THE INFLUENCE OF SOME BIOMINERALS AND ORGANIC COMPOUNDS UPON ACIDITY AND FREE AMINOACIDS CONTENT DURING YOGHURT PROCESSING

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Abstract: *Article goal consists in studing the influence of some minerals (Zn, Mg) and organic compounds (folic acid and lactose) addition upon acidity and free aminoacids content evolution during yoghurt processing. As a result of analysis accomplished during yoghurt processing, the free aminoacids content has had an oscillating evolution, evidencing in all searched variants, except the blank sample, higher values at the end of the thermostatic period (after 4 hours). The folic acid addition, but especially the combination of that one with Mg and Zn, with lactose or all together have determined an increase of the free aminoacids percentage within analysed samples.*

The values of the yoghurt samples titratable acidity have registered, in all cases, constant increases once with thermostatic period incresing. Even if, at analysed intervals, the evolution of the acidity could not be correlated with amount or type of addition, however, after 4 hours of thermostatic process, the variants with lactose addition has registered higher values of this index, in comparison with the other variants and blank.

Since some types and doses of additions used in this work has led, as compared to the blank, to important increases of free aminoacids percent and of titratable acidity, making possible the reduction of thermostatic period, these additions could be used within acid dairy produce industry to turn to good account light raw material, having less content of lactose or proteins.

Keywords*: free aminoacids, titratable acidity, pH, biocompounds, yoghurt.*

Introduction

The introduction of some nourishing substances within food is made to avert food lacks of balance caused by various deficiency state, being an efficacious way to ensure an optimum healthy state of people (Segal et al., 1987; Mincu et al., 1989; Juillet and Bornet, 1998). The addition of active biological compounds within products poor in nutritional substances is the method to obtain fortifiate food, which requires a sinergical and physiological adapted nutritional association, having as result the ensurance of a body maximum protection (Nicol, 1995; Nagy, 1999).

The dairy products can be supplemented, in need, with liposoluble vitamins (derivative of provitamins, respectively vitamins A and/or vitamins D), with hydrosoluble vitamine (tiamine, riboflavin, niacine, ascorbic acid) or with biominerals, such as: iodine, iron, fluor etc. (Segal, 1999; Banu et al., 2003).

In this work, the introduction of some biocompounds (folic acid, zinc, magnesium and lactose) at yoghurt processing has not been made to fortify this product, but to evidence the effect of theese additions on biochemical processes leading to the obtaining of these acid dairy produce, having, indirectly, in view the changes occured within transformations of carbohydrates and proteins made by lactic bacteria.

Materials and methods

In this work the materials has included: the raw material represented by cow milk, with a certain content of fat, lyophilized starter cultures produced by CHR HANSEN firm, and additions, in some proportions, of folic acid, zinc, magnesium and lactose.

In order to get yoghurt, it was used the classic technique, which included the following operations: milk reception and

cleaning - pasteurization - cooling - inoculation - allocation in small packings - fermentation - precooling - cooling - storage.

The yoghurt was made according to technological directions, observing effective health and health-veterinary measures, and the starter cultures have been lactical bacteria belonging to *Lactobacillus* and *Streptococcus* genera.

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

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 (%)	3,31
Free aminoacids (%)	0,95
Fat (%)	3,72
Density (g/cm^3)	1,028

Table 2: Manufactruring recipe for yoghurt

Compounds	Quantities
Cow milk (fat min. 2,8%)	250-300 litre
Lyophilized starter cultures type YC-X11 (CHR HANSEN)	50 units

The cow milk, after qualitative and quantitative reception, has been cleaned, normalized to a fat content of minimum 2,8%, homogenized, pasteurized at 85-95°C, 20-30 minute (in vane with mantle heating) and then cooled up to 45-48°C. There was made on milk inoculation, under permanent homogenization, with a lyophilized cultures type YC-X11 (CHR HANSEN) containing *Sptreptococcus termophillus* and *Lactobacillus bulgaricus*.

After inoculation, there were introduced biocompounds whose quantities are rendered in the table 3.

Table 3: Vitamins, mineral compounds and lactose additions established for analysed variants

Analysed product	Yoghurt					
Sample Addition*	PII	PIII	PIV	PV	PVI	PVII
Mg (mg/l)	47,8	-	47,8	47,8	-	47,8
Zn (mg/l)	10	-	10	10	-	10
FA (mg/l)	-	30	-	30	30	30
Lactoză (g/l)	-	-	1	-	1	1

• The addition doses have been calculated depending on recommended daily dose, so that should not negatively affect the human body as result of consumption. FA = folic acid; PI (blank sample) does not appear within the table.

