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Preparation and Standardization of Herbal Tablet Produced from Zingiber Officinale

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Abstract: *Ginger, the rhizome of Zingiber officinale, species of the ginger family Zingiberaceae has a long history of medicinal use for more than 2000 years as one of the most versatile medicinal plants having a wide spectrum of biological activity and a common condiment for various foods and beverages. Currently, there is a renewed interest in ginger, and several scientific investigations aimed at isolation, identification of active constituents, scientific verification of its pharmacological actions for treatment of several diseases and conditions. The chemicals responsible for medicinal properties of ginger are considerably variable, main components are gingerol, paradol, shogaols and their homologous which are responsible for its pungent taste. Ginger is usedas a food and medicine and as an aromatic, carminative, expectorant incough and cold, antiemetic and digestive and as common herbay remedy. It is also useful in sore throat and other infectious diseases. Chewable tablets are among the convenient dosage forms which patients prefer due to their advantages. Chewable tablets are the tablets which are required to be chewed or broken in between the teeth before ingestion. This study was aimed at formulating the aqueous extract of ginger rhizome to chewable tablet using syrup (66.7%). In the present research work, the chewable tablets of ginger were prepared by wet granulation. Compression of chewable tablets was done by Karnavati lab scale tablet compression machine. The pre-compression parameters assessed for the granules produced include angle of repose, bulk and tapped density, Carr's index, Housner's ratio. Compressed tablets were evaluated for thickness, hardness, friability..*

Keywords: Zingiber officinale, Aqueous extract

I. INTRODUCTION

Ginger scientifically known as Zingiber officinale Roscoe, belonging to family Zingiberaceae is one of the most important plant with several medicinal, nutritional and ethnomedical values therefore, used extensively worldwide as a spice, flavoring agent and herbal remedy. Traditionally, Z. officinale is used in Ayurveda, Siddha, Chinese, Arabian, Africans, Caribbean and many other medicinal systems to cure a variety of diseases such as nausea, vomiting, asthma, cough, palpitation, inflammation, dyspepsia, loss of appetite, constipation, indigestion and pain.The English botanist William Roscoe (1753- 1831) gave the plant the name Zingiber officinale in an 1807 publication. At least 115 constituents in fresh and dried ginger varieties have been identified by a variety of analytical processes.]Z. officinale is reported to possess essential oils, phenolic compounds, flavonoids, carbohydrates, proteins, alkaloids, glycosides, saponins, steroids, terpenoids and tannin as the major phytochemical groups. The pungency of dry ginger mainly results from shogaols, which are dehydrated forms of gingerols. The biological activities of several volatile and non-volatile constituents of ginger through selected in vitro and in vivo models reveal that ginger has Antioxidant,Antimicrobial, Anti-diabetic, Anti-cancer, Anti- inflammatory, Analgesic, Anti-platelet aggregation, Antipyretic, Anti angiogenic,Immunomodulatory,Hepato-protective.

Tablet is the most popular among all dosage forms existing today because of its convenience of self administration, compactness and easy manufacturing. Many patients find it difficult to swallow tablets and hard gelatin capsules and do not take their medication as prescribed. The difficulty is experienced in particular by pediatric and geriatric patients, but it also applies to people who are ill in bed and to those active working patients who are busy or traveling, especially those who have no access to water.

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Zingiber officinale:-

Botanical Classification:- Kingdom: Plantae Subkingdom: Tracheobionta Superdivision: Spermatophyta Division: Magnoliophyta
Class: Liliopsida-Monocotyledons Subclass: Zingiberidae
Order: Zingiberales Family: Zingiberaceae Genus: Zingiber P. Mill
Species: Zingiberofficinale Roscoe.

