

Origin, History and Manufacturing Process of Egyptian Dairy Products: An Overview

Abou-Donia S.A.

Dairy Science and Technology Dept., Fac. of Agric., Alexandria Univ., Alexandria, 21545, Egypt.

ABSTRACT

The manufacturing process of the Egyptian dairy products was originated since the Pharonic period from 3200 to 332 B.C. and was developed through the Greco-Roman period from 332 to 641 A.D., and then in the Arab Islamic period 641 A.D. until now. The manufacturing process of the Egyptian dairy products was very well developed, and modern automation took place in the large cities in both lower and upper Egyptian governorates. The manufacturing process of the traditional dairy products in the frontier governorates must be intensively and carefully investigated, because it has not been previously studied.

The objective of the present article is to describe the origin, history and manufacturing process of the following Egyptian dairy products; *Laban Rayeb*, *Laban Khad*, *Laban Zeer*, *Kishk*, *Laban Zabady*, *Labneh*, *Karish* cheese, *Mish* cheese, *Domiati* cheese, *Ras* cheese, and Egyptian adopted plastic curd cheese varieties (*Kashkaval*, *Provolone*, *Mozarella*, *Medaffarah* and *Halloumi*), processed cheese, Ice cream and *Al-Samn*.

Key words: *Egyptian dairy products, origin of dairy products, history of dairy products, processing of dairy products, Egyptian heritage.*

INTRODUCTION

Administratively, Egypt is divided into 28 governorates, which are classified into four groups; the first includes the six Urban Governorates (Cairo, Alexandria, Damietta, Port Said, Ismailia, Suez, Helwan and October). The second group includes seven rural governorates which are located in Nile Delta and known as "Lower Egypt", and also as *Fal-lahin* (Dakahlia, Sharkia, Kalubia, Kafr El-Sheikh, Gharbia, Monoufia and Behera). The third group includes eight rural governorates which are located in the Nile Valley and known as "Upper Egypt", and also known as "*Saide*", (Geza, Fayoum, Beni Suief, Menya, Assiut, Souhag, Kena, and Aswan). The fourth group includes five frontier governorates which are located on the Eastern and Western boundaries of Egypt and known as "Egyptian Sahari", and also as "*Badwainu*", (New Valley, Matrouh, North Sinai, South Sinai, and Red Sea). (EDHS, 1995, Abou-Donia, 1998, 1999 a, b).

The presence of earthenware pots from the pharonic period (3200 B.C.-332 B.C.), such as *Matrad* or *Shalia* for curdling of raw milk to prepare *Laban Rayeb*, *Ballas* or *Zalla* for ripening and storage of *Mish* cheese, *Zeer* for storage and thickness of *Laban Khad*, and *Barany* (Pot with glazed inner surface) for storage of *Samna* in the tomb of King Ho-

raha of the first dynasty (3200 B.C.). Also, of a mat of a type of reed *Juncus acutus* which is commonly used for the drainage of *Karish* cheese whey, and the earthenware pots "*Matrad*" or "*Shalia*", "*Ballas*" or "*Zallas*", *Zeer* and *Barany* and *Kerbah* (for butter making) which were found in the tombs of the Greco Roman Period (332 B.C-641 A.D.), near Sanoris indicate that the art of the primitive dairy industry to produce *Laban Reyeb*, *Laban Khad*, *Laban Zeer*, *Karish* cheese, *Mish* cheese, *Kishk* and *Al-Samn* was known by the Ancient Egyptians. (Iskander, 1942, Engelback, 1946, Abou-Donia, 1998, 1999 a, b).

After that, during the Egyptian Arab Islamic periods (641 A.D until now), the manufacturing process of the Egyptian dairy products was well developed, and the modern automation processing took place in the large cities in both lower and upper Egyptian governorates.

The manufacturing process of the traditional dairy products in the five frontier governorates must be intensively and are fully investigated, because it has not been previously studied (Abou-Donia 1998, 1999 a, b). The mammals whose milk is normally used for the manufacturing of the Egyptian dairy products are; buffalo (*Bubalus bubalis*), cow (*Bos taurus*), sheep (*Ovis aries*), goat (*Capra*

hircus), and the one humped camel (Arabian camel) (*Camelus dromedaries*).

Buffalo's, cow's, sheep's and goat's milks constitute 63.5%, 35.0%, 1.0% and 0.5% respectively of the total annual milk output in Egypt. Also, very small amounts of camel milk are also produced (Abou-Donia, 1986). It is believed that, buffalo, sheep, goat, and camel may introduced to Egypt since the Arab Islamic period (641. A.D), while the cow is very well known in Egypt since the pharonic period.

