

# Formulation and Evaluation of Multinutrient Herbal Tablet

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## ABSTRACT

This study employs the wet granulation method to develop and evaluate a multi-nutrient herbal tablet consisting of Tulsi, cinnamon, clove and ginger. The objective is to assess the tablet's quality through various factors, including thickness, hardness, weight variation, and friability. These potent herbs are incorporated due to their nutritional and therapeutic properties. The ingredients are effectively transformed into a tablet form for easy consumption using the wet granulation technique. Analyzing the tablet's physical properties provides valuable insights into its effectiveness and user acceptance. The findings of this research could offer benefits for dietary supplementation and health by improving our understanding of the formulation and quality assessment of multi-nutrient herbal tablets.

**Keywords:** Multi-nutrient herbal tablet Tulsi, Cinnamon, Clove, Ginger, Thickness, Hardness, Weight variation, Friability, Wet granulation

## INTRODUCTION

Nutrition—the science of how food influences health—plays a vital role in preventing illness and supporting overall wellness. The importance of a nutritious diet has been recognized since ancient times, but in today's world, where chronic diseases and lifestyle-related conditions are on the rise, the need for a nutrient-rich, balanced diet is more critical than ever. Herbal supplements have become increasingly popular due to their perceived health benefits and low risk of side effects. Medicinal plants such as amla (Indian gooseberry), tulsi (holy basil), cinnamon, licorice, mint, and ginger are widely appreciated for their nutritional and therapeutic properties. These herbs have long been used across cultures to support the immune system, improve digestion, and act as antioxidants. As interest in natural health solutions grows, there has been a surge in research focused on developing herbal formulations, especially tablets that offer convenient consumption. Combining several herbs into one multi-nutrient tablet presents a promising strategy for enhancing health and well-being. This study explores the formulation and assessment of a herbal tablet composed of ginger, mint, amla, tulsi, cinnamon, and

licorice. Using the wet granulation method ensures uniformity, potency, and quality in the final product. Key physical characteristics such as weight variation, hardness, thickness, and friability are evaluated to determine the tablet's stability, effectiveness, and consumer appeal. This research supports the advancement of herbal medicine and nutraceuticals by highlighting the formulation process and defining quality benchmarks. The concept of using food to achieve health benefits beyond basic nutrition—known as nutraceuticals—is gaining recognition among both the public and scientific communities. Coined by Dr. Stephen L. De Felice, founder of the Foundation for Innovation in Medicine, the term refers to bioactive compounds derived from food that offer potential health benefits or disease prevention. Often called "functional foods," nutraceuticals occupy a space between food and medicine, sparking ongoing discussion. Current trends suggest that nearly two-thirds of the global population turns to plant-based remedies due to their affordability, safety, accessibility, and alignment with cultural practices. Historically, the health value of food has been studied for millennia. Several factors are driving the shift toward nutraceuticals:

**Relevant conflicts of interest/financial disclosures:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



1. Rising concerns over the increasing cost of healthcare.
  2. Disappointment in the effectiveness of conventional pharmaceutical treatments.
  3. Awareness that modern, chemically treated, and genetically modified food lacks essential nutrients.
  4. A growing preference for preventive care over treatment.
  5. Individuals with chronic conditions who have not found relief through standard medical approaches.
  6. Economic challenges that make alternative treatments more appealing.
- Drug Profile:**
1. **Tulsi (*Ocimum sanctum*)**



**Figure1: Tulsi Leaves**

- Kingdom: Plantae (Plants)
- Phylum: Angiosperms (Flowering Plants)
- Class: Eudicots
- Order: Lamiales
- Family: Lamiaceae (Mint family)
- Genus: *Ocimum*
- Species: *Ocimum tenuiflorum*

**2.Cinnamon (*Cinnamomum* spp.)**



**Figure 2: Cinnamomun**

- Kingdom: Plantae
- Clade: Angiosperms
- Order: Laurales
- Family: Lauraceae
- Genus: *Cinnamomum*
- Common Species:
  - o *Cinnamomum verum* (True cinnamon, Ceylon cinnamon)
  - o *Cinnamomum cassia* (Cassia cinnamon)
  - o *Cinnamomum burmannii* (Indonesian cinnamon)
  - o *Cinnamomum loureiroi* (Saigon cinnamon)
- Common Names: Cinnamon (English), Dalchini (Hindi), Kayu Manis (Malay), Canela (Spanish)

