DEVELOPMENTS IN EGYPTIAN KASHKAVAL CHEESE: AN OVERVIEW ARTICLE

Abou-Donia, S. A.

Dept . of Dairy Science and Technology,
Fac. of Agric., Univ., of Alexandria, Egypt.

ABSTRACT

Egyptian Kashkaval cheese is produced in minor quantities in Egypt. It is rather similar to the typical Kashkaval type cheese originated in Eastern Europe and Balkan Peninsula countries. This overview article deals with Egyptian Kashkaval cheese manufacturing. The improvement of the manufacture process, chemical composition, microbiology, and ripening of Egyptian Kashkaval cheese are intensively reviewed.

Key Words : Egyptian Kashkaval cheese, cheese manufacture, microbiology, chemistry, ripening.

INTRODUCTION

Kashkaval is an Eastern European cheese, produced mainly in Rumania, Bulgaria and Russia. It is also produced in all countries of the Balkan Peninsula. Kashkaval cheese is usually made from ewe's milk. Similar varieties as Caciocavallo Siciliano, Provolone, and Mozarella are produced in Italy.

During the manufacturing process of Kashkaval and similar cheese types, the curd is immersed in hot water, kneaded and stretched until it becomes smooth and free of lumps, therefore it is known as plastic curd or pasta filata.

Kashkaval cheese is produced in Egypt in relatively small amounts as compared to Ras cheese. As Ras cheese, the Egyptian Kashkaval in the Egyptian markets is known as Rumi cheese. Like Ras cheese, it is probable that Egyptian Kashkaval cheese originated in Egypt during the early stage of the Egyptian industrial renosance after 1818.

The production of Egyptian Kashkaval was highly increased in all of the Egyptian provinces during the last decade because it is considered as principle component for the manufacturing of Pizza cakes.

Egyptian Kashkaval was first investigated by Safwat (1954), and then by Hofi & Abdel-Tawab (1966).

CHEESE MANUFACTURING

Sufficient rennet is added to either raw milk or that heated to 32^{o}C to complete coagulation in 45 minutes. The coagulum is cut into cubes of one cm3, left without stirring for 5-7 minutes and then gradually stirred very gently at the beginning, while keeping the temperature at 32^{o}C. After the curd has settled, half of the whey is drawn off, and stirring is continued with gradual raising of temperature up to 35-40^{o}C depending on the development of acidity. The whey is considered to be completely drawn off when cubes shows certain degree of firmness, and shrinks to about half of their initial size and while the whey shows a titratable acidity of 0.22-0.26%.

The curd is placed into cheese cloth, tied in a bundle and put into the vats ready to be pressed. Curd is pressed by a suitable weight (about 1 kg/1 kg of curd) to hasten the expulsion of the whey. The double jacket of the vat is covered to keep it warm. This cheddaring stage is completed when the titratable acidity of the curd reaches 1.25-1.35% and the pH value becomes 5.2. In practice, this moment is determined by cutting out some curd from every block of curd and be put into water at 75^{o}C. The kneaded curd is then taken out of the water and pressed by hand, pulled out and stretched to form a rope like drawn. The well-ripened curd can easily be drawn as a thin thread of a glossy surface and does not peal off when rubbed with the fingers.

The mass of ripened cheddared curd is then cut into large blocks (60×10×10cm) which are cut afterwards into thin slices (10 × 7×1.5 cm) and scalded with 8-9% brine at a temperature of 75±2^{o}C, and worked with two wooden rods for about 3-5 min to become a homogenous plastic paste.

The scalded or cooked curd is kneaded vigorously by hand to get rid of the remaining hot whey and then moulded into a bundle-like form. The plasticized curd is placed in a mould of 30cm diameter and 8 cm height. The bundle is squeezed by hand and the excess curd "The bundle knot" is cut by a sharp knife or by hand leaving no opening in the young cheese. The cheese is left in the mould until the following day.

The young cheese is removed into a cellar having a temperature of 18°C and relative humidity of 70-75%. Fourty gm of dry coarse salt is sprinkled daily on the cheese surface for 4 days, followed by 30 gm for 6-days. After salting, the cheese is cleaned using smooth brushes and warm water, then rubbed with 2% alcoholic sorbic acid solution or 1% aqueous potassium sorbate. Cheese is kept in piles in the cellar while being turned every two days. When the cheese becomes 35-45 days old, it is coated either with wax or plastcoat. Then the cheese is ripened at 13±2°C and 83±2% humidity for 6 months.