History & Origin:-

Ginger first appeared in the southern parts of the ancient China. From there, it spread to India, Maluku Islands (socalled Spice Islands), rest of the Asia and West Africa. Europe saw ginger for the first time in the 1st century when the ancient Romans traded with the India.Ginger, (Zingiber officinale), herbaceous perennial plant of the family Zingiberaceae, probably native to southeastern Asia, or its aromatic, pungent rhizome (underground stem) used as a spice, flavouring, food, and medicine(6). An early form of gingerbread can be traced to the ancient Greeks and Egyptians who used it for ceremonial purposes. Gingerbread made an appearance in Europe when 11th-century Crusaders brought back ginger from the Middle East for the aristocrats' cooks to experiment with .The first written record of ginger comes from the Analects of Confucius, written in China during the Warring States period (475–221 BC). In it, Confucius was said to eat ginger with every meal. In 406 AD, the monk Faxian wrote that ginger was grown in pots and carried on Chinese ships to prevent scurvy.During the Song Dynasty (960–1279), ginger was being imported into China from southern countries. Ginger first appeared in the southern parts of the ancient China.
It is a true cultigen and does not exist in its wild state. The most ancient evidence of its domestication is among the Austronesian peoples where it was among several species of ginger cultivated and exploited since ancient times. The ginger plant itself is a perennial that grows from 1- 3 feet in height. Its lush green spears sprout from thick underground rhizomes.

AIM: preparation and standardization of herbal tablet produced from zingiber officinale.
OBJECTIVES:
1. To formulate a safe, effective, and stable herbal tablet using Zingiber officinale as the active ingredient.
2. To maintain uniformity in weight, size, and active content of the herbal tablets for consistent therapeutic effect.
3. To retain the bioactive constituents of ginger, such as gingerols and shogaols, during processing and formulation.
4. To convert ginger into a convenient tablet dosage form that improves patient acceptability and compliance.
5. To establish standard parameters for quality control, including organoleptic, physicochemical, and phytochemical properties.
6. To evaluate tablet characteristics such as hardness, friability, disintegration time, and dissolution profile.
7. To ensure the final product is free from microbial contamination and safe for consumption.
8. To develop a standardized herbal formulation suitable for further pharmacological or clinical evaluation.

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LITERATURE REVIEW

1. Ali et al. (2008):
Zingiber officinale possesses significant pharmacological activities, including anti-inflammatory, antioxidant, antimicrobial, antiemetic, and analgesic effects. These effects are mainly due to the presence of active constituents like gingerols and shogaols. Grzanna et al. (2005) further emphasized the use of ginger in traditional medicine systems for treating conditions such as arthritis, motion sickness, and gastrointestinal discomfort.

2. Bartels and colleagues (2015):
investigated the effect of various extraction methods on the yield and quality of ginger extracts. Their findings indicated that ethanolic and methanolic extracts are particularly effective in extracting gingerols and shogaols. Bhattarai et al. (2001) also noted that the drying and extraction conditions significantly influence the concentration of bioactive compounds in ginger rhizome.

3. Kokate et al. (2009) and Handa et al. (1994):
discussed that herbal tablets offer advantages such as precise dosing, extended shelf life, improved patient compliance, and better taste masking when compared to crude plant powders and decoctions. Tablets are particularly useful for herbs like ginger, which have a strong odor and pungent taste.

4. World Health Organization (WHO, 2007):
guidelines, standardization of herbal formulations is critical for ensuring consistency, safety, and efficacy. Mukherjee (2002) highlighted that standardization involves evaluating parameters such as moisture content, ash values, extractive values, and marker compound quantification. In the case of ginger, standardization often includes determining the concentration of 6-gingerol as a marker compound.

5. Kadam et al. (2012):
studied the formulation of herbal tablets using powdered ginger extract. They found that excipients such as microcrystalline cellulose, starch, and magnesium stearate improved tablet hardness, friability, and disintegration time. Their study also included optimization of binding and disintegrating agents to ensure rapid release of active ingredients.

6. Tiwari and Rana (2010):
emphasized the need for evaluating physicochemical parameters like hardness, weight variation, friability, and disintegration time to ensure tablet quality. De Smet (2004) pointed out the importance of microbial testing in herbal products to ensure safety, especially since crude plant materials may be contaminated with bacteria or fungi.

7. Harborne (1998) and Trease and Evans (2002):
provided methods for preliminary phytochemical screening to detect the presence of alkaloids, flavonoids, saponins, and phenolic compounds in herbal formulations. For ginger-based tablets, such screening is important to confirm the presence of active constituents contributing to its therapeutic effects.

8. Singh et al. (2010):
discussed the growing acceptance of herbal formulations like ginger tablets in integrative medicine practices. They also stressed the importance of preparing standardized, clinically evaluated herbal dosage forms to support evidence-based herbal therapy.

