A CASE STUDY OF THE INDIGENOUS TECHNOLOGY FOR MAKING WHITE SOFT CHEESE KESONG PUTI IN LUMBAN, LAGUNA, PHILIPPINES

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ABSTRACT

A case study of the indigenous technology for processing white soft cheese was conducted in the town of Lumban in Laguna, Philippines. Information was gathered on the demographic profile of two cheese makers; their indigenous knowledge and practices; and the nature, volume, and marketing system of the kesong puti business. The receptivity of the cheese makers to the DTRI technology on white soft cheese processing and the chemical and microbiological qualities of the kesong puti produced in the town were determined. The cheese making business of the two cheese makers’ families dates back to 1900 and 1928, respectively. Cheese making is their main occupation. Both cheese makers use bahay asim (abomasum) to coagulate the milk. The average income from the business ranged from PhP15,000-40,000/month. Only one cheese maker expressed interest in the demonstration of the DTRI method for making white soft cheese. A major constraint to the adoption of the DTRI technology according to the cheese maker was the longer processing time and lower cheese yield obtained. The other cheese maker had confidence in her own traditional cheese making technology and expressed no interest in the DTRI method. Lumban cheese had 65.96-67.27% moisture, 2.20-2.60% ash, 11.49-13.14% total protein, 10.17-10.33% fat and 2.03-2.15% salt. The pH ranged from 6.18 to 6.34. The total bacterial counts and yeast and mold counts ranged from 1.4-8.4 x 10⁶ colony forming units (cfu)/g and 1.7-3.4 x 10⁴ cfu/g, respectively. The coliform colonies were too numerous to count at 10⁻¹ dilution, which is beyond the 10 cfu/g coliform count limit set by the Philippine Bureau of Food and Drugs.

Keywords: DTRI method, indigenous technology, kesong puti, white soft cheese

INTRODUCTION

Indigenous technology or knowledge refers to technology, specific to a place or culture, developed by local people and passed on in society over generations. The indigenous technology of kesong puti or the making of white soft cheese in Lumban, Laguna, Philippines is fast disappearing because of low adoption of research modifications and local cheese makers’ lack of desire for...
technological changes to improve the quality of the soft cheese. To date, only
organized cheese factories (e.g. members of cooperative federations have adopted
the Dairy Training and Research Institute (DTRI) method of manufacturing white soft
cheese. Home-based cheese makers still use their ancestral techniques
(Barraquio, 2006). Hence, there is a need to document indigenous cheese making
and to develop an interface between exogenous knowledge developed in research
institutions and indigenous knowledge. Previous studies were focused on the
physico-chemical and microbial quality of the milk used for cheese making,
manufacturing methods, and modifications of the manufacturing methods
(Barraquio, 2006).

White soft cheese popularly known as *kesong puti* or Santa Cruz cheese in
Laguna province, and *kasilyo* (local dialect for the Spanish word *quesillo*, meaning
small cheese in Cavite province) is an indigenous cheese of the Philippines. It is an
unripened type of cheese, whitish to creamy in color, and generally produced from
the raw milk of the carabao (domesticated Philippine swamp buffalo, a subspecies of
*Bubalus bubalis L.*), *Bubalus bubalis carabanensis* [(sub) Sp. Nov., Castillo 1998],
(Barraquio, 2006). Records show that the manufacture of white soft cheese is one
of the oldest cottage industries in the Philippines having been practiced even before
the 20th century (Dulay, 1991). During the early days of the Spanish regime, it was
reported that tamed carabaos from China were brought to the Philippines for milking
purposes. When the people established dairying as a business, they ventured into
the production of fresh cheese from carabao’s milk. Although of inferior quality, the
cheese became an item of trade in a number of provinces mostly in Laguna
(Mendoza, 1917; Barraquio, 2006). The *kesong puti* industry is concentrated in a
number of towns in Laguna, Cavite and Bulacan in Luzon; and in Cebu, Leyte and
Samar in the Visayas.

Recently, cheese makers have opted to use cow’s milk or a mixture of cow’s
and carabao’s milk in producing white soft cheese mainly because of the low supply
of carabao’s milk. Abomasal extract (rennet), dilute acetic acid or vinegar may be
used for milk coagulation (Kisworo and Barraquio, 2003). Cheeses obtained from
the different localities have distinct characteristic texture, flavor and keeping quality
due to differences in the procedures used (Bayot et al., 1999). The cheese is
marketed locally, wrapped either in banana leaves which highlights the indigenous
nature of the cheese, or packed in plastic containers which are used mainly for
convenience and sanitation and to differentiate between cheese producers
(Barraquio, 2006). The business has survived in spite of the limited area covered
and the industry’s expansion has been very slow mainly due to the poor keeping
quality of the cheese (Rajbhandary, 1962). Despite the numerous available scientific
studies and recommendations for improving the indigenous cheese making
processes, adoption of new techniques has been poor (Barraquio, 2006).

