Chapter 2

Feta cheese from buffalo milk

This chapter will present the history of feta cheese and the processing of feta cheese from buffalo milk produced by the Royal Project Foundation in Thailand.

2.1 History of feta cheese and global cheese consumption

Cheese is a major agricultural product. The varieties of cheese may be grouped or classified into many types according to criteria such as duration of ageing, texture, processes of making, fat content, animal milk, country or region of origin, etc. Cheese consists of proteins and fat from milk, usually the milk of cows, buffalo, goats, or sheep. Cheese is produced by coagulation of the milk protein casein. Milk is acidified and addition of the enzyme rennet causes coagulation in typical processing. The solids are separated and pressed into finishing products. Over 18 million metric tons of cheese were produced worldwide in 2004 according to the Food and Agricultural Organization of the United Nations**.**

Feta cheese has been produced for thousands of years in Greece. Greek regulations ensure that feta is made primarily from sheep's milk, with some goat's milk. It has become an issue of national authentic for Greece (Mike Peluso, 2005). But other producers, France and Denmark, commonly use cow's milk in the process instead because they lack the same resource as Greece. Nowadays, exported Greek feta cheese to the U.S. jumped 87 percent in the first quarter in 2012 bringing in revenues of US$5.0 million compared to last year's US$2.7 million for the same period. Greece is at the third place in the feta market in the U.S.A (Stella Tsolakidou, 2012).

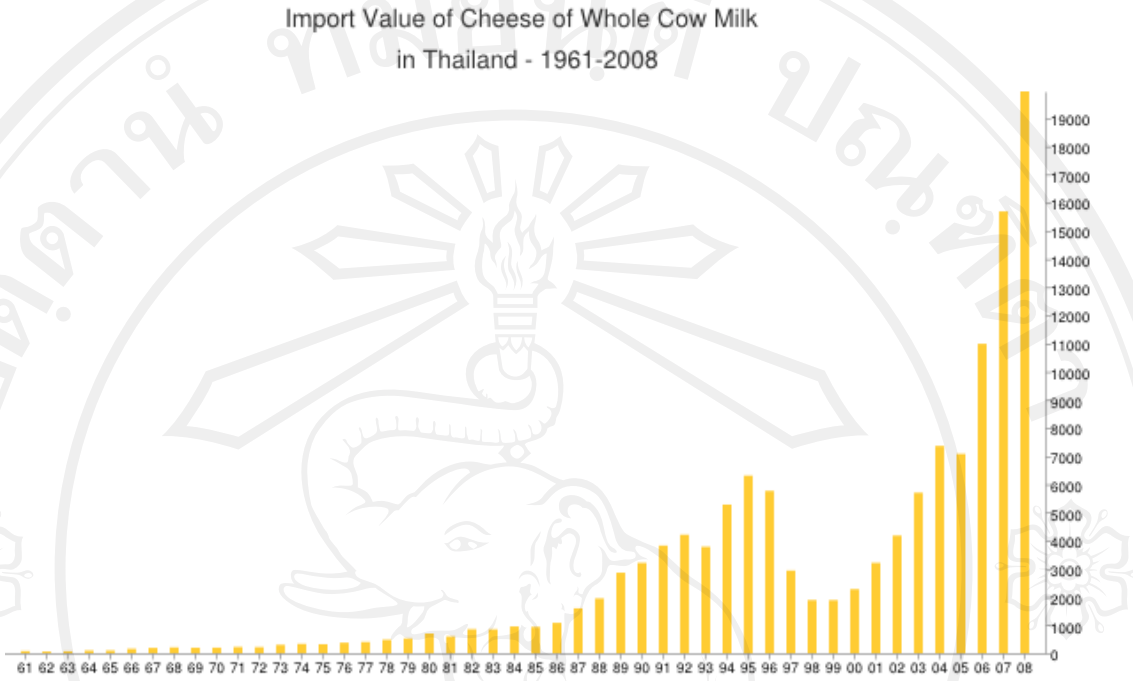

Figure 2.1: Import value of cheese from whole cow milk into Thailand during 1961-2008. Units: US$1000

Source: FAOSTAT database, 2008.

Figure2.1 shows that the imports of cheese of whole cow milk into Thailand have increased gradually since 1987. After the economic crisis in 1997, the imports dropped heavily. However, they increased sharply during 2006 to 2008. The import in 2008 reached US$20 million. These values represent the potential demand of feta cheese consumption which was launched to the cheese market later in 2010.

