The effects of packaging materials and filling methods on characteristics of herby cheese (Otlu peynir)
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The effects of packaging materials and filling methods on some characteristics of Herby cheese (Otlu peynir)

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Abstract

In this research, two kinds of filling methods (block and pieced cheese mixed with 30 % whey curd, lor) in to two containers (pot and, plastic) were used for the preparation of Otlu (herby) cheese samples. The cheeses were stored in the soil up to 150 days. It was found that the uses of different containers to the cheese influenced ($P<0.01$) the titratable acidity, pH values, dry matter, fat content, water soluble nitrogen (WSN) and TAMB counts significantly, except other properties ($P>0.05$). Total matter, protein, fat and titratable acidity values were higher in cheese plastic containers than the others. On the other hand, ripening index of cheeses in pot containers was higher than that of cheese in plastics. Although the water-soluble nitrogen (WSN) values of cheeses were affected significantly ($P<0.05$) containers, no significant differences exist ($P>0.05$) among lipolysis (acid degree value, ADV) values. The WSN of cheese samples in 120 and 150 days of ripening were significantly affected by packaging materials and filling methods, as lipolysis values had different cheeses in 90 and 120 days ($P<0.01$). Degradation rates of αs_1- and β-casein were higher in pieced cheeses in pot (P1F2), followed by block cheeses in pot (P1F1). Also, breakdown products of casein were higher in pieced cheeses in pot (P1F2) compared to other cheeses. The amounts of αs_1- and β-caseins of all cheese samples decreased continuously during the ripening period, while the amounts of α_{S1}-I casein and other breakdown products increased. TAMB counts were higher significant in block cheeses in pot than those of the other cheeses ($P<0.01$). All microorganism counts decreased generally during ripening. The obtained from the sensory evaluations, acceptability of cheeses in block form was high and most of the panelists preferred cheeses stored in plastic containers for higher dry matter.

Keywords: Otlu (Herby) cheese, packaging material, filling method, ripening

1. Introduction

Herby cheese, a semi-hard, salty and herb added, is manufactured in small family businesses for their needs and commercial purposes from raw milk between May and June. To produce of Herby cheese, milk is filtered through a coot-cloth and is heated

up to 30-35ºC. Then, it is coagulated by using rennet. After coagulated, curd is cut into small cubes. The herbs were added on the curd weight. The curd are drained and pressed for 3-5 hours. Then cheeses are cut into with dimensions different. Cheese blocks are salted with dry salt or brine. Cheeses are filled in pot or plastic container by mixed different ratios cacik (yoghurt curd) or lor (whey curd). The cheese blocks are placed into the bottom of container as first layer, then, cacik or lor is used to the spaces between blocks in the container in order to out the air, and another layer of the cheese is placed. This continues until the container is filled up completely (Coskun and Ozturk 2000). The containers are closed after covering the surface with salt. The top of the container is covered with a clean cloth and turned up side down and buried into the ground in a cheese house ripening for 3-8 months. Then the salty-surface layer removed and finally the cheese is stored at room temperature throughout consumption (Coskun 1998).

Coskun (1998) compared the characteristics of herby cheeses produced with two different methods. In the method, raw milk and herbs were used, and in the second method pasteurized milk and pasteurized herbs, and starter culture were used. The author found that higher degrees of proteolysis and lipolysis were obtained from those made with raw materials. In industry, pasteurization and addition of starter culture are taken into consideration. Tarakci et al. (2004), in study on fresh and ripened herby cheeses, were determined dry matter 40.04-66.05%, fat 14.50-31.50%, protein 16.59-25.98%, salt 3.86-9.07%, pH values 4.90-5.96, titratable acidity(LA) 0.2-2.37%. The addition of herb sirmo (*Allium* sp.), helis (*Prongos* sp.) and siyabo (*Ferula* sp.) in cheese, lipolysis and proteolysis of cheese were determined decreasing, but dry matter, fat, protein contents decreased significantly (Coskun and Tuncturk 2000, Tarakci 2004, Tarakci et al. 2004). Some researchers have reported that the herbs have antimicrobial activity (Sagun et al. 2006). Isolation of lactic acid bacteria from herby cheeses was performed by Sagdic et al. (2003).

