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Milk Culture in Insular Southeast Asia Recognized as a Non-milk Cultural Sphere

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Abstract

The issues of milk processing techniques and milk use in areas considered outside the milk cultural sphere is an extremely significant case study for analyzing the transmission and transition of culture. The purpose of this paper is to (1) identify the areas where milk culture is practiced in Insular Southeast Asia, (2) analyze the characteristics of milk processing techniques and milk uses, and (3) examine the origins and transitions of milk culture based on the results of the authors' fieldwork and literature surveys. Nakao's model was used to categorize the milk processing techniques and to analyze those characteristics. The characteristics of milk products in the Philippines and Indonesia are that milk products are produced mainly as a source of cash income from sales and consumed as nutritional supplements and luxury foods, not as essential subsistence foods. When milk culture was transferred to both countries from the milk cultural sphere where milk products are essential for a dairy diet, the abundant availability of plant and marine foods may have caused the lack of most milk processing techniques and the transition of milk products from essential subsistence foods to supplementary luxury foods. The Philippines adopts additive coagulation processes, while Indonesia adopts fermentation, heat condensation, and additive coagulation processes. This localized mosaic of milk processing techniques is a characteristic of milk culture in Insular Southeast Asia. This paper discovered that milk culture has spread to Insular Southeast Asia, but identical milk processing techniques were not widely shared in areas where milk culture was not an essential cultural element in local livelihoods. It is concluded that milk culture in the Philippines started with the influence of Spain and was subsequently modified under the influence of India and China, while milk culture in Indonesia originated under the influence of India.

Keywords: non-milk cultural sphere, cultural transmission and transition, milk processing and uses, local diversity, Insular Southeast Asia

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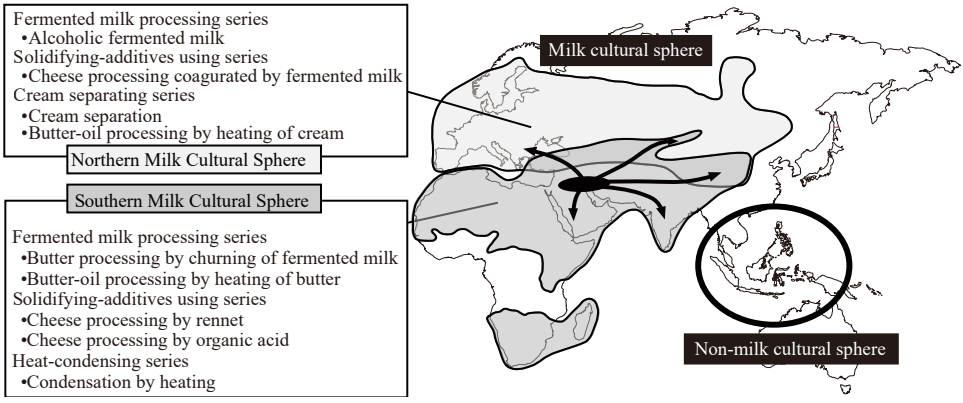
The origin of milking is estimated to be in the 8th millennium BC in West Asia (Vigne & Helmer, 2007). The invention of milking allowed people to change their methods for acquiring food resources, from slaughtering animals for meat to co-existing with animals for milk without slaughtering them. Since the efficiency of milk production from feed energy is 3.7 times higher than meat production (Kametaka et al., 1979), switching from meat to milk consumption greatly increased the production efficiency of livestock. In other words, the utilization of milk significantly improved continuous food production. Milk is also nutritious, containing lipids, proteins, carbohydrates (lactose), ash, and a wide variety of vitamins (Jenness, 1999). The calcium content in milk is as high as 118 mg in 100 ml of milk, and no other food resource has such good calcium digestion and absorption as milk (Harris, 1985; Uenishi et al., 1998; Saito, 2012). The quality of protein in milk is high, with an amino acid score of 100. Therefore, people acquired a highly nutritious food resource with the start of milking and the use of milk. The invention of milking and milk use led people to depend on livestock for much of their livelihood and begin a new mode of subsistence called *pastoralism* (Umesao, 1976).