2.2 Buffalo milk and cheese from buffalo milk

The water buffalo (*Bubalus bubalis*) is a main dairy animal on the Indian subcontinent and in Southeast Asian countries (Vijh et al, 2008). The swamp buffalo of China, Thailand, the Philippines, Indonesia, Vietnam, Myanmar, Laos, Sri Lanka, Cambodia and Malaysia are mainly used as draught animals for rice cultivation. The swamp buffalo can produce very little milk, only 1.0 to 1.5 liters per day. In contrast, the Indian sub-continent water buffalo are mainly raised for milk production and they yield six to seven liters daily(Mudgal, 1989). The water buffalo is well adapted to

severe heat and humidity (Eskandari and Karimpour,2012).In 2003, India had 97.9 million buffaloes (Department of Animal Husbandry and Dairying, Government of India, 2003).

Table2.1: Statistics of buffalo milk producers in 2008

Top ten buffalo milk producers	
Country	Production (Tons)
India	56,960,000
Pakistan	21,500,000
China	2,900,000
Egypt	2,300,000
Italy	2,000,000
Nepal	930,000
Iran	241,500
Myanmar	205,000
Turkey	35,100
Vietnam	31,000
World	**85,396,902**

Source: FAO, 2008

Table 2.1 shows the top ten producers of buffalo milk. India and Pakistan are the largest source**s** of milk supplying 78 million tons of world buffalo milk production. India produced 56.9million tons and Pakistan produced 21.5 million tons (FAO, 2008).

Buffalo milk has become increasingly popular because of its whitening properties with higher fat and protein percentage. Buffalo milk is considered to be suitable for the production of whey protein concentrate and fat-rich dairy products. A health advantage is the cholesterol content of buffalo milk, which is lower than that of cow milk.

Table 2.2 compares the nutrition facts between buffalo milk and cow milk. Buffalo milk contains less water than cow milk. The major nutrition values which are protein, fat, lactose and calcium of buffalo milk are higher than those of cow milk. Therefore, buffalo milk has the potential to be a valuable choice for health-oriented consumers.

Table 2.2: Comparison of nutrition fact between buffalo milk and cow milk (100 g).

Nutritions	Cow milk	Buffalo milk
Water (g.)	88	84
Energy (Kcal.)	61.0	97.0
Protein (g.)	3.2	3.7
Fat (g.)	3.4	6.9
Minerals (g.)	0.72	0.79
Lactose (g.)	4.7	5.2
Cholesterol (mg.)	14	8
Calcium (iu.)	120	195

Source: Babcock Institute (N.T.)

In Europe and other parts of Asia, buffalo has long been considered appropriate for commercial dairy production. The production of buffalo milk in the Asia-Pacific region exceeds 45 million tons annually, of which over 30 million tons are produced solely in India. The Indian consumer prefers buffalo milk to cow milk because the former has higher butterfat content and is tastier (Babcock Institute, 2007).

Water buffalo is the second largest milk supplier in many countries around the world. It allows for the production of many varieties of products includes symbiotic buffalo milk yogurt (Xue Han et al, 2012).Moreover, cheese made from buffalo milk has unique body and textural characteristics. Due to the chewing and stringing properties that are specially desired as in Mozzarella cheese, Buffalo milk is technologically preferable over cow milk (Kumar, 2007). Recently in Italy, a legislation has been introduced to restrict the use of the term " Mozzarella " to those products only made from buffalo milk. White mozzarella made from buffalo milk is sold at the finest quality in the western world.

Thailand is in a list of mozzarella global producers including Switzerland, U.S.A., Australia, Brazil, Canada, Venezuela, India, Argentina, U.K., Egypt and South Africa. All these countries use milk from their own herds of water buffalo. Due to high vitamin A, protein and low cholesterol in buffalo milk, it is the most favored species in cheese production (Zicarelli, 2004). In Europe, feta cheese made from

buffalo milk has become popular with younger consumers who prefer milder and creamier taste. (BangkokPost, 2011). As Thai consumers become more attracted by western food from various media, cheese will play a much more significant role in their diets (Euromonitor, 2012). Low fat yogurt from buffalo milk is a rich source of nutrients and nutritionally preferable to yogurt made from cow milk (Xue et al, 2012). It was confirmed that mozzarella cheese made from buffalo milk is more expensive than mozzarella from cow milk (Ayesha Sameen et al,2008).

