Formulation And Evaluation of Polyherbal Immunity Booster Powder

Ms. Ganvir Pallavi Vilas[1], Mr. Ingole Rupesh Venkatrao[2], Mr. Aditya Vijay Bhagat [3], Mr. Rutuja Govind Dapkekar[4], Mr. Munjaji Baburao Kadam[5], Ms. Trashna Deepak Kolambikar[6]

[1,2]*Associate Professor, Department of Pharmaceutical Chemistry, Kandhar College of Pharmacy, Nanded, Maharashtra, India*

[3,4,5,6]*Research Scholar, Department of Pharmaceutical Chemistry, Kandhar College of Pharmacy, Nanded, Maharashtra, India*

***Abstract*—The increasing demand for herbal nutraceuticals and natural immune-enhancing formulations has encouraged the development of polyherbal preparations with immunomodulatory potential. The present research work focuses on the formulation and evaluation of a polyherbal immunity booster powder containing medicinal herbs such as Ashwagandha (*Withania somnifera*), Tulsi (*Ocimum sanctum*), Giloy (*Tinospora cordifolia*), Amla (*Emblica officinalis*), Turmeric (*Curcuma longa*), and Ginger (*Zingiber officinale*). These herbs are traditionally known for their antioxidant, antimicrobial, anti-inflammatory, and immunostimulatory activities. The powdered formulation was prepared by shade drying, pulverization, sieving, and geometric mixing of all ingredients in optimized proportions. The prepared formulation was evaluated for organoleptic characteristics, physicochemical parameters, flow properties, phytochemical screening, microbial load, and stability studies. The results demonstrated acceptable color, odor, taste, moisture content, bulk density, angle of repose, and good flow characteristics. Phytochemical investigations confirmed the presence of alkaloids, flavonoids, tannins, glycosides, phenolics, and saponins which are responsible for immune-enhancing activity. The microbial load was found within acceptable pharmacopoeial limits, indicating the safety of the preparation. The study concluded that the formulated polyherbal immunity booster powder possesses satisfactory physicochemical properties and may serve as a safe and effective natural immunity-enhancing formulation.**

***Index Terms*—Polyherbal powder, Immunity booster, Herbal formulation, Immunomodulatory activity, Nutraceuticals, Phytochemicals.**

I. IMMUNITY AND IMMUNE SYSTEM

The immune system is a highly organized and complex biological defense mechanism that protects the human body from harmful microorganisms, toxins, allergens, and infectious agents. It consists of various cells, tissues, organs, and biochemical mediators that work together to identify and eliminate pathogens. The immune system plays a crucial role in maintaining homeostasis and preventing the development of diseases. A properly functioning immune system protects the body against bacterial, viral, fungal, and parasitic infections while also eliminating damaged or abnormal cells [1].

Immunity is generally classified into innate immunity and acquired immunity. Innate immunity acts as the first line of defense and includes physical barriers such as skin, mucous membranes, and physiological responses like inflammation and phagocytosis. Acquired immunity develops through exposure to pathogens or vaccines and involves specific immune responses mediated by lymphocytes and antibodies [2]. Modern lifestyle changes, stress, pollution, poor nutrition, lack of exercise, and environmental toxins adversely affect immune functions and increase susceptibility to diseases. Consequently, maintaining immune health has become a major public health concern worldwide.

The recent rise in infectious diseases and global viral outbreaks has significantly increased awareness regarding immune health and preventive healthcare approaches. Synthetic immunomodulatory drugs are available for immune enhancement; however, prolonged use of synthetic agents may produce

adverse effects such as hypersensitivity reactions, organ toxicity, and immune suppression. Therefore, researchers and healthcare professionals are increasingly focusing on herbal medicines and natural products as safer alternatives for immune enhancement [3].

Herbal medicines have been used for centuries in traditional systems of medicine such as Ayurveda, Siddha, Unani, and Traditional Chinese Medicine for improving immunity and promoting general well-being. Medicinal plants contain numerous phytoconstituents such as alkaloids, flavonoids, tannins, glycosides, terpenoids, saponins, and polyphenols that exhibit antioxidant, anti-inflammatory, antimicrobial, and immunomodulatory activities [4]. Polyherbal formulations prepared from combinations of medicinal herbs are considered more effective than single-herb preparations because of their synergistic therapeutic action.

