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Development and Evaluation of Polyherbal Formulation with Carminative Effect

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ABSTRACT

Carminative drugs, which reduce or prevent gastrointestinal flatulence and colic and have historically been used to enhance human health, is examined in this study. The carminative qualities of spices like clove, coriander, cardamom, fennel, nutmeg, black pepper, and ajowan are highlighted in particular. Numerous health benefits, including anti-inflammatory, antiseptic, anti-hypertensive, and myorelaxant qualities, are demonstrated by these spices. To enhance their effects, formulations were made utilizing a geometrical approach and different weights of these powders were combined and evaluated. To confirm the quality and safety of the carminative powder, organoleptic evaluation, physicochemical characteristics, rheological evaluation, and carminative potential were evaluated. The carminative powder, had a pH of 6.5, is free-flowing, non-sticky, and aesthetically pleasing, according to the results. Given the rising popularity of natural treatments and holistic healthcare, the future of carminative herbal medications is bright. Due to their digestive advantages, many herbs and mixtures have grown in popularity, and this pattern is predicted to continue. New carminative herbs and novel formulations may be found as a result of research and development in herbal medicine in the upcoming years. The market for carminative herbal medicines is projected to grow as consumer interest in plant-based treatments for digestive problems rises.

Keywords: *Herbal carminative drug; Flatulence; Coriander; Nutmeg; Clove; Fennel; Black pepper.*

Introduction

Gastrointestinal diseases affect the gastrointestinal tract from mouth to anus. Constipation, irritable bowel syndrome (IBS), nausea, food poisoning, gastric issues, bloating, Gastro oesophageal reflux disease (GERD) and diarrhoea are common example that affect the GI tract [1]. Digestion is the process of converting the food we eat into nutrients, which the body uses for energy, growth and cell repair. It also absorbs water, vitamins and minerals and eliminates wastes from the body. It is tubular system which extends from the mouth to anus [2]. The stomach is continuous with the oesophagus at the cardiac sphincter and with the duodenum at the pyloric sphincter. It has two curvatures. The lesser curvature is short, lies on the posterior surface of the stomach and is the downward continuation of the posterior wall of the oesophagus.

A plant or preparation is known as a carminative also known as a carminativum (plural carminative) is designed to either stop the development of gas in the digestive tract or make it easier for the gas to be expelled, so preventing flatulence. The word “carminative” comes from the Latin word “Carmen”

which means card for wool. According to the humoral hypothesis, carminative dilute and relax the gross humours from which the wind emanates combing them out like the knots in wool. Carminatives are frequently blends of herbal spices and essential oils that have a history in traditional medicine for this function. Examples of oils and spices that have a carminative effect includes fennel, nutmeg, coriander etc. Plants with volatile chemicals called carminative herbs have historically been employed for their medicinal effects on enhancing human health. These herbs 'phytonutrients mostly have therapeutic benefits on improving digestive health and impacting general wellbeing. Including carminative herbs in your diet and even breathing them can have a significant impact on lowering gas, bloating after meals, nausea and other unpleasant symptoms. The most commonly used plant parts as carminative are leaves, flowers and fruits [3].

Materials and Methods

All the natural materials used in the present study i.e., Coriander (Coriander sativum), Clove (Syzygium aromaticum), Cardamom (Elettearia cardamomum), Ajowan (Trachyspernmum ammi), Black papper (Piper nigrum), Fennel (Foeniculum Vulgare) and Nutmeg (Myristica fragrans) were obtained from the botanical garden of Nibha Institute of Pharmaceutical Sciences, Rajgir. The Carminative powder was prepared followed by cleaning, drying, and pulverizing the necessary material.

Coriander (Coriander Sativum)

Coriander consists of dried ripe fruits of Coriandrum sativum. It belongs to the family of Umbelliferae and contains a trace of protein and fixed oil. Lacunae appear in place of vittae due to the development of sclerenchyma containing n-decanal, which has a foul scent. Coriander is used commercially as a spice and condiment, as well as to create coriander oil. It is also used as a carminative, refrigerant, stimulant, diuretic, and rheumatism treatment [4,5].

