

The Influence of the Fruits Addition on the Quality Characteristics of Yogurt

Zorica Voşgan¹, Anca Dumuţa¹, Cristina Mihali¹, Lucia Mihalescu¹, Thomas Dippong¹, Alina Moldovan¹

¹Technical University of Cluj-Napoca, North University Center of Baia Mare, no.76 Victoriei Street, Romania

Abstract

Yogurt is considered a healthy food and by incorporating fruits the flavor and its nutritional value are improved. The objective of this study consists in obtaining and characterization of functional dairy products with added fruits, of yogurt type. The raw material used for obtaining the acid dairy products is cow milk, in which there were incorporated fruits: cherry, bananas and oleaginous fruits (nuts). The evolution in time of the acidity during fermentation is influenced by the addition of fruits, the highest acidity being reported in the cherry yogurt case. The ascorbic acid content of the fruity yogurts almost doubled compared to simple yogurt, the highest content of vitamin C was found in the yogurt with bananas. The amount of fat was higher in the yogurt containing nuts, because of the oleaginous fruits contribution, fact observed also due to a lower amount of whey released, followed by the yogurt with banana and the cherry yogurt, which released more whey. The study results also indicated that fruits have the effect of increasing the number of lactic acid bacteria, especially the cherry yogurt leading to a population of 4.84 ± 0.13 log CFU/ml.

Keywords: fruits, lactic acid bacteria, yogurt.

1. Introduction

Yogurt is a fermented dairy product, resulting from the growth of *Lactobacillus bulgaricus* and *Streptococcus thermophilus* bacteria, often in an unpredictable ratio to each other in warm milk. Yogurt is considered as healthy food due to its high digestibility and bioavailability of nutrients. Yogurt can be recommended to the people with lactose intolerance, gastrointestinal disorders and it is helpful in immune function and weight control [1, 2].

By incorporating fruits to yogurt the flavour and its nutritional value such as vitamin C and mineral content are improved. Also, the variety of yogurts is enhanced [2-5]. The demand for fruity yogurts with different flavors increased in recent years.

The market now offers a vast array of yoghurts to suit all tastes, in a variety of textures (e.g. liquid, set, smooth), fat contents (e.g. luxury, low-fat, virtually fat-free) and flavors (e.g. natural, fruit, cereal) [2]. Yogurt with fruits is a food appealing in terms of taste and appearance and is preferred by children. If it is not sweetened and prepared without additives or with a minimal amount of them, it is as healthy as plain yogurt [2].

The physical characteristics of yogurts, including the lack of visual whey separation and perceived viscosity, are essential aspects of the quality and overall sensory consumer acceptance of yogurts [6]. Acidic dairy products flavor is one of the qualities most valued by consumers, a leading role in its importance returns to the compounds of fruits and those developed by the yogurts specific bacteria [7].

Evaluation of the bacterial quality of yoghurt is necessary due to the high risk associated with consuming sub-standard or unhygienic yoghurt

* Corresponding author: Voşgan Zorica, Tel. 0749838509, Email zori_v13@yahoo.com

containing pathogenic organisms [8]. According to Tarakçi and Küçüköner [9], the aerobic mesophilic bacteria count can be significantly affected by the type of flavor additives used in yogurt.

The objectives of this study are to evaluate the effect of fruit addition on lactic fermentation and also on the physical, chemical and microbiological properties of yogurt as final product. Simple (plain) yogurt was also prepared for comparison.

2. Materials and methods

Preparation of the fruity yogurts

The raw material used for obtaining the acid dairy products is cow milk, in which there were incorporated fruits. The added fruits were: cherry (sour cherry), bananas and nuts. The cow's yogurt was prepared in laboratory conditions. The pasteurized milk was cooled at 45°C and inoculated with 5% culture of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. The fruits were also added in a 5 % ratio, except the simple yogurt. Then the inoculated milk was incubated at 42-45 °C in a thermostat for 5 hours to accomplish the stage of lactic fermentation of milk or milk-fruit mixture [10-11]. The product was cooled and stored in a refrigerator (at about 6-8°C) to reduce further acid development [10].

Physico-chemical and microbiological analysis

The evolution of the fermentation can be assessed by monitoring the lactic acid concentration that causes the increase of total acidity and the decrease of pH [10, 11]. The titrable acidity was monitored during 70 h taking samples at each 30 min in the first 3 hours of fermentation than again at 5 hours. The yogurt samples were cooled and stored at refrigerator at 6-8°C for 3 days. During the cool storage the maturation of yogurts took place. The titrable acidity continued to rise and was determined at the following times: 21, 44, 46 and 70 hours, considering as 0 the time when the inoculated milk, respectively the mixture of milk and fruits were introduced in the thermostat. The determination of the titrable acidity was performed according to the standardized method by titration against NaOH 0.1 N in the presence of phenolphthalein as indicator [12].

