INFLUENCE OF PARAMETERS ON SENSORY PROPERTIES AND CONSUMER ACCEPTANCE OF PROBIOTIC FRESH CHEESE

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ABSTRACT: Probiotics, because of their beneficial effects on human health, are used in the treatment of digestive disorders, the prevention of colon cancer, restoration of the intestinal microflora balance and stimulate the immune system. New discoveries of soy enter the list of functional foods, i.e. found between food and medicine. The aim of the work was to examine the effect of soy drink, thermalization (60°C/3 min), combinations of microbial starter cultures and addition of prebiotics on sensory properties, and acceptability of probiotic fresh cheese. Fresh cheese samples were produced from skimmed milk (0.9% milk fat) and combination of cow's milk and soy drink. Milk fermentation was carried out at 25ºC and 40ºC, with addition of Lyofast EF1 and combination of microbial starter cultures Lyofast MWO 030 and Lyofast EF1 in a ratio of 1:1. Half of the obtained fresh cheese was subjected to a thermalisation process (60ºC/3 min). All the samples produced had a creamy consistency. The sensory properties of probiotic fresh cheese were evaluated by a group of 15 assessors. The acceptability of probiotic fresh cheese was evaluated by a group of 40 consumers. The samples were evaluated after 1, 7 and 14 days of storage. The addition of soy drink and the combination of microbial starter cultures had an influence on the improvement of the sensory properties of probiotic fresh cheese, which was confirmed by statistical analysis of the results.

KEYWORDS: probiotic fresh cheese, Lyofast EF1, Lyofast MWO 030, soy drink, thermalization, sensory properties, acceptability

INTRODUCTION

The development of cheese production through history is the result of the importance and role that milk and dairy products have taken in the nutrition of population, as well as the aspiration of people to ensure adequate storage of the most important foods for them. Fresh cheeses are usually not, or are minimally aged, have high moisture content, do not have rind, and got very mild flavor and a soft and smooth texture. In this category, milk coagulation is due to rennet and/or acid produced from a bacterial culture or other sources such as lemon juice.

When bacteria are involved in their manufacture, they also contribute to the development of typical flavors, quality improvement, and/or promote health benefits if they display probiotic properties [1]. The use of soy as a food ingredient is gaining importance in the food industry and for consumers due to its role as functional food [2].

Soymilk is an inexpensive, nutritive dairy substitute that is used to make cheese and cheese analogs by people worldwide [3]. Soy prebiotics such as oligofructose and inulin have a great application potential in the food industry due to their functional properties. The use of alternative ingredients such as soy drink reduces lactose content in yogurt [4]. According to a study carried out by Martinez – Villaluenga et al. [5], it is possible to use *Enterococcus faecium*, isolated from raw soy drink, in production of fermented soy drink, which could be a promising strategy in the preventative therapy against cardiovascular diseases. Because of their role in mating and the development of cheese flavor, enterococci have been proposed to be used as a starter culture in the production of European cheeses due to the preferred technological and metabolic properties [6,7,8,9].

Bedani et al. [10] examined the effect of inulin and okara flour on textural and sensory properties of probiotic soy yoghurt (SY) throughout 28 days of storage at 4 °C. According to them, inulin has influnce on higher scores for sensory acceptability. Bibiana et al. [11] compared reduced-fat fresh cow's milk cheese with inulin (3%) with both full-fat and reduced-fat cheeses without prebiotic. The results showed that the reduced-fat cheese with inulin was more acceptable than its counterpart without inulin. Kinik et al. [12] investigate the effects of probiotics, and inulin on aromatic compounds, and on the textural and sensory properties of symbiotic goat

cheese during its ripening period. They study showed that the most favoured cheeses were found to contain *E. faecium* and oligofructose.

MATERIAL AND METHODS

MATERIALS

Production prototypes of milk based products with fresh cheese and fruits were conducted in the laboratory of Food Technology, the Faculty of Technology, University of Tuzla. For the production of fresh cheese, commercial UHT cow milk (Meggle) with 0.9% milk fat and commercial soy drink (Alpro) were used. For direct inoculation of milk, FD-DVS cultures were used:

1. Lyofast EF1 (*Enterococcus faecium)*
2. Lyofast MWO 030 : Lyofast EF1 in a ratio of 1:1

Lyofast MWO 030 (*Lactococcus lactis* ssp. *lactis, Lactococcus lactis* ssp. *cremoris)*

As a prebiotic supplement, Orafti®Synergy1, powder of inulin, was used.

