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COMPARATIVE STUDY OF THE MAXIMUM INCORPORATION OF ESSENTIAL FATTY ACIDS IN THE MANUFACTURE OF THE SANA VERSUS THE SPUN PASTE CHEESE

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Abstract

Sana is an acidic dairy product that is obtained by the fermentation of lactose in the milk composition, with the formation of both lactic acid and secondary compounds, which determine the finest consistency and flavor of the finished product. Characteristic in the production of spun paste cheese is the baking of the curd to obtain homogeneous and creamy cheese paste.

Also the raw milk is pasteurized at high temperature in the case of the san and at medium temperature in the case of the spun paste cheese. The operation of homogenizing milk mixed with fish oil is common to both products and it is intended to include essential fatty acids in fish oil within the fat globule membrane of the milk composition.For production were used sheep milk from the first lactation period and fish oil purchased from HOFIGAL. It was analyzed the evolution of the concentration of three essential fatty acids (linoleic acid, linolenic acid and γ -linolenic acid) specific to both sheep's milk and fish oil. The analysis resulted in the fish oil concentration of milk in the case of the sana of 0,289% and in the case of the spun paste cheese of 0,953%, the concentrations taken into consideration at the optimum threshold of incorporation of the three essential fatty acids taken into consideration.

Key words: sana spun paste cheese fatty acids ω-3 ω-6

INTRODUCTION

Sana and spun paste cheese are two dairy products that likens the creamy structure and aroma taste that are determined by the complex transformations during the manufacturing process. The high nutritional value of these products is given by both the chemical composition and the specific microflora.

Bacteria from lactic cultures used in the manufacture of the products have the capacity to produce a peptide inhibitor of angiotensin converting enzyme (ACE) to the beneficial role in human arterial hypertension (Ebrahim Elkhtab 2017). Also, the intestinal absorption of mercury is influenced by interactions with other food components. The use of lactic acid bacteria is intended to reduce the amount of solubilized mercury after gastrointestinal digestion (C. Jadán-Piedra, 2017). Lactic bacteria ferment fish, meat and milk and turn them into tasty food with a longer conservation. Other lactic acid bacteria help digest food and creating a healthy environment in the intestine (Bas Teusink, 2017

Casein is the milk protein that enters the structure of the coagulum in cheese production. The stability casein and casein micelles during heating coagulation and drying makes them valuable for their content of nutrients and bioactive substances (C.S. Ranadheera, 2016).

Enrichment with essential fatty acids in dairy products aims at increasing the biological value of the fatty substance in their composition with benefits regarding of human health.

Foods contain certain essential fatty acids (EFA). However, dietary habits are different depending on geographic regions and therefore foods contain different proportions of essential fatty acids omega-3 and omega-6. These differences can create imbalances that can change healthy physiology in pathophysiology. Informed food choices can lead to a voluntary change of diet by enriching it into essential components to balance tissues and to reduce the risk of disease (B. Lands, 2016).

HIV infection and low hemoglobin in children have been associated with a lower LCPUFA (essential fatty acids) content in fat (FA) which can still be tied up to a lower number of blood cells. Nutrition rehabilitation interventions need to pay more attention to PUFA intake (unsaturated fat) (Esther Babirekere-Iriso, 2016).

. Fish oil and essential fatty acids have many beneficial effects on human health. Nevertheless, these oils and fatty acids are sensible to environmental factors. Thus, nanoencapsulation is used by various methods, such as nanoemulsification, nanoliposomes, solid lipid nanoparticles (SLN) and has as a scoop increased stability and controlled release of these oils (İsmail Tontul, 2017).

MATERIAL AND METHOD

In order to obtain sane and cheese was used sheep milk known physico-chemical characteristics (Mierliţă D., 2009), to which fish oil was added for enrichment with essential fatty acids.

Collection of average samples for analysis: raw milk, according S.TA.S. 9535/1-74;STA.S. 9535/2-74;

Organoleptic exam, according S.T.A.S. 6345/95;

Physico-chemical analysis:

- raw milk: determination of acidity, according S.R. ISO 6091/2008; determination of fat content, according S.T.A.S. 6352/1-88;

- sana: determination of acidity, according S.R. ISO 6091/2008;
- spun paste cheese: determination of acidity, according S.T.A.S. 6353-85; determination of the percentage of Na Cl, according S.T.A.S. 6354-84; determination of protein substances, according S.T.A.S. 6355-89;

Gas-chromatographic analysis of fatty acids: Milk fat extraction was performed by mixing 1 ml of well homogenized sana and 0.6% ammonia solution, 2 ml ethyl alcohol, 4 ml ethyl ether and 4 ml. hexane, after which the mixture was stirred for 3 min. For the cheese 1 g of the sample was pre-mixed in 10 ml of distilled water and then 0.6% ammonia solution, 2 ml ethyl alcohol, 4 ml ethyl ether and 4 ml was added. hexane, after which the mixture was stirred for 3 min. After this process, the lower ammoniacal layer was removed and the mixture was filtered through a filter with cellulose and sodium sulphate (Na_2SO_4) and dried. Transesterification of the fatty acids in methyl esters was performed by reaction with boron trifluoride / methanol at 80 ° C for two hours in a closed glass tube Pyrex. The content was transferred to a separating tube. Extraction of the methyl esters was performed using 10 ml of hexane. The collected hexane fractions were dried with anhydrous sodium sulfate, filtered, concentrated under a stream of nitrogen and finally taken up in 1 mL of hexane. Chromatographic gas analysis was performed using a SHIMADZU GC-17A gas chromatograph equipped with a 25 m long CAPROPACK column and a 0.25 mm diameter, the stationary phase (a polyethylene glycol derivative) being deposited inside the column in the form a thin film of 0.2 μm. FID detector was used and the mobile phase was helium of 99.9% purity.

