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Formulation and Development of Fruit Leather Incorporated with Papaya Peel Powder

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Abstract: *Fruit leather, also known as a fruit bar or a fruit slab, is a dehydrated confectionery food item that is frequently consumed as a snack or dessert. It is chewy and flavourful, naturally low in fat and high in fibre and carbs, as well as being lightweight and simple to store and transport. Consuming fruit leather is a cost-effective and practical value-added alternative to natural fruits as a source of different nutrients. Fruit leathers made from fruit pulp are palatable to consumers and filling. Papayas were harvested on 418,604 acres in 2014, and 12,822,014 tonnes were produced worldwide. The majority of products made from papaya include tutti-frutti, powder, papaya chips, skin care items, papain, sweets, jam, jelly, pickles, sauce, squash, etc. The two main by-products of papaya processing, papaya peel (PP) and papaya seeds (PSs), account for roughly 12 and 8.5% of the fruit weight, respectively. The bioactive chemicals in PP and PSs have some additional value and can be employed as nutritional supplements, nutraceutical supplements, innovative culinary products, and medicinal goods. However, PPs can be used as a good source of beneficial substances, food additives, or nutritional supplements. They can also be transformed into other products with added value. The developed fruit leather was prepared by adding different ratios of papaya peel powder and brown sugar (70:20, 75:25 and 80:30). The sensory evaluation was conducted among 30 semi-trained panel members using 9-point hedonic scale and the overall acceptability was observed in variation – 2. The selected variation-1 was further analysed for nutritional composition and storage stability. The developed papaya fruit leather contains 212.67kcal, 54.78g of Carbohydrate, 0.44g of Protein, 0.44g of fat, 70.92mg of Calcium, 1233.92mg of Vitamin-A and 68.03mg of Vitamin-C for 100 grams. Thus, papaya peel leather finds best source of Vitamin-A and it helps for boosting the immune system, reproductive health, and growth along with effective functioning of various organs.*

Key Words: *Fruit leather, Dessert, Papaya peel (PP), Papaya seed (PS), Brown sugar, Vitamin-A*

1. INTRODUCTION:

Fruit leathers are a sweet and chewy confection made from dried fruit. It is a simple method for including fruit in a meal or snack. They are produced by spreading fruit puree onto a drying rack and drying them in an industrial oven or dehydrator. They resemble conventional fruit roll-ups and dried fruit sheets very much, yet they have less sugar and a more authentic fruit flavour.

Fruit that has been left over, fruit that is too ripe to be preserved, surplus fruit pulp from creating jams, and canned and frozen fruit can all be used to make fruit leathers. You have control over the sugar content when manufacturing fruit leather at home. Fruit leathers without sugar are a healthy option for desserts or snacks for those with diabetes. The amount of fruit permitted for a fruit exchange should be included in each fruit leathers.

They are made when fruit is cooked, dried, rolled, or cut out (for convenient storage and packaging), then pureed (often from a concentrate when mass-produced). The sticky mixture is then applied to a non-stick surface and allowed to dry. Fruit leather is a dried fruit that is stiff to the touch (thus the name) but flexible enough to roll. Depending on the type or variety of fruit leather, it is simple to cut the fruit leather into strips and other shapes.

Fruit leather typically keeps well in this state and doesn't need to be refrigerated. Since fruit leather is made from fruit that has had vitamins (especially vitamin C) added, many people believe that it is healthier than other confections, which is why its popularity has substantially expanded over the past ten years.

Numerous businesses produce fruit leather in large quantities, but it is very simple to make at home. Cookbooks are rife with recipes, such as instructions for producing fruit leathers on the stove with grapes, raspberries, apples and strawberries, and using the oven or a food dehydrator to speed up the drying process.

It's unclear who or when the first person to create fruit leathers. Many, however, contend that the Middle Eastern peoples were among the first to realise that fresh fruit, when boiled, dried, and pureed, could be used and kept all year round. It's likely that apricot was an early fruit leather flavour. Fruit leathers are really described as Persian or Middle Eastern in vintage recipes. The treat is known as "bastegh" in Armenian cookbooks, which also describe the "old ways" in which these fruit leathers were made while providing instructions for producing them at home.

