



A Case Study-based Analysis of Traditional Food Technology in Sri Lankan Ethno-Culture

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Abstract

Sri Lankan rural societies have maintained a unique food system for daily meals. Meanwhile, the North Central Province of Sri Lanka were developed a barter economy based on goods and services. Traditional rural people grew accustomed to preserving, storing, and protecting surplus production, leading to the creation of "lunu dehi" as a preserved food. As a citrus crop, limes and oranges were abundant in Sri Lanka, and lime cultivation was a significant part of their lifestyle as a popular drink, food, hair care, and ceremonial purposes. To examine the correlation between traditional knowledge, technology, and scientific knowledge, this research emphasizes the traditional method of making "lunu dehi" using lime fruits, and the skills of rural women in making it and used technology to produce "lunu dehi" (lime pickle). The process involves boiling well-ripened limes in a clay pot on a wood stove, draining them in a container, sun steaming with salt cubes for about 7-14 days and climate changes and better skill preventing the mold forming. The study aims to provide insights into the relationship between traditional knowledge, technology, and scientific knowledge in ancient Sri Lankan society. To prepare lime pickle, mature fruit should be cut into four quarters without separation for better absorption of salt, spices, and other pickling agents. Blanching is a short-term heat treatment applied to lime fruits before drying for fermentation to inactivate spoilage enzymes and improve absorption. Salt is a key agent to control water activity and maintain an optimal pH range and vinegar and spices used as flavor enhancers.

Keywords: *Culture; Lime pickle; Rural societies; Sri Lanka, Village*

1. Introduction

It is true that various social systems have emerged in Sri Lankan civilizations. Why? Because there is a correlation between civilizations, cultures, and societies (Spencer, 2000). Similarities can be seen in the emergence of cultures or civilizations on different continents of the world. For example, primitive civilizations contain such conditions. Hunting societies or primitive cultures will show similarities in the African, European, and Asian continents (González-Rivadeneira, et al., 2022). Similarly, the similarities

in the formation of various societies can also be identified as a common fact (Rajpoot, 2018). Primitive cultures or societies can be categorized as rural societies and urban societies (Siriwardhana, et al., 2019). This article focuses on a unique food system that was created in connection with the rural social structure. The special feature of the Sri Lankan rural society was the maintenance of its own lifestyle (see Fig. 3) based on an agricultural economy (Rajendram, et al., 2023). As a result of the transformation from the hunting era to the agricultural era, agriculture gradually developed through the life structure. Also, even while cultivating mud fields and plantations, the main feature seen in the traditional lifestyle was that a garden was present in all houses. Especially the household kitchens needed to prepare daily meals were included in the garden. The tanks and associated agriculture of the historical civilizations of Anuradhapura, Polonnaruwa were prominent among these. Village tanks, large tanks, natural reservoirs, amunu, canals, etc., as well as tanks and reservoirs based on state intervention, were very important for their cultivation. But it should be noted that the agricultural activities of the rural people in the North Central Province of Sri Lanka were unique (Abeywardhana, 2010). However, through the exchange of this surplus harvest, a barter economy based on goods and services was created (Hettige, 2005). The mutual relations between them provided a basis for this work. Meanwhile, the traditional rural people gradually became accustomed to preserving, storing, and protecting the surplus production. As a by-product of this method, "*lunu dehi*" is created as a safe way to preserve food. In Sri Lanka, in various dry climatic zones such as Uva, Wellassa, Bibila, Monaragala, Kurunegala, etc., as well as in the intermediate zones, it seems that citrus crops such as limes and oranges give a rich harvest (Ez zoubi, et al., 2022). These crops are famous among the villagers as homestead crops and as large-scale project crops. It seems that the lime cultivation is getting a rich harvest from the middle of the *Bak masa* (month of April) until the middle of the *Esala masa* (month of July) according to the Sinhala calendar. It is increasing in size even in the present during this period.

