THE STUDY OF PASTEURIZATION TEMPERATURE'S ACTION AND OF THE CASEIN ADDITION ON THE FORMATION OF YOGHURT RENNET

Ana LEAHU[1], Georgiana Gabriela CODINĂ[1], M. AVRĂMIUC[1]

[1] „Ştefan cel Mare" University Suceava,
Food Engineering Faculty,
e-mail: analeahu@usv.ro

The acid dairy products are acquired through the fermentation of the milk lactose, with the help of the milky starter cultures. Through lactose fermentation they obtain the milky acid, which increases milk acidity, determining his coagulation.

The application of pasteurization regime is made with the purpose of destroying all the forms of micro-organisms probable to be present, respectively of the noxious bacterium's, as well as of the ordinary milk's micro-flora, creating this way favorable conditions for the development of the selected milky bacterium's with what it is inseminated the milk.

For getting a superior quality yoghurt with a compact consistency on a colloidal thicker structure which puts on the brake the separation of the whey, it is also recommended the addition of caseinates and coprecipitates in order to grow the dry substance content, respectively to enhance the jelly properties and the sliminess of products.

The investigations regarding the study of the pasteurization temperature's action on the formation of whey and on the physics-chemical parameters were realized using yoghurt samples with addition of casein in a proportion of 1%, 2%, 3%, 4%, 5%. The technological bearing of the samples was analyzed through classical methods of analysis. From the analysis of the resulted data we conclude that the 80 Celsius degrees temperature is optimum for pasteurization process, and the sample with addition of 1% has physics-chemical characteristics approximately similar to the ones of the yoghurt obtained according to the recipe.

Key words: *acid dairy products, pasteurization, addition of casein*

The dietetical and alimentary value of the dairy-produces results of the fact that within them it is contained all the nourishing substances from milk, but in more accessible form for body. In order to obtain a superior quality yoghurt with a thick consistency on a tighter colloidal structure, which brakes the separation of the whey, it is recommended the growth of the dry substance content (1.04 density, the proteic titrate 5.0-5.5) through the mixture of cow milk with 10...30% sheep milk or buffalo cow milk through concentration or concentrated milk adding, 1-3% skimmed powder-milk or integral milk, or casein adding.

In milk industry, the caseinates and the coprecipitates are utilized to acquire the yoghurt, with the purpose of increasing the dry substance content, respectively of enhancing the gel properties and the sliminess of the products and reducing the sineresis (the separation of the whey).

Under the action of thin acids or of coagulant enzymes, the casein coagulate passing from the colloidal status to the jelly status (semi-solid consistency) which includes both grease and a part of the water from the milk. This casein property presents a particular importance in milk manufacturing process, and the way of getting this differs in accordance with the determining factors. This way, in the case of the milk coagulation under the action of the lactic acid produced by the lactic bacterium's through the lactose fermentation, the lactic acid combines with the calcium from the *Calcium Caseinate*, forming caseinic acid precipitate and milky calcium soluble, and the casein released by calcium goes to the coagulation status. This procedure is applied in the manufacturing of the acid dairy-produces, for example: the yoghurt, the butter-milk, etc.

The introduction of some nourishing substances within food is made to avert food lacks of balance caused by various deficiency states, being an efficacious way to ensure an optimum healthy state of people [5, 7, 9].

The addition of casein and active biological compounds within products poor in nutritional substances is the method to obtain fortified food, which requires a sinergical and physiological adapted nutritional association, having as result the insurance of a body maximum protection [1, 8].

The identification of microorganisms responsible for fermentation and their use for preparing pure cultures has led to the development of numerous probiotic products that are healthy for the human body as they improve the intestinal microbial equilibrium [3]. The main bacterial stems used as probiotics, *Lactobacillus acidophilus* and various species of bifidobacteria are dominant organisms in the small intestine and in the human colon [2]. These microorganisms are important throughout the process of inhibiting the development of the pathogen bacteria by producing organic acids and bacteriocine and by deconjugating the billiary salts [4, 6].

MATERIAL AND METHOD

Tables 1 and *2* reproduce the features of the raw material (milk) and the manufacturing recipe used for yoghurt.