The recipe advises making the fruit treat in dry, sunny weather because it calls for pouring the cooked and pureed fruit onto muslin sheets, hanging them outside to dry, spraying water on the other side so it can be peeled off the muslin, and then allowing them to dry again outside in the sun. The fruit leather should be brought inside at night, but if it isn't solid to the touch, it should be put back outside the next day.

The completed item was shaped as desired, then put into a glass jar for storage. For speedy, dependable drying, some updated recipes call for the cook to pour the slurry onto wax paper or plastic wrap and set it in the sun behind cheese cloth. However, some recipes advise using ovens or dehydrators.

Fruit leather recipes can frequently be found in organic and health-conscious recipe books. These recipes specify the use of organically grown fruit and forgo the use of processed sugar, artificial sweeteners, or added vitamins in favour of honey (if any sweetener is used at all). In actuality, two thirds of mass-produced fruit leathers are sugars and chemicals, and only roughly one third is fruit puree.

Fruit leathers have been produced in this nation by significant food producers for about 20 years. These fruit leathers come in an absurdly wide variety of tastes, including watermelon, and have vitamins added particularly to make them healthier. They are made with kids' interests in mind and are quite well-liked by them.

These producers have created a variety of vibrant colours for these fruit snacks, including hot and fluorescent hues that are not derived from actual fruit. Some manufacturers choose to add cartoon figures to their products rather from just cutting the leather into plain strips in order to boost marketing and sales. The product is more tempting to youngsters because of the famous cartoon or movie characters that are included on the packaging.

Papayas are a fruit that is readily available all year long and is reasonably priced. They have a delectable flavour and offer a number of skin and health benefits. The benefits of papaya fruit are well known, whether for health or for beauty. However, not only the fruit, but also the peels of this fruit, which you usually throw in the dustbin, can be really beneficial for your skin.

The papain enzyme, which is known to be a significant component of papaya peels, is found in abundance in papaya peels and is recognised for its proteolytic properties. An endolytic cysteine protease is papain. However, this fruit's peel is typically thrown away from homes, restaurants, and businesses.

The peel of the papaya has many advantages for the skin. According to a study in the International Journal of Scientific and Research Publications, papaya peel provides calming and moisturising properties for the skin, qualities that are highly valued in the cosmetics sector. Papain, an enzyme found in the papaya peel, helps exfoliate dead skin cells and contributes to the skin's brightness. The presence of folate and vitamin C guarantees that your skin is well moisturised.

Sugar cane and sugar beets must first be refined in order to make sugar. Sugar beets are farmed in 11 states in the United States. Minnesota is the state that produces the most sugar beets, followed by Idaho, North Dakota, and Michigan, according to the U.S. Department of Agriculture. Southern Florida, the Mississippi Delta region of Louisiana, and southern Texas are the three states where sugar cane is grown in the United States. Florida is the state that produces the most sugar cane, according to the U.S. Department of Agriculture.

When sugar crystals from the sugar-refining process are boiling, molasses syrup can be added to create brown sugar. It can also be produced by molasses-coating white granulated sugar. While both sugar cane and sugar beets are used to manufacture white granulated sugar, only cane molasses is utilised to make brown sugar. Brown sugar gets its colour from molasses made from sugar cane; more molasses are required to make dark brown sugar than light brown sugar. No of how it was made, brown sugar normally has at least 85% sucrose.

White table sugar and brown sugar both have about the same number of calories per teaspoon. The presence of molasses, which gives brown sugar its distinctive colour, flavour, and moisture, is the primary distinction between brown sugar and table sugar. Depending on their moisture level, which may be altered by various processing procedures and by modifying the amount of molasses they contain, brown sugars can come in a variety of forms (for example, coarse

or soft). People are probably more likely to be familiar with the soft light and dark varieties of brown sugar that are frequently used in baking.

Along with the mono-saccharides fructose and glucose, brown sugar also contains the disaccharide sucrose. When ingested, brown sugar is converted by the body into energy in a manner akin to how other sugars are broken down. Fructose and glucose are the by-products of the breakdown of sucrose. Fructose is processed in the liver and does not require insulin to be absorbed, whereas glucose is ultimately taken up by our cells with the help of insulin. Brown sugar is not thought to be healthier than other sugars, despite the fact that it contains a tiny quantity of different elements from molasses.