Clove (Syzygium aromaticum)

Clove is made from the dried flower buds of Eugenia caryophyllus Thunb. (synonym to Syzygium aromaticum) a member of the Myrtaceae family. The clove has a strong spicy, aromatic odor and pungent taste. Clove oil contains 14-21% volatile oil, eugenol, acetyl eugenol, gallotannic acid, and caryophyllenes, with 60-90% eugenol providing anesthetic and antiseptic properties. Clove has antiseptic, stimulant, carminative, aromatic, and flavouring properties. It is also used as an anodyne and an antiemetic. Clove oil is used by dentists as an oral anaesthetic and to disinfect root canals [4,6].

Cardamom (Elettearia cardamomum)

Cardamom is made from the dried mature seeds of Elettaria cardamomum which belongs to the Zingiberaceae family. Cardamom has simple, tall stems, lanceolate leaves, a dark green and glabrous upper surface, and a light green and silky below surface. On drooping flower stems, the little yellowish blooms develop in loose racemes. The seeds have 3 to 6% volatile oil, as well as fixed oil, potassium salts, a colouring principle, nitrogenous mucilage, an acrid resin, starch, ligneous fibre, and ash. Cineole is the active component of the volatile oil. Terpinyl acetate, terpineol, borneol, terpinene, and other aromatic chemicals are also present. Cardamom has fragrant, carminative, stimulant, stomachic, expectorant, diaphoretic, digestive, appetiser, and flavouring properties [4,7].

Ajowan (Trachyspernmum ammi)

Ajowan is the dried ripe seeds of Trachyspermum ammi, family is Apiaceae. Ajowan contains 2–3.5% essential oil, 17.1% protein, and 21.8 % fat. Ajowan oil is a white or brownish yellow liquid with a distinct thymol scent and a harsh flavour. Ajowan is a branched annual herb growing up to 90 cm tall, suitable for cold weather and dry conditions. It thrives on loams or clayey loams. Seeds are sown in moist soil from September to November, with germination taking 5-15 days. Flowering occurs in two months, and harvesting occurs in February or March. Ajowan is used for antibacterial, fragrant, and carminative properties [4,8].

Black pepper (Piper nigrum)

It is obtained from dried, unripe fruits of Pipper nigrum Linn. of the family Piperaceae. It contains an alkaloid piperine (5-9%), volatile oil (1-25%), resin (6%), piperidine and starch (30%). It is used as carminative, stomachic, flavoring agent [4,9].

Fennel (Foeniculum vulgare)

Fennel is obtained from the dried ripe fruits of the Umbelliferae family's Foeniculum vulgare Miller. Fennel varieties contain 4 to 5% volatile oil, with anethole and fenchone as primary constituents. The oil contains β-pinene, anisic acid, phellandrine, and anisic aldehyde. Fennel also contains 20% fixed oil and 20% proteins. Fennel is used as a digestive, pectoral, and flavouring agent, as well as a stomachic, aromatic, diuretic, carminative, and diaphoretic agent. Anethole may have estrogen-like activity and inhibit smooth muscle spasms [4,10].

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Nutmeg (Myristica)

Nutmeg is the dried ripe seed kernel of Myristica fragrans Houtten. The family is Myristicaceae. Nutmeg is made up of 5 to 15% volatile oil, lignin, stearin, starch, gum, colouring matter, and 0.08% acid. Clemicine, myristicin, geraniol, borneol, pinene, camphene, and dipentene are all present in the volatile oil. It also contains trace amounts of eugenol, safrol, p-cymene, and isoeugenol. Nutmeg has aromatic, carminative, and flavouring properties. Both nutmeg and mace are used to treat flatulence, nausea, and vomiting. In piles ointment, grated nutmeg is combined with lard [4,11].

Method of Preparation

Six different formulations were prepared with varying quantity/concentrations of all ingredients named F1, F2, F3, F4, F5 and F6. To obtain uniformly sized particles, all powdered materials were passed through a sieve with a mesh size of 44 and 80 followed by accurate weighing. Furthermore, all powder ingredients were geometrically combined to ensure consistent and even mixing. Table 1 shows the formula for preparing individual preparations with each ingredient. The individual preparation was stored in an airtight container, labelled as previously stated with the composition incorporated, and used for additional evaluation studies (Figure 1).

