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Development and Standardization of *Carica papaya* Powder Incorporated Food Products

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ABSTRACT

The present study was carried out during the academic year 2020-2021 in the Food Processing and Quality Control Lab in the Department of Home Science at V. V. Vanniaperumal College for Women, Virudhunagar, Tamil Nadu. Antioxidant is a substance that delays, prevents or removes oxidative damage and improve the immune power. Papaya consumption improves the immune power of the human being and decreases the antioxidant deficiency. Papaya has very poor keeping quality. Drying is a solution offered to overcome the post-harvest losses and improves the shelf-life. The research revealed that the raw and ripen papaya powders prepared by using cabinet dryer contained 50% and 66.6% of antioxidant activity respectively. The raw and ripen papaya powders prepared by using freeze dryer contained 69% and 87% of antioxidant activity respectively. It is concluded that the ripen papaya powder prepared by using freeze dryer contained more antioxidant activity. Even though the antioxidant activity is higher in the papaya powder prepared by using freeze drying but output of the papaya powder was low yield. So, it is concluded from the study that the ripen papaya powder prepared by using cabinet drying can be utilized for developing new food products. The selected *Carica papaya* powder was incorporated into the biscuit, milk shakes and milk kova at 2%, 4% and 6% level by using replacement method.

Key words: antioxidant elements, phytochemical test, freeze and cabinet dryer, nutritional content, milk kova.

INTRODUCTION

Antioxidants are called "Free- radical scavengers" which improve the immune power and decrease the risk of diseases. Foods rich in antioxidants play an important role in reducing the oxidative stress. Antioxidants through our diet play an important role in helping for the neutralization of excess free radicals. In 21st century, demand for intake of antioxidant food or dietary antioxidant has been increasing with the hope of keeping our body healthy and free from diseases. (Benzie, 2003) Antioxidant deficiency diseases are the major public health issues in the world. Oxidative stress is the main cause for the development of chronic and degenerative ailments such as cancer, arthritis, aging, autoimmune disorders and cardiovascular. Papaya is a common man's fruit with a high nutritive value available at a reasonable price. It contains more vitamins and minerals. The low calories content (32 Kcal / 100 g of ripe fruit) makes a favorite fruit of obese people who are into weight reducing regime. Papayas also contain high levels of antioxidants such as carotenes, vitamin C and flavonoids, which helps to reduce the risk of antioxidant deficiency. It improves the antioxidant defense in elderly patients even without any overt antioxidant deficiency state at the dose of 9 g/day orally. (NIH 1997) They also promote the health of the cardiovascular system and also provide protection against colon cancer. (Arvind *et al.*, 2003) During fiscal year 2020, the volume of papaya production in India amounted to over six million metric tons. (SRD, 2020) Papaya has very poor keeping quality. Drying is a solution offered to overcome the post-harvest losses and improves the shelf life through storage. (Kaleem *et al.*, 2006,)

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Drying can discharge approximately 80-90% of water from the fresh products and drying also prevents the growth of microorganisms and reduces the rate of chemical reaction spoilage. (Lau & Taip, 2011) Hence the study is undertaken to improve the immune power of human being which is the need of the hour. Keeping the health benefits and functional benefits of the papaya, the antioxidant rich papaya powder incorporated food products improve the immune power of the people in an economical way.

MATERIALS AND METHODS

1.1 a Preparation of the raw and ripen *carica papaya* powders by using cabinet drying

The raw and ripen papayas free from damages were collected and washed under the running water. Then the skin was removed gently using a peeler after weighing. Then it was cut half using a teaspoon the seeds were scooped and taken out and cut into pieces. After cutting, the raw papayas were weighed and spread over trays and placed into the cabinet dryer (which was indigenously designed by BIOTRONICS, Madurai) at 95°C for 20 hours. The dried papayas were collected and ground in a suitable grinding for 15 sec and sieved. After this process raw and ripen papaya fine powders were stored in a container.