Therefore, the objective of the present article is to describe the origin, history and manufacturing process through the great Egyptian heritage of the following Egyptian dairy products; *Laban Rayeb*, *Laban Khad*, *Laban Zeer*, *Kishk*, *Laban Zabady*, *Labneh*, *Karish* cheese, *Mish* cheese, *Domiat* cheese, *Ras* cheese, and Egyptian adopted plastic curd cheese varieties (*Kashkaval*, *Provolone*, *Mozzarella*, *Medaffarah*, *Halloumi*), processed cheese, Ice cream and *Al-Samn*.

Laban Rayeb

It is also known as *Laban Matrad*, natural sour milk, and gravity skimmed milk. In Lower Egypt, farmers put fresh milk in shallow or deep earthenware pots, *Matrad* or *Shalia*, and leave it without disturbed in a warm, dark place till the cream rises and the milk coagulates. This is called *Laban Rayeb* or *Laban Matrad* or gravity skimmed fermented milk (Abd-El-Malek & Demerdash 1970, El-Gendy, 1983, Abou-Donia, 1984, 1991, 1992, 1999 a, b)

Laban Khad

It is also known as natural sour butter milk. In Upper Egypt, milk is poured into skin bags, *Kerbah*, and left to sour for periods determined by experience.

Air is blown into the *Kerbah* before closing it tightly and shaking until the fat globules coalesce. After the removal of butter, the remainder is called *Laban Khad* or sour butter milk. (Abd-El-Malek & Demerdash, 1970, Abou-Donia, 1984, 1992, 1999a, b)

Laban Zeer

It is also known as earthenware stored *Laban Khad* or concentrated butter milk. During hot weather in Upper Egypt, the milk coagulates before the fat is removed. It is then stored in earthenware

containers, *Zeers*, and referred to a *Laban Zeer*. The walls of *Zeer* are porous and thus the whey differs and the *Laban Zeer* thickens. On addition of new batches of fresh sour milk, a suitable quantity of salt as judged by taste is added and the contents of the *Zeer* are mixed. The *Laban Zeer* is usually collected from May onwards to be used in the making of *Kishk*, after harvest of wheat. (Abd-El-Malek & Demerdash, 1970; El-Gendy, 1983, Abou-Donia, 1984, 1992, 1999a, b).

Kishk

It is also known as wheat fermented milk. In upper Egypt, *Kishk* is considered as a typical native food made of *Laban Zeer* and boiled, dried and crushed grains *Kishk* has good keeping quality and is consumed throughout the year.

The wheat grains are boiled in the water, the cooked grains are named "*Belila*", then the grains are dried in a sunny place for nearly a week. The dried product is crushed, sieved and the smooth particles are disposed of. The crushed wheat is put in an earthenware jar and gradually moistened, first with salted water and then with *Laban Zeer*. The ingredients are thoroughly mixed, the resultant paste is covered with a thick cloth in a warm place to keep the temperature constant for 24 hr. As a result of fermentation, the paste swells and is then divided into small round pieces, spread over straw mats and left to dry in the sun place for few days or dried in a warm oven. The final product is not hygroscopic and can be stored in open jars for two or three years without deterioration (Abd El Malek & Demerdash, 1970, El Gendy, 1983, Ahou-Donia, 1984, 1999 a, b. Atia & Khattah. 1985, Tamime & O' Connor, 1995).

Laban Zabady

Zahads, *Zabadi* or *Laban Zabady* is the traditional type of yoghurt manufactured in Egypt. The best *Zabady* is made from buffalo milk; though it can be made from cow's milk or from a mixture of the two milks. It is believed that *Zabady* is derived from the ancient Egyptian fermented milk *Laban Rayeb*.

Manufacturing of Zabady

The milk is filtered through a cloth, boiled for a few minutes and then left to cool to 37°C to 45°C. The starter culture is mixed and then added to the cooled milk. Inoculated milk is transferred to pots or plastic lined carton cubs containers and in-

cubated. The most popular incubators are wooden boxes, heated by charcoal. During the incubation period, the temperature is controlled manually. When the milk begins to coagulate, the source of heat is removed, and the pots are left until the milk sets. They are then removed to a cool place such as an ice chest or a refrigerator, to stop the development of acidity. Excess acid gives the product an objectionable sour taste and may cause separation of whey.

The final type of *Zabady*, smooth, porcelain like surface; bright white when made from buffalo's milk, and yellowish white when made from cow's milk; characteristic taste and aroma, full-pleasant, mildly sour; firm consistency without whey separation, custard like, nearly sliceable. (El-Gendy, 1983, Abou-Donia, 1984, 1992). *Zabady* was reviewed by Abou-Donia 2004b.

Labneh

The Egyptian *Labneh* is concentrated *Zabady*, super *Zahady*, or *Zabady* cheese. It is obtained from *Zabady* after removal part of its aqueous phase. In Egypt, the conventional method for producing *Labneh* is to make *Zabady* and store it overnight under refrigeration to the next day, salt is added, thoroughly mixed, put into cheese cloth bags and hung on racks to drain for about 12-24 hours, packed and stored under refrigeration. The final product should be soft, smooth and spreadable with a consistency resembles cultured cream, acidic clean flavour and milky white colour. (Abou-Donia *et al.*, 1992a, b, El Samragy, 1997). Manufacture and quality of *Labneh* was reviewed by Abou-Donia (2004b).

