RESEARCH AND CONTRIBUTIONS REGARDING BIOTECHNOLOGY OF STARTER CULTURES AND THEIR USE IN OPTIMIZING ACIDIC DAIRY PRODUCTS

ABSTRACT

Key words: **acidic dairy products, physicochemical analysis, sensory analysis, statistical analysis, surface glow**

The study conducted under the theme "*Research and contributions regarding biotechnology of starter cultures and their use in optimizing acidic dairy products*" aimed at obtaining acidic dairy products of superior quality with a new formula mixture of starter cultures.

The thesis treated the ways of improving the acid dairy product quality, showing the steps to be followed to improve the quality of certain dairy products classes.

In recent years, the dairy market has seen a considerable increase in the segment of fresh and fermented dairy products.

In Romania, although the market has undergone visible changes regarding the structure of consumption, there were no spectacular changes in sales trends. Romanian consumer's preferred product remains classic yogurt, together with buttermilk, skim yogurt and sana yogurt.

Classic yogurt, produced by all Romanian processors, has no constant sensory qualities, and this depends on many factors, among which the most important is the *raw material*. The starting point for this work was our personal experience in the processing industry and a desire to establish scientifically some good manufacturing practices and a new approach to the technology of producing classic traditional yogurt.

The scientific approach was based on an innovative action of milk processing, starting from the initial quality of the products available on the market and taking into

consideration the final result, based on microbiological studies, physicochemical and biochemical analysis, and based on sensory analysis performed by trained consumers.

The present paper was structured into two parts:

- **Theoretical part (1 chapter, 70 pages);**
- **Experimental part (2 chapters, 181 pages).**

The thesis also contains 116 figures and 79 de tables, two annexes and a list of bibliography to a total of 140 titles.

The importance of the chosen theme, the scope and objectives of the thesis have been synthetized in the first chapter which presents a brief history of the research regarding acidic dairy products.

In Chapter I, entitled "Current state of research in the field", we have made references to the way of achieving, at industrial level, acidic dairy products (yogurt, buttermilk and cream) and analysis of complex factors with direct impact on raw material quality in the dairy industry.

The raw material basis for producing acidic dairy products is given by the cow milk, but can also be milk from sheep, buffalo or goat. The quality of raw milk used to manufacture dairy acidic largely determines the finished product. Therefore, the quality reception of the raw material must be done very carefully, especially aiming at selecting milk with a normal composition and a low degree of microbiological and chemical contamination.

Yogurt is an acidic dairy product, fermented for a short period (3-5 hours) with thermophilic cultures. In general, for manufacturing yogurt cultures of lactobacillus delbrueckii subspecies bulgaricus and streptococcus salivarius subspecies thermophilus cultures are used, which generate the sensory and rheological specific of the product. Yoghurt is obtained from industrialized milk (received and thermally treated) with 0.1% and 4.5% fat. Classic yogurt has 2.8% fat. Currently, there are assortments of yogurt with added sugar, fruits or flavorings, as well as probiotic yogurts and fermented with certain cultures that have proven properties in sanogenetic processes.

Buttermilk is a product similar to yogurt, its specificity is given by the fermentation culture (Lactococcus lactis subsp. Lactis, Lactococcus lactis ssp. Cremoris, Lactococcus lactis subsp. Lactis biovar. Diacetylactis, Leuconostoc meszenteroides) and by the temperature of the process (28 °C - 32 °C) and by the time of fermentation (8-12 hours). On the Romanian market there are two types of buttermilk, differentiated by fat content. Therefore, labeling as buttermilk involves a fat content of 2% and to obtain a product called "Sana" milk with 3.2% fat content is used.

In Chapter II, entitled "Materials and Methods" we covered: physicochemical and microbiological analysis of milk as raw material, production cultures, preliminary treatment of milk, specific technologies to manufacture fermented milk products and sensory analysis.

In Chapter III, entitled "Results and discussion" we dealt with several types of analyses.

Organoleptic analysis was carried out according to SR 3665: 1999 standard which relates only to smell and taste.

