Utilization, Preparation and Quality Assessment of Fruit Leather made from Huani (Mangifera Odorata) Fruit

Maria Cathie Q. Aljas

Assistant Professor, Department of Industrial Technology-Food Technology, Zamboanga Peninsula Polytechnic State University

Abstract
The *Mangifera odorata* fruit, commonly known as Huani mango in the Philippines, is an underutilized *Mangifera* species in the Philippines, particularly in the Zamboanga Peninsula. This study aimed to enhance the value of Huani mango by developing two different preparations and assessing their consumer acceptability and quality. Two treatments were produced: Treatment 1 (T_1) and Treatment 2 (T_2). Fresh, ripe Huani fruit were pureed with citric acid and sugar, partially cooked, and then dried in a food dehydrator at 63-68°C for 6 hours. Sensory evaluation indicated that the Huani leathers from T_1 and T_2 did not differ significantly ($p<0.05$) in terms of appearance, aroma, flavor, and chewiness. However, there were significant differences ($p>.05$) in sweetness and overall acceptability, with T_1 being preferred. Physico-chemical analyses showed that both treatments had low moisture content, pH, and water activity. Proximate analyses revealed that the Huani leathers were high in carbohydrates and energy but low in crude protein and crude fat. Both treatments were within the safe limits for yeast and mold counts and aerobic plate counts. A storage study of the Huani leathers is therefore recommended.

Keywords: Huani fruit, Frut leather, Utilization, Product Development, Quality Assessment

1. Introduction

Fruit leather is a Type of confectionery made from dehydrated fruit, sometimes referred to as bars, slabs, or strips. These are naturally low in fat and abundant in carbs, chewy and tasty snacks or desserts. They pack comfortably, are lightweight, and are simple to store. Most fruits are appropriate for this kind of processing, which involves dehydrating fruit purée until it forms a cohesive "leather" [1].

The Carabao mango, also known as the Manila super mango, is the most widely used raw material in the Philippines for the production of fruit leathers, bars, slabs, and strips. As discussed by Kasnakoglu [2], the Carabao mango is regarded as one of the best and sweetest mango kinds worldwide. The physical-chemical features of mango leather have been the subject of numerous research, including those on its sorption-isotherm [3], dehydration of mango pulp [4], and alterations in its chemical, textural, and sensory characteristics [5]. On the other hand, a lesser-known species of *Mangifera*, called "Huani" (*Mangifera odorata*), exists. Huani, known for its intense, earthy aroma and slightly fibrous flesh, is often referred to as the durian mango [6]. Although many people in the Philippines may not be familiar with Huani, it has long been grown on the southern coast of Mindanao, particularly in Zamboanga City. Huani is considered a seasonal and highly perishable fruit due to its short storage period, which prevents it from reaching major supermarkets across the country. The peak season for Huani occurs from April to July, during which time the price of the fruit drops significantly. Unfortunately, some mature fruits are left to overripe, rot, and go to waste.

Therefore, developing low-cost processing technology for Huani is crucial to utilize the fruit and prevent spoilage. The preparation of Huani pulp into fruit leather presents a promising opportunity. Dehydrated fruit processing is gaining importance due to the long shelf-life, lightweight nature, improved handling during export, and variety it offers to consumers. Dehydration significantly reduces the moisture content, preventing the growth of microorganisms like molds and fungi, thus preserving the food for extended periods. This makes fruit leather a shelf-stable and appealing product for consumers. Thus, this encourages the researcher to produce a shelf-stable and acceptable product which is fruit leather.

