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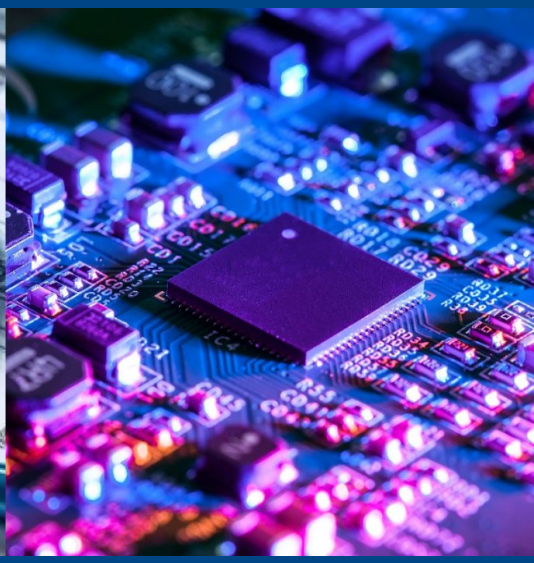

# International Journal of Multidisciplinary Research in Science, Engineering and Technology

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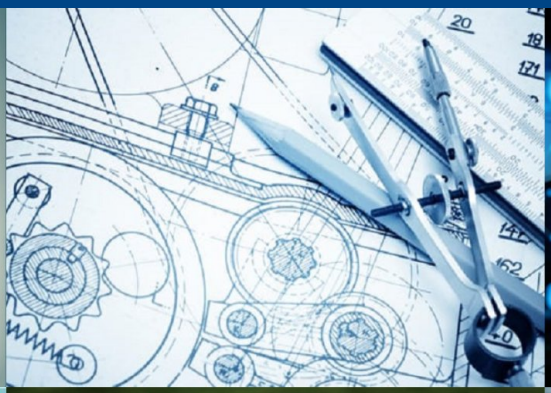

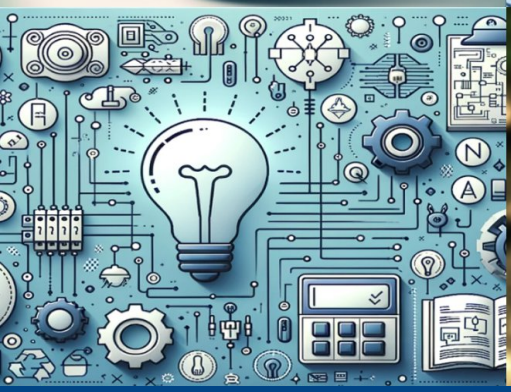

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# Development and Quality Evaluation of Dragon Fruit Leather Fortified with Cashew Nuts

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**ABSTRACT:** This study aimed to develop novel value-added fruit leather from dragon fruit (*Hylocereus undatus*) fortified with cashew nuts (*Anacardium occidentale*) to enhance its nutritional and sensory properties. Dragon fruit is a rich source of antioxidants and dietary fiber but is limited by low protein and fat content. To overcome this limitation, cashew nuts were incorporated at three levels (10%, 15%, and 20%). The fruit pulp was standardized to 20–25 ° Brix using sucrose, and citric acid (0.5%) was added to maintain the pH between 3.5 and 4.0. Xanthan gum (2.5%) was used as a stabilizing agent. The mixtures were dehydrated at 55–60°C for 6–10 hours until a moisture content of 15–20% was achieved. The products were evaluated for physicochemical, nutritional, and sensory characteristics. Results indicated that increasing cashew nut concentration significantly enhanced protein and fat content. However, sensory evaluation revealed that the formulation with 10% cashew nuts achieved the highest overall acceptability. The study concludes that dragon fruit–cashew nut leather is a functional snack with improved nutritional quality and consumer appeal.

**KEYWORDS:** Dragon fruit, Cashew nuts, Fruit leather, Functional food, Dehydration, Sensory evaluation

## I. INTRODUCTION

Consumer preference for natural, nutritious, and minimally processed foods has driven the development of innovative functional products. Fruit leather, a dehydrated fruit-based snack, has gained attention due to its extended shelf life, portability, and retention of essential nutrients.Dragon fruit (*Hylocereus spp.*) is noted for its high antioxidant content, especially betalains, as well as dietary fiber and vitamins. Despite these benefits, low protein and fat content limits its nutritional balance. Its high moisture content also contributes to rapid perishability and post-harvest losses. Cashew nuts (*Anacardium occidentale*) are rich in plant- based protein, healthy fats, and essential minerals such as magnesium and zinc. Incorporating cashew nuts into fruit-based products enhances nutritional value and improves texture and palatability. Therefore, this study was conducted to develop dragon fruit leather fortified with cashew nuts, aiming to improve its nutritional profile and sensory acceptability while reducing post-harvest losses.

### Materials and Methods

#### 1.1 Raw Materials

Fresh dragon fruits were obtained from a local market. Cashew nuts, sucrose, citric acid, and xanthan gum were used in the formulation, all of food-grade quality.

