

## Preparation of chocolate using *Moringa oleifera* leaf

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### Abstract

*Moringa oleifera* is a nutritionally rich plant widely used in traditional medicine and functional foods. Incorporation of moringa leaf into chocolate offers a novel approach to develop a value-added nutraceutical confection with enhanced antioxidant, mineral, and vitamin content. The present study aims to develop moringa leaf-enriched chocolate, evaluate its preparation method, physicochemical properties, sensory acceptability, and potential health benefits. The study highlights moringa chocolate as a functional food with promising commercial and nutritional applications.

**Keywords:** *Moringa oleifera*, herbal chocolate, functional food, nutraceutical, antioxidant

### Introduction

Chocolate is a popular confectionery product consumed across all age groups due to its pleasant taste, aroma, and energy-providing properties. Traditionally, chocolate is produced from cocoa solids, cocoa butter, sugar, and milk solids. Although cocoa contains natural antioxidants such as flavonoids, commercial chocolates are often high in sugar and fat, which limits their health benefits. This has led to increasing interest in the development of functional and nutraceutical chocolates fortified with plant-based bioactive ingredients.

*Moringa oleifera* Lam., belonging to the family Moringaceae, is widely cultivated in tropical and subtropical regions, including India. The leaves of moringa are considered a powerhouse of nutrition, containing high levels of proteins, essential amino acids, vitamins (A, B-complex, C, and E), minerals (iron, calcium, magnesium, zinc), and phytochemicals such as quercetin, kaempferol, and chlorogenic acid. Due to these properties, moringa leaves are used in food fortification to combat malnutrition and micronutrient deficiencies.

Incorporating moringa leaf powder into chocolate offers dual advantages: masking the herbal taste of moringa while delivering its nutritional and therapeutic benefits in an acceptable form. This research paper focuses on the formulation, processing, quality evaluation, and health significance of moringa leaf-enriched chocolate.

### Materials and Methods

#### Materials

- Fresh *Moringa oleifera* leaves

- Cocoa powder
- Cocoa butter
- Powdered sugar / jaggery powder
- Milk powder (for milk chocolate)
- Vanilla essence
- Lecithin (emulsifier)

#### Preparation of Moringa Leaf Powder

1. Fresh moringa leaves were collected and washed thoroughly with potable water.
2. Leaves were shade-dried at room temperature (25–30°C) for 5–7 days to preserve bioactive compounds.
3. Dried leaves were pulverized using a grinder.
4. The powder was sieved through a fine mesh and stored in an airtight container.

#### Preparation of Moringa Leaf Chocolate

1. Cocoa butter was melted using a double boiler at 45–50°C.
2. Cocoa powder and powdered sugar were gradually added with continuous stirring.
3. Moringa leaf powder (2–5%) was incorporated slowly to ensure uniform mixing.
4. Milk powder and vanilla essence were added.
5. Lecithin was added to improve texture and emulsification.
6. The mixture was conched for 20–30 minutes for smoothness.
7. The chocolate mass was tempered and poured into molds.
8. Molds were cooled at 10–15°C until solidification.





**Photograph of preparation**

### Physicochemical Analysis

The prepared moringa leaf chocolate samples were subjected to standard physicochemical evaluation to assess product quality and stability.

#### 1. Moisture Content

Moisture content was determined using the oven-drying method. Lower moisture levels are desirable for improved shelf life and prevention of microbial growth.

#### 2. pH Analysis

The pH of chocolate samples was measured using a digital pH meter. The incorporation of moringa leaf powder caused a slight increase in pH but remained within acceptable limits for chocolate products.

#### 3. Fat Content

Fat content was estimated using Soxhlet extraction. Cocoa butter remained the primary fat source, and moringa incorporation did not significantly alter fat percentage.

#### 4. Total Phenolic Content

Total phenolic content was determined using the Folin–Ciocalteu method. Moringa-fortified chocolate showed significantly higher phenolic content compared to control chocolate.

#### 5. Antioxidant Activity

Antioxidant activity was evaluated using the DPPH radical scavenging assay. Results indicated enhanced antioxidant potential proportional to moringa leaf concentration.

### Sensory Evaluation

Sensory evaluation was conducted to determine consumer acceptability of moringa leaf chocolate. A panel of 15 semi-trained members evaluated samples using a 9-point hedonic scale.

#### Sensory Parameters

- Appearance and color
- Aroma
- Texture and mouthfeel
- Taste and aftertaste
- Overall acceptability

### Results

Chocolate fortified with 2–3% moringa leaf powder received the highest scores for overall acceptability. Higher levels (above 4%) resulted in a noticeable green color and mild bitterness, which slightly reduced consumer preference. The addition of vanilla essence helped mask herbal notes and improved flavor.

### Nutritional and Health Benefits

- Rich source of antioxidants
- Enhanced mineral and vitamin content
- Potential anti-inflammatory and immune-boosting effects
- Suitable as a functional food for health-conscious consumers

### Applications and Commercial Potential

Moringa leaf chocolate has wide-ranging applications in both health and commercial sectors.

- Development of functional and nutraceutical chocolates
- Use in mid-day meal supplements and nutritional programs
- Health snacks for children, pregnant women, and elderly populations
- Herbal confectionery and wellness food industry
- Export-oriented value-added moringa products

The product aligns with current market trends favoring plant-based, antioxidant-rich, and clean-label foods.

### Conclusion

The present study confirms that *Moringa oleifera* leaf powder can be effectively incorporated into chocolate to develop a nutritionally superior and sensory-acceptable functional food. Moringa-enriched chocolate demonstrated enhanced antioxidant activity, improved nutritional composition, and good consumer acceptability at optimized levels. This product has strong potential for commercialization and can contribute to addressing nutritional deficiencies through an innovative food-based approach.

Future research may focus on shelf-life studies, clinical evaluation of health benefits, and large-scale industrial processing.

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