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Standardization and Evaluation of Poly Herbal Powder Blend for Capsule Filling

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Abstract :

The present study aimed to standardize and evaluate a polyherbal powder blend intended for capsule filling. The formulation contained selected herbal ingredients such as Tulsi, Giloy, Amla, Ashwagandha, Mulethi, Ginger, Fennel, Ajwain, and Black Pepper. The prepared powder blends were evaluated for micromeritic properties including bulk density, tapped density, Carr's index, Hausner ratio, angle of repose, and flow rate. The results indicated satisfactory flow characteristics and suitability for capsule filling. Capsule evaluation showed acceptable weight uniformity and disintegration time within pharmacopoeial limits. Preliminary phytochemical screening confirmed the presence of important phytoconstituents. Microbial limit tests demonstrated compliance with quality requirements. The study concludes that the standardized polyherbal powder blend possesses suitable physicochemical and flow properties for the development of herbal capsule dosage forms.

Keywords: Polyherbal formulation, Capsule filling, Standardization, Micromeritic properties, Herbal capsules, Quality evaluation.

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Introduction

Overview of Herbal Medicine

Herbal medicine, also known as phytotherapy, is one of the oldest systems of healthcare practiced worldwide. It involves the use of plant-derived substances for therapeutic purposes. For centuries, medicinal plants have played a vital role in maintaining human health, especially in traditional systems such as Ayurveda, Siddha, and Unani[1]. In recent decades, there has been a resurgence of interest in herbal medicines due to their perceived safety, affordability, and minimal side effects compared to synthetic drugs.

The World Health Organization (WHO) estimates that nearly 80% of the global population relies on herbal medicine for primary healthcare needs[2]. This growing acceptance has encouraged scientific validation, standardization, and formulation of herbal products into modern dosage forms such as capsules, tablets, and syrups[3].

Concept of Polyherbal Formulation

Polyherbal formulations involve the use of multiple herbs in a single formulation to achieve enhanced therapeutic efficacy. The concept is based on the principle of synergism, where the combined effect of herbs is greater than the sum of their individual effects. Polyherbal combinations are widely used in traditional medicine systems for treating complex diseases and improving overall health[4].

Advantages of polyherbal formulations include:

- Enhanced therapeutic effect
- Reduced toxicity
- Broad spectrum of activity
- Improved patient compliance

However, variability in raw materials and lack of standardization pose challenges in ensuring quality and reproducibility[5].

Importance of Standardization

Standardization of herbal formulations is essential to ensure their quality, safety, and efficacy. Unlike synthetic drugs, herbal products may vary in composition due to factors such as geographical location, harvesting time, and processing methods. Standardization involves:

- Identification and authentication of raw materials

- Physicochemical evaluation[6]
- Phytochemical analysis
- Microbial testing
- Stability studies[7]

These parameters help in maintaining batch-to-batch consistency and compliance with pharmacopoeial standards.

Selection of Herbs and Their Therapeutic Significance

Immunity Booster Herbs

The immunity booster blend includes Tulsi, Giloy, Amla, and Ashwagandha. These herbs are well known for their immunomodulatory and antioxidant properties.

- Tulsi (Ocimum sanctum): Exhibits antimicrobial, anti-inflammatory, and adaptogenic properties.
- Giloy (Tinospora cordifolia): Known for enhancing immune response and detoxifying the body. [9]
- Amla (Emblica officinalis): Rich in vitamin C and antioxidants.
- Ashwagandha (Withania somnifera): Acts as an adaptogen and stress reliever.

In recent years, there has been a growing emphasis on strengthening the immune system to prevent infections and maintain overall health. Herbal medicines play a crucial role in enhancing immunity due to their natural origin, safety, and therapeutic potential. The immunity booster powder blend is a polyherbal formulation composed of Tulsi, Giloy, Amla, and Ashwagandha, each known for its immunomodulatory and antioxidant properties. These herbs have been widely used in traditional systems of medicine such as Ayurveda for improving resistance against diseases. Tulsi is recognized for its antimicrobial and anti-inflammatory properties, while Giloy is known to enhance immune response and detoxify the body. Amla, being rich in vitamin C, acts as a potent antioxidant, protecting the body from oxidative stress[10]. Ashwagandha functions as an adaptogen, helping the body cope with stress and boosting immunity. The combination of these herbs results in a synergistic effect, improving the overall efficacy of the formulation. The formulation of this blend in powder form allows easy processing into capsules, ensuring accurate dosage and better patient compliance. The inclusion of diluents such as starch or microcrystalline cellulose may be required to improve flow properties and facilitate uniform capsule filling. The development of such standardized polyherbal formulations is essential to ensure quality, safety, and consistency[11]. Therefore, this study focuses on the preparation and evaluation of an immunity booster powder blend suitable for capsule dosage form.

