



Influence of Indigenous Microbial Culture Addition on Physicochemical and Sensory Properties of White-Brined Ewe's Milk Cheese

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In this study, it was aimed to reveal the effects of different indigenous bacteria (*Lactobacillus brevis*, *Lactobacillus plantarum*, *Enterococcus faecium*) and yeasts (*Kluyveromyces lactis*, *Yarrowia lipolytica*) on ewe's milk cheese. The indigenous cultures were isolated from a raw ewe's milk cheese and used as adjunct culture in cheese. After the production of white-brined cheese, the cheeses were ripened. After 120 days of ripening, chemical, physical and sensory analyzes were performed.

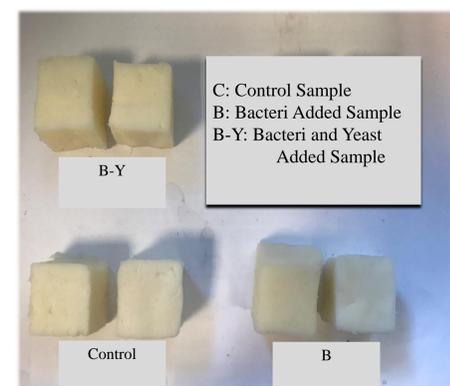
The influence of the inoculation of different culture combinations on the chemical, textural and sensory properties of cheeses were evaluated. With this aim, compositional analysis (pH, acidity, fat, protein, total solid contents), instrumental texture-profile-analysis and sensory evaluation depending on the hedonic scale were carried out.

According to the results the lowest pH values, associated with softer textures were determined in the cheeses produced with yeast addition (B+Y) after the ripening period. The fat contents of C and B were determined almost the same (24.75-25.0%). However, in B+Y, the fat content of cheeses was detected as 28.50%, most probably because of the lipid production capacity of *Y.lipolytica*. Protein and total solid contents (%) of all cheeses were determined closely, yet the ripening index of B+Y was detected as the highest with the value of 20.66, which was followed with B and C, with the values of 20.02 and 16.96, respectively. B+Y was selected as the best perceived product with respect to taste, odor and flavor, most likely due to its mild acidity, soft texture and desirable aroma comprised because of the enzymatic activities of adjunct microorganisms.

MATERIALS & METHODS

Three bacteria (*Lactobacillus brevis*, *Lactobacillus plantarum*, *Enterococcus faecium*) and two yeast (*Kluyveromyces lactis*, *Yarrowia lipolytica*) strains which were previously isolated from a raw ewe's milk cheese, were used as adjunct culture in white-brined cheese made from ewe's milk to promote the textural and sensory properties of cheeses at the end of 120 days of ripening. Three batches of brined cheese were produced from pasteurised milk (72°C for 15s) by the addition of different microbial cultures. A control batch (C) was manufactured without the addition of any culture. The second batch was inoculated with bacteria mix culture (B) only and the third batch was produced with the combination of bacteria and yeast mix culture (B+Y).

The pH of the samples was measured by using a pH meter (MP225, Mettler-Toledo, Columbus, OH) fitted with a combined electrode. The titratable acidity of the samples was defined according to the method reported by IDF/RM (2012) and calculated in lactic acid percentage. Total solid was determined according to AOAC (2006a) and fat content was analysed by the Gerber method (AOAC, 2006b). Total protein and WSN were analyzed using the Kjeldahl method (IDF, 1993). The ripening index was calculated with the WSN/TN ratio. Sensory evaluation of the samples was performed by seven trained panelists from the Department of Dairy Technology, Ankara University, according to the scoring card described by Clark & Costello (2016). Panelists were evaluated the appearance, body, flavor, and total acceptability. Mean scores were calculated to compare the samples. The samples were randomly coded with three digit numbers and served at 7-10°C.



Texture Profile Analysis (TPA) was performed with TA-XT Plus Texture Analyzer (Stable Micro System, UK) to examine the textural properties of cheeses. 25 kg load cell and P/20 cylindrical probe were used. As TPA parameters, hardness, adhesiveness, springiness, cohesiveness, gumminess, chewiness, and resilience properties were investigated. The pre-test speed was 1.0 mm/s, the test speed was 5.0 mm/s, the post-test speed was 5.0 mm/s, and the time between two compressions was 5 s.