2. LITERATURE REVIEW:

The review of literature deals with the study entitled on **"Formulation and Development of Fruit Leather Incorporated with Papaya Peel Powder"** is discussed below.

2.1 FRUIT LEATHER
2.2 PAPAYA PEEL
2.3 BROWN SUGAR

2.1 FRUIT LEATHER

Fruit leather, also known as a fruit bar or a fruit slab, is a dehydrated confectionery food item that is frequently consumed as a snack or dessert (Raab et al., 1976). According to Diamante et al. (2014), it is chewy and flavourful, naturally low in fat and high in fibre and carbs, as well as being lightweight and simple to store and transport.

Consuming fruit leather is a cost-effective and practical value-added alternative to natural fruits as a source of different nutrients. In addition, fruit leather contains significantly fewer calories per serving—less than 100 kcal—than many other snacks (Huang et al., 2005). Fruit leather is restructured fruit that is manufactured from fresh fruit pulp or a combination of fruit juice concentrates and other components via a complicated process that includes a dehydration step (Huang et al., 2005; Maskan et al., 2002).

Fruit leathers made from fruit pulp are palatable to consumers and filling. According to Diamante et al. (2014) and Singh Gujral et al. (2003), they include sizeable amounts of dietary fibres, carbs, minerals, vitamins, and antioxidants (which continue to be components of the completed product). Making fruit leather from fresh fruits is an efficient approach to preserve fruits because most fresh fruits have a limited harvest season and are susceptible to deterioration even when stored under refrigeration (Maskan et al., 2002).

Fruit puree is dehydrated into a leather-like layer to create fruit leathers (Raab et al., 1976). Until the fruit puree or a prepared boiling fruit juice with additions changes into cohesive "leathery" sheets, moisture is removed from the wet purees, which are often spread on a big flat tray (Moyls, A. L. 1981). The terms "pure," "sun-dried," and "rich in vitamins" are frequently used in health food marketing to characterise fruit leathers (Vatthanakul et al., 2010).

Numerous fruit leather goods, including mango leather, apricot fruit leather, grape leather, berry leather, kiwifruit leather, and jackfruit leather, are offered on the market. Also offered are mixed fruit leathers like guava and papaya fruit leather. Basically, fruit pulps are combined with the proper amounts of sugar, pectin, acid, and colour before being dried to produce products in the form of sheets. Mango leathers were modified by Gujral and Brar (Singh Gujral et al., 2003) by adding pectin and sugar.

Pectin was employed to thicken the pulp, alter the flexible texture, and guarantee the retention of the dried product's forms after the product's sweetness and solids content were enhanced by sugar. In order to improve the sensory attributes of the mango leather, they also added potassium metabisulphite to the preparation, and the end product was well received by clients and consumers. Papaya leathers were created by Chan Jr. and Cavaletto (CHAN JR et al., 1978) using sugar and sodium bisulfite (SO2). They discovered that SO2 lessened the papaya leathers' colour shift during processing and storage. Depending on the type of fruit leather, different additives can be utilised, including glucose syrup, sodium metabisulphite, and sorbic acid (Demarchi et al., 2013; Ruiz et al., 2012; Sharma et al., 2013).

The easiest technique of food drying is sun drying. The most well-liked sun-dried fruit varieties include raisins, sultanas, and dried apricots. The end product can have a translucent appearance, a typical colour, and a sticky texture thanks to sun drying. However, there are drawbacks, including a lengthy drying process that exposes the items to environmental pollution, reliance on weather, and the need for manual labour. Therefore, faster, safer, and more manageable alternate drying techniques were created to address the issues of time and hygiene (Maskan et al., 2002).

Fruit leathers with improved colour and flavour have been produced using modern dryers such tunnel dryers and forced air circulation cabinet dryers. The drying medium employed in more than 85% of industrial dryers is hot air or gases from direct combustion. In the course of drying, a product may shrink, inflate, or crystallise. The final product's

colour, texture, aroma, and other qualities can occasionally alter due to desired or unwanted chemical or biological interactions. By applying heat to the wet material, the liquid vaporises, resulting in drying.

