UTILIZATION OF LOCAL WOODAPPLE VARIETIES FOR THE PRODUCTION OF CHUTNEY.

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AFFECTIONATLY DEDICATED TO

MY PARENTS

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ABSTRACT

Woodapple (*Feronia elephantum*) is an underutilized fruit resource in Sri Lanka with immense post harvest losses. The ripen woodapples are highly susceptible to fungal infection. The mature unripe fruits stand longer and the losses can be minimized if large quantity of them are utilized for processing.

Mature unripe fruits were processed into chutney with spices, sugar, salt and vinegar and the flavour qualities were evaluated.

Results obtained in the sensory survey, with commercially available chutney products, proved that the product is inferior in terms of taste, aroma and overall acceptability, except for texture, but not poor or unacceptable. Although there is room for improving its sensory properties, the cost and other advantages associated with the prepared product make this a viable technology for local small scale processors.

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CHAPTER 1

INTRODUCTION

Sri Lanka harbours a rich assortment of delicious tropical fruits. Some of such fruits grown in Sri Lanka, like Mango, Pineapple, Banana, Papaya are said to be of high quality in terms of flavours. Because of this high flavour qualities they fetch good prices at the exotic markets. Hence, the exportation of fruits, both in the form of fresh and processed, from Sri Lanka has now become an important source of foreign exchange. According to the Cental Bank Annual Report (1997), exportation of fruits accounts for 5% foreign exchange.

Apart from mango, pineapple, banana and papaya, there are some other delicious fruit resources in Sri Lanka unexploited or under-exploited. Tapping these fruit resources with suitable technologies, would give an impetus for the present fresh fruit export and processing industries. The farming communities will also be benefited, if the demand for fruits is elevated.

Woodapple (*Feronia elephantum* L.) is one such under-exploited tropical fruit in Sri Lanka. It is a delicious fruit commonly found or cultivated in southern and north-western areas of the island. Woodapple is also a very nutritious fruit. Among the fruits, they account for high content of protein (7.1 gram per 100 gram of edible portion). Further, it contains fair amount of vitamin-C, ß-carotene, Vitamin B complex and minerals. Beside these, they possess high amount of pectin.

Woodapple is indigenous to Sri Lanka and naturally found in Puttlam, Anuradapura, Polonnaruwa, Monaragala, Hambantota, Ampara areas. There is hardly any organized cultivation found in the island. Most of the fruits found at markets are either collected from trees naturally grown near the farm yards or from forests.

During the woodapple season, which falls between July to December, an immense quantity of fruits are wasted. This is because of the short shelf life inherent to them and fungal diseases. The shell of the fruit is more susceptible to fungal attack. These fungus colonize first the outer shell and eventually penetrate to the pulp of the fruit. Though there is a time lag between fungal colonization on shell to pulp, the colonization make the fruits no more appealing and deprive the usage of unaffected pulp. Nevertheless, the deterioration takes place very rapidly and fruits can not be stored longer than 7 to 9 days under normal conditions.

Presently, only a little quantity of woodapple is utilized to make woodapple jam, RTS drinks and to export. This is because, the geographical distribution of the woodapple trees and infrastructure limitations are such that the post harvest marketing system can not cater the fruit processors or fresh fruit exporters with quality woodapple fruits. Therefore, the local processors and exporters are very reluctant to utilize this fruits.

Development of suitable post harvest technologies, to extend the shelf life and to utilize this fruit, is imperative to compact malnutritional problems in Sri Lanka and to boost local

processing and exportation. A considerable research activities have been focused in this direction by Sri Lankan scientists in the recent past. But success is yet to be proved.

The main problem faced by the fruit processing industry are high fungal infection to the woodapples and the bitter and undesirable flavour caused by damaged woodapple seeds upon processing. Preventing the fungal attack through both pre-harvest and post-harvest treatments are not practicable in present context. On the other hand, removing seeds from woodapple pulp is laborious and again impracticable.