The parameters of the production of fresh probiotic cheese were as follows:

- Thermalization: 60°C/3 min
- 2 volumes of the soy drink content: 10% and 15% in relation to the total amount of milk
- 2 different starter cultures: Lyofast EF1 and Lyofast MWO 030
- Orafti®Synergy1 supplement: 2.5g/ 100g cheese.

The milk was thermally processed at inoculation temperature (25°C and 40°C) and primed with the microbial starter cultures. The fermentation lasted between 19 and 20 hours (samples A and B) and between 10 and 11 hours (samples C and D) until a pH value of 4.6 was reached. Subsequently, curd was cut (samples A1-3, B1-3, C1-3 and D1-3 were thermalized and then cooled at temperature 37°C), squeezed through cotton fabrics for about 6 to 11 hours at 20°C. In samples B1-6 and D1-6, a prebiotic supplement was added. 24 samples were produced. The obtained products were stored in a refrigerator in a plastic container for 14 days at + 4°C. The sample markings are shown in Table 1. The sensory properties of probiotic fresh cheese samples were evaluated by a group of 15 assessors using a scoring method, after 1, 7 and 14 days of storage [13], and they are trained. The acceptance of the samples of produced fresh cheese was tested by 40 consumers using the hedonic scale according to Peryam. They expressed their general impression by rating the tested products on a scale of 1 to 9 [14]. The sample markings are shown in Table 1.

Samples	Thermalization 60°C/3 min	% soy Drink	Starter culture	**Orafti® Synergy1**
A1	-	-	Lyofast EF1	-
A2	-	10 %		-
A3	-	15 %		-
A4	+	-		-
A5	+	10 %		-
A6	+	15 %		-
B1	-	-		+
B2	-	10 %		+
B3	-	15 %		+
B4	+	-		+
B5	+	10 %		+
B6	+	15 %		+
C1	-	-	Lyofast MWO 030:Lyofast EF1 =1:1	-
C2	-	10 %		-
C3	-	15 %		-
C4	+	-		-
C5	+	10 %		-
C6	+	15 %		-
D1	-	-		+
D2	-	10 %		+
D3	-	15 %		+
D4	+	-		+
D5	+	10 %		+
D6	+	15 %		+

STATISTICAL ANALYSIS

Analysis of variance (ANOVA) was carried out using SPSS software (version 22). Duncan test was used to determinate which samples were statistically different by all the sensory properties and acceptance of product ($P<0.05$).

RESULTS AND DISCUSSION

The average values of sensory properties of fresh probiotic cheese are shown in Tables 2, 3 and 4.

During storage, the samples had a relatively good external appearance. The addition of soy drink had a positive effect on the appearance and consistency of fresh cheese samples. The combination of Lyofast MWO 030 starter

culture: Lyofast EF1 = 1:1 influenced better sample consistency (Tables 2, 3 and 4). Observing the sensory sensitivity of the fragrance, it is evident that the addition of Lyofast MWO 030 and soy drink contributed to better grades, which was also reflected in the taste of the product (Tables 2, 3 and 4). The cheese samples produced by inoculation of milk with Lyofast EF1 only had slightly bitter but still pleasing taste. The addition of the soy drink neutralized bitter taste, giving the sweet taste and smell of probiotic cheese, a better feeling in the mouth when consumed, and the creamy consistency.

Table 2. Average values of sensory properties of probiotic fresh cheese after 1 day of storage