Improvement of the manufacture process:

Modification of cheese technology:

Many succeeded attempts were tried to modify the manufacture process of the Egyptian Kashkaval cheese (Safwat, 1954, El-Beheiry, 1973, El-Shabrawy, 1973, Nassib, 1974, Anis, 1979, Nasr, 1980, Abd-El-Kader, 1981 & El-Sissi, 2003).

Milk Used:

Typical Kashkaval cheese is made from ewe's milk. Many Egyptian authors utilized buffaloe's or cow's milks for the manufacture of Kashkaval cheese. Buffaloe's milk was used by Safwat (1954), El-Shabrawy (1973), Amer *et al.* (1979a&b), Teama *et al.* (1979a&b) & El-Sissi (2003), While cow's milk was used by Amer *et al.* (1979a&b), El-Gazzar & Hefnawi (1981), Omar & El-Zayat (1986) & Gooda *et al.* (1988).

Starter addition to milk :

To retain the typical flavour and body characteristics of the Egyptian Kashkaval cheese, the addition of starter to pasteurized milk prior manufacturing was considered. Cheese with high scores was obtained when 1% of lactic starter consisting of *Lactococcus lactis* subsp. *lactis* + *Streptococcus thermophilus* in equal proportions was used (Abo-Elnaga, *et al.*, 1975). Also in 1980, Teama *et al.*, succeeded in manufacturing high quality Kashkaval cheese, using a starter of 50% *Lactococcus lactis* subsp. *lactis* + *Lactococcus lactis* subsp. *cremoris* and 50% *Streptococcus thermophilus* + *Lactobacillus delbruckii* subsp. *bulgaricus*.

Kneading of the curd :

Abo-Elnaga *et al.* (1974), reported that the time required for kneading the curd at 75°C during the manufacturing process of Kashkaval cheese was shorter than that at 55°C or 65°C. The best organoleptic indices were obtained when the curd was kneaded at 75°C and the cheese was dry salted.

Abo-Elnaga *et al.* (1975) found no significant differences between Kashkaval cheese kneaded in water, in whey or in a mixture of both with respect to the moisture content, fat, salt, soluble N and acidity.

Cheese coating:

Moneib & Safwat (1969), packed 3 months old Kashkaval cheese under vacuum in polyethylene bags. they observed some improvement in body and texture of the packed cheese but taste defects were caused by the extensive surface mould growth.

Moneib & Safwat (1972) reported that packing one month old Kashkaval cheese in polyethylene sacs or waxing the cheese helped in improving its quality, especially in body and texture.

Nasr (1982) prepared Kashkaval cheese made with cows' milk, dry salted and then 15 days later was coated by dipping in hot wax, covered with HALA-plast or brushed with HALA plast containing 0.5% delvocid. The cheese coated in HALA-plast without delvocid, had the best flavour, followed by that coated in HALA-plast with delvocid.

Cheese ripening :

Many investigators studied the ripening of Kashkaval cheese. One or more of the following criteria have been selected for the determination of ripening development of Kashkaval cheese, formol and/or shilovich ripening indices, increase in soluble nitrogen, ammonia, ammonia nitrogen, soluble tyrosine and soluble tryptophan, decrease in fat and lactose contents, and increase in total volatile acids.

The electrophoretic patterns of cheese proteins derived from several types of raw or heated milk (cow's and buffalo's) showed very little variation during manufacturing (Hofi *et al.*, 1978).

When Kashkaval cheese was made from heated buffalo's milk, lipolysis and proteolysis were delayed, and the resultant cheese had a chalky flavour, a hard body and fragile texture (Hagrass & El-Shabrawy, 1978).

A comparative study of the calcium paracaseinate phosphate complex (CPPC) of Kashkaval cheese made from buffalo's or cow's milk indicated that the rate of loss was greater in cow's CPPC than in buffalo's CPPC (Amer *et al.*, 1979a&b).

The H_2O_2 / catalase treatment of buffalo's milk in the manufacturing of Kashkaval cheese produced a slightly higher moisture content and lower acidity in the cheese, and protein degradation was slower (Teama *et al.*, 1979a). Meanwhile, adding of sodium citrate to milk in the manufacturing of Kashkaval cheese resulted a decrease of moisture content of cheese and accelerated proteolysis and fat hydrolysis (Teama *et al.*, 1979b).

Attia *et al.* (1980) produced Kashkaval cheese made from pasteurized milk with added 0.02% (w/w) β-galactosidase, and ripened at 13-14^{o}C. It was suggested that more proteolysis occurred during ripening of the hydrolyzed lactose cheese. Similar results were obtained by El-Shafie *et al.*(1989).