CONCEPT OF POLYHERBAL FORMULATION

Polyherbal formulations are preparations containing two or more medicinal herbs combined in a definite ratio to achieve enhanced therapeutic efficacy. The concept of polyherbalism is deeply rooted in Ayurveda, where combinations of herbs are used to improve effectiveness, reduce toxicity, and enhance bioavailability. According to Ayurvedic principles, the synergistic interaction among multiple herbs improves pharmacological activity and provides better therapeutic outcomes than individual herbs alone [5].

The rationale behind polyherbal formulations is based on the belief that herbs possess multiple phytoconstituents that act on different physiological pathways simultaneously. This synergistic mechanism improves therapeutic efficiency and minimizes adverse effects. Polyherbal preparations are widely used for the management of respiratory disorders, digestive problems, metabolic diseases, inflammation, stress, and immune-related conditions [6]. The use of polyherbal formulations as immunity boosters has gained immense popularity due to increased awareness regarding natural healthcare products. Herbal immunity boosters help improve the body's resistance against infections by stimulating immune cells, enhancing antibody production, and reducing oxidative stress. Additionally, medicinal herbs possess antioxidant activity that neutralizes free radicals and protects immune cells from oxidative damage [7].

Powder dosage forms are among the most commonly used traditional herbal preparations because of their simplicity, ease of preparation, stability, and cost-effectiveness. Herbal powders are easy to consume, possess improved shelf life, and can be mixed with water, milk, or honey for administration. Therefore, polyherbal immunity booster powder formulations have emerged as promising nutraceutical products for maintaining health and immunity.

IMPORTANCE OF HERBAL IMMUNITY BOOSTERS

Herbal immunity boosters are natural preparations containing medicinal plants known for their immunomodulatory properties. These herbal products help improve the body's defense mechanisms against infectious agents and environmental stressors. The growing interest in preventive healthcare and natural remedies has significantly increased the demand for herbal immunity boosters globally [8]. Herbal immunomodulators act by stimulating or regulating immune responses through activation of macrophages, lymphocytes, natural killer cells, and cytokine production. Many medicinal plants also possess adaptogenic properties that help the body cope with physical and psychological stress. Unlike synthetic drugs, herbal medicines are generally considered safe, economical, and suitable for long-term use [9].

Several medicinal plants commonly used in immunity-boosting formulations include Ashwagandha, Tulsi, Giloy, Turmeric, Ginger, Neem, Garlic, and Amla. These herbs are rich sources of bioactive compounds that exhibit potent pharmacological activities. Their regular consumption helps improve resistance to infections, reduces inflammation, enhances antioxidant defense mechanisms, and supports overall health [10].

Scientific studies have demonstrated that medicinal herbs can modulate both innate and adaptive immunity. Herbal compounds stimulate immune cells, increase production of immunoglobulins, and regulate inflammatory mediators. Additionally, antioxidant phytochemicals present in medicinal plants protect cells from oxidative damage caused by reactive oxygen species [3]. The use of herbal immunity boosters has increased significantly following the COVID-19 pandemic, during which people sought natural approaches for improving immune resistance.

Ayurvedic formulations containing Tulsi, Giloy, Turmeric, Ashwagandha, and Ginger were extensively recommended for immune enhancement and respiratory protection [8].

ROLE OF MEDICINAL HERBS IN IMMUNOMODULATION

Ashwagandha (*Withania somnifera*)

Ashwagandha is one of the most important medicinal herbs used in Ayurveda for rejuvenation and immune enhancement. It is commonly referred to as "Indian Ginseng" due to its adaptogenic and revitalizing properties. Ashwagandha contains bioactive compounds such as withanolides, alkaloids, sitoindosides, and flavonoids that contribute to its pharmacological activities [4]. Ashwagandha exhibits immunomodulatory, anti-inflammatory, antioxidant, anti-stress, and antimicrobial activities. It enhances immune function by stimulating macrophage activity, increasing white blood cell production, and improving antibody formation. Furthermore, Ashwagandha helps reduce stress-induced immune suppression and enhances physical endurance [11]. Studies have shown that Ashwagandha improves both cellular and humoral immunity by regulating cytokine production and lymphocyte proliferation. Due to its adaptogenic activity, it helps the body adapt to stress and maintain immune balance [12].

