YYÜ VET FAK DERG
(2007), 18(1):87-92

ORİJİNAL MAKALE

Some Microbiological And Chemical Characteristics Of Gorcola Cheese

Ufuk KAMBER[1] T.Haluk ÇELIK[2]
[1] Kafkas University Veterinary Faculty Food Hygiene and Technology Department Kars-Turkey
[2]Ankara University Veterinary Faculty Food Hygiene and Technology Department Ankara-Turkey

Sorumlu Araştırmacı, +90.474.2426800,: ufukkamber@hotmail.com

Summary *This study was undertaken to determine the chemical and microbiological characteristics of gorcola cheese, which is consumed in the Ardahan and Artvin regions of Turkey, and to promote the cheese. In the microbiological analyses conducted on gorcola cheese (average figures), the total aerobic mesophyl bacteria count was found to be $1.9x10^7$ cfu/g, the lactic acid bacteria count was $2.9x10^4$ cfu/g, the lactococcus bacteria count was $1.0x10^7$ cfu/g, the coliform group bacteria count was $1.5x10^4$ cfu/g, and the yeast-mold count was $1.4x10^5$ cfu/g. In chemical analyses of the cheese, the average content of dry matter was found to be 62.1%, fat 26.1%, protein 25.8%, salt 4.8%, ash 5.4% and acidity 0.5% LA.*

Key words: Gorcola, cheese, microbiological and chemical quality, Ardahan, Artvin, Turkey.

Gorcola Peynirinin Bazı Mikrobiyolojik ve Kimyasal Özellikleri

Özet: *Bu çalışma, Ardahan ve Artvin yöresinde tüketilen gorcola peynirinin kimyasal ve mikrobiyolojik özeliklerini ortaya koymak ve peyniri tanıtmak amacıyla yapılmıştır. Yapılan mikrobiyolojik analizlerde gorcola peynirinde (ortalama) toplam aerob mezofil bakteri; $1.9x10^7$ kob/g, laktik asit bakteri $2.9x10^4$ kob/g, laktokok bakteri $1.0x10^7$ kob/g, koliform grubu bakteri $1.5x10^4$ kob/g, maya ve küf $1.4x10^5$ kob/g düzeyinde izole edilmiştir. Kimyasal analizler sonucunda ise (ortalama); peynirlerde kuru madde miktarı %62.1, yağ %26.1, protein %25.8, tuz %4.8, kül %5.4 ve asitlik %0.5 LA olarak bulunmuştur.*

Anahtar kelimeler: Gorcola, peynir, mikrobiyolojik ve kimyasal kalite, Ardahan, Artvin, Türkiye

INTRODUCTION

Cheese is a dairy product which is produced and consumed with pleasure all over the world, and which plays an important role in nutrition. It is estimated that there are 1400 types of cheese worldwide [1]. Although Turkey is not renowned for the variety of its cheese, perhaps because it's white, kashar, tulum and cokelek cheeses are not frequently seen in supermarkets abroad, in fact the country produces many varieties of cheese [2]. Some of these are local cheeses, produced solely for family requirements, while others (such as Mihalic cheese, Erzincan tulum cheese, braided cheese, herb cheese) are known and produced in many parts of the country. Today, some of varieties of cheese are nearly forgotten, or are rarely produced. Produced in the Posof district of Ardahan and the Şavşat district of Artvin, gorcola cheese [2] is a local cheese type.

Gorcola cheese is a tasty and fatty cheese, white or light cream in color, granular in texture, and 3-8 mm in diameter. It is generally produced from skimmed cow's milk. The cheese is mostly made during the summer months (June-July). During maturation, the cheese develops mold, and becomes green, after which it is known locally as "gogermis gorcola" (maturated gorcola).

Production

Milk is filtered through a cotton cloth, and left to ferment (about 15 SH). It is then poured into a large container and boiled on the oven until it coagulates. The cooled coagulate is put into cloth bags and left to filter for 7-8 hours under a press. The curd obtained following the filtering operation is crumbled, spread 2-3 cm deep on a cloth, and left to dry for 2-3 days in the open air. During this time, the cheese water evaporates, and a very sharp odor develops. After this stage, the cheese is called "gorcola" in the region. The gorcola is crumbled by hand and put into a cloth which is then folded in two and placed into a deep container. The cheese remains here for 1.5 to 2 days, and is crumbled by hand every 2-3 hours. Then, "about 1 handful of fine ground salt is added for every 1 kg cheese" and the cheese is pressed into an animal skin with the help of a mallet.