Kashkaval cheese made from cow's milk, fortified with dried skim milk and with pepsin preparation (0.9 g. pepsin powder in 100 ml water) sprinkled onto the curd (7 g.) at the end of the kneading step scored the highest points for flavour, body and texture and showed enhanced ripening (El-Gazzar & Hefnawi, 1983).

The ripening of Kashkaval cheese was accelerated by the addition of either fungal esterase lipase powder to the cheese milk (Nasr, 1983), or by the addition of valine, isoleucine and lysine (Nasr, 1984).

Kashkaval cheese was made from cow's milk then ripened for 4 months. The percentages of fat, protein, soluble N, non-protein nitrogen and amino and free fatty acids were found to increase during ripening (Omar & El-Zayat, 1986).

The addition of cell free extract of *Streptococcus thermophilus* and *Lactobacillus delbruckii* subsp. *bulgaricus* to the curd of Kashkaval cheese after the kneading process showed enhanced ripening (Taha *et al.*, 1989). Recently, El-Sissi (2003), reported that addition of 2% slurry to Kashkaval cheese kneaded dough increased ripening indices.

Chemical composition of Kashkaval cheese:

The chemical composition of Kashkaval cheese was affected by various factors such as type of milk, season of milk production, pretreatment of milk, renneting and starter additions, additives to cheese curd, coating of cheese curd and ripening process of the resultant cheese.

Egyptian Kashkaval cheese was made from heated cows milk at 62^{o}C for 15 min, using added starter and calcium lactate. After 135 days of ripening, the chemical analysis of the cheese was, 33.2-35.9% moisture, 50.8-53.8% fat/d.m., 3.9-4.8% NaCl, and 5.8% TN (Abdel-Kader, 1981 & Abou-Donia *et al.*, 1985a).

Kashkaval cheese samples, 330 days- old were collected from Alexandria markets and analyzed. Chemical analysis showed the following values, pH 5.25, acidity 3.25%, TS 65.89%, fat d.m. 47.4%, NaCl 6.8%-TN 7.84%. Seventeen amino acids, volatile fatty acids, (formic, acetic, and propionic acids), diacetyl, acetaldehyde and hydrogen sulphide were determinated (Shoukry, 1982, & Abou-Donia *et al.*, 1985b). Recently, El-Sissi (2003) studied the chemical composition of Kashkaval cheese, the chemical analysis showed the following values, pH 5.6, acidity 0.88%, TS 60.5% fat d.m. 40.7%, NaCl 7.9, and TN 8.1.

Microstructure of Kashkaval cheese :

Hofi *et al.* (1977) reported that the internal structure of the curd of Kashkaval cheese was found to be made up of framework of large spherical casein aggregates held by bridges and enclosing fat. After scalding and kneading, the casein aggregates lost the spherical shape and formed fibrous network.

Omar & El-Zayat (1986) obtained similar results as mentioned previously, also dissociation and fusion processes occur in the protein fibres during ripening of Kashkaval cheese, forming a more homogeneous structure and interaction between layers of casein sheets to give a more compact structure.

Microbiology of Kashkaval cheese:

Moneib & Safwat (1969) observed some improvement in body and texture of Kashkaval cheese packed under vacuum in polyethylene sacs, but taste defects were caused by extensive surface mould growth. To avoid that defect, the same authors (1972) suggested applying 2% solution of sorbic acid in alcohol and glycerol, while, Nasr (1982) suggested applying of delvocid (Pimarcin) and then coating with HALA plast.

In two separate studies both of Abo-Elnaga *et al.* (1974), & Nassib (1974), found that most of the bacteria were destroyed during kneading of Kashkaval cheese curd, then a rapid multiplication of microorganisms occurred. Streptococci was predominant in the first stages of manufacturing cheese, of 90 days old, and after that lactobacilli was predominated.

Abd- El-Kader (1981) & Abou-Donia *et al.* (1985a) found that examined Kashkaval cheese was found to be free from pathogens, while, Streptococci and Lactobacilli were isolated.

Shoukry (1982) & Abou-Donia *et al.* (1985b) examined 330 days old Kashkaval cheese microbiologically, they reported the absence of Enterococci, proteolytic bacteria, lipolytic bacteria, yeasts and moulds from the samples.