Since ancient times, our villagers have been accustomed to using lime for various purposes. It was also used for cooking and as a hand medicine. According to traditional knowledge, there was an understanding of its medicinal properties (Walantheliyawa, 2006). Accordingly, it seems that all parts of the peel, citrus, juice, etc. were used. "*dehi ponsa*" (lime juice) was a very popular drink among the villagers. It was always needed for food as well as for cleaning the hair. It was also needed for ceremonial purposes (lime cutting), etc., and for various chemical methods. It should not be forgotten that a wide-mouthed and low-height clay pot, which was very popular among women in rural societies, was filled with sand, and limes were placed in it to preserve it (Kumarihami, 2006). The emphasis here is on explaining the traditional method of making "*lunu dehi*" popular among the rural people, based on the preservation of lime fruits (*dehi*). It seems that rural women were always accustomed to using various food flavoring agents. Also, rural women were skilled in making *lunu dehi* (Tikiriyadura, 2006).



Fig 1. Fresh lime fruits

2. Research Objectives

The main objective of this article was to investigate the technology used in the production of "lunu dehi" (lime pickle) for food in traditional societies in Sri Lanka. Also, to examine the correlation between that traditional knowledge, technology, and scientific knowledge. Here, the relationship between traditional knowledge and their experiences with scientific research is studied.

3. The Research Problem

Are the traditional knowledge, technology, and practices of ancient Sri Lankan society substantiated by scientific knowledge?

4. Methodology

Since the focus is mainly on investigating the traditional lime pickle (*lunu dehi*) creations that existed in the past rural societies of Sri Lanka, information was collected through interviews with experienced women associated with rural societies. Information was also collected about the folklore among the villagers. Data was also collected through reference to past documents and research based on rural culture in Sri Lanka. Thereafter, scientific data was collected based on traditional methods through scientific observation, experiments, comparisons and some written documents. The study and investigation focused on the scientific research methods of comparing the traditional methods and obtaining conclusions.

5. Traditional Methodology of Producing Lime Pickle (*Lunu Dehi*)

Among the elderly or middle-aged village women, making such creations was on the one hand, a hobby. On the other hand, it was effective time management. They were also good at getting young people and young women to participate in this. It did not interfere with daily household chores. The work was done a few days in advance. To prepare salt lime, they choose well-ripened but not overripe limes (see Fig. 1). They also often use limes of similar sizes. Their idea is that the limes can be dried evenly in a few days in the sun. A clay pot is placed on a wood stove, water is poured in well, and the fire is turned on. The limes are placed in the boiling water, and then immediately placed in a container that can be drained. The *Aethul patha* are often chosen for this. Soaking in hot water is often done in cold climates. Otherwise, the limes, which have been thoroughly washed and cleaned, will be placed in an *Athul patha* due to their moisture (Hettige, 2005). Then, if there is water, hold the lemons with the skin facing up, and hold them in both hands. Then, with a small, sharp knife, slice the lemons from top to bottom. But do not cut the lemons. This is done quickly, before the lemon juice gets on the knife. The village woman may have sensed that it could have adverse effects.

At the same time, a handful of large salt cubes, large enough to fit in the hand, are taken and filled well into each lime. But the salt cubes are not inserted with effort. This is because the village housewives have heard that food with a lot of salt is harmful to the body. This is done so that it is slowly absorbed into the citrus. Then it is steamed in the sun (*Awwe kekeraeima*) (Divulapitiya, 2006; Indrasili, 2007). This work is gradually done in strong sun, low sun, and wind. They state that this takes more or less 14, 10, or 7 days. The village women also believe that this time varies according to climate change. But they believed the rainy season should not be used for this in any way. They are skilled in preventing mold from forming. It is clear that they have a good understanding of producing lime pickle. Often, for such tasks, a box, a lid, etc. (*Watti, petti*, etc.) [Fig. 2] (Divulapitiya, 2006), which is made by the village women themselves, is used. Their fingertips are enough to check whether the salted lime, which has been prepared for several days, has been prepared properly. Because of their experience, it is better

(Divulapitiya, 2006; Indrasili, 2007; Kumarihami, 2007). Apart from being in the house for an hour and a half, the packaging container is prepared during that time. They say that a small, shallow clay pot with a small mouth is often suitable for packaging. A sufficient amount of well-ripened *kochchi* (kind of hot chilli) pods are taken, the upper end is cut off a little and kept aside for participant Observation. While the lime is being steamed in the sun, several limes are dried in the sun. About a teaspoon of coconut vinegar is added to it and mixed with a spoonful of coconut shell. Then first, the prepared salt and lime, and then the *kochchi* pods in between are put into the packaging container. At the same time, add the prepared lime peels little by little, shake the jar well, pour the last sour liquid over it, and take it (Kumarihami, 2007). Then, put a piece of banana peel and a piece of cotton cloth on top, tie it tightly, and again, take an earthenware jar and cover it. The sour is added to the packaging jar to make the lime peels steam and loosen (Indrasili, 2007; Village Baddegama, 2007).