Karish cheese

Karish, *Kariesh*, or *Kareish* cheese is one of the most popular soft fresh skimmed milk, lactic cheese. It contains most of the skim milk constituents including protein, small amount of sugar, some of water, soluble vitamins and most of the calcium and phosphorus.

Processing of Karish cheese

Karish cheese is made from defatted milk (buffalo or cows milk or a mixture of both). The defatted milk may be in the form of *Laban Rayeb*. *Laban Khad*. *Laban Zeer* or mechanically skimmed milk (*Laban Farz*).

Although details of *Karish* cheese making differ depending upon the type of defatted milk, the

principle of its preparation is roughly the same (Fahmi, 1950). Either buffalo or cows are poured directly into special earthenware pots known as "*Shallia* or *Zeer*" with a capacity of about 4-7 kg. The pots of milk are kept in a suitable place so that the fat may rise and form a surface layer and the milk underneath may sour and clot. After removing the cream layer, which is formed within 24 to 36 hr during summer and from 2 to 3 days during winter, the curd is poured onto a mat, which is usually made of a type of reed. *Juncus* sp., to drain. After a few hours, the end of the mat are tied together to permit a portion of the whey to drain. This process of spreading the curd, then squeezing it in the mat is repeated once or twice. Finally, the mat is hung from the joined ends in order to complete the drainage of whey. Draining of the whey takes two or three days, or until the desired texture of cheese is obtained. Finally, cheese is cut into suitable pieces, then dry salted to taste. The salted cheese is left for a few more hours in the mat until no more whey drains out and is then ready to be consumed as fresh cheese.

The quality and composition of *Karish* cheese may vary considerable due to such factors as the quality and composition of the clotted skim milk, the method of manufacture, the time required to complete the drainage of whey, the quality of salt added and the method of handling the finished cheese. (Fahmi, 1950, El-Gendy, 1983; Abou-Donia, 1984, 1991, 1995, 1999a, b).

Mish cheese

It is also known as picked ripened skimmed milk cheese. Although details of traditional *Mish* cheese making differ from one area to another, and even from home to home in the same part of the country, the basic steps of the preparation are essentially the same.

The first step in *Mish* cheese making is the preparation of *Karish* cheese. Then, cubes of *Karish* cheese (8cm³) are packed under microaerophilic conditions in a large clean earthenware pot called '*Ballas* or *Zallaa*'. The spaces between the pieces of cheese are filled with whole milk, skimmed milk or buttermilk which is known as '*Laban Khad*'; to the above media, about 10% edible salt is added. Nutritive substances are added such as '*Kosba*' (the cake obtained after extracting the oil from sesame seeds), '*Morta*' (the precipitate found after the boiling of butter for the manufacture of butter oil),

together with one or more of the following oriental spices and medicinal plants: powders of fenugreek (*Trigonella fenum graecum*), red pepper (*Capsicum frutescens* var. *faseiculatum*), hot pepper (*Capsicum frutescens* var. *chilli*), paprika (*Capsicum frutescens* var. *tetragonium*), black pepper (*Piper nigrum*), grains and or flowers of aniseed (*Pimpinella anisum*), common caraway (*Carlina caraway*), cumin (*Cuminum cyminum*), fennel (*Foeniculum officinalis*), pick looth (*Ammi visnaga*), clove (*Syzygium aromaticum*), nutmeg (*Areca catechu*), thyme (*Thymus vulgaris*) and nigella (*Nigella arvensis*). The fruits of sweet green peppers (*Capsicum frutescens* var. *grosu*) and some old *Mish* (as a natural starter, from 2-7% of the whole mixture to be pickled) must be added. Borax, i.e. sodium borate, which is known locally as "Tinkar", is usually added in a small cloth bag and placed on the surface of the milk to kill *Pyophilla casei* larvae, which may contaminate the cheese during preparation. No figures could be obtained as to the exact amount of borax added.

The spiced milk covering the curd should be reached to the neck of the *Ballas*, and the opening is then covered by means of a palm leaf sheath (fibres and fibro-vascular bundles) and a piece of cloth. After that, the *Baiis* is tightly sealed by means of a mud paste mixed with chaff. The hard paste keeps the contents under partially anaerobic conditions during ripening, which requires one year of storage in a warm place, or transfer from time to time to a sunny place. (Hamdy & Taha, 1954, El-Gendy, 1983, Abou-Donia & El Soda, 1986, Abou-Donia, 1991, 1999a, b).