Materials and Methods

A. Immunity Booster Powder Blend

1. Tulsi powder 2) Giloy powder 3) Amla powder 4) Ashwagandha powder

B. Digestive Herbal Powder Blend

1. Ginger powder 2) Fennel powder 3) Ajwain powder 4) Black pepper powder

C. Respiratory Herbal Powder Blend

1. Tulsi powder 2) Mulethi powder 3) Black pepper powder 4) Ginger powder

D. Starch or microcrystalline cellulose as diluent (if required)

E. Capsule shells (size 0 or 00) F. Analytical balance G. Grinder and sieve set H. Tapped density apparatus

Methods

Preparation of Herbal Powder Blend Clean and dry plant materials at 40-50°C. Grind separately to fine powder. Pass through mesh no. 60. Mix in predetermined proportions using geometric mixing[12].

Standardization Tests Organoleptic properties:

a) Color, b) Odor, c) Taste, d) Texture

Physicochemical parameters:

1. Loss on drying, Total ash Acid, insoluble ash, Water soluble extractive, Alcohol soluble extractive.

Flow Property Evaluation

A. Bulk density, Tapped density, Carr's index, Hausner's ratio, Angle of repose.

Phytochemical Screening Tests for:

1. Alkaloids, Flavonoids, Tannins, Saponins.
2. Phenols

Microbial Limit Test

1. Total bacterial count
2. Total fungal count
3. Absence of pathogenic organisms

Capsule Filling and Evaluation[13]

a. Fill capsules with standardized blend.
b. Perform weight variation test as per pharmacopoeial limits.

Stability Study Store capsules at:

a) Room temperature 40°C ± 2°C/75% RH Evaluate periodically for
b) Colour,
c) Flow,
d) Microbial load.

Experimental Work

4.1 Preparation of Herbal Powder Blend: Procedure

The selected plant materials are first cleaned thoroughly to remove dust, dirt, and foreign particles. They are then dried at a controlled temperature of 40–50°C using a hot air oven to reduce moisture content and prevent microbial growth, while preserving active constituents[14].

After drying, each herbal material is ground separately using a grinder to obtain a fine powder. The powdered materials are then passed through sieve number 60 to ensure uniform particle size, which is important for proper mixing and flow properties.

The sieved powders are accurately weighed using an analytical balance and then mixed in predetermined proportions based on the formulation requirements. Mixing is carried out using the geometric dilution method, where the drug with smaller quantity is mixed with an equal amount of another powder, and the process is repeated until all components are uniformly blended.

If required, a suitable diluent such as starch or microcrystalline cellulose may be added to improve flow properties and facilitate capsule filling.

Finally, the prepared polyherbal powder blend is stored in an airtight container to protect it from moisture, light, and contamination until further evaluation or capsule filling[15].

Standardization Tests Organoleptic properties

Organoleptic Evaluation – Procedure

Organoleptic properties are evaluated using sensory organs to assess the physical characteristics of the herbal powder blend. a) Color

- Take a small quantity of the powder blend on a clean white tile or paper.
- Observe the sample under natural daylight or proper illumination.
- Note the color, uniformity, and presence of any discoloration or foreign particles.
- Record the observed color (e.g., greenish-brown, light brown, etc.). b) Odor
- Take a small amount of the sample in a clean container.
- Gently smell the powder by wafting the air towards the nose (do not inhale directly).
- Identify and record the characteristic odor (aromatic, pungent, pleasant, or absence of odor).
- Ensure no irritation or unusual smell indicating spoilage. c) Taste
- Take a very small quantity of the sample on the tongue.
- Identify the taste such as bitter, pungent, sweet, or astringent.
- Rinse mouth immediately after testing.

- Perform this test carefully and only when the sample is safe for tasting. d) Texture
- Rub a small quantity of powder between fingers.
- Assess the feel of the powder (smooth, coarse, gritty, or fine).
- Note any presence of lumps or uneven particles.

Physicochemical parameters Loss on Drying (LOD) Procedure:

- Weigh about 2–5 g of the sample in a pre-weighed evaporating dish.
- Place the dish in a hot air oven at 105°C.
- Dry for 3–5 hours or until constant weight is obtained.
- Cool in a desiccator and weigh again.
- Calculate % loss in weight.