Milk culture spread from West Asia to the surrounding regions. The areas of the milk cultural sphere where people milk their livestock, utilize milk products as important foods and cash goods, and largely depend on milk for their livelihood are mainly in arid regions in West Asia, North Asia, Central Asia, South Asia, Europe, and Africa (Hirata, 2020) as shown in Figure 1. Figure 1 represents the areas where milk use was prevalent in the fifteenth century. It indicates that milking was not traditionally practiced in North and South America, parts of Africa, Oceania, East Asia, and Southeast Asia. However, through the authors' field research conducted over many years, it was revealed that milk processing and milk use were locally conducted in the Philippines and Indonesia in Insular Southeast Asia (Tsuji, 2017a; Tsuji, 2017b; Tsuji, 2018; Tsuji, 2021a; Tsuji, 2021b; Tsuji, 2021c; Tsuji et al., 2022; Hirata & Urashima, 2011; Hirata et al., 2015). The study of milk used in areas considered outside the milk cultural sphere is extremely interesting for analyzing how the transmission and transition of milk culture occurred.

Figure 1

Milk Cultural Sphere in Afro-Eurasian Continent and Non-milk Cultural Sphere in Insular Southeast Asia (Source: Modified from Hirata (2020) — Origin of Milk Culture)



The purpose of this paper is to (1) identify the areas where milk culture is practiced in Insular Southeast Asia, (2) analyze the characteristics of milk processing techniques and milk uses, and (3) examine the origins and transitions of milk culture based on the results of the authors' fieldwork and literature surveys.

