Formulation And Evaluation of Herbal Immunobooster Tablet Containing Ashwagandha, Tulsi, Aloe Vera and Turmeric by Using Direct Compression Method

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***Abstract*—Herbal medicines have gained significant attention due to their safety, efficacy, and minimal side effects in comparison with synthetic drugs. The present study was aimed at the formulation and evaluation of an herbal immunobooster tablet containing Ashwagandha, Tulsi, Aloe vera, and Turmeric by using the direct compression method. These herbal ingredients were selected based on their well-known immunomodulatory, antioxidant, anti-inflammatory, and antimicrobial properties. The powdered extracts of the selected herbs were blended with suitable excipients including binders, diluents, lubricants, and disintegrants to prepare tablets by direct compression technique. The prepared formulations were evaluated for pre-compression parameters such as angle of repose, bulk density, tapped density, Carr's index, and Hausner's ratio to determine the flow properties of the powder blend. Post-compression evaluation of tablets was carried out for parameters including hardness, thickness, friability, weight variation, disintegration time, and drug content uniformity. The formulated tablets showed acceptable physicochemical characteristics within pharmacopeial limits. The optimized formulation exhibited satisfactory hardness, low friability, uniform weight distribution, and appropriate disintegration time, indicating good mechanical strength and stability.**

The study concluded that the direct compression method is a simple, economical, and effective technique for the preparation of herbal immunobooster tablets. The formulated polyherbal tablet may serve as a potential natural immune-enhancing dosage form for improving overall health and resistance against infections.

***Index Terms*—Herbal immunobooster tablet; Ashwagandha; Tulsi; Aloe vera; Turmeric; Direct compression; Polyherbal formulation; Immunomodulatory activity.**

I. INTRODUCTION

Herbal medicines have been an integral part of traditional healthcare systems for thousands of years. In India, the use of medicinal plants for promoting health and preventing diseases has been documented in Ayurveda, Siddha, Unani, and other indigenous systems. One of the most important and highly researched areas in herbal medicine is its role in enhancing the immune system, which protects the body from a wide range of infectious agents such as bacteria, viruses, fungi, parasites, and environmental toxins.

The human immune system consists of innate and acquired mechanisms. A strong immunity helps in early detection and elimination of harmful pathogens, reduces the severity of infections, promotes faster recovery, and improves overall well-being. Various medicinal plants possess immunomodulatory activities due to the presence of natural phytochemicals such as alkaloids, flavonoids, tannins, saponins, glycosides, terpenoids, and polysaccharides. These compounds help in boosting both cellular and humoral immune responses.

In recent years, there has been an increased demand for herbal immunity-boosting formulations, especially after global health challenges and viral outbreaks. Herbal medicines are preferred over synthetic drugs because they are generally safer, well-tolerated, have

minimal side effects, and provide long-lasting benefits. Modern research supports the use of polyherbal formulations (combinations of multiple herbs) because they work synergistically, where the combined effect is greater than the individual extracts alone.

This project focuses on the formulation of a polyherbal immunity-booster tablet using four widely used medicinal plants:

Ashwagandha (Withaniasomnifera) – an adaptogenic herb known for improving strength, reducing stress, enhancing stamina, and boosting immunity. Its active constituents, withanolides, exhibit strong anti-inflammatory and immunostimulatory properties.

Tulsi (Ocimum sanctum) – commonly known as holy basil, considered a sacred herb in Ayurveda. Tulsi possesses antimicrobial, antiviral, antioxidant, and immunomodulatory actions. Compounds like eugenol and ursolic acid contribute to its strong immunity-enhancing effects.

Aloe vera (Aloe barbadensis) – known for its soothing and healing properties. Aloe contains polysaccharides such as acemannan, which stimulate macrophages, enhance antibody production, and support digestion, which plays a vital role in immunity.

Turmeric (Curcuma longa) – contains curcumin, a well-established antioxidant and anti-inflammatory agent. Curcumin helps in reducing oxidative stress, improving immune cell activity, and protecting the body from infections.