1.1 b Preparation of the raw and ripen papaya powders by using freeze drying

The raw and ripen papayas free from damages were collected and washed under the running water. Then the skin was removed gently using a peeler after weighing. Then it was cut in to half. Using a teaspoon the seeds were scooped and taken out and then the pulp was cut into pieces. After cutting the raw papayas were weighed and ground by blender and placed the papaya juices inside the Freeze Dryer (FD) which was indigenously designed by Kamaraj Engineering College, Virudhunagar, with total pressure and the temperature inside the vaccum chamber of -0.102mbar and -53°C respectively. Then the extraction was carried out by placing extracted papaya juices into a 50ml falcon tube, which were prefrozen in a -70°C freezer overnight. The samples were placed in the FD until pure crystalline ice formed and turned into a powder like product. (Mustapa & Ahmad 2019) For FD, 10g of the extracted papaya juices was placed in each falcon tube and processed for 3 days.

1.2 Comparison of the antioxidant activity of raw and ripen papaya powders prepared by cabinet and freeze drying

DPPH free radical scavenging assay was measured for Carica powder prepared by cabinet and freeze drying methods. DPPH solution was added to 3ml of ethanol and the absorbance was noted at 520 nm. A different level volume of test sample (0.5, 1, 1.5,2 and 2.5ml) was made up to 3ml with ethanol.3ml of DPPH solution was added to each of the above test tube. All the test tubes were incubated at room temperature in dark for 30 minutes. (Eugehio *et al.*, 2012) Absorbance was taken at 520 nm in colorimeter after 30 minutes and percentage of inhibition was calculated by using the formula,

$$\% \text{ Antioxidant} = \frac{Ac - At \times 100}{Ac - As}$$

1.3 Phytochemical screening of the *Carica papaya* powder

The phytochemical tests were also performed in the distilled water extracts of the *Carica papaya* powder. They were carried out using standard qualitative methods as described by Raaman, 2006.. The qualitative phytochemical activity of *Carica papaya* powder was carried out to detect the various constituents such as saponin, sugar, tannins, alkaloids, phenols and quinone.

2.3.1. Test for Saponins:

Foam Test:

2 ml of extract was treated with 2 ml of distilled water shaken vigorously for 2 minutes and adding of 1 ml of olive oil to the foam. Stable foam indicates the presence of saponin.

2.3.2. Test for Reducing Sugars:

Benedict's test :

1 ml of extract was treated with 1 drops of Benedict's reagent and allow to boil for 2 minutes in water bath. Appearance of green colour indicates the presence of reducing sugar.

2.3.3. Test for Tannins:

Ferric Chloride Test:

1 ml of extract was treated with 2 ml of 5 % Ferric chloride solution. Appearance of dark blue or greenish black colour indicates the presence of tannin.

2.3.4. Test for Alkaloids:

Mayer's Test:

2 ml of extract was treated with 1ml of Mayer's reagent (Potassium Mercuric Iodide). Formation of a

yellow colour precipitate indicates the presence of alkaloids.

2, 3.5.Test for Phenols:

Lead Acetate Test:

3 ml of extract was treated with 1ml of 10% lead acetate solution. Appearance of white precipitate indicates the presence of phenol.

2.3.6.Test for Quinone

1 ml of the extract was added to 1 ml concentrated sulphuric acid. Formation of red color indicates the presence of quinones

1.4 Development of the selected *Carica papaya* powder incorporated biscuit, milkshake and milkkova

The selected *Carica* powder was incorporated into biscuit, milkshake and milk kova by using replacement method in the proportions of 2%, 4% and 6%.

1.4.1 Preparation of the selected *Carica papaya* powder incorporated biscuit

The procedure for the preparation of the selected papaya powder incorporated biscuit is described in the flow chart 1.

Sieved all the dry ingredients

↓

Mixed all the dry ingredients (Wheat flour, selected papaya powder, palm sugar and baking powder)

↓

Added the butter and made it into dough and rest it for 30 minutes

↓

Divided the dough into separate balls and rolled it

↓

Cut into various shapes using biscuits mould and baked at 110◦C for 20 minutes.

