

LEVELS OF PROTEOLYSIS IN IMPORTANT TYPES OF TURKISH CHEESES

ÖNEMLİ BAZI TÜRK PEYNİRLERİNİN PROTEOLİZ DÜZEYLERİ

Celalettin KOCAK¹, Serdar AYDEMİR², Zeynep B. SEYDİM³

¹Ankara University, Faculty of Agriculture, Department of Dairy Technology, Ankara

²Enka Dairy and Food Inc., Konya

³Süleyman Demirel University, Faculty of Agriculture, Department of Food Engineering, Isparta

ABSTRACT: In 2001, 9 495 554 tons of milk were produced in Turkey out of which 43 % was transformed into cheese, 23 % into fermented milk products (yoghurt, ayran, etc.), 17 % into butter and 16 % was consumed as fluid milk. As it is evident, close to half of total milk production was processed into cheese, thus placing this product amongst the exceptional and important Turkish milk products. Approximately 50 % of cheese milk was used for Beyaz Cheese (White Pickled Cheese) and Kashar Cheese. The rest was used to produce other traditional Turkish cheeses like Tulum, Mihaliç, Dil, Oltu, Çökelek, Civil, Çömlek etc. Amongst these traditional Turkish cheeses, Tulum Cheese is the most important and it is ranked third in terms of production and consumption quantity after Beyaz and Kashar cheeses.

Whereas, Beyaz Cheese is a semi-hard ripened cheese and has a slightly salty and acid taste, Kashar is a hard-ripened cheese belonging to the "kneaded cheese" type and it has a piquant flavor. Tulum Cheese is a hard cheese ripened in a goat skin and has a piquant, rancid and a sharp flavor.

This review describes the results of the studies conducted to determine the levels of proteolysis of Beyaz, Kashar and Tulum cheeses, on 124 samples (40 Beyaz, 42 Kashar and 42 Tulum.) The average amounts of total nitrogen (TN), water soluble nitrogen (ripening coefficient), 12 % TCA soluble nitrogen, protease-peptone nitrogen, phosphotungstic acid soluble nitrogen of Beyaz cheeses were 2.347, 0.490 (20.74 % of TN), 0.285, 0.204, 0.111 g/100g, respectively. The same properties of the Kashar cheeses were 4.174, 0.523 (12.48 % of TN), 0.280, 0.243 and 0.117 g/100g, respectively. The concentrations of the same characteristics in the Tulum cheeses were 3.416, 0.598, (17.61 % of TN), 0.444, 0.155 and 0.239 g/100g, respectively.

Keywords: Proteolysis, cheese, ripening

ÖZET: 2001 yılında Türkiye de 9 495 554 ton süt üretilmiştir. Bunun % 43 'ünün peynire, % 23 ' ünün fermente ürünlere (yoğurt, ayran v.b.) % 17 'sinin tereyağına ve % 16 'sının da içme sütüne işlendiği tahmin edilmektedir. Kısaca belirtmek gerekirse, peynir üretimine ayrılan süt miktarı toplam üretimin yarısı kadardır. Bu durum da açıkça görülmektedir ki; peynirin Türk süt ürünleri içerisinde önemli bir yeri vardır.

Peynir ayrılan sütün yaklaşık % 50'si Beyaz peynir (White Pickled Cheese) ve Kaşar Peynirine (Kashar Cheese) işlenmektedir. Geriye kalan bölüm, Tulum, Mihaliç,

Dil, Oltu, Çökelek, Civil, Çömlek v.b. peynirlerin üretiminde kullanılmaktadır. Geleneksel Türk peynirleri arasında, Tulum Peyniri, üretim ve tüketim miktarları yönünden Beyaz ve Kaşar peynirinden sonra üçüncü sırada yer almaktadır.