These four herbs complement each other and are well-known in Ayurveda for their immune-boosting potential. When combined in a polyherbal formulation, they offer enhanced therapeutic activity, including antioxidant protection, stress reduction, improved metabolism, and immune enhancement. Tablet dosage form is widely preferred in pharmaceutical and herbal industries because it is stable, easy to handle, portable, economical, and provides accurate dosing. Tablets ensure uniform distribution of herbs, better shelf-life, and enhanced patient acceptability compared to powders or liquids. Preparing herbal tablets, however, requires careful selection of processing methods and excipients to ensure proper flow, compressibility, stability, and dissolution.

For this project, the direct compression method is selected for tablet preparation. Direct compression is one of the simplest and most economical techniques for tablet manufacturing, as it does not require wet granulation or drying steps. It reduces processing time, minimizes equipment use, and is suitable for heat-sensitive herbal ingredients. The method involves directly mixing powdered herbs with excipients like binders, diluents, lubricants, and disintegrants, followed by compression using a tablet punching machine.

The formulation development process includes selection and weighing of ingredients, blending, optimization of excipients, evaluation of powder flow properties, and compression into tablets. After formulation, the tablets are evaluated using standard quality control tests such as hardness, friability, weight variation, thickness, disintegration time, and organoleptic properties. These tests help ensure that the tablets meet acceptable pharmacopeial standards and are suitable for consumption.

Overall, this project not only highlights the importance of herbal medicines in immunity enhancement but also demonstrates the practical aspects of formulating a stable, effective, and safe herbal tablet using direct compression technology. The formulation aims to provide a natural, affordable, and scientifically validated immunity-booster that combines the therapeutic power of Ashwagandha, Tulsi, Aloe vera, and Turmeric in a convenient tablet dosage form. In recent years, there has been a significant shift in global healthcare trends toward the use of natural and plant-based remedies for the prevention and management of diseases. This shift is largely driven by increasing awareness of the side effects associated with synthetic drugs, rising healthcare costs, and a growing preference for holistic approaches to wellness. Among these natural approaches, herbal formulations designed to enhance the immune system—commonly known as immunoboosters—have gained considerable importance. Herbal immunobooster tablets represent a modern adaptation of traditional medicine, combining ancient knowledge with contemporary pharmaceutical techniques to produce effective, safe, and convenient dosage forms.

The immune system plays a crucial role in protecting the body against infections, diseases, and foreign

pathogens. It consists of a complex network of cells, tissues, and organs that work together to defend the body. However, factors such as stress, poor nutrition, pollution, sedentary lifestyle, and chronic illnesses can weaken immune function, making individuals more susceptible to infections. In this context, immunomodulators—substances that help regulate or enhance immune responses—have become increasingly relevant. Herbal immunoboosters, derived from medicinal plants, are particularly valued for their ability to support immune health without causing significant adverse effects.

Traditional systems of medicine such as Ayurveda have long emphasized the use of herbs to strengthen immunity and maintain overall health. These systems rely on natural substances that not only treat illness but also promote balance within the body. Similarly, other traditional practices around the world have utilized plant-based remedies for centuries to enhance resistance against diseases. With advancements in scientific research, many of these traditional claims are now being validated through pharmacological and clinical studies, leading to increased acceptance of herbal medicines in modern healthcare.

Herbal immunobooster tablets are formulated using a combination of medicinal plants known for their immunomodulatory, antioxidant, anti-inflammatory, and adaptogenic properties. Commonly used herbs include Tinospora cordifolia, which is known for its ability to enhance immune function and detoxify the body; With aniasomnifera, recognized for its stress-reducing and adaptogenic effects; and Ocimum sanctum, valued for its antimicrobial and immune-supportive properties. Other herbs such as Emblica officinalis (Amla), Curcuma longa (Turmeric), and Zingiber officinale (Ginger) are also frequently incorporated due to their rich phytochemical content and therapeutic benefits.

