International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 6 Nov-Dec 2021, pp: 848-856 www.ijprajournal.com ISSN: 2249-7781

Development and evaluation of carminative herbal chewable tablets based on turmeric, fennels,seed and mango ginger

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Submitted: 05-12-2021 Accepted: 20-12-2021

ABSTRACT-
The present study aimed at the formulation of carminative herbal chewable tablets using herbal constituents.Curcuma longa (turmeric), Foeniculum vulgare (fennel), and Curcuma amada (mango ginger) are the most celebrated herbs in Indian system of traditional medicine.In the present research work, oral chewable tablets were prepared by direct compression and wet granulation method incorporating these three herbs.In both the methods, the powder of turmeric, fennel seed, and ginger mango was prepared initially and it was mixed with additives and preservatives. Physicochemical analysis of the individual drugs, pre-formulation studies, and post-formulation standardization was done to evaluate the quality and purity of the conformation. In the pre-formulation study, it was observed that all the parameters checked for the ingredients were within standard range. Thus, the ingredients were processed for preparing tablets following IP.During the evaluation of tablets, it was found that all the prepared batches of tablets were within the standard range of chewable tablet parameters.
Thus, considering these values and following the IP, we found that the chewable tablet that was prepared without altering its therapeutic property was satisfactory with general characteristics of tablet, namely, hardness, disintegration time, friability, and weight variation.Therefore, it is concluded that the developed chewable tablets may be better alternative to the conventional uses of the herbs.**Keywords:** Chewable tablet, Curcuma amada, Curcuma longa, Foeniculum vulgare, Herherb

I. INTRODUCTION-

Herbal medicines are becoming increasingly popular and reliable in the global market as pharmaceutical scientists acquire a better understanding of the physicochemical and biochemical parameters and their evaluation by modern techniques.The demand for plant-based therapeutics is increasing in both developed and developing countries due to the growing recognition that these are natural products, easily biodegradable, non-narcotic, have no adverse side effects, and easily available at affordable prices.Species of Curcuma are perennial rhizomatous herbs belonging to the family Zingiberaceae.Curcuma species plants also play a major role in the socioeconomic and culture.In the indigenous system of medicine, turmeric enjoys the reputation as a stomachic, blood purifier, useful in common cold, leprosy, intermittent fevers, dropsy, purulent ophthalmia, indolent ulcers,
pyogenic infection, anti-inflammatory, antitumor, aromatic, stimulant, and carminative properties in native medicine.
It is used as an external applicant in bruises, leech bites and is said to be antihelminthic and anti-protozoan.
Foeniculum vulgare is commonly called a fennel seed.
F. vulgare has been enormously used in indigenous medicine for a large range of ailments.
Its stem, fruit, leaves, seeds, and the whole plant itself are medicinally used in different forms in the treatment of a variety of diseased conditions.

Turmeric -
Turmeric is a flowering plant,
Botanical origin – Curcuma longa
Family - Zingiberaceae
Common Name - Turmeric
Urdu Name - Haldi
Part used - Dried Rhizomes
The plant is a perennial, rhizomatous, herbaceous plant native to the Indian
subcontinent and Southeast Asia, that requires temperatures between 20 and 30 °C (68 and 86 °F) and a considerable amount of annual rainfall to thrive.
Plants are gathered each year for their rhizomes, some for propagation in the following season and some for consumption.

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Turmeric powder has a warm, bitter, black pepper–like flavor and earthy, mustard-like aroma.
Curcumin, a bright yellow chemical produced by the turmeric plant, is approved as a food additive by
the World Health Organization, European Parliament, and United States Food and Drug Administratio

ABOUT TURMERIC POWDER-
Turmeric, also identified as Curcuma Longa, is an Ayurvedic skincare remedy used for over 4000 years now. It is considered as the holy powder for its medicinal value. The critical antioxidant Curcumin in Turmeric has many researched-backed and time-tested benefits. Curcumin is also the compound that gives Turmeric its signature yellow-orange tinge.Turmeric powder, coined as the most potent spice of all, is made from the roots of Curcuma zedoaria - native to Southeast Asia. Its list of healing properties includes antiviral, anti-fungal, antioxidant, antibacterial, anti-carcinogenic, anti-inflammatory, anti-mutagenic, and much more.Ayurveda uses Turmeric to balance Vata, Pitta, and Kapha (though it can aggravate Vata and pitta when taken in excess). It is very beneficial for rasa and rakta dhatus - the blood and plasma of the circulatory systems