One indirect way to overcome all these problems is to utilize mature unripe woodapples without damaging their seeds. Because, unlike ripe woodapples, mature unripe withstand much longer. But developing products and processing technologies to utilize mature unripe woodapples are formidable task.

This study was carried out to make use of mature unripe woodapple fruits for the production of woodapple chutney. As unripe fruits are taken for processing of chutney, the post harvest loss of them can substantially be reduced. Further, the process of chutney production needs no fine crushing of pulp which causes damages to seed content. Therefore, production of chutney from woodapple will be an ideal bonanza for the fruit processing industry of Sri Lanka.

OBJECTIVES OF THIS STUDY

- To produce chutney utilizing locally available woodapple varieties.
- To conduct a consumer preference survey for the developed product.
- To determine the feasibility of industrializing the process.

CHAPTER 2

LITERATURE REVIEW

2.1 Origin of woodapple

The woodapple plant is native to India and Sri Lanka (Macmillan, 1993; Krishnamurty *et al.*, 1969). They are also common in Burma, Malaysia, Pakistan, and Bangladesh. The woodapple is known be growing well in tropical Asian regions near to the equator. Records indicate that it is used as indigenous medical item in prehistorical time (Kirtikar and Basu, 1993).

2.2 Botany of woodapple

The woodapple (*Feronia elephantum* (L.) Merril) is a terrestrial perennial plant. It belongs to the family Rutaceae. The tree is of moderate size growing to 30-40 feet height, with straight sharp strong spines 1 to 7 cm long (Macmillan, 1993). The leaves alternate, imparipinnate and smelling of aniseed. Petiole and rachis flat, often narrowly winged; leaflets 3 to 9, opposite 2.2.5 by 1.2-2.5 cm., cuneate or obovate; tip often crenulate. Flowers are small, numerous, dull red in colour and in lateral or terminal pubescent panicles. Male and female flowers are often found in the same panicle. Calyx is small and lobed into 5 or 6. Lobes are triangular in shape. Petals are elliptic, oblong, free and 5 to 6 in number 5 mm long spreading or

deflexed stamens 10-12. Seriate; filaments equal, subulate densely hairy at the base within; anther large oblong. Ovary glabrous sessile. Fruit 5-6.3 cm diameter, globose, hard pericarp woody, rough, grey coloured. Seed embedded in an edible pulp (Purseglove, 1982; Kirtikar and Basu, 1993). The fruit is sour, sweet, acrid with flavour and taste (Macmillan, 1993). About 300 to 400 fruits can be obtained from a tree per season.

2.3 Cultivation

Favourable rainfall for cultivation of woodapple is 500-1000 ml annually and altitude below 500 m. This plant is capable of withstanding severe water stress conditions.

The suitable temperature range is between 25-32 °C. Well drained soil with alkaline pH is suitable for growing woodapple (Department of Agriculture, 1993).

Low country dry zone of Sri Lanka, which has 500-1000 ml annual rainfall and temperature varies between 28-33 °C, is a very favourable area for the cultivation of woodapple. Hence, Two third of the Sri Lanka is suitable for woodapple farming. Presently, woodapple is commonly found in Hambantota, Tangalle, Tissamaharama, Kataragama, Weerawila, Puttlam, Anuradapura, Nikaweratiya, Monaragala and Ampara.

2.4 Harvesting and storage

There is no established maturity index to determine the harvesting period in woodapple. Generally, in woodapple trees the matured fruits fall out and therefore harvesting is not adopted. Though this procedure of collecting woodapples is advantageous, often the fallen fruits get cracks and damages which intern lead to easy infection by pathogens.

Apart from this, it is a traditional practice to determine the maturity of woodapples by dropping and observing their jumps.

2.5 Nutrition value

Woodapple is a fruit with plenty of nutrients like Vitamin-C, Vitamin B complex, precursor of Vitamin A, and also minerals. Among the fruits it contains the highest content of protein. The composition of woodapple pulp is given Table 2.1.