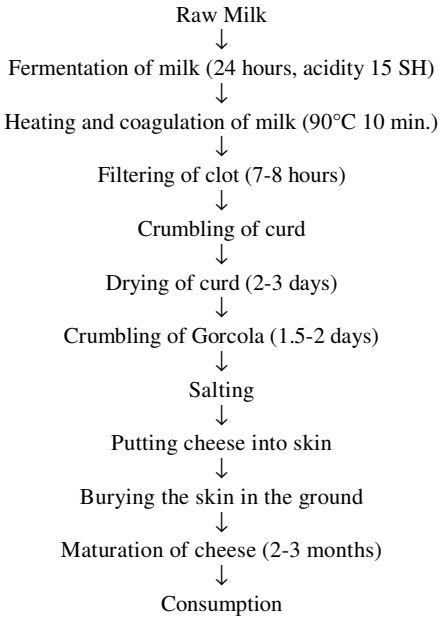

Figure 1 : Production diagram of gorcola cheese

The open end of the skin is covered with a finger thickness of salt and tied with a rope. The filled skin is then turned upside down, buried in damp soil at a depth of about 0.5-1 meter, and left to mature for about 2-3 months. At the end of this time, the cheese is taken out of the soil and kept at room temperature until it is consumed [3]. The cheese is ready for consumption at the beginning of winter, and can be kept unspoilt until the start of the next cheese season.

Although many studies have been made on the chemical and microbiological properties of the white, kashar and tulum (skin) cheeses widely consumed in Turkey [4], there are few studies concerning local cheese. A literature review yielded no studies on the properties of gorcola cheese. Therefore, the aim of this study was to identify some properties of gorcola cheese, and to promote awareness of the cheese.

MATERIALS and METHODS

As gorcola cheese is currently produced in very small quantities, it was only possible to sample 9 cheeses in this study. Three cheese samples were acquired from families originally from Posof resident in central Kars, 3 cheese samples from families' resident in central Artvin, and 3 cheese samples from houses in the Posof district.

Microbiological Analyses

Ten grams of each cheese sample was homogenized in 90 ml 0.1% peptone water in a stomacher (BAG-MIXER). Then, factor of ten dilutions of the samples were made in 0.1% peptone water and were inoculated into the relevant selective medium [5].

Plate Count Agar (Oxoid CM325) was used for the total aerobic bacteria count. Planted using the drop plate method, the petri dishes were aerobically incubated for 24-48 hours at 37°C. [6]. MRS Agar (Oxoid CM361), as recommended by Deman et al. [7], was used for the lactic acid bacteria count. All colonies created after incubation at 35°C for 48-72 hours of plates planted with two layers were counted. Ten percent sterile lactose added M17 Agar (Difco 1857-17) was used to count lactococci. The colonies which reproduced after the plates had been incubated aerobically at 35 °C for 48-72 hours were counted [8]. Violet Red Bile Agar (Oxoid CM107) medium was used to coliform count. After the plates had been incubated at 37 °C for 24-48 hours in anaerobic conditions, dark red colonies with a diameter of 1-2 mm, precipitating the bile, and surrounded by a red zone, were counted [9]. Chloramphenical Antibiotic Supplement (Oxoid SR78) added Rose Bengal Agar (Oxoid CM549) was used in the yeast and mold count. Petri dishes planted using the drop plate method was aerobically incubated for 5 days at 25 °C. At the end of this period, typical colonies reproduced in the medium were considered to be yeast and mold [6].

Chemical Analyses

The dry matter content of cheese samples was determined using the SARTORIUS MA-309 device; protein content was determined using the LECO FP-528 Protein/Nitrogen

Analyzer device; fat content was determined by the Gerber method [5]; salt content by the Mohr method [10]; ash content by the oven method [5]; and acidity by the standard method TS 591[11].

RESULTS and DISCUSSION

The microbiological content of gorcola cheese is given in Table 1, and its chemical content is given in Table 2.

Table 1 : Microorganism count in the gorcola cheese samples (cfu/g)