PLAN OF WORK:

1. Sourcing and Preparation of Rhizome
a] Sourcing: Procure authenticated, contaminant-free ginger rhizomes from certified sources.

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b] Cleaning and Drying: Wash, slice, and dry the rhizomes using suitable drying methods. Ensure moisture content is below 10 percent. c]Grinding: Grind dried rhizomes to fine powder and sieve. Store in airtight, moisture-free containers.

2. Extraction of Bioactive Compounds
a] Solvent Selection: Choose appropriate solvent (ethanol, methanol, water, or hydroalcoholic) based on gingerol solubility and safety. b]Extraction: Perform maceration, percolation, or Soxhlet extraction to isolate bioactive compounds.
c]Filtration and Evaporation: Filter and concentrate the extract. Dry to obtain a semisolid or powdered extract.

3. Formulation of Herbal Tablets
a] Tablet Formulation: Mix the extract with excipients (binders, fillers, lubricants).
b] Tablet Preparation: Use direct compression or wet granulation based on powder flow characteristics.
c] Tablet Optimization: Adjust formulation parameters to meet tablet quality criteria such as hardness and disintegration time.

4. Standardization and Quality Control
a] Physicochemical Analysis: Assess moisture (loss on drying), ash values, and extractive values.
b] Microscopic Analysis: Verify powdered drug identity through microscopic features (e.g., starch grains).
c] Phytochemical Analysis: Conduct chemical profiling via TLC or HPLC to quantify key actives like gingerols.
d] Tablet Evaluation: Test tablets for weight uniformity, hardness, friability, thickness, and disintegration time.

MATERIALS AND METHODS

Materials:
Ginger rhizomes were obtained from the local market of Solapur. All other ingredients used.
i.e. Lactose, Aspartame, Magnesium stearate, glucose were of pharmaceutical grade.

Preparation of Extracts:
Fresh sample of Zingiber officinale rhizomes were peeled and washed with distilled water.
The rhizomes were air dried to a constant weight and size reduced using pestle and mortar.
The weight of the sample was then noted. The sample was then soaked in 1 L of distilled water for 24 hours at room temperature with occasional mechanical shaking. The filtrate
obtained was concentrated and the extract subsequently air dried. The weight of the aqueous
extract obtained was recorded.

Preparation of granules for aqueous extract of Zingiber officinale:
Wet granulation method of massing and screening was employed in preparing all the batches of granules. The aqueous extract of Zingiber officinale powder and the intra-granular excipients (lactose and aspartame) were dry-mixed thoroughly in a porcelain mortar and pestle. An appropriate quantity of freshly prepared maize glucose syrup solution ofconcentration 66.7% w/v was added. The damp mass was passed through a sieve number 5 to form granules. The wet granules were air dried for 24 hours and passed through number 8 stainless steel sieve in order to produce uniformly sized granules.

Pre-compression parameters:
1] Angle of Repose.
The angle of repose of the Zingiber officinale granules produced were determined using a glass funnel clamped on a retort stand which is 10 cm away from the flat surface of a bench.30 g of granules were poured gently into the funnel

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and allowed to flow freely forming a conical heap. The angle of repose was calculated from the heap of each sample using the equation;

Angle of repose, tan θ = h/r

Where, h = height

r = radius of the circular heap

2] Bulk and Tapped Densities.

This was carried out by measuring the volume occupied by a 20 g weight of the granules into a dry measuring cylinder. The bulk density was calculated using the formula;

Bulk density = Weight of the sample / Volume of the sample

The measuring cylinder then tapped 100 times on a wooden table from a height of 2 cm and the taped volume was noted. The tapped density was calculated as;

Tapped density = Weight of sample / Tapped volume of sample

3] Determination of Carr's index.

Carr's index was calculated using results obtained for both bulk density and tapped densities by the relation;

Carr's index (%) = Tapped density - Bulk density/ Tapped density x 100

4] Determination of Hausner's ratio

Hausner's ratio was determined using the result obtained for both bulk densities and tapped densities. It was calculated using the formula; Hausner's ratio = Tapped density / Bulk density

Procedure:-

1] Preparation of Plant Material

a. Collection and Authentication:

Collect healthy ginger rhizomes.

Authenticate the plant material through a qualified botanist.

b. Cleaning and Drying:

Wash thoroughly to remove soil and contaminants.