The salt and lime jar is thus packaged. It has not been used for several months. Then the excess lime will be used up, and the sour shortage period will begin. Also, the salt and lime jar will be prepared to the base. However, the jar is shaken and stirred several times during the closed period (Indrasili, 2007). The use of salt and lime in dishes such as fried dried fish (*Karawala Bedduma*), coconut sambal (*Pol Sambola*), and katta sambal (*Katta Lunumirrisa*) is famous among the villagers (Village Baddegama, 2007). Keeping a piece of salt and lime next to the rice is a popular practice among villagers. It is known from experience that it is suitable for treating bloating and food aversions. They are especially careful when taking out the *lunu dehi* (lime pickles) from the jar. Here, a piece of wooden spoon or a clean, small coconut shell spoon is used for this. They know from experience that brass spoons or iron spoons are not suitable for this. Also, when taking out the lime pickle, only the amount needed by the family members for the meal is taken out at a time. They have seen from their experience that mixing water into salt and lime jar causes its shelf life to expire.



Fig 2. Rural kitchen in Sri Lanka

Source: Modified from: <https://www.istockphoto.com/photo/old-home-kitchen-in-sri-lanka-gm1128480728-297792985>



Fig 3. Village life in rural society in Sri Lanka

Source: Modified from: <https://www.istockphoto.com/photo/old-home-kitchen-in-sri-lanka-gm1128480728-297792985>

6. Scientific Approach

Lime fruit (*Citrus aurantifolia*), a member of the citrus family is one of the most widely grown Sri Lankan tropical fruit crops, where it maintains high consumer demand throughout the year (Liyanage, 2020). The extent and production of limes in 2023 were 8,800 ha, and the yield was recorded as 280,813 (Department of Census and Statistics, 2024). The crop grows well in both Badulla and Monaragala in the dry and intermediate zones of Uva province, Maho, Galgamuwa, and Ehetuwewa in Northwestern province as well as Thirappane, Nochchiyagama, and Thuruwila in North Central province, like medium-scale fields or as a fence a barrier for wild elephants or in home gardens. Lime fruits play a special role in the culinary, medicine, and food processing industries, with lime juice being especially valued for its strong sour flavor and aroma, as a key ingredient in Sri Lankan cuisine. Nutritionally, lime is rich in carbohydrates, fiber, antioxidants, water, and vitamin C, with functional components including phenolics, linonoids, flavonoids, and polysaccharides that contribute to its health benefits (Kandegama, 2021). Lime peel is also used in East Asia and China essential traditional herbal medicine for its antioxidant, antibacterial, anti-inflammatory, and anti-tumor values (Kurbett & Khyadagi , 2022).

However, lime is a highly perishable fruit due to the high moisture content, making it prone to spoilage caused by insects, bacteria, and fungi (Suherman, et al., 2020). Notably, significant postharvest losses of limes result from weight loss and physical damage, largely due to improper handling. Therefore, to address these challenges and extend the usability of excess mature limes harvested during peak

seasons, ancient people used lime pickling, or *lunu dehi*, which has emerged as a valued preservation method. Nonetheless, indigenous and traditional Sri Lankan fermented foods, inherited and unique traditions continued from several thousands of years up to now and are often referred to as the “king of pickles,” rely on fermentation, a natural preservation method with deep cultural significance.

Accordingly, our ancient people have used several steps in the process of lime pickling, involving selecting properly mature limes, cleaning and cutting into quarters equally upside-down lime fruits, hot water blanching before drying, proper salting, and ensuring a slow drying technique throughout the process to ensure effective preservation. However, they used those traditional methods only from their own knowledge inherited from generations without understanding any scientific background. Therefore, this study details each step and the associated techniques of lime pickling, emphasizing its role in food preservation, cultural heritage, and extending the shelf life of lime fruits.