Also the analysis of ascorbic acid in the prepared yogurts was performed using the titrimetric method based on 2,4 dichlorophenol indolphenol [13].

The lipid content was analysed using the petroleum ether extraction method [12]. The separated whey was measured by the method used by Vahedi et al. [14]. The dry matter and water content of fruity and simple yogurts were analysed according to the standard methods recommended also by AOAC [15].

To register the bacterian upload (including the lactic acid bacteria) it was proceeded to the determination of the total number of germs by the method of cultures in plates. The plates were incubated at 37°C for 48 hours and then there were enumerated the plates containing 30-300 colonies and the CFU/ml yogurt was calculated [16].

3. Results and discussion

The evolution in time of the acidity during fermentation is influenced by the addition of fruits, the highest acidity among the fruity yogurts being reported in the cherry yogurt case. After the first 90 minutes of fermentation (1.5 hours), the simple yogurt became the most acid product with the highest fermentation rate. The titrable acidity increases in time following a logarithmic function due to the multiplication of lactic bacteria. Finally, the product with the highest acidity was simple yogurt followed by cherry, nuts and banana yogurt (Figure1).

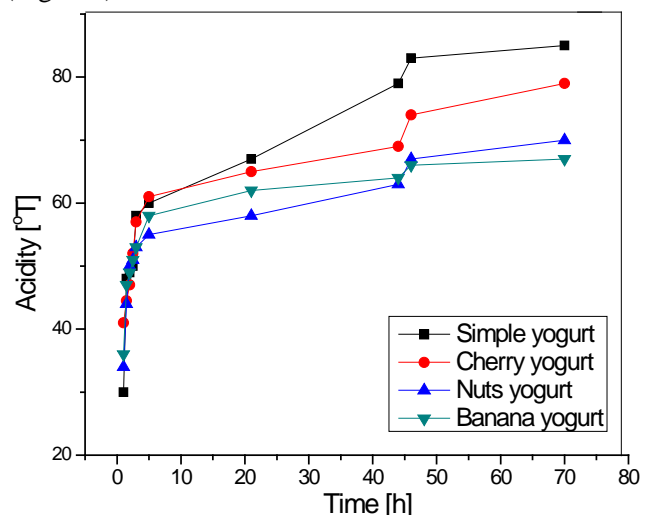


Figure 1. Acidity changes of yogurt in time

The ascorbic acid content of the fruit yogurt almost doubled compared to simple yogurt, the highest content of vitamin C was found in the yogurt with bananas (Figure 2).

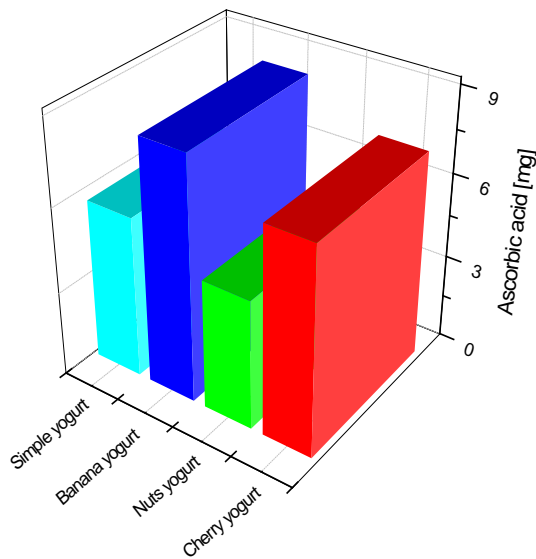


Figure 2. The ascorbic acid concentration of fruit yogurt

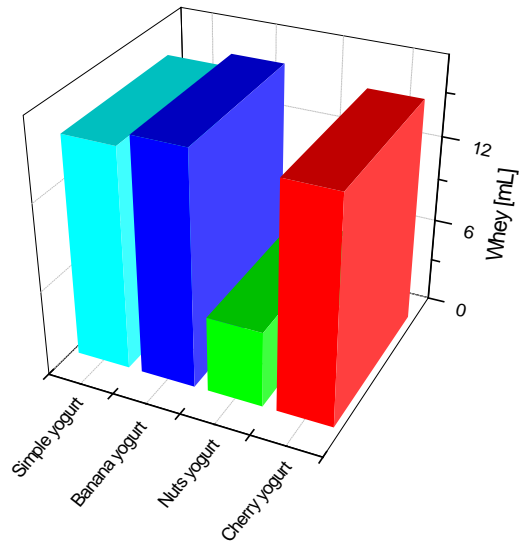


Figure 4. The amount of whey released from yogurt

The amount of fat was higher in the yogurt containing nuts, because of the oleaginous fruits contribution, fact observed also due to a lower amount of whey released, followed by the yogurt with banana and the cherry yogurt, which released more whey (Figures 3, 4) [17]. Similar results were obtained by Şengül et al. [18]. Their researches showed that an increase of the cherry pulp concentration added in the yogurt led to the increase of the whey separation while the other parameters such as total solid, fat, protein, ash, titrable acidity and viscosity decreased [15].