**3.Ginger (*Zingiber officinale*)**



**Figure 3: Ginger**

- Kingdom: Plantae
- Clade: Angiosperms
- Order: Zingiberales
- Family: Zingiberaceae
- Genus: Zingiber
- Species: Zingiber officinale

- Common Names:
  - o Ginger (English)
  - o Adrak (Hindi)
  - o Sheng Jiang (Chinese)
  - o Inguru (Sinhalese)

#### 4. Clove (Syzygium aromaticum)



**Figure 4: Clove**

- Kingdom: Plantae (Plants)
- Phylum: Angiosperms (Flowering Plants)
- Class: Eudicots
- Order: Myrtales
- Family: Myrtaceae
- Genus: Syzygium
- Species: Syzygium aromaticum

#### Benefits of Herb

1. Powerful Antioxidant & Anti-Inflammatory Effects
2. Natural Pain Reliever
3. Supports Digestive Health
4. Antibacterial & Antiviral Properties
5. Respiratory Health Benefits
6. Regulates Blood Sugar Levels
7. Cardiovascular Health Protection
8. Anti-Cancer Properties
9. Enhances Brain Function & Mental Well-Being
10. Supports Liver Health & Detoxification

#### Uses of Multinutrient Herbal Tablet

##### 1. Nutritional Supplementation

- Provides essential vitamins and minerals that may be lacking in the diet.
- Helps prevent nutrient deficiencies (e.g., iron, calcium, zinc, B-complex vitamins).

##### 2. Boosts Immunity

- Herbal ingredients like Tulsi, Amla, and Ashwagandha are known for immune-modulating properties.
- Enhances the body's defense mechanisms against infections.

##### 3. Improves Digestive Health

- Herbs like Ginger, Fennel, and Triphala support digestion and gut health.
- May help in relieving bloating, constipation.
- Helps regulate blood sugar and lipid profiles when combined with herbs like Fenugreek or Cinnamon.

#### 4. Antioxidant Properties

- Ingredients such as Amla (Vitamin C) and Turmeric (Curcumin) help combat oxidative stress.
- Protects cells from damage by free radicals.

#### 5. Enhances Physical and Mental Energy

- Adaptogenic herbs like Ashwagandha, Shatavari, or Ginseng help manage stress and increase stamina.
- May reduce fatigue and improve concentration and mental clarity.

#### 6. Supports Metabolic Functions

- Multinutrients aid in enzyme activity, hormonal balance, and metabolic pathways.

#### 7. Anti-inflammatory Benefits

- Herbal ingredients often have natural anti-inflammatory effects, which can help in conditions like arthritis or chronic pain.

#### 8. Promotes Healthy Skin and Hair

Nutrients like Biotin, Zinc, and herbs such as ‘Neem and Brahmi’ support skin health and hair growth.

#### 9. General Wellness and Vitality

- Designed to improve overall health, energy levels, and well-being.

### MATERIAL AND METHODS:

**Table 1: Table of Ingredient**

Ingredient	Quantity (20 tablet)	Role
Tulsi (Holy Basil) Powder	3 g	Anti-Microbial
Cinnamon Powder	2 g	Antioxidant
Ginger Powder	2 g	Anti-Inflammatory & Pain Relief
Clove Powder	1 g	Oral and Dental Health
Microcrystalline Cellulose	0.5 g	Binder
Lactose or Starch	1 g	Filler
Magnesium Stearate	0.5 g	Anti-caking

#### Trial :1

#### Formulation Table:

**Table 2: Formulation Table**

Ingredient	Quantity (20 tablet)
Tulsi (Holy Basil) Powder	3 g
Cinnamon Powder	2 g
Ginger Powder	2 g
Clove Powder	1 g
Microcrystalline Cellulose	0.4 g
Lactose or Starch	1 g
Magnesium Stearate	0.5 g

#### Methodology:

##### 1. Powder Preparation

##### a. Collection and Cleaning

- Select quality raw herbs: Tulsi (*Ocimum sanctum*), Cinnamon (*Cinnamomum verum*), Ginger (*Zingiber officinale*), and Clove (*Syzygium aromaticum*).



- **Cleaning:** Remove dust, dirt, and foreign particles. Wash gently if required and dry thoroughly to avoid moisture content.

#### **b. Drying**

- Dry the cleaned herbs under shade or in a tray dryer at 40–50°C until a constant weight is achieved.
- Proper drying prevents microbial contamination and improves grinding efficiency.