Lime pickling technology involves creating an environment that inhibits microbial growth and enzymatic activity to enhance shelf life and maintain the quality of fruits. Limes are naturally acidic fruits due to containing citric acid, and the process typically involves adding salt may increase the extraction of juice and acids from the lime tissues, intensifying the acidic environment. Further, salt creates a low water activity environment, making it difficult for microorganisms, of bacteria, molds, and yeasts, to grow further (Mani, et al., 2017). These techniques not only preserve fruit but also improve its flavor enhancement and develop the distinct sensory profiles characteristic of pickles. The combination of the antimicrobial action of lime with controlled storage conditions, lime pickling, effectively enhances the usability of seasonal fruits.

6.1. Choose Mature But Not Ripe Limes at the Correct Maturity Stage

Citrus fruits, including limes, are non-climacteric, which do not continue to ripen further once harvested, so harvesting at the correct stage of maturity is essential to achieve optimal internal quality attributes such as acidity, soluble solids, and juice content (Lado, et al., 2015). For limes, this ideal stage is nearly fully maturity (90-95%), where the fruit exhibits proper color and size without progressing into over-mature stages that could affect texture and flavor. In lime pickling, maturity plays a crucial role in ensuring high-quality end products as immature limes lack adequate flavor and color, while over-mature ones risk becoming tough, fibrous, or soft (Gupta, et al., 2021). Basically, maturity in citrus fruits like limes can be determined by a complex of internal and external changes, including physical (color, size, shape, and hardness) and chemical (pH, acidity, and Total Soluble Solids (TSS)) parameters.

Based on that, according to the results of fruit harvest maturity time of days after fruit set (Table 1), lower fruit weight was recorded in immature lime fruit, typically containing less juice, making it harder and difficult to absorb the pickling solution effectively. Although within the time of fruit set, weight is increased, and in the over-maturity stage, again it begins to lose weight (see Fig. 4). Also, fruit hardness value (N) is decreased during the time of fruit set and its causes easier fruit fermentation during the pickling process (see Fig. 5). However, when increasing the maturation, the pH value is decreased and the TSS value is increased due to the increase of sugars, minerals, and organic acids (Champa, et al., 2022; Kandegama, 2021; Kandegama, 2021). Not only the obtained results of the colorimeter in terms of L-lightness, a-greenness, b-yellowness indicate the deterioration of peel greenness changes depending on the maturity time of days after fruit set and become fully yellow at the over-maturity stage due to the different contents of chlorophyll present at the different harvest stages. Accordingly, at the correct limes ripen stage, their acidity may decrease, compromising the preservation and safety of the pickles, and have already begun fermentation or rotting, introducing unwanted microorganisms or off-flavors to the pickles. Therefore, selecting fully mature limes with a firm texture and a greenish color featuring up to 30% yellow patches ensures better quality for pickling and other culinary applications, blanching desirable flavor, color, and consistency.

Table 1. Physicochemical properties of lime fruit during its different growth and development stages

Lime sample	Parameter						
	Weight (g)	Total Soluble Solid content (TSS) %	pH value	Hardness (N)	Peel Color		
					L (Lightness (0=black, 100=white))	a (-a=greenness, +a=redness)	b (-b=blueness, +b=yellowness)
A	36.2±0.4	6.9±0.0	1.96±0.1	90.03±0.7	36.1±0.2	22.4±1.3	27.1±0.3
B	43.0±0.1	6.9±0.1	2.19±0.0	79.63±0.6	43.5±0.5	19.4±0.4	31.1±0.2
C	44.3±1.0	7.2±0.1	2.17±0.0	76.18±1.1	48.2±0.3	19.5±0.4	33.4±0.4
D	53.0±0.1	7.5±0.0	2.16±0.0	70.0±0.2	53.3±0.1	19.2±0.4	34.1±0.1
E	53.7±0.0	7.4±0.1	2.17±0.1	68.60±0.7	58.5±0.8	21.3±1.1	34.8±0.1
F	54.6±0.0	7.4±0.0	2.16±0.0	68.60±0.0	69.6±0.4	20.2±0.2	36.2±0.2
G	52.5±0.1	7.6±0.0	2.18±0.1	68.1±0.3	71.3±0.9	9.4±0.0	42.2±0.2
H	46.2±0.0	7.9±0.0	2.21±0.1	40.9±0.8	76.1±0.3	9.0±0.1	37.3±0.2