The cow milk, after qualitative and quantitative reception, has been cleaned, normalized to a fat content of minimum 2,8%, homogenized, pasteurized at 85°C, 25 minute (in vane with mantle heating) and then cooled up to 45-48°C.

Table 1

Features of the raw material used to obtain yoghurt

Biochemical indices	Values
Acidity (ºT)	17
pH	6,57
Total nitrogen (%)	0,52
Crude protein (%)	3,14
Free aminoacids (%)	0,95
Fat (%)	3,91
Density (g/cm^3)	1,029
Freezing point ^{0}C	**- 0,535**

Table 2

Manufacturing recipe for yoghurt

Compounds	Quantities
Cow milk (fat min. 2,8%)	250-300 litre
Lyophilized starter cultures type DI-PROX YBA 986	50 units

There was made on milk inoculation, under permanent homogenization, with a lyophilized cultures type DI-PROX YBA 986 delivered by Enzymes&Derrivates Romania. DI-PROX YBA 986 is a mesophilic culture which contains 6x 10^9 cells of *Bifidobacterium* and 6x 10^9 *Lactobacillus acidophilus.* The producer recommends the use at 37˚C of a dosis of 5 UA/100 litters of milk. type. After inoculation, there were introduced casein whose quantities are rendered in the *table 3*.

Table 3

Casein additions established for analyzed variants

Analyzed product	Yoghurt					
	P	P1	P2	P3	P4	P5
Sample addition % casein	0	1	2	3	4	5

For the six samples obtained, the following aspects were analyzed: characterization of the sour milk products obtained from a sensorial, physical-chemical, the evolution of the fermentative process of the dairy products obtained.

The quality assessment of the samples was performed by Romanian standards, using physical and chemical methods. Moisture content was determined by STAS 6344-88, pH by STAS 8201-82, acidity by SR ISO 11169.

The physical-chemical characteristics of milk and sour milk (fat content, protein substances, lactose, density) were carried out using Eco Milk device.

RESULTS AND DISCUSSIONS

The study of the pasteurising temperature action toward in formation of the clot, at various temperatures

The application of the pasteurising regime it is made with the purpose of destroying all the forms of micro-organisms likely to be present, respectively of the noxious bacteriums, as well as of the ordinary milk micro-flora, formed by the

milky bacteriums, the dregs and the moulds, thus creating favorable conditions for the development of the selected milky bacteriums which are used to sow the milk.

The research on this study of the action of pasteurising temperature toward the formation of the clot and regarding the organo-leprics and physico-chemical indexes was realized at different pasteurising temperatures - 70°C, 80°C, 90°C.

The results of determinations are reproduced in the *table 4.*

Table 4

The evolution of acidity and pH values in yoghurt samples

Analyzed product	Yoghurt			
	P	P1	P2	P3
Temperature of pasteurization ^{0}C	85	70	80	90
Acidity (ºT)	120	115	112	105
pH	5.83	5.02	5.07	4.97

One may observe that the titrable acidity is obviously influenced by the pasteurising temperature. According (to the *figure 1*), pasteurization at 90°C conducts to the decrease of the acidity, from 120°C control exhibit to 105°C for sample P3, which reached pasteurization at 90°C.

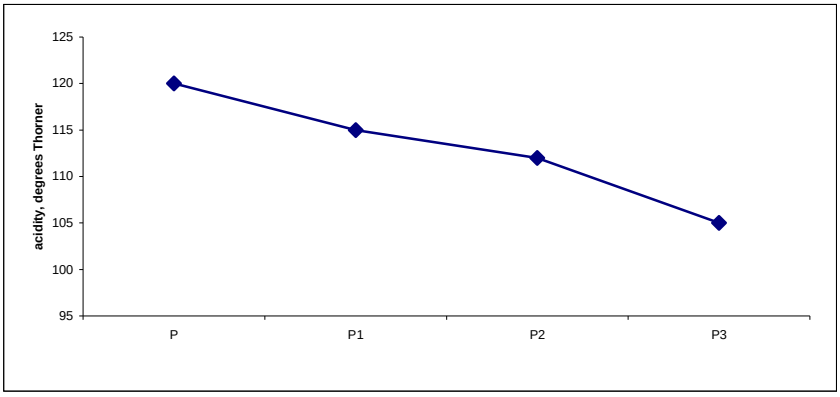

Figure 1 **The evolution of acidity values in yoghurt samples to influence of temperature of pasteurization ^{0}C**

2. The study of casein adding in the formation of the clot

Casein is defined as an heterogenous group of phosfoproteins which precipitates from degreased milk at 4,6 pH and at the temperature of 20°C. Casein represents 80% from the total of proteins comprised in milk, its concentration in milk being of 2.5-3.5%.