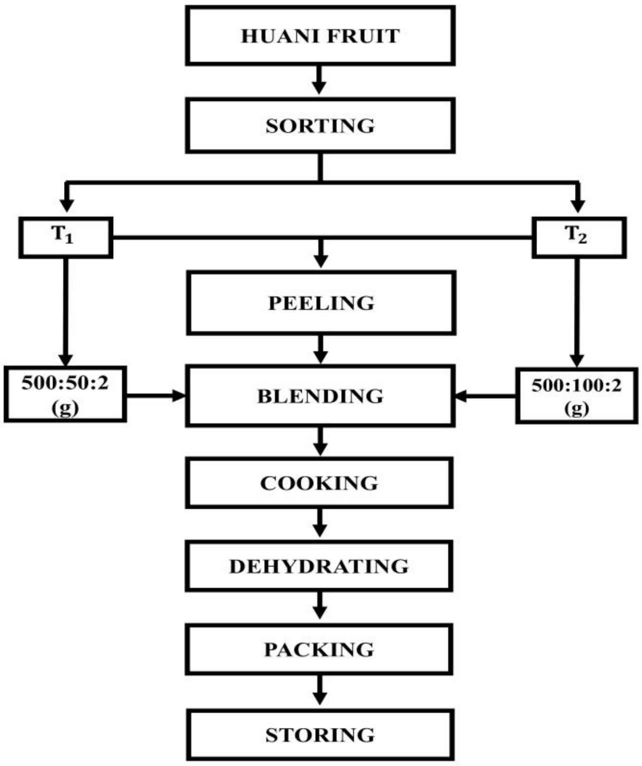
2. Materials and Methods

2.1 Procurement of Raw Material

Fresh, mature Huani fruits were harvested in Barangay Cawit, Zamboanga City. These fruits were then transported to the Food Technology Laboratory at Zamboanga Peninsula Polytechnic State University, also located in Zamboanga City, for product formulation. The fruits were allowed to ripen naturally before further processing.

2.2 Formulation of Huani Fruit Leather

Figure 1: Process Flow Chart of Huani Leathers in Treatment 1 and Treatment 2



Ripe Huani fruits were selected for product formulation and sorted into two groups: T_1 (Treatment 1) and T_2 (Treatment 2). Fresh ripe Huani was peeled and pulp was sliced using a stainless-steel knife. Ingredients were added such as sugar and citric acid. These were pureed following the formulation ratio proportions 500:50:2 g for T_1 and 500:100:2 g for T_2. Following the cooking method as discussed by Raab and Oehler [7], the cold break method for T_1 was used. In this method, Huani fruit is first pureed and then cooked in a boiler for 10 minutes. For T_2, hot break method was used. In the hot break method, pieces of chopped Huani fruit were steamed for 15 minutes, cooled and pureed. Then, the 400 g of puree in each treatment was poured and spread evenly on the aluminum trays. These were subsequently dried in an oven at 63-68ºC for 6 hours or until 15% moisture content (MC) is achieved. The fruit leathers were removed in the oven and will be sliced and packed with wax paper.

2.3 Sensory Evaluation of Huani Leather

A consumer's test was employed for the sensory assessment of Huani leathers from two (2) distinct treatments. ZPPSU panelists totaling fifty (50) assessed the product. One quality scoring score sheet per treatment was provided to each panelist on a separate piece of paper. For the T_1 and T_2, samples were given to them. They were told to rate the fruit leathers' sensory qualities based on appearance (color), aroma (specific Huani aromas), flavor (specific Huani flavors), sweetness, chewiness, and general acceptability.

2.4 Physico-chemical and Proximate Analysis

Tests for the presence of moisture content (MC), water activity (Aw), potential hydrogen (pH), crude protein, crude fiber, crude fat, crude ash, and total carbohydrates were conducted at ZPPSU, Food Technology Laboratory.

2.5 Microbiological Analysis

Following the Food and Drug Administration's Bacteriological Analytical Manual (BAM) [8], the microbiological analysis for the Huani leathers was conducted at ZPPSU, Food Technology Laboratory.

3. Results and Discussions

3.1 Formulation of Huani Fruit Leather

Ripe and fresh Huani fruits were brought to Zamboanga Peninsula Polytechnic State University, Food Technology Laboratory to be used in the product's formulation. The Huani fruits were carefully collected and then allowed to naturally ripen. The formulation for the Huani fruit leathers was developed by trial-and-error process, which is sometimes referred to as the one-factor-at-a-time approach [9]. Two treatments variations, denoted as T_1 (Treatment 1) and T_2 (Treatment 2), were prepared.