In Turkey, although there are many traditional cheese varieties, their production is largely based on small-scale dairies and family farms. Recently, the industrial production of Otlu (herby) cheese (cheese added different herbs) has been introduced. Since there no study about the effect of packaging materials (pot and plastic) on Herby cheese ripens and the changes taking place during ripening, this research was aimed at standardizing a method for production of Herby cheese, to compare the of packaging materials and to examine chemical, biochemical, microbiological and sensorial changes during ripening.

In this research, two kinds of filling methods in pot and plastic containers (P1F1; block cheese in pot, P1F2; pieced cheese in pot, P2F1; block cheese in plastic, P2F2; pieced cheese in plastic) in were used for the preparation of cheese samples. Cheese samples were stored in the soil up to 150 days. The cheese samples were analyzed for physical, chemical microbiological and organoleptic properties after 2, 90, 120 and 150 days of the ripening period. The objectives of this study were to utilize 30% curd with herby cheese to fill into the containers, and to investigate the effect and usability of plastic and pot containers on the cheese ripening.

2. Materials and Methods

Cow's milk was supplied from Yuzuncu Yil University Agriculture Faculty dairy plant. Totally, 1000 L of milk was used for experimental cheese production in each trial, commercial animal rennet was obtained from Pinar Company, Istanbul. Herbs known as "sirmo" (*Allium* sp.) in region, in pickled form were obtained from dairy products market in Van. Lactic culture (*Lactococcus lactis* subsp. *lactis and Lactococcus lactis* subsp. *cremoris*) in lyophilized form obtained from "Wiesby GmbH & Co.KG." (Niebüll, Germany) was used as starter culture. 5 kg pot container, production cooked soil and 5 kg plastic container, produced from poly ethylene was purchased from Van market. Lor (whey curd) was obtained from Van dairy fabric.

2.1. Cheese manufacture

The necessity quantities raw cow's milk was pasteurized at 65°C for 30 min, cooled to 32°C, a mixture starter culture was applied at the level of 1.0% in the cheese production. Milks were coagulated with rennet for 90 min. The herbs were thoroughly mixed into the curds. After the removal of the whey, the curd was portioned into blocks of 7×7×7 cm. Cheeses were salted with dry salt (the amount of dry salt used was 5 of cheese weight). At the end of this time, cheese samples were packed in pot (soil cup, P1) and plastic (P2) containers. In this research, two filling methods were applied. In the first method (F1), one layer lor (30%), one layer block cheese (70%) was used until the containers completely full. In the second method (F2), cheese (70% partially pieced cheese) and lor (30%) were mixed and filled in to the containers and were marked P1F1, P1F2, P2F1, and P2F2 codes to cheeses. After that, cheese containers were stored in the soil to ripe the experiment cheese. The cheese samples were analyzed for some chemical, biochemical, microbiological and sensorial properties after 2, 90, 120 and 150 days of the ripening period.

2.2. Chemical and Biochemical Analysis in cheeses

The cheese samples were analyzed titrable acidity, pH, total nitrogen, salt, ash, fat, dry matter and ripening index, according to methods given by Kurt et al. (1993). Lipolysis was done using the BDI method and measured as Acid Degree Value (Case et al. 1985). The electrophoretical analysis of protein patterns was conducted with the method given by Creamer (1991). Total aerobic mesophilic bacteria, psychrotrophs and yeast and mould were determined according to (Frank et al. 1985). Sensorial analysis of the cheeses after 90, 120, and 150 d of ripening was carried out by a ten-member panel (Astol et al. 1985).

3. Results and Discussion

Physico-chemical, microbiological and sensorial changes of herby cheeses are Table 1. The effect of packaging materials on the dry matter contents of cheese samples was significant ($P<0.01$). The dry matter contents of cheese in the pots (46.63±2.33 %) were higher than cheese ripened on the plastic containers (48.54±3.33 %). The filling methods did not affect dry matter contents statistically. Dry matter content of cheese samples significantly ($P<0.01$) increased during the ripening period. These

differences might be due to water-holding capacity of herb, which is in agreement with the results of Coskun and Tuncturk (2000).

