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FORMULATION AND EVALUATION OF HERBAL IMMUNITY BOOSTER TABLET

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ABSTRACT

Investigation of Immunity Booster Tablets and TheirImmuno modulatory Effects The immune system is important in protecting the body from various diseases such as bacteria, viruses and fungi. Improving immunity is an ongoing research priority. This study investigated the anti- inflammatory properties of various herbs including gall bladderwort (Giloy), Piper nigrum (Black Pepper), Curcuma longa (Curcuma longa), Tulsi (Tulsi) and Glycyrrhiza glabra (Glycyrrhiza glabra). The anti-inflammatory properties of this herb are well defined. In addition, this study investigates the formulation and evaluation of this herb using gum arabic and enriched with important anti- inflammatory substances such as zinc and vitamins A, C, D and E. Long granulation Grind, grind and mixAPI ingredients with powdered excipients. Prepare the cream. Mix the binder with the powder to form a wet mass. Grind the wet flour intopellets or granules using a sieve.

KEYWORDS: Immune system, Immunomodulatory effects, Immunity booster tablets, Zinc and vitamin A, C, D, E.

1. INTRODUCTION

Immunity and Herbal Medicine: A Comprehensive Overview

Immunity refers to the body's ability to resist pathogenic agents, providing protection against infections caused by bacteria, viruses, fungi, and other microorganisms. The immune system comprises two primary defense mechanisms: Innate (Natural) and acquired (Specific) immunity. Innate immunity, present prior to exposure to pathogens, serves as the first line of defense through physical barriers, soluble components, and phagocytic cells. In contrast,

acquired immunity develops through exposure to specific foreign substances, often enhanced by vaccination strategies.

Immunology, as a branch of biomedical science, investigates the complexities of immune responses across various organisms. The Ayurvedic system of medicine emphasizes both the prevention and treatment of diseases, highlighting the importance of enhancing immune function. In contemporary health practices, the demand for immunity boosters has surged, particularly during seasonal transitions. However, many individuals face challenges with the taste of herbal ingredients, leading to an increased interest in immunity booster tablets that are easy to consume.

Natural and herbal remedies have a long-standing history in the treatment of respiratory infections and are increasingly recognized as effective agents in both medicinal and dietary applications. Ongoing research aims to optimize the utilization of herbal medicine for disease prevention, including strategies against emerging pathogens such as COVID-19. There is a notable interest in herbal products that contain bioactive compounds exhibiting antimicrobial, antiviral, anti-inflammatory, and immune- stimulating properties, including curcumin, black pepper, and Tulsi.

Turmeric, extensively used in Asian traditional medicine, is particularly noted for its antioxidant, anti- inflammatory, and antimicrobial effects. Numerous herbal products leverage these active compounds toexert antiviral and immune-stimulating actions, primarily through the suppression of viral replication.

Ayurvedic herbs are employed to enhance immune response and provide protection against infections, with practitioners frequently recommending a range of medicinal plants—such as turmeric, Tulsi, blackpepper and liquorice—for their substantial immunological benefits.

2. MATERIALS AND METHODS

Materials and Methods

The preparation of the herbal tablet formulation involved several steps. First, dried powders of Giloy, black pepper, Tulsi, turmeric, and liquorice were individually triturated using a mortar and pestle to obtain fine core powders. These powders, along with other required ingredients sourced from the laboratory, were subsequently mixed and triturated together.

For the tablet formulation, the wet granulation method was employed. Excipients utilized in

the formulation included microcrystalline cellulose as a diluent, magnesium stearate as a lubricant, sucrose as a filler, talc for its glidant properties and aesthetic enhancement, and acacia as a binder.

In detail, the process began with accurate weighing and thorough mixing of all ingredients. A 1% binding agent was prepared and gradually incorporated into the mixture to form a damp mass.

This mass was then passed through a No. 22 sieve to create uniform granules. The granules were subsequently dried atroom temperature until fully dried, preparing them for compression using a hand-operated tablet punching machine. This method ensured a consistent and effective tablet dosage form incorporating theherbal components.

