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Development and sensory evaluation of value added mixed fruit leather

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Abstract
The objective of this study was to formulate carrot, beetroot pulp, guava, papaya and grapes leather from locally grown fruits using natural ingredients like pectin, and citric acid and sodium benzoate. The fresh juices mixed with natural ingredients, and try dried in dryer at 60 C for 7 hours. The sensory attributes were determined. The results showed that fruit lather made form mixed fruits is significantly better in taste. The taste score of the Sample average 7.25. The panelists liked the mixed fruit leather sample moderately. The taste of fruit leather is contributed by the amounts of sugar contained in the fresh pulp. The colour score of sample average is 7.0, the panellist liked the mixed fruit leather sample moderately.

Keywords: Development, sensory evaluation, value added mixed fruit leather

Introduction

Fresh fruits are known to be excellent sources of energy, vitamins, minerals, antioxidants and fibres. The nutritional value of fruits greatly depends on the quality and quantity of its nutritive substances. There are numerous ways of utilizing and processing fruits such as processing into juice, jams, concentrates, pulp, dehydrated products, jellies and fruit leather.

Fruit leather, also called a fruit bar or a fruit slab, is a dehydrated fruit-based confectionery dietary product which is often eaten as snack or dessert. It is chewy and flavorful, naturally low in fat and high in fiber and carbohydrates; it is also lightweight and easily stored and packed. Fruit leathers are referred to the dried sheets of fruit pulp that taste sweet and have a soft, rubbery texture. Their production involves the dehydration of fruit puree to a leathery sheet (Raab and Oehler, 1999). Consuming fruit leather is an economic and convenient value-added substitute for natural fruits as a source of various nutritional elements. Furthermore, fruit leather has far fewer calories, less than 100 kcals per serving, than many other snacks Huang X and Hsieh (2005) [3]. Fruit leathers are restructured fruit made from fresh fruit pulp or a mixture of fruit juice concentrates and other ingredients after a complex operation that involves a dehydration step. They contain substantial quantities of dietary fibers, carbohydrates, minerals, vitamins, and antioxidants (which remain constituents of the finished product).

Basically, fruit pulps are mixed with appropriate quantities of sugar, pectin, acid, and colour and then dried into sheet-shaped products. The sugar gave the product a sweeter taste and increased the solids content; then pectin was used to thicken the pulp, modify the flexible texture, and ensure the retention of the shapes of the dried product. Furthermore, they also prepared mango leather with the addition of potassium metabisulphite to get better sensory qualities and the results were satisfactory for customers/consumers. Chan Jr. and Cavaletto 1978 [2], made papaya leathers with sucrose and sodium bisulfite (SO_2).

Beetroot (chukandar): Beetroots are great for your heart and are enriched with nutrients including vitamin A, C, B-complex, iron, potassium, magnesium and copper. They have antioxidants like lycopene and anthocyanins that give this vegetable a deep pink-purple colourc that further helps build our immune system and control the growth of bad cholesterol. According to Mr. Tomar, beetroot provides betalaine which is an anti-inflammatory substance, which helps in protecting our liver. They also contain anti-aging properties. It has soluble fibers that fight the fat stored in our body and help shed those extra kilos.

Carrot: Carrots contain a wide array of nutrients including vitamins such as vitamin A, B1, B2, B3, B6, C, E and K and nutrients such as niacin, folate and pantothenic acid and minerals like phosphorus, calcium, potassium, magnesium and selenium. One of the most important components that make carrots distinct from others is beta-carotene. Our body converts beta-carotene to vitamin A to aid the functioning of the eyes and the immune system. Vitamin A helps in flushing out the toxins from the body and reduces bile and fat from the liver. Interestingly, they also scrape off the plaque and food particles and the minerals in carrots prevent tooth damage. The consumption of carrots, both fresh and processed, has increased in recent years. This vegetable has one of the highest levels of carotene, and it is rich in vitamins, fiber and minerals. However, fresh carrots wilt rapidly after harvest under unsuitable storage conditions. Drying is an effective method to improve the shelf life and retain the nutritional quality of carrots. Currently, many drying techniques have been applied to carrots, among them solar drying, hot air, and microwave. Each method has its own set of advantages and disadvantages

Grapes

Grapes contain powerful antioxidants known as polyphenols. These are thought to have anti-inflammatory and antioxidant properties. One of these is resveratrol. It is found in the skins of red grapes. Laboratory studies have suggested that resveratrol may be able to slow or prevent the growth of tumors in lymph, liver, stomach, breast, colon, skin cancer, and leukemia. Resveratrol is also present in red wine. Few studies have looked at the association between red wine and cancer risk in humans, but it has been shown that high intakes of alcohol on a consistent basis can increase the risk of cancer. Moderation is key.