Researches concerning the study of the influence of casein adding toward the physico-chemical indexes during the formation of the clot were realized using the samples of yoghurt with addition of casein in proportion of 1%, 2%, 3%, 4%, 5%.

The investigations were realized in two stages:

- The evaluation of yoghurt's organoleptic indexes with addition of casein;
- The study of yoghurt's physico-chemical indexes with addition of casein

The yoghurt's organoleptic indexes with addition of casein

From a sensorial point of view, the characteristics presented in table 5 have been obtained. The best sensorial characteristics were reflected in sample P1 with 1% casein added during processing.

Table 5

The sensorial characteristics of the youghurt samples obtained

Indices	Characteristics					
	P	P1	P2	P3	P4	P5
Aspect and consistency	Homogenous, fluid-viscous, with few fat content agglomera_tions.	Homogenous, viscous, without fat content agglomeration or proteic substances.	Homogenous, more viscous than P1, without fat content agglomeration	Homogenous, more viscous than P2, without fat content agglomeration	Homogenous, more viscous than P3, without fat content agglomeration	Homogenous more viscous than P4, a little sediment casein can be noticed, without fat content agglomeration
ste and flavor	Pleasant, flavored, slightly sour, without foreign taste or smell	Pleasant, flavored, slightly sour, without foreign taste or smell	Pleasant, flavored, slightly sour, without foreign taste or smell	Pleasant, flavored, sweet-sour flavor, with cereal smell, and a perceived taste of flour	Pleasant, slightly sour flavor, with cereal smell, and a perceived taste of flour	Pleasant, weak flavor smell and acute taste of flour
Color	White-yellow, homogenous	White, with a weak grayish nuance homogenous White, with a weak grayish nuance homogenous	White, with a grey nuance, homogenous	White, with a grey nuance, homogenous	White, with a grey nuance homogenous	White, with a stronger nuance of grey, homogenous

According to the results we can say that the consistency flaws for yoghurt are diminished in the same time the product's casein adding grows. Nevertheless, we cannot propose for production the recipes with the highest casein content, because it posseses defects in aspect, consistency, taste and smell. Interpretating the results, we may come to the conclusion that the sample with 1% adding is approximately similar to the one of the yoghurt we had keeping with the recipe.

The study of yoghurt's physico-chemical indexes with addition of casein

In an initial phase we intended the evolution of the fermentation process (*figure 2*).

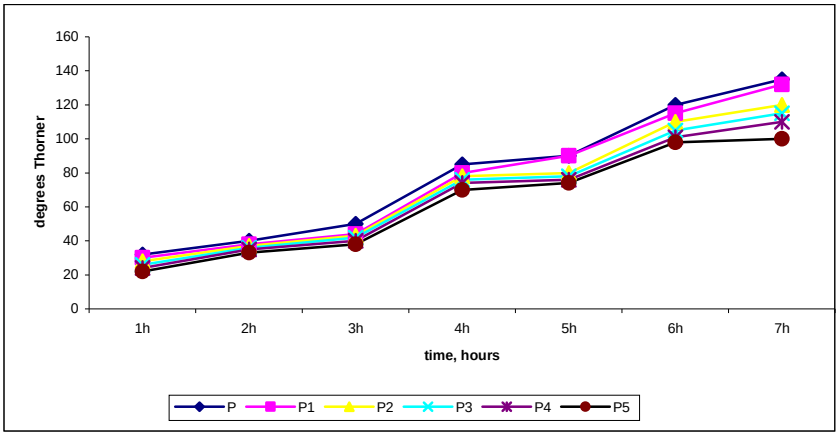

Figure 2 **The evolution of the fermentative capacity of the yoghurt samples during fermentation (7 hours)**

One can observe that the developped acidity in the yoghurt samples that were studied, decreased proportionally with the decreasing of casein adding incorporated in the fabrication recipe.