For this, these biocompounds have been dissolved within a small amount of pasteurized and cooled milk, and the milk enriched with additions, according to each variant of research, has been distributed in packaging sales, prior properly sterilized. The product, packed in vessels of 250 g, has been subdued to thermostatic process at a temperature between 42 and 45°C for 4 hours, then precooled at 20°C, cooled at 2-8°C and stored at 2-4°C.

The samples for analysis have been taken from hour to hour since the beginning of thermostatic process determining the

values of the following indices: titratable acidity, pH and free aminoacids.
It also has been carried out a blank, in the same work conditions, but without additions.
The determination of the titratable acidity, expressed in degree Thőrner (°T), was made according to AOAC standard (Cunniff, 1995), and of pH according to STAS 8201/82 (Costin et al., 2003).
The total nitrogen (%) and the crude protein (%) were determined according to Kjeldahl method (Costin et.al., 2003), and for free aminoacids dosing (%) it was used s-a folosit Sőrensen method (Vâță et.al., 2000).
The density (g/cm^3) was determined using a lacto-thermo-density device, and fat (%) was determined by means of acid-butirometric method (Costin et.al., 2003).

Results and discussion

The results of determinations are reproduced in the table 4.
Analysing the free aminoacids content, it can observe that, after the first thermostatic hour, the highest values heve registered, in order, samples PVI (with folic acid and lactose), PVII (with Mg, Zn, folic acid and lactose), PV (with Mg, Zn and folic acid), PI (the blank), and the least value sample PIV (with Mg, Zn and lactose). At the other analysed intervals, the evolution of percentage values of aminoacids has been oscillating and similar in most samples, in the sense of decreasing at 2 and 4 hours, and of increasing at 3 hours of thermostating process. In the end of analysed period (after 4 hours of thermostatic time) there was evidenced the same hierarchy of aminoacids content, with higher values for samples PVI, PVII, PV, the least one being at sample PIV. In fig. 1 are rendered the values of aminoacids content at the end of the thermostatic, as compared to raw material (milk).
The variation of these protein compounds it can explain through two processes, having influence on features of finished product namely: a) increasing, on the one hand, of the free aminoacids and peptides percentage within analysed product, as a result of hydrolisis process of serum proteins and of caseine (in a small extent) and b) the decrease, on the other hand, of free aminoacids percentage, through their transformation in aroma compounds, which accumulate within the final product, influencing its organoleptic properties.
It seems that, in the case of samples having aminoacids content superior to the blank, the respective additions have stimulated (intensified) the proteolytic enzymes or have promoted the synthesis of increased amount of these enzymes in lactic bacteria cells. The folic acid and its derivatives represent increase factors for micro-organisms, zinc and magnesium are co-factors of some important enzymes participating in sugar and protein metabolism of organisms, and lactose is a lactic fermentation substrate.
As to titratable acidity, the values of this one have registered constant increase along with thermostatic period increase. After an hour of thermostatic process, the most increase of acidity were at samples PI, PII and PIV, after two hours at samples PIII, PIV and PV, after three hours at samples PVII, PVI şi PV, and after four hours at samples PVI, PVII and PIII. At the end of thermostatic period (after four hours) the highest value of titratable acidity has registered the sample PVI., but it can observe that, ganarally, higher values of this index have been found in samples with lactose addition. The fig. 2 reproduces the titratable acidity values of yoghurt samples at the end of thermostatic period, comparative with raw material.
pH has registered the most decrease, in all cases, after two thermostatic hours. At the end of analysed period, the most reduced value was found in sample PVI

Table 4: The evolution of acidity and free aminaocids values in yoghurt samples

Sample number and compounds added	Analysed parameter	Thermostatic length			
		1 hour	2 hours	3 hours	4 hours
PI (blank)	Free aminoacids (%)	1,503	1,352	1,420	1,390
	Acidity (°T)	50	58	73	75
	pH	5,83	5,10	4,92	4,89
PII (Mg, Zn)	Free aminoacids (%)	1,202	1,127	1,503	1,352
	Acidity (°T)	43	45	68	72
	pH	6,02	5,22	5,04	4,94
PIII (folic acid)	Free aminoacids (%)	1,350	1,277	1,578	1,427
	Acidity (°T)	39	65	72	75
	pH	5,71	5,13	4,9	4,89
PIV (Mg, Zn, lactose)	Free aminoacids (%)	1,052	1,150	1,560	1,202
	Acidity (°T)	43	68	73	77
	pH	5,59	5,01	4,92	4,85
PV (Mg, Zn, folic acid)	Free aminoacids (%)	2,329	2,280	2,350	2,630
	Acidity (°T)	40	65	74	74
	pH	5,73	5,08	4,93	4,83
PVI (folic acid, lactose)	Free aminoacids (%)	2,855	2,770	2,910	2,930
	Acidity (°T)	41	64	77	85
	pH	5,68	5,07	4,82	4,77
PVII (Mg, Zn, folic acid, lactose)	Free aminoacids (%)	2,630	2,580	2,705	2,705
	Acidity (°T)	39	60	78	76
	pH	5,71	5,19	4,98	4,93