Table 3.1: Formulation of Huani Leathers

Ingredients	Formulation (g)		Formulation (%)	
	T_1	T_2	T_1	T_2
Hunai Pulp	500	500	90.58	83.06
Sugar	50	100	9.02	16.61
Citric Acid	2	2	0.40	0.33

Total	552	602	100	100

Making fruit leather generally entails puréeing fruit, either with or without extra ingredients, then combining and drying [10]. The Huani fruit leathers used in this study were made with the addition of sugar and citric acid. The two treatments were prepared using the techniques outlined by Raab Oehler [7]. For T_1 (Treatment 1), the cold break method was used. The fruits were sliced into pieces and blended at an appropriate speed for approximately 3-5 minutes. The puree was then placed in a double boiler and cooked for 20 minutes at a temperature of 70°C. For T_2 (Treatment 2), the hot break method was employed. The fruits were sliced and placed in a double boiler to prevent scorching and cooked for 15 minutes before being pureed in a blender at an appropriate speed and time (approximately 3-5 minutes).

Fruit leathers can be prepared without any preservatives [5]. However, in this study, sugar and citric acid were added to the Huani leathers. Research on fruit leather has demonstrated that fruit puree can be combined with other components, including sugar, to improve the product's flavor, texture, and color. Additionally, popular ingredients like ascorbic acid and citric acid can be added to preserve color and control the pH, while honey, cinnamon, chopped nuts, and coconut can serve as flavor enhancers.

3.2 Percent Yield Recovery of Huani Leathers

The Huani fruits used in this study were mature and underwent natural ripening process, as described by Bompard [11]. A total of 4 kg of Huani fruits were used in each treatment. The fruits were peeled, and the pulp was sliced to remove the seeds. The total waste of the fruits, including the peel and seeds, was 40% for 47.5% for T_2. A total of 60% pulp was recovered for T_1 and 52.5% for T_2. In addition, 10% sugar and 0.3% citric acid were added for T_1, while 19% sugar and 0.3% citric acid were added for T_2. The percent yield recovery of Huani leathers in each treatment was computed using the formula provided by [12]. The total weight of fruit leathers was divided by the weight of the puree. The average percent yields recovery of Huani leather in each treatment in this study is presented in Table 3.2.

Table 3.2: Yield Recovery of Huani Leather

Treatment (Samples)	Weight of Huani Fruits (g)	Weight of Waste (g)	Weight of Pulp (g)	Weight of Sugar (g)	Weight of Citric Acid (g)	Yield Recovery (%)
T_1	4,000	1,600	2,400	250	8	42.4
T_2	4,000	1,900	2,100	400	8	55

Singh [13] reported that different treatments significantly affect the yield recovery of guava and papaya leather. In their study, Singh [14] observed that the maximum yield recovery (29.18%) was obtained with 100% guava pulp, while the minimum yield recovery (24.07%) was observed in papaya fruit leather. In this study, a yield recovery of 42.20% was obtained for T1, while T2 achieved a higher yield recovery of 55%. The addition of sugar in T1 (50 g per 500 g of pulp) impacted the total yield recovery of Huani leather, resulting in a lower yield compared to T_2. The increased amount of sugar in T_2 (100 g per 500 g of pulp) contributed to a higher yield recovery. This suggests that the sugar content plays a significant role in determining the yield of fruit leathers, likely due to its influence on the texture, sweetness, and overall mass of the final product.

3.3 Sensory Quality of Huani Leathers

The general quality of the fruit leathers was presented in Table 3 for T_1 and Table 4 for T_2. A total of fifty (50) consumer panelists evaluated the Huani leather product in T_1 and T_2 and using a 5-point rating scale.

Table 3.3: General Sensory Quality of the Huani Leather in Treatment 1 (n=50)

Scaling					
Sensorial Parameters	**Highly Acceptable (%)**	**Acceptable (%)**	**Moderately Acceptable (%)**	**Slightly Acceptable (%)**	**Not Acceptable (%)**
Appearance	43.50	47.50	9	0	0
Aroma	37.50	55	17.50	0	0
Flavor	50	25	25	0	0
Sweetness	42.50	32.50	25	0	0
Chewiness	45	17.50	2.50	15	0
General Acceptability	35	50	15	0	0

Table 3.3 demonstrates that most participants gave the product high approval ratings for flavor (50%), sweetness (42.50%), and chewiness (50%). Conversely, the participants rated the appearance (47.50%), aroma (55%), and general acceptability (50%) as acceptable, in that order.

Table 3.4 shows the general sensory quality of Huani leather in T_2. As observed in the table the majority of the panelists rated the sensory parameters in T_2 as acceptable with a rating of appearance (55%), aroma (62.50%), flavor (55%), sweetness (42%), and general acceptability (52.5%) with the exemption of sweetness which is (47.50%) as moderately acceptable. On the other hand, some of the panelists rated the product in T_2 in terms of aroma and sweetness as slightly acceptable (2.5%).