Beyaz Peynir, olgunlaşmış, yarı sert bir peynir olup, hafif tuzlu ve asidik bir tada sahiptir. Kaşar peyniri ise, teleme-nin haşlanıp yoğurulması ile elde edilen, keskin(piquant) aromaya sahip, olgunlaşmış ve sert yapıda bir peynir çeşididir. Tu-lum peyniri, keçi derisi içinde olgunlaşmış sert tip bir peynir olup, keskin ve ransid bir aromaya sahiptir.

Bu çalışmada, toplam 124 adet peynir örneğinin (40 adet Beyaz Peynir, 42 adet Kaşar Peyniri ve 42 adet Tulum Peyniri) proteoliz düzeyleri incelenmiştir. Beyaz peynir örneklerine ait toplam azot (TN), suda çözünen azot (olgunlaşma kat-sayısı), % 12 TCA da çözünen azot, proteoz-pepton azotu ve fosfotungstik asitte çözünen azotun ortalama miktarları sırasıyla, 2.347, 0.490 (% 20.74), 0.285, 0.204 ve 0.111 g/100g düzeyinde belirlenmiştir. Aynı nitelikler Kaşar peynirlerinde sırasıyla, 4.174, 0.523 (% 12.48), 0.280, 0.243 ve 0.117 g/100g, Tulum Peynirlerinde ise sırasıyla, 3.416, 0.598 (% 17.61' i), 0.444, 0.155 ve 0.239 g/100g düzeyinde bulunmuştur.

Anahtar Kelimeler: Proteoliz, peynir, olgunlaştırma

¹ E-posta: kocak@agri.ankara.edu.tr

INTRODUCTION

Milk production of Turkey was 9.495.554 tons in 2001. Out of which 43 % was transformed into cheese, 23 % into fermented milk products (yoghurt, ayran, etc), 17 % into butter and 16 % was consumed as fluid milk (Yener and Koçak 2000) As these percentages show, cheese has an exceptional and important place among the dairy products produced in Turkey. Approximately 50 % of cheese milk was used for White Pickled Cheese and Kashar Cheese at the factories. The rest was used to produce other traditional Turkish cheeses such as Tulum, Mihaliç, Dil, Otlu, Çökelek, Civil, Çömlek etc. Among these traditional Turkish cheeses, Tulum Cheese is the most important and it is ranked third in term of production and consumption quantity after White Pickled and Kashar cheeses.

The properties and technologies of the three major types of cheese, namely White Pickled, Kashar and Tulum cheeses are as follows;

WHITE PICKLED CHEESE (Beyaz Peynir)

Name: White Cheese (Beyaz Peynir), but it may be called White Pickled Cheese (Salamura Beyaz Peynir)

Type: It is a semi-hard cheese ripened in brine

- ✓ It has a smooth white and wet coat
- ✓ It is cubical or rectangular in shape (7x7x7, 7x7x14)
- ✓ Its body is homogeneous without gas holes
- ✓ It has a slightly salty and acid taste

Composition: Moisture: max. 60%, fat content: 10-45% FDM, salt: max. 10% FDM

Technology: White Pickled Cheese can be made from cow, sheep or goat milk or from their combinations. Standardized milk is pasteurized at 72-74 °C for 15-20 sec. or 68 °C for 10 min. Calcium chloride (0.01-0.02 %) and Lactic starter (*S. lactis*, *S. cremoris* 0.5-2 %) are added after pasteurization. Milk is pre-ripened at 28-32 °C for 20-30 min. before rennet addition. Coagulation is completed within 60 to 90 min. after rennet addition. Curd is cut into 2-3 cm cubes and is left to settle for up to 30 min. Then coagulum is ladled into a cheese cloth; this process can be made with direct method and is pressed in bulk of natural draining for two or more hours. Then the pressed curd is cut into pieces of suitable size and is salted in brine (14-20 %) for 4-12 hours. The brined cheese is canned in 1, 2, 3, 5, 20 kg packages and cheeses are ripened at 8-12 °C for 30-90 days (Koçak and Gürsel 1992, Yener and Koçak 2000).