Table 1: Formulation of carminative powder.

S.N.	Name of Ingredient	Scientific Name	Weights (gm)					
			F1	F2	F3	F4	F5	F6
1.	Ajowan	Trachyspermum ammi	2	3	4	7	10	15
2.	Black pepper	Piper nigrum	7	7	7	7	7	7
3.	Cardamom	Elettearia cardamomum	1	1.5	2	3	4	5
4.	Clove	Syzygium aromaticum	6	7	7	6	5	3
5.	Coriander	Coriander sativum	15	12	10	8	6	4
6.	Fennel	Foeniculum vulgare	6	7	7	6	5	3
7.	Nutmeg	Myristica fragrans	3	3	3	3	3	3

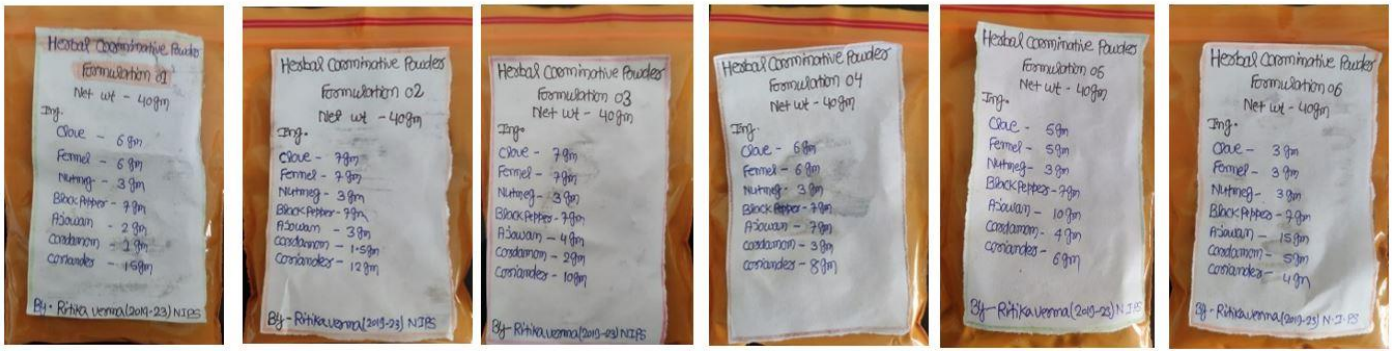

Figure 1: Formulations F1 to F6.

Evaluation Parameters

Prepared carminative powder was evaluated using following parameters to ensure supremacy of prepared [12].

Organoleptic Evaluation

Organoleptic evaluations were done on things like colour, smell, appearance, texture, and smoothness. For the evaluation of colour and texture, touch sensation and visual perception were used, respectively [12,13].

Physicochemical Evaluation [12-14]

pH: A digital pH metre was used to determine the pH of the preparation. The pH metre was initially calibrated at various pH levels with an appropriate buffer solution. In distilled water, a 10% (w/v) dispersion of the product was made, and the pH was evaluated directly without any further dilutions.

Moisture content: Moisture content and loss on drying (LOD) are significant characteristics for plant-based goods. Inadequate drying of these agents may result in the enzymatic breakdown of active ingredients. The LOD technique was used to determine the moisture content of the preparation. 2 gm of sample was carefully weighed and placed in a previously weighed petri plate (W1). W2 is the weight of the petri dish containing the sample. The petri dish was heated in a hot air oven at 100-108°C until the sample's contestant weight was reached. Measured the weight after 30 minutes up to standard weight.

Ash value: The ash value of a herb is computed to identify its inorganic content. It is used to determine the identity or purity of a medication. An extremely high ash value, in general, indicates adulteration, contamination, or substitution during product manufacturing. About 2-4 gm of powder medication was placed in a crucible dish that had previously been fired and weighed. The temperature was progressively raised so that it did not reach the red. The ash is cooled and weighed once it has been completely burned.

