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Formulation And Evaluation Of Herbal Edible Gummies Containing Liquorice And Adulsa For Immune Booster

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ABSTRACT :

This study focuses on the formulation and development of herbal immune-boosting gummies incorporating liquorice (Glycyrrhiza glabra) and adulsa (Justicia adhatoda), two medicinal plants renowned for their immunomodulatory and respiratory health benefits. The gummies aim to provide a convenient, palatable, and natural alternative to traditional herbal remedies. Liquorice, rich in glycyrrhizin, offers antiviral, anti-inflammatory, and antioxidant properties, while adulsa is well known for its expectorant and bronchodilator effects, making the combination particularly effective for supporting respiratory and overall immune health. The formulation includes natural sweeteners and gelling agents to ensure taste acceptability, stability, and bioavailability. Preliminary organoleptic and stability tests indicate good consumer compliance and potential effectiveness as a daily supplement. This product caters to growing consumer demand for plant- based, easy-to-consume immune boosters, especially in the wake of increased awareness around preventive healthcare.

Keywords:- Herbal Gummies, Immune booster, Gelatin Candy

CHAPTER 1

INTRODUCTION

The oral route is the most common route of drug administration. Till today, it is still a widely preferred and acceptable route among patients owing to its advantages, such as ease of administration, safeness, and convenience for self-administration.However, one of the obstacles to oral drug delivery experienced by many patients, particularly paediatric and geriatric population, is dysphagia. [1] Dysphagia causes difficulties in swallowing conventional solid oral medicines and the risk of choking by liquid preparations. Consequently, patients usually try to crush hard tablets or open capsules and mix them with food or water to become swallowing easily.[2] Such behaviour can result in dosing inaccuracy and changing of drug release and absorption, as well as undesirable drug taste palatability.Today, one of the appropriate potential alternative oral dosage forms is gummies, similar to gelatinous food.[3]The gummies can address swallowing problems, ensure patient safety, and ease of handle and taken without water. Thus, gummies can improve patient compliance in addition to their flavouring taste and pleasant appearance. Gummies have advantages of both solid and liquid preparations[4]

Gummies have been a great way of delivering the active constituents for consumption by children. Their use for adults has gained acceptance as well. [5] The gummies industry is expected to reach

4.17 million US dollars by 2025. [6] Gelatine has been the favoured gelling agent for these kinds of preparation.Herbal gummies are a convenient and tasty way to consume herbal supplements, offering an enjoyable alternative to traditional pills or capsules. [7] These gummies are made from various plant-based ingredients and herbs known for their potential health benefits, such as relaxation, improved digestion, or immune support. [8] In addition to their therapeutic properties, herbal gummies are typically made with natural sweeteners and are free from artificial additives, making them a healthier choice for people looking to incorporate herbal remedies into their daily routine. [9]

Immunity boosters are substances, often dietary supplements or lifestyle choices, that aim to strengthen the immune system and make it more resilient to infection. They work by either providing essential nutrients the body may be lacking or by helping the body produce chemicals and hormones that support immune function. While numerous products claim to boost immunity, the most reliable approach involves a combination of healthy habits, including a balanced diet, regular exercise, adequate sleep, and stress management.

How Immunity Boosters Work

1. **Nutrient Support:** Many boosters provide essential nutrients like Vitamin C, Vitamin D, Zinc, and antioxidants, which are crucial for immune cell function and overall health.
2. **Stress Reduction:** Stress can suppress the immune system, so managing stress through techniques like meditation, exercise, and spending time with loved ones is important.
3. **Lifestyle Factors:** Healthy habits like eating a balanced diet, getting enough sleep, and exercising regularly also contribute to a strong immune system.

Specific Examples of Immunity Boosters:

1. **Nutrient-rich foods**: Fruits and vegetables, especially those high in Vitamin C and antioxidants, are excellent immune boosters.
2. **Probiotics:** These beneficial bacteria, found in foods like yogurt and kefir, can help regulate the gut microbiome, which is linked to immune health.
3. **Herbal supplements**: Some herbs, like echinacea and ginger, have been traditionally used to support the immune system, but more research is needed to confirm their effectiveness.
4. Lifestyle adjustments: Practicing good hygiene, getting enough sleep, and managing stress can also contribute to a stronger immune system.