KASHAR CHEESE (Kaşar Peyniri)

Name: Kashar Cheese (Kaşar Peyniri)

Type: It is a hard ripened cheese belongs to the 'pasta filata' variety

- ✓ It has a smooth, dry and yellowish rind.
- ✓ It has a flat cylindrical or rectangular shape (sizes variable)
- ✓ Its body is homogenous without gas holes.
- ✓ The flavour is piquant, slightly salty

Composition: Moisture: max. 45%, fat content: 15-45% FDM, salt: max. 10% FDM

Technology: Kashar Cheese can be made from sheep or cow milk or from their combinations. In general, standardized and pasteurized milk (72 °C for 15-20 sec.) is used but some cheese makers use raw milk for Kashar Cheese making. When heat treatment is used, calcium chloride and starter are added. Cheese milk can be pre-ripened. The coagulation process is completed within 40-60 min. at 32-34 °C. Curd is cut into pieces of 1-1.5 cm and is stirred for 10-15 min. Sometimes the curd is scalded to 36-40 °C. Then the curd grains are gathered in a cheese cloth and are pressed in bulk for 2 to 4 hours. The pressed curd is cut into blocks (25x15 cm) and is fermented for 2-10 hours at 15-20 °C until pH reaches 5.2. The ripened curd blocks are cut into 0.3-0.5 cm thick slices. Then these slices are dipped into hot water (72-75 °C) or hot brine (72-75

°C, 5-6 % salt) until the curd is plasticized. Then curd is kneaded and is molded into metal hoops. Cheese is dry salted on the surface every day for 15-20 days. When slices are dipped into hot brine, cheese isn't dry salted. This cheese is marketed without being fully ripened. In general, cheese are ripened at 12-16 °C for 30-90 days with 85 % humidity (Koçak and Gürsel 1992, Yener and Koçak 2000).

TULUM CHEESE (Tulum Peyniri)

Name: Tulum cheese is a hard cheese ripened in a goat skin

Type: It has a thin, dry and yellowish rind.

- ✓ Its body is homogeneous without gas holes.
- ✓ Its shape and weight depend on the size of the goats skin used.
- ✓ It has a piquant rancid and sharp flavor.

Composition: Moisture: max. 40%, fat content: 15-45% FDM, salt: max. 10% FDM

Technology: Normally, Tulum cheese is made from sheep or goat milk or the mixture of these milks. But it can also be made from cow milk. Raw milk is used for traditional Tulum cheesemaking. When it is industrially produced, standardized and pasteurized milk is used and calcium chloride and starter are added. Coagulation is obtained (home-produced rennet can be used) within 60-150 min. at 32-34 °C after rennet addition. Coagulum is cut 0.5 to 3 cm pieces. After cutting (curd can be heated to 40-50 °C for 5-10 min.) coagulum is ladled into a cloth bags and hung up for draining for 14-16 hours at room temperature. Then coagulum is pressed for 6-24 hours. Subsequently, when curd reaches the desired moisture, it is broken into small pieces to be dry salted with 2-3 % salt. Salted curd is put in a goat skin and pressed. Then cheese is ripened in natural caves at 4-12 °C for 90-120 days with 75-85 % humidity (Koçak and Gürsel 1992, Koçak, Gürsel, Avşar and Semiz 1995b, Yener and Koçak 2000).

As described, these cheeses is normally marketed after a ripening period. The three primary biochemical changes (glycolysis, lipolysis and proteolysis) occur in cheese during ripening. Among these biochemical changes the most complex and the most important one is proteolysis. Moreover it is a useful index of cheese maturity and quality (Fox, Guinee, Cogan and McSweeney 2000). Therefore, this study was carried out to evaluate the degree of proteolysis in the three major types of cheeses.