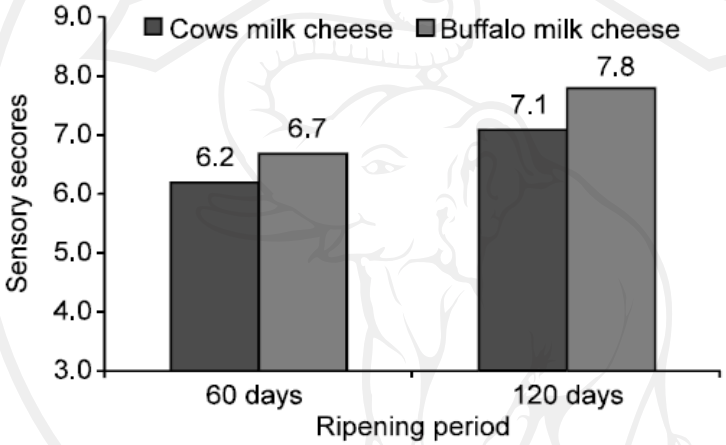

Figure 2.2: Effect of ripening on flavor scores of Cheddar cheese

Source: Land and Shepherd, 1988.

Cheese made from different types of milk were compared for sensory characteristics after 60 and 120 days of ripening by a panel of assessors on a nine-point hedonic scale (Land and Shepherd, 1988). This study revealed higher scores for buffalo milk on both flavor and aroma.

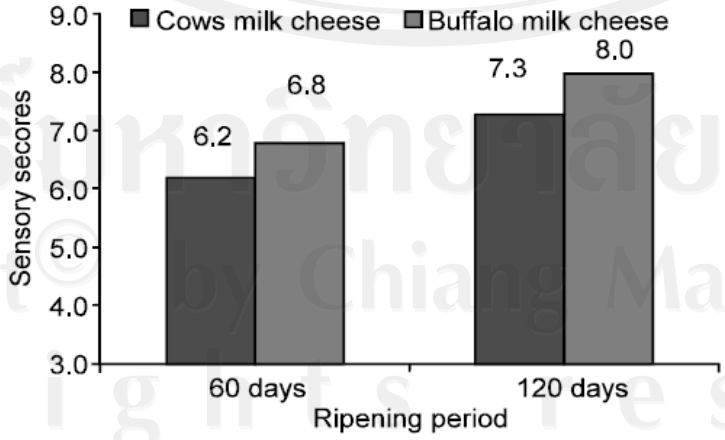

Figure 2.3: Effect of ripening on aroma scores of Cheddar cheese

Source: Land and Shepherd, 1988.

Cheese made from different types of milk were compared for sensory characteristics after 60 and 120 days of ripening by a panel of assessors on a nine-point hedonic scale (Land and Shepherd, 1988). This study revealed higher scores for buffalo milk on both flavor and aroma.

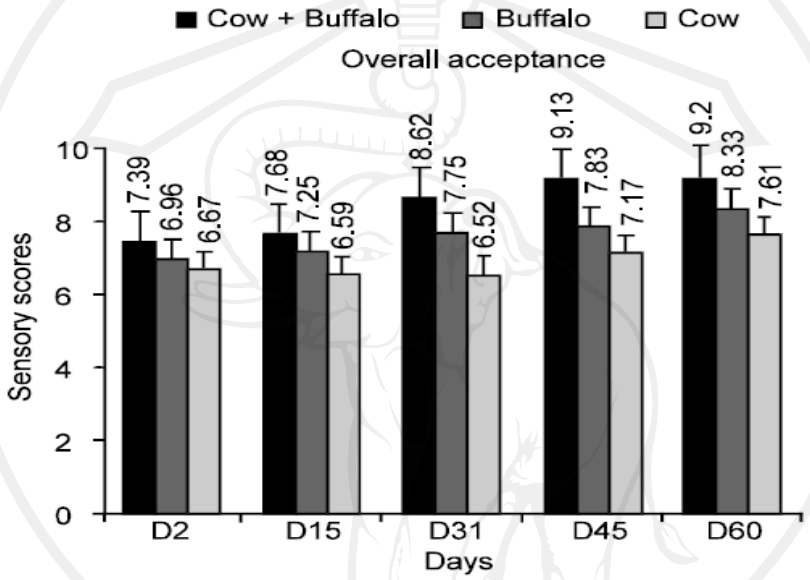

Figure 2.4: Overall scores acceptance

Source: Land and Shepherd, 1988.

Figure 2.4 compares the overall acceptance sensory evaluation of different types of milk. It shows the effect of the durations of storage on cheese melt ability for various attributes, e.g.,taste, flavor, texture and overall acceptability. The experiments were complete by a trained panel of judges using the nine-point hedonic scale (Land and Shepherd, 1988). This study concluded that buffalo milk is superior to cow milk.

Furthermore, the above study concluded that cheese from buffalo milk has higher fat and protein content than other cheese samples. Cheese from combination of cow and buffalo milk had higher meltability and sensory scores and are therefore more suitable for pizza toping than cheese from just buffalo or cow milk.