It was noticed, as well, that the acidity developped varied meaningfully between the different samples, reaching a maximum value in the P1 variant (1% added casein) at 7 hours from the beginning of the fermentation process (132°T).

This fact is to be explained because the casein constitutes a source of nitrogen for bacteria, stimulating the lactic fermentation. At the same time, the casein has an pH ~7.0, which leads to a decrease of acidity yoghurt.

The results indicate the fact that P1 sample (with 1% casein adding) and P2 sample (with 2% casein adding) has an acidity of 132°T, respectively of 120°T, closed to the acidity prescribed by STAS which is between 120°-140°T.

The data in figure 2 reveal a clear increase of milk acidity proportionally with the fermentation time, which is to be explained by the fact that the lactic bacteria have produced a lactic fermentation through lactose hydrolyze in glucose and galactose. Glucose is afterwards decomposed in various ways in the lactic acid, which leads to a significant increase of milk acidity.

The physical-chemical characteristics of the samples obtained determined by the Eco Milk are presented (in *table 6*). One can notice that the values obtained for the 6 samples of yoghurt are very close and they correspond to the values given by the specialty literature.

From the analisys of the presented dates (*table 6*) it can be seen that the dynamics of the content of grease, proteins, density and dry substance decreases proportionally with the procent of added casein. It results that the grease content decreases from 2.5% for the control sample to 0,8% for the sample with 5% casein, their difference being of 1,2% grease.

Table 6

The phisical-chemical characteristics of the yoghurt samples

Analysed product	Yoghurt					
	P	P1	P2	P3	P4	P5
Sample addition % casein	0	1	2	3	4	5
Acidity ˚T	135	132	120	115	110	100
Fat content (%)	2,5	1,5	1,4	1,2	1	0,8
Crude protein (%)	3,4	3	2,8	2,7	2,5	2,2
Dry substance, %	14	12,6	11,8	10,5	9,5	9
Density, %	33	30	28	27	25	22

CONCLUSIONS

The pasteurising temperature has a major influence over titrable acidity. Thus, the pasteurization at 90°C goes to the fall of the acidity, from 120°T for the control sample to 105°T for P3 sample, which reached the pasteurization at 90°C.

The best sensorial characteristics were reflected in sample P1 with 1% casein added during processing.

From the analysis of the resulted data we conclude that the 80 Celsius degrees temperature is optimum for pasteurization process.

From the analysis of the resulted data we conclude that the sample with addition of 1% has physics-chemical characteristics approximately similar to the ones of the yoghurt obtained according to the recipe.

BIBLIOGRAPHY

1. Chandan, R.C., Shahani, K.M., Hui, Y.H. editor, 1993 - *Dairy Science and Tehnology Handbook (chapter Yougurt)*, U.S.A., pp. 39-40.
2. Chandan, R.C., Enhancing, 1999 - *Market value of milk by adding cultures*, J. Dairy Science, 82: p 2245-2256.
3. Gomes, A.M.P., Malacta, F.X, 1999 - *Bifidobacterium spp. And Lactobacillus acidophilus: biological, biochemical, technological and therapeutical properties relevant for use as probiotics,* Trends in Food Science and Technology, 10: p 139-157.
4. Hoover, D.G., 1993 - *Bifidobacteria: Activity and Potential Benefits*, Food Technology, 47 (6): p 120-124.
5. Juillet M.T., Bornet F., 1998 - *Assurer une alimentation équilibrée popur maintenir la santé*. Ind. Alim. Agric., 115, 12, 19.
6. Martine, H., 2000 - *Effect of lactic acid bacteria on diarrheal diseases,* Journal of American College of Nutrition, 19 (2): p 137-146.
7. Mincu, I. et.al, 1989 - *Orientări actuale în nutriţie,* Ed. Medicală, Bucureşti.
8. Nagy, K., 1999 - *The role of Food Fortification in Combating Micronutrient Deficiences*. F Hoffmann - La Roche Basle-Switzerland.
9. Segal, B. et al., 1987 - *Metode moderne privind îmbogăţirea valorii nutritive a produselor alimentare,* Ed. Ceres, Bucureşti.