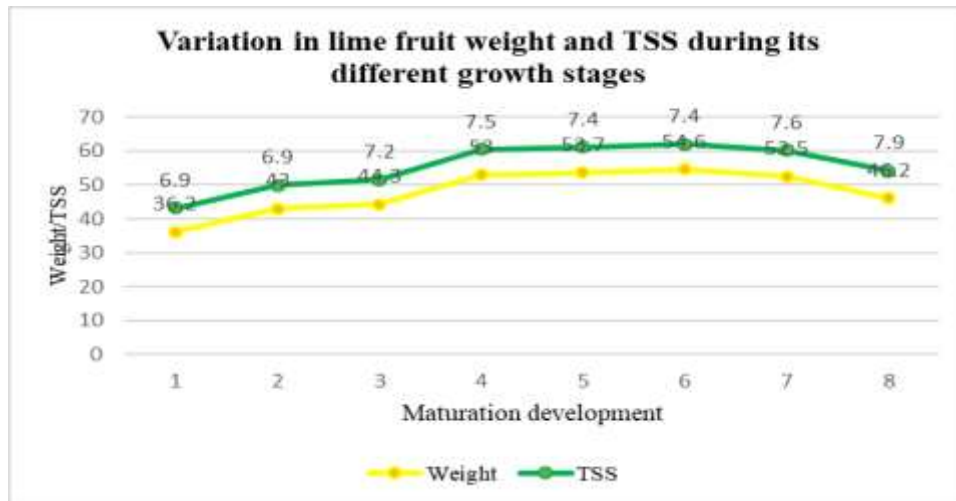


Fig 4. Variation in lime fruit weight and TSS during its different growth stages

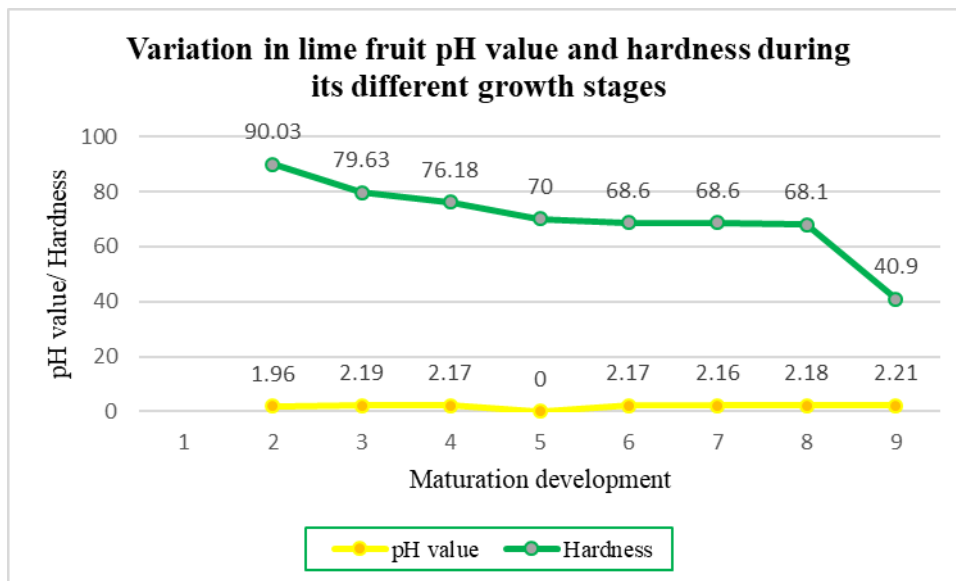


Fig 5. Variation in lime fruit pH value and hardness during its different growth stages



Fig 6. Variation in lime fruit size and peel color during its different growth and development stages

6.2. Lime is Cut into Four Quarters Equally and Should Not Be Separated at the Base

Accordingly, fully mature fruits are taken to prepare lime pickle, and properly cleaned fruit should be cut into four quarters as shown in Fig. 7, in such a way that it should not be separated from each other, attached at the base (Champa, et al., 2022). Since cutting the lime into quarters without separating exposes more surface area, which facilitates better absorption of salt, spices, and other pickling agents into the lime, and this promotes a more uniform and faster pickling process (see Fig. 9). It can be scientifically proven based on the indicated results of moisture content determined by the oven dry method (Table 2), sun-dried, un-separated, quarterly-wise cut lime pieces recorded low water activity compared (see Fig. 10) to separated lime pieces (see Fig. 11). Further, an un-separated sun-dried sample with low water content helps in preserving the fruit by creating an environment unfavorable for microbial growth as well. Not only that, un-separated cut fruit also easier to handle the limes during mixing, turning, and packing into jars and more visually appealing in the final product.