REFERENCES

Abd El-Kader, Y.M. **1981**. Technological & Bacteriological Studies on Kashkaval-Like Cheese. M.Sc. Thesis, Dairy Science, Fac. of Agric., Alex. Univ., Alex., Egypt.

Abo-El-Naga, I.G., Abdel-Mottaleb, L. & Hassan, A. **1974**. Factors influencing the properties of Kashakaval cheese. I- Effect of kneading temperature and salting method. Cheme Mikrobiologie Technologie der Lebenmittel, **3**(1): 82-32.

Abo-El-Naga, I.G., Abdel-Mottaleb, L. & Hassan, A. **1975**. Factors influencing the properties of Kashkaval cheese. II- Effect of kneading media and type of starter. Chemic Mikrobiologie Technologie der Lenmittel, **4** (2): 52-55.

Abou-Donia, S.A., Abdel-Kader, Y., Rakshy, S. & Sirry, I. 1985a. A procedure to produce homogenous Romi cheese in short ripening period. Journal of Dairy Science. P. 68 (Suppl. 1) 99.

Abou-Donia, S.A., Shoukry, Y., Rakshy, S. & Sirry, I. **1859b**. Microbiological and chemical analysis of Egyptian old Romi cheese. Journal of dairy Science. P. 68 (Suppl. 1) 100.

Amer, S.N., Naghamoush, M.R. & Anis, S.M.K. **1979a**. Changes in the calcium paracaseinate phosphate complex during cheddaring of Kashkaval cheese as affected by the kind of milk. Egyptian Journal of Dairy Science, **7**(1): 17-23.

Amer, S.N., Naghamoush, M.R. & Anis, S.M.K. **1979b**. Changes in the calcium paracaseinate phosphate complex during ripening of Kashkaval cheese as affected by the kind milk. Egyptian Journal of Dairy Science, **7** (1): 25-32.

Anis, Sh.M.K. **1979**. Studies on Romi Cheese Making. Ph.D. Thesis, Dairy Science, Fac. of Agric., Cairo Univ., Cairo, Egypt.

Attia, I.A., Gooda, E. & Salem, S.A. **1990**. Gelfiltration of soluble nitrogenous compounds and free amino acids in hydrolyzed lactose Kashkaval cheese during ripening. Alexandria Science Exchange, **11**(3): 93-111.

El-Beheiry, M.M. **1973**. A Study on the Effect of Salting Method and Use of Starter on Some Chemical and Physical Properties of Kashkaval Cheese. M.Sc. Thesis, Dairy Science, Fac. of Agric., Al-Azhar Univ., Cairo, Egypt.

El-Gazzar, H. & Hefnawi, S. **1981**. A recommended method for producing Kashkaval cheese of good quality in a short period at low cost of production. Agricultural Research Review. **59**(6): 271-279.

EL-Gazzar, H.A., Hefnawy, S.A. & Moneib, A. **1983**. Effect of total solids content of milk and salt content of kneading solution on the composition and properties of Kashkaval cheese. Egyptian Journal of Dairy Science. **11**(1): 45-52.

El-Shabrawy, E.A. **1973**. Studies on Kashkaval Cheese Made from Buffaloes Milk, M.Sc. Thesis, Dairy Science, Fac. of Agric., Ain-Shams Univ., Cairo, Egypt.

El-Shafei, N.M., Aly, M.E. & Farag, A.A. **1989**. Manufacture and ripening changes of Kashkaval cheese produced from hydrolysed lactose milk, Zagazig. J. Res., **16** (3): 65-72.

El-Sissi, M.G.M. **2003**. Improvement of the quality of Kashkaval cheese made from buffaloe's milk. Egyptian Journal of Dairy Science, **31** (1): 147-158.

Gooda, S., Salem, S.A., Attia, I.A. & Salam, A.E. **1988**. Chemical, microbiological and rheological properties of Kashkaval cheese manufactured from cow's milk of partially hydrolyzed lactose during ripening. Egyptian Journal of Dairy Science, **16** (1): 107-117.

Hagrass, A.E. & El-Shabrawy, S.A. **1978**. Effect of heat treatment on the quality and chemical composition of Kashkaval cheese made

from buffaloe's milk. Research Bulletin, Fac., of Agric., Ain-Shams Univ., 849, pp 13.

Hofi, A.A. & Abdel-Tawab, G. **1966**. Analytical study on market Kashkaval cheese with special reference to flavour. Annals of Agric., Sci., Fac. of Agric., Ain-Shams Univ., Cairo **11**(11): 1966.