Therefore, this study was undertaken to: 1) document the indigenous
knowledge and practices of the cheese makers in Lumban; 2) show the socio-
demographic profile; 3) determine the nature, volume and marketing of *kesong puti*;
4) introduce the DTRI method to the indigenous cheese makers and assess their
receptiveness to the technology; and 5) determine the chemical and microbiological
quality of the *kesong puti* processed in Lumban, Laguna. This study will help
national and local government agencies and research institutions undertaking multidisciplinary research to promote cheese making in the country. The study can also help in heritage conservation and preservation of local culture in white soft cheese making and as an alternative means of livelihood in localities where milk producing animals are raised.

MATERIALS AND METHODS

Data gathering

Arrangements were made with the local government of Lumban, Laguna and the cheese makers to gain the cooperation of the respondents. An initial survey shows there were originally three cheese makers. However, there were only two (Linda and Ben, not their real names) in Lumban at the time of the study. The two were interviewed using a structured questionnaire. The third cheese maker who stopped making white cheese eight years ago refused to be interviewed. Only one of the respondents, Ben agreed to have his traditional method of making white soft cheese observed and documented.

DTRI method demonstration

The results of the interview showed that only one cheese maker signified interest in the DTRI method of white soft cheese making. The demonstration on the DTRI method was conducted on February 23, 2009 at the cheese maker’s residence in Rizal St., Brgy. Maracta, Lumban, Laguna. Almost all the cheese maker’s family members attended the demonstration. The modified DTRI method demonstrated to the cheese maker’s family is schematically outlined in Figure 1.

Raw carabao’s milk (2 L) + 2% salt (40 g or about 3 tbsps.)
Strain through cheesecloth
Pasteurize at 72°C
Cool to 40°C
Add 40 ml rennet (about 3 tbsps)
Leave to coagulate for about 20 minutes
Scoop into cheese mold lined with cheesecloth
Leave for about 1 hour to drain at room temperature

Figure 1. Schematic flow of the DTRI method of producing kesong puti from carabao’s milk (Dulay, 1988).
Proximate analysis

Cheese samples from the two cheese makers in Lumban were analyzed along with DTRI cheese. The Association of Official Analytical Chemists (AOAC, 1990) methods were followed to determine the moisture, ash, protein and salt contents. The Kjeldahl method was used to determine protein. Salt content was analyzed using the modified Volhard method. The fat in cheese was determined following the Gerber method of the Milk Industry Foundation (MIF, 1959). The pH was read on the pH meter using grated cheese samples mixed with distilled water at the ratio of 1:1.

Microbiological examination

The entire cheese or package of cheese was collected (for small cheeses and retail packed cheeses) as a sample. Cheese samples were aseptically mixed to make the sample homogeneous. Total bacterial count (TBC), coliform count (CC) and yeast and mold counts were done following the American Public Health Association (APHA, 2004) procedures.

RESULTS AND DISCUSSION

Socio-demographic profile of respondents

The two remaining cheese makers in Lumban were both college graduates, single, aged 63 and 70 years old). The 43 year-old married nephew of one of the respondents, who is a part time physical therapist, is presently producing the cheese. The income from cheese making business for both respondents ranged from PhP15,000-PhP40,000/month.

Indigenous technology used in cheese making

The family’s cheese making business which was inherited from the parents of the respondents has been in existence since 1900 and 1928. One of the respondents could produce 300 pieces (~50 to ~100 g/piece) of white cheese per day from 15 liters of milk, while the other one could produce 160 to 200 pieces per day, sold at PhP25 each from an average of 40 liters of milk. Both cheese makers used carabao’s milk. The milk in plastic or stainless steel containers is delivered daily by a farmer supplier in Lumban. The volume of milk made into cheese varied because of the seasonality of milk production and volume of delivery.