Preparation of Ash: In a silica crucible over the burner, 2-4 gm of drug was cremated. The charred material was heated for six hours in a muffle furnace at 600-650 °C. The resulting ash was white and carbon-free. It was then cooled and weighed on ash-free filter paper.

Rheological Evaluation

It included evaluating powder properties. The sample was evaluated using several physical requirements such as angle of repose, bulk density, tapped density, and Hausner's ratio.

Angle of Repose: The height and radius of the heap are noticed and recorded after the requisite amount of dried powder is dropped from a height of 6 cm. The angle of repose (θ) for the above approach can be calculated the using the formula:

$$\text{Angle of repose } (\theta) = \tan \frac{H}{R}$$

Where,

θ - Angle of repose,
H- Height of the heap,
R - Radius of the base

Bulk Density: It is the amount of a substance in a certain volume. It is determined by dividing the given mass of powder by its bulk volume. It is calculated by using a funnel to transfer an accurately weighed amount of powder sample to the graduated cylinder. The initial volume was recorded. The weight-to-volume ratio was computed using a formula:

$$\text{Bulk density} = \frac{\text{Mass of powder}}{\text{Volume of powder}}$$

Tapped Density: It is calculated by placing a known amount of powder (10 gm) into a graduated cylinder and tapping it a certain number of times. The starting volume was reported. For 10-15 minutes, the graded cylinder was tapped continually. The density can be calculated by dividing the mass of the powder by the tapped volume.

$$\text{Tapped density} = \frac{\text{Mass of powder}}{\text{Tapped volume}}$$

Housner's ratio: The Housner's ratio can be used to determine the flowability of powders. It is the ratio of the powder's tapped density to its bulk density.

$$\text{Housner's ratio} = \frac{\text{Tapped Density}}{\text{Bulk Density}}$$

Carr's index: The powder flow property, often known as percent compressibility, is also measured. It is proportional to the relative flow rate of cohesiveness and particle size. To get the % compressibility index, use the following equation:

$$\text{Carr's index} = \frac{\text{Tapped density} - \text{Bulk density}}{\text{Tapped density}} \times 100$$

Sweeling index: The swelling index is the volume in millilitres occupied by 1 gram of a medication after 24 hours of swelling in an aqueous medium, including any adhering mucilage. Place 1.0 g of the face pack powder, whole or ground to the degree of comminution specified in the monograph, in a 50 mL graduated cylinder. Close the cylinder after moistening the face pack with 25 mL of water, unless otherwise directed. For 1 hour, vigorously shake every 10 minutes. Allow to stand for 3 hours. At 90 minutes after the start of the test, rotate the cylinder about a vertical axis to release any substantial volumes of liquid retained in the drug layer and any drug particles floating on the surface of the liquid. Calculate the volume of the medication, including any adhering mucilage. Perform three tests at the same time. The swelling index is calculated by taking the average of the three tests. And other method is done for swelling index of face pack mucilage. The swelling index is the volume in millilitres taken up by swelling of one gram of plant material under particular conditions. Swelling agent water in the amount specified for each plant material. 50 ml volumetric flask + 20 ml water in an upward direction + shake after 10 min. after 1 hr + stand for 24 hr + measured the volume in ml occupied by the extract. and weight accurately of swelled powder using formula.

$$\text{Swelling Percentage} = \frac{\text{W2} - \text{Taken Sample}}{\text{Taken Sample}} \times 100$$

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Carminative Potential: Some Indian spices have carminative properties. Spices were homogenised and dried in the shade, and the resulting mass was powdered, weighed, and tested for carminative and antacid properties of the drug. To assess the carminative profile 2.5gm of formulation extract was poured into a balloon from an Erlenmeyer flask containing 100 ml of distilled water and 100 ml of NaOH (IM, previously standardised by oxalic acid). The balloon was immediately wrapped around the flask's neck. The flask was agitated slowly with a magnetic stirrer, then vigorously for the next 30 minutes before being left to stand overnight. The evolved carbon dioxide gas was allowed to enter a balloon filled with excess sodium hydroxide. It was absorbed and converted into sodium carbonate in the same amount. The resulting mixture of excess sodium hydroxide and sodium carbonate was titrated with standard HCL using phenolphthalein indicator to obtain the first endpoint, followed by the second endpoint. Was discovered using the methyl orange indicator. The procedure was repeated with 0.1gm of standard sodium bicarbonate. The carbon dioxide content per gramme of sample was calculated using the difference in millilitres between the first and second endpoints. The following formula was used to calculate the mass of carbon dioxide produced by the drug sample and standard [13].