LEVEL OF PROTEOLYSIS OF BEYAZ, KASHAR AND TULUM CHEESES

In this review, the results of the studies conducted to determine the levels of proteolysis of White Pickled, Kashar and Tulum cheeses on 124 samples (40 White Pickled, 42 Kashar and 42 Tulum) were described. Cheese samples were purchased from various supermarkets in Ankara.

Total nitrogen (TN), water soluble nitrogen (WSN), 12% TCA soluble nitrogen (TCASN) and phosphotungstic acid-soluble nitrogen (PTASN) were determined according to the Kjeldahl method (Gripon, Desmazeaud, Bars and Bergere 1975). The proteose-pepton nitrogen (PPN) was calculated by subtracting the amount of WSN from the amount of NPN. The ripening index(RI) was calculated ($WSN/NT \times 100$).

Results given in Table 1 indicate that the nitrogen contents (TN, WSN, TCASN, PPN and PTN) of cheese samples show a wide variation. Moreover ripening indexes of cheese samples ranged from 6.467 % (for Kashar cheeses) to 41.640 % (for White Pickled Cheese). Variation of White Pickled Cheese ripening index was higher than the values of Kashar and Tulum cheeses. The average values of RI of White Pickled, Kashar and Tulum cheeses were 20.74 %, 12.48 % and 17.60, respectively. This can be attributed to the composition of cheese and other factors (milk, technology used, etc.).

Result of the study showed that the extent of proteolysis varies from a cheese variety to another. It can be said that the level of proteolysis of White Pickled Cheese was higher than others.

Our RI results are in agreement with previous investigators (Gönç 1974, Koçak, Gürsel, Avşar and Semiz 1995a). As known, nonspecific method include determination of soluble nitrogen in cheese and is valuable for the routine assessment of cheese maturity, since soluble nitrogen correlates well with cheese age

Table 1. Nitrogen composition of cheese samples (%)

| | | Min. | Max. | Mean |
|----------------------|-------|--------|--------|--------|
| White Pickled Cheese | TN | 1.800 | 3.079 | 2.347 |
| | WSN | 0.246 | 0.956 | 0.490 |
| | TCASN | 0.146 | 0.480 | 0.285 |
| | PPN | 0.073 | 0.566 | 0.204 |
| | PTASN | 0.045 | 0.208 | 0.111 |
| Kashar Cheese | RI | 10.680 | 41.640 | 20.740 |
| | TN | 3.579 | 5.053 | 4.174 |
| | WSN | 0.257 | 0.966 | 0.523 |
| | TCASN | 0.133 | 0.600 | 0.280 |
| | PPN | 0.122 | 0.472 | 0.243 |
| Tulum Cheese | PTASN | 0.059 | 0.323 | 0.117 |
| | RI | 6.467 | 22.309 | 12.483 |
| | TN | 2.507 | 4.153 | 3.416 |
| | WSN | 0.247 | 0.784 | 0.598 |
| | TCASN | 0.214 | 0.682 | 0.444 |
| | PPN | 0.033 | 0.306 | 0.155 |
| | PTA | 0.131 | 0.431 | 0.239 |
| | RI | 6.685 | 25.667 | 17.609 |

(Uraz and Şimşek 1998, Koçak, Erşen, Aydınöğlü and Uslu 1998, Koçak , Gürsel , Uslu and Aydınöğlü 1996)

and to a lesser extent with quality (Koçak vd 1995). Therefore soluble nitrogen contents of cheese samples indicated that some cheese samples were not fully ripened.

Results in Table 1, revealed that the cheese samples purchased from various supermarkets in Ankara showed significant differences in their nitrogen composition mainly due to the quality and the composition of raw milk, the different technology and rennet used by cheese makers and the ripening conditions. Moreover, values of proteolysis in Kashar and Tulum cheese samples were almost at the same level as that of unripened cheeses. This indicates that these cheeses are generally not stored by their cheese makers for a period of time in order to be aged. Ripening index values have become very essential for the determination of ripened or unripened cheese varieties.

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