Table 1 shows that the cheese makers used bahay asim (abomasa), the local term for rennet which coagulates the milk. They learned this practice from their ancestors. One respondent did not elaborate on the preparation of bahay asim while the other one used raw milk, salt and bahay asim or abomasal extract in whey. Milk pasteurization is not practiced and never done by this respondent. This is due to the belief that it can alter the cheese’s taste. One respondent pasteurized the milk by heating. No temperature nor heating period were revealed. Neither respondent used starter culture. Their processing facility was the kesuhan or cheese making room. The utensils were stainless steel and the containers were made of plastic that are solely used for cheese making. Banana leaves costing PhP3.00 to PhP4.00 per leaf were used as packaging materials for the product’s...
The leaves were prepared the night before by soaking in hot water mainly to make them pliable.

One respondent used banana leaves for the local market and two sizes of microwaveable plastic containers for large-sized cheeses taken out of the country as *balikbayan* presents to relatives. One of the respondents refused to allow their traditional method of cheese making to be documented. Only the other one shared his cheese making technology.

The rennet extract was prepared by soaking 2x3-inch pieces of dried abomasum in the whey from the previous day’s cheese making. The whey is the yellow colored liquid by-product that drains from the curd during cheese making. The fresh abomasum were stretched with bamboo sticks and tied like a kite then dried under the sun. Daily, a new piece of abomasum is added and one piece of old, extracted piece is removed. Before use the rennet extract is filtered using *katsa* or cheese cloth.

The traditional method of cheese making of one respondent is as follows. First, molded banana leaves are prepared and readied for the day’s cheese making. About 20 liters of raw milk is then filtered into a plastic pail lined with two to three layers of white cloth. About 1.5 liters of the rennet extract is added to the milk with

### Table 1. Indigenous technology and practices used by cheese makers in Lumban, Laguna.

<table>
<thead>
<tr>
<th></th>
<th>Linda</th>
<th>Ben</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk coagulant</td>
<td><em>Bahay asim</em></td>
<td><em>Bahay asim</em> (abomasal extract in whey)</td>
<td>No difference both used <em>bahay asim</em></td>
</tr>
<tr>
<td>Pasteurization method</td>
<td>Practices pasteurization but temperature and time of heating withheld</td>
<td>none</td>
<td>No pasteurization for Ben</td>
</tr>
<tr>
<td>Starter culture</td>
<td>Not used</td>
<td>Not used</td>
<td>None</td>
</tr>
<tr>
<td>Processing facility</td>
<td><em>Kesuhan</em> or Cheese making room</td>
<td><em>Kesuhan</em> or Cheese making room</td>
<td>None</td>
</tr>
<tr>
<td>Utensils and containers</td>
<td>Stainless steel utensils and plastic containers</td>
<td>Stainless steel utensils and plastic containers</td>
<td>None</td>
</tr>
<tr>
<td>Packaging material</td>
<td>Banana leaves, Microwaveable plastic containers</td>
<td>Banana leaves and plastic films Microwaveable plastic containers</td>
<td>None</td>
</tr>
<tr>
<td>Packaging material preparation</td>
<td>Soaking in hot water (if not pliable enough for molding) Washing of banana leaves</td>
<td>Washing in warm water</td>
<td>None</td>
</tr>
<tr>
<td>Storage</td>
<td>Freshly made cheeses are stored in styrofoam box w/ice</td>
<td>Chest type freezer</td>
<td>Storage difference</td>
</tr>
</tbody>
</table>
the use of a plastic cup. The milk is left undisturbed for about 20-30 min. The coagulated milk is then scooped and placed in a plastic strainer to drain for about 15 minutes. The drained curd is transferred to a plastic bowl and then 1-1.5 handfuls of salt is added according to the taste of the cheese maker. With the use of hand mixer the curd is beaten for about two minutes until the curd is well grated. The mixture is then scooped and poured into molded banana leaves and then wrapped in plastic sheet or directly scooped into microwaveable plastic containers. The cheese is then stored in a chest-type freezer.

**Marketing of kesong puti**

The marketing of *kesong puti* by the two cheese makers is presented in Table 2. One of the respondent, Linda has two regular peddlers who walk around the town to sell and get orders for white soft cheeses from the customers. The price and size of the cheese made by Ben do not vary. Customers buy or order white cheese in his house. Most customers are from Lumban and other towns in Laguna. Ben used to deliver *kesong puti* to various restaurants and supermarket in Manila (Cravings, Via Mare, Skyline, Ilustrado, and Shopwise). However, he stopped delivery to these establishments because of competition offered by cheese makers near Manila who imitated Lumban cheese. Currently, he sells white soft cheese only in Lumban. The marketing problems encountered are attributed to the low purchasing power of the customers. White cheese is not a primary food need of most people and only those who are well-off and can afford it, buy in substantial amounts. At present, they have no marketing plans due to the small scale of their