Vol. of titrant × Molarity of std. acid × mol. Wt. of CO_2 = Mass of CO_2 in gm.

Results

The following are the results of all evaluation parameters used to ensure the superior quality of the developed face pack.

Organoleptic evaluation

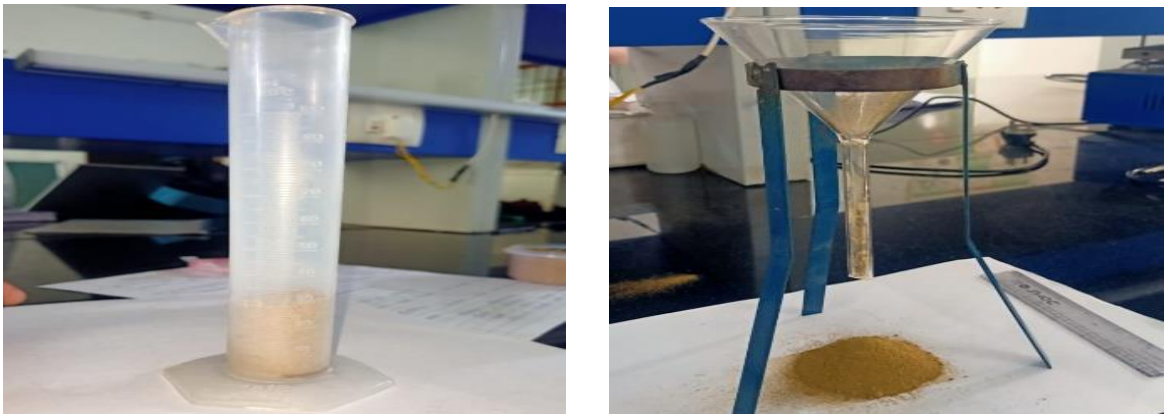
The current study's herbal carminative powder was tested for several organoleptic factors, and its observations such as colour, odour, texture, and smoothness are shown in Table 2.

Table 2: Result of organoleptic properties.

S.N.	Parameters	Observations					
		F1	F2	F3	F4	F5	F6
1.	Appearance	Powder	Powder	Powder	Powder	powder	Powder
2.	Colour	Brown	Brown	Brown	Brown	Brown	Brown
3.	Taste	Pungent	Pungent	Pungent	Pungent	Pungent	Pungent
4.	Texture	Fine	Fine	Fine	Fine	Fine	Fine
5.	Smoothness	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth

Rheological evaluation

The observations of rheological evaluation such as bulk density, tapped density, angle of repose, Housner's ratio, Carr's index, are given in table 3. This supports the carminative powder flow qualities, as it was discovered to be a free flowing and non-sticky powder in nature (Figure 2).



(a) Tapped Density (b) Angle of repose

Figure 2: Determination of (a) Tapped density (b) Angle of repose.

Table 3: Result of rheological properties of F1 to F6.

S. No.	Parameters	Observation						Inference
		F1	F2	F3	F4	F5	F6	
1	Bulk Density	0.5	0.45	0.45	0.43	0.43	0.43	Good
2	Tapped Density	0.62	0.58	0.55	0.63	0.63	0.55	Good
3	Housner's ratio	1.25	1.28	1.2	1.3	1.3	1.3	Passable
4	Carr's index	20%	22.4%	18.2%	21.8%	25.9%	21.8%	Passable
5	Angle of repose	32.27	34.2	33.13	34.2	35	34.05	Between 31-35° consider as good

Physicochemical Parameters

Results of formulation are shown in Table 4.

Physico-chemical parameters such as pH, Moisture Content and ash value.

Table 4: Result of physicochemical evaluation of F1 to F6.