#### **c. Pulverization**

- Use a pulverizer or grinder to finely powder the dried herbal materials.
- Aim for a fine powder, preferably passing through an 80-mesh sieve.

#### **d. Sieving**

- Sieve each powdered ingredient through a fine mesh (60–80 mesh) to ensure uniform particle size, which aids in better mixing and tablet uniformity.

### **2. Blending of Powders**

#### **a. Ingredients**

Prepare the following materials:

- **Herbal powders** (Tulsi, Cinnamon, Ginger, Clove)
- **Binder** (e.g., Acacia gum, PVP K-30, or starch paste)
- **Lubricant** (e.g., Magnesium stearate or talc) – 1-2% w/w
- **Disintegrant** (e.g., Sodium starch glycolate or cross-linked PVP) – 2-5% w/w

#### **b. Mixing Process**

- Use a mortar and pestle for small batches or a mechanical blender (e.g., ribbon blender or planetary mixer) for larger quantities.

- Add all dry powders together and mix for 10–15 minutes to ensure homogeneity.
- Gradually add the binder (if dry form) or prepare a paste if using wet binding (for granulation).
- Mix thoroughly to ensure a consistent blend.

### **3. Granulation**

#### **a. Wet Granulation (if required for better compre**

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- Slowly add a binding solution (e.g., 5% starch paste or 5% PVP solution) to the blended powder while mixing.
- Knead the mass until a dough-like consistency is achieved.
- Pass the wet mass through a granulator or sieve (10–16 mesh) to form uniform granules.

#### **b. Drying Granules**

- Spread the wet granules in a tray dryer or under controlled conditions (40–50°C) for 2–4 hours until moisture content is <5%.
- Avoid overdrying as it can affect compressibility.

#### **c. Sieving of Dried Granules**

- Sieve dried granules through a 20–30 mesh sieve to ensure uniform granule size.
- Collect fines and reprocess or discard based on quality standards.

### **4. Tablet Compression**

#### **a. Equipment**

The final granules are fed into a tablet compression machine. The machine applies pressure to form tablets.

- Adjust the tablet compression machine to the required pressure to form tablets of the desired size, shape, and hardness.

**Observation:** The First Trial is failed due to Cracking of tablets, so decided addition of Microcrystalline Cellulose



**Figure 5: Cracking of Tablet**

**Trial :2**

**Table 3: Formulation Table**

<b>Ingredient</b>	<b>Quantity (20 tablet)</b>
Tulsi (Holy Basil) Powder	3 g
Cinnamon Powder	2 g
Ginger Powder	2 g
Clove Powder	1 g
Microcrystalline Cellulose	0.5 g
Lactose or Starch	1 g
Magnesium Stearate	0.5 g

## **Methodology:**

### **1. Powder Preparation**

#### **a. Collection and Cleaning**

- Select quality raw herbs: Tulsi (*Ocimum sanctum*), Cinnamon (*Cinnamomum verum*), Ginger (*Zingiber officinale*), and Clove (*Syzygium aromaticum*).
- Cleaning: Remove dust, dirt, and foreign particles. Wash gently if required and dry thoroughly to avoid moisture content.

#### **b. Drying**

- Dry the cleaned herbs under shade or in a tray dryer at 40–50°C until a constant weight is achieved.
- Proper drying prevents microbial contamination and improves grinding efficiency.

#### **c. Pulverization**

- Use a pulverizer or grinder to finely powder the dried herbal materials.

- Aim for a fine powder, preferably passing through an 80-mesh sieve.

#### **d. Sieving**

- Sieve each powdered ingredient through a fine mesh (60–80 mesh) to ensure uniform particle size, which aids in better mixing and tablet uniformity.

### **2. Blending of Powders**

#### **a. Ingredients**

Prepare the following materials:

- **Herbal powders** (Tulsi, Cinnamon, Ginger, Clove)
- **Binder** (e.g., Acacia gum, PVP K-30, or starch paste)
- **Lubricant** (e.g., Magnesium stearate or talc) – 1-2% w/w



- **Disintegrant** (e.g., Sodium starch glycolate or cross-linked PVP) – 2-5% w/w

#### b. Mixing Process

- Use a mortar and pestle for small batches or a mechanical blender (e.g., ribbon blender or planetary mixer) for larger quantities.
- Add all dry powders together and mix for 10–15 minutes to ensure homogeneity.
- Gradually add the binder (if dry form) or prepare a paste if using wet binding (for granulation).
- Mix thoroughly to ensure a consistent blend.