Total Ash

Procedure:

- Accurately weigh 2 g of air-dried sample in a silica crucible.
- Incinerate gradually by increasing temperature to 500–600°C in a muffle furnace.
- Continue heating until carbon-free ash is obtained.
- Cool in a desiccator and weigh.
- Calculate % total ash. Acid Insoluble Ash Procedure:
- Take the total ash, add 25 ml dilute hydrochloric acid.
- Boil for 5 minutes.
- Filter through ashless filter paper.
- Wash residue with hot water.
- Ignite the residue in a crucible until constant weight.
- Cool and weigh to determine acid-insoluble ash. **Water Soluble Extractive** Procedure:
- Weigh 5 g of powdered drug.
- Macerate with 100 ml distilled water for 24 hours (shake occasionally).
- Filter and evaporate 25 ml filtrate to dryness in a dish.
- Dry at 105°C, cool, and weigh.
- Calculate % extractive value.

Formula for Calculation

$$\text{Water Soluble Extractive Value (\% w/w)} = \frac{\text{Weight of dried extract} \times 100 \times 100}{\text{Weight of sample} \times 25}$$

Where:

- Weight of sample = 5 g
- 25 ml filtrate used for evaporation

Alcohol Soluble Extractive

Procedure:

- Weigh 5 g of sample.
- Macerate with 100 ml alcohol (ethanol) for 24 hours.
- Filter and evaporate 25 ml filtrate to dryness.
- Dry at 105°C, cool, and weigh.
- Calculate % extractive value.

Flow Property

Evaluation A. Bulk

Density Procedure:

- Weigh accurately about 10 g of powder sample.
- Transfer it into a graduated measuring cylinder (50 or 100 ml) without tapping.
- Note the initial volume (V_o) occupied by the powder.
- Calculate bulk density using:

$$\textbf{Bulk Density} = \frac{\textbf{Weight of powder}}{\textbf{Bulk volume } (V_o)}$$

B. Tapped Density

Procedure:

- Use the same sample in the measuring cylinder.
- Place the cylinder on a tapped density apparatus.
- Tap the cylinder for 500–1000 taps or until volume becomes constant.
- Record the final tapped volume (Vt).
- Calculate tapped density:

$$\textbf{Tapped Density} = \frac{\textbf{Weight of powder}}{\textbf{Tapped volume (Vt)}}$$

C. Carr's Index

(Compressibility Index)

Procedure:

- Calculate using bulk and tapped density values:

$$\text{Carr's Index (\%)} = \frac{\text{Tapped Density} - \text{Bulk Density}}{\text{Tapped Density}} \times 100$$

- Lower values indicate better flow properties. **D. Hausner's Ratio Procedure:**
- Calculate using:

$$\text{Hausner's Ratio} = \frac{\text{Tapped Density}}{\text{Bulk Density}}$$

- Values close to 1 indicate good flow. **E. Angle of Repose**

Procedure:

- Allow powder to flow through a funnel fixed at a certain height onto a flat surface.
- Form a conical heap.
- Measure:
  - Height (h) ○ Radius (r) •

Calculate:

$$\tan \theta = \frac{h}{r}$$

- Lower angle = better flowability.

Phytochemical Screening Tests for:

1. Alkaloids

Procedure:

Take small amount of extract in a test tube. Add 1–2 ml of dilute hydrochloric acid (HCl) and warm gently. Filter the solution. Add specific reagents separately: **a) Mayer's Test**

Add Mayer's reagent → cream precipitate indicates alkaloids b) Dragendorff's Test

Add Dragendorff's reagent → orange-red precipitate indicates alkaloids

Flavonoids

Procedure:

Take extract in a test tube. Add small pieces of magnesium ribbon and few drops of concentrated HCl.

Shinoda Test:

Appearance of pink/red coloration indicates flavonoids

Tannins

Procedure:

Take extract in a test tube. Add 1–2 ml of 5% ferric chloride solution.

Observation:

Blue-black or green coloration indicates tannins

Saponins

Procedure:

Take extract in a test tube. Add distilled water and shake vigorously for 30 seconds.

Froth Test:

Formation of stable foam lasting for 10–15 minutes indicates saponins

Phenols

Procedure:

Take extract in a test tube. Add 1–2 drops of ferric chloride ($FeCl_3$) solution.