Important Considerations:

1. **Individual Needs**: The best way to boost immunity varies from person to person, depending on their age, health status, and lifestyle.
2. **Consult a Healthcare** Professional: Before taking any supplements or making significant lifestyle changes, it's always a good idea to consult with a doctor or registered dietitian.
3. **Realistic Expectations**: While immunity boosters can play a role in supporting the immune system, they are not a guaranteed cure-all for illness.

Here are several widely used plants known for their immunomodulatory properties, meaning they can help regulate or boost the immune system:

Echinacea (Echinacea purpurea) – Commonly used to prevent or treat colds and respiratory infections.
Ashwagandha (Withania somnifera) – An adaptogen that helps balance immune response and reduce stress-related immune suppression.
Turmeric (Curcuma longa) – Contains curcumin, a compound with anti-inflammatory and immune-enhancing effects.

Ginger (Zingiber officinale) – Boosts immunity with antioxidant and anti-inflammatory properties.
Tulsi / Holy Basil (Ocimum sanctum) – Strengthens immune response and has antimicrobial activity.
Garlic (Allium sativum) – Enhances immune function and helps fight infections.

Ginseng (Panax ginseng or Panax quinquefolius) – Stimulates immune cells and boosts resistance to illness.
Amla / Indian Gooseberry (Phyllanthus emblica) – Rich in vitamin C and antioxidants, supports immune health.
Guduchi / Giloy (Tinospora cordifolia) – A powerful immunomodulator used in Ayurvedic medicine**.**
Licorice root (Glycyrrhiza glabra) – Supports immune response and soothes inflammation.
Green tea (Camellia sinensis) – Contains catechins and L-theanine, which support immune health.

TYPES OF HERBAL GUMMIES:-

1. **For Stress and Sleep**

Ashwagandha gummies (adaptogen, reduces stress) Valerian root gummies (supports sleep)
Chamomile gummies (calming, helps with anxiety and sleep) Lavender gummies (relaxation)

2. **For Immunity**

Elderberry gummies (immune booster) Echinacea gummies (cold/flu prevention)
Turmeric + Ginger gummies (anti-inflammatory, immune support)

3. For Digestion

Ginger gummies (relieves nausea, aids digestion) Peppermint gummies (soothes stomach)
Licorice root gummies (gut health)

4. For Energy and Focus

Ginseng gummies (boosts energy and cognitive function)

CHAPTER 2

Literature Survey

Mohammed Ashiq M J,2024:- Hereby mentioned data revealed that Formula 3 has showm the effective characteristic features of the oral gummies throughout the research period. The gummies had good homogeneity, pH, non-stickiness, consistency, spreadability and palatability. The activity of added herbal extracts was previously proven by others. The key extract was Vasaka extract, in which the main active constituent is vasicine.

vijay A Takle, rushikesh d. Mohite 2024:- The oral route of administration is the most preferred route by patients. The strategies for enhancing oral solid dosage acceptance by paediatric, geriatric and patients with swallowing difficulties is to formulate the drug as gummies. Gummies are palatable, chewable, easier to swallow and offer more effortless method for administrationas compare to other formulations.Ashwagandha is a super ingredient obtain naturally, it is a plant material that has been used for centuries in traditional medicine systems.

Pratiksha Kale,2023:- In the current study, ginger powder herbal gummies were developed and evaluated for their potential to cure oral thrush. The creation of novel herbal dosage forms and the examination of the impact of various herbal medications on oral thrush were the major reasons for the interest in such a dosage form.

Neha Karki : Cinnamon gummies formulated for the management of PCOS offer a promising dietary supplement option, combining the therapeutic benefits of cinnamon with a user-friendly delivery method.

Gupta et al., 2022 conducted a clinical trial on a herbal liquid toner containing green tea, lemongrass, and hibiscus extracts.

Kanchana Yadav, Gummies made with 8% gelatine were found to be the best formulations, meeting all physical property requirements, showing no syneresis, and having the most pleasant texture.

Dikshita Rajendra Dengane: In conclusion, anti-diabetic gummies formulated from herbal drugs offer a promising approach to managing diabetes. These gummies combine the benefits of natural ingredients, convenience, and palatability, making them an attractive option for patients seeking complementary or alternative therapies.

