,00
C0,15	55,3	22,5	50,34	21,6	2,5	150	15,32

NS - soluble nitrogen
NT- total nitrogen

Between samples of cheese with added fish oil and there is no difference in the blank terms of physical-chemical parameters.

The evolution of the concentration of fatty acids in spun paste cheese rich essential fatty acids from sheep mik: Highest concentration in pasteurized milk has a palmitic acid (25-26% of total fatty acids) and oleic

acid (14.5 to 17.5%) in the unsaturated fatty acids which vary widely (between 14-23% of total fatty acids). 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. Following the changes taking place in this process is the increasing proportion caproate acid detected in mature cheese samples from 1.08% (the CM) to 1.96% (at C0, 15), of total fatty acids. Saturated fatty acids have lower values in ripened cheese containing 0.15% fish oil compared with raw milk 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%. Values determined fatty acids are presented in Table 3.

Table 3.

Fatty acid concentration in the spun paste cheese matured sheep's milk rich in essential fatty acids compared to raw material

No	Fatty acids	Abrv	Raw sheep's milk			Spun paste cheese ripened		
			0%	0,05%	0,15%	CM	C0,05	C0,15
1.	Butyric	4:0	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
2.	Caproic	6:0	0,88	0,31	n.d.	1,08	1,37	1,96
3.	Caprilic	8:0	3,05	2,24	1,84	1,55	2,30	2,55
4.	Capric	10:0	14,00	11,71	10,96	5,89	10,27	10,81
5.	Lauric	12:0	8,91	7,76	7,30	5,13	6,76	7,23
6.	Miristic	14:0	14,97	14,12	13,83	12,02	13,25	13,41
7.	Miristoleic	14:1	0,34	0,31	0,36	0,57	0,26	0,30
8.	Pentadecanoic	15:0	1,22	1,21	1,25	1,27	1,19	1,16
9.	Cis-10-pentadecanoic	15:1	n.d.	n.d.	n.d.	n.d.	n.d.	0,17
10.	Palmitic	16:0	24,99	25,52	26,20	27,04	25,83	24,70
11.	Palmitoleic	16:1	1,71	1,63	1,65	0,30	1,62	0,22
12.	Heptadecanoic	17:0	0,45	0,52	0,54	1,52	0,52	0,49
13.	Cis-10-heptadecanoic	17:1	0,32	0,33	0,34	0,53	0,34	0,33
14.	Stearic	18:0	1,69	2,33	2,75	7,94	2,97	2,27
15.	Oleic	18:1	14,45	17,03	17,65	21,50	17,64	16,84
16.	Elaidic	18:1	1,78	2,22	2,16	1,20	2,16	2,11
17.	Linoleic	18:2	2,55	2,68	3,01	2,53	3,00	3,15
18.	Linolenic	18:3	0,97	1,00	1,10	0,84	1,20	1,39
19.	γ-Linolenic	18:3	0,72	0,84	0,96	1,09	1,26	1,31

Compared with the blank finished cheese from sheep's milk with added fish oil, weight loss and increase the share of saturated fatty acids essential fatty acids to total fatty acids in proportion to the amount of fish oil added. Increasing concentrations of essential fatty acids is shown in Fig. 1.

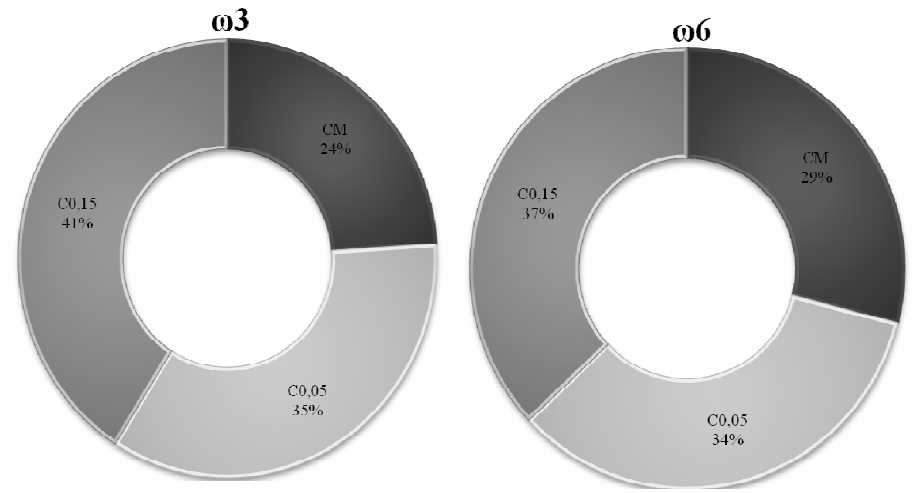

Fig.1. Increasing concentration of essential fatty acids in samples from sheep's milk cheese by adding fish oil

CONCLUSIONS

The research presented in this chapter has sought to lay the foundations of making spun cheese rich in essential fatty acids. Aroma and taste of fish, fish oil added printed in raw sheep's milk with essential fatty acids enrichment, and is perceived differently in fresh sheep's milk and

cheese added to the degree, disappear after 15 days of ripening at 16-18 ℃

to cheese. In the evolution of physical-chemical parameters, acidity, percentage of moisture, sodium chloride, no significant differences were observed between cheeses with no added fish oil and cheese with added increasing percentage. The spectrum of fatty acids in cheese, the addition of fish oil causes a change in the percentage of fatty acids to total fatty acids: decreases the proportion of monounsaturated fatty acids to total satuarați and fatty acids, decreases as the proportion of short-chain saturated fatty acids, with a small number of carbon atoms (C6-10), because their solubility

in scalding whey solution, concentration of fatty acids ω-3 essential ω-6 and virtually unchanged compared with cheese Spun concentration in raw milk. Therefore no significant loss occurring essential fatty acids during the technological process.

The result shows that the study can be obtained from sheep's milk spun paste cheese with added 0.05% and 0.15% fish oil, due to increased content of essential fatty acids, can be considered as a functional product.

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