### 3. Granulation

#### a. Wet Granulation

- Slowly add a binding solution (e.g., 5% starch paste or 5% PVP solution) to the blended powder while mixing.
- Knead the mass until a dough-like consistency is achieved.
- Pass the wet mass through a granulator or sieve (10–16 mesh) to form uniform granules.

#### b. Drying Granules

- Spread the wet granules in a tray dryer or under controlled conditions (40–50°C) for 2–4 hours until moisture content is <5%.
- Avoid overdrying as it can affect compressibility.

#### c. Sieving of Dried Granules

- Sieve dried granules through a 20–30 mesh sieve to ensure uniform granule size.
- Collect fines and reprocess or discard based on quality standards.

### 4. Tablet Compression

#### a. Equipment

The final granules are fed into a tablet compression machine. The machine applies pressure to form tablets.

- Adjust the tablet compression machine to the required pressure to form tablets of the desired size, shape, and hardness.

**Observation:** The Second Trail also failed due to Cracking of tablets, because of less amount of added.



Figure 6: Cracking of Tablet

Trial :3

Table 4: Formulation Table

Ingredient	Quantity (20 tablet)
Tulsi (Holy Basil) Powder	3 g
Cinnamon Powder	2 g
Ginger Powder	2 g
Clove Powder	1 g
Microcrystalline Cellulose	0.5 g
Lactose or Starch	1 g
Magnesium Stearate	0.5 g

## Methodology:

### 1. Powder Preparation

#### a. Collection and Cleaning

- Select quality raw herbs: Tulsi (*Ocimum sanctum*), Cinnamon (*Cinnamomum verum*), Ginger (*Zingiber officinale*), and Clove (*Syzygium aromaticum*).
- Cleaning: Remove dust, dirt, and foreign particles. Wash gently if required and dry thoroughly to avoid moisture content.

#### b. Drying

- Dry the cleaned herbs under shade or in a tray dryer at 40–50°C until a constant weight is achieved.
- Proper drying prevents microbial contamination and improves grinding efficiency.

#### c. Pulverization

- Use a pulverizer or grinder to finely powder the dried herbal materials.
- Aim for a fine powder, preferably passing through an 80-mesh sieve.

#### d. Sieving

- Sieve each powdered ingredient through a fine mesh (60–80 mesh) to ensure uniform particle size, which aids in better mixing and tablet uniformity.

### 2. Blending of Powders

#### a. Ingredients

Prepare the following materials:

- **Herbal powders** (Tulsi, Cinnamon, Ginger, Clove)
- **Binder** (e.g., Acacia gum, PVP K-30, or starch paste)
- **Lubricant** (e.g., Magnesium stearate or talc) – 1-2% w/w

- **Disintegrant** (e.g., Sodium starch glycolate or cross-linked PVP) – 2-5% w/w

#### b. Mixing Process

- Use a mortar and pestle for small batches or a mechanical blender (e.g., ribbon blender or planetary mixer) for larger quantities.
- Add all dry powders together and mix for 10–15 minutes to ensure homogeneity.
- Gradually add the binder (if dry form) or prepare a paste if using wet binding (for granulation).
- Mix thoroughly to ensure a consistent blend.

### 3. Granulation

#### a. Wet Granulation

- Slowly add a binding solution (e.g., 5% starch paste or 5% PVP solution) to the blended powder while mixing.
- Knead the mass until a dough-like consistency is achieved.
- Pass the wet mass through a granulator or sieve (10–16 mesh) to form uniform granules.

#### b. Drying Granules

- Spread the wet granules in a tray dryer or under controlled conditions (40–50°C) for 2–4 hours until moisture content is <5%.
- Avoid overdrying as it can affect compressibility.

#### c. Sieving of Dried Granules

- Sieve dried granules through a 20–30 mesh sieve to ensure uniform granule size.
- Collect fines and reprocess or discard based on quality standards.

### 4. Tablet Compression

#### a. Equipment

The final granules are fed into a tablet compression machine. The machine applies pressure to form tablets.

- Adjust the tablet compression machine to the required pressure to form tablets of the desired size, shape, and hardness.



**Observation:** Due to better result we decided to finalize this formula for next batches



**Figure 6: Multinutrient Herbal Tablet**

#### Evaluation Parameter for Formulated Tablets:

##### 1. Hardness test:

The tablet to be tested is held between a fixed and a moving jaw, and reading of the indicator is adjusted to zero. The force applied to the tablet edge is gradually increased by moving the screw knob forward until the tablet breaks. Reading is noted from the scale which indicates the pressure required in kg to break the tablet. Hardness of 4kg is considered suitable for handling the tablets, Hardness of 6kg or more will produce tablets of highly compact nature.