Dwyane Emanuel U. Romano1: It is concluded that Euphorbia hirta gummies are accepted and recommended as alternative supplements. Moreover, future researchers should explore different ingredient variations to refine texture and enhance taste.

Peter Amwoga Ayeka: In summary, licorice polysaccharide especially of low molecular weight exhibit anticancer and immunomodulatory activities by suppressing tumor growth and improving general health of mice. They also augment the thymus/spleen index and population of T lymphocytes. Furthermore, the polysaccharides enhance the levels of serum antitumor cytokines, IL 2, IL 6 and IL 7 while decreasing pro-tumor cytokine .

Neha Manish Munot: Viral infections continue to be a significant cause of morbidity and mortality globally, spreading rampantly at an alarming rate. Currently available antiviral therapies are often ineffective due to constant viral mutations, emergence of aggressive strains, drug resistance, and potential side effects. Numerous epidemiological and experimental studies have demonstrated that many medicinal plants and their phytochemicals have been utilized consistently to treat various infections owing to low toxicity and reduced side effects.

Swati P. Deshmukh : In conclusion, the formulation of medicated gummies for smoking cessation support involved a systematic approach encompassing the extraction of bioactive compounds from selected herbs, preparation of the gel base, incorporation of herbal extracts, and rigorous quality control testing. The use of Soxhlet extraction ensured efficient extraction of key compounds from the herbs, contributing to the therapeutic efficacy of the gummies. Quality control tests confirmed theconsistency and quality of the final product, meeting established criteria for appearance, texture, taste, and weight variation.

CHAPTER 3

AIM AND OBJECTIVE

Aim and Objectives

AIM :-

"Formulation And Evaluation Of Herbal Edible Gummies Containing Liquorice And Adulsa For Immune Booster"

OBJECTIVE:

1. To Improved Patient Compliance:

Gummies are more appealing in taste and form, making it easier for people—especially children and elderly patients—to take their supplements or medications.

2. To Masking Unpleasant Tastes:

The flavoring and texture help mask the bitter or metallic taste of active ingredients.

3. To Convenient and Portable:

Gummies are easy to store, carry, and consume without water.

4. **To Dose Accuracy:**

Each gummy typically contains a pre-measured amount of the active ingredient, ensuring consistent dosing.

5. **To Enhanced Bioavailability:**

Some gummies are formulated to improve the absorption of nutrients or medications in the body.