Flow chart 1 : Preparation of the selected *Carica papaya* powder incorporated biscuit

1.2.2 Preparation of the selected *Carica papaya* powder incorporated milkshake

The procedure for the preparation of the selected papaya powder incorporated milk shake is described in the flow chart 2.

Mixed all the Ingredients (milk, palm sugar, fresh cream, ice cubes and selected papaya powder)

↓

Blended it

↓

Stored in refrigerator

Flow chart 2 : Preparation of the selected *Carica papaya* powder incorporated milk shake

1.4.3 Preparation of the selected carica papaya powder incorporated milk kova

The procedure for the preparation of the selected papaya powder incorporated milk kova is described in the flow chart 3.

↓

Boiled the milk

↓

Added the sugar, cardamom andselected papaya powder

↓

Added ghee and served it hot

Flow chart 3 : Preparation of the selected *carica papaya* powder incorporated milk kova

2.5.4 Preference of the selected *carica papaya* powder incorporated food products by the consumers

Ranking is a test which is used to determine how several samples differ on the basis of a single characteristic. A control need not be identified. All the samples with code numbers were given to panelists. They were asked to rank all the samples according to the intensity of the specific characteristic. In consumer analysis, the panelists were asked to rank the coded samples according to their preference. The selected *Carica papaya* powder incorporated food products such as biscuit, milkshake and milk kova were given to the consumers to rank their preference for the overall acceptability of the products.

1.5 Sensory evaluation of the selected *carica papaya* powder incorporated biscuit, milk shake and milk kova

When the quality of the food product is assessed by means of human sensory organs, the evaluation is said to be sensory or subjective or organoleptic. (Shrilakshmi, 2018) The developed products were assessed by eight panel members. The panelists were asked to determine the sensory attributes on the basis of 5 point hedonic scale and they scored on the basis of sensory qualities such as colour, flavor, consistency, taste and over all acceptability. The overall acceptability was evaluated by the means core of all the attributes.

2.7 Nutritional analysis of the *Carica papaya* powder, control milk kova and the selected *Carica papaya* powder incorporated milk kova

Nutritional analysis of the selected *Carica papaya* powder, control milk kova and the selected *Carica papaya* powder in corporated milk kova was carried out for the detection of various constituents such as potassium, phosphorus, magnesium, vitamin C, vitamin A, iron, calcium and carbohydrate by using standard procedures (AOAC,2012).

2.8 Cost analysis of the selected papaya powder incorporated milk kova

The cost analysis was done considering the raw materials, labor cost and electricity used for the research. The cost was calculated for 100 g of the developed products.

RESULTS AND DISCUSSION

3.1 Comparison of the weight of the dried papaya powder prepared by using cabinet and freeze drying

De hydration is the best method in order to increase the shelfli feoffruits. The *Carica papaya* powder was prepared by using cabinet and freeze drying methods.

Table 1 : Comparison of the weight of the dried papaya powder prepared by using cabinet and freeze drying

S.No	Fruit Powder	Drying Method	Papaya pulp weight (g)	Papaya powder weight (g)
1	Ripen papaya	Cabinet dryer	100g	16.2%
2	Raw papaya	Cabinet dryer	100g	16.2%
3	Ripen papaya	Freeze dryer	100g	4.2%
4	Raw papaya	Freeze dryer	100g	4.2%

Table 1 shows the weight of the papaya powder prepared from raw and ripened papaya by using freeze and cabinet dryers. The research revealed that the 100g of raw and ripen papayas dried under the cabinet dryer contained 16.2% of powder but the 100g of raw and ripen papayas dried under the freeze dryer contained 4.2% of powder. So the weight of papaya powder prepared by using cabinet dryer got more weight than the freeze dryer.

3.1 Comparison of the antioxidant activity of the raw and ripen papaya powders by using cabinet and freeze dryers

The antioxidant activity of the raw and ripened *Carica papaya* powder prepared by cabinet and freeze dryers was determined and the results are presented in table2.