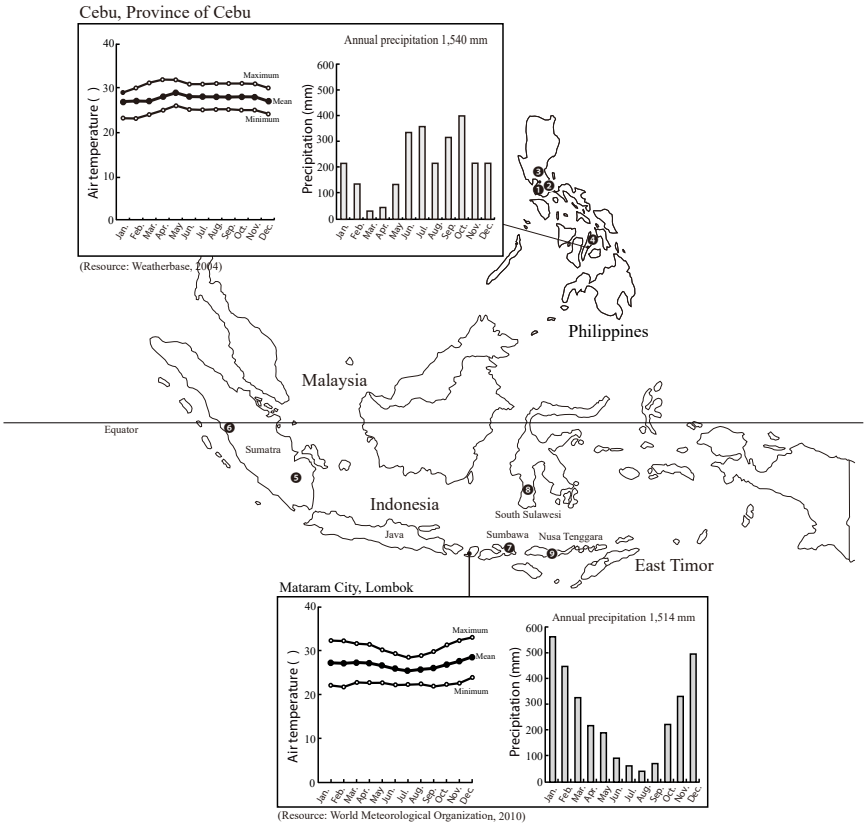
Materials and Methods

Fieldwork and Literature Survey

The fieldwork conducted by the authors was carried out in the Philippines and Indonesia. Milk processing was observed while staying at each site, and interviews were conducted on related issues. In the Philippines, the surveys covered General Trias in Cavite Province (Case 1) (Tsuji, 2021a), Los Baños and Santa Cruz in Laguna Province (Case 2) (Tsuji, 2018), San Miguel in Bulacan Province (Case 3) (Tsuji, 2018), and Compostela and Danao in Cebu Province (Case 4) (Tsuji, 2017a; Tsuji, 2017b). In Indonesia, the surveys were conducted in Ogan Komering Ilir Regency in South Sumatra Province (Case 5) (Tsuji et al., 2022), Bukittinggi City, Lima Puluh Kota Regency, and Tanah Datar Regency in West Sumatra Province (Case 6) (Hirata & Urashima, 2011), and Bima Regency of Sumbawa Island in West Nusa Tenggara Province (Case 7) (Hirata & Urashima, 2011). Literature surveys were conducted in Laguna Province (Case 2) and Bulacan Province (Case 3) in the Philippines (Kozaki, 2001) as well as in South Sulawesi Province and the Nusa Tenggara area (Case 9) in Indonesia (Hosono, 1984), as shown in Figure 2. The climate in the Philippines is characterized by high rainfall and hot and humid conditions, with little variation in rainfall and temperature throughout the year. The climate in Indonesia shares characteristics similar to those of the Philippines.

Figure 2

Survey Sites and Weather Conditions in Insular Southeast Asia



In the Philippines, there is a division of labor tasks between milk-producing households and milk-processing households. All milk-processing households purchase raw water buffalo milk (Case 1, Case 2, Case 3, and Case 4). In Indonesian cases, milk-processing households keep livestock and produce their own milk for processing. Water buffaloes, cattle, goats, chickens, and ducks are kept, and water buffalo is only milked in South Sumatra (Case 5). Water buffalo is only kept and milked in West Sumatra (Case 6). In the case of Sumbawa Island, they keep horses, goats, Bali cattle, water buffalo, and chicken, and the mare is only milked (Case 7). Our literature surveys indicate that water buffalo milk is used for milk processing in Cases 2 and 3 in the Philippines, as well as in Case 8 in South Sulawesi Province and Case 9 in the Nusa Tenggara Region in Indonesia.

Model for Analyzing Milk Processing System

The analysis of the milk processing system in this paper was conducted according to Nakao's model, which was used to categorize the world's milk processing techniques (Nakao, 1972). Nakao categorized the world's milk processing techniques into the following four types: (1) Fermentation processes, which start by making fermented milk from raw milk; (2) Cream separation processes, which start by separating cream from raw milk; (3) Additive coagulation processes, which involve adding a coagulant to raw milk to make cheese, and (4) Heat condensation processes, which are based on heating and condensing raw milk. The coagulants include rennet (enzyme synthesized in the abomasum or fourth stomach of ruminants), sour milk, plant-based organic acid, and plant enzyme. This paper describes the cases of milk processing systems in the Philippines and Indonesia and discusses those characteristics using Nakao's model.

Results and Discussion

The current situation of milk culture in the Philippines and Indonesia is reported, and then the characteristics of milk utilization and processing are discussed. It becomes clear that milk products in Insular Southeast Asia, the non-milk cultural sphere, are not essential for subsistence as food resources but are part of daily life as supplementary nutritional foods, luxury items, or sources of cash resources. It is described that this localized mosaic of milk processing techniques, which includes fermentation processes, heat condensation processes, and additive coagulation processes, is a characteristic of milk culture in Insular Southeast Asia. In this non-milk cultural sphere, milk culture is not an essential cultural element in local livelihoods. Finally, the results of this paper suggest the origin of milk culture in the Philippines and Indonesia.

