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PROFILE OF CLOVE IN DENTAL PRODUCTS- A REVIEW

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ABSTRACT

A well-known Ayurvedic plant is lavanga. Lavanga are the fragrant flower buds of a tree in the myrtaceae family with the Latin name *Syzygium aromaticum*. Due to its ability to balance the kappa, it is known as Lavanga. The cough, pitta, blood disorder, thirst, nausea, discomfort, hiccups, and abdominal distension are all controlled by it. Beta caryophyllene makes about 13% and 78% respectively of eugenol. Eugenol, a chemical component found in cloves, is frequently used as a local anesthetic and painkiller, especially in dentistry. The best treatment for toothaches is clove oil. Natural analgesic, antiseptic, and antibacterial qualities may be found in clove oil. Some toothpastes and Clovacaine solution, a local anesthetic used to treat oral ulcers and inflammation, are made using clove oil. Clove has anti-inflammatory, anesthetic, pain-relieving, anti-viral, anti-microbial, anti-diabetic, anti-inflammatory, antithrombotic, and insect repellent qualities. The aromatic spice known as clove, *Syzygium aromaticum* L., is a member of the Myrtaceae family. In order to wrap off this review, we will outline the advantages and conventional uses of Clove.

KEYWORDS

Cloves, eugenol, toothache, Biological activity, volatile, spice, Clove oil.

INTRODUCTION OF CLOVE

The *Syzygium aromaticum* tree, a member of the Myrtaceae family, produces fragrant flower buds known as cloves. Due to differing harvesting seasons in different countries, cloves, a blooming plant native to Asia and South America, are available all year. [16]. The clove is primarily grown in coastal regions at a height of no more than 200 meters.[11] Ayurvedic medicine mostly use clove. The term "lavang" is typically used to describe it. The primary usage of clove is in culinary preparation. The antibacterial, antiviral, anti-inflammatory, antidiabetic, and antioxidant properties of clove oil are employed.[17] It has historically been used to cure conditions including tooth pain, digestive issues, hiccups, mouth ulcers, and inflammation or cramping. It has stimulating properties and is particularly effective in easing the symptoms of spasmodic condition. It relieves flatulence and stimulates blood circulation that is slow, improving digestion [18]. The length of a clove ranges from roughly 12 to 34 inches, and it contains 14–20% essential oil. Due to the high concentration of eugenol in cloves, which can be extracted by distillation to produce the essential oil, cloves are pungent. For medical purposes, clove buds have been thought to be safe when taken orally. Humans have been using clove for therapeutic purposes for more than two thousand years.[21] Eugenol (80%–90%), eugenyl acetate (15%–17%), beta caryophyllene (5%–12%), alpha humulne (0.55%), alpha terpenyl acetate (0.1%), and methanol eugenol (0.2%) are the three compounds that may be found in cloves. [9] Due to its deodorizing qualities, clove is utilized in fragrances and cosmetics. Everybody experiences stress, but it may be reduced with the use of a hydroalcoholic extract of clove oil. Due to its antioxidant properties, it helps to prevent cancer.[20] Different vernacular names for clove exist in many languages. In Arabic, Bulgarian, and Chinese, it is known as qaranful, Karamfil, and Ding xiang. Danish names include Kruidnagel, Garifalo, Mikhaki, Nelke, Szegfu, Indonesian names include Cengkeh, Japanese names include Choji, and Korean names include Jeonghyang. Latvian for "krustnaglinas" Nepalese Lwaang, Portuguese Carvo de India, Persian Mikhak, Pashto Kala, Russian Gvosdika, Spanish Clavo, Turkish Carenil, Thai Garn ploo, Vietnamese Dhing huong, and Urdu/Punjabi/Hindi Laung [24]. Due to the substantial volumes of eugenol, it contains, clove essential oil has biological and antibacterial effects. Numerous gram-positive, gram-negative bacteria, and a variety of yeast have shown that eugol and the phenolic components of clove essential oil interact with phospholipids in cell membranes and denature proteins, influencing their growth and permeability.[23] Clove essential oils have biocidal effect against *A. albopictus* (tiger mosquitos), which aids in the prevention and treatment of malaria. The hydro-alcoholic extracts of clove oil may also be used to ease stress, which is quite prevalent in everyone. Due to its antioxidant properties, it helps to prevent cancer.[20] Over 2,000 years ago, China began using clove as a spice and scent. Clove has been used to cure illnesses including dyspepsia, acute or chronic gastritis, and diarrhea since ancient times. For the first time (1640), clove oil was used medicinally in France as a toothache medication. Its usage for treating asthma and other allergic conditions by oral administration was later mentioned in "Practice of Physic." [22] Clove oil should be used as an aid in the treatment of periodontitis since *Actinobacillus actinomycetemcomitans* and *coli* are vulnerable to its antimicrobial effects. Oral use of clove prevents *C. albicans* from overgrowing in healthy areas, particularly the oral cavity. When used as a clove stick to treat aphthous ulcers, clove oil functions as a biocide, active against parasites, irritating tiny organisms, and, oddly, going after hatchlings.[19]