The addition of oleaginous fruits (nuts), besides the increasing of the concentration of fat in the yogurt, also favored a more viscous consistency by reducing the ratio of the separated whey. Thus, the content in dry matter increased being 47.30% compared to the cherry yogurt with only 33.51% dry matter.

Cherries, which have diuretic properties, favored the increasing of the product's water content until a percentage of 66.49%, higher in comparison to the plain yogurt without added fruit that contained 53.44% water and to the yogurts with banana or nuts with water content of 55.83 and 52.70%.

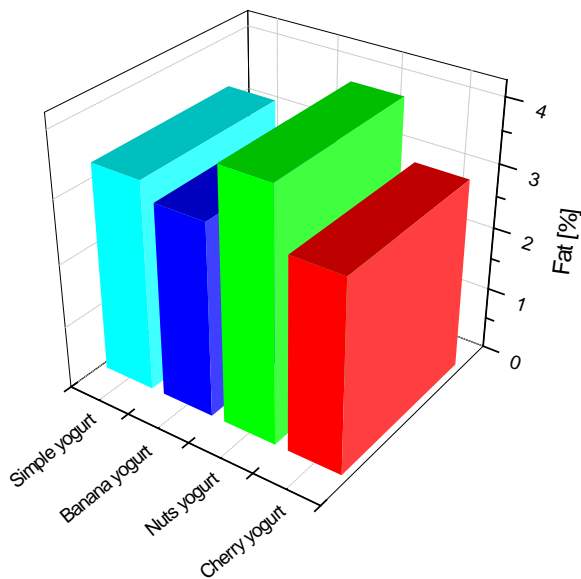


Figure 3. Fat concentration of fruit yogurt compared with simple yogurt

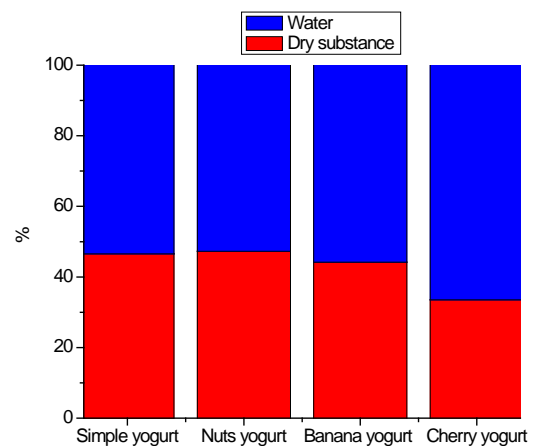


Figure 5. Dry substance and water

Yoghurt is a very popular flavorful product which is produced through the fermentation of lactic acid bacteria (LAB) [19]. Considering the fruity

yogurts, the best growth of lactic acid bacteria was registered in the case of cherry yogurt that showed a stimulating effect on the bacteria growth attaining to a population of $4.84 \pm 0.13 \log$ CFU/ml. The variation of CFU/ml in the case of simple yogurt and of the fruity yogurts can be seen in Figure 6.

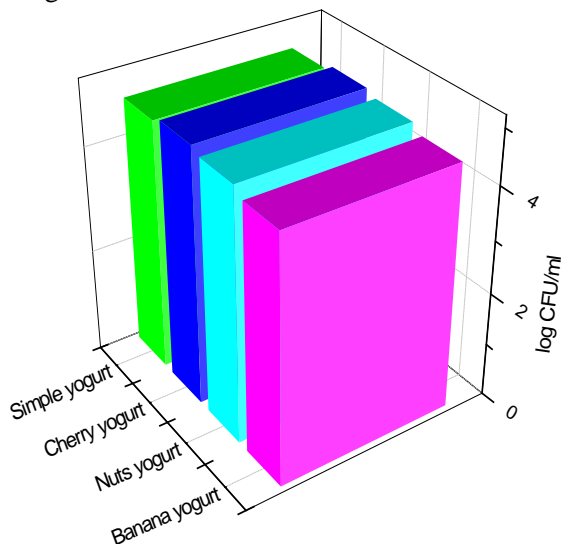


Figure 6. Microbiological characteristics of yogurts

4. Conclusions

As other dairy products, yogurts are not important sources of vitamin C. The ascorbic acid was supplemented by the addition of fruits in the proposed fruit added yogurts (with nuts, bananas and cherry). In the analyzed yogurt samples, thus the bananas yogurt provides an important source of ascorbic acid (vitamin C). The diets recommend a low calorie yogurt as yogurt with cherries, which has the lowest fat content. The most pronounced acidity, the one of the cherry yogurt favored the multiplication of acidophilus bacteria and addition of nuts also has a positive effect on increasing the quality of lactic acid producing bacteria. Fruit yogurts provide important sources of constituents, which can be consumed as a nutritional and medicinal alternative.

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