Sample	External appearance (2,0)	Consistency (4,0)	Smell (3,0)	Taste (9,0)	Color (2,0)	Σ (20,0)
A1	1.73(±0.45)^{1}	3.25(±0.84)^{1}	2.38(±0.87)^{1}	7.69(±1.09)^{1}	1.98(±0,07)	17.01
A2	1.94(±0.17)^{2,3}	3.88(±0.35)^{3}	3.00(±0.00)^{3}	8.31(±0.79)^{1,2,3,4,5}	2.00(±0.00)	19.13
A3	2.00(±0.00)^{3}	3.88(±0.35)^{3}	2.91(±0.18)^{3}	8.16(±0.90)^{1,2,3,4,5}	2.00(±0.00)	18.95
B1	1.94(±0.17)^{2,3}	3.41(±0.71)^{1,2}	2.68(±0.50)^{3}	8.08(±0.91)^{1,2,3,4}	2.00(±0.00)	18.10
B2	1.96(±0.07)^{2}	3.61(±0.43)^{1,2,3}	2.88(±0.35)^{3}	8.81(±0.37)^{4,5}	2.00(±0.00)	19.26
B3	1.86(±0.09)^{1,2,3}	3.80(±0.36)^{2,3}	2.98(±0.07)^{3}	8.73(±0.45)$^{3.4.5}$	2.00(±0.00)	19.36
C1	2.00(±0.00)^{3}	3.99(±0.03)^{3}	2.95(±0.09)^{3}	8.56(±0.49)^{2,3,4,5}	1.98(±0.07)	19.48
C2	2.00(±0.00)^{3}	4.00(±0.00)^{3}	3.00(±0.00)^{3}	8.88(±0.35)^{5}	2.00(±0.00)	19.88
C3	2.00(±0.00)^{3}	4.00(±0.00)^{3}	3.00(±0.00)^{3}	8.75(±0.46)^{3,4,5}	2.00(±0.00)	19.75
D1	2.00(±0.00)^{3}	3.88(±0.35)^{3}	3.00(±0.00)^{3}	7.88(±0.58)^{1,2}	2.00(±0.00)	18.75
D2	2.00(±0.00)^{3}	3.88(±0.35)^{3}	2.98(±0.07)^{3}	8.25(±0.65)^{1,2,3,4,5}	2.00(±0.00)	19.10
D3	2.00(±0.00)^{3}	4.00(±0.00)^{3}	2.94(±0.17)^{3}	8.56(±0.03)^{2,3,4,5}	2.00(±0.00)	19.50
A4	1.79(±0.36)^{1,2}	3.56(±0.72)^{1,2,3}	2.53(±0.71)^{1,2}	8.01(±1.05)^{1,2,3}	1.97(±0.737)	17.99
A5	1.94(±0.17)^{2,3}	3.94(±0.17)^{3}	2.93(±0.21)^{3}	8.75(±0.46)^{3,4,5}	2.00(±0.00)	19.55
A6	1.94(±0.17)^{2,3}	3.88(±0.35)^{3}	3.00(±0.00)^{3}	8.56(±0.82)^{2,3,4,5}	1.97(±0.70)	19.35
B4	1.98(±0.07)^{3}	3.88(±0.23)^{3}	2.85(±0.22)^{3}	8.59(±0.41)^{2,3,4,5}	1.93(±0.17)	19.23
B5	2.00(±0.00)^{3}	3.81(±0.37)^{2,3}	3.00(±0.00)^{3}	8.88(±0.23)^{5}	2.00(±0.00)	19.69
B6	2.00(±0.00)^{3}	3.81(±0.37)^{2,3}	2.75(±0.46)^{2,3}	8.19(±0.88)^{1,2,3,4,5}	2.00(±0.00)	18.75
C4	1.94(±0.17)^{2,3}	4.00(±0.00)^{3}	2.81(±0.37)^{2,3}	8.44(±0.56)^{1,2,3,4,5}	1.93(±0.17)	19.13
C5	2.00(±0.00)^{3}	3.98(±0.07)^{3}	3.00(±0.00)^{3}	8.75(±0.46)^{3,4,5}	2.00(±0.00)	19.73
C6	2.00(±0.00)^{3}	3.98(±0.07)^{3}	3.00(±0.00)^{3}	8.81(±0.37)^{4,5}	2.00(±0.00)	19.79
D4	2.00(±0.00)^{3}	4.00(±0.00)^{3}	3.00(±0.00)^{3}	8.44(±0.53)^{1,2,3,4,5}	2.00(±0.00)	19.44
D5	2.00(±0.00)^{3}	3.75(±0.46)^{2,3}	2.94(±0.17)^{3}	8.75(±0.46)^{3,4,5}	2.00(±0.00)	19.44
D6	2.00(±0.00)^{3}	3.88(±0.35)^{3}	3.00(±0.00)^{3}	8.31(±0.53)^{1,2,3,4,5}	2.00(±0.00)	19.19

^{1,2,3,4,5,6} *- Mean values in the same column, with different superscript are significantly different (P<0.05)*

Table 3. Average values of sensory properties of probiotic fresh cheese after 7 days of storage