Tulsi (*Ocimum sanctum*)

Tulsi, also known as Holy Basil, is regarded as a sacred medicinal plant in Ayurveda. It possesses antimicrobial, antiviral, antioxidant, anti-inflammatory, and immunomodulatory properties. Tulsi contains important phytochemicals such as eugenol, ursolic acid, rosmarinic acid, flavonoids, and essential oils [1]. Tulsi enhances immunity by stimulating immune cells and improving the body's defense against infections. It is particularly beneficial in respiratory disorders such as cough, cold, bronchitis, and asthma. The antioxidant activity of Tulsi protects cells from oxidative stress and improves overall health [10]. Research studies have demonstrated that Tulsi improves natural killer cell activity and enhances antibody responses. It also exhibits antiviral activity against several pathogenic viruses and helps maintain respiratory health [4].

Giloy (*Tinospora cordifolia*)

Giloy, also known as Guduchi, is an important Ayurvedic herb traditionally used as an immunomodulator and rejuvenating agent. It contains alkaloids, glycosides, diterpenoid lactones, steroids, and polysaccharides responsible for its medicinal properties [8]. Giloy stimulates macrophage activation, improves phagocytic activity, and enhances immune cell function. It also possesses antipyretic, anti-inflammatory, antioxidant, hepatoprotective, and antimicrobial activities. Giloy is widely used in Ayurvedic formulations for fever, respiratory infections, and immune-related disorders [5]. Several studies have reported that Giloy improves resistance against microbial infections and enhances immune responses by regulating cytokine secretion and oxidative stress pathways [9].

Amla (*Emblica officinalis*)

Amla, commonly known as Indian Gooseberry, is a rich source of vitamin C, polyphenols, tannins, and flavonoids. It is widely used in traditional medicine as a rejuvenating and antioxidant herb. Amla exhibits antimicrobial, anti-inflammatory, antioxidant, and immunomodulatory properties [2]. The high vitamin C content of Amla enhances immune function by improving white blood cell activity and antibody production. Antioxidants present in Amla protect immune cells from oxidative stress and support overall health [13]. Amla also improves digestion, detoxification, and metabolism, thereby contributing to better immune health. Due to its rejuvenating activity, Amla is an important ingredient in many Ayurvedic formulations such as Chyawanprash and Rasayana preparations [6].

Turmeric (*Curcuma longa*)

Turmeric is a widely used medicinal spice containing curcumin as its principal active constituent. Curcumin exhibits potent antioxidant, anti-inflammatory, antimicrobial, antiviral, and immunomodulatory activities [3]. Turmeric enhances immune responses by regulating inflammatory mediators, cytokines, and immune cell signaling pathways. Curcumin inhibits oxidative stress and inflammatory reactions associated with chronic diseases [14]. Research studies have demonstrated that turmeric improves immune resistance against infections and supports respiratory health. Due to its anti-inflammatory activity, it is

extensively used in herbal immunity formulations [10].

Ginger (*Zingiber officinale*)
Ginger is an important medicinal herb used for digestive disorders, respiratory diseases, and immune enhancement. It contains bioactive compounds such as gingerols, shogaols, zingerone, and flavonoids responsible for its pharmacological activities [1]. Ginger exhibits antimicrobial, antioxidant, anti-inflammatory, antiviral, and immunostimulatory properties. It improves circulation, digestion, and respiratory function while supporting immune health. Ginger also helps reduce inflammation and oxidative stress, thereby enhancing resistance against infections [5]. Studies have shown that ginger stimulates immune responses by improving macrophage function and reducing inflammatory mediators [9].

Advantages of Polyherbal Immunity Booster Powder
Polyherbal immunity booster powders offer several advantages over conventional synthetic preparations. These formulations contain natural medicinal herbs that are generally considered safe and suitable for regular consumption. Herbal powders are economical, easy to prepare, and possess improved patient compliance [7]. The synergistic interaction among multiple herbs enhances therapeutic efficacy and broadens pharmacological activity. Polyherbal formulations provide antioxidant, antimicrobial, anti-inflammatory, adaptogenic, and immunomodulatory effects simultaneously [6].

