Journal of Animal and Veterinary Advances 5 (12): 1050-1052, 2006

Effect of Ripening Time on Mineral Contents of Herby Cheese

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Abstract: Herby cheese is a salted traditional cheese manufactured in the Eastern and South-eastern of Turkey. Its name, herby, comes from adding herb in cheese. The aim of this study was to assess the changes in the mineral contents and some chemical parameters in herby cheese during 90 days of ripening. The total solids, ash, salt, Na, Cu, Fe, Mn contents and pH values increased significantly ($p<0.05$), while Ca, Mg and Zn contents decreased significantly ($p<0.05$) during ripening. P, Co, Cr, Ni and Cd contents of the cheeses were not significantly ($p>0.05$) altered during ripening. The results indicated that the mineral of herby cheese showed a very variable behaviour during ripening due to likely manufacturing technology.

Key words: Herby cheese, mineral content, ripening time

INTRODUCTION

Herby cheese is a special semi-hard cheese produced especially in the Eastern and Southeastern of Turkey. It is generally made from unpasteurized whole milk. Different species of Herb (*Allium* sp., *Ferula* sp., etc) are added into the cheese to give a special taste and aroma. Therefore, the name of herby cheese comes from adding of these herbs and this cheese variety has been stored under soil in containers throughout ripening without controlling temperature.

First study on herby cheese was carried out by Eralp[1]. He described some chemical characteristics of the cheese and found that herby cheese had total solids content between 44.95–68.72 %, salt 3.28–14.51 and titratable acidity 0.78–2.88 %. Our previous work[2] showed that histamine gradually increased during ripening of Herby cheese. In addition, we studied the effect of salt concentration on chemical, microbial and sensory changes in Herby cheese[3]. Recently, we demonstrated that increase of the herb ratio (*Chaerophyllum* sp.) in herby cheese caused more proteolysis and lipolysis[4]. Mendil[5] studied some mineral contents of herby cheese (Van otlu peynir) samples obtained from markets and found the following: Fe content of the cheeses 12.5, Mn 0.38, Zn 10.8, Cu 0.13, Cr 0.10, Ni 0.22, Na 6229, Ca 4151 and Mg 56.3 μg g^{-1}.

As seen from the literature reviewed above, several aspects of herby cheese have already investigated. However, to our knowledge, effect of ripening on the mineral content of herby cheese have not been studied. Since some of the mineral salts may migrate from the central part towards the external layer of the cheese block during ripening, the contents of some elements in the final product might change.

Complementary information dealing with the effect of ripening on mineral content of Herby cheese would be useful in order to determine product characteristics of Herby cheese. The objective of this study was to investigate the effect of ripening on mineral content of herby cheese.

MATERIALS AND METHODS

Materials: Whole cow's milk was supplied from Van Agriculture High School. Commercial animal rennet was obtained from Mayasan Company® (Istanbul, Turkey). The herb known as "Sirmo" in the region (*Allium* sp.) was obtained from a market in Van province of Turkey. *Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus* (YC-180) obtained from Christina Hansen's Company® (Denmark) were used as starter culture.

Cheesemaking and sampling: Raw milk was pasteurized at 65 °C for 30 min and cooled to 32°C. Starter culture was

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Table 1: Chemical parameters of cheese samples during ripening*

	Ripening time (days)				
Parameters	1	15	30	60	90
Total solids (%)	46.01±0.98^{c}	47.09±1.15^{bc}	47.58±0.88^{b}	48.05±0.63^{b}	49.63±0.90^{a}
Ash (%)	6.42±0.5 ^{b}	6.88±0.70^{ab}	7.11±0.67^{ab}	7.26±0.51^{ab}	7.50±0.72^{a}
Salt (%)	4.87±0.51^{b}	5.44±0.72^{ab}	5.71±0.68^{ab}	5.81±0.51^{a}	6.12±0.76^{a}
pH	5.30±0.02^{c}	5.34±0.05^{c}	5.45±0.02^{b}	5.49±0.05^{b}	5.67±0.05^{a*}

Different letters indicate p<0.05 between ripening time

Table 2: Changes in contents of main (m g 100 g^{-1} TS) minerals during ripening of Herby cheese*

	Ripening time (days)				
Minerals	1	15	30	60	90
Ca	1076.80±40.30^{a}	1022.90±18.08^{b}	998.20±7.07^{bc}	990.70±10.72^{bc}	967.85±24.32^{c}
P	558.32±23.15^{a}	568.11±16.63^{a}	563.98±17.27^{a}	549.62±8.48^{a}	546.36±12.32^{a}
Na	2633.50±61.36^{c}	2763.00±55.63^{b}	2779.50±52.36^{b}	2858.50±34.21^{a}	866.50±42.63^{a}
Mg	29.70±2.41^{a}	28.80±3.16^{a}	24.30±1.35^{b}	22.90±1.28^{b}	22.10±1.39^{b*}

Different letters indicate p<0.05 between ripening time

Table 3: Changes in contents of trace (mg kg^{-1} TS) minerals during ripening of Herby cheese*