Table 2.1: Nutritional composition of woodapple pulp

Composition in 100 g of edible portion

Moisture(g)	64.2
Energy(kcal)	134
Protein(g)	7.1
Fat(g)	3.7
Carbohydrate(g)	18.1
Calcium(mg)	130
Phosphorus(mg)	110
Iron(mg)	0.6
β-Carotene(μg)	61
Thiamine(μg)	40
Riboflavin(μg)	170
Niacin(mg)	0.8
Vitamin-C(mg)	3

Source: Tables of Food Composition, for use in Sri Lanka (1979).

2.6 Uses and importance of woodapple

The ripen woodapple fruit has many uses in processing industry like RTS drink, jams, and nectar. When we consider woodapple it contains more pectin, therefore it is highly compatible for jam industry.

Woodapple flesh contains a mass of soft, bitter sweet mealy substance, which is used for making a pleasant cooling drink and a preserve, also used in native medicine. The fruit is sour, sweet; refrigerant, cardiotonic, tonic to the liver and lungs, astringent and binding diuretic; strengthening the gums; the juice is good for stomatitis and sore throat; useful in biliousness; topically it relieves the pain due to stings of wasps and other insects. The leaves are aromatic and carminative, and are prescribed in the indigestion and slight bowel affection of children. The fruit, root, bark and leaf are prescribed in the treatment of snake-bite. The fruit is recommended in scorpion-bite (Kirtikar and Basu).

The woodapple trees also find many uses in grafting lemon family plants.

2.7 Chutney

Chutneys are pungent spicy relishes prepared with fruits, spices and herbs. The name may come from the Hindustani word *Chatni* a sweet pickle or relish prepared with sweet fruits, acidified with lemon, lime and sour herbs, and flavoured with hot spices such as chilies and cayenne pepper. A good chutney should be palatable and appetizing (Bhatia, *et al.*, 1990).

Chutney products are popular in some region where they are used as accompaniments to meals. They are hundreds of varieties in existence and they can be made form wide range of fruits and vegetables (Mcwilliams and Paine, 1984). Such as apple chutney, tomato apple chutney and tomato pear chutney. In the preparation of such products it is essential to use enough acid usually vinegar, sweetening so that the product will be acid enough to inhibit bacterial spore germination and also keep fairly well after the processed product is opened.

Sugar made into a heavily spiceseed syrups and with 5% vinegar spices or spice emulsions should be depend on preference. The syrup is brought to a boil and poured over prepared fruit slices or chunks in the container. Following sealing a short 5 minuets cook in hot water is sufficient (Treasler and Woodroof, 1976). These products are hot filled (Fellows and Hamption, 1982).

2.8 Woodapple Chutney

Woodapple based chutney is yet to be introduced to the market. The major constrain encountered are; In now a days woodapple chutney can not be seen markets. But it will be introduced to market could be a better demand due to their flavour characteristic, nourishment and deliciousness. The chutneys which are available in the markets are very expensive, but introducing cheaper woodapple chutney we can replace expensive chutney product in the market.

2.9 Sensory evaluation

Quality of the food items is the ultimate criterion deciding the consumer preference. The quality attributes depend on the sensory characteristics of the product. Instrumental measurement of these sensory properties is not effective. Hence, these properties are subjectively measured utilizing senses of human beings. In sensory evaluations, the sensory capabilities of an individual or a group of individuals to assess one or several qualitative aspects of a food substance (taste, odour, appearance, colour, texture, etc.) are utilized. In the absence of scientific instruments for making such measurements, the judgements of selected panellists assist in making numerous decisions concerning the quality of food substance all the way from checking row ingredients to foodstuffs in-process, final products, products being developed, and product already in the distribution channels. It is common and growing practice to utilize sensory evaluation panels in the food industry. Expertise in the design and

administration of tests and in the analysis and extrapolation of findings has made impressive progress during the past few decades. At one time, sensory evaluation was regarded mainly interms of coffee, tea, spices and wine tasting and testing. The sensory quality is an important parameter for both producers and consumers to the processor, since it attracts consumers; to the consumers, since it satisfies his aesthetic and gustatory sense.