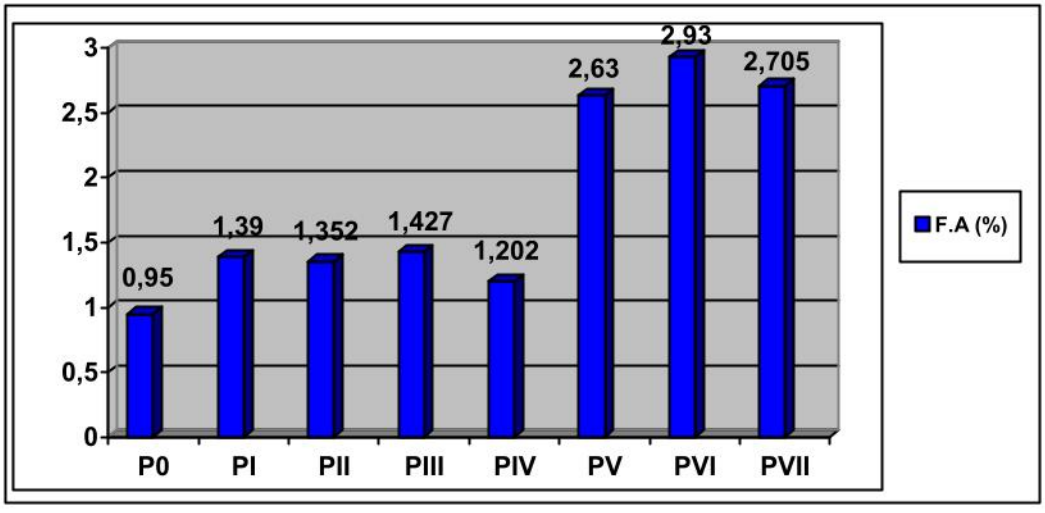

Figure 1. Percentage values of free aminaocids (F.A.) from raw material (milk) and from yoghurt samples at the end of thermostatic period P0 = milk sample ; PI = blank (yoghurt); PII….PVII = work samples (yoghurt)

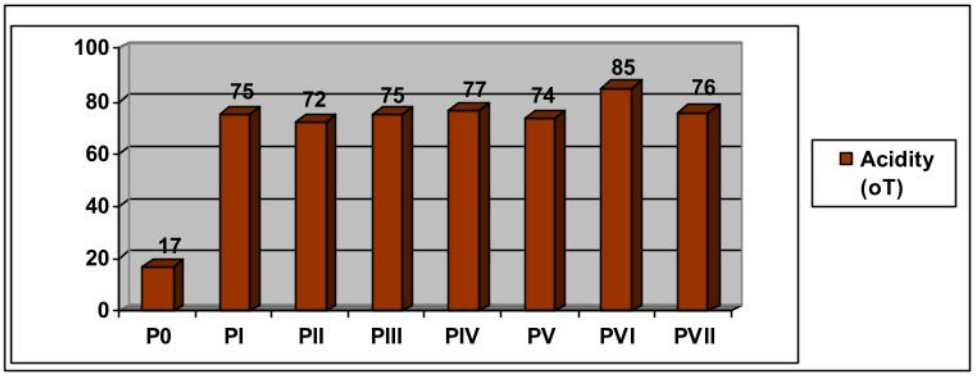

Figure 2. Values of titratable acidity (°T) of raw material (milk) and of the yoghurt samnples at the end of thermostatic period
P0 = milk sample; PI = blank (yoghurt); PII….PVII = work samples (yoghurt)

Conclusions

The introduction of some biocompounds (folic acid, zinc, magnesium and lactose) within raw material destined to yoghurt obtaining has led to modifications of the acidity and of the free aminoacids content of this product, comparatively with blank (obtaining from milk without additions).

During yoghurt processing, the free aminoacids content has had an oscillating evolution, evidencing in all searched variants, except blank, superior values at the end of the thermostatic period (after 4 hours). The addition of folic acid (single), but especially in combination with Mg and Zn, with lactose or with all three compounds has determined an increase of free aminoacids percentage within analysed samples.

The values of titratable acidity of yoghurt samples have registered, in all cases, constant increase at the same time with thermostatic period increase. Even if, at analysed intervals, the evolution of the acidity could not be correlated with amount or type of addition, however, after 4 thermostatic hours, the variants with lactose addition has had higher values of this index, comparative with the other variantes and blank.

Because some types and doses of additions used in this work have led, comparative with blank, to important increase of free aminoacids percentage and titratable acidity, these additions could be used within acid dairy produce industry to turn to good account light raw materials, having a more reduced content of lactose and proteins.

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