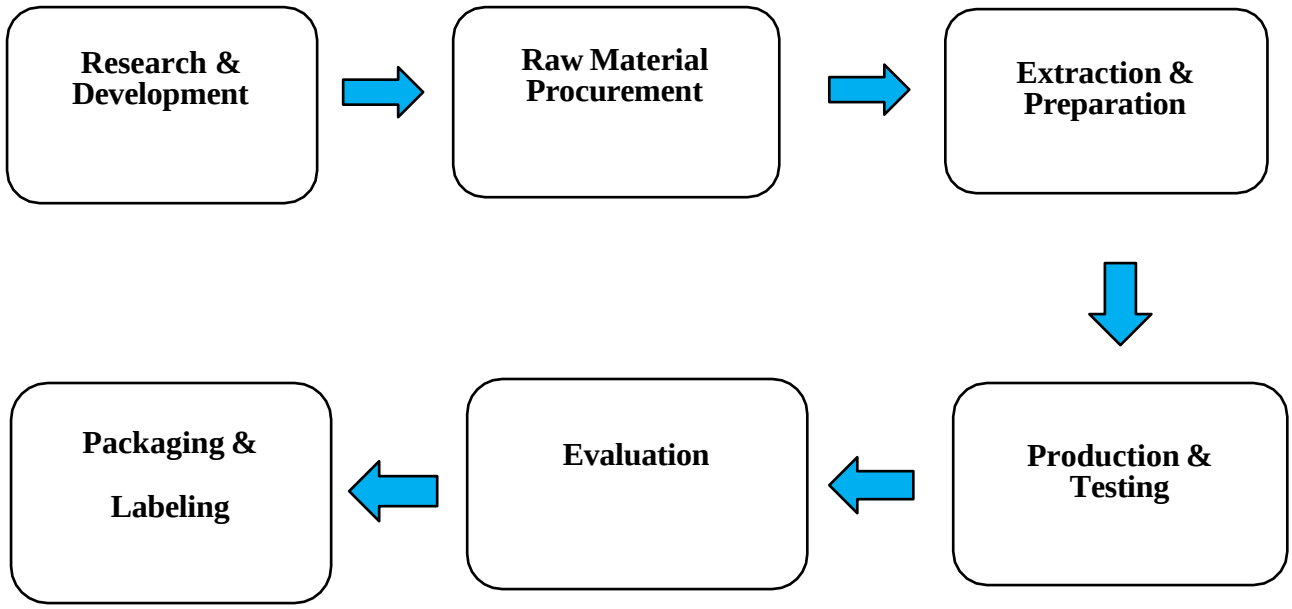
6. **To Non-invasive:**

Unlike injections or some tablets, gummies do not require special administration technique

CHAPTER 4

PLAN OF WORK

PLAN OF WORK:-



CHAPTER 5

Drug Profile

1. ***Liquorice :***

- **Name**: Liquorice
- **Other Names**: Glycyrrhiza glabra, Sweet Root, Mulethi

Drug Class:

- Herbal supplement

- Demulcent (soothes mucous membranes)
- Anti-inflammatory agent

Source:

- Roots and stolons (underground stems) of Glycyrrhiza glabra plant

Active Constituents:

- Glycyrrhizin (glycyrrhizic acid) — main active compound
- Liquiritin (a flavonoid)
- Glabridin (an isoflavan)

Mechanism of Action:

- Anti-inflammatory action via suppression of prostaglandin and leukotriene synthesis.
- Antiviral, antimicrobial, and antioxidant properties.
- Soothes and protects mucous membranes.

Pharmacological Actions:

- Anti-inflammatory
- Demulcent (soothing agent)
- Antiviral and antimicrobial
- Antiulcerogenic (promotes healing of ulcers)

Therapeutic Uses:

- Peptic ulcers and gastritis
- Sore throat and cough (as a soothing agent)
- Chronic inflammatory conditions
- Adjuvant in viral infections (e.g., hepatitis, herpes)
- Adrenal fatigue (controversial and under investigation)
- Skin conditions (eczema, psoriasis — topical use)

Dosage (Typical):

- Dried root powder: 1–5 grams/day
- Standardized extract: typically 380–1140 mg/day (standardized to contain 20% glycyrrhizin)

Side Effects:

- Hypertension (high blood pressure)
- Hypokalemia (low potassium levels)
- Edema (swelling due to fluid retention)
- Headaches

ADULSA:-

Justicia adhatoda / Adhatoda vasica Linn (fam: Acanthaceae) is commonly known as Vasaka or Arusha. It is a well-known herb in the Ayurveda system for its medicinal advantages. In India, Vasaka was called the Malabar nut tree. For centuries, vasaka has been used for the treatment of Immune booster, various pulmonary conditions, such as asthma, chronic bronchitis, and other respiratory disorders..

Uses:

- **Respiratory Disorders**: Adulsa is used to treat asthma, bronchitis, coughs, and tuberculosis.
- **Fever Management**: The plant's antipyretic properties help reduce body temperature and alleviate symptoms associated with fever.
- **Wound Healing**: Adulsa's saponins and tannins promote tissue regeneration, accelerate wound healing, and reduce bleeding

Gelatin:-

- **Generic Name:** Gelatin

Pharmaceutical Category:

- Excipient (a substance formulated alongside the active ingredient of a medication)
- Stabilizer, binder, thickener, capsule material

Pharmaceutical Uses:

- Capsule production (both soft and hard capsules)
- Tablet coating (protective layer)

Agar:-

Common Name: Agar Synonyms:

Agar-agar, Kanten

Source: Red algae (Rhodophyceae), mainly Gelidium and Gracilaria

Uses:

1. Microbiology

2. Pharmaceuticals:
3. Food Industry:

Honey:

Common Name: Honey

Botanical Source: Produced by bees (Apis mellifera) from floral nectar

Type: Natural product / Traditional remedy

Dosage Form: Syrup, ointment, lozenge, raw (oral/topical)

Therapeutic Uses:

Wound and burn treatment (topical) Cough and sore throat (oral)
Gastrointestinal conditions (e.g., ulcers, gastritis) Skin conditions (acne, eczema)
General tonic and immune support

CITRIC ACID:

Drug Name: Citric Acid

Class: Alkalinizing Agent / Acidulant / Chelating Agent (depending on use)

Mechanism of Action:

Citric acid acts as a weak organic acid, buffering pH and neutralizing excess acids or alkalis. In urinary alkalinization, it raises urine pH, making it less acidic.