Methods of Statistical Analysis: The limit of incorporation of fatty acids within the fat globule was determined using the ROC curves (Receiver Operator Characteristic (Teusdea, A, 2008, 2009). For multiple comparisons, Tukey, Duncan and Fisher tests were used. For comparison with the control and Dunnett's test was used (Teusdea, A, 2008, 2009).

RESULTS AND DISSCUSIONS

The study in this article aimed at analyzing the limit of incorporation of essential fatty acids from fish oil added to raw sheep's milk in the manufacture of the sana compared to the inclusion limit for the production of fresh spun paste cheeses. The fish oil concentrations added to the raw milk have been established to the following values: 0.05%, 0.10% and 0.15%. The technological process has been adapted taking into account the inclusion of essential fatty acids in the product and maintaining the sensory qualities of the sana and fresh spun paste cheese. The physico-chemical

characteristics of the obtained products do not differ significantly from those obtained by classical processes.
The study was performed on 4 variants (control and three samples with added fish oil) gave the following results:

The inclusion limits for essential fatty acids studied in the sana, taking into account the concentration of fish oil in raw milk, are shown in table 1.

Table 1

Concentrations of fatty acids
at the maximum incorporation limit in sana samples

Fatty acids	Conc. Fish oil (%)	The threshold asymptotically
Linolenic	1.3009	of the regression values
Linolenic	1.3011	of the regression derived values
Linolenic	0.6505	theoretical
γ -Linolenic	1.4090	of the regression values
γ -Linolenic	1.4093	of the regression derived values
γ -Linolenic	1.3200	theoretical

The statistical analysis showed that linoleic acid has no fat inclusion limit in the fat globule. The optimum concentration of fish oil at the optimum threshold of incorporation of the three fatty acids in the sana is shown in table 2.

Tabel 2

Number of values, sample averages, standard deviation

Variable	No. of values	No. of valid values	No. of invalid values	sum of percentages	sample averages	standard deviation
Conc. fish oil (%)	6	6	0	6	1.232	0.289

The limits of inclusion of essential fatty acids studied in fresh spun paste cheese are presented in table no. 3. Consider the fish oil concentration of raw milk.

Tabel 3

Concentrations of fatty acids
at the maximum incorporation limit in fresh spun paste cheese samples

Fatty acids	Conc. Fish oil (%)	The threshold asymptotically
Linoleic	2.9057	of the regression values
Linoleic	2.9057	of the regression derived values
Linoleic	0.3773	theoretical
Linolenic	1.1406	of the regression values
Linolenic	1.1407	of the regression derived values
Linolenic	0.3970	theoretical
γ -Linolenic	1.0635	of the regression values
γ -Linolenic	1.0636	of the regression derived values
γ -Linolenic	0.7694	theoretical

The optimal concentration of fish oil added to the raw milk at the optimum threshold of incorporation of the three fatty acids in fresh spun paste cheese is shown in table 4.

Tabel 4

Number of values, sample averages, standard deviation

Variable	No. of values	No. of valid values	No. of invalid values	sum of percentages	sample averages	standard deviation
Conc. fish oil (%)	9	9	0	9	1.307	0.953

Tabel 5

Concentration in fish oil from products to
the threshold limit of the fatty acid inclusion

Product	Conc. fsh oil (%)
sana-linolenic	1.0842
sana-γlinolenic	1.3794
fresh spun paste cheese-linolenic	0.8928
fresh spun paste cheese -γlinolenic	0.9655

The statistical analysis shown in Table 5 shows that linoleic acid has no embedding limit in sana, and linolenic and γ-linolenic essential fatty acids are included in 1.0842% and 1.3794% of fish oil added to raw milk. In the case of fresh spun paste cheeses, the situation is as follows: ssential linolenic and γ-linolenic fatty acids are incorporated at 0,8928% and 0,9655% of fish oil added to the raw milk. The average fish oil concentration for the sana is 1.2318% and for fresh spun paste cheeses it is 0.9291%.

As can be seen, fatty acids in fish oil are included in the sana at a higher threshold compared to fresh spun paste cheeses. This is due both to the different treatment of raw milk, but also to the action of lactic streptococci in the selected lactic culture used in the manufacture of the sana and which, through metabolism, there is the possibility to form essential fatty acids. It is also inevitable to lose fat in the scalding water to obtain the cheese.

CONCLUSIONS

To obtain the sana and fresh spun cheese, sheep's milk was added with the addition of fish oil with the concentration between 0.05% and 0.15%.
The maximum enclosure limit for both sana (1,2318) and for fresh spun paste cheese (0,9291) is higher than the one used. This is necessary because during the production process there are inevitable losses. It should also be

noted that in sana essential fatty acids are included 75% more. compared to fresh spun paste cheese.

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