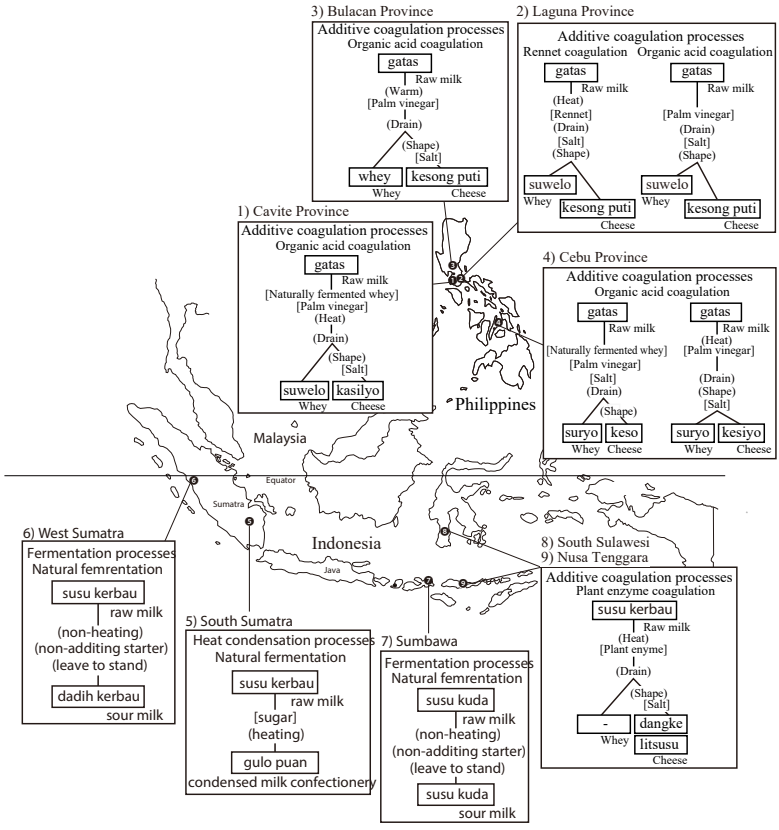
Milk Culture in the Philippines

Raw water buffalo milk is primarily used to process fresh cheeses for marketing purposes in the Philippines. While raw milk is rarely consumed, people often purchase and enjoy fresh cheese, especially on special occasions such as birthdays, All Saints' Day, and Christmas. Fresh cheese is commonly eaten on bread or with bananas (Tsuji, 2021a).

In Cavite Province, naturally fermented whey and palm vinegar are added to raw milk as coagulants, and then the mixture is heated to 72°C to promote coagulation into curd (Tsuji, 2021a), as showin in Figure 3. The curds are poured into molds to dehydrate and shape them into cheese. The cheese is salted and wrapped in banana leaves. This type of fresh cheese is known as *kasilyo*. Therefore, fresh cheese is processed using the milk processing technique of additive coagulation processes with naturally fermented milk and organic acids as coagulants in Cavite Province. The technique for long-term storage of cheese is not applied. Unsold fresh cheese is consumed by the producers or offered to neighbors.

Figure 3

The Case Study of Milk Processing Systems in Insular Southeast Asia



In Laguna Province, palm vinegar and rennet are used as coagulants to process fresh cheese (Kozaki, 2001; Tsuji, 2018). Raw water buffalo milk is heated, and palm vinegar is added to coagulate it. Salt is added to the curds, which are poured into molds made of banana leaves to dehydrate and shape into fresh cheese. The cheese is finally wrapped in banana leaves and packed in the tree bark of betel palm. This type of fresh cheese is called *kesong puti.* Cheese made with rennet as a coagulant is also called *kesong puti.* The process of making cheese with rennet as a coagulant is identical to using palm vinegar. Thus, fresh cheese is processed using the milk processing technique of additive coagulation processes with organic acids or animal enzymes as coagulants in Laguna Province. The technique for long-term storage of fresh cheese is not applied. Fresh cheese is sold to tourists within two days.

In Bulacan Province, fresh cheese processing also involves using a coagulant (Tsuji, 2021b). Palm vinegar is used to coagulate raw water buffalo milk. The process for making fresh cheese is the same as in Laguna Province. Rennet may not be used in Bulacan Province. Therefore, fresh cheese is processed using the milk processing technique of additive coagulation processes with organic acids in Bulacan Province. It is sold within a few days and is not processed for long-term storage.

In Cebu Province, raw water buffalo milk is coagulated by adding a mixture of naturally fermented whey and palm vinegar as a coagulant to process cheese (Tsuji, 2017a; Tsuji, 2017b). The curds are then salted, dehydrated in a compressor, and wrapped in banana leaves. This type of fresh cheese is called *keso*. No heating is involved in the process of making *keso*. Fresh cheese is also processed by pasteurizing raw milk and adding palm vinegar. The curds are dehydrated, molded, and salted to produce fresh cheese. This variety of fresh cheese is called *kesiyo*. Thus, fresh cheese is processed using the milk processing technique of additive coagulation processes with naturally fermented milk and organic acids in Cebu Province. The technique for long-term storage of fresh cheese is not applied. Fresh cheese is neatly wrapped in banana leaves and sold.