Fruit leathers are made using a variety of techniques, including conduction (such as contact or indirect dryers), convection (such as direct dryers), radiation (such as putting the wet material in a microwave or radio frequency electromagnetic fields), and volumetric drying. The methods selected depend on the type of fruit and the market circumstances.

In many processes, improper drying techniques cause irreparable quality degradation to the finished product, rendering it unsellable (Huang et al., 2005; Singh Gujral et al., 2003). Fruit leathers can be dried at any time of year to meet consumer demands thanks to contemporary dehydrators and well-designed drying techniques.

2.2 PAPAYA PEEL

The most economically significant fruit in the Caricaceae family and one that is grown all year round is the papaya (Carica papaya L.). The majority of papaya production occurs in tropical and subtropical nations, with India, Brazil, Indonesia, Nigeria, and Mexico being the top papaya producers. Papayas were harvested on 418,604 acres in 2014, and 12,822,014 tonnes were produced worldwide. According to Faostat (F. A. O. 2017) and Pathak et al. (2019), the majority of products made from papaya include tutti-frutti, powder, papaya chips, skin care items, papain, sweets, jam, jelly, pickles, sauce, squash, etc.

The antioxidant capabilities of the many bioactive substances found in papaya, including carotenoids, phenolic compounds, vitamins A, C, and E, pantothenic acid, minerals (potassium and magnesium), folate, and fibre, have been linked to a number of positive health impacts on human bodies. In addition, papaya is a natural source of papain, a digestive enzyme that is used in the pharmaceutical, brewing, and cosmetic industries to tenderise meat.

As a result, it should come as no surprise that using these fruits for the aforementioned uses generates a lot of waste and by-products, especially during the harvesting and post-harvesting processes. The two main by-products of papaya processing, papaya peel (PP) and papaya seeds (PSs), account for roughly 12 and 8.5% of the fruit weight, respectively. The bioactive chemicals in PP and PSs have some additional value and can be employed as nutritional supplements, nutraceutical supplements, innovative culinary products, and medicinal goods.

Traditionally, PP has been used in cosmetics, household treatments, and animal feed. If improperly managed, PPs that are dumped into the environment might result in environmental damage (Pathak et al., 2019; Parniakov et al., 2015). However, PPs can be used as a good source of beneficial substances, food additives, or nutritional supplements. They can also be transformed into other products with added value. Due to the fact that PPs can be utilised to create products with a high added value and that their recovery may have economic significance, this idea has attracted a lot of interest.

The urge to create "wealth from waste" arises from the necessity to develop a way or procedure that will allow us to repurpose PP to create profitable and valuable items. Several publications on the extraction of/production of beneficial by-products from PP have been published in this area. Here, we examine a few of those studies that emphasise the creation of various value-added goods employing these wastes.

Knowledge of PP's physical and chemical properties must be complete in order to utilise it to the fullest. The knowledge of these qualities might aid in creating an environmentally benign approach for using PP (Pathak et al., 2016). Unripe papaya is a good source of vitamins, proteins, and carbs.

It has been noticed that the protein, lipid, and carbohydrate contents of PP substantially decrease as it ripens. Carbon (38.10%) and nitrogen (1.49%), according to a final analysis of PP, are present. When raw materials' C-to-N ratios fall between 25 and 30:1, microbes can develop and flourish appropriately. The outcome demonstrates that PP has a healthy C-to-N ratio (26:1), indicating that microbial interactions can take place without difficulty on the surface of PP (Kumara et al., 2010).

