A Systematic Methodology for Preparation of Vegetable Leather

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Abstract

Vegetable leather is processed snacks that are highly delicious and nutritious. The product is developed out of dried purees of different vegetables prepared easily at home or in small-scale industries that requires minimum investment and preparation time. They are restructured vegetable made from fresh vegetable pulp or a mixture of its juice concentrates and other ingredients after a complex operation that involves a dehydration step. Pulp-based vegetable leathers are nutritious and organoleptically acceptable to customers. Generally, fruit leathers are highly available in the market as a form of dessert that kids enjoy to consume. Leathers from vegetables are not much available and also not widely accepted. The nutritional compositions of vegetable leathers are equally appreciable in comparison with vegetables. Hence through this study, leather is prepared from two main ingredient beetroot and carrot which naturally possesses colour, flavour, texture and sweetness as compared to few fruits. Along with the sample one more variation is developed through addition of beetle leaves extract is also involved. The study expounds developing techniques of beetroot leather and evaluation process.

Keywords: Vegetable Leather, Beetroot, Carrot and Beetle leaves

Introduction:

Vegetable Leather is great either eaten out of hand or added to soup and stew, and literally any vegetables can be made into leather or dehydrated. Vegetable leather, also called a vegetable bar or a vegetable slab, is a dehydrated vegetable-based confectionery dietary product which is often eaten as snack or dessert. It is chewy and flavourful, naturally low in fat and high in fibre and carbohydrates; it is also lightweight and easily stored and packed. Consuming vegetable leather is an economic and convenient value-added substitute for natural fruits as a source of various nutritional elements. Furthermore, vegetable leather has far fewer calories, ≤ less than 100 kcal per serving, than many other snacks (Busch, 2014)1. Most fresh vegetables have a short harvest season and are sensitive to deterioration and even when stored under refrigerated conditions; therefore, making vegetable leather from fresh vegetables is an effective way to preserve it. Sun drying is the simplest method of drying foods. Sun drying permits the final product to have a translucent appearance, a normal color, and a juicy texture. However, there are disadvantages, such as a long drying process-exposure of the products to environmental contamination, dependency on weather conditions, and hand labour requirements. Therefore, alternative drying methods were developed to overcome the problems of hygiene and time, as these methods are rapid, safe, and controllable. In the current growing market of vegetable leathers, commercial packaging is necessary. Packaging materials for fruit leather are required to prolong the shelf-life of the product and, normally, relate to the stability of water activity, microbiological stability, sensory properties, and physicochemical characteristics (Bai, 2014). Beetroot is recognized as health promoting food due to presence of essential components such as vitamins, minerals, phenolics, carotenoids, nitrate, ascorbic acids and betalains that promote health. Betalains occur in two forms i.e. betacyanin (red-violet pigment) and betaxanthin (yellow-orange pigment) and are recognizable commercially as a food dye due to non-precarious, non-toxic, non-carcinogenic and non-poisonous nature. The betel leaf commonly known as ‘Paan’ or ‘Nagvalli’ (family-Piperaceae) is an evergreen and perennial creeper. Significance of leaves has been explained in relationship to every sphere of human life including social, culture, religious and is very much relevant even in modern days. From ancient time betel are chewed along with areca nut, slaked lime, cardamom and clove in many Asian countries. Various properties of betel leaf include antioxidant, antifungal, antiulcerogenic, antiplatelet, antidiabetic, immunomodulatory, antileishmanial, antimicrobial, anti-inflammatory, antifilarial and antimicrobial, antifertility, antihyperglycemic, antidermatophytic, antinaceptive and radioprotective properties (Kushava, 2019)2. Carrot is one of the important root vegetables rich in bioactive compounds like carotenoids and dietary fibers with appreciable levels of several other functional components having significant health-promoting properties. The consumption of carrot and its products is increasing steadily due to its recognition as an important source of natural antioxidants having anticancer activity. Carrot waste contains high amounts of residual bioactives, with currently little commercial values. These phytochemicals could be profitably utilized for the fortification and development of functional foods, pharmaceuticals, and medicines (Vuclid, 2020)3. Hence the vegetable leather prepared out of beetroot, carrot and beetle leaves extract tends to provide nutritional and fulfilled dessert with no involvement of chemical preservatives.

Materials and Methods:

Preparation:

Leathers are manufactured by dehydrating a vegetable puree into a leather-like sheet. Moisture is removed from the wet purees, which are usually laid on a large flat tray until the vegetable puree or a prepared boiled vegetable juice with additives changes into cohesive “leathery” sheets.
Basically, vegetable 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.