Pharmacological Uses:

1. **Urinary alkalinization:** Helps prevent kidney stones by alkalinizing urine.
2. **Effervescent tablets or solutions**: Used with bicarbonates or carbonates for effervescence.
3. **pH control agent**: Used in pharmaceuticals to adjust pH.
4. **Chelating agent**: Binds metals in formulations (e.g., preserves stability of ingredients).
5. **Excipients:** Used as a flavoring agent or preservative in liquid medications.

CHAPTER 6

Material And Methods

EQUIPMENTS:

Equipment's used and their manufacturers

NO.	INSTRUMENTS	MANUFACTURES
1	Ph Meter	Henna Instrument
2	Heating Mental	Thermo Fisher Scientific

METHODOLOGY:

FORMULATION OF HERBAL EDIBLE GUMMIES:

Sr.No.	INGREDIENTS	USES	F1	F2
1	Liquorice extract	Antiviral,,immune modulating	5ml	7ml
2	Adulsa extract	Antibacterial, anti -inflammatory	5ml	7ml
3	Gelatin (g)	Thixotropic agent	10gm	15gm
4	Propylene glycol	Plasticizer	5ml	5ml
5	Citric acid (%)	Acidity modifier	1ml	1ml
6	Methyl paraben	Preservative	0.01ml	-
7	Honey	Sweetener	5ml	5ml
8	Agar	Thickening agent	7ml	7ml
9	Orange juice	Sweetener	5ml	5ml
10	Distilled water		Q.S	Q.S

Extraction process :-

LIQUORICE:-

1. Prepare the Licorice Root: If using whole dried roots, chop them into small pieces or grind them into powder.
2. Fill the Jar: Add licorice root to a clean glass jar, filling it about 1/3 full.
3. Add Solvent: Pour alcohol (or chosen solvent) over the root until the jar is almost full. Ensure the root is fully submerged.
4. Maceration Process: Seal the jar and shake well. Store it in a cool, dark place for 4-6 weeks, shaking it every few days.
5. Strain the Extract: After maceration, strain the liquid through cheesecloth or a fine mesh strainer to remove solids.
6. Storage: Transfer the filtered extract into a container.

ADULSA:-

1. Prepare the Adulsa material: Clean and dry the Adulsa leaves or roots. If using dried material
2. Combine Adulsa and solvent: Place the Adulsa material in the container and add the solvent.
3. Steep and macerate: Close the container and let it steep in a cool, dark place for 2- 3 weeks.
4. Shake the container daily to facilitate maceration.
5. Filter the extract: After the maceration period, filter the extract using cheesecloth or filter

6. paper. Discard the solids or by simply letting it sit in a cool, dry place.

PROCEDURE:-

1. Take clean and dry glassware for experiment, before use.
2. Take 250ml of orange juice in water bath. Add Agar-agar, honey and gelatine with stirring.
3. Heating at 70-75 C.
4. Then add Liquorice & Adulsa powder with continuous stirring to make mixture uniform.
5. After complete homogenization, the mixture is transfer to molds.
6. Cool the mixture at room temperature for 30 min.
7. Then place in the refrigerator for 24 hours.
8. After 24 hours, gummies remove from the molds and stored in closed container, that keep in refrigerator.