Sample of PP	Moisture content (%)	Dry matter (%)	Crude fibre (%)	Ash (%)	Crude protein (%)	Fat (%)	CHO (%)
Unripe	54.48	45.52	14.52	5.25	10.56	0.23	30.35
Hard ripe	58.22	41.78	13.67	4.84	9.04	0.31	27.87
Very ripe	68.39	31.61	9.67	3.15	6.89	0.33	20.04

TABLE 1: Proximate compositions of PP at different stages of ripening (Khattak *et al.*, 2017)

Sample of peel	Vitamin A (IU/mg)	Vitamin C (IU/mg)	Riboflavin (mg)	Thiamine (mg)	Niacin (mg)
Unripe	731.28	71.01	0.05	0.04	0.37
Hard ripe	1232.82	68.03	0.06	0.04	0.41
Very ripe	1164.10	65.70	0.08	0.06	0.45

TABLE 2: Vitamin composition of PP at different stages of ripening (Khattak *et al.*, 2017)

Sample of peel	Phenol (%)	Alkaloid (%)	Flavonoid (%)	Tannin (%)	Saponin (%)
Unripe	0.38	1.35	0.47	0.61	1.47
Hard ripe	0.30	1.23	0.41	0.54	1.43
Very ripe	0.17	0.39	0.33	0.35	0.49

TABLE 3: Non-nutritive components of peels at different stages of ripening (Khattak *et al.*, 2017)

2.3 BROWN SUGAR

According to (Abdullah et al., 2014), countries with tropical climates such as China, Thailand, Vietnam, India, Korea Selatan, Bolivia, Brazil, and Indonesia produce brown sugar. One of the developed nations that produce brown sugar is Indonesia, which has a significant export market for the substance. Both as a producer of brown sugar and as a potential consumer, a developing nation.

It agrees with (Cardona et al., 2014) who said that investors' interest in investment opportunities in emerging markets has increased and that these markets have now taken on significant economic importance. In ancient India, brown sugar was frequently used as a health food. It is still often used in many Indian areas today. The health of women is severely affected by this (Abdullah et al., 2014).

Then, according to (Abdullah et al., 2014), brown sugar has a lot of medical benefits in traditional cultures. It is extensively utilised in Siddha and Ayurveda, two branches of Indian medicine. It is well known for fighting colds and lung-related illnesses. In addition to serving the same purpose as a sweetener, brown sugar's potential as a sugar substitute is also a result of its natural composition, distinctive flavour and scent, and nutritional value. Brown sugar includes more calcium, phosphorus, and iron than white sugar, as well as thiamine and riboflavin (Abdullah et al., 2014).

Mineral	Brown sugar	White sugar
Micro mineral mg/L (ppm) in dry matter		
Manganese (Mn)	1.30	0.00
Baron (B)	0.30	0.00
Zinc (Zn)	21.90	1.20
Iron (Fe)	2.30	1.20
Copper (Cu)	2.30	0.60
Macro mineral mg/L (ppm) in dry matter		
Nitrogen (N)	2.02	0.00
Phosphorus (P)	790.00	0.70
Potassium (K)	10.30	25.00
Calcium (Ca)	60.00	60.00

Table 4: Comparison of macro and micro minerals in brown sugar and white sugar (Abdullah *et al.*, 2014)

3. METHODOLOGY:

The methodology pertaining to study entitled on **"Formulation and Development of Fruit Leather Incorporated with Papaya Peel Powder"** is presented.

3.1 Selection of raw materials:

- Food ingredients namely papaya peel and brown sugar were selected for the development of the product.

3.2 Procurement of raw materials:

- Papaya is collected from the home garden and the waste peel is used for the development of the product.
- Brown sugar is purchased from the local shop.

Papaya peel

Brown sugar

3.3 STANDARDIZATION OF PAPAYA FRUIT LEATHER

The product was standardized in terms of the amount of ingredients procedure and serving size. Standardization was done to obtain reproducible results for the purpose of standardized products and number of preliminary trails was conducted like incorporating with papaya peel to the fruit leather. Different variations of developed papaya peel leather were prepared by altering the proportions of all ingredients for standardization.