This was followed by physico-chemical analyses of conventional acidic dairy products and optimized finished product. Physicochemical analyses were the usual ones and included: fat content, g/100g, by SR ISO 2446: 2009; protein content, g/100g by SR ISO/TS 17837: 2009; casein content, g/100 g with MilkoScan; lactose content, g/100 g by FIL IDF 141C: 2000; SUN g / 100g, by SR ISO 6731: 1996; pH with MilkoScan; freezing point in °C SR EN ISO 5764: 2003; added water percentage; residues of antibiotics with Beta Star Combo; urea content in mg/dl with MilkoScan.

Determination of aroma compounds (D/L lactic acid and acetaldehyde) of acidic dairy products fermented was performed for a better appreciation of the microorganisms quality involved in the processes of fermentation and sensory qualities of the finished product. For the product to have a pleasant, balanced and valued by the end consumer taste, there must be a balance between the existing flavoring substances.

Microbiological analysis covered the microbiological aspects analyzed in the case of raw material milk where it was monitored the total of aerobic and mesophilic germs and

the number of somatic cells. In the case of acidic dairy products, the microbiological analysis was divided into two categories of tests: tests of compliance and tests to determine the number of viable lactic acid bacteria in the product. The second category of tests was performed by culturing in Petri dishes, using the insemination method of successive dilutions in MRS medium, helping us to establish the optimal ratio between *Streptococci* and *Lactobacilli*. The new formula has been performed using this method and resulted in a product optimized from all points of view considered.

Sensory analysis, which include sciences such as: neurophysiology, physiology, psychology, has included sensory evaluation and market studies for sensory perception mechanisms for:

- effects of physiological differences in perception,

- effect of the concentration and composition of the stimulus in perception,

- effect of sensory and non-sensory properties of products on consumer preference.

Statistical analysis of the data was done using the test t-Student and determined which analyzed products were different and which were similar in statistical terms. The fact that there are statistically significant differences means the rejection of the hypothesis of equal environments of two products compared to a significance level of $p < 0.05$, and that there are no statistically significant differences means that we cannot reject the hypothesis of equal environments of the two products compared at a level of importance $p > 0.05$.

Statistical analysis of data was performed using dispersion analysis, ANOVA. Results recorded have confirmed the results obtained in practical terms for products studied.

In this chapter we have included: comparative and technological analysis of the acidic dairy products, optimization of technologies and ingredients for obtaining top quality products. Through the research carried out we have reached to develop two new products, which recorded high values of desired properties.

In Chapter IV, entitled "Conclusions" it has been stressed that the proposed study objectives were achieved. Both from the sensory, physicochemical and microbiological testing point of view, the products can be considered of top quality. Furthermore, the following conclusions have been drawn:

1. technological processes dependent on biochemical processes cannot be reduced and treated as simple equations because they depend on countless factors; biochemical processes can be influenced, controlled, but never fully mastered;

2. lactic acid is not solely responsible for the acid taste of fermented dairy products; acid taste can be enhanced by the presence or absence of other constituents, or even the presence of high amounts of whey;

3. classic CR09 yogurt product, manufactured after the optimization of the technological flux and the DVS culture, has been a success in terms of technology, streptococci and lactobacilli ratio being favorable; *Streptococcus delbriki subsp. thermophilus* developed better in mixed culture and stimulated the activity of *lactobacillus bulgaricus*.

4. any single product improvement led sooner to the destabilization of the entire balance than achieving real improvements;

5. even the improved or optimized products can be considered further perfectible and optimizable.

In the spirit of the last conclusions it can be said that this scientific approach was a first step in research on food sciences. So far as time, trade and financial aspects allow it, we shall try new formulas of optimization for the benefit of small processors and consumers.

Since the research in the field such an issue has not been addressed, we consider it useful for all professionals in the dairy industry. We also believe that the results of this paper are available to every technologist who wants to achieve a higher quality milk acidic product. Moreover, they can be a useful tool for the research and use of lactic cultures from the local area, which could help maintain the identity of traditional Romanian dairy products.

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