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RESEARCHES ON PHYISICAL-CHEMICAL PROPERTIES OF SOME FLUIDIC YOGURT TYPES

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Abstract

The aim of this paper is a physico-chemistry characterization of some fluidic yogurt types (classical, classical with stabilizer and probiotic) as well as a study about the influence of fat content from raw material regarding to basic technological parameters (acidity and pH) during fermentation.
Key words: *yogurt, milk composition, fermentation, acidity.*

Introduction

Yogurt is the most widely spread and used acidic dairy product all over the world. The acidic dairy products are fermented milk products obtained by the action of lactic bacteria upon the lactose, this resulting in lactic acid, carbon dioxide, acetylaldehide, diacetyl and other compounds which provide the characteristic fresh taste (Costin *et al.* 2005).

Some strains like *S. thermophillus* and *Lb. bulgaricus* produce neutral extra-cell polyglucides made of galactose, glucose, rhamnose and N-acetylgalactosamin in different proportions depending on the strain. These polyglucides cover the cell surface with a uniform film thus favoring cell associations and viscosity growth (Hassan *et al.* 2003). The starter cultures able to produce exopolysaccharides can improve both the consistency and structure of the fermentative milk products (Hassan *et al.* 2002).

The paper attempts to characterize the various types (classical, classical with stabilizer and probiotic) of yogurt in terms of physico-chemical features and to analyze the basic parameters of the fermentative process (acidity and pH). A special attention has been focused on the fat content in the milk intended for yogurt fabrication.

Experimental

For the experiment purpose, UHT milk for daily use made by the OKE Company distributed by Friesland Romania SA and produced by SCIL Mures SA was used.

Three types of milk with different fat content were used: drinking milk of 0.1%, 1 % and 2.8 % fat. The milk was pasteurized at 90°C for 20 minutes and was poured into 9 *Berzelius* glasses (500 ml each), followed by cooling down to the optimum inoculating temperature with starter cultures. After the cooling down, the samples were inoculated with lactic bacteria and maintained at fermentation temperature.

The classical yogurt was maintained at 45°C and the probiotical yogurt at 37°C. During the yogurt fermentation (from hour to hour), the pH and the acidity were determined by titration. The yogurt fermentation was interrupted when the pH reached the optimum value which should be within 4.65 - 4.7 and then the product were cooled down to 4°C.

For the classical with stabilizer yogurt samples, the used stabilizer was the food starch produced by “Dr Oetker” company. A percentage of 1% of food starch, previously dissolved into 50 ml milk, was added.

To obtain classical yogurt, a “Milli” product was used as culture. The samples were inoculated by 1% yogurt. To obtain probiotic yogurt the ATB-1 culture under liophilization form produced by Chr. Hansen’s was used. The samples were analyzed as follows: the chemical composition of the raw material and the end product, the acidity and pH.

It had been achieved 9 samples. The obtained yoghurt types and codified samples are shown in the table 1. For the chemical analysis of the raw material and the end product the following measurements were made: total dry matter (SUT)-STAS 6344-88, fat- determined by the Gerber method, nonfat dry substance (SUN)- calculated by the difference: SUN%= SUT-fat % or SUN%= total protein + mineral salts + lactose.

Proteins (total nitrogen) was determined by Kjedahl method, the mineral salt (ashes) was determined by burning to 660° C, lactose- by the difference, acidity– according to STAS 6353-85, pH- was determined by means of the pH meter ORION model 710A, ROSS pH electrodes, model 8135 – combination flat surface electrode, 0-14 pH, epoxy glass (for calibration – select two buffers wick bracket the expected sample pH; the first should be near the electrode isopotential point (pH 7) and the second near the expected sample pH (e.g., pH 4 or pH10).