***Materials needed**

- Active Pharmaceutical Ingredient (API)
- Excipients (Fillers, Binders, Lubricants)
- Solvent (Water, Ethanol or Other solvents)
- Granulating agent (Starch, cellulose)
- Equipment:
- Mixer (Planetary or ribbon)
- Wet granulator (High-shear or fluid bed)
- Dryer (Tray or fluid bed)
- Mill (Hammer or conical)
- Tablet press

Wet granulation process

Step 1: Weighing and Mixing

1. Weigh API, excipients, and granulating agent according to formulation.
2. Mix ingredients in a planetary or ribbon mixer.

Step 2: Wet Granulation

1. Add solvent to mixture while mixing.
2. Continue mixing until a uniform paste or granules form.

Step 3: Wet Massing

1. Transfer wet mass to a high-shear mixer or fluid bed granulator.

2. Mix until granules are uniform, free-flowing.

Step 4: Drying

1. Transfer wet granules to tray dryer or fluid bed dryer.
2. Dry at controlled temperature (50-60°C) and humidity.

Step 5: Milling

1. Mill dried granules into fine powder.

Step 6: Lubrication

1. Mix lubricant (e.g., magnesium stearate) with granules.

Step 7: Tablet Compression

1. Feed lubricated granules into tablet press.
2. Compress into tablets using desired shape and size.

Step 8: Quality Control

1. Check tablet weight, hardness, friability.
2. Perform dissolution testing.

***Table 1: Compression of formulation ingredients of tablet.**

Serial no.	Drugs	Quantity	Constituents	Uses
1	Turmeric	2mg	Nonvolatile curcuminoids and the volatile oil	disorder of
				the skin, upper respiratory tract
2	Giloy	2mg	Cordifolia, Terpenoids, alkaloids, ligand	Improve immunit y, liver disease
3	Tulsi	2mg	Eugenol, Carvacrol,linalol	Reduce cold, cough reduce stress and B.P
4	Black pepper	2mg	Alkaloids, Flavanoids, Carotenoids, Terpenoids	Good for digestion, prevent constipation
5	Liquorice	2mg	Sugar,starch	lungs & liver disease

1. Turmeric

Synonyms: Haldi, Halada.

Biological source: Turmeric (Called Haldi in hindi language) and named by british as curry spice, isthe dried rhizome powder of Curcuma longa.

Family: Zingiberaceae

Active constituent: Turmeric's primary pharmacological ingredient is thought to be the polyphenol compound curcumin (Diferuloylmethane), which gives the spice its bright yellow color. Thecurcuminoids atlantone and bisdemethoxycurcumin are found in turmeric. Together with curcumin, there is also demethoxycurcumin, diarylheptanoids, and turmerone.

2. Giloy

Synonym: Guduchi

Biological source: Tinospora cordifolia

Family:- Menispermaceae

Active constituents

Giloy (Tinospora cordifolia) contains many active chemical constituents, including Alkaloids, Glycosides, Steroids, Flavonoids, Phenols, Tannins, Terpenoids, Polysaccharides, Essential oils, and Fatty acids.

3. Black pepper

Nickname: Pipper nigrum, Madagascar pepper

Biological source: Pipper Nigrum, also known as black pepper, is a plant belonging to the Piperace ae family. It is cultivated for its fruit. Its ability to improve absorption through precise processes is not fully understood. Piperin passes through the digestive tract very

quickly.

4. Tulsi

Synonyms: Holy basil

Biological source: Tulsi is an aromatic perennial plant belonging to the species Lamiaceae family.

Family: Lamiaceae

Active ingredients: This plant contains a wide range of active compounds, including carvacrol, β- elemene, β-caryophyllene, rosmarinic acid, ursolic acid, eugenol, and germacrene. These bioactive substances contribute to Tulsi's reputed diuretic and immune-boosting properties.

Mechanism of action: The plant's effectiveness in combating various microorganisms is attributed to its combination of antimicrobial activities, which include anthelmintic, antiviral, antifungal, antibacterial, and anti-protozoal effects.

5. Liquorice

Synonyms:- Glycrrhiza glabra

Biological Source:- From the root and Rhizome of the Glycyrrhiza Plant.