Hence, the milk processing techniques in the Philippines only involve additive coagulation processes. Coagulants such as plant organic acids, naturally fermented milk, and rennet are used, varying from region to region. The technique for long-term cheese preservation is not commonly applied. Local households mainly process fresh cheese as a source of cash income through sales. Raw milk and milk products (cheese) are consumed in the Philippines as nutritional supplements and luxury foods rather than essential subsistence foods.

Milk Culture in Indonesia

Water buffalo in South Sumatra Province is primarily milked for sales purposes (Tsuji et al., 2022). Raw water buffalo milk, known as *susu kerbau*, is rarely consumed. Raw water buffalo milk is processed into milk confectionery for sale by adding sugar and concentrating through heating (Figure 3). Naturally, fermented milk is not produced from raw water buffalo milk in this region. Therefore, milk processing techniques are limited to heat condensation processes in South Sumatra Province.

In West Sumatra Province, water buffalo is milked primarily for the production of naturally fermented milk (Hirata & Urashima, 2011). Raw water buffalo milk, also called *susu kerbau*, is only consumed if there is surplus milk from the production of naturally fermented milk for sale. Local people consume about 100 mL of water buffalo milk twice a week. After milking, the raw milk is immediately poured into a bamboo tube without heating. The previous day's sour milk is not used as a fermentation starter. The top of the tube is covered with plastic film or banana leaves and left to stand for one or two nights to process natural fermentation. Naturally fermented milk is called *dadih kerbau*, literally "sour milk of water buffalo". Cream rises to the top layer during fermentation, although no specific term refers to it. Neither the cream nor the lower layers are separately taken or further processed into cheese or butter. Therefore, raw water buffalo milk is applied to the milk processing technique of fermentation processes without heat pasteurization or the addition of fermentation starters in West Sumatra Province.

Naturally fermented milk in West Sumatra Province is commonly used as a condiment. It is mixed with salt and sliced onions and served over rice. The people in West Sumatra consume naturally fermented milk twice a week, not on a daily basis. Dried compressed glutinous rice, *ampiang*, is rehydrated in hot water and mixed with naturally fermented milk, topped with sugar, coconut milk, or sugar cane molasses. It is sweetened so much that the flavor of the naturally fermented milk is masked. This sweetened dessert of naturally fermented milk is known as *ampiang dadih*. Therefore, naturally fermented milk is used as a supplementary dressing or dessert rather than a main food resource in West Sumatra Province.

Mare is milked in Sumbawa Island. The main purpose of milking from mare is for sales (Hirata & Urashima, 2011). Raw mare milk is called *susu kuda*, literally "milk of mare". Raw mare milk is consumed once a week in approximately 150 mL portions. If raw mare milk is not consumed or sold to traders from Jakarta or Bima, it is left to naturally ferment for a few days or weeks. The naturally fermented mare milk is also called *susu kuda*. Naturally, fermented mare milk is not processed

into cheese or butter. Therefore, raw mare milk is processed using the milk processing technique of fermentation processes without heat pasteurization or the addition of fermentation starters in Sumbawa Island. Some people in Indonesia, including those in Sumbawa Island, mix raw mare milk with raw eggs and consume it as a milkshake for health benefits. Raw mare milk and naturally fermented mare milk are consumed as nutritional supplement drinks to restore strength.

In South Sulawesi Province, fresh cheese is processed using plant coagulant enzymes (Hosono, 1984). Raw water buffalo milk is heated and coagulated by adding chopped papaya leaves, stems, and unripe fruits. The resulting curd is dehydrated and shaped using coconut shells, salted, and wrapped in banana leaves. This type of fresh cheese is known as *dangke*. A similar technique is used to process fresh cheese in the Nusa Tenggara area, where a wide variety of plants, including *Pohon litsusu* (Oleaceae), *Mimosa pudica* (Fabaceae), and *Solanum torvum* (Solanaceae), are used as coagulants. The fresh cheese produced using these plant coagulants is called *litsusu*. Therefore, fresh cheese is processed using the milk processing technique of additive coagulation processes with plant coagulant enzymes in South Sulawesi Province and the Nusa Tenggara area.

Hence, milking is regionally practiced only in West and South Sumatra, South Sulawesi Province, and the Nusa Tenggara area. Milk processing techniques in these regions include fermentation, heat condensation, and additive coagulation processes. Local households mainly process milk products to earn cash income from sales. Raw milk and milk products are consumed in Indonesia as nutritional supplements and luxury foods rather than as essential foods for subsistence.