A randomized complete block design was applied for statistical evaluation. to analyze the variables relating to characteristics of fermented milk. To determine the significant differences between the evaluated responses, analysis of variance (ANOVA) general linear model (GLM) procedure of Minitab statistical package (version 15.0, Minitab Inc., State College, PA) was carried out. Tukey's multiple-comparison, were used to compare the treatment means and to determine if there was a significant difference ($P < 0.05$) between treatments.

RESULTS & DISCUSSION

As a result of this research, it has been seen that the addition of bacteria and yeast has a significant effect on the properties of ewe's milk cheese. Analyzes on cheese samples ripened for 120 days showed that the addition of bacteria and yeast changed the characteristics of the ewe's milk cheese positively. In particular, the B+Y sample to which both bacteria and yeast mixture was added was the best example for all tested properties. It had the highest acidity (0.954%), protein (20.66), and fat content (28.50%) (Table 1). But it can be said that the samples had similar results in terms of dry matter and protein. In addition, the B+Y sample received the highest scores in terms of sensory properties (Figure 1 and 2). The most favorite example of consumers was B+Y. However, the body scores of the B+Y samples were found to be lower than the other samples (Figure 1). These results are in line with texture results. For all TPA values, B+Y samples had low values. In particular, it was found to be significantly softer than other samples (Table 2).

Table 1. Chemical properties of ewe's milk cheese

Samples	pH-value	Lactic acid (%)	Fat (%)	Total Solid (%)
C	5.80±0.01	0.900±0.00	24.75±0.25	53.817±0.207
B	5.55±0.01	0.953±0.05	25.00±0.50	54.255±0.713
B+Y	5.51±0.02	0.954±0.05	28.50±1.50	53.614±0.021
Samples	Protein (%)	WSN (%)	Ripening Index	
C	24.34±1.116	0.765±0.00	20.12±1.421	
B	24.56±0.223	0.653±0.10	16.96±0.640	
B	24.79±0.223	0.802±0.00	20.66±0.657	

Table 2. Textural properties of ewe's milk cheese

Samples	Hardness	Adhesiveness	Springiness	Cohesiveness	Gumminess	Chewiness	Resilience
C	3812.5±705.0	-8.16±1.223	0.912±0.083	0.219±0.078	1388.6±50.586	1347.8±16.394	0.103±0.028
B	3015.0±67.10	-0.72±0.073	0.775±0.072	0.341±0.021	1023.6±14.405	792.0±62.318	0.133±0.011
B+Y	2568.6±226.7	-0.39±0.165	0.852±0.025	0.346±0.005	886.3±31.082	753.9±4.528	0.162±0.002

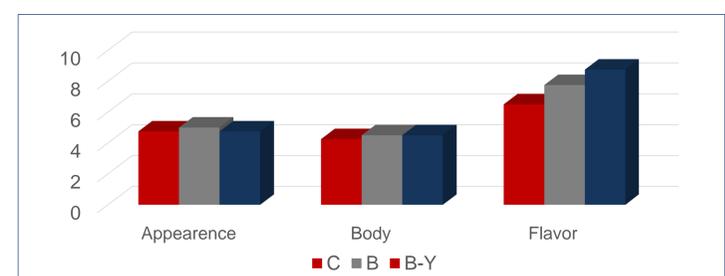


Figure 1. Sensory properties (Appearance, Body, Flavor) of ewe's milk cheese

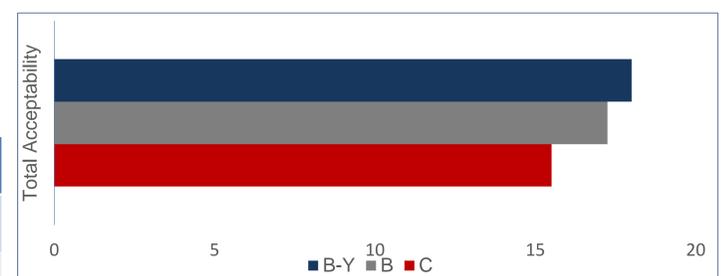


Figure 2. Sensory properties (Total Acceptability) of ewe's milk cheese

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