Fig 7. Un-separated quarterly wise cut lime fruit pieces



Fig 8. Separated quarterly wise cut fruit pieces

Table 2. Moisture content of sun-dried un-separated quarterly wise cut lime pieces versus separated quarterly wise cut lime pieces.

Sample	Moisture content of sun-dried un-separated quarterly-wise cut lime pieces (%)	Moisture content of sun-dried, separated, quarterly-wise cut lime pieces (%)
Treatment 1	13.63±0.1	16.51±0.5
Treatment 2	14.08±0.1	16.55±0.0
Treatment 3	13.29±0.2	15.52±0.5

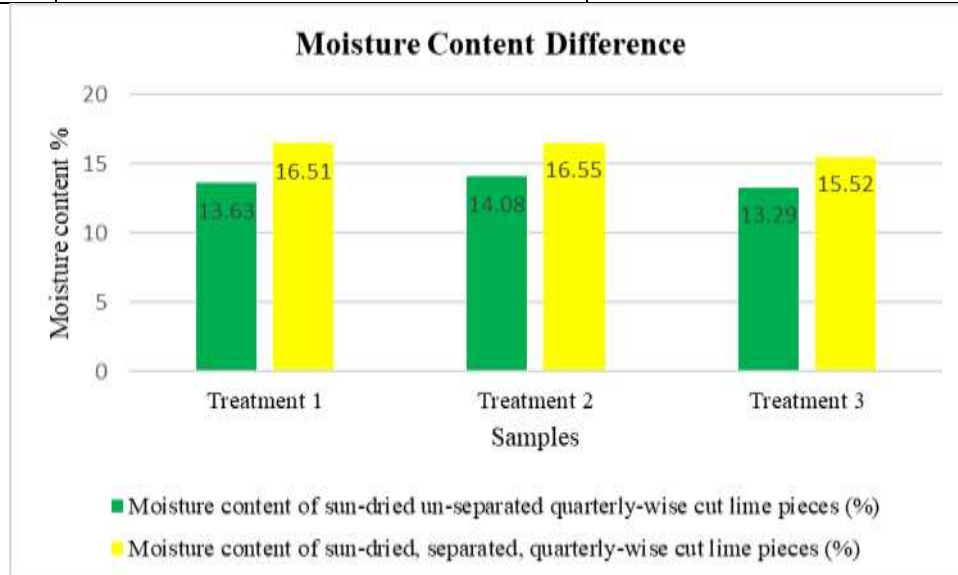


Fig 9. Moisture content of sun-dried un-separated quarterly wise cut lime pieces versus separated quarterly wise cut lime pieces

6.3. Short-Time Heat Treatment Application (Quick Boiling)

Most fruits and vegetables undergo enzymatic changes during maturation that influence their color and flavor. These changes may become extensive when food surfaces are cut and exposed to air and continue during drying and storage unless the enzyme activity is controlled further. Therefore, blanching as a pretreatment is a short-time heat-treatment generally applied to lime fruits prior to the drying process in the lime fermentation. The hot water blanching facilitates the inactivation of enzymes that cause spoilage, loosens tissues (cell walls), and easy to better absorb lime and brine into the food matrix. Simultaneously, it avoids surface contaminants and reduces the microbial load, creating a more favorable environment for pickling. Notably, rapid removal from hot water ensures minimal thermal degradation of nutrients and preserves the crispness of the product and maintaining the quality and sensory attributes of lime-pickled products while ensuring food safety and extended shelf-life as well (Putnam, 1914; Tunde-Akintunde, et al., 2011).