Dommati cheese

Dommati or *Damietta* cheese (*Gebnah Dommati*) is the most popular soft white pickled cheese variety, and is named after the city and governorate of Damietta (Dumyat) in the north of Egypt. It is also known as white cheese (*Gebnah baida*) and as soft cheese (*Gebnah tariyah*). *Dommati* cheese is made and consumed not only in *Damietta* but also in all of the 25 Egyptian governorates. It is well known and consumed in the Arab world in general, and variants are made in Europe and in many other countries. It closely resembles Greek Feta cheese, and it is believed that *Dommati* cheese originated in Egypt after 332 BC (Abou-Donia, 1986).

Dommati cheese was first investigated by Sharrara (1947, 1957) and Fahmi & Sharrara (1950), and

was first reviewed by Abd El-Salam *et al.* (1976) and then Abd El-Salam (1986), Abd El-Salam *et al.* (1991, 1993), and also by Abou-Donia (1981, 1986, 1990, 1991, 1995, 2007) and El-Soda *et al.* (1996).

Dommati cheese differs chiefly from other pickled varieties in that it is salted at the first step in its manufacture; the salt is added directly to the milk. The shape of finished *Dommati* cheese varies widely with the curd forms used for whey drainage. It may be cubic or cylindrical.

A cubic shape is more common; the cheese is packed into rectangular tins in layers, of about nine pieces per layer and is each piece measuring about 8 cm² by 3.5 cm in thickness. Cylindrical shape of cheese may be produced in different dimensions, e.g. 12 cm in diameter and 3.5 cm thick or 6 cm in diameter and 4 cm thick.

Dommati cheese has a distinctive flavour. It is mild and rather salty when fresh. As the cheese ages it develops considerable acidity. At 12 months or older a pungent flavour similar to that of *Mish* cheese develops, and is accompanied by a change in colour from white to light brown.

Fresh *Dommati* cheese has a soft body. As it ripens in the pickle the body usually becomes firmer up to the third month of age after which it mellows, mainly as a result of protein breakdown. It possesses a close texture with no holes; as ripening proceeds it becomes slightly flaky and is brittle rather than elastic when broken.

Dommati cheese processing

In Egypt, the manufacturing process for *Dommati* cheese differs only in the size of the batches of milk. In private dairies in Damietta and the other Egyptian governorates, milk batches of about 500 kg are used.

The manufacturing process (as described by Abou-Donia, 1986) can be summarized as follows: approximately one-third of the standardized milk (8, 4 and 2% fat for full cream, half cream and quarter cream cheese, respectively) is heated to 80°C, and the salt (5-14%) is added to the remainder. The percentage of salt differs according to the season of the manufacture and the ripening temperature of the cheese. For refrigerator-stored cheese, known locally as 'Tallaga cheese', salt is added to the milk at a level of 5-6% in winter, 6-7% in spring and autumn, and 7-8% in summer;

for ambient-temperature-stored cheese, known locally as *Khazin* cheese, salt is added at a level of 8-10% in winter, 10-12% in spring and autumn, and 12-14% in summer. The two portions of milk are mixed and renneted.

The best temperature for coagulation is about 38°C. Coagulation takes place 2-3 hr it and the coagulum is ladled out into moulds of wood or steel lined with coarse cloth or netting. The mould, vary greatly at size, with very large mould, being used for industrial scale manufacture. Small mould, are turned frequently; for large mould, the curd is put under pressure and is then cut into blocks of convenient size. The drainage time varies from 12 hr to 24 hr.

The mould, are removed prior to marketing the cheese; in the case of wooden moulds, the cheese is cut into pieces 8 cm². It is then wrapped in waxed paper. The cheese may be consumed fresh, if the cheese is pickled, it is held to a salty whey for 4-8 months. The cheese pieces are arranged in layers in suitable tins and are completely covered with brine. The tins are soldered and then stored at refrigerator or ambient temperature.

Ras cheese

Ras cheese is the main Egyptian hard cheese that is rather similar to the Greek, *Kefalotyri*. The names from both countries mean "head". Perhaps because the cheese resembles a bold head. It must be noticed, that Ras cheese term, only known in the scientific literature, while the local commercial name in the Egyptian markets is *Romi* cheese (*Gebnah/Romi*), except in Alexandria markets is known as *Torky* cheese (*Gebnah/Torky*). It is probable that the basic Ras cheese originated in the Balkans, then originated in Egypt during the early stage of the Egyptian Industrial renaissance after 1818. (Abou-Donia, 2002).

Ras cheese is now the best-known hard cheese in Egypt, and indeed throughout the Arab World, and the best quality cheese is reported to be made by private cheese companies in the Damietta Governorate of Egypt. Ras cheese was first investigated by Youssef (1966) and subsequently by Hofi *et al.* (1970) and was first reviewed by Abou-Donia (2002).