The formulation of herbal tablets involves several critical steps, beginning with the selection and authentication of raw plant materials. The quality of the final product depends heavily on the purity, potency, and consistency of these ingredients. Once selected, the plant materials are cleaned, dried, and processed into fine powders or extracts. These are then blended in appropriate proportions to achieve the desired therapeutic effect. Excipients such as binders, disintegrants, lubricants, and fillers are added to improve the physical properties of the tablet and ensure proper manufacturing. The mixture is then compressed into tablets using suitable techniques such as direct compression or wet granulation.

One of the major challenges in herbal formulation is the variability in the chemical composition of plant materials due to factors such as geographical location, climate, and harvesting conditions. Therefore, standardization of herbal ingredients is essential to ensure batch-to-batch consistency and reproducibility of therapeutic effects. This involves the identification and quantification of active constituents, as well as adherence to quality control parameters established by regulatory authorities.

Evaluation of herbal immunobooster tablets is a critical aspect of formulation development. It involves assessing both the physical and chemical characteristics of the product to ensure its quality, safety, and efficacy. Pre-compression parameters include the evaluation of powder flow properties such as angle of repose, bulk density, tapped density, and compressibility index. These parameters help determine the suitability of the powder blend for tablet formation.

Post-compression evaluation includes tests such as hardness, which measures the mechanical strength of the tablet; friability, which assesses its resistance to abrasion; weight variation, which ensures uniformity of dosage; and disintegration time, which indicates how quickly the tablet breaks down in the body. Dissolution studies are also conducted to evaluate the release profile of active constituents, which is crucial for determining bioavailability and therapeutic effectiveness.

In addition to physical evaluation, phytochemical screening is performed to identify the presence of bioactive compounds such as alkaloids, flavonoids, tannins, and glycosides. These compounds are responsible for the therapeutic effects of the herbal formulation. Stability studies are conducted under various environmental conditions to determine the shelf life of the product and ensure that it retains its potency over time.

The development of herbal immunobooster tablets also involves consideration of regulatory guidelines and safety standards. Although herbal medicines are generally considered safe, it is important to evaluate potential toxicity, drug interactions, and contraindications. Proper labeling, dosage

recommendations, and clinical validation are essential to ensure consumer safety and confidence.

In conclusion, herbal immunobooster tablets represent a promising approach to enhancing immune health through natural means. By integrating traditional knowledge with modern pharmaceutical practices, these formulations offer a safe, effective, and convenient alternative to conventional therapies. The formulation and evaluation processes play a vital role in ensuring the quality and efficacy of these products, making them suitable for widespread use in preventive healthcare. As research in this field continues to advance, herbal immunoboosters are likely to play an increasingly important role in promoting health and well-being in the modern world.

1.1. Advantages

1. Natural and Safe Immunity Enhancement

All four herbs Ashwagandha, Tulsi, Aloe vera, and Turmeric are natural sources of bioactive compounds. They boost immunity through natural mechanisms without causing harmful side effects commonly associated with synthetic drugs. This makes the formulation suitable for long-term use.

2. Polyherbal Synergistic Effect

Polyherbal formulations are known to provide better therapeutic action compared to single herbs. Ashwagandha reduces stress, Tulsi fights infections, Aloe vera enhances digestion and antibody production, while Turmeric works as a powerful antioxidant.

Together, they create a synergistic effect, improving overall immune strength.

3. Cost-Effective and Easy Production Using Direct Compression

Direct compression does not require granulation, heating, drying, or multiple processing steps.

This reduces production time, laborcost, equipment needs, and energy consumption.

Therefore, the formulation is affordable and easy to scale up for large-scale production.

4. Suitable for Heat-Sensitive Herbal Ingredients

Herbal powders may lose activity when exposed to heat.

Since direct compression does not involve water or heat, the active phytochemicals remain stable and retain their therapeutic effect.

5. Convenient Tablet Dosage Form

Tablets have several advantages such as:

- Easy to store
- Highly stable
- Accurate dosing
- Easy administration
- Better patient compliance

Compared to powders, tablets are more convenient and improve shelf-life.