Sample	External appearance (2,0)	Consistency (4,0)	Smell (3,0)	Taste (9,0)	Color (2,0)	Σ (20,0)
A1	1.63(±0.58)^{1}	2.71(±1.00)^{1}	2.50(±0.92)^{1,2,3,4}	6.38(±1.59)^{1}	1.98(±0.07)	15.19
A2	1.79(±0.36)^{1,2}	3.59(±0.49)^{2,3,4,5}	2.86(±0.35)^{3,4}	7.50(±1.06)^{1,2,3,4,5}	1.98(±0.07)	17.71
A3	1.85(±0.35)^{1,2}	3.29(±0.92) ^{2,3}	2.60(±0.68) ^{2,3,4}	7.50(±1.30)^{1,2,3,4,5}	1.91(±0.18)	17.15
B1	1.81(±0.37)^{1,2}	3.01(±0.87) ^{1,2}	1.94(±0.62) ^{1}	6.63(±1.30)^{1,2}	1.88(±0.35)	15.26
B2	1.85(±0.22)^{1,2}	3.35(±0.55)^{2,3,4}	2.33(±0.70)^{1,2,3}	7.56(±0.82)^{1,2,3,4,5}	2.00(±0.00)	17.09
B3	1.71(±0.18)^{1,2}	3.44(±0.41)^{2,3,4,5}	2.29(±0.56)^{1,2,3}	7.73(±1.55)^{1,2,3,4,5}	1.88(±0.35)	17.04
C1	1.88(±0.23)^{1,2}	3.94(±0.17)^{4,5}	2.60(±0.50)^{2,3,4}	6.81(±1,06)^{1,2}	1.98(±0.07)	17.20
C2	1.95(±0.10)^{1,2}	4.00(±0.00)^{5}	2.81(±0.37)^{2,3,4}	7.63(±1.48)^{1,2,3,4,5}	2.00(±0.00)	18.39
C3	1.90(±0.19)^{1,2}	3.81(±0.37)^{3,4,5}	2.75(±0.46)^{2,3,4}	7.38(±0.80)^{1,2,3,4}	2.00(±0.00)	18.46
D1	1.81(±0.25)^{1,2}	3.38(±0.44)^{2,3,4,5}	2.69(±0.44)^{2,3,4}	7.44(±0.51)^{1,2,3,4}	2.00(±0.00)	17.31
D2	1.94(±0.17)^{1,2}	3.63(±0.44)^{3,4,5}	2.81(±0.25)^{2,3,4}	7.88(±0.64)^{2,3,4,5}	2.00(±0.00)	18.25
D3	2.00(±0.00)^{2}	4.00(±0.00)^{5}	3.00(±0.00)^{4}	8.44(±0.41)^{4,5}	2.00(±0.00)	19.44
A4	1.79(±0.36)^{1,2}	3.31(±1.16)^{2,3,4}	2.19(±0.63)^{1,2}	6.88(±1.55)^{1,2,3}	1.87(±0.23)	16.04

Sample	External appearance (2,0)	Consistency (4,0)	Smell (3,0)	Taste (9,0)	Color (2,0)	Σ (20,0)
A5	1.63(±0.44) [1]	3.75(±0.37)[3,4,5]	2.4(±0.60)[1,2,3,4]	7.25(±0.92) [1,2,3,4]	1.75(±0.46)	16.79
A6	1.80(±0.22)[1,2]	3.80(±0.35)[3,4,5]	2.63(±0.51)[2,3,4]	7.81(±0.70)[2,3,4,5]	1.85(±0.22)	17.89
B4	1.79(±0.36)[1,2]	3.50(±0.70)[2,3,4,5]	2.44(±0.49)[1,2,3,4]	7.31(±1.38)[1,2,3,4]	1.81(±0.37)	16.85
B5	1.85(±0.22)[1,2]	3.87(±0.41)[3,4,5]	2.50(±0.44)[1,2,3,4]	7.56(±0.45)[1,2,3,4,5]	1.93(±0.23)	18.64
B6	2(±0.00)[2]	3.78(±0.23)[3,4,5]	2.91(±0.22)[3,4]	8.31(±0.83)[4,5]	2.00(±0.00)	18.56
C4	1.88(±0.23)[1,2]	3.88(±0.23)[3,4,5]	2.50(±0.92)[1,2,3,4]	7.56(±1.14)[1,2,3,4,5]	1.94(±0.17)	17.75
C5	1.94(±0.17)[1,2]	3.79(±0.24)[3,4,5]	2.91(±0.18)[3,4]	8.31(±0.88)[4,5]	1.88(±0.35)	18.83
C6	1.88(±0.23)[1,2]	3.76(±0.253)[3,4,5]	2.66(±0.35)[2,3,4]	7.73(±1.33)[1,2,3,4,5]	1.99(±0.03)	18.01
D4	2.00(±0.00)[2]	4.00(±0.00)[5]	3.00(±0.00)[4]	8.44(±0.53)[4,5]	2.00(±0.00)	19.44
D5	2.00(±0.00)[2]	3.88(±0.35)[3,4,5]	3.00(±0.00)[4]	8.88(±0.35)[5]	2.00(±0.00)	19.75
D6	2.00(±0.00)[2]	4.00(±0.00)[5]	2.88(±0.35)[3,4]	8.25(±0.37)[3,4,5]	2.00(±0.00)	19.13