It could be said that carefully selected, well trained, professional sensory panellists serve as proxies for the much larger population in terms of determining what is acceptable quality in many food stuffs.

There are various sensory evaluation tests available to assess sensory attributes of foods. The descriptive sensory analysis is being extensively employed in product development work. It gives a complete description of sample differences and guides the product developer in modifying product characteristics to meet consumer demands.

CHAPTER 3

MATERIALS AND METHODS

3.1 MATERIALS

Woodapple: Fresh woodapples of local varieties were obtained from the market in Buttala, Monaragala. Randomly selected fruits were matured, unripe and fruits free from diseases, defects or damages.

Sugar (refined)

Salt (Table Salt)

Spices (cinnamon, clove, cardamom, chilly, ginger, garlic)

Vinegar (acetic acid)

EQUIPMENT

Gas Stove

Glass Jars

3.2 METHODS

It was first intended to produce woodapple chutney to carry out a sensory evaluation and then to determine quality parameter (pH, brix, acidity and microbial count) using AOAC methods.

3.2.1 Preparation of Chutney

The fruits selected for the processing were washed thoroughly with portable water to remove dirt, mud and microbes adhering on their surfaces. Then their shells were splitted and the flesh was separated. Then flesh were cut into small chunks with the help of stainless steel knife. After cutting whole woodapple chunks, they were put in to stainless steel, non-stick pan and were mixed with sugar. The small chunks facilitate the mixing of sugar. This mixture was then heated till the woodapple chunks become tender.

Then the wet spices (ginger and garlic) mixture of 20 g was added to the mixture and mixed thoroughly using wooden spoon. This was then cooked for 5 minutes. Then the dry spices (cinnamon, cardamom and clove) mixture of 6 g and finely ground salt (table salt) of 3.5 g were added one by one and mixed thoroughly. Finally a 40 g chilly dissolved in vinegar of 375 ml. Then simmering was carried out till brix reaches 68°. Then the mixture was filled into clean jars when it was hot. Soon after filling the jars, they were sealed. The flow chart sown in Figure 3.1 illustrates the processing steps.

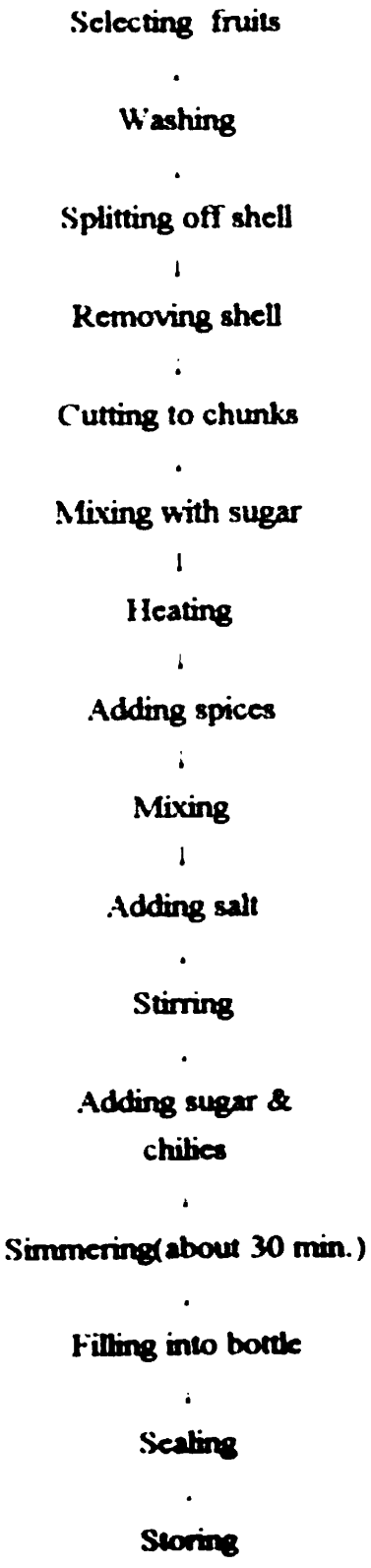

Figure 3.1: Flow chart of woodapple chutney.