Table 3.4: General Sensory Quality of the Huani Leather in Treatment 2 (n=50)

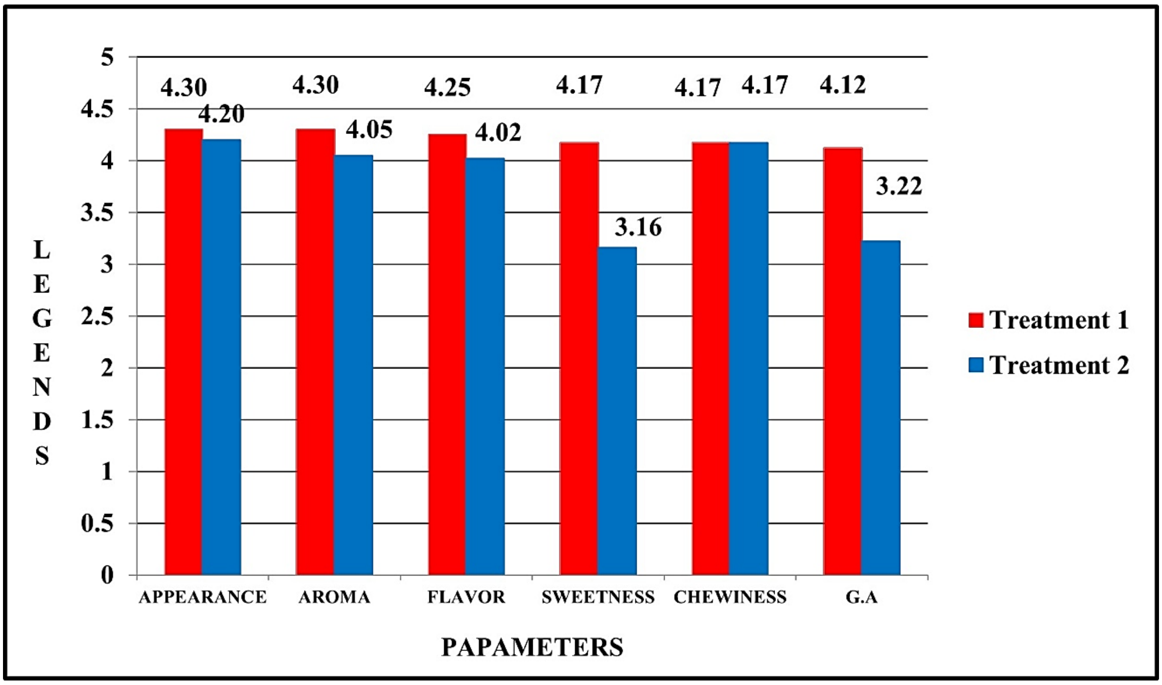
Scaling					
Sensorial Parameters	**Highly Acceptable (%)**	**Acceptable (%)**	**Moderately Acceptable (%)**	**Slightly Acceptable (%)**	**Not Acceptable (%)**
Appearance	25%	55%	25%	0%	0%
Aroma	20%	62.50%	10%	2.5%	0%
Flavor	25.50%	55%	19.50%	0%	0%
Sweetness	10%	42.5%	47.5%	0%	0%
Chewiness	42.5%	40%	12.5%	2.5%	2.5%
General Acceptability	0%	52.5%	47.50%	0%	0%

Comparing the results in Tables 3 and 4, it can be seen that the sensory qualities of Huani leather in T_2 (Treatment 2) were rated lower than the T_1 as highly acceptable. The majority of the Huani leather in T_1 was rated as highly acceptable in terms of flavor, sweetness, and chewiness. On the other hand, panelists rated the product in T_1 as acceptable in all sensory quality parameters.

3.4 Sensory Analysis of Huani Leathers

Huani leathers are delicious as toppings, nibbles, or desserts. To assess the acceptability of Huani Leathers prepared by utilizing two different formulations, T_1 and T_2 a consumer-type sensory study was carried out. Key sensory aspects such as appearance (color), aroma (characteristic Huani aroma), flavor (characteristic Huani flavor), sweetness, chewiness and general acceptability were the focus of the evaluation.