Observation:

Blue, green, or violet coloration indicates presence of phenols

Microbial Limit Test

Total Bacterial Count

(TBC) Procedure:

- Weigh 1 g of sample aseptically.
- Add to 9 ml sterile normal saline or phosphate buffer (make serial dilution if needed).
- Transfer appropriate dilution into sterile Petri dishes.
- Add sterile nutrient agar medium (pour plate method).
- Mix gently and allow to solidify.
- Incubate at 37°C for 24–48 hours.
- Count the number of bacterial colonies formed and express as CFU/g (colony forming units per gram). **Total Fungal Count (TFC) Procedure:**
- Prepare sample dilution similar to bacterial count.
- Inoculate into Sabouraud Dextrose Agar (SDA) plates.
- Spread evenly or use pour plate method.
- Incubate at 25°C for 3–5 days.
- Count fungal colonies and express as CFU/g. **Absence of Pathogenic Organisms Procedure:**
- Prepare sample suspension in sterile medium.
- Inoculate into selective media:

a) E.coli: Mac Con key agar
b) Salmonella: XLD agar / Selenite F broth
c) Staphylococcus aureus: Mannitol salt agar
d) Incubate under appropriate conditions.

Capsule Filling and Evaluation a) **Capsule Filling Procedure:**

- Select suitable capsule shells (size 0 or 00) based on powder bulk.
- Accurately weigh the standardized herbal powder blend using an analytical balance.
- Fill the powder into capsule shells using manual capsule filling method or capsule filling machine.
- Ensure uniform filling by tamping and leveling the powder bed.
- Close the capsule shells properly and check for defects like leakage, cracks, or improper sealing.
- Store filled capsules in a clean, dry container for evaluation.

b) **Weight Variation Test**

Procedure:

- Randomly select 20 capsules from the batch.
- Weigh each capsule individually using an analytical balance.
- Calculate the average weight of the capsules.
- Compare individual weights with the average weight.
- Determine percentage deviation for each capsule.

Pharmacopeial Acceptance Criteria:

- Capsules should not deviate more than ±10% for average weight ≤300 mg
- Not more than 2 capsules should exceed the limit, and none should exceed double the limit.

Stability Study Store capsules at: Stability Study Procedure:

- Take a sufficient quantity of prepared herbal capsules and pack them in suitable airtight containers.
- Store the samples under two different conditions:

a) **Room Temperature Storage**

- Store capsules at 25°C ± 2°C / ambient humidity.
- Keep in a dry place away from direct sunlight.

b) **Accelerated Stability Condition**

- Store capsules at 40°C ± 2°C / 75% Relative Humidity (RH) in a stability chamber.

Evaluation Parameters:

The capsules are evaluated at regular intervals (0, 1, 2, and 3 months or as required) for: a) **Colour**

- Observe any change in capsule shell or powder colour.
- Note discoloration, fading, or darkening.

b) **Flow Properties**

- Open capsules and evaluate powder blend for changes in:
  - Angle of repose
  - Bulk density
  - Tapped density
  - Check for caking or aggregation.

c) **Microbial Load**

- Perform microbial limit tests:
  - Total bacterial count
  - Total fungal count
- Check for growth of pathogenic organisms.

Calibration Curve Procedure

Preparation of Standard Solution

1. Accurately weigh the required quantity of drug/reference standard.
2. Dissolve it in a suitable solvent to prepare a stock solution of known concentration.
3. From the stock solution, prepare standard solutions of concentrations:
   - 10 µg/ml, 20 µg/ml, 30 µg/ml, 40 µg/ml, 50 µg/ml

Measurement of Absorbance

1. Switch on the UV-Visible spectrophotometer and allow it to stabilize.
2. Select the appropriate wavelength (λmax) for analysis.
3. Use the solvent as blank solution and calibrate the instrument.
4. Measure the absorbance of each standard solution at the selected wavelength.
5. Record the absorbance values.

Weight uniformity

Capsule weight uniformity was conducted to ensure that each capsule contained a consistent dose of CMDE. Indonesian Pharmacopoeia stated that in 20 capsules, there should not more than 2 capsules has a deviation more than 7.5% and none of the capsule exceed 15% deviation [14]. As shown in table 4, F1 had one capsule with deviation value more than 15%; F3 had 7 capsules that exceed 7.5%; F4, F5 and F6 also showed capsules that did not meet the requirement of Indonesian Pharmacopoeia. There was only F2 capsule formula that had fulfilled the Indonesian Pharmacopoeia requirement.

Delayed-type hypersensitivity (DTH) response

The administration of *C. mangga* capsule of formula F2 enhanced the footpad thickness of rats as compared to those of negative control ($P<0.05$). Of all samples tested, *C. mangga* capsule at dose of 400 mg/kg bw demonstrated the highest stimulation on DTH response (fig. 3). Suprisingly, the stimulation was higher than those of positive control with paw volume of 3.14±0.19; 2.14±0.21, for *C. mangga* capsule and positive control, respectively.