3.2.2 Determination of brix

The brix value of the chutney was determined using a "Erma" refractometer. The chunks of the chutney with the juice were taken into a pestle and ground vigorously. The resultant pulp was filtered through a Whatman no 1 filter paper and the filtrate excluding the first three drops was used to smear the refractometer prism. The refractometer reading and the room temperature for the temperature correction were recorded.

3.2.3 Determination of pH

A 10 g of formulated chutney was taken into flask and dissolved in 50 ml of distilled water and prepared a sample for pH determination. The pH value was recorded using "Hanna" portable digital pH meter.

3.4 Determination of acidity

A 10 g of formulated chutney was taken into a 250 ml Erlenmeyaer flask. Distilled water was added to it till solution becomes colourless. 10 ml of above prepared sample was taken in to the titration flask, and 3 drops of phenolphthalein indicator was added. This was then titrated against 0.1 N NaOH solution till a permanent pink colour results.

Calculation:

$$\text{Acidity} \quad \frac{b\ c\ d\ e\ x\ 100}{f}$$

where

b - Titration

c - Normality of alkali

d - Volume made up

e Equivalent weight of acid

f - Weight of sample taken

3.2.5 Sensory evaluation of woodapple chutney

A consumer preference test was carried out to evaluate the quality of the woodapple chutney. Sensory properties aroma, texture, taste and overall acceptability were investigated using a descriptive sensory analysis score card. An untrained consumer type panel consisting 28 university students of Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka was used for this purpose. Precautions were taken to have representatives of all income levels in selecting the sensory evaluation panellists.

For the sensory evaluation, panellists were assigned to individual booths. Each panellist was

provided with drinking water to rinse mouth in between tasting.

Each tasting booth was sufficiently illuminated and the panellist were served with a score card for the descriptive analysis with scaling. A sample of score card is shown in Figure 3.2.

DESCRIPTIVE ANALYSIS WITH SCALING

Name :..... Date :.. ....

Please evaluate the aroma, texture, taste and overall acceptance of the sample.

1 Aroma - Make vertical lines on the horizontal line to indicate your rating of the aroma of each sample Label each vertical line with the code number of the sample it represents

weak Strong

2 Texture - Make vertical lines on the horizontal line to indicate your rating of the texture of each sample Label each vertical line with the code number of the sample it represents

very soft very hard

3 Taste - Make vertical lines on the horizontal line to indicate your rating of the taste of each sample Label each vertical line with the code number of the sample it represents

very raw very pleasant

4. Overall acceptance - Make vertical lines on the horizontal line to indicate your rating of the overall acceptance of each sample Label each vertical line with the code number of the sample it represents

Figure 3.2: Descriptive Score Card

The panellists were requested to mark a vertical line across the horizontal line at the point that reflects his perception of the magnitude of the properties assessed.

After the panellists had completed their judgements, the scores were tabulated by measuring the length from the left end to the vertical line made by the panellists.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Preparation of chutney

Cooking is an important operation in the manufacture of chutneys. Long and slow cooking is considered as best for chutneys as it would allow to extract all the flavours. Over-cooking may lead to shrinkage of the chutney with prolong storage. Contrastly, under-cooking may lead to mouldy chutney and liquid accumulation on the surface of the chutney.

Packaging plays an important role in chutney production. The keeping quality of chutneys mainly depends on the processing parameters and the storage conditions. Wide mouth jars with suitable lids are preferable for the purpose. Sealing the jars very tightly with non-corrosive lids is essential. Metal screw-top lids with plastic linings are the best choice, because they ensure that the vinegar does not evaporate and dry out the chutney.