INGREDIENTS	VARIATION-1	VARIATION-2	VARIATION-3
Papaya peel powder (dry)	5	6	7
Papaya peel powder (after soaked)	70	75	80
Brown sugar	20	25	30

TABLE 5: Standardization of papaya peel leather

CONTROL

VARIATION - 1

VARIATION – 2

VARIATIONS – 3

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3.4 Processing of ingredients:

Processing of papaya peel powder

Selection of papaya

↓

Wash in running water

↓

Peel the skin

↓

Blanch the papaya peel for 5 minutes

↓

Drying (sun dry for 2 days)

↓

Grinding

↓

Sieving

↓

Stored in air-tight container

Papaya peel

Blanching

Drying (day 1)

Drying (day 2)

Grinding

Sieving

Processing of papaya peel leather

Papaya peel powder

↓

Addition of water

↓

Soaked (15 minutes)

↓

Cook the papaya peel puree

↓

Addition of brown sugar

↓

Add pinch of cardamom

↓

Grease the tray and add the mixture to the tray

↓

Drying (sun dry for 2 days)

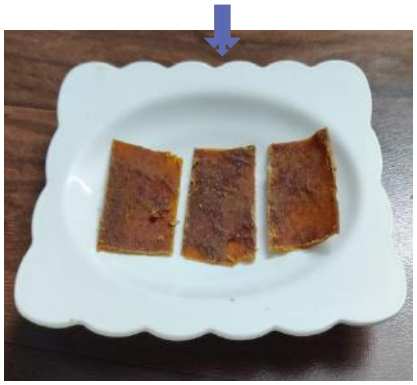
↓

Stored in air-tight container

Papaya peel powder

Mixing of all ingredients & cook

Drying (day 1)



Drying (day 2) & cut into pieces

4. RESULT:

4.1 ORGANOLEPTIC EVALUATION OF THE DEVELOPED PAPAYA PEEL LEATHER

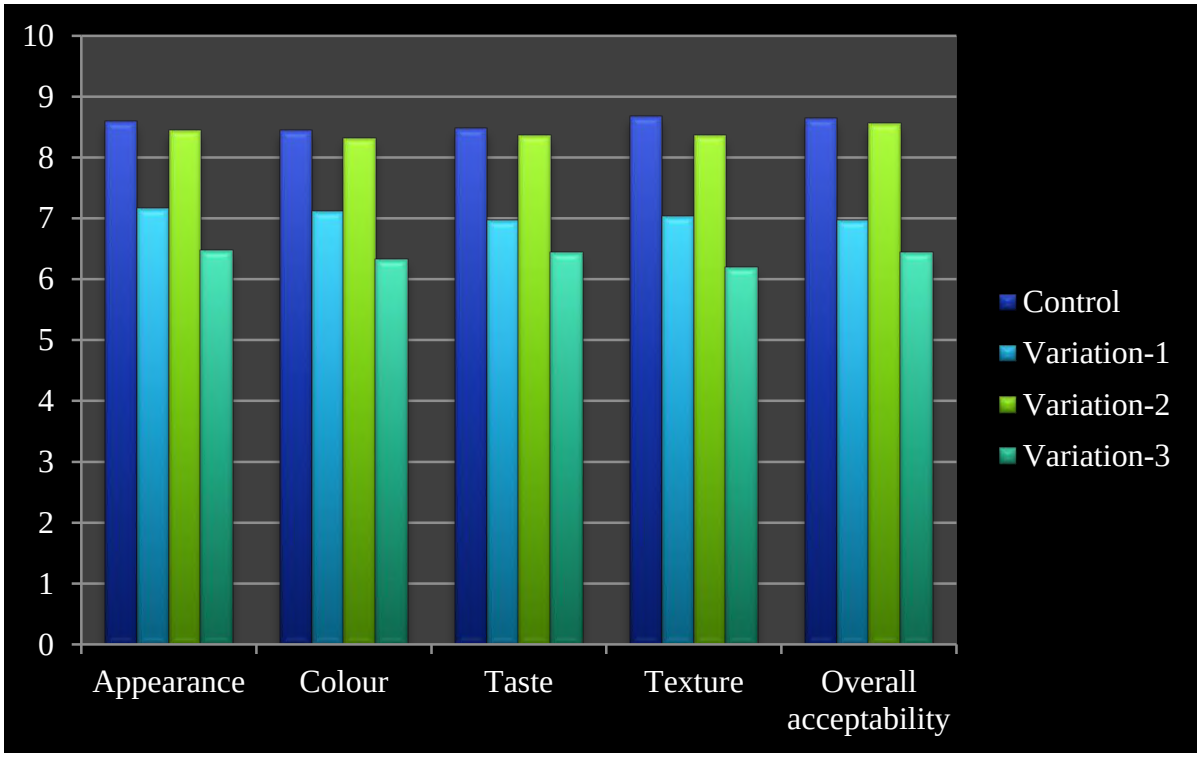
Organoleptic evaluation of the developed papaya peel leather was assessed by 30 semi-trained panel members, using the score card with the 9 point hedonic rating scale.