<table>
<thead>
<tr>
<th>Table 2. Marketing of <em>kesong puti</em>.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Marketing</strong></td>
</tr>
<tr>
<td>Use of appointed peddlers within the town</td>
</tr>
<tr>
<td>Customers directly buy and order</td>
</tr>
<tr>
<td><strong>Price of cheese (PhP)</strong></td>
</tr>
<tr>
<td>Medium size (~80 g) = 25</td>
</tr>
<tr>
<td>Large size (~150 g) = 50</td>
</tr>
<tr>
<td>Round container (~300 g) = 60-100</td>
</tr>
<tr>
<td>Rectangular container (~700 g) = 50-200</td>
</tr>
<tr>
<td>Rectangular container (~700 g) = 200</td>
</tr>
<tr>
<td><strong>Place of origin of customer</strong></td>
</tr>
<tr>
<td><strong>Quality of carabao milk supply</strong></td>
</tr>
<tr>
<td><strong>Shelf life of <em>kesong puti</em> with storage</strong></td>
</tr>
</tbody>
</table>

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business. They welcome visits and field trips, as visitors buying white cheese provide additional sales.

The price of the cheese does not vary but its size varies with the increase in the price of raw milk when the milk supply is low. The packaging depends on customers’ preference. Usually, the cheese produced daily by Linda is sold out in Lumban. Other customers are from the neighboring towns (Pagsanjan, Los Baños, Calamba) and from Metro Manila and Rizal province.

Because of the good sales in Lumban, Linda has no marketing problems. However, marketing is affected when the milk supply is heavily adulterated with water, i.e. half a liter of water is added to one liter of milk. This affects milk coagulation and the cheese produced is of poor quality.

According to customers’ feedback the shelf life of kesong puti varies. If refrigerated properly, the cheese lasts up to four weeks. Cheeses brought abroad and stored frozen last for three months. To date, there have been no complaints of early spoilage of white soft cheese. Both cheese makers believe that refrigeration and freezing improved the shelf life of the cheese.

The cheese is highly saleable because customers’ have a good impression of the product. The cheese does not shrink as the whey further drains out. The cheese makers use pure carabao’s milk. The only modification to their family’s (Ben’s) product is the use of outer plastic sheet wrapping of the cheese in banana leaves mold. Ben’s cheese has a long shelf life. If refrigerated properly, it can last for two-three weeks and when stored frozen, it can last for one year. No complaints on cheese spoilage have been reported. This was attributed to the practice of draining most of the whey and storing the cheese in the freezer.

**Receptivity to DTRI cheese making method**

Linda is aware of the UPLB-DTRI technology of soft cheese making but is not willing to adopt it. She prefers her family’s cheese making technology because of her familiarity with the traditional method and expertise gained over the years. Ben on the other hand is not aware of the UPLB-DTRI technology because no brochures or advertisements reached him. However, he is interested to know the DTRI method and to compare it with the traditional method (Table 1). This indicates the need for UPLB-DTRI to extend the technology to other Lumban cheesemakers.

A demonstration of the DTRI method of white soft cheese making was conducted for Ben and his family members. He was impressed by the stronger clotting activity of the DTRI rennet compared with the bahay asim and asked how the rennet was prepared. He also expressed interest in using the left over rennet from the demonstration. Ben found the DTRI method long compared with traditional method in Lumban. Pasteurization and draining the curd lengthened the process. The Lumban method usually takes only more or less an hour because draining time is only 15 min. However, Ben commented that cheeses made using the DTRI method were hygienic. Pasteurization, which is not practiced in the Lumban method, will improve the safety and shelf-life of the cheese. Another difference between the two methods is the addition of salt based on the weight of the milk in the DTRI method while in the Lumban method, the amount of salt is added according to the taste of the cheese maker. Such practice will cause the inconsistent quality of cheese. Lumban and DTRI methods of cheese making are compared in Table 3.
Table 3. Differences between Lumban and DTRI methods of cheese making.