Family: - Fabaceae family (Also known as leguminosae)

Active ingredients: - The main active ingredient in licorice is glycyrrhizin, a triterpene

glycosidethat's 50 times sweeter than sugar.

***Table 2: Excipient.**

Serial no.	Excipient	Quantity	Category
1	Microcrystalline cellulose	2g	Diluent
2	magnesium stearate	0.1g	Lubricants
3	Sucrose	0.8g	Filler
4	acacia	0.1	binder
5	Talc	0.01g	Glidant
6	starch	5% solution	Disintigrates

***Evaluation**

Pre-Formulation Studies.

***Bulk density**

Bulk density testing was performed using a 100 mL measuring cylinder that was dried beforehand. Theformula below was applied to the dried granules after they were poured into the cylinder:

Bulk Density = Mass of the granules / Bulk volume of the granules

***Tapped density**

Tapped density was determined by adding dried granules into a 100 mL measuring cylinder, followed by100 taps. The volume after tapping was noted, and the tapped density was calculated using the following formula:

Tapped Density = Weight of the granules / Volume of the tapped granules

***Hausner's Ratio**

The Hausner's ratio is the relationship between the tapped density and bulk density of the granules. It is calculated using the formula below. Table 3 displays the flow properties of the granules.

Hausner's Ratio = Tapped Density / Bulk Density

***Carr's Index**

The Carr's Index, also known as the compressibility index, is determined using the formula below. Table3 provides the flow properties of the granules.

Carr's Index = (Tapped Density – Bulk Density) / Tapped Density × 100

***Angle of repose**

The angle of repose was determined using the funnel technique. The following formula was applied tocalculate the angle of repose:

$\Theta = \text{Tan}^{-1}[h/r]$ Where,

H = Height of the granule cone formedR = Radius of the granule cone formed

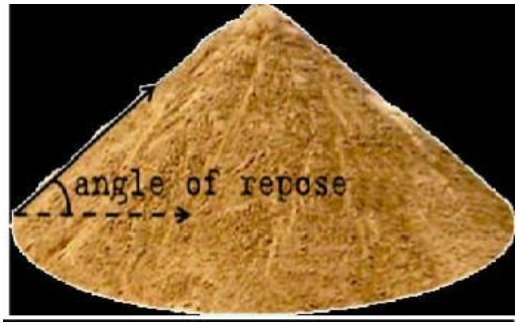

***Table 3:- Pre-formulation studies.**

Tapped density	0.5gm/ml
Bulk density	0.33gm/ml
Hausner's ratio	1.66
Carr's index	40%
Angle of repose	40 degree

***Table 4: Scale of flow ability.**

Flow character	Hausner's ratio	Carr's index	Angle of repose
Excellent	1.00-1.11	>10	25-30
Good	1.12-1.18	10-15	31-35
Fair	1.19-1.25	16-20	36-40
Passable	1.26-1.34	21-25	41-45
Poor	1.35-1.45	26-31	46-55
Very poor	1.46-1.59	32-37	56-65
Very-very poor	>1.60	>38	>66

*Physical evaluation of tablets

The tablets underwent a series of evaluation tests. General appearance

The general appearance and color of tablets were assessed visually.

Color-Yellowish Brown

Shape- Cylindrical Weight variation test

The weight variation test was conducted using the following procedure: Ten tablets were weighed individually and designated as X1, X2, X3, ..., X10. The average weight of the tablets was calculated usingthe formula:

Average weight= X1+X2+X3+….+X10/10

Each tablet's weight was then compared to the established upper and lower limits. For the tablets to pass, no more than two tablets should show a weight deviation greater than the permissible percentage error from the average. Additionally, none of the tablets should have a weight deviation exceeding twice the allowed percentage error.