Disintegration time

The disintegration time of formula prepared was 3.20±0.67, 2.15±0.76; 3.20±1.11; 10.16±5.56, 3.46±1.37, and 4.13±0.84 for F1-F6, respectively. All of the formula met the requirement of Indonesian Pharmacopoeia disintegration time, which is not more than 15 min. The fastest formula to disintegrate was shown by F2 with 2.15±0.76 min. According to the capsule evaluation, it was obtained that F2 met all the requirements of Indonesian Pharmacopoeia in terms of weight uniformity and disintegration time. This formula was then chosen as the formula to prepare capsule dosage form for animal studies.

Formulation table

Table -1 Formulation table with list of ingredients and quantities Mentioned

Ingredients name	Category	F-1	F-2	F-3	F-4	F-5	F-6
Tulsi powder	Immunity Booster	50	**60**	70	80	90	100
Giloy powder	Immunity Booster	40	**50**	60	70	80	90
Ajwain powder	Digestive Herbal Powder Blend	30	**35**	40	45	50	55
Black pepper powder	Digestive Herbal Powder Blend	10	**10**	15	15	20	20
Mulethi powder	Respiratory Herbal Powder	40	**45**	50	55	60	65
Ginger powder ***(Curcuma mangga)***	Digestive Herbal Powder Blend	20	**25**	30	35	40	45
Fennel powder	Digestive Herbal Powder Blend	20	**25**	30	35	40	45
Amla powder	Immunity Booster	60	**70**	80	90	100	110
Ashwagandha powder	Immunity Booster	50	**60**	70	80	90	100
Microcrystalline cellulose	Diluent	Q.S.	**Q.S.**	Q.S.	Q.S.	Q.S.	Q.S.

Total Capsule Weight

Each formulation adjusted to:

- **500 mg per capsule**

Formula used for percentage calculation:

$$\% \, Composition = \frac{Weight\ of\ Ingredient}{Total\ Capsule\ Weight} \times 100$$

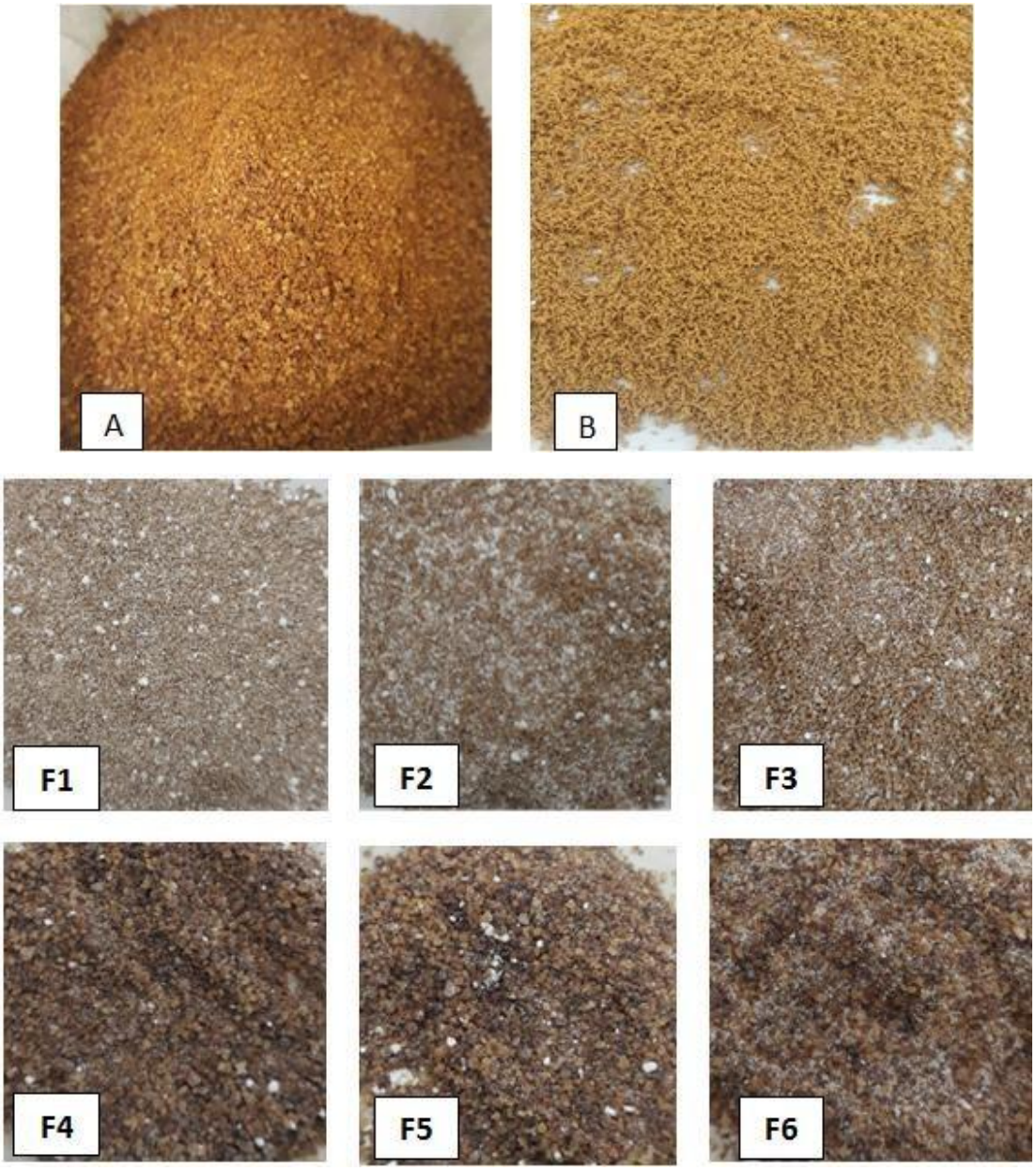
Meaning of "q.s."