6. Improved Stability and Longer Shelf-Life

Herbal extracts in tablet form are protected from moisture, microbial growth, and oxidation. Proper packaging further improves stability, making the product reliable for consumers.

7. Minimal Risk of Contamination

Since direct compression requires fewer steps, the chances of microbial contamination and handling errors are reduced.

This ensures better hygiene and product consistency.

8. Eco-Friendly and Non-Toxic

Contains plant-based ingredients and minimal synthetic chemicals.

The formulation leaves a lower environmental footprint compared to conventional pharmaceuticals

Disadvantages of Bilayer Tablet [7, 10]

- Drugs with poor wetting, slow dissolution properties, optimum absorption high in GIT may be difficult to formulate or manufacture as a tablet that will still provide adequate or full drug bioavailability.
- Difficult to swallow in case of children and unconscious patients.
- Adds complexity and bilayer rotary presses are expensive.
- Some drugs resist compression into dense compacts, owing to amorphous nature, low density character.

1.2. Disadvantages:

1. Poor Flow Properties of Herbal Powders

Herbal powders often have fibrous or sticky nature, leading to poor flow and compressibility. This can

create challenges during tablet punching and may affect uniformity.

2. Variability in Phytochemical Content

The concentration of active ingredients in herbs may vary depending on:

- Climate
- Soil condition
- Harvesting season
- Storage conditions

Such variations can affect the consistency and therapeutic strength of tablets.

3. Moisture Sensitivity

Herbal powders tend to absorb moisture from the environment, which can cause: •Lumping

- Reduced flow
- Poor compressibility

Especially for Aloe vera and Turmeric, moisture management is critical.

4. Taste and Odor Challenges

Herbs like Tulsi and Turmeric have strong aroma and taste, which may affect patient acceptability unless taste-masking agents or coatings are used.

5. Limited Technological Control Compared to Synthetic Drugs

Herbal formulations lack strict standardization protocols due to natural variability.

This makes it harder to measure exact active compound amounts compared to synthetic tablets.

Formulation of Tablet

Sr. No	Ingredient	Category	Quantity (Mg)	Function
1	Ashwagandha Powder/Extract	Active Ingredient	100	Immunomodulator, Adaptogen
2	Tulsi powder/extract	Active ingredient	75	Antimicrobialanti-inflammatory
3	Aloe vera powder	Active ingredient	75	Immunomodulatory, soothing agent
4	Turmeric powder/extract	Active ingredient	50	Antioxidant, anti-inflammatory
5	Microcrystalline Cellulose (MCC)	Diluent, Binder	120	Improves compressibility
6	Lactose	Diluent	60	Adds bulk and improves flow
7	Sodium Starch Glycolate	Superdisintegrant	10	Promotes rapid disintegration
8	Talc	Glidant	5	Enhances powder flow
9	Magnesium Stearate	Lubricant	5	Prevents sticking

II. RESULTS AND DISCUSSION

Results

1. Preformulation Studies

1.1. Organoleptic Properties

The herbal powders (Ashwagandha, Tulsi, Aloe vera, and Turmeric) were evaluated for color, odor, and texture.

- Ashwagandha: Light brown, characteristic odor
- Tulsi: Greenish, aromatic
- Aloe vera: Pale green, slightly mucilaginous
- Turmeric: Bright yellow, characteristic pungent odor

The blend showed a uniform yellowish-green color with acceptable odor, indicating proper mixing and compatibility.

1.2 Flow Properties of Powder Blend

Parameter	Result	Interpretation
Angle of Repose	25–30°	Good flow
Bulk Density	~0.45 g/cm³	—
Tapped Density	~0.55 g/cm³	—
Carr’s Index	15–20%	Fair to good flow
Hausner Ratio	1.18–1.25	Acceptable

Discussion:

The powder blend exhibited good flow properties, which is essential for the direct compression method. The presence of Aloe vera (slightly sticky) did not significantly affect flow due to proper use of excipients like microcrystalline cellulose and lubricants.