***Table 5: Weight variation tolerance.**

Average weight of tablet(mg)	Max. % difference is allowed
80 or less	10%
80-250	7.5%
More than 250	5%

***Table 6: Hardness test and thickness test.**

Sr. no	Thickness of tablet (mm)	Sr.no	Hardness of tablet(kg/cm)
1	8	1	2.9
2	7.5	2	2.8
3	7.9	3	3.1
Average	7.8	Average	2.9

***Table 7: Weight of tablets.**

Sr. no	Weight of tablet (mg)
1	180
2	200
3	210
4	200
5	210
6	190
7	200
8	180
9	200
10	210

Total weight of 10 tablets = 1980

Average weight of tablets = 198 5% of 198mg = 9.9

Lower limit = Average weight - (average weight* % error)

= 198-9.9

= 188.1

Upper limit = Average weight+ (Average weight* % error)

=198+9.9

= 207.9

According to I.P Average weight of tablets more than 250 allows 5% variation. All the individual weight of tablets is within the upper and lower limit.

***Friability test**

The friability of tablets can be assessed using a Roche Friabilator, a device designed to evaluate the mechanical strength of tablet formulations. The instrument comprises a rotating plastic chamber that operates at a speed of 25 rpm. During the test, tablets are subjected to repeated dropping from a heightof six inches as the chamber rotates for a total of 100 revolutions. After completion of the test, the tablets are carefully reweighed. A tablet formulation is considered acceptable if the weight loss does notexceed 0.5% to 1.0% of the initial tablet weight.

10 Tablets are weight together Initial weight = 2020 mg

Final Weight after variation = 1810mg

Friability= Initial weight – Final weight/Initial weight*100

= 2020-1810/100

=210/100

=2.1%

***Disintegration test**

This test evaluates the time required for a tablet to disintegrate into its constituent particles under controlled conditions. It evaluates the duration required for a group of tablets to disintegrate into smaller particles within a set time frame. The purpose of this test is to assess the disintegration of tablets within a defined period.

Time taken for the disintegration of the tablet = 17 minutes

***Dissolution test**

A dissolution test is a laboratory procedure used to measure the rate at which a drug or active pharmaceutical ingredient (API) dissolves in a specific solvent, typically under controlled conditions. This test is essential in assessing the bioavailability of a drug, as it provides information on how quickly and to what extent the drug becomes available for absorption in the body. The dissolution test is commonly performed using a dissolution apparatus where

the drug is placed in a container of liquid (Usually a buffer solution), and its concentration is measured over time to determine the dissolution profile. The results help ensure the consistency and quality of pharmaceutical formulations, including tablets and capsules.

Time taken for the dissolution of tablet = 2 hours

***RESULT**

Research on the possible advantages of herbal immune booster tablets is underway, although opinion on how efficient they are have varied as have the findings. cwrtain herbs and components are frequently present in immunity booster tablets, like Turmeric, giloy, tulsi, have been linked in certainstudies to immune system support and decreased risk of infection It is crucial to remember that the effectiveness of herbal immune booster tablets might vary depending on a number of factors, such as the specific health problems of each individual and the quality and dose of ingredients, as well as lifestyle choices in general. Herbal immunity boosting tablets may have beneficial effects for certain individuals, such as decreased disease frequency or increased vitality. Others might not detect any appreciable differences. It's critical to use cautions when using herbal supplements.

***DISCUSSION**

The Herbal Immunity Booster is an Ayurvedic blend of natural herbs known for their ability to strengthen the immune system. Among its key ingredients, Tulsi has demonstrated strong antibacterial, antiviral, and antifungal properties, which help combat a variety of pathogens. Giloy is rich in compounds like 11-hydroxymustakone and magnoflorine, which are believed to support immune modulation and offer cytotoxic effects. Black pepper is valued not only for its anti-inflammatory and antioxidant qualities but also for its potential to improve immune function. Turmeric, with its active compound curcumin, is widely recognized for its anti- inflammatory benefits. Licorice, a versatile herb, has been traditionally used to treat various ailments, including infections and respiratory issues. Clinical observations indicate that regular use of this herbal supplement can effectively enhance immune response and promote overall physical well-being.

***CONCLUSION**

The herbal immunity booster tablet formulation demonstrated excellent physical, chemical, and microbiological properties, as well as effective immune-modulating activity in preclinical studies. The product showed stability, uniformity, and high dissolution rates, making it a promising natural supplement for immune health. Future studies are recommended to explore

long-term clinical trials and the bioavailability of individual active components in human subjects.

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