"q.s." means:

> Quantity sufficient

Microcrystalline cellulose is added only to make the final capsule weight exactly 500 mg.

Fig-1 Characteristic results of *Curcuma mangga* (ginger Powder) dried extract



Results Table-2 Calibration table at 278nm

S.NO	Con.(µg/ml)	Absorbance(nm)
1	10	0.013
2	20	0.020
3	30	0.030
4	40	0.040
5	50	0.051

Fig-2-Standard curve of Poly herbal extract

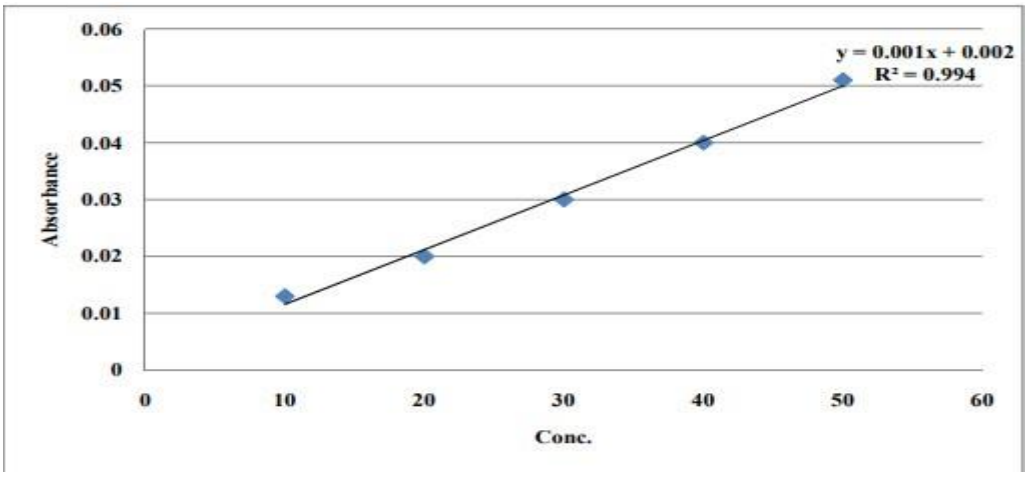


Table-3 Micromeritic Evaluation of Powder/Granules

Parameters	F1	F2	F3	F4	F5	F6
Tapped Density (g/mL)	0.42 ± 0.08	**0.36 ± 0.01**	0.42 ± 0.01	0.37 ± 0.01	0.67 ± 0.03	0.73 ± 0.00
Bulk Density (g/mL)	0.35 ± 0.01	**0.31 ± 0.01**	0.37 ± 0.09	0.43 ± 0.09	0.58 ± 0.01	0.44 ± 0.00
Carr's Index (%)	16.40 ± 2.33	**17.74 ± 1.60**	10.62 ± 0.38	16.34 ± 1.20	14.32 ± 1.97	12.26 ± 0.09
Hausner Ratio	1.19 ± 0.08	**1.18 ± 0.03**	1.08 ± 0.01	1.09 ± 0.02	1.16 ± 0.03	1.13 ± 0.01
Angle of Repose (°)	22.45 ± 0.38	**23.61 ± 0.29**	23.50 ± 1.31	22.68 ± 1.53	30.59 ± 1.40	23.45 ± 1.36