PHYTOCONSTSTITUENTS OF TURMERIC-
Turmeric powder is about 60–70% carbohydrates,
6–13% water,
6–8% protein,
5–10% fat
3–7% dietary minerals,
3–7% essential oils,
2–7% dietary fiber,
1–6% curcuminoids.
Phytochemical components of turmeric include diarylheptanoids, a class including numerous curcuminoids, such as curcumin, demethoxycurcumin, and bisdemethoxycurcumin.Curcumin constitutes up to 3.14% of assayed commercial samples of turmeric powder (the average was 1.51%); curry powder contains much less (an average of 0.29%).Some 34 essential oils are present in turmeric, among which turmerone, germacrone, atlantone, and zingiberene are major constituents

Pharmacological actions OF TURMERIC-
Several medical properties have been attributed to see Curcuma longa Linn.
Rhizome of Haridra is known to possess therapeutic activities and has been used by medical practitioners as an
anti-diabetic hypolipidemic , anti-inflammatory ,anti-diarrhoeal ,hepatoprotective ,anti-asthmatic and anti-cancerous drug.
Haridra is widely used in cosmetology .The following section discusses its various therapeutic uses in medicine.

Medicinal uses-
Respiratory disorders:
The fresh juice of rhizome is given in bronchitis.
In rhinitis and cough boil Haridra in milk and mixed with jiggery given internally.
In catarrhal cough, sore throat, and throat infection the decoction of rhizome is used for gargle and
also the piece of rhizome is slightly burnt and given for chewing .
The chemical constituents of Curcuma longa like Tumerones, curcuminoids, Curcumin and

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tetrahydrocurcumin has an anti-asthamatic action .

In asthma and congestion, fumes of Haridradi dhumvarti (fumes wick) is given

FENNEL SEEDS -

Botaniclal Name : fennel, (Foeniculum vulgare)
Family : Apiaceae
English Name : Fennel ,sweet fennel ,Bitter fennel
Urdu Name : Saunf
Part Used : Drip Ripe fruit
Chemical Class :Volatile oils

Fennel came into Old English from Old French fenoil which in turn came from Latin faeniculum, a diminutive of faenum, meaning "hay".Fennel, Foeniculum vulgare, is a perennial herb.It is erect, glaucous green, and grows to heights of up to 2.5 metres , with hollow stems.

FRUITS-

The fruit is a dry schizocarp from 4–10 millimetres long, half as wide or less, and grooved.
Since the seed in the fruit is attached to the pericarp, the whole fruit is often mistakenly called "seed".

PHYTOCONSTITUENTS OF FENNEL SEEDS -

Major Constituents : Anethole
Other Constituents : Fenchone
Anisic Acid
Salts Na,K,P
Coumarin,
Anisic Aldehyde
Vitamins A & C
Volatile oils

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Limonene
Estragol

Uses -
Anethole is used as anti-cancer and anti-inflammatory.
Fennel is used as carminative.
Fennel contains Vitamin C which is used as anti-oxidant.
Coumarin shows anti-coagulant effect.
Fennel has bronchodilator effect.
Anethole may influence milk secretion.

PHARMACOGICAL ACTION OF FENNEL SEEDS -
Antimicrobial

According to a 2016 review, components naturally available in both fennel plants and fennel seeds have:antibacterial properties antifungal qualities anti-inflammatory properties This may help get rid of bacteria that can cause gassiness in cases of food poisoning or an upset of stomach.
Antinflammatory
Fennel seeds also reduce inflammation. This may help soothe swelling or irritation in the intestines and improve digestion.
Fennel seeds may also relax muscles in the intestines, which can help relieve constipation. Soothing muscles in the stomach and intestines helps to relieve gassiness that's from constipation or acid reflux.