In this evaluation, the qualities of the product were asked to judge 30 semi-trained panel members with respect to appearance, colour, flavour, consistency, taste and over acceptability. Thus the individual mean sensory score for variation-I, variation-II and variation-III were given.

CRITERIA	CONTROL	VARIATION-1	VARIATION-2	VARIATION-3
APPEARANCE	**8.6±0.5**	7.17±0.65	**8.44±0.50**	6.48±1.02
COLOUR	**8.44±0.50**	7.12±1.05	**8.32±0.69**	6.32±1.28
TASTE	**8.48±0.50**	6.96±1.01	**8.36±0.90**	6.44±1.12
TEXTURE	**8.68±0.47**	7.04±0.61	**8.36±0.63**	6.2±0.95
OVERALL ACCEPTABILITY	**8.64±0.48**	6.96±0.84	**8.56±0.58**	6.44±1.04

TABLE 6: Mean ± standard deviation values of the formulated variations-V1, V2 & V3.

From the above table it is clear that organoleptic score for the variation-2 had got highest mean score for all the sensory attributes which includes Appearance (8.44±0.50), Colour (8.32±0.69), Taste (8.36±0.90), Texture (8.36±0.63) and Overall acceptance (8.59±0.58) in comparison with other variation-1 and variation-3. Compared to all other variations the Variation-2 secured highest mean score for overall acceptability. So, it was selected for further study.



GRAPH 1: Mean ± standard deviation values of the formulated variations-V1, V2 & V3.

4.2 NUTRITIVE VALUE OF PAPAYA FRUIT LEATHER

S. NO	FOOD ITEM	QUANTITY (g)	ENERGY (kcal)	CHO (g)	PROTEIN (g)	FAT (g)	CALCIUM (mg)	VIT-A (mg)	VIT-C (mg)
1.	Papaya peel	75g	104.92	27.87	-	0.31	31.27	1232.82	68.03
2.	Brown sugar	25g	95	24.52	0.03	-	20.75	-	-

3.	Cardamom powder	5g	12.75	2.39	0.41	0.13	18.9	1.1	-
		TOTAL	**212.67**	**54.78**	**0.44**	**0.44**	**70.92**	**1233.92**	**68.03**

TABLE 7: Nutritive value of papaya peel leather

The designed papaya peel leather contains nutritional values like Energy (212.67kcal), Carbohydrate (54.78g), Protein (0.44g), Fat (0.44), Calcium (70.92mg), Vitamin-A (1233.92mg), and Vitamin-C (68.03mg), as can be seen in the above table. The chosen variant contains extra vitamin A. Therefore, it is crucial for healthy vision, the immune system, reproduction, growth, and development, as well as for the efficient functioning of the heart, lungs, and other organs.

5. CONCLUSION:

Fruit leathers are a practical and handy alternative to eating fresh fruit, but they need to go through the right processes and be stored properly in order to be of excellent quality and appealing to consumers. The delicious fruit papaya is well-known for its culinary and nutritional qualities all over the world. Papaya peel (PP) and seeds are often seen as trash and thrown away after the pulp has been used. Our most recent research, however, indicates that PP is a valuable source of bioactive chemicals that can be turned into products with added value. Additionally, this study was conducted to show the public a wholesome and nutritious food. The papaya peel powder was made and added to the fruit leather to create a nutrient-rich product. In contrast to Variation 1 and Variation 3, Variation 2 is very acceptable. The combination of papaya peel powder and brown sugar provides a healthy source of calcium, vitamin C, vitamin A, and energy. According to consumer preference, the sensory qualities were the most acceptable, proving that it would be a safe and wholesome food for everyone.