Table 2: Comparison of the antioxidant activity of the raw and ripen papaya powders by using cabinet and freeze dryer

S.No	Name of the Sample	Drying method	Antioxidant activity
1	Ripen papaya powder	Cabinet dryer	66.6%
2	Raw papaya powder	Cabinet dryer	50%
3	Ripen papaya powder	Freeze dryer	87%
4	Raw papaya powder	Freeze dryer	69%

The research revealed that the raw and ripen papaya powders prepared by using cabinet dryer contained 50% and 66.6% of antioxidant activity respectively. The raw and ripen papaya powders prepared by using freeze dryer contained 69% and 87% of antioxidant activity respectively. It is concluded that the ripen papaya powder prepared by freeze drying contained more antioxidant activity. Even though the antioxidant is higher in the papaya powder prepared by using freeze drying but output of the papaya powder was low in yield. So, it is concluded from the study that the ripen papaya powder prepared by using cabinet drying can be utilized for developing new food products.

3.3 Phytochemical screening of the selected *Carica papaya* powder

The phytochemical active compounds of the selected *Carica papaya* powder were qualitatively analyzed and the results are presented in table 3

Table 3: Qualitative analysis of Phytochemicals in the selected *Carica papaya* powder

S.No.	Name of the test	Presence or absence in the selected papaya powder
1	Tannin	+
2	Phenol	+
3	Reducing sugar	+
4	Quinones	-
5	Saponins	+
6	Alkaloids	+

The phytochemical tests were performed in the distilled water extracts of the selected *Carica papaya* powder. The phytochemicals like saponin, alkaloid, tannin, reducing sugar and phenol were present in *Carica papaya* powder. The result to obtained was similar to the result of the research done. (Akshata, 2017)

3.4 Sensory evaluation of the selected *Carica papaya* powder incorporated food product

3.4.1 Sensory evaluation of the selected *Carica papaya* powder incorporated biscuit

Table 4 shows the mean score of colour, flavour, taste, consistency and overall acceptability of the *Carica papaya* powder incorporated biscuit.

Table 4: Sensory evaluation of the selected carica papaya powder incorporated biscuit

S.No	Sensory Attributes	Control	Experimental		
			Sample A	Sample B	Sample C
1	Colour	4.2±0.5	3.8±0.5	4.9±0.2	3.7±0.7
2	Flavour	4.5±0.4	3.6±0.7	4.7±0.4	3.7±0.6
3	Taste	4.6±0.4	3.7±0.4	4.6±0.3	3.5±0.6
4	Consistency	4.8± 0.2	4.0± 0.2	4.8± 0.5	3.5± 0.2
5	Overall acceptability	4.5±0.3	3.9±0.3	4.7±0.4	3.4±0.4

It was found that 4% of the selected *Carica papaya* powder incorporated biscuit was excellent in the overall acceptability and the mean score was 4.7. But in the 2% and 6% powder incorporated biscuit mean scores were 3.9 and 3.4 respectively. Out of the three various formulations, 4% *Carica papaya* powder incorporated biscuit scored the best in quality attributes like appearance, colour, texture, flavor and taste.

3.4.2 Sensory evaluation of the selected *Carica papaya* powder incorporated milkshake

Table 5 shows the mean score of colour, flavour, taste, consistency and overall acceptability of the *Carica papaya* powder incorporated milk shake.

Table 5: Sensory evaluation of the selected *Carica papaya* powder incorporated milk shake

S.No	Sensory Attributes	Control	Experimental		
			Sample A	Sample B	Sample C
1	Colour	4.4±0.3	3.8±0.5	4.9±0.2	3.5±0.5
2	Flavour	4.0±0.5	3.8±0.7	4.7±0.4	3.7±0.6
3	Taste	4.4±0.3	3.7±0.5	4.8±0.4	3.9±0.4
4	Consistency	4.5± 0.3	4.0± 0.3	4.8± 0.2	3.6± 0.3
5	Overall acceptability	4.1±0.3	3.9±0.3	4.8±0.4	3.5±0.4

It was found that 4% *Carica papaya* powder incorporated milkshake was excellent in the overall acceptability and the mean score was 4.8. But in the 2% and 6% *Carica papaya* powder incorporated milkshake mean scores were 3.9 and 3.5 respectively. Out of the three various formulations, 4% *Carica papaya* powder incorporated milkshake scored the best in quality attributes like colour, consistency , flavour, taste and overall acceptability.