Figure 3.1: Summary Mean Score Results of Huani Leathers



From the analysis, it is evident that T_1 achieved higher mean scores across all sensory attributes compared to T_2, including the overall acceptability of the product. Notably, the sweetness in T_2 contributed significantly to its general acceptability. According to Perera [15], general acceptability typically correlates with all sensory attributes if food products. However, T_1, formulated with 50 g of sugar and 2 g of citric acid, emerged as the most preferred in all sensory attributes, suggesting that this combination was favored by the respondents.

To confirm whether the differences in mean scores between the treatments were statistically significant, a t-test with a 95% confidence level was conducted using SPSS software. For a two-tailed t-test, the p-value should be less than 0.05, indicating a significant difference at the 5% confidence level [16]. The results revealed a significant difference ($p<0.05$) between T_1 and T_2 in terms of sweetness and general acceptability. However, the fruit leathers produced from both treatments did not differ significantly ($p>0.05$) in terms of appearance, aroma, flavor and chewiness.

Overall, the findings indicate that T_1 (Treatment 1) was the preferred choice among the panelists for the general acceptability of Huani leathers, highlighting the importance of the sugar and citric acid combination in enhancing the product's appeal.

Table 3.5: Summary Mean Scores and *t*-test of the Sensory Evaluation of Huani Leathers

Sensory Parameters	Mean Scores			
	T_1 (Treatment 1)	T_2 (Treatment 2)	P-value ($\alpha = 0.05$)	Remarks
Appearance	4.30	4.20	0.06	Not Significant
Aroma	4.30	4.05	0.07	Not Significant
Flavor	4.25	4.02	0.18	Not Significant
Sweetness	4.17	3.16	0.00	Significant
Chewiness	4.17	4.17	1.00	Not Significant
General Acceptability	4.30	4.20	0.06	Not Significant

Note: Legends = 5 – Highly Acceptable; 4 – Acceptable; 3 – Moderately Acceptable, 2 – Slightly Acceptable; 1 – Not Acceptable

3.5 Physico-chemical and Proximate Analysis of Huani Leathers

The physico-chemical and proximate analysis results for Huani fruit leathers are shown in Table 6, with particular attention paid to moisture content (MC), water activity (Aw), and potential hydrogen (pH). The results show that fruit leathers with low moisture content were produced by both T_1 and T_2. Higher temperatures and longer drying times can be used to produce fruit leathers with a reduced moisture content, according to Man [17]. The findings show that the fruit leathers' moisture content from both treatments satisfies the requirements established by the Philippine National Standards/Bureau of Food and Drugs [18]. The potential hydrogen (pH) levels of Huani leathers in both T_1 and T_2 decreased during processing. This decrease in pH was attributed to the addition of citric acid to the fruit leather puree, a phenomenon similarly observed by Nayak [19] in Guava leather and [20] in Indian mango leather. Additionally, the drying process concentrates the natural acidity present in the fruits, further lowering the pH.

Fruit leathers with high acidity (low pH) have a benefit since it prevents bacteria from growing, which guarantees the product's safety. Furthermore, as noted by Karki [21], it aids in maintaining the fruit's flavor and color, enhancing the overall quality and appeal of the finished product. Huani leathers have regulated acidity, which prolongs their shelf life while preserving their sensory qualities and increasing customer appeal.

Table 3.6: Physico-chemical and Proximate Analysis of Huani Leathers

Treatments	Parameters							
	pH	a_w	MC (g/100g)	Crude Protein (g/100g)	Crude Fat (g/100g)	Crude Ash (g/100g)	Carbohydrates (g/100g)	Energy (g/100g)
T_1	4.36	0.65	7.50	1.00	0.16	2.29	88.69	365.24
T_2	4.69	0.70	8.20	0.89	0.23	2.14	87.18	354.79

The nutritional profile of Huani leathers was evaluated through a series of proximate analyses, assessing moisture content, crude protein, crude fat, crude fiber, crude ash, and total carbohydrates to provide a comprehensive understanding of the product's qualities. For T_1 the analysis revealed a moisture content of 7.50 g, crude protein content of 1.0 g, crude fat of 0.16 g, and crude ash of 1.39 g. The total carbohydrate content was found to be 88.69 g, contributing to a total energy value of 365.24 kcal.