Flow Rate (g/s)	1.40 ± 0.41	**1.40 ± 0.48**	1.41 ± 0.07	1.50 ± 0.05	1.11 ± 0.10	1.74 ± 0.09

Table-4 Delayed-Type Hypersensitivity (DTH) Response of *C. mangga* Capsule

Formulations

Group / Sample Tested	**Dose**	**DTH Response (Paw Volume / Footpad Thickness)**	**Observation**
Negative Control	—	Lower response	Showed minimal stimulation of immune response
Positive Control	Standard	2.14 ± 0.21	Produced significant DTH response
Group / Sample Tested	**Dose**	**DTH Response (Paw Volume / Footpad Thickness)**	**Observation**
	drug		
C. mangga Capsule (F2)	400 mg/kg bw	3.14 ± 0.19	Highest stimulation of DTH response
C. mangga Capsule (Other doses/formulations)	Various doses	Moderate response	Enhanced footpad thickness compared to negative control

- Administration of *C. mangga* capsule formulation F2 significantly enhanced the delayed-type hypersensitivity (DTH) response in rats compared with the negative control ($P < 0.05$). Among all tested samples, the 400 mg/kg body weight dose showed the maximum immune stimulation. The immune response produced by the F2 capsule formulation was unexpectedly higher than the positive control.

Table-5 Disintegration Time of Capsules (Minutes)

Capsule No.	F1	F2	F3	F4	F5	F6
1	2.70	2.10	7.30	14.04	7.25	6.34
2	2.70	3.90	8.05	3.15	1.45	4.68
3	2.70	3.90	9.20	5.15	4.55	6.34
4	2.70	3.90	3.45	2.58	7.25	0.83
5	8.11	2.10	8.05	2.58	7.25	0.83
6	18.92	2.10	3.45	2.58	1.45	6.34
7	2.70	3.90	9.20	2.58	16.14	0.83
8	2.70	3.90	8.50	8.58	7.25	4.68
9	2.70	3.90	9.20	2.58	1.45	4.68
10	2.70	2.10	3.45	2.58	1.45	0.83
11	2.70	3.90	3.45	3.15	7.25	6.34
12	13.51	3.90	3.45	2.58	1.45	0.83
13	8.11	2.10	1.45	14.04	15.94	1.46
14	2.70	2.10	2.30	3.15	7.25	0.83
15	2.70	3.90	9.20	3.15	15.94	0.83
16	2.70	3.90	8.05	8.58	7.25	4.68
17	2.70	2.10	9.20	3.15	1.45	0.83
18	2.70	2.10	8.05	3.15	7.25	11.05
19	2.70	2.10	13.79	8.58	1.45	11.05
20	2.70	2.10	13.79	8.58	1.45	0.83