Characteristics of Milk Use in Insular Southeast Asia

Raw milk and fresh cheese are rarely consumed in the daily diet but are used as nutritional supplements or luxury items in the Philippines. In the case of fishermen on Mactan Island, Cebu, in the Visayas region, milk and milk products are not used in any fish dishes that make up the main diet. They are mainly consumed as nutritional supplements, luxury foods, and bread and biscuits for breakfast and between meals (Hirata et al., 2015). Similarly, in Indonesia, people use mare milk as a nutritional supplement for better health and buffalo water milk as dressing or desserts rather than an essential meal ingredient. Ariga (1997), who investigated milk utilization in the West Sumatra Province, also reported that buffalo water sour milk was only used as desserts. Raw milk and milk products are not essential foods in the diet, but they also serve as a source of cash resources in Indonesia.

The supplementary use of milk products in the Philippines and Indonesia is symmetrical to milk usage in the milk cultural sphere, which has mainly developed in arid regions of Asia and Africa (Figure 1). In the milk cultural sphere, sour milk, butter, and cheese are integral to the daily diet and play a crucial role in nutrition. Milk products are processed into long-term conservable forms, such as butter oil and dried cheese (Hirata, 2020). Even mare milk serves as a major source of nutritional intake during the summer in Mongolia (Ishii, 2005).

Hence, milk products in Insular Southeast Asia, the non-milk cultural sphere, are not essential for subsistence as food resources but are part of daily life as supplementary nutritional foods, luxury items, or sources of cash resources.

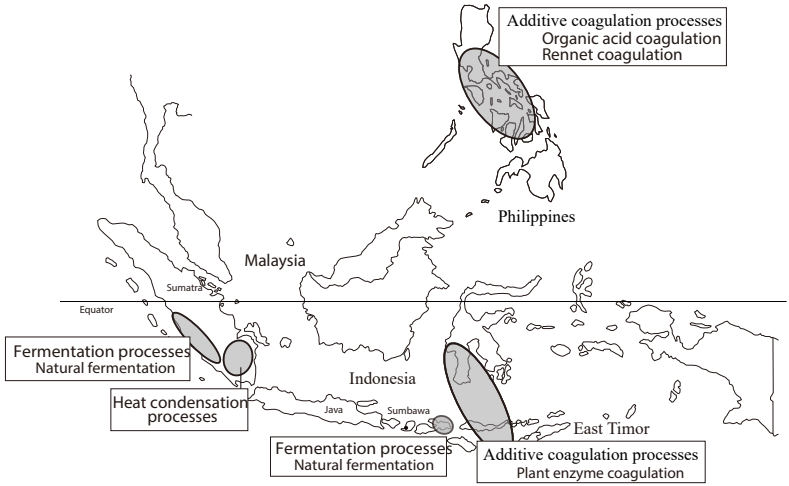
Characteristics of Milk Processing Technique in Insular Southeast Asia

In Insular Southeast Asia, milk processing was only regionally practiced at the household level in central and northern Philippines, parts of Sumatra, and Nusa Tenggara to South Sulawesi regions in Indonesia. There are no reports of milk processing being practiced in other regions. Milk processing in the Philippines is characterized by adopting techniques involving additive coagulation processes, which utilize plant organic acids, naturally fermented milk, and rennet as coagulants.

On the other hand, milk processing in Indonesia is characterized by the adoption of techniques involving fermentation processes, heat condensation processes, and additive coagulation processes. Plant coagulant enzymes are used for processing cheese, as shown in Figure 4. Neither region applies techniques for the long-term storage of milk products. Different milk processing techniques are practiced regionally in the Philippines and Indonesia. This localized mosaic of milk processing techniques, which includes fermentation processes, heat condensation processes, and additive coagulation processes, is a characteristic of milk culture in Insular Southeast Asia, the non-milk cultural sphere. It can be figured out that milk culture has spread to Insular Southeast Asia for some reason. However, identical milk processing techniques were not widely shared in areas where milk culture was not an essential cultural element in local livelihoods.