3.4.3 Sensory evaluation of the selected *Carica papaya* powder incorporated milk kova

Table 6 shows the mean score of colour, flavour, taste, consistency and overall acceptability of the *Carica papaya* powder incorporated milk kova.

Table 6: Sensory evaluation of the selected *Carica papaya* powder incorporated milk kova

S.No	Sensory Attributes	Control	Experimental		
			Sample A	Sample B	Sample C
1	Colour	4.3±0.5	4.0±0.5	4.6±0.3	3.7±0.7
2	Flavour	4.5±0.4	3.8±0.5	4.7±0.4	3.8±0.7
3	Taste	4.4±0.4	4.1±0.3	4.8±0.2	3.5±0.6
4	Consistency	4.8± 0.2	4.2± 0.5	4.9± 0.2	3.3± 0.4
5	Overall acceptability	4.5±0.3	4.1±0.2	4.9±0.2	3.4±0.4C

It was found that 4% *Carica papaya* powder incorporated milk kova was excellent in the overall acceptability and the mean score was 4.9. But in the 2% and 6% *Carica papaya* powder incorporated milk kova mean scores were 4.1 and 3.4 respectively. Out of the three various formulations, 4% *Carica papaya* powder incorporated milk kova scored the best in quality attributes like colour, consistency, flavor, taste and overall acceptability.

3.4.4 Preference of the selected *Carica papaya* powder incorporated food products by the consumers

Figure 1 shows the preference of *Carica papaya* powder incorporated food products by the consumers

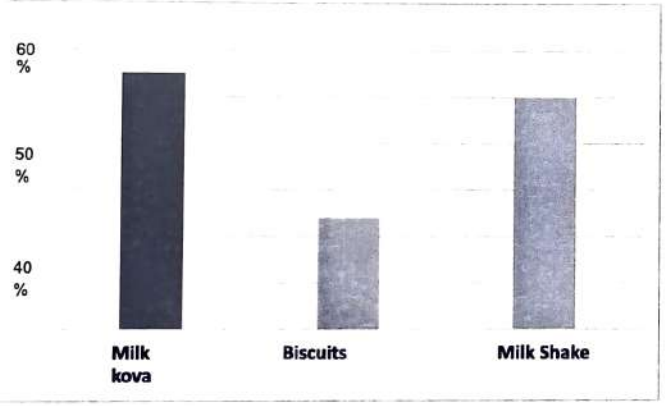

Figure 1: preference of *Carica papaya* powder incorporated food products by the consumers

The prepared products were subjected to ranking test in order to find out the preference of the selected *Carica papaya* powder incorporated food products by the consumers. Then the most preferred food product was used for biochemical and cost analysis. It was found that milk kova was preferred by 55% of the consumers. The selected *Carica papaya* powder incorporated biscuits and milk shake were preferred by 24% and 21% respectively.

3.4 Nutritional analysis of the selected *Carica papaya* powder and the selected *carica papaya* powder incorporated food product

3.5.1 Nutrient analysis of the selected *Carica papaya* powder

The nutrient content of the selected *Carica papaya* powder was analysed and the results are given below in table 7.

Table 7: Nutritive value of the selected *Carica papaya* powder

S.No	Nutrients	Nutritive value of the selected *Carica papaya* powder
1	Phosphorus (mg)	2.3
2	Iron (mg)	0.14
3	Potassium (mg)	17.3
4	Magnesium (mg)	33
5	Calcium (mg)	20
6	Vitamin C (mg)	15
7	Vitamin A (IU)	13
8	Fiber (%)	1.0
9	Carbohydrate (g)	9.8