2. Post-Compression Evaluation

2.1 Physical Parameters of Tablets

Parameter	Result	Pharmacopoeial Limit
Appearance	Smooth, uniform	Acceptable
Average Weight	500 mg ± 5%	Within limit
Thickness	3.5–4.0 mm	Uniform
Hardness	4–6 kg/cm²	Adequate
Friability	<1%	Pass
Disintegration Time	10–15 min	<15 min

Discussion:

- Tablets showed uniform weight and thickness, indicating proper die fill and compression.
- Hardness was sufficient to withstand handling but not too high to delay disintegration.
- Friability below 1% confirms good mechanical strength.
- Disintegration time was within acceptable limits, suggesting rapid availability of active constituents.

2.2 Uniformity of Weight

All tablets complied with IP/BP standards, showing minimal variation.

Interpretation: Ensures dose uniformity of herbal actives.

2.3 Drug Content Uniformity

Component	% Content
Ashwagandha	95–102%
Tulsi	94–101%
Turmeric	96–103%

Discussion:

The results confirm uniform distribution of herbal actives, indicating effective blending and suitability of direct compression.

2.4 Dissolution Study

- Approximately 75–85% release within 30–45 minutes.

Discussion:

The formulation showed satisfactory release of phytoconstituents. The presence of disintegrants enhanced drug release, while turmeric (hydrophobic) slightly slowed dissolution but remained within acceptable range.

No significant change in:

- Color
- Hardness
- Disintegration time
- Drug content

3. Overall Discussion

The herbal immunobooster tablet prepared by direct compression method demonstrated:

- Good flowability and compressibility of powder blend
- Acceptable mechanical strength and low friability
- Rapid disintegration and satisfactory dissolution profile
- Uniform drug content and weight consistency
- Stability under storage conditions

The combination of Ashwagandha (adaptogen), Tulsi (antioxidant), Aloe vera (immunomodulator), and Turmeric (anti-inflammatory) makes the formulation potentially effective as a natural immunobooster.

The study confirms that direct compression is a simple, cost-effective, and efficient method for preparing herbal tablets without compromising quality.

Evaluation of Formulaion

Evaluation is carried out in two stages:

1. Pre-compression parameters (powder blend)
2. Post-compression parameters (tablets)

1. Pre-Compression Evaluation

Parameter	Method	Significance
Angle of Repose	Fixed funnel method	Indicates flow property of powder blend
Bulk Density	Volume measurement before tapping	Helps in packaging and flow assessment

Parameter	Method	Significance
Tapped Density	Volume after tapping	Used for compressibility calculation
Carr's Index (%)	(Tapped − Bulk) / Tapped × 100	Indicates compressibility (≤15% = good flow)
Hausner Ratio	Tapped Density / Bulk Density	≤1.25 indicates good flow

2. Post-Compression Evaluation

Parameter	Method	Standard/Limit
Appearance	Visual inspection	Uniform color, no cracks
Weight Variation	Weigh 20 tablets	±5% deviation (for 500 mg tablets)
Hardness	Monsanto/Pfizer tester	4–8 kg/cm²
Thickness	Vernier caliper	Uniform thickness
Friability	Roche friabilator	<1% weight loss
Disintegration Time	Disintegration test apparatus	≤15 minutes
Content Uniformity	Assay method	85–115% of label claim

3. Additional Evaluation (Optional but Valuable)

Test	Purpose
Dissolution Study	Determines release of active constituents
Stability Study	Checks shelf-life under different conditions
Moisture Content	Important for herbal formulations

4. Interpretation of Results

- Good flow properties indicate suitability for direct compression
- Adequate hardness + low friability = mechanically stable tablets
- Fast disintegration ensures quick release of herbal actives
- Uniform drug content ensures dose accuracy

III. SUMMARY AND CONCLUSION

SUMMARY

The present study focused on the formulation and evaluation of a herbal immunobooster tablet containing Ashwagandha, Tulsi, Aloe vera, and Turmeric using the direct compression method. These herbs were selected based on their well-known immunomodulatory, antioxidant, and anti-inflammatory properties.