Although chutneys can be eaten immediately, most are best left for one month before eating, to allow the flavours to be developed. Chutneys generally keep for up to one year if stored in a cool dry and dark place, but some chutneys have different storage times, which are given individual recipes.

4.2 Physio chemical parameters of woodapple chutney

When we consider organoleptic properties and shelf life of the woodapple chutney, very important criteria are physio chemical parameters. The brix, acidity and pH are the important parameters of organoleptic qualities. The Table 4.1 shows the physio chemical parameters of woodapple chutney determined using three replicates each.

Table 4.1: Physio chemical parameters of woodapple chutney

Physio chemical property	Value
brix	55
Acidity (g l)	2.8
pH	3.5

Comparing the commercially available chutney products and prepared woodapple chutney, there is no much difference in physio chemical parameters. Chutneys with low brix value and high pH are highly susceptible to mould infection. The high acidity and the high content of sugars make the chutney a long standing preservative item.

4.2 Sensory evaluation

The sensory evaluation of the prepared woodapple chutney was carried out with descriptive scale sensory evaluation technique. As a standard, a chutney product commonly used by the majority of consumers-Mango chutney manufactured by Kist, was taken into consideration.

The sensory properties aroma, taste, texture and overall acceptability were taken into account. The Table 4.2, 4.4, 4.6, and Table 4.8 show the sensory scores obtained for aroma, taste, texture and overall acceptability respectively.

Table 4.2: Sensory score for aroma

Aroma

Judges	A*	B*
1	3.8	8.7
2	1.4	6.2
3	5.1	9.4
4	4.3	7.5
5	7.1	4.4
6	4.0	7.5
7	6.0	5.0
8	8.3	3.3
9	1.4	8.4
10	2.6	8.2
11	4.9	8.0
12	1.4	5.3
13	3.9	9.4
14	2.9	8.0
15	2.7	8.5
16	4.4	7.9
17	3.8	8.0
18	5.5	6.7
19	3.4	6.9
20	7.9	9.1
21	5.3	4.5
22	7.2	9.0
23	3.8	7.0
24	4.3	8.6
25	3.3	8.2
26	5.8	3.7
27	7.2	5.5
28	3.6	9.5
Total	125.3	202.4
Mean	4.4	7.2

Table 4.3: Analysis of variance for aroma

S.O.V	d.f	S.S	M.S	F	F-table
Sample	1	106.15	106.15	23.32**	7.64
Judges	27	63.40	2.34	0.51	2.13
error	27	122.93	4.55	0.51	
Total	55	292.48			

Table 4.4: Sensory score for texture

Texture

Judges	A*	B*
1	3.4	7.4
2	6.1	5.3
3	6.1	5.3
4	6.4	4.5
5	5.9	6.3
6	6.7	7.1
7	5.5	7.2
8	3.5	7.7
9	4.0	6.0
10	4.9	7.3
11	7.0	6.7
12	4.7	6.7
13	6.2	5.6
14	7.8	5.9
15	8.1	5.0
16	8.2	5.5
17	7.6	6.1
18	6.9	4.2
19	7.1	5.4
20	5.2	8.7
21	7.3	9.0
22	3.4	6.2
23	7.0	6.8
24	6.2	2.7
25	6.7	5.3
26	2.1	7.2
27	7.1	6.4
28	7.5	6.5
Total	168.6	174
Mean	6.021	6.021

Table 4.5 Analysis of variance for texture

S.O.V	d.f	S.S	M.S	F	F-table
Sample	1	0.52	0.52	0.18	7.64
Judges	27	39.38	1.45	0.51	2.13
error	27	76.29	2.82		
Total	55	116.19			