Sample No	Microorganisms				
	Total Aerobic bacteria	Lactic acid bacteria	Lactococcus	Coliform bacteria	Yeast and Molds
1	$1.1x10^7$	$4.0x10^4$	$3.4x10^6$	$8.0x10^4$	$1.2x10^5$
2	$2.0x10^7$	$1.4x10^4$	$1.2x10^7$	$1.0x10^2$	$6.0x10^4$
3	$1.8x10^7$	$4.8x10^4$	$5.5x10^6$	$2.2x10^2$	$5.5x10^4$
4	$7.7x10^6$	$1.9x10^4$	$4.9x10^6$	$8.6x10^3$	$7.0x10^5$
5	$7.4x10^7$	$1.5x10^4$	$3.2x10^7$	$1.6x10^4$	$1.8x10^5$
6	$8.9x10^6$	$6.0x10^3$	$4.8x10^6$	$2.7x10^3$	$9.0x10^4$
7	$5.4x10^6$	$7.2x10^4$	$5.1x10^6$	$1.2x10^3$	$9.3x10^3$
8	$2.2x10^7$	$8.7x10^3$	$1.4x10^7$	$2.4x10^4$	$1.8x10^4$
9	$8.9x10^6$	$4.2x10^4$	$7.8x10^6$	$6.9x10^3$	$8.4x10^4$
Mean	$1.9x10^7$	$2.9x10^4$	$1.0x10^7$	$1.5x10^4$	$1.4x10^5$
Min	$5.4x10^6$	$6.0x10^3$	$3.4x10^6$	$1.0x10^2$	$9.3x10^3$
Max	$7.4x10^7$	$7.2x10^4$	$3.2x10^7$	$8.0x10^4$	$7.0x10^5$

Table 2 : Chemical composition of the gorcola cheese samples (%)

Sample No	Parameter					
	Dry matter	Fat	Protein	Salt	Ash	Acidiy (% LA)
1	56.7	22.4	23.5	5.3	5.5	0.64
2	60.9	30.3	21.6	4.4	4.6	0.59
3	62.8	26.8	26.1	4.7	5.2	0.55
4	66.4	27.5	30.0	4	4.9	0.50
5	59.4	26.6	22.0	4.6	6.2	0.53
6	67.1	24.6	31.6	5.1	5.8	0.51
7	59.3	23.5	24.1	5.8	5.9	0.48
8	64.2	25.1	28.2	5.3	5.6	0.51
9	62.3	27.3	25.2	4.7	5.1	0.50
Mean	62.1	26.1	25.8	4.8	5.4	0.50
Min	56.7	22.4	21.6	4	4.6	0.48
Max	67.1	30.3	31.6	5.8	6.2	0.64

Gorcola cheese is a regional cheese produced in Şavşat, Artvin and in Posof, Ardahan. The cheese is produced by local traditional methods to meet family needs and consumed in the same region. Because production of the cheese is seasonal and restricted to a very specific area, or because it is not possible to produce it industrially, relatively small quantities are made. There are no statistics available on production.

In microbiological analysis of the cheese samples (average figures) the total aerobic mesophyl bacteria count was found to be $1.9x10^7$ cfu/g, the lactic bacteria count was $2.9x10^4$ cfu/g, the lactococcus bacteria count was $1.0x10^7$ cfu/g, the coliform group bacteria count was $1.5x10^4$ cfu/g, and the mold and yeast count was $1.4x10^5$ cfu/g. It was also determined that lactococcus bacteria formed the dominant flora. Gorcola cheese may be compared with other tulum cheeses, matured in skins, and with kulek cheese, which is maturated in barrels and produced using a

similar technique, in order to identify similarities and differences and to determine the place of gorcola amongst other types of cheese.

In previous studies made on tulum cheese [12-17] (Table 3), the counts of the total aerobic mesophyl bacteria and lactic bacteria found were higher than our results. The coliform group bacteria level found in our study is lower than the results of Kurt et al. [15] and Patir et al. [16], and higher than the results of other researchers [12-14]. The yeast and mold count was lower than that found in all previous research [12-16], possibly because the cheese was dried in the sun for 1-2 hours during its preparation. When compared with kulek cheese, which has a similar production technique, the total aerobic mesophyl bacteria count found in the gorcola samples studied was higher than that reported by Yazici et al. [17], while the coliform group bacteria and yeast and mold counts were lower. This might be accounted for by the high humidity in the Black Sea Region where kulek cheese is made. The coliform group bacteria count found in our study might be the result of the maturation of the cheeses in tulum.

Table 3 : Microbiological results of some studies made on tulum cheese (cfu/g)

Studies	Total aerobic bacteria	Lactic acid bacteria	Lactococcus	Coliform bacteria	Yeast and Molds
Bostan (1996) [12]	$1.9x10^8$	$1.7x10^8$	$1.0x10^8$	$6.2x10^3$	$2.8x10^6$
Digrak et al.(1994) [13]	$1.8x10^9$	$1.1x10^7$	-	$2.4x10^3$	$3.6x10^6$
Guven et al.(1995) [14]	$7.0x10^7$	-	-	-	-
Kurt et al.(1991) [15]	$2.1x10^9$	$1.8x10^5$		$73.2x10^6$	$1.8x10^6$
Patir et al.(2001) [16]	$4.1x10^8$		$7.7.x10^7$	$1.0x10^7$	$4.6x10^4$
Yazici et al.(1998) [17]	$5.9x10^5$	-	-	$2.4x10^3$	$1.3x10^6$

In the chemical analyses of the cheese (Table 2), the dry matter value was found to be 62.1%, fat 26.1%, protein 25.8%, salt 4.8%, ash 5.4% and acidity 0.5 LA. The humidity and protein contents of the cheese were found to be parallel to the dry matter levels.