Ras cheese processing

Standardized milk (3% fat) is heated to 32° C, and sufficient rennet is added to complete coagula-

tion in 35 minutes. The coagulum is cut into small pieces, about the size of wheat grains, and then vigorously stirred. The temperature of the vat is then raised to 45° C over a period of around 40 minutes, and gentle stirring is maintained throughout. After the curd has settled and the whey drained out, salt is sprinkled over the curd at a rate of 1% (w/w), and the curd is manually pushed to the sides of the vat. Moulds, lined with cheese cloth, are filled with sufficient curd to produced one finished cheese, and manual pressure is applied to expel some of the adhering whey. Light mechanical pressure follows over the next 4 hr, at which point the cheese is reversed in the press and left under pressure for 24 hr. The wheels of cheese are then removed from the moulds and cloths and placed in brine (20% salt solution) for 24 hr. After draining for a further day at ambient temperature, the surfaces of each cheese are covered with a small amount of dry salt. By the next day, most of the salt will be absorbed into the cheese, so that the wheels are turned and the dry salting process repeated once again. This dry salting procedure is continued for a period of around two months, either daily or every other day. If a cheese becomes hard, wet salt may be used instead, but this problem is usually avoided by washing the cheese in brine at least twice a week. (Abou-Donia, 1995).

Kashkaval cheese

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. In Italy, similar varieties as Caciocavallo, Siciliano, Provolone, and Mozzarella are produced.

During the manufacturing process of Kashkaval and similar cheese types, the curd is immersed in hot water, kneaded and stretched until it is 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 renaissance after 1818. (Abou-Donia, 2004a).

The Egyptian Kashkaval cheese is known in small private dairy plants in Damietta city as "Gebnet el tassieh" or melting cheeses Egyptian Kashkaval was first investigated by Safwat (1954), and then by Hofi & Abdel-Tawab (1966), and was recent reviewed by Abou-Donia (2004a)

Kashkaval cheese processing

To raw milk heated to 32°C, sufficient rennet is added to complete coagulation in 45 minutes. The coagulum is cut into cubes of one cm³, then left without stirring for 5-7 minutes and then gradually stirred very gently at the beginning, and keeping the temperature at 32°C. After the curd has settled, half of the whey is drawn off, and stirring is continued with raising temperature gradually up to 35-40°C depending on the development of acidity. The whey is completely drawn off when cubes show certain degree of firmness, shrunk to about half of their initial size and the whey has titratable acidity of 0.22-0.26%.

By means of a scoop, 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 curd) to enhance the expulsion of the whey. The double jacket of the vat is covered to keep it warm. This cheddaring stage is completed when the acidity of the curd reaches 1.25-1.35%, and the pH 5.2. In practice, this moment is determined by cutting out some curd from every block of curd and put into water at 75°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, has a glossy surface and does not peel off when rubbed with the fingers.

The mass of ripened cheddared curd is then cut into large blocks (60×10×10 cm) which are cut afterwards into thin slices (10×7×1.5 cm) and scalded with 8-9% brine at a temperature of 75±2°C, and worked with two wooden rods for about 3-5 mm 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 molded into a bundle-like form. The plasticized curd is placed in a mould of 30 cm diameter and 8 cm height, the bundle is squeezed by hand and the excess curd "The bundle knot" was cut by a sharp knife or by hand leaving no opening in the young cheese. The cheese is left in the mould until the next day.

The young cheese is removed into the cellar having a temperature of 18°C and relative humidity of 70-75%. Forty gram of dry coarse salt is sprinkled daily on the cheese surface for 4 days, followed by 30 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 with turning every two days. When, the cheese is 35-45 days old, it is coated either with wax or plastcoat. The cheese is ripened at 13±2°C and 83±2% humidity for 6 months (Abou-Donia, 2004a).

Egyptian Adopted Provolone Cheese

Provolone cheese is a cheese variety of the pasta filata family, which its origin in southern Italy, probably in Sicily. Provolone cheese adopted in Egypt by the Italian emigrants in Alexandria and now it is consumed and manufactured in many Egyptian provinces. Egyptian Provolone was first investigated by El-Soda (1973) and then by Soliman, (1979) and was recently reviewed by Abou-Donia (2005)

Provolone cheese processing

A suitable amount of rennet is added to raw milk so as to obtain a good firm curd within one hr. The curd is cut and then left in the whey for approximately 15 min after which the whey is removed and the curd is transferred to a cloth-lined round metal hoop and left for 2-3 hr.

The curd is then cut into small pieces and left at room temperature until the curd gave the proper test in hot water. The test is made by dipping a piece of curd in hot water bath at 79.3°C for a few seconds thereafter it is twisted and stretched slowly into a fine thread a yard long without tendency to break. If the test is positive, the curd is ready for shaping.

The shaping is done by dipping the curd in 79.3°C hot water bath until it becomes more elastic; then it is shaped by hand to a suitable, ball form. The balls are dipped in 20% salted whey solution for 24 hr, and then placed in a rope net which is hanged from the ceiling, after 24 hr the smoking procedure is accomplished by exposing the cheese to the smoke from burning wood in a half cut barrel. The smoked cheese is placed in a ripening room at 10°C to 12°C for 4 weeks (El-Soda & Abou-Donia, 1981).