In contrast, T_2 showed a slightly higher moisture content of 8.20 g, with crude protein at 0.89 g, crude fat at 0.23 g, and crude ash at 2.14 g. The carbohydrate content in T_2 was 87.18 g, resulting in a total energy value of 354.79 kcal.

The crude protein content in both treatments decreased during the processing of the Huani leathers. This reduction can be attributed to protein denaturation or changes during the drying process. The denaturation may have caused the release of amino acids, which could then react with other compounds via Mallard reactions, as noted by Di Scala et al. [22].

Additionally, the analysis revealed low crude fat content in both treatments. Barbosa et al. [23] reported that fresh raw Huani contains approximately 1.22 g of crude fat, and the observed decrease in crude fat content in the leathers is likely due to enzymatic hydrolysis during drying or lipid oxidation caused by thermal treatment Perera [15]. This reduction in crude fat content is beneficial for extending the shelf life of the product by reducing the likelihood of rancidity.

The ash content observed in the fruit leathers was a result of moisture removal, which correlates with an increase in dry matter content, as reported by Riftyan et al. [24]. Higher ash content in the fruit leathers indicates that the product is a good source of minerals, supporting findings by de Lumen et al. [25]. Furthermore, the elevated carbohydrate content in the leathers suggests they could serve as a substantial source of energy, making them a potentially valuable snack option.

3.6 Microbiological Analysis of Huani Leathers

The microbial count results for the Treatment 1 and Treatment 2 of the Huani leathers are presented in Table 7. The data indicates a minimal presence of microorganisms across all three treatments. This low microbial count can be attributed to several factors.

Table 3.7: Microbiological Analyses of Huani Leathers

Parameters	**Treatments**		**Standards***
	T_1	**T_2**	
Yeast and Molds Count (YMC)	< 1 cfu	< 1 cfu	100 cfu
Aerobic Plate Count (APC)	100 cfu	120 cfu	10,000 cfu

***Source: Food and Drugs Administration (2023)**

Huang et al. [26] suggest that the limited microbial presence in fruit leathers is likely due to the low moisture content (MC), low pH, or low water activity (Aw) of the product. These conditions create an environment that is less conducive to microbial growth, thereby enhancing the safety and shelf life of the Huani leathers.

4. Conclusions

The study aimed to develop and formulate fruit leather from Huani (*Mangifera odorata*) fruit to diversify innovative products, contributing to food sustainability and safety in the region. The acceptability of Huani fruit leather's appearance, aroma, flavor, sweetness, chewiness, and general accept ability was evaluated through sensory parameters. The sensory evaluation results indicated that both treatments were acceptable in terms of appearance, aroma, flavor, and chewiness. However, T_1 was the most preferred in terms of sweetness and general acceptability. T_1, containing 500 g of Huani pulp, 50 g of sugar, and 2 g of citric acid, was favored by the panelists. Both treatments produced fruit leathers with low moisture content (MC), water activity (Aw), and low potential hydrogen (pH), classifying them as low-moisture and acidic foods, which is typical of dried products. The proximate analyses revealed that the processing impacted the nutritional composition of the leathers. The fruit leathers from both treatments were low in fat and protein but high in fiber, carbohydrates, and energy. These findings suggest that despite a slight decrease in protein and crude fat, the increase in crude fiber, ash, and carbohydrates makes the fruit leathers nutritious.