Figure 4

Typological Classification of the Milk Processing Systems in Insular Southeast Asia



The milk processing technique for fermented milk is not found in the Philippines. Palm vinegar is brewed through alcohol and acetic acid fermentation in the Philippines. Fish sauce, produced through complex fermentation processes, is used as the main seasoning (Yoshida, 1990). Additionally, some fish pickles are made using rice malt. The culture of fermented food has been passed down from generation to generation in the Philippines. Chinte-Sanchez (1999) isolated lactic acid bacteria, including *Lactobacillus* spp. and *Streptococcus* spp., from fresh cheese called *kesong puti*. With the knowledge and experience of traditional fermenting foodstuffs in the Philippines, it is possible to utilize these indigenous lactic acid bacteria to process raw milk into fermented milk. The reality, however, is that raw milk is not processed into fermented milk in the Philippines. It is an issue to be discussed and analyzed why the milk processing technique for fermented milk has not developed in the Philippines.

Origin of Milk Culture in the Philippines

Morga (1966), Alcina (2004), and Tsuji (2017) mentioned that the beginning of milk culture in the Philippines can be attributed to Spanish influence. It has been noted that the processing of cheese using buffalo water milk in the Philippines started in the 16th century under Spanish rule. In Spain, cheese is called *queso*, and whey is called *suero*. Similarly, cheese is called *keso*, and whey is referred to as *suwelo* or *suryo* in the Philippines, which indicates a Spanish origin for these vocabulary

terms. Therefore, it can be ascertained that Spain indeed influenced the origin of milk culture in the Philippines.

However, there are also indications of influences from India or China on milk processing techniques in the Philippines. Fresh cheese in the Philippines is processed using rennet and plant organic acids as coagulants. Fresh cheese is processed in India using plant organic acids as coagulants (Hirata, 2005). Milk is heated, and lemon or lime juices are added as coagulants. Acetic and citric acid water are also used as coagulants in present-day practices. The curd is then dehydrated by weight and processed into fresh cheese called *chhenaa*. Fresh cheese dehydrated by machines under strong pressure is called *paneer*. Neither *chhenaa* nor *paneer* is processed into long-stored cheese. These milk processing techniques in India are very similar to those practiced in the Philippines. Yoshida (1990) noted that the current food culture of the Philippines is influenced by India but significantly by Spain, the United States, and China. This report suggests that the influence from India to the Philippines can be found even if there is a small.

On the other hand, in China, the book "Complete Collection of Household Necessities" was edited in the early Yuan dynasty, describing the process of boiling milk, adding vinegar to it, allowing the milk to gradually coagulate, and then wrapping the curd in cloth and pressing it with a stone. This process closely resembles the techniques used in the Philippines for *kesong puti*, *keso*, and *kasilyo*, which involve the use of plant organic acids. Kozaki (2001) discussed the existence of a milk coagulation technique using acetic acid in ancient China, which may have been transmitted to the Philippines.

Hence, milk culture in the Philippines originated under the influence of Spain and was later modified under the influence of India and China.

Origin of Milk Culture in Indonesia

Mare milk's milking method and processing techniques in Sumbawa Island, central Indonesia, are identical to those used for water buffalo milk in West Sumatra Province, western Indonesia. The milking methods, including the use of a juvenile animal to induce milk letdown, holding a container with one hand while milking with the other, using the juvenile animal once again to stimulate milk secretion, and allowing the mother and juvenile animals to drink the residual milk after milking, are similar in both regions. Additionally, fermentation processes are commonly used for milk processing in both regions, where raw milk is left unheated to naturally ferment. Raw and sour milk are not consumed as the primary food in the daily diet but as supplementary ingredients. These similarities in milking methods, milk processing techniques, and milk utilization in the daily diet between central and western Indonesia indicate a common origin of milk culture. It is presumed that milk culture was initially adopted in Indonesia at a certain time and then spread throughout the country.

Indonesia was strongly influenced by India and China long before Dutch colonization in the 17th century (Reid, 1997). Many cultural similarities are recognized between Indonesia and India or China, and Indonesia has had long-standing relationships with both countries as important maritime trade hubs. In India, sour milk is known as *dahi*/*dahee* (Hirata, 2005). The milking method in India involves allowing the young animal to suckle from the mother for a minute before separating it from the udder. In the case of water buffalo, the juvenile animal is completely separated from the mother after suckling, and then the mother is milked. The milker either puts a bucket on the ground or holds it at the elbow and milks the mother for 5 to 7 minutes. The juvenile animal is allowed to suckle again during milking. If the mother is not willing to be milked, her legs may be tied to control her movements. The milking methods for water buffalo in India are similar to those in Indonesia. The processing of raw milk into sour milk in India often involves heating before adding a starter, although the starter is added without heating also in some areas of India.