[1,2,3,4,5,6] *- Mean values in the same column, with different superscript are significantly different (P<0.05)*

Table 4. Average values of sensory properties of probiotic fresh cheese after 14 days of storage

Sample	External appearance (2,0)	Consistency (4,0)	Smell (3,0)	Taste (9,0)	Color (2,0)	Σ (20,0)
A1	1.75(±0.35)[1,2,3]	2.81(±0.56)[1]	2.08(±0.61)[3,4]	4.85(±1.47)[1]	1.98(±0.07)[2,3]	13.40
A2	1.86(±0.22)[2,3]	3.49(±0.44)[2]	2.41(±0.60)[3,4,5,6]	5.88(±1.80)[1,2,3,4]	1.98(±0.07)[2,3]	15.61
A3	1.81(±0.37)[2,3]	3.38(±0.87)[2]	2.19(±0.84)[3,4,5]	6.44(±2.19)[1,2,3,4,5]	1.85(±0.35)[2,3]	15.66
B1	1.44(±0.49)[1]	2.31(±0.45)[2]	1.25(±0.37)[1]	5.50(±0.75)[1,2,3]	1.88(±0.35)[2,3]	12.38
B2	1.85(±0.22)[2,3]	3.56(±0.56)[2]	2.25(±0.65)[3,4,5]	7.25(±1.03)[4,5,6]	2.00(±0.00)[3]	16.91
B3	1.76(±0.23)[1,2,3]	3.44(±0.41)[2]	2.25(±0.26)[3,4,5]	7.50(±1.36)[4,5,6]	1.88(±0.35)[2,3]	16.83
C1	1.75(±0.21)[1,2,3]	3.44(±0.49)[2]	2.26(±0.54)[3,4,5]	5.94(±1.01)[1,2,3,4]	1.98(±0.07)[2,3]	15.36
C2	1.88(±0.23)[2,3]	3.81(±0.37)[2]	2.31(±0.59)[3,4,5]	6.38(±1.30)[1,2,3,4,5]	2.00(±0.00)[3]	16.38
C3	1.88(±0.23)[2,3]	3.88(±0.23)[2]	2.19(±0.75)[3,4,5]	7.31(±1.33)[4,5,6]	2.00(±0.00)[3]	17.25
D1	1.76(±0.33)[1,2,3]	3.63(±0.44)[2]	2.13(±0.64)[3,4,5]	5.25(±1.90)[1,2]	2.00(±0.00)[3]	14.76
D2	1.89(±0.18)[2,3]	3.88(±0.35)[2]	2.33(±0.70)[3,4,5]	5.50(±2.20)[1,2,3]	2.00(±0.00)[3]	15.59
D3	2.00(±0.00)[3]	4.00(±0.00)[2]	3.00(±0.00)[6]	8.50(±0.46)[6]	2.00(±0.00)[3]	19.50
A4	1.56(±0.49)[1,2]	2.75(±1.25)[1]	1.44(±0.67)[1,2]	4.88(±2.41)[1]	1.88(±0.22)[2,3]	12.50
A5	1.66(±0.44)[1,2,3]	3.50(±0.70)[2]	1.89(±0.62)[2,3]	6.56(±0.11)[2,3,4,5]	1.63(±0.51)[1]	15.24
A6	1.81(±0.25)[2,3]	3.68(±0.69)[2]	2.35(±0.40)[3,4,5,6]	6.94(±0.77)[3,4,5,6]	1.73(±0.36)[1,2]	16.50
B4	1.81(±0.37)[2,3]	3.44(±0.72)[2]	2.56(±0.49)[3,4,5,6]	7.00(±1.07)[3,4,5,6]	1.81(±0.37)[1,2]	16.63
B5	1.91(±0.18)[2,3]	3.63(±0.44)[2]	2.69(±0.45)[4,5,6]	7.88(±0.64)[5,6]	1.94(±0.17)[2,3]	18.04
B6	2.00(±0.00)[3]	3.69(±0.37)[2]	2.81(±0.25)[5,6]	7.31(±0.75)[5,4,6]	1.94(±0.17)[2,3]	17.75
C4	1.75(±0.37)[1,2,3]	3.63(±0.74)[2]	2.19(±1.06)[3,4,5]	6.38(±1.99)[1,2,3,4,5]	1.94(±0.17)[2,3]	15.88
C5	1.85(±0.22)[2,3]	3.73(±0.36)[2]	2.73(±0.45)[4,5,6]	7.35(±1.58)[4,5,6]	2.00(±0.00)[3]	17.65
C6	1.75(±0.26)[1,2,3]	3.75(±0.37)[2]	2.54(±0.39)[3,4,5,6]	7.06(±1.08)[3,4,5,6]	2.00(±0.00)[3]	17.10
D4	2.00(±0.00)[3]	4.00(±0.00)[2]	3.00(±0.00)[6]	8.50(±0.65)[6]	2.00(±0.00)[3]	19.50
D5	2.00(±0.00)[3]	3.88(±0.35)[2]	2.19(±0.37)[3,4,5]	7.75(±0.46)[5,6]	2.00(±0.00)[3]	17.81
D6	2.00(±0.00)[3]	4.00(±0.00)[2]	2.50(±0.53)[3,4,5,6]	7.00(±0.00)[3,4,5,6]	2.00(±0.00)[3]	17.50