Powder dosage forms possess better stability compared to liquid preparations and do not require complex manufacturing techniques. Additionally, herbal powders can be administered with milk, water, or honey according to individual preferences [8].
The increasing preference for herbal nutraceuticals and preventive healthcare products has created significant demand for herbal immunity booster powders in pharmaceutical and nutraceutical industries.

Although several herbal immunity boosters are available in the market, there remains a need for scientifically formulated and standardized polyherbal preparations with proven physicochemical quality and therapeutic potential. Many marketed herbal products lack proper standardization, quality control, and scientific validation [7]. The present study aims to formulate and evaluate a polyherbal immunity booster powder containing medicinal herbs such as Ashwagandha, Tulsi, Giloy, Amla, Turmeric, and Ginger. These herbs possess scientifically established immunomodulatory and antioxidant activities. The study focuses on evaluating physicochemical characteristics, phytochemical constituents, flow properties, microbial quality, and stability of the formulation. The development of a safe, effective, economical, and natural immunity booster powder may provide a valuable herbal nutraceutical for improving immune health and overall well-being.

II. MATERIALS AND METHODS TO BE ADOPTED

2.1. Materials and Methods
The present research work was designed to formulate and evaluate a polyherbal immunity booster powder using selected medicinal herbs possessing immunomodulatory, antioxidant, antimicrobial, and rejuvenating properties. The methodology included procurement and authentication of raw materials, preparation of herbal powders, formulation of the polyherbal powder, and evaluation of the prepared formulation using standard physicochemical and phytochemical parameters.

2.2. Research Design
The study was based on an experimental laboratory design involving formulation development and evaluation of a polyherbal immunity booster powder. The selected medicinal herbs were processed individually and blended in optimized proportions to prepare the final formulation. The prepared powder was subjected to various quality control and evaluation tests to assess its suitability as an herbal immunity booster formulation.

2.3. Selection of Herbal Ingredients
Medicinal herbs were selected on the basis of their traditional use in Ayurveda, reported immunomodulatory activity, antioxidant potential, safety profile, and availability. Herbs possessing synergistic therapeutic effects were preferred to enhance the overall efficacy of the formulation.

The following herbs were selected for the formulation:

Sr. No.	Common Name	Biological Name	Family	Therapeutic Role
1	Ashwagandha	*Withania somnifera*	Solanaceae	Adaptogen and immunomodulator
2	Tulsi	*Ocimum sanctum*	Lamiaceae	Antioxidant and antimicrobial
3	Giloy	*Tinospora cordifolia*	Menispermaceae	Immunostimulant
4	Amla	*Emblica officinalis*	Phyllanthaceae	Antioxidant and vitamin C source
5	Turmeric	*Curcuma longa*	Zingiberaceae	Anti-inflammatory
6	Ginger	*Zingiber officinale*	Zingiberaceae	Antimicrobial and antioxidant
7	Black Pepper	*Piper nigrum*	Piperaceae	Bioavailability enhancer

2.4. Procurement of Raw Materials

All herbal ingredients required for the formulation were procured from authenticated local herbal suppliers and Ayurvedic medical stores. The raw materials were collected in dried form and transported in clean airtight containers to avoid contamination and moisture absorption.

The collected crude drugs were examined for foreign matter, adulteration, color, odor, and texture before use. Any damaged or contaminated material was discarded. The herbs were stored in dry and cool conditions until further processing.

2.5. Authentication of Plant Materials

The procured herbal materials were authenticated by a qualified pharmacognosist or botanist based on their macroscopic and microscopic characteristics. Authentication was carried out using standard pharmacognostic methods including morphological examination, organoleptic evaluation, and comparison with official monographs.

Voucher specimens of all plant materials were maintained for future reference and documentation.

2.6. Cleaning and Drying of Herbal Materials

The crude herbal materials were cleaned thoroughly to remove dust, dirt, stones, and other foreign particles. Washing was performed using potable water wherever necessary.