Mango ginger-
Botany and taxonomy of curcuma amada-
Curcuma amada is a unique spice having morphological resemblance with ginger (Zingiber officinale)
but imparts a raw mango (Mangifera indica) flavour.
The genus name Curcuma was coined by Linnaeus in 1753 in his Species Plantarum.
The word probably derives from the Arabic word 'kurkum', which means yellow colour .
Curcuma amada Roxb. is commonly known as mango ginger.
It is a perennial, rhizomatous, aromatic herb belonging to the family Zingiberaceae.
This family is composed of 70–80 species of rhizomatous annual or perennial herbs .
The genus originated in the Indo-Malayan region, and is widely distributed in the tropics of Asia to Africa and Australia .
The plant grows to a height of 1 m. The leaves are long, oblong, lanceolate, radical, sheathed, petiolate and in tufts.
Each plant bears 5 to 6 pairs of leaves. Mango ginger rhizomes are fleshy, buff coloured, 5–10 cm long, 2–5 cm in diameter and demarcated into nodes and internodes.
At the rhizome nodes scaly leaves are arranged circularly giving the appearance of growth rings with
scars on the surface.

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The taxonomical hierarchy of mango ginger is as follows:

Kingdom : Plantae
Super division : Spermatophyta
Division : Magnoliophyta
Class : Monocotyledonae
Order : Zingiberales
Family : Zingiberaceae
Genus : Curcuma
Species : C. amada Roxb.

Chemical constituents OF MANGO GINGER -
Proximate and nutrient analysis of edible rhizome plays a crucial role in assessing their nutritional significance and nutraceutical quality.
The mango ginger rhizome was found to be a rich source of fibres and starch.

1 Volatile constituents -
There are many reports on the composition of mango ginger volatile oil.
The mango flavour is mainly attributed to presence of car-3-ene and cis-ocimene among the 68 volatile aroma components present in the essential oil of mango ginger rhizome.

2 Curcuminoids
Curcuminoids in mango ginger The well-known curcumin, demethoxy curcumin and bis-demethoxy curcumin (figure 3) are the major constituents from acetone extract.

Uses of mango ginger:
Use of mango ginger in food industry
Mango ginger has a typical exotic flavour of raw unripe mango.
Therefore, it is used as a basic ingredient in pickles, preserves, candies, sauces, curries, salads .
Use in traditional medicines (Ayurveda and Unani)
Properties of mango ginger are depicted in the following Sankrit shloka:
Raw mango flavoured ginger has a cooling effect on the body.
It aggravates Vata. It also pacifies deranged Pitta, cures all types of itching and skin diseases.
Ayurveda, the oldest system of medicine in India, attributed multiple uses of rhizome as an appetizer, alexteric, antipyretic, aphrodisiac and laxative.
Additional health benefits of C. amada rhizome reported were biliousness, itching, skin diseases, asthma and inflammation due to injuries .
Asthma and inflammation due to injuries .
According to the Unani systems of medicine, it is a diuretic, maturant, emollient, expectorant, antipyretic and appetizer. Moreover, several reports have demonstrated the C. amada rhizome's ability against inflammation in the mouth and ear, gleet, ulcers on the male sex organs, scabies, lumbago and stomatitis

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Jaggery-

Jaggery is a traditional non-centrifugal cane sugarconsumed in the Indian Subcontinent and Southeast Asia.7

It is a concentrated product of cane juice and often date or palm sap without separation of the molasses and crystals, and can vary from golden brown to dark brown in colour.

It contains up to 50% sucrose, up to 20% invert sugars, and up to 20% moisture, with the remainder made up of other insoluble matter, such as wood ash, proteins, and bagasse fibres.

Jaggery is very similar to muscovado, an important sweetener in Portuguese cuisine and British cuisine.

Maharashtra in India is the largest producer and consumer of jaggery known as "gul" (गुळ) in Marathi, "gur" in Gujarati, "miṣṭa" (मिष्ट) in Sanskrit, gur (गुड़) in Hindi.

Most vegetable dishes, curries, and dals, and many desserts contain it. Jaggery is especially used during Makar Sankranti for making a dessert called tilgul.