When the results of our chemical analysis are compared with previous studies (Table 4), the dry matter content is seen to be higher than that found by Arici and Simsek[18], Digrak et al. [13], Guven and Konar [20], Nazli and Yildirici[23], and Yazici et al. [17], but consistent with the results of Bostan et al. [19], Izmen [21], and Kocak et al. [22]. The high level of dry matter in gorcola when compared with most types of cheese may be due to a decrease in humidity as a result of open air drying during the preparation of the cheese. The average amount of fat in the samples examined (26.1%) was lower than the findings of researchers Guven and Konar [20], Kocak et al. [22], Nazli and Yildirici [23], and parallel with the results of Arici and Simsek [18], Bostan et al. [19], Digrak et al. [13], and Izmen [21]. The protein content (25.8%) of the cheese was lower than that found by Yazici et al. [17], similar to that found by Izmen [21] and Arici and Simsek [18], and higher than the findings of other researchers [13,20,22]. The amount of salt (4.8%) found was consistent with the value found by Izmen [21] in tulum cheese, but different from the results of other researchers [13,16,18-20,22,23]. The average ash content (5.4%) was consistent with the findings of other researchers, since it depends on the composition of the milk used in production. The acidity levels in gorcola were found to be lower than the values reported by previous researchers [13,16-23], perhaps as a result of the aeration of the cheese during its production.

Table 4 : Chemical results of some studies on cheeses resembling gorcola (%)

Studies	Dry matter	Fat	Protein	Ash	Salt	Acidity (% LA)
Arici and Simsek (1991) [18]	55.0	25.1	25.1	-	3.2	87*
Bostan et al.(1992) [19]	60.6	27.1	-	4.4	3.3	1.3
Digrak et al.(1994) [13]	53.7	27.7	16.9	5.2	3.4	1.6
Guven and Konar (1995) [20]	57.4	31.8	20.9	-	2.6	2.6
Izmen (1938) [21]	63.4	26.8	26.8	7.5	5.1	1.4
Kocak et al.(1996) [22]	62.9	34.9	22.1	-	2.9	1.1
Nazli and Yildirici (1995) [23]	56.6	47.7	-	-	6.1	1.8
Patir et al.(2001) [16]	65.1	-	-	-	6.7	1.3
Yazici et al.(1998) [17]	46.4	6.7	28.2	8.2	7.1	2.7

by Soxhelet Henkel

Our results demonstrate that although gorcola cheese appears to resemble the kulek cheese made from skimmed milk in the Artvin region, it can in fact be distinguished by its sensorial, chemical and microbiological attributes. Moreover, gorcola was also found to differ from tulum cheese with regards to its chemical and microbiological properties. Whereas in tulum cheese the dominant flora is created by lactic bacteria, in gorcola cheese the dominant flora is created by lactococcus bacteria. Again, from a chemical perspective, the acidity levels in gorcola were found to be much lower than in tulum cheese, which may explain why lactococcus was the dominant flora.

In conclusion, local cheeses, which are known only in their own area, or which risk being forgotten due to changing living conditions, have to be brought to light, and their characteristics and technologies studied and developed, so that they may be produced industrially and marketed commercially. Therefore, efforts must be made in order to ensure that types of local cheese other than white cheese, kashkaval and tulum cheese are produced at industrial level. Much loved in its region, gorcola cheese might be desired produced to industrial standards and marketed.

REFERENCES

1. Anon (2006) http://www.cdr.wisc.edu, Date of arrival 10 March .

2. Kamber, U. (2005) Geleneksel Anadolu Peynirleri, Miki Matbaacılık AS, Ankara, p:174.

3. Anon (2003) Posof ilçesi Baykent köyünden Nezaket Akça ile yapılan kişisel görüşme.

4. Tekinsen, O. C. (2000) Süt Ürünleri Teknolojisi, 3.Baski, Selçuk Üniv. Basımevi, s139, Konya.

5. APHA (2002) Standard Methods for the Examination of Dairy Products, American Public Health Association, 16th Edition, Washington DC.