Egyptian Adopted Mozzarella Cheese

Mozzarella cheese is a soft, unripened cheese variety of the pasta filata family, which had its origin in the Buttigaglia region of Italy. The finished cheese is lightly, white, soft, with a very lovely surface sheen and has a unique property called stretchability to form fibres or strings when it is hot, therefore it is considered the most suitable cheese variety as a topping on pizza (Kosikowski, 1970).

Mozzarella cheese adopted in Egypt by the Italian Emigrants in Alexandria city, and now it is consumed and manufactured in many of the Egyptian provinces, Egyptian mozzarella was first investigated by Anis & Ladkani (1988), and was recently reviewed by Abou-Donia (2005).

Mozzarella cheese processing

Raw milk is pasteurized at 72°C/15 sec. cooled at 35°C, and 0.02% CaCl₂ is added, then 1% starter is added until reached pH 6.1 in about 20-30 min. or cooled at 10°C, and 0.02 CaCl₂ is added, then direct acidified with lactic or acetic or citric acid until pH 5.8, the milk is warmed at 35°C and 0.002% rennet powder is added. The coagulum is cut and scalded at 42°C for 20-30 min till pH 5.8. The whey is drawn off and cheddaring the curd is carried out at 42°C until pH 5.4. The curd is milled kneaded in hot water, moulded at 85°C, cooled and salted in saturated brine (23%) for 5hr at 4-6°C.

The cheese is removed from brine, the surface is dried, and wrapped, in polyethylene pouches and salted. The cheese is stored in refrigerator at 4°C or in a deep freezer at -18°C (Kosikowski, 1970).

The curd may taken in the hand, kneaded and pulled to form, cord, every three cords are formed in braid shape, the tress of cheese is cut in pieces about 8 cm. long for each as Syrian *Medaffarah* cheese (Abou-Donia & Abdel Kader, 1979).

Egyptian Adopted Medaffarah Cheese

Medaffarah or *Majduala* cheese is a soft, unripened cheese variety of the pasta filata family. It is traditionally home made cheese in the Middle Eastern countries such as Syria, Lebanon, Jordan and Palestine. Also, it is manufactured in Alexandria city Egypt in small private dairies. *Medaffarah* cheese is considered as the similar cheese variety to Mozzarella cheese. Egyptian adopted *Medaffarah* cheese was first reviewed by Abou-Donia (2005).

Medaffarah cheese processing

Medaffarah or *Majdula* or braided cheese is manufactured in Alexandria, Egypt and Aleppo, Syria by the same method as described by Abou-Donia & Abdel-Kader (1979) as follows:

Milk is renneted at 35°C in galvanized tins and coagulated within 4 hrs. The coagulum is put in cheese clothes bags in about 1 Kg quantities, well tighted, left about 8 hrs for whey drainage, then the coagulum is cut to pieces about 15x15x3 cm. A weight equal to that of the curd is put on top of the cheese cloth and left about 24 hrs for the curd to develop acidity and ripen.

Ripening is assessed by taste a piece of curd which is warmed at 75°C. The curd is then taken in the hand, kneaded and pulled to form a cord of four meters long. If it breaks before reaching this length, then the ripening is not completed.

When the curd is ripe, it is cut into smaller pieces 3x3x3cm., put in perforated separator, warmed in water at 75°C for about 3 min (high amount of fat is lost), the curd is then taken in the hand, kneaded and pulled to form a cord, every three cords are formed in braid shape, the cheese tress are cut in pieces about 8 cm long for each.

The cheese tress is immersed in saturated brine at room temperature for about 1 week. Finally, the salted cheese tress is removed from brine, exposed to the sun to dry for 2 or 3 days, thereafter held in tight containers until used. They are eaten after being soaked in water for 24 hrs. (Abou-Donia & Abdel-Kader, 1979).

Egyptian Adopted Halloumi cheese

Halloumi cheese is the traditional cheese of Cyprus and for many years, it has been produced from sheep's milk, goat's milk or their mixture of the two types (Anifantakis & Kaminarides, 1981). *Halloumi* cheese is widely popular throughout the Middle Eastern countries such as Syria, Lebanon, Jordan and Palestine. It is also produced in Alexandria city Egypt in small private dairies. The *Halloumi* cheese is a cheese variety of pasta filata family.

Halloumi cheese is semi-hard to hard elastic, has no obvious skin/rind and the texture is close with no holes and it is easily sliced. It can be consumed raw, but it is usually grilled, fried or grated over hot dishes.