Hofi, A.A., El-Nemr, A.A., Shabrawy, E.A.E. & Abd-El-Salam, M.H. **1977**. Changes in the submicroscopic structure of Kashkaval cheese during manufacture. Egyptian Journal of Dairy Science, **5** (1): 25-30.

Hofi, A.A., Teama, Z.y., Abd-El-Salam, M.H. & El-Shabrawy, S.A. **1978**. Changes in electrophoretic patterns of Kashkaval cheese protein during manufacture and ripening. Egyptian Journal of Dairy Science, **6**(2): 177-185.

Moneib, A., & Safwat, I. **1969**. Studies on improving locally manufactured Kashkaval cheese. Increasing then yield and improving the body and texture. Agric., Res. Rev., Cairo, **47**(6): 267-273.

Moneib, A. & Safwat, I. **1972**. Studies on improving locally manufactured Kashkaval cheese. II. Effect of waxing of packing in polyethelene sacs on the physical and chemical properties of the cheese. Agric. Res. Rev., Cairo, **50**(3): 169-174.

Nasr, M.M.A. **1980**. Technological Studies on Hard Cheese. Ph.D. Thesis, Dairy Science, Fac. Of Agric., Zagazig Univ., Zagazig, Cairo.

Nasr, M.M. **1982**. Plastic coating of Romi cheese. Agric. Res. Rev., Cairo, **60**(6): 197-210.

Nasr, M **1983**. Acceleration of Romi cheese ripening by addition of fungal esterase lipase powder. Egyptian Journal of Dairy Science, **11**(2): 309-315.

Nasr, M. **1984**. Effect of adding valine, leucine, isoleucine and lysine on the properties of Romi cheese. Egyptian Journal of Dairy Science, **12**(1): 83-88.

Nassib, T.A. **1974**. The effect of manufacturing processes on the microflora of Kashkaval cheese. Assiut Journal of Agricultural Sciences, **5** (1): 131-137.

Omar,M.M. & El-Zayat,A.I. **1986**. Ripening changes of Kashkaval cheese made from cow's milk . Food Chemistry, **22**(2): 83-94.

Safwat, A. **1954**. A Study on the Manufacture and Ripening of Kashkaval Cheese. Ph.D. Thesis, Dairy Science. Fac. of Agric., Cairo Univ., Cairo, Egypt.

Shoukry, Y.M. **1982**. Microbiological and Chemical Studies on Kashkaval Like Cheese. Ph.D. Thesis, Dairy science, Fac. of Agric., Alex. Univ., Alex., Egypt.

Taha,S.N., Aly, M.E. & El-Shafie, N.M. **1989**. Quality of Kashkaval-type cheese as affected by using some culture additives of lactic acid bacteria. Egypt J. Appl. Sci., **4** (1)B: 322-332.

Teama, Z.Y., El-Sadek, G.M., Abdel-Kader, A.E. & El-Shabrawy, E.A. **1979a**. Manufacture of Kashkaval cheese from buffaloe's milk. I- Hydrogen peroxide-catalase treatment. Egyptian Journal of Dairy Science, **7**(2): 191-198.

Teama, Z.Y., El-Sadek, G.M., Abdel-Kader, A.E. & El-Shabrawy, E.A. **1979b**. Manufacture of Kashkaval cheese from buffaloe's milk. II- Addition of sodium citrate. Egyptian Journal of Dairy, **7**(2): 199-208.

Teama, Z.Y., Hofi, A.A., Abd-El-Malek, M.H., & El-Shabrawy, S.A. **1980**. Gel filtration and thin layer chromatography of soluble nitrogenous compounds of Kashkaval cheese from heat treated milk. Egyptian Journal of Dairy Science, **8** (1): 71-79.

تطورات صناعة الجبن الكاشكفال المصري : مقال مرجعي

سـمير أحمد أبو دنيـا

قسم علوم وتكنولوجيا الألبان – كلية الزراعة – الشاطبي – الإسكندرية

يعتبر الجبن الكاشكفال المصري ذا أهمية ثانوية من ناحية الإنتاج ، وهذا الصنف من الجبن يشبه الكاشكفال الأصلي سواء المنتج في دول أوروبا الشرقية أو دول البلقـان · ويناقش هذا المقال المرجعي طريقة صناعة الجبن الكاشكفال المصري ومدى تطور هذه الصناعة · كما تم أيضا إلقاء الضوء بإيجازعن كل من التركيب الكيماوي والفلورا الميكروبية والتسوية لهذا الصنف من الجبن.