<table>
<thead>
<tr>
<th>Step</th>
<th>Lumban</th>
<th>DTRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of banana leaves for molding and packaging</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>Milk used</td>
<td>Carabao’s milk</td>
<td>Cow’s milk</td>
</tr>
<tr>
<td>Pasteurization</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Rennet</td>
<td>Rennet extract</td>
<td>Rennet extract from fresh abomasum</td>
</tr>
<tr>
<td>Cutting of the coagulum into cubes</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Scooping curd after coagulation</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>Stir for further whey removal</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Addition of salt after milk coagulation</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>Mixing curd after salt addition</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>Draining cheese in mold lined with cheese cloth</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Duration of draining</td>
<td>15 min</td>
<td>1 hour</td>
</tr>
<tr>
<td>Cutting curd into blocks</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Packaging</td>
<td>Plastic film or microwaveable container</td>
<td>Plastic sheet</td>
</tr>
</tbody>
</table>

Proximate analysis of the cheese

The mean moisture, ash, total protein, fat, and salt contents and pH of the cheeses are presented in Table 4. The mean moisture content of the cheeses ranged from 62.15±7.3 % to 67.27±2.5 %. The moisture content was lowest in DTRI white soft cheese which was made from cow’s milk and highest in the cheese produced by Ben. The latter could be attributed to the short draining period in the Lumban method. Cheese texture is related to its moisture content. Ben’s cheeses have a rough texture due to the crumbling and mixing of the curd after the addition of rennet extract from fresh abomasum.

Table 4. Mean moisture, ash, total protein (T.P.), fat, salt contents and pH of Lumban and DTRI white soft cheeses.

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Linda</th>
<th>Ben</th>
<th>DTRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture (%)</td>
<td>65.96 ± 5.5</td>
<td>67.27 ± 2.5</td>
<td>62.15 ± 7.3</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>2.20 ± 1.17</td>
<td>2.60 ± 1.54</td>
<td>2.58 ± 1.21</td>
</tr>
<tr>
<td>T.P. (%)</td>
<td>13.14 ± 1.03</td>
<td>11.49 ± 0.95</td>
<td>12.04 ± 1.76</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>10.33 ± 3.21</td>
<td>10.17 ± 1.15</td>
<td>13.0 ± 0.9</td>
</tr>
<tr>
<td>Salt (%)</td>
<td>2.15 ± 0.07</td>
<td>2.03 ± 0.71</td>
<td>3.0 ± 0.61</td>
</tr>
<tr>
<td>pH</td>
<td>6.34 ± 0.11</td>
<td>6.18 ± 0.14</td>
<td>6.81 ± 0.06</td>
</tr>
</tbody>
</table>

Number of samples analyzed = 3.
of salt. The mean moisture content of cheeses from Cavite and Laguna ranged from 57.55-67.17% (Kisworo and Barraquio, 2003).

The ash content of the Lumban and DTRI cheese samples ranged from 2.2±1.17 % to 2.6±1.54 % respectively (Table 4). Kisworo and Barraquio (2003) reported ash contents ranging from 2.76-3.23% in Cavite and Sta. Cruz cheeses.

The samples showed that total protein content of cheese produced by Linda was the highest at 13.14±1.03% while that of the cheese produced by Ben was the lowest at 11.49±0.95% (Table 4). The total protein contents reported by Kisworo and Barraquio (2003) for Cavite and Sta. Cruz cheeses were higher, ranging from 17.60-18.70 %. The quality of the milk used and the extent to which the whey is drained may have caused the differences.

The fat content of the cheeses ranged from 10.17±1.15% to 13.0±0.9%. DTRI cheese which was made from cow’s milk had a higher fat content than the Lumban cheeses which were made from carabao’s milk. The low fat content of Lumban cheeses could be due to its high moisture content (caused by the shorter draining period thus retaining most of the whey) and the probable adulteration of milk used i.e. addition of water to raw milk by the farmer supplier as noted previously by the respondents.

The values for salt content of the cheeses ranged from 2.03±0.71% (Lumban) to 3.0±0.61% (DTRI). Lumban cheeses have lower salt content than DTRI cheese. The salt contents reported by Kisworo and Barraquio (2003) for Cavite and Sta. Cruz cheese were 1.87- 2.01%, lower than those for the Lumban and DTRI cheese. The pH of the cheeses ranged from 6.18±0.14 to 6.81±0.06. DTRI cheese had a pH of 6.81± 0.06 which is normal. Lumban cheeses had a mean pH ranging from 6.18±0.14 and 6.34±0.11. This slightly acidic pH can be attributed to the age of the milk used.

**Microbiological examination of the cheese**

The mean total bacterial, yeast, mold and coliform counts of the cheeses are presented in Table 5. Although Ben don’t pasteurize the milk for cheese making, his white soft cheese showed the lowest bacterial count of 1.4x10^6 whereas the cheese produced by Linda had the highest count of 8.4x10^6 colony forming units (cfu)/g. The differences may be due to the microbiological quality of the raw milk supplied to the cheese makers and the hygienic practices of the cheese makers. Total

### Table 5. Mean total bacterial counts (TBC), yeast and mold counts (YM) and coliform counts (CC) of Lumban and DTRI white soft cheeses.