After cleaning, the materials were subjected to shade drying at room temperature for several days to preserve heat-sensitive phytoconstituents. Direct sunlight was avoided because it may lead to degradation of active compounds such as flavonoids, volatile oils, and vitamins.

Drying was continued until constant weight was achieved to ensure complete removal of moisture and prevention of microbial growth. Proper drying also improves grinding efficiency and stability of the formulation.

2.7. Pulverization and Sieving

The dried herbal materials were separately pulverized using a mechanical grinder to obtain coarse powder. Pulverization helps increase surface area and improves uniformity of the formulation.

The powdered materials were passed through sieve number 80 to obtain fine and uniform particle size. Sieving also helps remove fibrous materials and coarse particles that may affect mixing and flow properties.

Each powdered ingredient was stored separately in airtight containers protected from light and moisture until formulation.

2.8. Formulation of Polyherbal Immunity Booster Powder

The polyherbal immunity booster powder was prepared using the geometric mixing method to ensure uniform distribution of all ingredients throughout the formulation.

Formula Composition

Ingredient	Quantity (%)
Ashwagandha powder	20
Tulsi powder	15
Giloy powder	20
Amla powder	20
Turmeric powder	10
Ginger powder	10
Black pepper powder	5

Procedure

1. All powdered ingredients were accurately weighed according to the required quantity using a digital weighing balance.

2. Individual powders were transferred to a clean and dry mortar.
3. Powders were mixed geometrically by gradually increasing the quantity of ingredients to ensure uniform mixing.
4. The blending process was continued for 20–30 minutes to achieve homogeneity.
5. The final blended powder was observed visually for color and uniformity.
6. The prepared formulation was packed in airtight amber-colored containers to protect it from moisture, oxidation, and microbial contamination.
7. The containers were labeled properly and stored under suitable environmental conditions for further evaluation.

2.9. Evaluation of Polyherbal Immunity Booster Powder

The prepared formulation was evaluated using standard physicochemical, phytochemical, microbiological, and stability parameters.

2.9.1.Organoleptic Evaluation

Organoleptic evaluation was performed to determine the sensory characteristics of the prepared formulation.

The following parameters were evaluated:

- Color
- Odor
- Taste
- Texture
- Appearance

The observations were recorded visually and manually.

2.9.2.Determination of Bulk Density

Bulk density is defined as the ratio of powder mass to the bulk volume occupied by the powder.

Procedure

1. Accurately weighed powder was transferred into a graduated measuring cylinder.
2. The initial volume occupied by the powder was noted.
3. Bulk density was calculated using the formula:

$$\text{Bulk Density} = \frac{\text{Mass of powder}}{\text{Bulk volume}}$$

2.9.3.Determination of Tapped Density

Tapped density was determined by mechanically tapping the measuring cylinder containing powder until constant volume was obtained.

Formula

$$\text{Tapped Density} = \frac{\text{Mass}}{\text{Tapped volume}}$$

2.9.4.Determination of Angle of Repose

Angle of repose was determined to assess the flow properties of the powder.

Procedure

1. Powder was allowed to flow through a funnel fixed at a certain height.
2. A cone-shaped heap was formed on a flat surface.
3. Height and radius of the powder heap were measured.

Formula

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

Angle of repose was determined by funnel method to assess flow properties.

Where,

h is height

r is radius of the powder heap.

Angle less than 30° indicates good flow (Carr, 1965).

2.9.5.Determination of Carr's Index

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

Values below 15% indicate good flow (Carr, 1965).

2.9.6.Determination of Hausner Ratio

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

Values less than 1.25 indicate good flowability.

2.9.7.Phytochemical Screening

Preliminary phytochemical tests were performed to identify the presence of major phytoconstituents.

The formulation was tested for:

- Alkaloids
- Flavonoids
- Tannins
- Glycosides

- Saponins
- Phenolics
- Terpenoids

Standard qualitative chemical tests were used for phytochemical analysis.

2.9.8.Microbial Evaluation

Microbial analysis was carried out to determine the microbial safety of the formulation.

The following tests were performed:

- Total bacterial count
- Total fungal count
- Detection of pathogenic microorganisms

The results were compared with official pharmacopoeial limits.