Table 1. Technological characteristics of yoghurt samples

Fat content, %	Type of culture	Stabilizer	Obtained yoghurt types
0.1	ABT-1	-	Probiotic yogurt
1.0	ABT-1	-	Probiotic yogurt
2.8	ABT-1	-	Probiotic yogurt
0.1	classical	-	Classical yogurt
1.0	classical	-	Classical yogurt
2.8	classical	-	Classical yogurt
0.1	classical	Yes	Classical yogurt with stabilizer
1.0	classical	Yes	Classical yogurt with stabilizer
2.8	classical	Yes	Classical yogurt with stabilizer

Results and Discussions

From table 2 it can be seen that the three kinds of milk used as raw material to make yogurt have a balanced composition, except the fat content which varies from 0.1 % to 2 .8 %.

Table 2. Chemical composition of the raw material (%) used to make yogurt

Milk	Water	Total dry substance	Fat	Nonfat dry substance	Total protein	Mineral salts	Lactose
Sample A	91.81	8.93	0.1	8.83	3.49	0.69	4.65
Sample B	90.16	9.84	1.0	8.84	3.66	0.63	4.55
Sample C	88.60	11.40	2.8	8.60	3.41	0.66	4.53

The nonfat dry substance varies within 8.6 % (for the type C milk) and 8.84 % (for the type B milk).

The total protein content varies between 3.41 % (sample C) and 3.66 % (sample B). The protein content relative to the nonfat dry substance (39 % and 41 %) is quite similar. The lactose varies from 4.53% (sample C) to 4.65 % (sample A). It can be concluded that all of the three types of milk used as raw material have a balanced nutritive content.

The chemical composition of the manufactured yogurts (see table 3) is quite similar for all the nine samples and they respect the professional standards for this product.

Table 3. Chemical composition of the yogurts

Compounds (%)	Samples with ABT-1 culture			Samples with classic culture			Samples with classic culture and stabilizer		
	1	2	3	4	5	6	7	8	9
Water	91.95	90.81	89.72	91.98	90.99	89.70	92.01	90.96	89.64
Total dry substance	8.05	9.09	10.28	8.02	9.01	10.30	7.99	9.04	10.36
Fat	0.1	1.0	2.8	0.1	1.0	2.8	0.1	1.0	2.8
Nonfat dry substance	7.95	8.09	7.48	7.92	8.01	7.50	7.89	8.04	7.56
Total protein	3.39	3.60	3.38	3.41	3.60	3.39	3.49	3.62	3.4
Mineral salts	0.66	0.61	0.62	0.66	0.60	0.64	0.65	0.62	0.65
Lactose	3.90	3.88	3.48	3.85	3.81	3.47	3.75	3.80	3.51

The acidity variation analysis during yogurt fermentation of the 9 samples (figures 1 - 3), shows the following:

In case of the pro-biotic yogurt, the acidity increase slowly during the 10 hours of fermentation. It can be relieved that the highest fat content sample had a slow acidity evolution (65°T as compared with 67°T for sample 2 and 72°T for sample 1).