[1,2,3,4,5,6] *- Mean values in the same column, with different superscript are significantly different (P<0.05)*

The combination of starter cultures Lyofast MWO 030 with Lyofast EF1 in the ratio of 1:1 improved the taste of cheese, which is also evident from the ratings given by the sensory assessors, and which was shown by statistical analysis (Tables 2, 3 and 4). In the research carried out by Rasouli Pirouzian et al. [15], samples of Iranian white UF cheeses containing *Enterococcus faecium* showed lower scores of cheeses that were diluted with milking with a combination of mesophilic (*Lactococcus cremoris* and *L. lactic*) and thermophilic (*Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus*) cultures. The panelists commented that the cheeses produced with *E. faecium* lacked a good taste and had a less pronounced aroma after two months of storage. Some bacteria produce additional cellular proteolytic and lipolytic enzymes

that can cause unwanted texture and flaws [16]. There are contradictory statements about the influence of enterococci on the sensory characteristics of cheese. High concentrations of enterococci are considered to cause deterioration in organoleptic properties in parmesan [17, 18]. In contrast, many authors claim that enterococci can play a positive role in the cheese production process [19]-[22]. The color, as sensory property, of all samples was the most stabile during storage. The consistency of thermalized samples was enhanced during storage, indicating that thermalisation had a positive impact on consistency.

Table 5. Average values of acceptance of non thermalized probiotic fresh cheese after 14 days of storage

Sample	X	D (%)	ND (%)
A1	5.188(±1.06)^{1,2,3}	87.50	12.50
A2	6.438(±1.267)^{1,2,3,4}	87.50	12.50
A3	6.588(±2.01)^{2,3,4}	75.00	25.00
B1	5.750(±0.70)^{1,2,3}	100.00	0
B2	7.125(±0.83)^{3,4}	100.00	0
B3	7.250(±1.16)^{3,4,5}	100.00	0
C1	6.225(±1.12)^{1,2,3,4}	100.00	0
C2	6.750(±1.38)^{2,3,4}	100.00	0
C3	7.438(±1.23)^{4,5}	100.00	0
D1	5.000(±1.30)^{1}	75.00	25.00
D2	5.500(±1.92)^{1,2}	75.00	25.00
D3	8.625(±0.35)^{5}	100.00	0

x- Average values; D – desirability; ND – non desirability
^{1,2,3,4,5}- Mean values in the same column, with different superscript are significantly different (P<0.05)

Table 6. Average values of acceptance of thermalized probiotic fresh cheese after 7 days of storage

Sample	X	D (%)	ND (%)
A4	6.938(±1.26)^{1}	100.00	0
A5	7.93(±0.41)^{2,3}	100.00	0
A6	8.125(±1.64)^{3}	100.00	0
B4	7.063(±1.65)^{1,2}	100.00	0
B5	8.313(±0.37)^{3}	100.00	0
B6	8.000(±0.91)^{2,3}	100.00	0
C4	8.000(±0.92)^{2,3}	100.00	0
C5	8.438(±0.72)^{3}	100.00	0
C6	8.000(±1.02)^{2,3}	100.00	0
D4	8.500(±0.41)^{3}	100.00	0
D5	8.875(±0.35)^{3}	100.00	0
D6	8.475(±0.35)^{3}	100.00	0

x- Average values; D – desirability; ND – non desirability
^{1,2,3}- Mean values in the same column, with different superscript are significantly different (P<0.05)

Table 7. Average values of acceptance of thermalized probiotic fresh cheese after 14 days of storage