	Ripening time (days)				
Minerals	1	15	30	60	90
Zn	35.16±1.24^{ab}	35.93±0.93^{a}	34.06±0.49^{b}	32.57±0.61^{c}	32.50±1.20^{c}
Cu	8.50±0.38^{b}	8.75±0.56^{b}	9.35±0.35^{a}	9.66±0.24^{a}	8.79±0.36^{b}
Fe	28.73±2.29^{b}	29.73±0.57^{b}	32.44±0.86^{a}	31.84±1.15^{a}	32.88±1.28^{a}
Mn	2.39±0.29^{b}	2.39±0.19^{b}	2.66±0.27^{ab}	2.75±0.13^{a}	2.70±0.20^{ab}
Co	0.08±0.02^{a}	0.07±0.02^{a}	0.07±0.02^{a}	0.06±0.01^{a}	0.06±0.02^{a}
Cr	0.20±0.04^{a}	0.19±0.03^{a}	0.18±0.02^{a}	0.17±0.02^{a}	0.17±0.03^{a}
Ni	0.20±0.02^{a}	0.21±0.02^{a}	0.21±0.02^{a}	0.20±0.02^{a}	0.19±0.02^{a}
Cd	0.17±0.04^{a}	0.14±0.05a	0.16±0.02^{a}	0.18±0.02^{a}	0.16±0.02^{a*}

Different letters indicate p< 0.05 between ripening time

added at level of 1% and held for 60 min. Then the milk was coagulated with rennet for 75 min. After coagulation, the curd was cut into 8-10 mm cubes with a wire knife. Herb at the ratio of 2% of milk weight was added to the curd and pressed for 120 min. Then, the curd was salted with dry salt (the amount of dry salt used was 7% of cheese weight) and held 24 h. At the end of this time, cheeses were filled in plastic containers. The containers were placed upside-down for drain moisture in the soil for ripening for up 90 days. Five replicates of cheese were made and analyzed after ripening for 1, 15, 30, 60 and 90 days.

Chemical and mineral analyses: Total solids and salt contents were determined according to the Mohr method described by Bradley *et al.*[6] pH values were measured using a pH meter (NEL-890). Ash contents were determined using muffle furnace[7]. All the mineral elements were measured by Flame Atomic Absorption Spectrophotometer (Unicam, 929, Cambridge-UK) from soluble ash except phosphours, which was measured by UV Spectrometer (Shimadzu, UV-1201 V, Kyoto-Japan). All the analyses were performed in duplicate.

Statistical analyses: Statistical analyses were performed by ANOVA procedures using SAS® PROC GLM/STAT[8]. Significant differences (p<0.05) among means were identified using Duncan multiple range test.

RESULTS AND DISCUSSION

Compositional analyses: The total solids, ash, salt content of herby cheese increased significantly (p<0.05) during ripening Table 1. The pH value increased significantly (p<0.05) throughout ripening as a consequence of consumption of lactic acid via biochemical pathway by the microflora. Similar trends were also reported in our previous studies for herby cheese[2,3].

Main mineral contents: Significant differences (p<0.05) were observed in the contents of all the main minerals except P during ripening Table 2. Ca content decreased significantly (p<0.05), while P content remained constant throughout ripening (p>0.05). The content of Mg decreased significantly (p<0.05) during ripening. Final Mg content showed lower value than that reported by Mendil[5] for herby cheese. These differences might be due to salting procedure, which herby cheese salted with dry salt. Santoro[9] reported that salting technology influenced the composition of the mineral fraction; dry-salted cheeses had a very variable mineral concentration.

Na content increased significantly ($p<0.05$) during the first 15 days of ripening and remained constant throughout the rest of the ripening. This mineral content in herby cheese had higher levels compared to the other cheeses[10-12], suggesting that significant amounts of salt (NaCl) were added to the cheese during manufacturing.

Trace mineral contents: The contents of Cu and Fe increased significantly ($p<0.05$), while the content of Zn significantly decreased ($p<0.05$) during ripening. On the other hand, the contents of Co, Cr, Ni and Cd remained constant throughout the ripening ($p>0.05$) (Table 3).

Trace mineral results (especially Fe and Cu) had higher levels of the mineral compared to the other cheese[10-12]. As stated in introduction section, this kind of cheese is ripened in the containers with the open side down to permit the removal of moisture. Therefore, the contents of the mineral parameters discussed were generally higher than other cheese varieties. Similar observations were also reported by Mendil[5] for herby cheese. High Fe and Cu in cheese can represent a problem in dairy technology because of catalytic effect on oxidation of lipids as well as their nutritional and biological function[13].

CONCLUSION

The mineral contents of herby cheese showed a variable behaviour during ripening: while Na, Cu, Fe and Mn concentrations increased significantly, Ca, Mg and Zn levels decreased. On the other hand, the contents of P, Co, Cr, Ni or Cd remained constant throughout ripening. These variations could be originated from dry salting procedures in herby cheese manufacturing.

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