References

1. Moyls, Drying of Apple Purees. Journal of Food Science 46 (3) (1981) 939–942.
2. Kasnakoglu H., FAOSTAT and COUNTRYSTAT: Integrated Global and National Food and Agriculture Statistical Databases, in: Proceedings of the xliii scientific meeting, Societa Italiana di Statistica, Universita di Torino, 2006, pp. 14–16.
3. Mir M. A., Nath N., Sorption isotherms of fortified mango bars, Journal of Food Engineering 25 (1) (1995) 141–150.
4. Narayana C., Rao D. S., Roy S. K., Mango Production, Postharvest Physiology and Storage, Tropical and Subtropical Fruits: Postharvest Physiology, Processing and packaging (2012) 259–276.
5. Azeredo H. M., Brito E. S., Moreira G. E., Farias V. L., Bruno L. M. Effect of Drying and Storage Time on the Physico-Chemical Properties of Mango Leathers, International Journal of Food Science & Technology 41 (6) (2006) 635–638.
6. Campbell R. J., The Potential of New *Mangifera* species in Florida, in: Proceedings of the Florida State Horticultural Society, Vol. 120, 2007, pp. 11–12.
7. Raab N. O. S. U. E. S., Oehler C. A, Making dried fruit leather, International Journal of Current Microbiology Applied Sciences (1999).
8. Manual B. A., Bam: Rapid Methods for Detecting Foodborne Pathogens, Food and Drug Administration US (2001).
9. Rao J., Ren R., Chen H., Liu X., Yu Y., Hu J., Zhou Y., Predictability of Stratospheric Sudden Warmings in the Beijing Climate Center Forecast System with Statistical Error Corrections, Journal of Geophysical Research: Atmospheres 124 (15) (2019) 8385–8400.
10. Diamante L. M., Bai X., Busch J., Fruit leathers: Method of Preparation and Effect of Different Conditions on Qualities, International Journal of Food Science 2014 (1) (2014) 139890.
11. Bompard J., *Mangifera odorata* griff, PROSEA: Plant Resources of South-East Asia, Edible Fruits and Nuts 2 (1992) 218–220.
12. Ball D. W., Key J. A., Introductory Chemistry, BC Campus, 2014.
13. Singh J., Tiwari B., Development of Nutritious Fruit Leather by Blending Guava and Papaya, International Journal of Current Microbiology Applied Sciences 8 (7) (2019) 813–820.
14. Singh L. J., Tiwari R., Ranjitha K., Studies on Effect of Different Packaging Materials on Shelf-Life of Blended Guava-Papaya Fruit Leather, European Journal of Nutrition & Food Safety 12 (8) (2020) 22–32.
15. Perera C. O. Selected Quality Attributes of Dried Foods, Drying Technology 23 (4) (2005) 717–730.

16. Hampton J., Closing the Yield Gap in Soybean (glycine max) with Combined Improved Management Practices, Master's thesis, Auburn University (2023).
17. Man Y. B. C., K. Sin K., Processing and Consumer Acceptance of Fruit Leather from the Unfertilized Floral parts of Jackfruit, Journal of the Science of Food and Agriculture 75 (1) (1997) 102–108.
18. P. N. Standards, Philippine National Standard, Recommended Code of Practice for the Processing and Handling of Dried Fruits, Philippine National Standards (2007).
19. Nayak S., Preparation and Storage Study of Guava Leather., Ph.D. thesis, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (2017).
20. Domingo C. J. A., Austria V. C., Preparation and Consumer Acceptance of Indian Mango Leather and Osmo-dehydrated Indian Mango, Asia Pacific Journal of Multidisciplinary Research 5 (3) (2017) 123–127.
21. Karki M. Evaluation of fruit leathers made from New Zealand Grown Blueberries, Ph.D. Thesis, Lincoln University (2011).
22. Di Scala K., Vega-Gálvez A., Uribe E., Oyanadel R., Miranda M., Vergara J., Quispe I., Lemus-Mondaca R. Changes of Quality Characteristics of Pepino Fruit (*Solanum muricatum* ait) during Convective Drying, International Journal of Food Science & Technology 46 (4) (2011) 746–753.
23. Barbosa I., Caballero K. P., Ledesma N., Sáyago Ayerdi S. G., García Magaña M. d. L., . Bishop von Wettberg E. J, Montalvo-González E., Changes in the nutritional quality of five *Mangifera* Species Harvested at Two Maturity Stages, Journal of the Science of Food and Agriculture 97 (14) (2017) 4987–4994.
24. Riftyan E., Ivoni M., Pato U., Johan V., et al., The Characterization and Sensory Assessment of Fruit Leather with a Combination of Puree Jicama and Pineapple, in: IOP Conference Series: Earth and Environmental Science, Vol. 1182, IOP Publishing, 2023, p. 012068.
25. de Lumen B. O., Thompson S., Odegard W. J., Sulfur Amino Acid-Rich Proteins in Acha (*Digitaria exilis*), a Promising Underutilized African Cereal, Journal of Agricultural and Food Chemistry 41 (7) (1993) 1045–1047.
26. Huang X., Hsieh F.-H., Physical Properties, Sensory Attributes, and Consumer Preference of Pear Fruit Leather, Journal of Food Science 70 (3) (2005) E177–E186.