6.4. Salt Concentration and Fermentation

In the traditional lime pickle preparation, ancient salt has been used to serve as a key agent in fermentation and preservation. Sodium chloride (NaCl) not only increases the taste but also reacts a vital role in controlling water activity and maintaining an optimal pH range for fermentation which salt inhibits microbial growth by plasmolysis or water is drawn out of the lime tissues by osmosis due to the higher concentration of salt outside the cell and makes an environment to decrease the microbial growth for most bacteria, molds, and yeast require water to thrive (Mani, et al., 2017). Accordingly, salt should be added into 4:1 ratio for the quarterly cut of pre-treated lime fruits (Sagarika, 2016). Based on the results mentioned in Table 2, the water content of sun-dried lime samples clearly shows that the lime fruit cutting method, as well as the ratio of added salt, is key factors for minimizing the water content of the final product. In addition, the preparation techniques vary among Sri Lankans, incorporating ingredients such as vinegar and a variety of spices used to improve the flavor, and contributing to the product's shelf life and sensory qualities as well.



Fig 10. Sun-dried un-separated quarterly wise cut lime fruit pieces



Fig 11. Sun-dried separated quarterly wise cut lime fruit pieces

6.5. Sun Drying and Burning Technique

The traditional dehydration method as sun drying, is used in Sri Lanka to reduce the water content in food matrices that leads to the retardation of microbial growth. Accordingly, the salted lime fruit should be sun-dried, and it needs to be taken few days with abundant sunlight throughout the day, and it can be confirmed when the fruit pieces will not let any juices come out when properly dried, and the salt should have been melted and absorbed (Champa, et al., 2022). However, conventional drying methods that react to high-intensity sunlight often result in nutrient degradation, flavor alterations, and uneven drying. Although slow drying techniques minimize exposure to extreme temperatures and ultraviolet radiation, since preserve essential nutrients, volatile oils, and natural pigments. Also, slow drying promotes uniform moisture removal and retains higher concentrations of vitamin C, phenolic compounds, and antioxidant capacity compared to traditional methods. Additionally, the controlled drying process reduces the risk of microbial contamination and rancidity as well as ensuring the quality and nutritional integrity of the final product (Samaradiwakara, et al., 2023).

Not only that, in lime pickling, lime fruits are fermented in clay pots instead of aluminum pots, as aluminum reacts with acids and salt, releasing aluminum ions into the pickle, which can pose health risks and alter the flavor, but also the absence of chemical reactions in clay ensures the preservation of vitamins, antioxidants, and minerals in the lime. Nonetheless, the use of clay pots in lime pickling not only results in a product with superior nutritional quality, including higher antioxidant levels, but also eliminates health risks associated with aluminum leaching.

Accordingly, the process of lime pickling, from selecting properly mature limes, brining, and fermenting them, plays a critical role in ensuring a high-quality product. Quarterly cutting lime fruits and proper salting and brining reduce spoilage by inhibiting microbial growth, while fermentation develops complex flavors. Short-time hot water blanching before drying helps save some of the vitamin content, sets the color, hastens drying by relaxing the tissues, and helps prevent undesirable changes. Furthermore, ensuring a slow drying technique throughout the process stages allows for consistent texture and taste, maximizing the value and appeal of lime pickles. By following these technologies precisely, lime pickling can be optimized for both commercial production and home preservation, delivering a healthy, long-lasting food product and enjoyed year-round, especially in off off-season (Yalman, 1962).