2.3 Feta cheese from buffalo milk produced by the Royal Project Foundation (RPF)

Seventeen Mehsana buffaloes, an Indian breed named after the western district from which they come were received by RPF livestock development centre in the northeastern province of Buri Ram in 2007. The RPF brought them to Mae Tha Nua Royal Project Development Centre in Chiang Mai where local farmers were amazed to see the animals. The Mehsana are bigger than the local swamp buffalo but with shorter horns that curl inwards. Mehsana buffalo does not like wallowing in the mud like their Thai swamp buffalo cousins. At that time, farmers were doubtful that the Mehsana buffalo could produce good milk or even cheese for consumption (Bangkok Post, 2011).

Figure 2.5: Mehsana buffalo
Source: Hindustan Animal Feed, 2012

At Mae Tha Nua, the Mehsana herd has grown from 17 to 27 during the past three years. They produce six to eight kilograms of milk a day which is used to produce the feta, yogurt and mozzarella. The brandname "Bubalos" was created. All by-products of buffalo milk from the foundation are sold under this brand. In 2011, sales of the water-buffalo milk products topped THB 1,000,000 or around US$30,000.

At local markets, a 200-gram block of Bubalos feta costs THB145 or around US$5 (RPF,2012).

Figure 2.6: Feta cheese from buffalo milk produced by RPF
Source: Royal Project Foundation

According to the RPF, the richness of buffalo milk makes it ideal for cheese production. In order to produce 1 kg of cheese, a cheese-maker requires 8 kg of cow milk but only 5 kg of buffalo milk. Raw buffalo milk is stored in big stainless steel containers before being brought to the cheese production plant. At the plant, it goes through a careful process that involves heating, curdling, maturation, spinning, shaping and cooling. Then, it is delivered into a pickling tub. At the RPF centre in Mae Tha Nua, most of the buffalo milk is used for the production of feta cheese and yogurt.

For many small rural farmers in Mae Tha Nua, buffaloes are their major source of income and also their largest investment. Buffaloes increase farm productivity and allows farms to produce greater variety of products. A tractor usually requires at least 20 rai of farmland to be economically feasible. The maintenance of tractors is difficult in rural areas. Therefore, small farms prefer working animals to tractors.

Compared with other domestic livestock, water buffalo is generally healthier. This is particularly impressive because most buffaloes live in hot and humid regions

where disease is more likely. Buffaloes are vulnerable to most diseases and parasites that can affect cattle. Vaccines developed for cattle work equally well on buffalo, and treatments are available for most of serious buffalo diseases. At Mae Tha Nua development centre, the buffaloes are milked twice a day, at 4 a.m. and 2 p.m. Milk is processed into cheese on the following day.

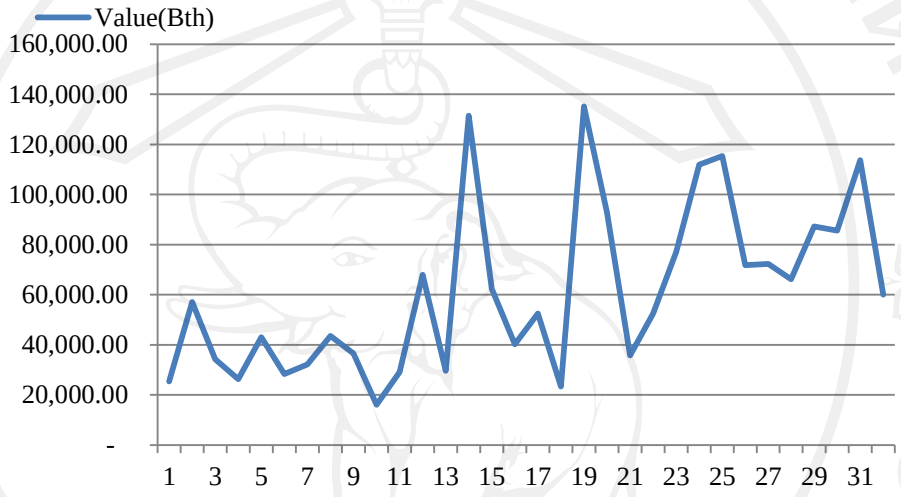

Figure 2.7: Monthly sales of feta cheese from buffalo milk
Source: Royal Project Foundation

Monthly sales of feta cheese from buffalo milk of the RPF have risen almost three times from around THB40,000 to THB120,000 during January 2010 to August 2012 as shown in Figure 2.7. Feta cheese made from buffalo milk is available at all Royal Project Foundation's shops in northern provinces. Moreover, it is sold at Villa Market, Rim Ping superstore, many retailers, Four Seasons Resort and popular hotels in Chiang Mai. In Bangkok, feta cheese is already sold at Royal Project Foundation's shops, Aor Tor Kor market located opposite to Chatuchak weekend market, Future Park department store in Rangsit, and Kasetsart University(Bangkok Post,2011).