Uses of jaggery

a pinch of it is sometimes added to sambar, rasam and other staples in Udupi cuisine.

Jaggery is added to lentil soups (dāl) to add sweetness to balance the spicy, salty, and sour components, particularly in Gujarati cuisine.

Method of preparation-

Collection and Drying of the Plant Material The rhizome of C. long and C. amada, and seeds of F. vulgare were collected from Nagaon district, Assam, in the winter season in February 2019.

Usually, the plant part (rhizome) of turmeric and mango ginger and seeds of fennel were collected as a whole and dried in shade.

In fresh condition, it is then oven-dried at reduced temperature (40°C) to make suitable for grinding purpose.

The seeds were crushed in the mixed grinder to a coarse powder.

The coarse powder is then stored in an airtight container or polybags and kept in a cool, dark, and dry place for further.

Formulation of Chewable Tablet –

Direct compression method-

In this method of compression, all the ingredients were weighed separately.

Turmeric powder, fennel seeds powder, mango ginger, sucrose, mannitol, black salt, citric acid, MCC, and methyl paraben were blended for 10 min in a mortar pestle.

The above blend was then lubricated with magnesium stearate and talc for 2 min.

The powder blend was evaluated for the flowing properties and was found to be good..

The evaluated blend was compressed into tablets of 642.7 mg weight each. A minimum of 50 tablets was prepared for each batch.

The manufacturing formula for the tablets .

Wet Granulation Method -

In this method, all the ingredients were separately weighed.

Turmeric powder, fennel seeds powder, and mango ginger were blended for 10 min in mortar pestle.

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Then, a small amount of sucrose with distilled water was prepared separately in a test tube.
The above blend was granulated with the sucrose solution and sifted using sieve no.16 and dried in a drier at the temperature of 40°C until the moisture of the mixture gets reduced.
After drying, the dried granules were passed through sieve no. 30, and mannitol, MCC, methyl paraben, black salt, and citric acid required quantities were added and blended for 10 min in mortar pestle.
A uniform paste of starch with water was prepared in a beaker. Then, the above dry mixture was granulated with binder solution (starch paste) and sieved using sieve no. 16 and dried in a drier at the temperature of 40°C until the moisture reduce down.
Again, the dried granules were passed through sieve no. 30. All these granules were lubricated with magnesium stearate and talc for 2 min. The evaluated blend was compressed into tablets of 646.4 mg weigh each.

Composition of the prepared chewable tablet -
Ingredients (mg.) Wet granulation (mg) Direct compression (mg)
Turmeric 12.5 12.5
Fennel 25 25
Mango Ginger 50 50
Sucrose 50 50
Mannitol 300 300
Black salt. 50 50
Citric acid 25 25
Starch 35
Methyl paraben. 1.3 1.3
Mg. stearate 12.9 12.9
Talc 16.2 16
Total weight 646.4g. 642.7g

II. OBSERVATION -

Determination of physicochemical parameters-
In physicochemical evaluation, moisture content, determination of pH, and physical characteristics of crude powder help in understanding the pharmacopoeial standards of the drug.
Physical constants were determined following Shah and Quadry (1996) and Kokate (1994).

Determination of Moisture Content-
About 10 g of fresh crude powder was weight into a flat porcelain dish and subjected to hot air oven at 105°C for 1 h. The sample was then stand for cool and weight was taken by electric balance.
This was repeated till constant weight was obtained and percentage of loss on drying was calculated with reference to the air-dried drug.

Determination of pH -
The powder sample prepared from the able formulation was weighed about 5 g immersed in 100 ml of water in a beaker.
The beaker was closed with aluminum foil and left behind for 24 h at room temperature.
Later, the supernatant solution was decanted into another beaker and the pH of the formulations was determined using a calibrated pH meter.

Determination of Bulk -
Density It is determined by transferring an accurately weighed amount of powder sample to the graduated cylinder with the aid of a funnel.
The initial volume was noted.
The ratio of weight of the volume it occupied was calculated.