2.9.9.Stability Study

The prepared polyherbal powder was subjected to stability studies under room temperature conditions for a specified period.

The formulation was evaluated periodically for:

- Color change
- Odor
- Moisture content
- Flow properties
- Microbial growth

Stability studies help determine the shelf life and storage conditions of the formulation.

2.10. Statistical Analysis

All evaluation parameters were carried o

III. RESULTS AND DISCUSSION

The formulated polyherbal immunity booster powder was successfully prepared using selected medicinal herbs possessing immunomodulatory, antioxidant, antimicrobial, and rejuvenating activities. The prepared formulation was evaluated for organoleptic properties, physicochemical characteristics, phytochemical constituents, microbial quality, and stability parameters. The obtained results confirmed that the developed formulation possessed acceptable quality attributes suitable for use as an herbal immunity-enhancing supplement.

3.1. Organoleptic Evaluation

Organoleptic evaluation plays an important role in determining the acceptability and quality of herbal formulations. The prepared polyherbal powder exhibited a characteristic herbal appearance with pleasant aromatic odor due to the presence of Tulsi, Ginger, and Black Pepper. The slightly bitter and pungent taste was attributed to phytoconstituents present in Giloy and Turmeric.

Table 3.1 Organoleptic Characteristics of Polyherbal Immunity Booster Powder

Sr. No.	Parameter Evaluated	Observation	Interpretation
1	Color	Light brownish green	Indicates uniform mixing of herbal ingredients
2	Odor	Pleasant aromatic odor	Presence of volatile phytoconstituents
3	Taste	Slightly bitter and pungent	Characteristic taste of medicinal herbs
4	Texture	Fine and smooth powder	Proper pulverization and sieving
5	Appearance	Free flowing powder	Good handling and formulation quality

Discussion

The organoleptic properties of the prepared formulation were found satisfactory and acceptable for oral administration. The fine texture and free-flowing nature of the powder indicated effective drying, grinding, and blending of ingredients. No unpleasant odor or discoloration was observed, suggesting good stability of phytoconstituents.

3.2. Physicochemical Evaluation

Physicochemical parameters are essential for determining powder quality, flowability, compressibility, and stability. Bulk density, tapped density, angle of repose, Carr's index, and Hausner ratio were evaluated using standard procedures.

Table 3.2 Physicochemical Characteristics of Polyherbal Powder

Sr. No.	Parameter	Result Obtained	Standard Range	Interpretation
1	Bulk Density	0.45 g/ml	0.40–0.60 g/ml	Suitable packing ability
2	Tapped Density	0.52 g/ml	0.45–0.70 g/ml	Good compactness

3	Angle of Repose	27.8°	<30°	Excellent flow property
4	Carr's Index	13.46%	10–15%	Good compressibility
5	Hausner Ratio	1.15	<1.25	Good flowability
6	Moisture Content	4.1%	<5%	Good stability

Discussion

The obtained bulk density and tapped density values indicated proper packing characteristics of the powder formulation. The angle of repose value below 30° confirmed excellent flow properties, which are important for handling and packaging operations.

Carr's index and Hausner ratio values demonstrated good compressibility and low interparticle friction, indicating uniform particle size distribution. The moisture content was found within acceptable limits, suggesting minimal risk of microbial contamination and improved shelf life.

3.3. Phytochemical Screening

Phytochemical analysis was performed to identify the presence of bioactive compounds responsible for immunomodulatory and antioxidant activities.

Table 3.3 Preliminary Phytochemical Screening of Polyherbal Powder

Sr. No.	Phytoconstituent	Test Performed	Observation	Result
1	Alkaloids	Dragendorff's test	Orange precipitate formed	Present
2	Flavonoids	Alkaline reagent test	Yellow coloration observed	Present
3	Tannins	Ferric chloride test	Bluish-black color formed	Present
4	Glycosides	Keller-Killiani test	Brown ring observed	Present
5	Saponins	Foam test	Persistent foam formed	Present
6	Phenolic compounds	Ferric chloride test	Dark green coloration	Present
7	Terpenoids	Salkowski test	Reddish-brown interface	Present

Discussion

The phytochemical investigation confirmed the presence of various secondary metabolites such as flavonoids, alkaloids, tannins, glycosides, and phenolic compounds. These phytoconstituents are known to exhibit potent antioxidant, antimicrobial, and immunomodulatory activities.