Fig-2 Disintegration time of capsule of different sizes

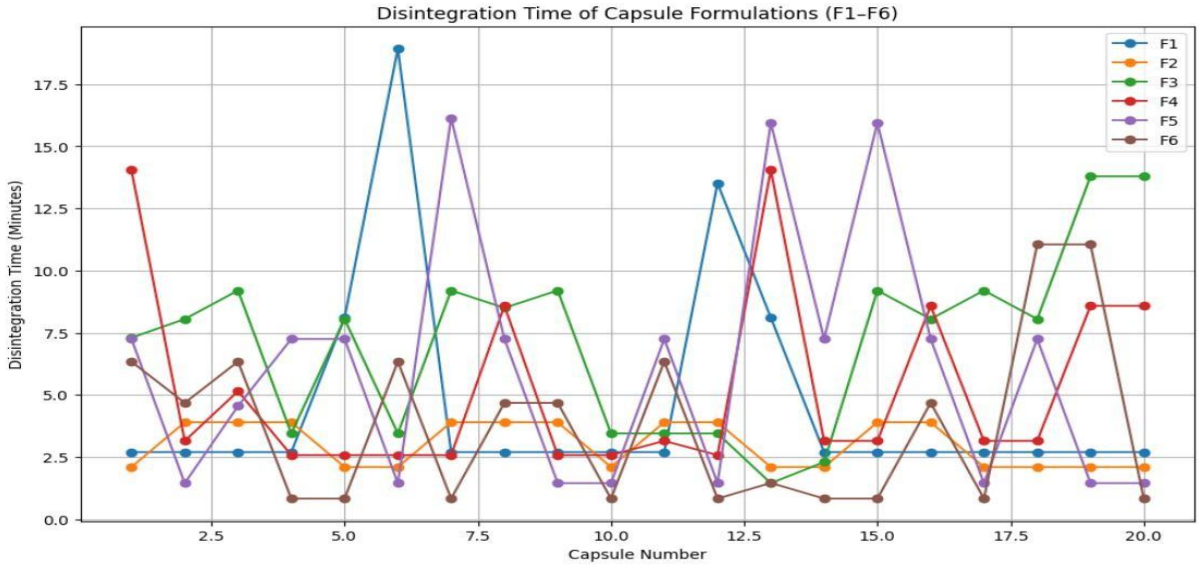


Table-6 Water Soluble Extractive Value Determination

Step No.	Procedure	Observation/Details
1	Weight of powdered drug taken	5 g
2	Volume of distilled water used	100 ml
3	Maceration time	24 hours
4	Shaking	Occasional shaking during maceration
5	Volume of filtrate taken for evaporation	25 ml
6	Drying temperature	105°C
7	Final observation	Residue dried, cooled, and weighed
8	Calculation	% Water soluble extractive value calculated

Table-7 Total Fungal Count

Dilution	Plate No.	No. of Colonies Counted	Average Colonies	CFU/g Calculation	Final CFU/g
10^{-1}	1	____			
10^{-1}	2	____	____		
10^{-2}	1	____			
10^{-2}	2	____	____		
10^{-3}	1	____			
10^{-3}	2	____	____		

Table-8- Absence of Pathogenic Organisms

Pathogenic Organism	Selective Media Used	Incubation Conditions	Observed Growth	Result
Escherichia coli	MacConkey Agar	37°C for 24 hrs	No pink colonies observed	Absent
***Salmonella* spp.**	XLD Agar / Selenite F Broth	37°C for 24–48 hrs	No red/black centered colonies	Absent
Staphylococcus aureus	Mannitol Salt Agar	37°C for 24 hrs	No yellow colonies (no fermentation)	Absent

Table-9 Preliminary Phytochemical Screening

S.No	Phytochemical Group	Test Name	Procedure / Reagent Used	Positive Observation	Result
1	**Alkaloids**	Mayer's Test	Mayer's reagent added to extract	Cream precipitate formed	Present / Absent
2	**Alkaloids**	Dragendorff's Test	Dragendorff's reagent added	Orange-red precipitate formed	Present / Absent

3	**Flavonoids**	Shinoda Test	Mg ribbon + conc. HCl added to extract	Pink / red coloration observed	Present / Absent
4	**Tannins**	Ferric Chloride Test	5% $FeCl_3$ solution added	Blue-black / green coloration	Present / Absent
5	**Saponins**	Froth Test	Shake extract with distilled water	Stable foam (10–15 min) formed	Present / Absent
6	**Phenols**	Ferric Chloride Test	1–2 drops $FeCl_3$ added	Blue / green / violet coloration	Present / Absent

Discussion

The present study aimed to standardize and evaluate a polyherbal powder blend intended for capsule filling. The formulation contained selected herbal ingredients such as Tulsi, Giloy, Amla, Ashwagandha, Mulethi, Ginger, Fennel, Ajwain, and Black Pepper. The prepared powder blends were evaluated for micromeritic properties including bulk density, tapped density, Carr's index, Hausner ratio, angle of repose, and flow rate. The results indicated satisfactory flow characteristics and suitability for capsule filling. Capsule evaluation showed acceptable weight uniformity and disintegration time within pharmacopoeial limits. Preliminary phytochemical screening confirmed the presence of important phytoconstituents. Microbial limit tests demonstrated compliance with quality requirements. The study concludes that the standardized polyherbal powder blend possesses suitable physicochemical and flow properties for the development of herbal capsule dosage forms.

Conclusion

The present study successfully standardized and evaluated a polyherbal powder blend intended for capsule filling. The formulation exhibited acceptable physicochemical characteristics, good flow properties, and satisfactory capsule quality parameters. The results of micromeritic evaluation confirmed the suitability of the blend for efficient capsule filling and handling during manufacturing. Phytochemical screening indicated the presence of important bioactive constituents, while microbial studies demonstrated acceptable quality and safety. Based on the overall evaluation, the developed polyherbal powder blend can be considered a suitable candidate for herbal capsule formulation and may be further investigated for its therapeutic applications and long-term stability.

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AUTHOR CONTRIBUTIONS

Zakir Hussain: Conceptualization, formulation development, experimental work, data collection, interpretation of results, and manuscript drafting.

Mitta Chaitanya: Analytical evaluation, data analysis, validation of results, and critical review of the manuscript.

Santosh: Literature survey, experimental assistance, statistical analysis, and manuscript editing.

Maheswari: Research supervision, study design, regulatory guidance, manuscript review, final editing, and approval of the final manuscript.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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