Determination of Carr's Index -
It is the property of the powder to be compressed. Based on the apparent bulk density and tapped density, the percentage compressibility of the powder can be determined Pal et al., 2014.
A Carr's index >25 is considered to be an indication of poor flowability and below 15 of good flowability.

Determination of Tapped -
Density It is measured by transferring a known quantity 10 g of powder into a graduated cylinder and tapping it for a specific number of times.
The initial volume was noted.
The graduated cylinder was tapped continuously for a period of 10–15 min.
The density can be determined as the ratio of mass of the powder to the tapped volume.

Evaluation of Prepared Tablet-
1.Physical characterization:
The general appearance of tablets, its visual identity, and overall elegance are essential for consumer acceptance.
The formulated chewable tablets were evaluated for size, shape, and organoleptic characters such as color, odor, and taste.
The diameter and thickness of the tablets were measured using Vernier caliper scale.

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2. variation :
Twenty tablets of each batch were selected at random and weighed individually and collectively on a digital weighing balance.
Average weight was calculated from the total weight of all tablets. The weight of individual tablets was compared with the average weight.
The difference in weight variation will show in percentage followed by permissible limits.

3.Hardness test :
The hardness of the tablets was measured using Monsanto hardness tester. The values were expressed in kg/cm2 Chauhan et al., 2013.

4.Friability test :
The friability of tablets was determined using Roche's friabilator. Six tablets were weighed and placed in friabilator and rotated at 25 rpm for 4 min.

III. RESULTS -

This study was an attempt to develop a formulation of chewable tablets by direct compression method and wet granulation method using C. longa powder, C. amada powder, and F. vulgare powder.
In both the methods, the formulated tablets were prepared by adding additives and preservatives to improve the stability of the tablets.
The physicochemical analysis, pre-compression and postcompression studies were tested and compared with the studies performed on chewable tablets and it showed within normal limits which are discussed below.
Physicochemical analysis of the individual drugs and formulation has been done to evaluate the quality and purity of the conformation .
The pH of C. longa powder and F. vulgare powder was found to be 6.46 and 5.69, respectively.
The result of moisture content for C. longa powder and F. vulgare powder was found to be 11.53 % and 2.9%, respectively.
In the pre-compression the granules and powder thus prepared were evaluated which were shown in Tables 4 and 5 respectively.
Angle of repose of powder and granules was found to be 32.56 ± 3.56 and 28.065 ± 0.46, respectively.
Angle of repose ≤30 indicates excellent flow property so it was concluded that the granules prepared by wet granulation had excellent flow property.
In post-compression studies, the organoleptic properties such as color, odor, taste, and shape were observed. The general appearance of the tablet for both powder and granules were found to be round in shape, light yellow in color, smooth texture, and odorless.
The thickness and diameter were found to be 7 mm and 10 mm.
Appearance of the tablet for both powder and granules were found to be round in shape, light yellow in color, smooth texture, and odorless. The thickness and diameter were found to be 7 mm and 10 mm.
Evaluation of tablets, it was found that all the prepared batches of tablets were within the standard range of chewable tablet parameters.
Using Monsanto hardness tester, the strength of the tablets was tested. All the tablets showed good hardness.
Tablet showed different weight variation within the given limits.
Thus, considering these values and following the IP, we found that the chewable tablet that was prepared without altering its therapeutic property was satisfactory with general characteristics of tablet, namely, hardness, disintegration time, and friability and weight variation.
The formulation was tested for common people with respect to taste; odor and time required for complete chewing and showed that it can be accepted for the present trends of newer drug delivery dosage forms.

IV. CONCLUSION-

Compressed tablets are the most widely used solid dosage form so they must satisfy a number of physical requirements in terms of hardness, friability, and uniformity.
Both wet granulation and direct compression method could be used successfully for developing tablet formulation by incorporating turmeric, fennel seeds, and mango ginger.
Hence, the present study recommends the current needs to generate similar data for different herbal drugs or Ayurvedic formulations, which is highly essential in industrial applications and to meet consumer preferences and demands.
Therefore, it is concluded that the developed chewable tablets may be better alternative to the conventional uses of the herbs.
Moreover, this work may enlighten the field of herbal technology in future.

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