7. Discussion and Conclusion

- As a non-climacteric fruit, after harvesting, limes are not continuing to ripen further. The correct maturity stage at harvesting is important to achieve optimal internal quality attributes such as acidity, soluble solids, and juice content. The most relevant stage is nearly full maturity (90-95%), where the fruit shows proper color and size without making it into over-mature stages that could affect texture and flavor. Although immature limes lack adequate flavor and color, while over-mature ones risk getting tough, fibrous, or soft. The maturity of limes depends on internal and external changes, including physical and chemical parameters. Selecting fully mature limes with a firm texture and vibrant green color with up to 30% yellow patches ensures the best quality for pickling and other culinary applications (Table 1 and Fig. 6).
- The above analysis suggests that both areas of traditional to prepare lime pickle, fully mature fruit should be cut into four quarters without separation, allowing better absorption of salt, spices, and other pickling agents. Un-separated quarters with low moisture content, sun-dried, and low moisture content can preserve the fruit and make it easier to handle during mixing, turning, and packing into jars. This method promotes a uniform and faster pickling process (Table 2 and Fig. 7).
- Enzymatic changes in fruits and vegetables cause color and flavor, leading to spoilage. Blanching is a short-term heat-treatment applied to lime fruits before drying for fermentation purposes and inactivates spoilage enzymes, loosens tissues, and enhances absorption of lime and brine. It causes to avoidance of surface contaminants and reduces microbial load, preserving product crispness and quality.
- As an essential agent of salt in traditional lime pickle preparation, it controls water activity and maintains an optimal pH range. Notably, It increases taste and avoids microbial growth. A 4:1 salt-to-water ratio is recommended for quarterly cut pre-treated lime fruits. The cutting method and salt ratio are key factors in minimizing moisture content, and vinegar and spices were added in the pickle preparation for flavor and shelf life.
- Salted limes need to be sun-dried for three days with abundant sunlight to prevent microbial growth and to avoid exposure, extreme temperatures and ultraviolet radiation, preserving essential nutrients, volatile oils, and natural pigments. The slow drying technique was followed further. Also, slow drying react to get uniform moisture removal and retain higher concentrations of vitamin C, phenolic compounds, and antioxidant capacity. Specifically, in the lime pickling in clay pots, preserves vitamins, antioxidants, and minerals without releasing aluminum ions, reducing health risks and ensuring the superior nutritional quality.

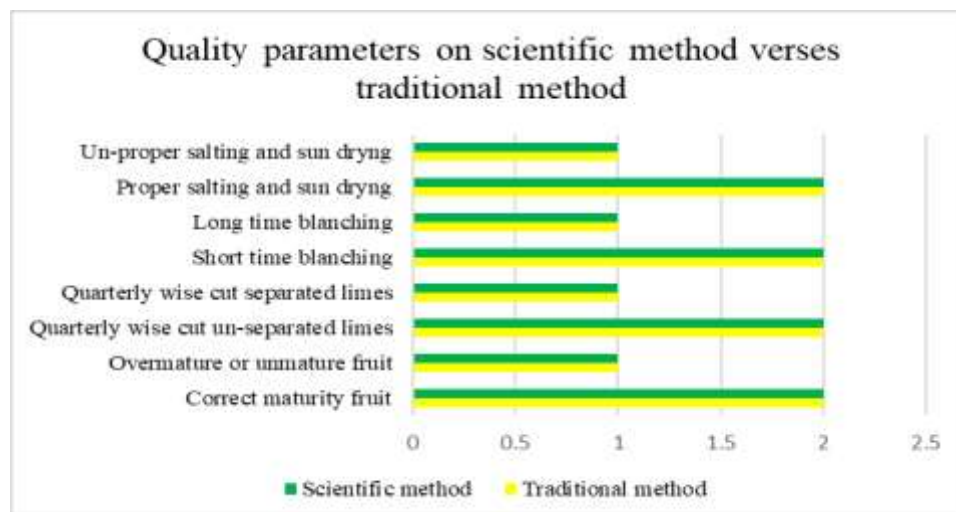


Fig 12. Quality parameters on scientific method verses traditional method in the lime pickling process

The process of lime pickling includes selecting mature limes, brining, and fermenting them to ensure a quality product and proper salting, brining, and fermentation decrease spoilage and enhance complex flavors. Short-time blanching and slow drying techniques maximize the value and appeal of lime pickles, making them suitable for commercial and home preservation. Knowledge and science are mostly similar. Although the Sri Lankan rural people did not know the scientific reasons, their life experiences were sufficient for that. They also took steps to carry forward that knowledge through tradition. This is because traditional knowledge was part of that culture. It is also clear that there is a scientific truth in every aspect of the work of traditional lime pickle production (*lunu dehi*) that Sri Lankan rural women pay attention to (see Fig. 12). Important points here are the selection of limes, never allowing a drop of water to mix, cutting the lime into equal quarters, filling with salt cubes, steaming in the sun at different temperatures, packaging, storing, preservation, and protection, as well as the method used.

8. Statements and Declarations

8.1. Ethics Approval and Consent to Participate

Not applicable

8.2. Consent for Publication

Authors provide consent for the publication of the manuscript information.

8.3. Availability of Data and Materials

All data analyzed during this study are included in this research paper.

8.4. Competing Interests

The authors declare that they have no competing interests.

8.5. Funding Source

The study was conducted with personal commitments to research design, data collection and data analysis, and writing the manuscript for publication.

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