Guava

(*Psidium guajava* L.) is the fifth most important fruit crops in India and occupies the area of 220.0 thousand ha and production 2510.0 thousand MT with average productivity of 11.4 MT per ha fruit per year in 2011-12 (Indian Horticulture Database, 2012). Guava is a fruit with excellent digestive and nutritive value, pleasant sour-sweet taste, high palatability and availability in abundance at moderate price. The fruit contains ascorbic acid (260 mg/100gm.), pectin (1.15%), minerals like phosphorous, calcium etc. Fresh fruit has limited shelf life. Therefore, it is necessary to utilize this fruit for making different products to increase its availability over an extended period stabilize the price during glut season. A number of products are being prepared from this fruit including jam, jelly, slices in syrup, and it's diversified utilization gives potential to combat malnutrition by developing innovative and novel products which 2 could be prepared from guava pulp as such and in combination with other fruit pulp by blending.

Papaya

(*Carica papaya* L.) is the fourth most important fruit crops in India, which is cultivated in about 117.0 thousand ha of land with production of 4457.0 thousand MT and average productivity of 38.1 MT ha-1 in 2011-12 (Indian Horticulture Database, 2012). Papaya fruits are called protective foods because of their nutritive contributions such as vitamins, minerals, bulk cellulose and protopectin. Fruit contain a proteolytic enzyme, papin, which helps in digestion of protein rich foods. The vitamin A content in papaya (2020IU/100g) is next to mango. Papaya is also a rich source of other vitamins like thiamine, riboflavin, nicotinic acid and ascorbic acid. Unfortunately papaya fruit is not much popular among consumers as much as it deserves, mainly because of its odour which is not highly appealing and thus limits it's commercial exploitation at processing levels. Today, foods are not only intended to satisfy hunger and provide necessary nutrients for humans but also to prevent nutrition-related diseases.

The dehydration and storage stability of papaya leather was investigated by Chan Jr. and Cavaletto (1978) [2]. The papaya leather was prepared by steaming whole papaya for 1 minute, slicing, and then separating the flesh, skin, and seeds. They pulped the treated fruits and acidified them until the pH was 3.5. After inactivating the enzymes by heating the puree, the puree was stored frozen at C. Sugar (10% w/w) at 4.9 kg/m^2 (11 b/ft^2) was added in the papaya puree and then the puree was poured evenly onto Teflon-coated pans or pans sprayed with a lecithin release agent. Sodium bisulfite was added to give low (552 ppm) and high (1105 ppm) levels of SO_2 treatment. The purees were dried in a forced draft oven until they reached about 12-13% moisture content or a water activity of 0.50–0.52. Babalola *et al*. also made pawpaw (papaya) leather by peeling the fresh fruits and adding 20% sugar, 0.2% citric acid, and 0.1% sodium benzoate to a concentration of 80% pulp. The pulp was then boiled, cooled, and spread on trays that had been previously oiled with glycerol and then dried at C for 8 hours.

There is good possibility of enhancing the flavor and acceptability by using blending technology. One of the best ways of utilizing and preserving fresh fruits is processing them into leathers. Scientific production in the topic began around 1978 and, in beginning of the 21st century, from which fruit leathers began to receive more attention from researchers. Blending of guava pulps could be an important preposition to improve their overall acceptability of papaya product as guava is a cheap fruit crop and available in abundance twice or thrice in a year. It is valued for its characteristics flavour and rich nutritional qualities at economical rates. It contains five times as much vitamin C as oranges while papaya is a rich source of carotenoid. Development of such guava and papaya and other mixed fruits leathers may prove to be a good source of food which can be eaten as a confectionary and help in utilizing underutilized fruits in a better way by reducing post harvest losses and product diversification.

Methodology

Sample preparation

- Guava : 200g
- Carrot 150g
- Beet root pulp: 80 ml
- Papaya : 150g
- Grapes : 100g
- Sugar: 10%
- Citric acid : 2%

Procedure

All fruits papaya, carrot and guava were washed, peeled, and chopped into pieces and made pulp using blender. Mixed fruit leather was made by mixing the pulps of guava, carrot and papaya, grape and beet root pulp in different ratios. The blended all fruit pulps were mixed, the brix and acidity of all the blends were adjusted to Brix 20. The pulp mixture obtained was heated to85◦ C to inactivate the enzymes and cooled to about 45 ◦C. Potassium metabisulphite (0.2%) was

also added as a preservative before; the mixture was poured as a 1.00 cm thick layer in trays previously smeared with butter and dried in a try drier cabinet at 60 ◦C for 10 hours.

A new process of making guava fruit leather was reported in (Vijayanand *et al*., 2010). The guava leather was prepared by washing ripe guava, then crushing, and extracting them through a pulper to get a puree. The pectolytic enzyme Rohapect D5 L was added to the guava puree at a concentration of 0.5 mL/kg and then the puree was incubated at C. After 2 hours, guava juice was obtained by pressing the puree and this was then mixed with maltodextrin, sucrose, soluble starch, wheat flour, pectin, and an antibrowning agent until it reached total soluble solids of Brix. The mixture was then spread on stainless steel trays smeared beforehand with glycerol at the rate of 12 kg/m^2 and was then dried at C, 12% RH in a cross-flow hot air dryer with a 2.5 m/s flow rate to a final moisture content of 14 to 15%.