Additionally, India is the only country known to adopt the milk processing technique of heat condensation processes at the household level (Hirata, 2005). The presence of heat condensation processes in southern Sumatra suggests India has a strong influence. Considering the long and strong relationship between Indonesia and India, as well as the similarities in milk product vocabulary and milking techniques, it is presumed that milk culture in Indonesia originated from India.

However, the main difference between Indonesia and India in milk culture is that sour milk is an essential ingredient in India, as it is frequently eaten and served over rice. In Indonesia, sour milk is only occasionally consumed as a supplement. Although the milking techniques were transferred from India to Indonesia, most milk processing procedures and the use of sour milk have changed significantly in Indonesia, which is considered a non-milk cultural sphere. Indonesia grows a wide variety of foodstuffs and has an abundant variety of food sources, including cereals, vegetables, and marine resources, making the diet sufficient without milk products. Hirata (2019) reported that the form in which milk products transfer into areas where milk use is not essential penetrated society as a supplementary luxury food rather than the main ingredient in the diet. This abundant availability of plant and marine foods in Indonesia may have shifted the position of milk products in the subsistence from essential foods to supplementary nutritional foods and luxury foods.

Fresh cheese is processed using plant coagulant enzymes in South Sulawesi Province and Nusa Tenggara. The use of plant coagulant enzymes for cheese processing has not been reported in India (Hirata, 2005). The name *danke* for fresh cheese in South Sulawesi Province is derived from the story that the Dutch called 'dank u wel' when they received cheese from the local people (Hosono, 1984). Cheese processing using plant coagulant enzymes is commonly practiced in Europe, suggesting that cheese processing using plant coagulant enzymes would be initiated under European influence. However, there is also the possibility that the use of plant coagulant enzymes started independently in these regions. Further investigation is needed to determine the origin of the milk processing technique using additive coagulation processes with plant coagulant enzymes in South Sulawesi Province and the Nusa Tenggara area.

Hence, milk culture in Indonesia started under the influence of India. Then, when milk culture spread to Indonesia, the abundant availability of plant and marine foods may have caused the lack of most of the milk processing techniques and the transition of milk products as supplementary luxury foods.

Conclusion

Even in Insular Southeast Asia, where subsistence does not depend on milk products, milk processing, and uses have been identified regionally in the Philippines and Indonesia. This paper discusses and identifies the areas where milk culture was practiced in the Philippines and Indonesia to analyze the characteristics of milk processing techniques and milk uses and examine the origins and transitions of milk culture.

As the result of the authors' fieldwork and literature surveys in Insular Southeast Asia, it was found that milk processing was practiced in the central and northern parts of the Philippines, and the west and south Sumatra, Sumbawa Island in West Nusa Tenggara Province, South Sulawesi Province and the Nusa Tenggara area in Indonesia.

The characteristics of milk products in the Philippines and Indonesia are that milk and milk products are produced mainly as a source of cash income from sales and consumed as nutritional supplements and luxury foods, not as essential subsistence foods. When milk culture was transferred to both countries from the milk cultural sphere where milk products are essential for a dairy diet, the

abundant availability of plant and marine foods may have caused the lack of most milk processing techniques and the transition of milk products to supplementary luxury foods.

In terms of milk processing techniques, the Philippines adopts additive coagulation processes, while Indonesia adopts fermentation processes, heat condensation processes, and additive coagulation processes, respectively. This localized mosaic of milk processing techniques is a characteristic of milk culture in Insular Southeast Asia, the non-milk cultural sphere. This paper discovered that milk culture has spread to Insular Southeast Asia, but identical milk processing techniques were not widely shared in areas where milk culture was not an essential cultural element in local livelihoods. It is presumed that milk culture in the Philippines started with the influence of Spain and was subsequently modified under the influence of India and China, while milk culture in Indonesia originated under the influence of India. Regarding the issue of fresh cheese processes using plant coagulant enzymes in eastern Indonesia, further investigation is needed to determine its origin.

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Conflict of Interest Statement

We have no conflict of interest to disclose.

AI Disclosure

We declare that this manuscript was prepared without the assistance of artificial intelligence. Hence, the content of this paper is original.

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