Table 4.6: Sensory score for taste

Taste

Judges	A*	B*
1	6.2	6.8
2	4.5	8.3
3	4.5	8.3
4	5.1	7.5
5	6.8	5.7
6	4.1	7.1
7	5.7	6.5
8	5.7	6.2
9	5.5	5.9
10	6.9	4.7
11	4.8	8.5
12	4.8	8.7
13	5.7	9.6
14	8.0	9.6
15	4.6	8.6
16	4.4	8.0
17	6.5	8.4
18	5.7	7.9
19	3.2	9.4
20	4.0	7.9
21	7.1	8.2
22	4.1	3.4
23	2.4	7.7
24	3.2	7.4
25	5.3	7.9
26	5.0	7.4
27	3.4	7.9
28	5.5	7.9
Total	142.7	208.4
Mean	5.096	7.442

Table 4.7 Analysis of variance for taste

S.O.V	d.f	S.S	M.S	F	F-table
Sample	1	77.08	77.08	36.18**	7.64
Judges	27	50.62	1.87	0.87	2.13
error	27	57.62	2.13		
Total	55	185.32			

Table 4.8: Sensory score for overall acceptance

Overall acceptance

Judges	A*	B*
1	4.6	7.3
2	5.8	6.8
3	5.8	8.2
4	5.7	8.2
5	4.7	8.6
6	7.5	6.2
7	5.7	8.6
8	6.2	7.1
9	4.9	7.5
10	5.4	7.8
11	5.7	8.7
12	5.8	8.3
13	3.2	7.2
14	5.1	8.3
15	5.2	9.1
16	3.6	8.9
17	5.9	8.6
18	6.9	7.6
19	4.6	5.9
20	3.3	8.5
21	3.3	7.0
22	6.6	8.7
23	4.9	8.2
24	5.1	9.0
25	5.5	8.0
26	5.5	9.5
27	6.0	8.8
28	2.9	6.9
Total	145.4	224.5
Mean	5.19	8.01

Table 4.9: Analysis of variance for overall acceptance

S.O.V	d.f	S.S	M.S	F	F-table
Sample	1	111.73	111.73	122.77**	7.64
Judges	27	32.22	1.19	1.30	2.13
error	27	14.74	0.91		
Total	55	168.69			

Commercially available chutney

Woodapple chutney.

The results reveal that there is no significant difference between the woodapple chutney and commercially available chutneys. However, the woodapple chutney was rated to be of inferior to commercially available chutney for aroma, taste and overall acceptance. This could be due to the fact that the woodapple chutney product was taken for the sensory evaluation soon after the preparation, because the chutney products get their qualities improved with storage period. However, it seems that except for the texture all the other sensory properties of this product need to be improved to compete with existing products.

The inferiority of woodapple chutney to commercially available item does not mean that woodapple chutney is totally unacceptable. The mean score values obtained for aroma, taste and overall acceptability exceed 4 and indicate that they are not poor in these aspects. Conducting a sensory evaluation with 5 or 9 hedonic scales for acceptance of quality attributes would reveal this very explicitly.

The flavour qualities of woodapple chutney can be improved by incorporating other compatible fruits like mango and pineapple. Addition of different spices and flavouring compounds can also be tried.

Considering the production cost and consequent marketing price of woodapple chutney, it

would be the much more cheaper chutney product compared to all other range of such products available in the local markets. This cost benefit in slight expense of quality attributes, would boost the marketing of this product.

On the other hand, the simple production technology, which suits the small scale processors, is an added benefit to local small scale processors. Processing the woodapples into chutney at the site of production by small scale processors would substantially reduce the post-harvest losses.

As Sri Lanka is a developing country, tapping the endogenous fruits resources and producing unique products of higher qualities with effective technologies are much felt need. In this context, production of woodapple chutney can play a pioneer role effectively.

CHAPTER 5

CONCLUSIONS

The woodapple chutney produced observed to be similar to that of commercially available chutney products, in terms of their physio chemical properties. The sensory attributes - aroma, taste and overall acceptability were inferior to commercially available chutney products. But they were not unacceptable or poor. However, improvement in aroma, taste and overall acceptability would further boost the attractiveness of this technology. Considering the cost benefit and other advantages associated with the production of woodapple chutney, it would become a viable venture for Sri Lanka.

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