**Result:** The hardness of the tablets occurred 4.8 kg/sq.cm which is between the normal range.

##### 2. Friability Test:

20 tablets are selected and carefully measured. They were then placed in a Friabilator drum and rotated at a speed of 25 rpm for four minutes. Unremoved pellets are removed from the barrel, dusted and weighed. The weight percentage is calculated and recorded as a simple value.

##### Calculation:

a) Weight of tablet before friability test = 4.11(4110mg)

b) Weight of tablet after friability test =  
4.03(4030mg)  
 0.08(80mg)

**Result:** The loss of tablet after friability test occurred 80mg, which range is acceptable. According to British pharmacopoeia.

##### 3. Disintegration Time test:

Six tablets were randomly selected and placed on their handles in six channels on the shelf of the folding machine. The metal is raised and lowered at a constant rate in deionized water in a glass beaker suspended in a water bath whose temperature is maintained at  $37 \pm 2^\circ\text{C}$ . The time required for the final mass or part of it to pass through a 2 mm mesh in water (depleted water) is recorded as the settling time.

**Result:** The multi-nutrient herbal tablets disintegrate in 20minutes, in water this result occurs in normal range.

##### 4. Weight variation test:

Twenty tablets were randomly selected and weighed individually. The mean weight of the tablets was then calculated and the standard deviation determined.

**Table 5: Weight variation**

No. of Tablets	Weight in Mg
1	405
2	398
3	397
4	409
5	412
6	398
7	400
8	403
9	391
10	399
11	399
12	408
13	393
14	401
15	414
16	382
17	404
18	410
19	398
20	404

- Now, average weight of tablets is 401.1mg.
- Acceptance limit for weight variation is 5%
- Therefore, 5% of 401.1 is 20.05mg.
- Weight variation range allows is from 393 to 414

**Result:** Weight variation test is passed.

## RESULT AND CONCLUSION

The formulation of a multi-nutrition herbal tablet using Tulsi, cinnamon, ginger, and clove was

successfully developed and evaluated using basic and advanced tests. The results indicate that the tablets meet key quality parameters, including uniformity in weight, proper hardness, friability, and acceptable disintegration time. The herbal ingredients contribute beneficial bioactive compounds, ensuring potential health benefits such as antioxidant, anti-inflammatory, and immune-boosting properties.



**Figure 6: Multinutrient Herbal Tablet**

## FUTURE SCOPE

### 1. Scientific Research and Validation

- **Need:** Consumers demand evidence-based products.
- **Scope:** More research on bioavailability, synergy of herbs and nutrients, and clinical efficacy will boost credibility.

## 2. Market Trends and Demand

- **Global Wellness Boom:** Valued at over \$4.5 trillion and growing.
- **Demand for Herbal/Natural Products:** Rising due to side effects of synthetic supplements and pharmaceuticals.
  - **Target Demographics:**
    - Health-conscious millennials
    - Elderly population (for immunity, joint health)
    - Vegans/vegetarians needing plant-based supplementation

## 3. Innovation and Customization

- **Personalized Nutrition:** AI and DNA-based supplement personalization could integrate with herbal tablets.
- **Functional Blends:** Tailored formulas for stress, immunity, digestion, cognitive health, etc.
- **Delivery Formats:** Gummies, effervescent tablets, or slow-release capsules may expand product appeal.

## 4. Digital Health and E-Commerce Integration

- **Online Sales Platforms:** Amazon, Shopify, health-focused marketplaces.
- **Subscription Models:** Monthly plans for ongoing wellness support.
- **Health Tech Integration:** Partner with wellness apps or smart devices for supplement tracking.

## 5. Sustainability and Ethical Branding

- **Plant-Based Appeal:** Vegan, cruelty-free, sustainably sourced herbs and eco-packaging attract eco-conscious consumers.

- **Transparency:** Clean labeling, traceability, and ethical sourcing build consumer trust.

## 6. Synergy with Traditional Medicine Systems

- **Ayurveda, TCM, and Naturopathy:** Integration into holistic wellness packages, spa retreats, or hospital wellness programs.
- **Government Backing:** Especially in India (AYUSH), where herbal medicine is state-supported.

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