Halloumi cheese processing

Raw milk is coagulated with rennet at 34°C within 7-8 min. The curd is cutting to 0.5 cm³ grains, rest for 1 hr, gentle stirring for 10 min., heating to 45°C within 20 min and holding for further 40 min, stirring after heating for 20 min. The whey is drawn off, heated to 80°C, the curd is pressed (7 Kg/Kg-1) for 1 hr, then the curd is transferred to hot whey and continuous heating of the whey and curd for 1 hr. (cooking the curd). Then drainage of cooked pieces of curd on cheese table for cooling to 30°C, salting in brine solution 10% for 30 min and finally addition of fresh or dried *Baladi* mint leaves (*Mentha viridis*), then packed into polyethylene bags, or conserved in brine (Robinson, 1991).

The knowledge about the improvement of the manufacture of Egyptian *Halloumi* cheese should be based dependent on the two excellent research papers of Abdou *et al.*, (2002, 2003). Egyptian adopted *Halloumi* cheese was recently reviewed by Abou-Donia (2005).

Egyptian pasteurized processed and spreads cheeses

The term process or processed cheese is applied to those products that have been heated and packed into selected containers. World War I (1914-1918) stimulated wide interest in processing cheese to avoid spoilage and permit distant shipment.

Processing cheese has advantages beyond the increased keeping time of the product. Of primary importance, also is the fact that any' pathogenic microorganisms that may be present are destroyed during heating (Foster *et al.* 1961).

The processed cheese industry was recently adopted in Egypt after the Egyptian Revolution in 1952, then the research work regarding science and technology of the Egyptian pasteurized processed and spreads cheeses started. It was first investigated by Hofi (1957), and subsequently by El-Sadek & Zaki (1958) and Nassib (1965). Recently, Abd El-Salam *et al.* (2005) reviewed the studies on processed cheese in Egypt, then the processed cheese was recently reviewed by Abou-Donia (2006a). The processed cheese is known among the Egyptian consumers as *Gebnah Matbukha* (cooked cheese), and also *Gebnah Muthallathat* (triangular cheese) referring to the most popular shape of processed cheese packages.

Egyptian ice cream (*Gelatti*)

Ice cream generally means a pure, clean, frozen product made from various milk products, dry or liquid forms of glucose, sucrose, or corn sugar, and water. It generally may contain an edible flavouring, and may not include an edible colouring, some egg products, and an added stabilizer composed of whole some edible materials.

Ice cream and related frozen products have been classified on the basis of composition into the following categories: plain, nut, fruit, mousse, bisque, puddings, custards, ices, sherbets, special and novelties, ice milk is an ice cream like product (Foster *et al.*, 1961).

The primitive ice cream (*Gelatti*) industry in Egypt, may originated since many centuries, but the modern automation processing and therefore the related scientific research was began only since about fifty years ago.

During the primitive industry of ice cream in Egypt, it was known as (*Gelatti*), (the Italian name) and (*Dandorma*) and (*Granita*) (the Turkish names), but now it is known as ice cream (the American name). In Syria, Lebanon, Jordan and Palastein, the ice cream is known as (*Bausa*) and in Russia, *Marognei*.

The Egyptian ice cream was first investigated by Naguib (1961), and then by Hofi & Khalafalla (1970) who suggested the following classification of Egyptian ice cream.

- 1- Ice cream for dairy products fulfilling the legal standards for ice cream.
- 2- *Gelatti* for ice milk.
- 3- Granita for ice water and sherbets.

Egyptian ice cream (*Gelatti*) was reviewed for the first time by Abou-Donia (2006b).

Ice cream processing

Two major factors affect the manufacture process of ice cream.

1-Ingredients of ice cream mix

Fresh and dry milk products, other milk ingredients, sweetening agents, stabilizers, fruits & nuts, colors, flavours, egg products and emulsifiers.

2-Processing steps of ice cream mix

Mixing, pasteurizing, homogenizing, cooling, aging, freezing, packaging, hardening and storage.

***Al-Samn*, the Egyptian pure clarified concentrated milk fat product**

The pure clarified concentrated milk fat products are very well known worldwide. These products can be classified into two main groups according to method of making.

1. Traditional methods by direct boiling of salted sour butter or cream; this group including *Al-Samn* or *Samna*, or *Masli*, produced in Egypt and some Middle East Arab countries, Ghee produced in India and other Indian Peninsula countries and Roghan produced in Iran.
2. Mechanical methods by melting sweet butter at 50-70°C, centrifugation, and the clear fat is collected. This product is known as butter fat or butter oil, and also dry or anhydrous milk fat or fat. This product is produced since the second world war (1939-1945) to decrease costs of butter storage and cooling.

The butter oil is known in England, Australia, New Zealand, USA with the name butter oil or butter fat, in France, *Beurre fonda* or *Graisse de beurre*, in Germany, *Butter Schmalz*, in Italy, *Burro fuso*, in Spain *Mantiguella fundida* and in Russia, *Taplonni Masla* (heated butter).