REFERENCES:

1. Abdullah, W. G., Rianse, U., Iswandi, R. M., Taridala, S. A. A., Rianse, I. S., Zulfikar, L. Z., & Baka, W. K. (2014). Potency of natural sweetener: Brown sugar. *Advances in Environmental Biology*, *8*(21), 374-386.
2. Cardona, J. M., Andreu, J. O. R. D. I., & Cano, S. E. B. A. S. T. I. A. N. (2014). A new risk history: The Eastern Europe case. *WSEAS Transactions on Business and Economics*, *11*, 188-198.
3. CHAN JR, H. T., & CAVALETTO, C. G. (1978). Dehydration and storage stability of papaya leather. *Journal of Food Science*, *43*(6), 1723-1725.
4. Demarchi, S. M., Ruiz, N. A. Q., Concellón, A., & Giner, S. A. (2013). Effect of temperature on hot-air drying rate and on retention of antioxidant capacity in apple leathers. *Food and bio products processing*, *91*(4), 310-318.
5. Diamante, L. M., Bai, X., & Busch, J. (2014). Fruit leathers: method of preparation and effect of different conditions on qualities. *International journal of food science*, *2014*.
6. Faostat, F. A. O. (2017). Available online: http://www. fao. org/faostat/en/# data. *QC (accessed on January 2018)*.
7. Huang, X., & Hsieh, F. H. (2005). Physical properties, sensory attributes, and consumer preference of pear fruit leather. *Journal of food science*, *70*(3), E177-E186.
8. Khattak, K. F., & Rahman, T. U. (2017). Analysis of vegetable's peels as a natural source of vitamins and minerals. *International Food Research Journal*, *24*(1).
9. Kumara, M. P. P. R., & Wijetunga, S. (2010). Biogas production potential of select raw materials commonly found in house hold waste. In *Proceedings of International Forestry and Environment Symposium* (Vol. 15).
10. Maskan, A., Kaya, S., & Maskan, M. (2002). Hot air and sun drying of grape leather (pestil). *Journal of food engineering*, *54*(1), 81-88.
11. Moyls, A. L. (1981). Drying of apple purees. *Journal of Food science*, *46*(3), 939-942.
12. Parniakov, O., Roselló-Soto, E., Barba, F. J., Grimi, N., Lebovka, N., & Vorobiev, E. (2015). New approaches for the effective valorization of papaya seeds: Extraction of proteins, phenolic compounds, carbohydrates, and isothiocyanates assisted by pulsed electric energy. *Food Research International*, *77*, 711-717.
13. Pathak, P. D., Mandavgane, S. A., & Kulkarni, B. D. (2016). Valorization of banana peel: a biorefinery approach. *Reviews in Chemical Engineering*, *32*(6), 651-666.
14. Pathak, P. D., Mandavgane, S. A., & Kulkarni, B. D. (2019). Waste to wealth: a case study of papaya peel. *Waste and Biomass Valorization*, *10*, 1755-1766.
15. Raab, C., & Oehler, N. (1976). Making Dried Fruit Leather, Oregon State University. *Extension Service*. s

16. Ruiz, N. A. Q., Demarchi, S. M., Massolo, J. F., Rodoni, L. M., & Giner, S. A. (2012). Evaluation of quality during storage of apple leather. *LWT*, *47*(2), 485-492.
17. Sharma, S. K., Chaudhary, S. P., Rao, V. K., Yadav, V. K., & Bisht, T. S. (2013). Standardization of technology for preparation and storage of wild apricot fruit bar. *Journal of Food science and Technology*, *50*, 784-790.
18. Singh Gujral, H., & Singh Brar, S. (2003). Effect of hydrocolloids on the dehydration kinetics, colour, and texture of mango leather. *International Journal of Food Properties*, *6*(2), 269-279.
19. Vatthanakul, S., Jangchud, A., Jangchud, K., Therdthai, N., & Wilkinson, B. (2010). Gold kiwifruit leather product development using quality function deployment approach. *Food Quality and preference*, *21*(3), 339-345.
20. Wang, L., Boussetta, N., Lebovka, N., & Vorobiev, E. (2020). Cell disintegration of apple peels induced by pulsed electric field and efficiency of bio-compound extraction. *Food and Bio products Processing*, *122*, 13-21.