6. Anon (1990) The Oxoid Manuel of Culture Media, 6th Ed., Published by Uniped Limited, England.

7. Deman, J. C., Rogosa, M. and Sharpe, M. E. (1960) A medium for the cultivation of lactobacilli. Journal Applied Bacteriology, 23, 130-135.

8. Terzaghi, B. E. and Sandine, W. E. (1975) Improved medium for lactic Streptococci and their bacteriophages. Journal Applied Microbiology, 29, 807-813.

9. Harrigan, W. F. and McCance, M. E. (1976) Laboratory Methods in Food and Dairy Microbiology, Academic Pres, London.

10. Fox, P. F. (1963) Potaintiometric determination of salt in cheese. Journal Dairy Science, 46, 744-745.

11. Anon (1995) TS 591, Beyaz Peynir Standardı, Türk Standartlar Enstitüsü, Ankara.

12. Bostan, K. (1996) Farklı Malzemelerde Muhafaza Edilen Tulum Peynirlerinin Duyusal, Kimyasal ve Mikrobiyolojik Özellikleri. In: Demirci M (Ed): Her Yönüyle Peynir, Hasat Yayıncılık, Istanbul, p: 255-259.

13. Dığrak, M., Yılmaz, Ö. and Özçelik, S. (1994) Elazığ kapalı çarşısında satışa sunulan tulum peynirlerinin mikrobiyolojik ve bazı fiziksel kimyasal özellikleri. Gıda, 19, 381-387.

14. Güven, M., Konar, M. and Kleeberger, A. (1995) İnek, koyun ve keçi sütlerinden üretilen ve deri tulumlarda olgunlaştırılan tulum peynirlerinin bazı mikrobiyolojik özelliklerinin saptanması üzerine karşılaştırmalı bir araştırma. Doğa Türk Tarım ve Ormancılık Dergisi, 44, 293-297.

15. Kurt, A., Çağlar, A., Çakmakcı S. and Akyüz, N. (1991) Erzincan Tulum (Savak) peynirinin mikrobiyolojik özellikleri. Doğa Türk Tarım ve Ormancılık Dergisi, 16, 41-50.

16. Patır, B., Ateş, G. and Dinçogğu, A. H. (2001) Geleneksel yöntemlerle üretilen tulum peynirinin olgunlaşma sırasında meydana gelen mikrobiyolojik ve kimyasal değişimler üzerine araştırmalar. Fırat Üniversitesi Sağlik Bilimleri Dergisi, 15(1):1-8.

17. Yazıcı, F., Dervişoğlu, M. and Temiz, H. (1998) Külek Peynirinin Duyusal, Fiziksel, Kimyasal ve Mikrobiyolojik Özellikleri. In: Demirci M (Ed): Geleneksel Süt Ürünleri, 5. Sut ve Sut Urunleri Sempozyumu, 21-22 Mayıs, MPM Yay. No: 621, Ankara, p: 133-145.

18. Arici, M., Simsek, O. (1991) Kültür kullanımının tulum peynirinin duyusal fiziksel kimyasal ve mikrobiyolojik özelliklerine etkisi. Gıda, 16, 53-62.

19. Bostan, K., Uğur, M. and Çiftçioğlu, G. (1992) Deri ve plastik bidonlar içinde satışa sunulan tulum peynirlerinin duyusal, kimyasal ve mikrobiyolojik özellikleri. Pendik Veteriner Mikrobiyoloji Dergisi, 23, 75-83.

20. Güven, M. and Konar, M. (1995) Ankara, İstanbul ve Adana piyasalarında farklı ambalajlarda satılan tulum peynirlerinin bazı kimyasal özelikleri ve standarda uygunluğu. Doğa Türk Tarım ve Ormancılık Dergisi, 4, 287-291.

21. İzmen, E. R. (1938) Türkiye Mihalic, Tulum ve Beyaz Peynirlerinin Terkipleri, Yüksek Ziraat Enst. Yay. No:86, Ankara.

22. Koçak, C., Gürsel, A., Avşar, Y. K. and Semiz, A. 81996) Ankara piyasasındaki tulum peynirlerinin bazı nitelikleri, Doğa Türk Tarım ve Ormancılık Dergisi, 1, 121-125.

23. Nazlı, B., Yıldırıcı, G. (1995) İstanbul'da satılan tulum peynirlerinde saptanan organoleptik ve fiziko-kimyasal özelliklerin, deneysel üretim ile karşılaştırmalı analizi, İstanbul Üniversitesi Veteriner Fakültesi Dergisi, 2(21): 485-501.