S.N.	Parameters		Observation					
			F1	F2	F3	F4	F5	F6
1.	pH		6.4	6.6	6.5	6.6	6.6	6.5
2.	Moisture Content		11.4%	10%	9.2%	9%	9%	8.2%
3.	Ash Value	Total Ash Value	2.95%	2.73%	2.11%	2.39%	2.33%	2.37%
		Acid insoluble Ash value	0.97%	0.92%	0.89%	0.91%	0.97%	0.98%
		Water soluble ash value	1.33%	1.35%	1.33%	1.28%	1.35%	1.39%
4.	Swelling index		160%	140%	135%	102%	102%	118%

Table 5: Result of amount of CO_2 produced at different doses of the formulation.

Dosage in Gram	Amount of CO_2 released					
	F1	F2	F3	F4	F5	F6
1	3.04 ± 0.01	2.08 ± 0.02	4.03 ± 0.09	1.8 ± 0.04	3.08 ± 0.02	4.04 ± 0.01
2.5	8.09 ± 0.03	9.21 ± 0.02	6.02 ± 0.03	7.02 ± 0.4	9.21 ± 0.02	9.09 ± 0.03
5	15.7 ± 0.04	14.28 ± 0.04	22.06 ± 0.08	12.08 ± 0.2	12.28 ± 0.04	15.7 ± 0.04
7.5	23.0 ± 0.06	16.21 ± 0.42	15.45 ± 0.04	16.02 ± 0.11	20.0 ± 0.06	16.21 ± 0.42

Discussion

The phytonutrients in these plants primarily promote digestive health and are beneficial for overall health. Due to their digestive properties, traditional remedies including fennel, clove, coriander, ajowan, black pepper, nutmeg, and cardamom have become more and more popular. The F1 to F6 formulation technique used a geometrical approach with various powder weights to enhance benefits. This approach involved in-depth examinations like organoleptic, rheological, and physicochemical evaluations. When the findings are considered collectively, it is clear that the carminative powder has good flowability and non-

stickiness, both of which are required for usage. The powder was described as being fine, silky, brown, and deliciously fragrant as positive results of the organoleptic test. Additionally, the physicochemical characteristics, particularly the pH of 6.5, testify to its efficacy. Rheological investigations revealed that the bulk and tapped densities, angle of repose (31–35°), Housner's ratio, and Carr's index were all satisfactory. These results demonstrate the product's superior quality and security.

Conclusion

It is anticipated that spices like Clove, Coriander, Cardamom, Fennel, Nutmeg, Black pepper and Ajowan will prove to be the best treatment for managing activity and flatulence without having any negative side effects. Overall, the results of the study indicate that spices are a rich source of phytochemical elements, giving the traditional intake of these foods by the native population of south India scientific support. Additionally, the extracts of all the spices demonstrated good antacid and carminative properties. Future studies would be conducted to identify the bioactive substances responsible for antacid and carminative effects and create the medication formulation. According to this study, Clove (Syzygium aromaticum), Coriander (Coriandrum sativum), Cardamom (Elettaria cardamomum), Fennel (Foeniculum vulgare mill), Nutmeg (Myristica), Black papper (Piper nigrum) and Ajawain (Trachyspermum ammi) have anti-edemic, anti- inflammatory, antiseptic, anti-hypertensive and myorelaxant effect respectively. All formulation created as F1, F2, F3, F4, F5 and F6 by Geometrical method with variation in the weights of the powders for maximum benefits. Organoleptic evaluation, rheological evaluation, physicochemical parameters, among the parameters evaluated. The results of each of these examinations provide useful information about the quality and safety of the powder, these parameters collectively confirm that the carminative powder is a free-flowing and non-sticky powder, making. In addition, all the results were found to be adequate. Carminatives are herbs or substances that help alleviate gastrointestinal discomfort by reducing gas and bloating. Traditional remedies like Clove, Coriander, Ajowan, Black pepper, Nutmeg, Cardamom and Fennel have gained popularity for their digestive benefits, and this trend is likely to continue. In the coming years, research and development in herbal medicine may lead to the discovery of new carminative herbs and formulation.

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Conflict of Interest

None declared.

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