Ripening time and packaging materials affected significantly (P<0.01) fat content of cheese. The average fat content of cheese samples, stored in plastic containers, was 23.24±2.01 % and the average fat content in pot containers was 22.13±1.33 %. Fat content of experimental cheese samples increased continuously during the ripening period. Fat content in dry matter of cheese samples were 46.40 - 48.11% and general average was calculated as 47.58±0.84 %.

The average protein content of cheese samples in of plastic containers was 19.04±1.28 %, and in pot containers were 18.46±0.96%. Ripening period, packaging materials and filling methods statistically affected protein content of cheese samples (P<0.01).

Table 1 Physico-chemical, microbiological and sensorial changes of herby cheeses

	Cheese types			
Properties	P1F1	P1F2	P2F1	P1F2
Total solids (%)	47.02±2.32	46.64±2.41	48.38±3.15	48.54±3.33
Fat (%)	22.30±1.42	22.07±1.29	23.37±2.21	23.11±1.88
Protein (%)	18.58±0.86	18.40±0.88	19.15±1.46	18.93±1.13
Salt (%)	3.47±0.27	3.43±0.29	3.70±0.45	3.67±0.35
Ash (%)	4.68±0.26	4.64±0.32	4.88±0.43	4.85±0.34
Acidity (%)	1.49±0.45	1.39±0.41	1.59±0.51	1.56±0.47
pH	4.83±0.24	4.95±0.26	4.89±0.24	4.84±0.23
Lipolysis (ADV)	1.74±0.21	1.81±0.15	1.95±0.17	1.76±0.28
WSN (%)	11.25±5.50	12.06±6.06	11.10±5.01	11.13±5.21
TAMB	7.02±0.45	6.69±0.47	6.67±0.49	6.92±0.33
Yeast and mould	6.93±0.29	6.96±0.34	6.89±0.47	6.91±0.34
Psychotropic	4.26±0.56	4.26±0.52	4.20±0.50	4.15±0.48
Appe. and color	7.35±0.21	7.15±0.35	7.78±0.23	7.16±0.15
Body and texture	7.35±0.26	6.99±0.32	7.47±0.25	7.15±0.23
Taste and flavor	7.54±0.21	6.95±0.28	7.47±0.13	6.98±0.16
Saltiness	7.83±0.22	7.72±0.20	7.80±0.57	7.99±0.21
Acceptability	7.52±0.18	7.21±0.21	7.63±0.16	7.34±0.13

P1F1; block cheese in pot, P1F2; pieced cheese in pot, P2F1; block cheese in plastic, P2F2; pieced cheese in plastic. TAMB; Total aerobic mesophilic bacteria,

The salt content of experimental cheese samples were changed between 3.07 % and 3.89 %, and the general mean value was calculated as 3.56±0.36 %. Ripening periods and packaging materials significantly affected salt content of cheese samples. The calculated average salt content in dry matter changed from 7.11 to 7.77 %. The general mean value of salt content was 7.45±0.35 %. The rate of salt absorption was very high at the first month due to a movement of NaCl molecules as a result of the osmotic pressure and difference moisture contents of cheeses (Guinee and Fox 1993). Salting of cheese can influence the cheese pH due to its effect on microbial activity.

Low levels of salt can stimulate bacterial activity; however, concentrations >2.5% have a negative effect (Guven et al. 2006).

Ash content of experimental cheese samples were statistically affected by the ripening times and the packaging materials. Ash content increased depended upon the increasing of salt and dry matter contents of cheese samples during the ripening period. The average ash content of cheese samples in plastic containers was 4.81±0.38 %; on the other hand, the average ash content of cheese samples in pots was 4.66±0.29 %.

The pH values of cheese samples were not affected statistically by packaging materials, but filling methods significantly affected pH values of cheese samples. At the beginning of ripening period, there was a little decrease on pH values (4.66), but later stages of ripening period pH values were increased.

The average titratable acidity value of fresh cheese samples was found as 0.77 %, and it reached the highest point at the end of the 90 days after that it was started to decrease. It was found that ripening period, packaging materials and filling methods significantly ($P<0.01$) affected titratable acidity of experimental cheese samples.