**FIGURE 1**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beetroot/Carrot</td>
<td>½ kg</td>
</tr>
<tr>
<td>Sugar</td>
<td>2 tablespoons</td>
</tr>
<tr>
<td>Beetle Leaves</td>
<td>12g</td>
</tr>
</tbody>
</table>
Step-wise preparation of Vegetable Leather

Evaluation of Beetroot Leather

Sensory evaluation

The criteria that are considered for the sensory evaluation are appearance, colour, size and shape, surface texture and taste. Advanced Foods Laboratory in the Department of Food Science and Technology in Arul Anandar College, Karumathur, Madurai was selected as the venue. The sensory evaluation is done by the group of selected semi-trained panel members of the Department of Food Science and Technology. This method involves the process of judging the quality of food by a panel of judges. The evaluation process deals with measuring, analysing and interpreting the qualities of food as they are perceived by the senses of sight, taste, touch, etc.

Results and Discussion:
Development of Vegetable Leather:
Vegetable leather was prepared from the basic ingredients and dried for about 24 hours under the fan or sunlight. The beetle leaves were added as a value addition to improve its mouth freshening quality.

Evaluation of the Vegetable Leather:
The vegetable leather developed from beetroot and carrot along with/without value addition have been evaluated based on the five points hedonic rating scale for the sensory attributes like appearance, taste, texture, colour and overall acceptability by twenty semi-trained panel members and compared with the fruit leather.

Table: II
Mean Acceptability of Standard Vegetable leathers and with value additions

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Standard</th>
<th>Standard carrot</th>
<th>Variation</th>
<th>One-way</th>
</tr>
</thead>
</table>

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From the calculated results of beetroot, carrot and variation based fruit leather from the standard and variations both were best in texture and taste. Beetroot leather were best as per mean values of appearance, texture, taste, colour in comparison with standard carrot leather. Flavour was same for both standard and variations and overall acceptability score of leathers with variations was higher than standard vegetable leathers.

* - Significant  ** - Not significant

<table>
<thead>
<tr>
<th></th>
<th>beetroot leather</th>
<th>leather</th>
<th>(with beetle leaves)</th>
<th>Anova</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>4.80±0.407b</td>
<td>4.50±0.731b</td>
<td>3.80±0.714a</td>
<td>0.000*</td>
</tr>
<tr>
<td>Taste</td>
<td>4.57±0.728a</td>
<td>4.67±0.711a</td>
<td>4.57±0.728a</td>
<td>0.826**</td>
</tr>
<tr>
<td>Texture</td>
<td>4.73±0.521a</td>
<td>4.57±0.679b</td>
<td>4.53±0.629a</td>
<td>0.404**</td>
</tr>
<tr>
<td>Colour</td>
<td>4.77±0.430a</td>
<td>4.13±0.860a</td>
<td>4.13±0.860a</td>
<td>0.001*</td>
</tr>
<tr>
<td>Flavour</td>
<td>4.73±0.450a</td>
<td>4.30±0.750a</td>
<td>4.30±0.794a</td>
<td>0.021*</td>
</tr>
<tr>
<td>Overall acceptability</td>
<td>4.73±0.450a</td>
<td>4.20±0.484a</td>
<td>4.33±0.547a</td>
<td>0.000*</td>
</tr>
</tbody>
</table>

Discussion:
Vegetable leathers are restructured vegetable made from fresh vegetable pulp or a mixture of its juice concentrates and other ingredients after a complex operation that involves a dehydration step. Pulp-based vegetable leathers are nutritious and organoleptically acceptable to customers. They contain substantial quantities of dietary fibers, carbohydrates, minerals, vitamins, and antioxidants (which remain constituents of the finished product).

The product actually requires effective sensory skills that enable the developer to choose right vegetable or right combination with apt ratio in preparation. This leather holds a high chance of value additions along with enrichment and fortification of nutrients to improve its overall quality.

Out of the developed vegetable leathers from beetroot, carrot and along with beetle leaves extract, both the vegetables along with beetle leaves combination stood high in terms of taste, texture, flavour and odour. But in terms of appearance, beetroot leather holds high in comparison with carrot leather and with their respective value additions. Overall as a product, beetroot leather with and without beetle leaves extract scored high in comparison with carrot leather and its variation.

This product may help in effective inclusion of vegetable in way well accepted by all age groups and equally good in comparison with fruit leathers available in the market. The vitamins and minerals from beetroot, carrot and beetle leaves enrich the product and its mouth freshening effect.
Conclusion

It is always recommended to include more vegetables to improve antioxidant level in body due to high spread of diseases, in such situation it becomes need of the hour to reconstruct as well as gain equal nutrients as from the same sources. Hence through the study, the vegetable leather is developed as a nutritional enhancer as well as an attempt to develop leather from a vegetable sources which are rarely available in market in comparison with fruit leathers.

Acknowledgement

We thank the management of Arul Anandar College, Karumathur, Madurai and Dean of Research for selecting and funding this project along with cordial support throughout entire process.

Reference