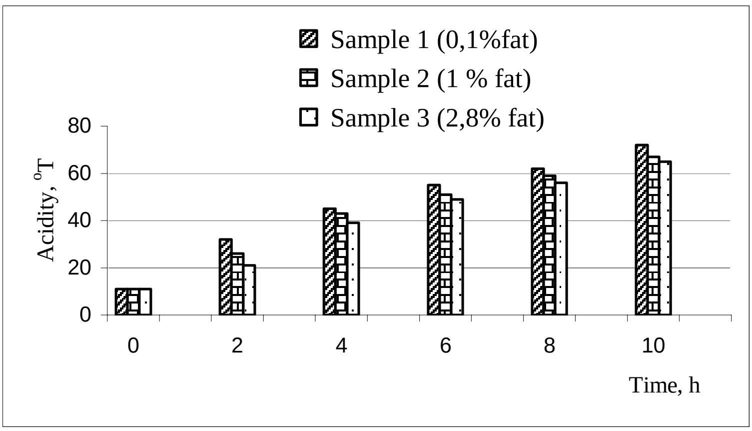

Fig. 1. The variation of acidity of the samples with ABT-1 culture yogurt

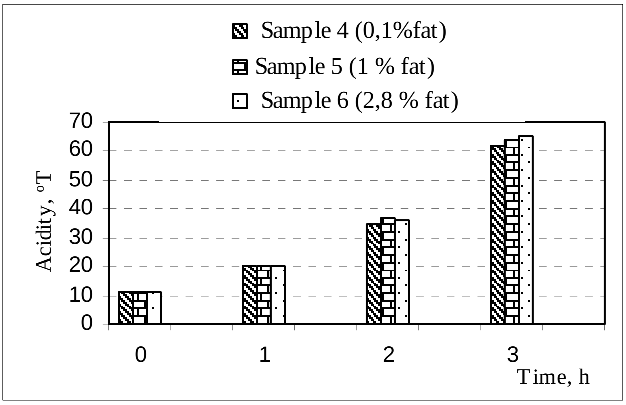

Fig. 2. The variation of acidity of the samples with classical culture yogurt

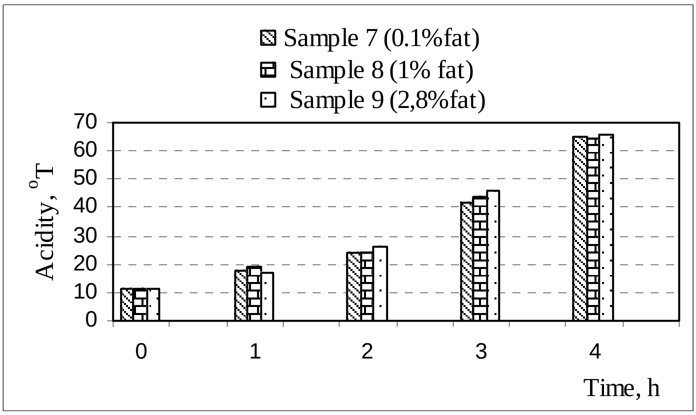

Fig. 3. The variation of acidity of the samples with classical with stabilizer culture yogurt

In case of classical yogurt, fermented for 3 hours, the final acidity of the samples varied proportionally with the fat content of the samples (62°T for the 0.1 % fat sample, 64°T for the 1 % fat sample and 65°T for the 2.8 % fat sample).

In case of classical yogurt with stabilizer, fermented for 4 hours, there were no significant differences of acidity between the three samples, therefore it can be concluded that for this type of yogurt the low fat content does not affect decisively the increase in the acidity.

The variation of pH during yogurt fermentation is shown in table 4 for probiotic yogurt, in table 5 for classical yogurt, respectively in table 6 for classical yogurt with stabilizer.

Table 4. The pH variation during thermostating probiotic yogurt

Time		0 h	2h	4h	6h	8h	10h
Sample with ABT-1 culture	Fat content, %	pH					
1	0.1	6.50	5.81	5.34	5.20	4.98	4.41
2	1.0	6.49	6.08	5.37	5.24	5.11	4.60
3	2.8	6.50	6.00	5.61	5.29	5.22	4.76

Thus, the pH registered at the end of the experiment, in the case of probiotic yogurt varies between 4.41 for the sample 1 and 4.76 for the sample 3. It can be stated that this significant variation is due to the different fat content in the samples (the starter culture used for the probiotic yogurt did not growth in optimum conditions in the presence of fats).

Table 5. The pH variation during thermostating classical yogurt

Time		0h	1h	2h	3h
Sample with classical culture	Fat content, %	pH			
4	0.1	6.50	6.38	5.76	4.81
5	1.0	6.49	6.24	5.72	4.70
6	2.8	6.50	6.29	5.74	4.68

Table 6. The pH variation during thermo stating classic with stabilizer yogurt

Time		0h	1h	2h	3h	4h
Sample with classical culture with stabilizer	Fat content, %	pH				
7	0.1	6.50	6.46	5.93	5.55	4.71
8	1.0	6.49	6.50	5.95	5.51	4.71
9	2.8	6.50	6.36	5.89	5.50	4.69

In cases of classical and classical with stabilizer yogurt, there was not found the same final pH variation comparative with probiotic yogurt. The pH of the classical yogurt fermented 3 hours and classical with stabilizer yogurt fermented 4 hours, showed no significant difference.