EVALUATION TEST:-

1. **Physical evaluation**:- The medicated jelly can be examined physically for appearance like colour, odour, transparency, etc.
2. **Stickiness and grittiness**:-Texture of the medicated jelly in terms of stickiness and grittiness can be determined by mildly rubbing the jelly between fingers.
3. **PH** :-The pH determination test was carried out by dipping the pH meter into the gel mass water bath and poured into the mold. The pH value of the preparation is measured by looking at the pH value listed on the pH meter.
4. **Weight variation**:-The weight variation was conducted by weighing 10 gummies individually and average weight and standard deviation were calculated.
5. **Moisture content**: The moisture content was determined by drying finely grounded samples (10 g) in a hot air oven at 105 °C until a constant weight was achieved.
6. **Spreadability:** The spreadability of jelly was tested by placing it between two slides with a 1000 g weight and pressing it for 5 minutes to a consistent The spreading area of the jelly was then estimated using the equation ($A = \pi r2$), which is represented as the area of a circle.
7. **Stability study**: The stability of the formulation was studied for a period of 4 weeks by keeping it at a temperature of 25–30 °C.

CHAPTER 7

Result Ang Discussion

Result:-

In this research gummies were prepared and evaluated by various evaluation parameters. The ingredients included in the formulation is edible, safe and suitable for consumption. The preparation and formulation of gummies was done successfully.

OBSERVATION:

SR.NO	EVALUATION TEST	OBSERVATION F1	OBSERVATION F2
1	Color	Brown	Brown
2	Odour	Orange Like	Orange Like
3	Test	Orange Like	Orange Like

4	Trancpercy	Opaque	Opaque
5	Texture	Smooth	Normal Smooth
6	Stickiness	Non Sticky	Sticky
7	Grittiness	Non Gritty	Non Gritty
8	Ph	Slightly Acidic	Acidic
9	Weight Variation	Passes The Test	Passes The Test

DISCUSSION

- **Appearance**- The gummies exhibit a vibrant orange color, visually appealing and consistent across all formulations.- Uniformly shaped and sized, ensuring consistency in product presentation.No signs of discoloration or uneven distribution of coloring observed.
- **Texture:** Upon handling, the gummies feel soft and consistent in texture. During chewing, they maintain a pleasant chewiness without excessive stickiness.The texture is smooth, with no noticeable grittiness, providing an enjoyable mouthfeel.
- **Odour :**A strong and inviting orange aroma emanates from the gummies, consistent with the intended flavor profile.
- **pH**: The pH of the gummy formulations was assessed using pH paper. The average pH value across all formulations was visually estimated to be around 4.5, 5 and 4 indicating a slightly acidic environment conducive to stability and microbiological safety
- **Taste** Ratings for sweetness, orange flavor intensity, and overall taste were consistent across all formulations. The gummies achieved a balanced sweetness level, with a strong and appealing orange flavor profile contributing to a positive overall taste experience.
- **Weight Variation :**The weight of individual gummies within ±10% of the Average weight which is acceptable.

CHAPTER 8

SUMMARY AND CONCLUSION

Summary:

Ashwagandha (for stress relief and relaxation),Elderberry (for immunity support),Turmeric & Ginger (for anti-inflammatory benefits),Chamomile (for calming and sleep aid),Echinacea (for respiratory and immune health),Amla (Indian Gooseberry) (for skin health and immunity),Ginseng (for energy and focus)

Key Benefits: Boost immunity, Reduce stress and anxiety, Support digestion, Improve sleep quality, Enhance skin, hair, and overall wellness, Provide antioxidant protection.

Features Tasty, flavored, and easy to chew Can be vegetarian or vegan (using pectin instead of gelatin) Often fortified with extra vitamins (like C, D3, Zinc),Portable and convenient — no need for water Appealing to adults and children.

Conclusion:-

One of the innovative novel dosage forms that, if properly developed, will have a significant impact on the pharmaceutical industry is the use of medicated gummies to administer medications to children.

These dosage forms promote patient compliance and are well liked by both parents and children while yet retaining good effectiveness & bio availability. The Gummies were prepared by melt granulation method. The gummies were tested for different evaluation parameters such as physical appearance, thickness, hardness, weight variation, drug content.

The gummies tested were found to be within the range for all the evaluation parameter also the technique is simple, economical & time saving. As a result of their many additional benefits, such as patient compliance, convenience & comforts for effective treatment, including low dose, immediate onset of action & economical factor, medicated gummies will be the ideal dosage form for the paediatric patient.

They will provide a more effective & creative dosing for.

CHAPTER 9

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