Sample	X	D (%)	ND (%)
A4	5.188(±2.06)^{1}	62.50	37.50
A5	7.313(±0.94)^{2}	100.00	0
A6	7.313(±1.16)^{2,3}	100.00	0
B4	6.875(±1.45)^{2}	100.00	12.50
B5	7.938(±0.41)^{2,3}	100.00	0
B6	7.375(±0.69)^{2,3}	100.00	0
C4	6.938(±1.74)^{2}	100.00	0
C5	7.375(±1.57)^{2,3}	100.00	0
C6	7.313(±1.03)^{2,3}	100.00	0
D4	8.563(±0.49)^{3}	100.00	0
D5	7.875(±0.35)^{2,3}	100.00	0
D6	7.375(±0.51)^{2,3}	100.00	0

x- Average values; D – desirability; ND – non desirability
^{1,2,3}- Mean values in the same column, with different superscript are significantly different (P<0.05)

The analysis of the variance (Table 5, 6 and 7) showed that there was a statistically significant difference ($p < 0.05$) between the sensory properties of the samples of probiotic fresh cheese during storage, for appearance, consistency, smell and taste for all days of storage. According to the results (Table 4), the color, as a sensory property, was statistically significant ($P < 0.05$) only after 14 days of storage. Considering the statistically significant difference ($P<0.05$), the Duncan test was conducted by which it was determined which samples were the best by certain sensory properties also during the storage. The samples which were produced with the combination of starter cultures and addition of soy drink had a better external appearance, consistency and smell than other samples. Also, addition of inulin had a positive influence on consistency and smell. The samples with soy drink C2 and B5 had the best taste. The worst smell and taste had the sample without soy milk and inulin A1. There was a change of sensory properties during storage. Based on the statistical analysis of the results, it is evident that most D group samples were the most stable during storage. The results of the consumer acceptance for the produced fresh cream cheese samples are shown in Tables 5, 6 and 7. The preferred product is considered to be the one whose average grade (x) is at least 7.5 when applying a scale with nine possible grades [14]. This criterion was satisfied by all samples of probiotic fresh cheese after 1 day of storage. All samples were

100% preferred, indicating that no assessor rated the fresh cheese samples with a grade lower than 5. Soy drink influenced the stable acceptability during the first 7 days of storage. After 14 days of storage, only the samples with added soy drink and inulin D3, B5, D4 and D5 might be considered desirable. Considering the statistically significant difference ($P<0.05$), the Duncan test was conducted.

CONCLUSION

Sensory properties of probiotic fresh cheese were variable during storage for 14 days. During storage, the samples had a relatively good outer appearance.

Soy drink and the combination of microbial starter cultures had a positive influence on the external appearance, consistency, smell and taste of the samples.

Observing the results for the color of the probiotic fresh cheese, this sensory characteristic was found to be the most stable during storage. The thermalisation of the curd affected a slightly firmer consistency of the product, and during storage, the surface of the product did not extract whey.

The samples inoculated with the combination of microorganisms Lyofast MWO 030 and Lyofast EF1 with inulin addition were the most stable during storage for all sensory properties. All the investigated samples showed a high percentage of 100% preference for the first day of storage. During storage, the percentage of desirability decreased in each sample (up to 62.50%).

REFERENCES

[1] A. R. Hill and P. Kethireddipalli, "Dairy products: cheese and yogurtin," in *Biochemistry of Foods*, N. A. M. Eskin and F. Shahidi, Eds. Elsevier Science & Technology Books, San Diego, Calif, USA, 3rd edition, 2012, pp. 319–362.

[2] H. Walsh, J. Ross, G. Hendricks, M. Guo, "Physico-chemical properties, probiotics survivability, microstructure, and acceptability of a yogurt-like symbiotic oats-based product using pre-polymerized whey protein as a gelation agent," *Journal Food Science* vol. 75(5), pp. 327-337, 2010.

[3] R.K.C. Jeewanthi and H.D. Paik, "Modifications of nutritional, structural, and sensory characteristics of non-dairy soy cheese analogs to improve their quality attributes" *Journal Food Science Technology* vol .55(11). pp. 4384-4394, 2018

[4] N.K. Zanhi, I. A. Jideani, "Physico-chemical and sensory qualities of soy and milk solids fortified low fat yoghurt," *African Journal of Agricultural Research* vol. 7(38), pp. 5336-5343, 2012.