Preformulation studies showed that the powder blend possessed good flow characteristics, making it suitable for direct compression. The tablets were successfully prepared using appropriate excipients such as binders, disintegrants, and lubricants.

Post-compression evaluation revealed that the tablets met all standard quality control parameters, including weight variation, hardness, friability, and disintegration time. Drug content uniformity indicated proper mixing of herbal ingredients. The dissolution study demonstrated satisfactory release of active constituents, ensuring potential bioavailability.

Short-term stability studies confirmed that the formulation remained stable without significant changes in physical and chemical properties.

CONCLUSION

The study concludes that a stable and effective herbal immunobooster tablet can be successfully formulated using the direct compression method. The prepared tablets showed acceptable physicochemical properties, good mechanical strength, and satisfactory drug release profile.

The combination of Ashwagandha, Tulsi, Aloe vera, and Turmeric provides a synergistic effect that may help enhance the immune system naturally. The direct compression method proved to be simple, economical, and suitable for large-scale production.

Overall, the developed formulation can be considered a promising herbal alternative for boosting immunity, with good stability and patient compliance.

REFERENCES

[1] C. K. Kokate, A. P. Purohit, and S. B. Gokhale, *Pharmacognosy*, 52nd ed. Pune, India: Nirali Prakashan, 2022.

[2] L. Lachman, H. A. Lieberman, and J. L. Kanig, *The Theory and Practice of Industrial Pharmacy*, 4th ed. CBS Publishers, 2021.

[3] L. V. Allen and H. C. Ansel, *Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems*, 11th ed. Wolters Kluwer, 2020.

[4] *Indian Pharmacopoeia (IP)*. Ghaziabad, India: Indian Pharmacopoeia Commission, Ministry of Health and Family Welfare, Government of India, 2018.

[5] *Ayurvedic Pharmacopoeia of India (API)*. New Delhi, India: Ministry of AYUSH, Government of India, 2016.

[6] World Health Organization, *Quality Control Methods for Herbal Materials*. WHO Press, 2011.

[7] P. D. Gupta, K. K. Birhman, and R. K. Goyal, "Formulation and evaluation of herbal tablets using direct compression technique," *Int. J. Pharm. Pharm. Sci.*, vol. 12, no. 4, pp. 45–52, 2020.

[8] Sharma and A. Singh, "Phytochemical and pharmacological significance of Ashwagandha (*Withania somnifera*)," *J. Herbal Med.*, vol. 9, no. 2, pp. 112–118, 2021.

[9] T. Patel and N. Patel, "Formulation development of polyherbal tablets by direct compression method," *Indian J. Nat. Prod.*, vol. 5, no. 1, pp. 33–40, 2022.

[10] K. Karthikeyan, "Review on therapeutic properties of Tulsi (*Ocimum sanctum*)," *J. Med. Plants Stud.*, vol. 7, no. 3, pp. 25–29, 2019.

[11] D. Singh, "Antioxidant and immunomodulatory effect of *Curcuma longa*," *J. Herbal Pharmacol.*, vol. 4, no. 2, pp. 65–72, 2020.

[12] R. Kumar, "Evaluation and standardization of *Aloe barbadensis* powder used in herbal formulations," *Asian J. Pharm. Res.*, vol. 11, no. 1, pp. 54–60, 2021.

[13] *United States Pharmacopoeia (USP): General Chapters—Tablet Evaluation*. USP Convention, 2020.

[14] Indian Council of Medical Research, *Guidelines for Herbal Drug Research*. New Delhi, India: ICMR, 2017.

[15] V. D. Rangari, *Pharmacognosy and Phytochemistry*, Part-II, 11th ed. Career Publications, 2022.

[16] *Trease and Evans Pharmacognosy*, 17th ed. Elsevier Publications, 2018.

[17] ResearchGate — Research articles on herbal tablet formulation and evaluation.

[18] PubMed — Scientific literature on herbal immunomodulators.

[19] Ministry of AYUSH — Standard references for Ayurvedic herbs, monographs, and quality guidelines.

[20] World Health Organization — WHO guidelines for herbal drug standardization and quality control.