The nutrient content of the selected *Carica papaya* powder is reported as 2.3mg of phosphorus, 0.14mg of iron, 17.3mg of potassium, 33mg of magnesium, 20mg of calcium, 15mg of vitamin C, 13 IU of vitamin A, 1.0% of fibre and 9.8g of carbohydrate

4.5.2 Nutrient analysis of the control milk kova and the selected *Carica papaya* powder incorporated milk kova

The potassium content of control milk kova and the selected *Carica papaya* powder incorporated milk kova was 22.7mg and 23.6mg respectively. The magnesium content of control milk kova and the selected *Carica papaya* powder incorporated milk kova was 14.3mg and 15mg respectively. The calcium content of control milk kova and the selected *Carica papaya* powder incorporated milk kova was13.8mg and15.5mg respectively. The vitamin A content of control milk kova and the selected *Carica papaya* powder incorporated milk kova was 3.4IU and 5.7 IU respectively. The crude fiber content of control milk kova and the selected *Carica papaya* powder incorporated milk kova was 1.0% and1.2% respectively. Hence, the incorporation of the papaya powder increased the nutritive value of the milk kova. Figure 2 shows the nutrient content of the control milk kova and the selected *Carica papaya* powder incorporated milk kova

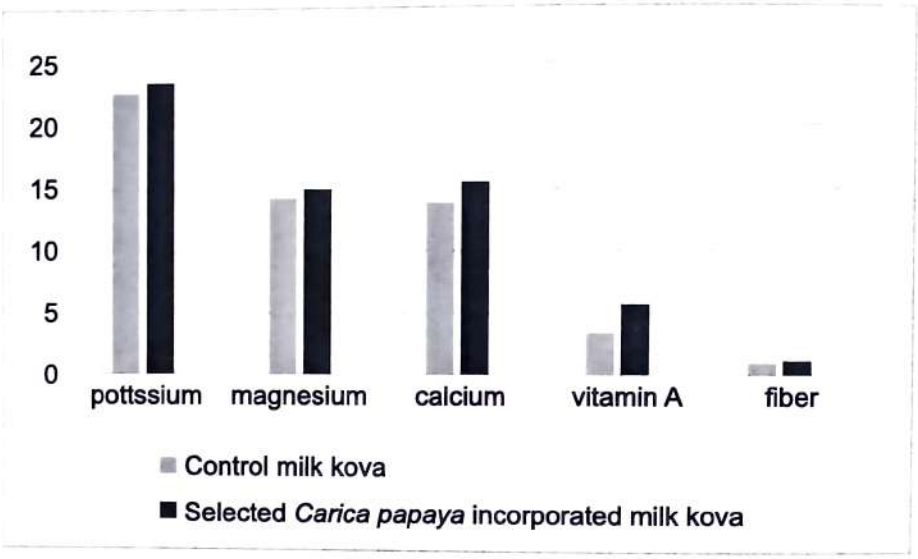

Figure 2: Nutrient analysis of the control milk kova and the selected *Carica papaya* powder incorporated milk kova

3.4 Cost analysis of the selected papaya powder incorporated food product

The cost calculated for the 100 gm of the *Carica papaya* powder incorporated milk kova was Rs.18.75.

CONCLUSION

Carica papaya is rich in antioxidant elements. Human being needs more antioxidant elements in order to combat various deficiencies related to it. Since papaya has low shelf life, drying is the best solution and it decreases the global malnutrition due to its excessive availability. The research revealed that the ripen *Carica papaya* powder by using freeze dryer method contained 87% antioxidant activity. Hence, it is concluded that the ripen *Carica papaya* powder obtained through freeze dryer method has more antioxidant element. Even though the antioxidant is higher in the papaya powder prepared by using freeze drying but output of the papaya powder was low in yield. So, the ripen papaya powder prepared by using cabinet drying can be utilized for developing new food products economically. It was found that 4% of the selected *Carica papaya* powder incorporated milk kova was excellent in the overall acceptability and the mean score was 4.9 and preferred by 55% of the consumers. So, it is concluded from the study that the ripen papaya powder prepared by using cabinet drying can be utilized for developing new food products which pave way for improving the health of the people.

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