#### 1.2 Preparation of Fruit Leather

##### 1.2.1 Pulp Preparation

Dragon fruits were washed, peeled, and blended to a uniform pulp.

##### 1.2.2 Formulation

The pulp was standardized to 20–25 °Brix using sucrose. Citric acid (0.5%) was added to maintain pH 3.5–4.0, and xanthan gum (2.5 g/100 g pulp) was incorporated as a stabilizer. Finely ground cashew nuts were added at different concentrations according to the experimental design.

#### 1.3 Experimental Design

Three formulations were prepared:

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- **$T_1$:** 90% dragon fruit pulp + 10% cashew nuts
- **$T_2$:** 85% dragon fruit pulp + 15% cashew nuts
- **$T_3$:** 80% dragon fruit pulp + 20% cashew nuts

Each treatment was replicated three times under identical conditions.

### 1.4 Drying Process

Mixtures were spread evenly (3–5 mm thickness) on trays and dried in a cabinet dryer at 55– 60°C for 6–10 hours until a non-sticky texture was achieved.

### 1.5 Analytical Methods

#### 1.5.1 Physicochemical Analysis

- **pH:** Digital pH meter
- **Total soluble solids (TSS):** Refractometer
- **Moisture content:** Oven drying method
- **Water activity:** Water activity meter

#### 1.5.2 Nutritional Analysis

- **Protein:** Kjeldahl method
- **Fat:** Standard extraction
- **Vitamin C:** Titration
- **Antioxidant activity:** Standard assay methods

#### 1.5.3 Sensory Evaluation

A semi-trained panel evaluated taste, texture, color, aroma, and overall acceptability using a 9- point hedonic scale.

## II. RESULTS AND DISCUSSION

**Physicochemical Properties**

| Treatment | pH | TSS (°Brix) | Moisture (%) | Water Activity |
|---|---|---|---|---|
| $T_1$ | 3.62 | 22.5 | 16.8 | 0.61 |
| $T_2$ | 3.68 | 23.1 | 17.5 | 0.64 |
| $T_3$ | 3.72 | 24.0 | 18.3 | 0.67 |

Slight increases in pH and TSS with higher cashew nut content are likely due to nut composition. Moisture content increased marginally, possibly because fat reduces drying efficiency. All values remained within safe limits for shelf-stable products.

**Nutritional Composition**

| Treatment | Protein (%) | Fat (%) | Vitamin C (mg/100g) | Antioxidant Activity (%) |
|---|---|---|---|---|
| $T_1$ | 3.8 | 6.5 | 18.2 | 72.5 |
| $T_2$ | 5.2 | 8.9 | 17.4 | 70.1 |
| $T_3$ | 6.7 | 11.3 | 16.0 | 67.8 |

Protein and fat content increased significantly with higher cashew nut levels, confirming successful fortification. Vitamin C and antioxidant activity decreased slightly, likely due to thermal degradation during drying.

**Sensory Evaluation**

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| **Attribute** | **$T_1$** | **$T_2$** | **$T_3$** |
|---|---|---|---|
| Taste | 8.6 | 7.9 | 7.2 |
| Texture | 8.4 | 7.8 | 7.0 |
| Color | 8.8 | 8.5 | 8.2 |
| Aroma | 8.3 | 7.7 | 7.1 |
| **Attribute** | **$T_1$** | **$T_2$** | **$T_3$** |
| Overall Acceptability | 8.7 | 8.0 | 7.3 |

$T_1$ (10% cashew nuts) had the highest overall acceptability. Higher cashew content improved nutrition but negatively affected texture and flavor, producing a firmer, nutty product.

**Implications for Product Development**

Dragon fruit–cashew nut leather can serve as a functional snack combining antioxidants, fiber, and plant-based protein. The 10% cashew formulation provides the optimal balance of sensory appeal and nutritional enhancement, making it suitable for commercial production. Dehydration extends shelf life, reducing post-harvest losses. Future work could explore additional functional ingredients and long-term storage stability.

## III. CONCLUSION

This study successfully developed a novel dragon fruit leather fortified with cashew nuts, demonstrating that fortification can significantly enhance protein and fat content while maintaining a high level of bioactive compounds. Among the tested formulations, the 10% cashew nut inclusion ($T_1$) provided the optimal balance between nutritional enhancement and sensory acceptability, producing a palatable, firm, and flavorful fruit leather.The results indicate that dragon fruit–cashew nut leather has strong potential as a functional snack, offering a combination of antioxidants, dietary fiber, and plant-based protein. Moreover, the dehydration process extends shelf life, reducing the fruit's perishability and post-harvest losses. These findings support the commercial viability of the product as a convenient, nutritious, and value- added food option. Future research could explore the incorporation of additional functional ingredients, such as seeds or natural flavorings, and evaluate long-term storage stability to further optimize quality and consumer appeal. Scaling up production under industrial conditions will require careful control of drying parameters to maintain texture, nutrient retention, and sensory characteristics.

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