Cut into small pieces and dry (oven at 40–50°C or air-dry in shade). Alternatively, use freeze-drying for better phytochemical preservation.

c. Pulverization:

Grind the dried rhizomes to a fine powder.

Sieve through mesh (e.g., 60 mesh) to ensure uniform particle size.

2] Extraction (Optional for Extract-based Tablets) a.Solvent Extraction:

Macerate or reflux ginger powder in ethanol (70%) or water.Filter and

concentrate the extract under reduced pressure.

b. Drying of Extract:

Use spray drying, oven drying, or freeze-drying to get a dry extract.

Formulation of Tablets

a. Mixing:

Mix ginger powder or extract with excipients: Diluent: Microcrystalline cellulose or lactose Binder: Starch paste or PVP

Disintegrant: Cross-linked PVP or starch Lubricant: Magnesium stearate

Glidant: Talc

b. Granulation (if wet granulation used): Moisten the mixture with binder solution. Pass through sieve to form granules. Dry the granules and sieve again for uniformity.

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c. Compression:
Compress the granules into tablets using a tablet press. Adjust pressure to obtain uniform size, shape, and hardness.

III. Standardization
1. Physical Evaluation:
Weight variation: Check 20 tablets and ensure % deviation within pharmacopeial limits.

1. Hardness: Measure using a hardness tester. 2.Friability: Use friabilator (⩽1% weight loss acceptable).
3. Disintegration time: Should be within 15–30 minutes for uncoated tablets.
4. Uniformity of thickness and diameter

2. Chemical Evaluation:
Identification tests: TLC or HPLC fingerprinting for gingerol/shogaol. Assay of Active Constituents: Quantify gingerols using HPLC or UV spectrophotometry.
1.Moisture content: Karl Fischer titration or loss on drying method. 2.Microbial load: According to pharmacopeial standards.

3. Stability Studies:
Conduct accelerated and real-time stability studies to determine shelf life (ICH guidelines).

IV. Packaging and Storage
1. Package in airtight containers (blister packs or HDPE bottles).
2. Store in cool, dry place away from sunlight.
3. Let me know if you need a sample formulation table or SOP format.

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Result:-

In the present work. Evalution of Nutritional tablet of gingerstudies were carried to find out nutritional benefits of ginger nutritional tablet The hardness of tablet was determined and found in the range of5 kg/cm2. The Disintegration time of tablet was found to be 13 min. The friability of nutritional tablet was found to be 0.73%. The thickness was found to be 4mm. The formulation of nutritional tablets containing ginger was successful, with the tablets exhibiting desirable characteristics such as appearance, weight variation, hardness, friability, and disintegration.

The pre-formulation studies showed that the bulk density, tapped

density, angle of repose, Carr's index, and Hausner ratio were within acceptable ranges, indicating good flow properties of the granules. The characterization of blend formulations also confirmed the suitability of the powder blend for tablet compression.

II. CONCLUSION

Ginger is an ancient herb used widely in history for its many natural medicinal properties andparticularly as an antiemetic. The best available evidence demonstrates that ginger is an effective and inexpensive treatment for nausea and vomiting and is safe.This marvelous spice and medicinal plant, ginger, is constrained severely by the absence of seed set, and the breeder is left with the alternative of clonal selection or induced mutations with all its uncertainty and limitations.

The powdered aqueous extract of Zingiber officinale and the granules produced (moist granulation prior to compression) were evaluated for pre-compression parameters and the values were found to be within prescribed units for tablet formulation. The granules produced however showed better flow property compared to the powered Zingiber officinale (aqueous extract).

The formulation and evaluation of ginger extract tablets demonstrated promising potential for anti inflammatory activity. Standardized ginger extract, rich in active constituents like gingerols and shogaols, was successfully incorporated into a stable tablet dosage form using appropriate excipients to ensure desirable physicochemical properties. The optimized formulation showed satisfactory results in pre- compression and post compression parameters, including hardness, disintegration time, friability, and uniformity of content. Pharmacological evaluation through in vitro and in vivo anti- inflammatory models indicated significant inhibition of inflammatory responses, comparable to standard anti inflammatory drugs, supporting the therapeutic efficacy of ginger extract. The findings affirm the potential of ginger as a natural, safe, and effective alternative in managing inflammatory condition.

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