Origin and history of *Al-Samn*

The main object of the primitive dairy industry in the rural districts of Egypt is to separate milk fats for making butter, and to make the remainder into products which are consumed a such or after storage throughout the year. In Lower Egypt, farmers put fresh milk in shallow or deep earthen ware-pots, *Matrad* or *Shalia*, and left of undisturbed in a warm, dark place till the cream rises and the rest milk coagulates. The cream layer is removed and beaten into butter, which is boiled and therefore converted into *Samna*, (known as *Al-Samn Al-Fallahi*), while in upper Egypt, the fresh milk poured into skim bags (*Kerbah*) leave, left to sour, then closing tightly and shaking until fat globules coalesce, then resultant butter converted to *Al-Samn* (known as *Al-Samn Al-Saidi*). Both of *Al-Samn Al-Fallahi*, and *Al-Samn Al-Saidi* is known as *Al-Samn Al-Baladi*.

The presence of earthenware pots, such as used in cream making, and *Barany* (Pot with glazed inner surfaced for storage of *Al-Samn* in the tomb of king horaha of the first dynasty (3200 B.C.), indicates

that the art of *Al-Samn* making was known to the ancient Egyptians (Abou-Donia, 1988, 1999a, b).

***Al-Samn* processing by the Egyptian traditional method**

Al-Samn is usually made from butter produced from ripened cream. Also, it can be made using cream prepared from salted or unsalted whey. The resulting *Al-Samn* is called whey cream *Al-Samn*. Many authors described in detail method of *Al-Samn* making by the Egyptian traditional method (El-Sokkary & Ghoneim, 1951. El-Sokkary & Zaki, 1953, Fahmi, 1961. Fahmi *et al.*, 1973, Ahmed, 1968, Helal, 1970, Abou-Donia & El-Agamy, 1993, 2003, Abou-Donia, 1984 & 1999 a, b.

Recently, El-Shibiny *et al.*, (2005) summarized *Al-Samn* making as follows; *Al-Samn* is traditionally prepared by direct heating of salted sour butter until most of the water evaporates. Care must be taken during this stage to avoid frothing by continuous stirring and slow heating rate. When foams recess, the rate of heating is increased with continuous stirring until the aggregated butter solids not fat (SNF) acquire a creamy colour and temperature reaches 118-120°C. Heating is then discontinued and *Al-Samn* is left to cool at room temperature to allow setting of the aggregated SNF (termed *Morta*) and the clear fat is separated by decantation. The slow cooling of *Al-Samn* allows for the formation of fat crystals which characterize *Al-Samn*.

Organoleptic characteristics of *Al-Samn*

Fahmi *et al.* (1973) reported that *Al-Samn* is characterized by pleasant flavour that arises from various compounds which are formed during the manufacturing process i.e, fermentation and heating.

Abou-Donia & El-Agamy (1993, 2003) enumerated the good quality *Al-Samn* characteristics as follows; color of cow's milk *Al-Samn* has a golden yellow colour (owing to the high content of β -carotene), while in case of buffaloes' milk *Al-Samn*, it has a white, slightly greenish colour, the *Al-Samn* should be of cooked flavour, slight, sweet flavour and free from rancidity, the fat content should be not less than 99.5%, the moisture content not more than 0.3%, the main flavour compounds in *Al-Samn* are methyl ketones, 2-enals, and 2,4 di-enals. *Al-Samn* was reviewed for the first time by Abou-Donia (2006c).

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أصل وتاريخ وطرق تصنيع منتجات الألبان المصرية: نظرة شاملة

أ.د. سمير أحمد أبودنيا

قسم علوم وتكنولوجيا الألبان - كلية الزراعة - جامعة الإسكندرية

نشأت صناعة منتجات الألبان المصرية منذ العصر الفرعوني (٣٢٠٠ - ٣٣٢ قبل الميلاد) وتطورت خلال العصر اليوناني الروماني (٣٣٢ قبل الميلاد حتى ٦٤١ ميلادية) وأيضاً أثناء العصر العربي الإسلامي (٦٤١ ميلادية وحتى الآن). ولقد تطور تصنيع المنتجات اللبنية المصرية تطوراً كبيراً وأدخلت طرق الميكنة الحديثة في المدن الكبيرة في كل من الوجهين البحري والقبلي. أما بالنسبة لمحافظة الحدود فإن صناعة منتجات الألبان بها لم تحظ بالدراسة الكافية، مما يستوجب إعطاء عناية أكبر لهذا الموضوع.

ولقد كان الهدف من هذا المقال هو توضيح أصل وتاريخ وطرق تصنيع منتجات الألبان المصرية الآتية: اللبن الرايب، اللبن الخض/لبن الزيز، الكشك، اللبن الزبادي، اللبنة، الجبن القريش، جبن المش، الجبن الديمياطي، الجبن الراس، وأصناف الجبن المصري المطبوخة مرنة الخثرة وهي (الجبن الكاشكافال، الجبن البروفولون، الجبن المزاريل، الجبن المضفرة، الجبن الطومي)، الجبن المطبوخ، الأيس كريم والسمن.