<table>
<thead>
<tr>
<th></th>
<th>Linda</th>
<th>Ben</th>
<th>DTRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>TBC (cfu/g)</td>
<td>8.4 x 10^6</td>
<td>1.4 x 10^6</td>
<td>3.6 x 10^6</td>
</tr>
<tr>
<td>YM (cfu/g)</td>
<td>1.7 x 10^4</td>
<td>3.4 x 10^4</td>
<td>0.75 x 10^1</td>
</tr>
<tr>
<td>CC (cfu/g)</td>
<td>TNTC (10^{-1} dilution)</td>
<td>TNTC (10^{-1} dilution)</td>
<td>2.7 x 10^1</td>
</tr>
</tbody>
</table>

Number of samples analyzed = 3; TNTC = too numerous to count.
bacterial counts of raw carabao’s milk from the second district of Laguna ranged from $10^6$ to $27 \times 10^7$ colonies per ml (Lerpido et al. 1970). This may be attributed to the observed unhygienic practices in the milking sheds. In this case study, the DTRI cheese had $3.6 \times 10^6$ cfu/g which is higher than the cheese sample of Ben. White soft cheese sold by Ben had the highest yeast and mold counts of $3.4 \times 10^4$ cfu/g while cheese produced by Linda had lower count of $1.7 \times 10^4$ cfu/g and DTRI cheese had the lowest with an estimated yeast and mold count of $0.8 \times 10^1$ cfu/g. High yeast and mold counts may be attributed to the use of unsterilized banana leaves.

The coliform counts of Lumban cheeses were too numerous too count (TNTC) at $10^1$ dilution for both respondents. This may be attributed to the use of raw milk and contaminated water and packaging materials. The coliform counts can be reduced by pasteurization of the milk and use of sanitized utensils and packaging materials as in the DTRI method. The coliform count of DTRI cheese was low ($2.7 \times 10^1$ cfu/g). Barraquio, et al.(1995) noted that kesong puti samples from Laguna had a mean total bacterial count of $5.8 \times 10^5$ cfu/g, $4.1 \times 10^5$ cfu/g coliforms and $5.9 \times 10^4$ cfu/g yeast and molds. Although Escherichia coli type I and Listeria sp. were found in kesong puti, no disease outbreak from the consumption of kesong puti from Laguna has been documented. It is probable that these organisms were present below the infective dose level. For pathogenic E. coli, illness occurs with large numbers, greater than or equal to $10^6$ cells. For Listeria and other etiological agents, the infective dose has yet to be determined (D’ Aoust, 1989). The coliform count limit set by the Philippine Bureau of Food and Drugs is not more than 10 cfu/g. Coliforms such as E. coli are indicator organisms closely associated with the presence of pathogens but are not necessarily pathogenic themselves. Coliforms are able to ferment lactose with the production of acid and gas. They are able to degrade milk proteins and can cause rapid spoilage of milk. They are killed by pasteurization. Therefore the presence of coliforms after treatment is indicative of contamination.

CONCLUSION

This case study shows that although the method used in Lumban is traditional in nature, present-day cheese makers have applied some modifications to their ancestors’ technique for making white soft cheese. The modifications are microwaveable plastic containers and transparent plastic sheets in addition to the use of the traditional banana leaves as packaging material. Although the milk is not pasteurized, there were no reported outbreaks to date of diseases caused by consuming white soft cheeses produced in Lumban. The Lumban cheese maker noted the longer processing time required and the lower cheese yield with the use of the DTRI method. Pasteurization which was not practiced by the Lumban cheese maker together with the longer draining period lengthened the DTRI method. The Lumban cheese samples showed higher moisture and total protein contents than those of DTRI cheese samples which were made from cow’s milk. The pH, fat and salt contents of Lumban cheese samples were lower than the DTRI cheese samples. The coliform counts of DTRI cheese samples were lower than the Lumban cheese samples. The coliforms detected in this study were non pathogenic.
as there were no disease outbreaks so far reported from the consumption of white soft cheeses. Pasteurization and hygienic handling during cheese production will reduce the microbial load of the cheeses. The kesong puti industry is still very promising as an alternative livelihood. Its survival indicates conservation of a heritage and preservation of an indigenous technology.

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REFERENCES