The lowest ripening degree of cheese samples was found at 2 day (3.76 %) and the highest ripening degree was found at 150 days (17.78 %) and average value was 11.38±5.27 %. The effects of ripening periods, packaging materials and filling methods on the ripening degree of cheese samples were significantly important ($P<0.01$).

Lipolysis degrees were found as 1.63 ADV 90 days, 1.88 ADV 120 days and 2.00 ADV 150 days. Lipolysis content of cheese samples were increased during ripening period.

The highest counts of total bacteria and mold-yeast counts were found in all fresh cheese samples while the lowest counts were found at 150 day of ripening period. Psychotropic counts of cheese samples declined during ripening period. Determined differences in counts of microorganism between different groups were significant ($P<0.01$) at the ripening periods. However, packaging materials and filling methods did not significantly affect the bacterial counts of cheese samples.

According to the results obtained from the sensory evaluations, acceptability of cheese samples in block form was high. Most of the panelists preferred cheese samples stored in plastic containers.

During the ripening period, the amounts of α- and β- caseins of all cheese samples were decreased. However, the amounts of α_{S1}-I peptit, γ-casein and other metabolites were increased. Casein break-down products of cheese samples were seen more filled in the pot containers than the others (Figure 1 and 2).

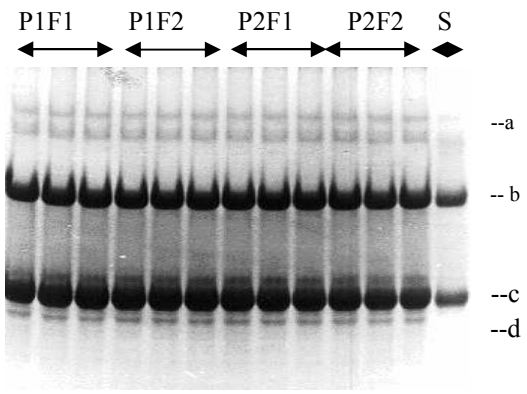

Figure 1 Urea-PAGE profiles of Herby cheeses for 2 days

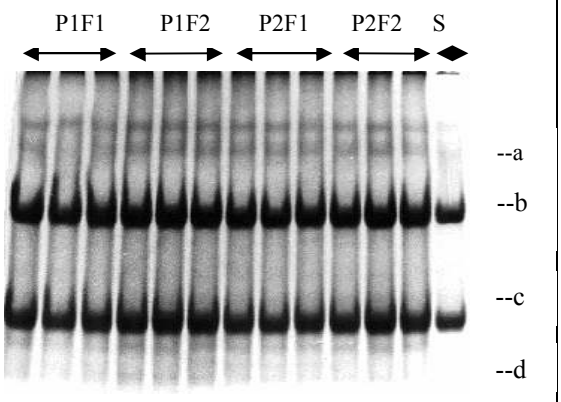

Figure 2 Urea-PAGE profiles of Herby cheeses for 150 days.

P1F1; block cheese in pot, P1F2; pieced cheese in pot, P2F1; block cheese in plastic, P2F2; pieced cheese in plastic; **S:** Casein standard, **a:** γ-caseins, **b:** β-casein, **c:** α_{S1}-casein, **d:** Casein degradation products.

4. Conclusion

According to obtained results, cheese samples in plastic containers had higher dry matter, fat, protein, salt and ash contents than cheese ripened in pots. The pH changes were similar in both methods. Titratable acidity was higher in cheese ripened in plastic containers. Changes in ripening degree were very similar in terms of packaging materials. Breakdown of casein fraction was higher in pots, and this effected proteolysis of cheese samples. The packaging materials did not affect microflora of cheese samples. The cheese samples ripened in plastic containers had higher amount of dry matter, as a result the acceptability was higher in these cheeses than the others. Different filling methods did not markedly affect dry matter, fat, salt and ash content of cheese samples. However, the first filling method affected significantly the protein content of cheese samples. Different filling methods affected titratable acidity and pH values of cheese samples at the different rates. Using second filling method with pots increased ripening degree, and breakdown products of casein were clearly seen in the cheese samples.

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