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PRODUCTION OF FROZEN YOGURT WITH ADDED BLUEBERRY PULP (FRESH, POWDERED): PHYSICOCHEMICAL, BIOACTIVE, AND SENSORY CHARACTERISTICS

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Abstract: *The development of new products is a challenge for the food industry as it tries to meet consumer demand for healthy and appealing foods. This category includes dairy desserts, which are made from both dairy and non-dairy ingredients, in various types and appropriate proportions. Frozen yogurt is a fermented and frozen dessert that combines the nutritional value of classic yogurt with the refreshing taste of ice cream, having a low fat and lactose content. In this sense, frozen yogurt can be considered a healthy alternative to ice cream due to its nutritional composition and content of protein, calcium, and vitamins. The aim of this study was to develop and characterize frozen yogurt fortified with blueberries added in two forms: the first as fresh pulp, and the second as powder. The frozen yogurt samples, prepared with pulp/powder, were characterized and compared with a control formulation that used the food coloring E162 to determine the effect of using fresh blueberry pulp along with the powder obtained from their pulp on the proximate composition, and sensory quality of the frozen yogurt.*

• Introduction

Frozen yogurt-like desserts are still relatively new on the market. Therefore, it shouldn't be surprising that consumers usually tend to compare the sensory attributes of this product with those of ice cream, which is known for its mild, pleasant taste and rich, creamy texture. Flavor remains a concern for a number of consumers, who cite it as a reason for eating ice cream more than frozen yogurt. Texture is also an important feature for many consumers. Blueberries are considered a superfood of the 21st century, but they have been eaten by Native Americans for over 10,000 years. The abundance of polyphenolic compounds in these fruits is often thought to be responsible for the benefits of eating blueberries, but questions have been raised about their bioavailability in the human body and, therefore, their biological activity. To address this, our proposed product recipe tried to meet these challenges by choosing blueberries fruit powder as a base to create a frozen dessert with properties similar to classic yogurt.

• Material and method

The raw material, cow's milk, was purchased from the Teaching Station of the University of Life Sciences 'King Michael I' in Timișoara. In this experiment, the following ingredients were used: (a) skimmed milk powder, sugar, and fresh blueberries bought from a local supermarket, (b) blueberry powder purchased online (SUT content 94%), (c) lyophilized yogurt culture DVS (ST-5M, CHR_HANSEN), and (d) stabilizer (guar gum) purchased from a health food store. The fresh pulp was prepared in an industrial blender by grinding 1000 g of blueberries until the fruit was completely dissolved. The pulp was packed and heat-treated at 90°C for 10 minutes, the container was cooled, and stored in the fridge at 5°C. The frozen yogurt formulations were prepared in triplicate, following procedures described in specialized literature with some modifications.



• Results and discussions

1.Physico-chemical characterization of yogurt samples

Table 1. Composition of frozen blueberry yogurt samples

Parameter	Frozen yogurt with fresh pulp	Frozen yogurt with powdered pulp	Control
pH	3.96[a]	3,98[a]	4.10[a]
Air volume (%)	29,89[a]	29.07[a]	29.12[a]
Density (g/cm^3)	0,833[a]	0,817[a]	0,918[a]
Fat (%)	3.47[a]	3, 52[a]	3.50[a]
Proteins (%)	3.34[a]	3.46[a]	3.26[a]
Total solids (%)	13.23[a]	13.34[a]	12.58[b]

2. Analysis of the color stability of frozen blueberry yogurt samples

Table 2. Average L*, a* and b* results for blueberry frozen yogurt samples over the storage period

Days	Frozen yogurt with fresh pulp			Frozen yogurt with powdered pulp			Control		
	L*	a*	b*	L*	a*	b*	L*	a*	b*
1	84,87[a]	4,32[a]	11,60[a]	83,77[a]	2,20[a]	13,35[a]	86,5[a]	4,39[a]	7,83[a]
7	83,87[b]	2,76[b]	11,47[a]	83,46[a]	2,06[a]	12,22[b]	85,69[a]	3,12[b]	7,70[a]
14	83,75[b]	2,44[b]	11,30[a]	81,49[b]	1,93[b]	11,89[c]	84,53[b]	2,98[c]	7,57[a]
21	83,75[b]	2,35[b]	11,15[a]	79,05[c]	1,19[b]	10,34[d]	84,40[b]	2,79[c]	7,14[ab]
28	82,01[c]	2,02[bc]	11,06[a]	60,10[d]	1,14[b]	9,86[e]	83,29[c]	2,59[c]	6,98[b]
36	80,23[d]	1,93[c]	10,87[a]	59,87[e]	1,11[b]	9,25[e]	82,45[d]	2,12[c]	6,85[b]

3. Microbiological Analysis of frozen blueberry yogurt samples

Table 3. The average number of viable lactobacilli (CFU/mL) in frozen yogurt samples during the analyzed storage period

Yogurt samples	Storage timp					
	1 day	7 days	14 days	21 days	28 days	36 days
With fresh pulp	1,8x10^{10Aa}	7,5x10^{9Ab}	9,0x10^{9Ab}	5,6x10^{9Ab}	5,6x10^{9Ab}	1,9x10^{9Ab}
With powdered pulp	8,3x10^{9Ba}	4,8x10^{9Aa}	6,1x10^{9Aa}	1,4x10^{9Aa}	1,4x10^{9Aa}	1,2x10^{9Aa}
Control	1,2x10^{10Ca}	1,2x10^{10Ba}	2,8x10^{9Bb}	1,3x10^{9Ab}	1,3x10^{9Ab}	1,1x10^{9Ab}

Conclusions

The results show that adding blueberry pulp (fresh or in powdered form) promoted a tendency to reduce pH and a consecutive increase in total titratable acidity ($p < 0.05$). As for the total solids content, small variations in values were observed, and the differences ($p < 0.05$) noted do not indicate clear trends related to the formulation used. Fat and ash content did not show significant differences between groups ($p > 0.05$). Frozen yogurt samples showed similar results for appearance, flavor, and texture; however, those with added powder received a significantly lower rating for flavor. Considering the already proven bioactive value of blueberries, this study showed the technological potential of the product in powder form, as the frozen yogurt with added powder had similar physico-chemical characteristics and sensory evaluation to the product made with fresh pulp.