Maskan *et al*. (2002) [8] reported that hot air drying and sun drying for preparation of pestil (grape leather). The pestil (grape leather) was made by washing the grapes to remove dirt, leaves, and foreign materials and then crushing and pressing them manually. The mixture was boiled for 3–5 minutes in order to inactivate the enzymes which cause colour changes. The total juice was divided into two parts. The concentrated grape juice mixture samples were dried until there was no weight change. For the sun-dried products, the samples were dried under direct sunlight for 14 hours.

Ripe fruits
↓
Washing
↓
Pulping
↓
Addition of sugar + citric acid + pectin
↓
Mixing
↓
Cooking
↓
Spreading on trays
↓
Drying
↓
Cutting into slabs
↓
Packing
↓
Labeling

A process flow chart of papaya leather production

Sensory evaluation of the mixed fruit leather samples

A consumer acceptability sensory evaluation was conducted at foods and nutrition department, PG&RC, PJTSAU in the sensory evaluation laboratory. Panellists comprised 20 volunteers who were staff or students at thedepartment. Each panellist was asked to taste sample. Attributes selected for the mixed fruit leather were Appearance, taste, texture, colour and overall acceptability. In this study, the hedonic scale was implemented; on a scale of 1 to 9 there were tabulations of scores, where 1 indicates "extremely dislike" and 9 represents "extremely like" (Ihekoronye and Ngoddy (1985) [4] For reliability purposes, drinking water was given to the panelists for them to rinse the mouths between evaluations.

Statistical analysis: Data were expressed as the means values ± standard deviation. Mean of minimum three measurements were compared by analysis of variance (ANOVA). Significant differences between means were determined by Windostat software.

Results and discussion

The result of the sensory evaluation of the mixed fruit leather prepared using different fruits (guava, carrot, beet root, papaya and grape). The result showed that the average score for appearance of sample (60% banana: 20% pineapple: 20% apple) as 7.75 recorded. All the samples were liked moderately by the panellists. The average texture score of the mixed fruit leather samples were 7.6. It is worth noting that the texture of fruit leathers can be evaluated in several ways. The human mouth is more complex at evaluating the texture as opposed to a penetrometer which might measure just one aspect of texture (Huang and Hsieh, 2005; Pomeranz and Meloan, 2000) [3, 9]. The taste score of the Sample average 7.25. The panelists liked the mixed fruit leather sample moderately. The taste of fruit leather is contributed by the amounts of sugar contained in the fresh pulp. The colour score of sample average is 7.0, the panellist liked the mixed fruit leather sample moderately. Increase in the amount of sugar beyond optimum amounts may however, reduce the taste ratings thus, requiring optimization (Jain and Nema, 2007) [5, 6]. Sweetness rating may also depend on the type of the fruit and may also vary during storage (Ashaye *et al*., 2005).

Table 1: Sensory evaluation of mixed fruit leather sample

Sample	Appearance	Texture	Taste	Colour	Acceptability
403	7.75±0.2	7.6±0.3	7.25±0.1	7.0±0.23	7.45± 0.13

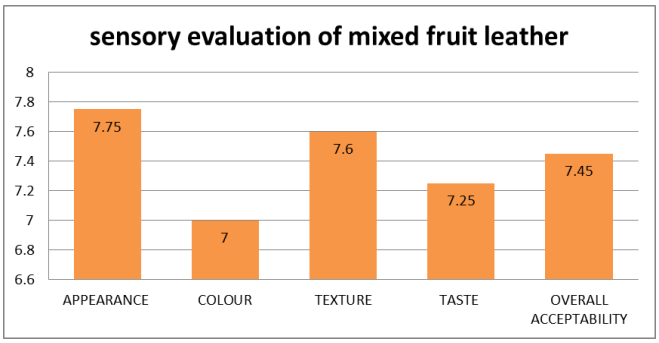

Fig 1: Sensory evaluation of mixed fruit leather

All the samples of the mixed fruit leather had average score of 7.45 for general acceptability. Karmas and Harris (1988) reported that the acceptability of fruits and vegetables is influenced by their taste and aroma. In this study, however, the results of the overall acceptability were positively correlated with the entire sensory attribute tasted.

Conclusion

Fresh fruits are known to be excellent sources of vitamins, minerals, fibers, carbohydrates, and other bioactive compounds. Fruit leathers provide attractive, colored, and flavorsome products for people. A variety of researches have been carried out to study the effects on fruit leathers of different methods of preparation, different drying conditions, and packaging and storage conditions, Drying of fruits into leather will help to reduce the post harvest losses due to highly perishable nature of the fruits as a result of high

moisture content and help in the utilization of fruits such as guava, carrot, beet root, papaya to extend their shelf life. The sensory evolution studied showed that taste and texture more compared with colour, the mixed fruit leather moderately accepted by panellist.

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