[5] C. Martinez-Villaluenga, M.I. Torino, V. Martín, R. Arroyo, P. Garcia-Mora, I. Estrella Pedrola, C.Vidal-Valverde, J.M. Rodriguez, J. Frias, "Multifunctional properties of soy milk fermented by *Enterococcus faecium* strains isolated from raw soy milk," *Journal of Agricultural and Food Chemistry* vol. 60(41), pp.10235-44, 2012

[6] E. Litopoulou-Tzanetaki, N. Tzanetakis, A. Vafopoulou-Mastrojiannaki, "Effect of type of lactic starter on microbiological, chemical and sensory characteristics of Feta cheese," *Food Microbiology*, vol. 10, 31– 41, 1993.

[7] F. Villani, S. Coppola, (1994): "Selection of enterococcal strains for water-buffalo mozzarella cheese manufacture," *Ann. Microbiol. Enzimol.* Vol. 44, pp. 97–105, 1994.

[8] J.A. Centeno, S. Menendez, M.A. Hermida, J.L. Rodriguez-Otero, "Effects of the addition of Enterococcus faecalis in Cebreiro Cheese manufacture," *International Journal of Food Microbiology* vol. 48, pp. 97– 111, 1999.

[9] P. Sarantinopoulous, G. Kalantzopoulous, E. Tsakalidou, "Effect of Enterococcus faecium on microbiological, physicochemical and sensory characteristics of Greek Feta cheese," *International Journal of Food Microbiology,* vol. 76 (1-2), pp. 93– 105, 2002.

[10] R.Bedani, M. Campos, I. Castro, A. E. Rossi, S. Saad, "Incorporation of soybean by-product okara and inulin in a probiotic soy yoghurt: Texture profile and sensory acceptance," *Journal of the science of food and agriculture*, vol. 94(1), pp. 119-122, 2013

[11] J. Bibiana, A. Zamora, F. Quintana, B. Guamis, A-J. Trujillo, "Effect of inulin addition on the sensorial properties of reduced-fat fresh cheese," *International Journal of Dairy Technology,* vol. 66(4), pp.472-483,2013.

[12] Ö.Kınık, H. Kesenkaş, P. Günç Ergönül, E. Akan, "The effect of using pro and prebiotics on the aromatic compounds, textural and sensorial properties of symbiotic goat cheese," *Mljekarstvo* vol. 67 (1), pp.71-85, 2017

[13] R. Radovanović, J. Popov-Raljić, Senzorna analiza prehrambenih proizvoda, Poljoprivredni fakultet Beograd i Tehnološki fakultet Novi Sad, 2001.

[14] H. Stone, J.J. Sidel, Sensory Evoluation Practices, Academic Press, Inc. New York. 1985

[15] H. Rasouli Pirouzian, J. Hesari, S. Farajnia, M. Moghaddam, Sh. Ghiassifa, "Effects of *Enterococcus faecalis* and *Enterococcus faecium*, Isolated from Traditional Lighvan Cheese, on Physicochemical and Sensory Characteristics of Iranian UF White Cheese," *Journal of Agricultural Science and Technology* vol. 14, pp.1023-1034, 2012.

[16] M. Hatzikamari, E. Litopoulou-Tzanetakiand, N. Tzanetkis, "Microbiological Characteristics of Anevato: A Traditional Greek Cheese," *Journal of Applied Microbiology*, vol. 87, pp.595- 601, 1999.

[17] T.L. Thompons, E.H. Marth, "Changes in Parmesan cheese during ripening: Microflora - coliforms, enterococci, anaerobs, propionibacteria and staphylococci," *Milchwissenschaft*, vol 41, pp.201–204, 1986.

[18] T.M. Lopez-Diaz, J.A. Santos, C.J. Gonzales, B. Moreno, M.L. Garcia, "Bacteriological quality of traditional Spanish blue cheese," *Milchwissenschaft*, vol. 50, pp.503–505, 1995.

[19] J.P. Jensen, G.W. Reinbold, C.J. Washam, E.R. Vedamuthu, "Role of enterococci in Cheddar cheese: proteolytic activity and lactic acid development," *Journal of Milk Food Technology*, vol.38, pp.3–7, 1975b.

[20] J.P. Jensen, G.W. Reinbold, C.J. Washam, E.R Vedamuthu, "Role of enterococci in Cheddar cheese: free fatty acid appearsnce and citric acid utilization," *Journal of Milk and Food Technology*, vol. 38, pp.142-145, 1975c.

[21] J.A. Ordoñez, R. Barneto, M. Ramos, "Studies on Manchego cheese ripened in olive oil," *Milchwissenschaft* vol. 33, pp.609–612, 1978.

[22] L.D. Trovatelli, A. Schliesser, "Identification and significance of enterococci in hard cheese made from raw cow and sheep milk," *Milchwissenschaft* vol.42, pp.717–719, 1987.

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