Flavonoids and phenolic compounds contribute significantly to free radical scavenging activity, while alkaloids and terpenoids are associated with antimicrobial and anti-inflammatory effects. The presence of these compounds supports the therapeutic potential of the formulated immunity booster powder.

3.4. Evaluation of Flow Properties

Flow characteristics are important for determining the handling, mixing, and packaging behavior of powdered formulations.

Table 3.4 Flow Property Evaluation

Sr. No.	Parameter	Result	Flow Character
1	Angle of Repose	27.8°	Excellent
2	Carr's Index	13.46%	Good
3	Hausner Ratio	1.15	Good
4	Particle Uniformity	Uniform	Homogeneous blend
5	Flowability	Free flowing	Suitable for packaging

Discussion

The prepared formulation showed excellent flow properties due to uniform particle size and low moisture content. Proper flowability is essential for achieving uniformity during filling and packaging processes. The results indicated that the prepared polyherbal powder can be conveniently handled during large-scale manufacturing.

3.5. Microbial Evaluation

Microbial evaluation was carried out to assess the microbiological safety of the prepared formulation.

Table 3.5 Microbial Quality Assessment

Sr. No.	Microbial Test	Observed Count	Pharmacopoeial Limit	Result
1	Total Bacterial Count	1.8×10^2 CFU/g	$<10^3$ CFU/g	Within limits
2	Total Fungal Count	0.7×10^1 CFU/g	$<10^2$ CFU/g	Within limits
3	*Escherichia coli*	Absent	Absent	Passed
4	*Salmonella* spp.	Absent	Absent	Passed
5	*Staphylococcus aureus*	Absent	Absent	Passed

Discussion

The microbial analysis indicated that the prepared formulation complied with official microbial limits for herbal preparations. The absence of pathogenic microorganisms confirmed the microbiological safety of the formulation. The low microbial count may be attributed to proper drying, hygienic processing conditions, low moisture content, and antimicrobial activity of ingredients such as Tulsi, Ginger, Turmeric, and Black Pepper.

3.6. Stability Study

Stability studies were conducted to evaluate the physical and microbial stability of the formulation during storage.

Table 3.6 Stability Study of Polyherbal Immunity Booster Powder

Storage Period	Color	Odor	Moisture Content	Flowability	Microbial Growth
Initial	Light brownish green	Aromatic	4.1%	Excellent	Absent
15 Days	No change	No change	4.2%	Excellent	Absent
30 Days	No change	No change	4.3%	Good	Absent
45 Days	Slight dullness	Aromatic	4.4%	Good	Absent

Discussion

The stability study revealed that the formulation remained stable throughout the storage period without significant changes in color, odor, flowability, or microbial quality. Slight changes in color after prolonged storage may be due to natural oxidation of herbal constituents. The low increase in moisture content indicated effective packaging and storage conditions. Overall, the prepared formulation demonstrated acceptable stability characteristics suitable for storage under normal environmental conditions.

3.7. Overall Interpretation of Results

Table 3.7 Summary of Evaluation Results

Evaluation Parameter	Observation	Final Outcome
Organoleptic properties	Acceptable	Suitable for oral use
Flow properties	Excellent	Good handling characteristics
Moisture content	Within limits	Improved stability
Phytochemical profile	Rich in bioactives	Strong therapeutic potential
Microbial quality	Safe	Free from contamination
Stability study	Stable	Good shelf life potential

Overall Discussion

The formulated polyherbal immunity booster powder demonstrated satisfactory pharmaceutical and physicochemical properties. The presence of important phytoconstituents such as flavonoids, alkaloids, tannins, and phenolics confirmed the therapeutic significance of the formulation. The synergistic combination of Ashwagandha, Tulsi, Giloy, Amla, Turmeric, Ginger, and Black Pepper may contribute to enhanced immunomodulatory and antioxidant activity. The formulation also exhibited acceptable microbial quality and stability, indicating its safety and suitability as a natural herbal immunity booster.

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