After 24 h storage, the acidity of yogurt samples was varying normally (figure 4), except the probiotic yogurt whose acidity increase at values over 80°T for all of the 3 samples.

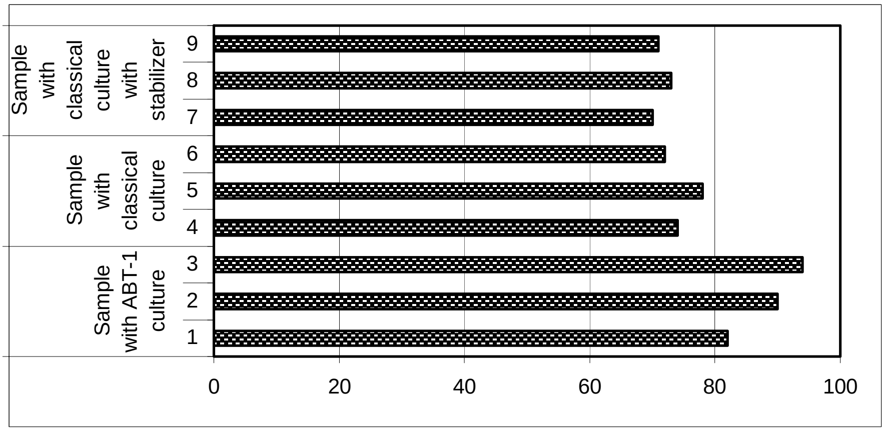

Fig. 4. The variation of acidity after 24 h storage yogurt at 4^oC

The pro-biotic culture acidity had a higher level than classical culture, presumably because the acidity of the environment favors the pro-biotic culture development, even during the storage period.

As shown in table 7, for samples with classical culture and classical culture with stabilizer the pH level is quite similar (approximately 4.6). In case of probiotic samples, the last pH level is noticeably higher, this show us that the bacterium ABT-1 develop themselves during storage period.

Table 7. The pH variation after 24 h storage yogurt at 4^oC

	Sample with ABT-1 culture			Sample with classical culture			Sample with classical culture with stabilizer		
No.	1	2	3	4	5	6	7	8	9
pH	4.28	4.10	3.98	4.61	4.56	4.65	4.72	4.65	4.69

Conclusions

The physico-chemistry composition of the manufactured yogurt showed quite similar values in respect to the professional standards for this product. The increase of acidity during the fermentation process occurred as expected; for the probiotic yogurts there was a slow increase, in10 hours. In the end of the experiment, the sample with the highest fat percentage had the lowest acidity. The optimum acidity value was reached in classical yogurt after 3 hours of fermentation, while classical with stabilizer yogurt after 4 hours of fermentation. The classical yogurt acidity level varied in direct ratio to fat content of the sample. The classical with stabilizer yogurt acidity levels shows no major differences between all-three samples, so it can be concluded that the fat content of this yogurt manifest no important influence to acidity level.

Comparing the acidity variation in case of classical yogurt and classical with stabilizer yogurt, it can be concluded that the stabilizer inhibit the development of lactic bacteria in all–three samples. The three samples of probiotic yogurt had different pH values, due to different fat content. So, it can be concluded that fats do not favor probiotic starter culture development. In cases of classical and classical with stabilizer yogurt, no significant differences between pH values were observed. The acidity level of yogurt samples varied normally during 24 hours, except the acidity of probiotic yogurt whose acidity increase over 80°T. This fact can be due to acidity of the environment who favors the probiotic culture development even during the storage period.

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