CLOVE

Synonyms-Cloves, Caryophyllus, Lavang, Laung, Grambu, Grampus, Krambu. [17]

Biological source- It consist of a dried flower bud of *Eugenia caryophyllus*. [17]

Botanical name - *Syzygium Aromaticum* [7]

Botanical Classification-

Kingdom- Plantae

Sub Kingdom-Tracheobionta

Super Division- Spermatophyta

Division-Magnoliphyta

Class- Magnoliopsida

Subclass-Rosidae

Order-Myrtales

Family- Myrtaceae

Genus-Syzygium

Species- aromaticum

Chemical Composition-

Both volatile and non-volatile components make up clove.

Volatile Constituents: Clove produces a variety of volatile oils, including oil derived from:

Fruit Oil: Fruits produce 2% oil, which is 50–55% eugenol. [9]

The essential oil has a total of 23 known compounds, with eugenol accounting for 76.8% of them.

17.4% beta-caryophyllene

2.1% alpha-humulene

1.2% eugenyl acetate 59

The amount of eugenol produced by a kilogram (2.2 lbs) of dried buds is around 150 ml (1/4 of a pint).

Even in relatively modest doses, like 5ml, eugenol can be harmful. [12]1) leaves

2) stem

3) buds

4) fruit

Leaf Oil: The essential oil from clove leaves is 3.0-4.8%.

Clove stem oil produces 6% volatile oil: The oil is a clear to light yellow liquid that contains 6.6% B-caryophyllene and 80.2% eugenol.

Bud Oil: 15-20% of the essential oil is present in high-quality clove buds. Eugenol (70–85%), eugenyl acetate (15%), and B-caryophyllene (5–12%%), which together account for 99% of the oil, are the main components.

USES OF CLOVE

Cloves are used to reduce foul breath. Because they are antiseptic, cloves aid in reducing infection.[12]. Chinese medicine, western herbalism, and ayurveda all make substantial use of clove. It is used commercially to make clove oil, which has a variety of medicinal properties including antioxidants, anti-inflammatory properties, and antiviral properties. [1, 4] Using clove as a dental analgesic [2] Clove oil or its extract has been used as a flavouring ingredient in the food sector for mouthwashes, ice cream, baked products, and whiskey.[22] Clove bud extracts may potentially be utilized as food antioxidants. Encapsulated clove powder made by spray drying with maltodextrin and Arabic gum as the wall components might be used to create a controlled release of antioxidants.[25] Additionally used as an antiseptic in the treatment of oral infections is clove oil. Clove essential oil inhibits the growth of bacteria, yeast, and mold. In cheese and tryptone Soy Broth, it was proven to be effective against *S. enteritidis* and *L. monocytogenes*. [23] Clove essential oils have biocidal effect against *A. albopictus* (tiger mosquitos), which aids in the prevention and treatment of malaria. The hydro-alcoholic extracts of clove oil may also be used to ease stress, which is quite prevalent in everyone. As a result of its antioxidant properties, it helps to prevent cancer.[20] The essential oil of clove is utilized in dentistry, Chinese medicine, and Indian medicine as an anodyne (pain reliever) for dental crises.[18] Eugenol is added to root canal sealers (Endomethasone, Caryosan), to temporary fillings and to pastes used for direct pulp capping (Caryosan, zinc oxide). It serves as a precipitator when silver nitrate is being used to impregnate the dentin or is used to disinfect tooth canals in the treatment of pulp necrosis.[18] In Indian Ayurvedic medicine, Chinese medicine, herbalism, and dentistry, clove oil has been used to enhance digestive functions, ward off intestinal

parasites, and act as an antibacterial agent for centuries. Clove oil is extracted from the leaves, flower buds, and fruit. [11] Clove is used as an expectorant and to treat unsettled stomach. Phlegm is simpler to cough up while using expectorants. [9] Cloves contain eugenol, which has potent anticarcinogenic qualities and is used to treat ovarian, breast, and lung cancer in its early stages.[17]

TYPES OF CLOVE OIL

Three varieties of clove oil exist.

Bud oil- *S. aromaticum* flower buds are used to make bud oil. Eugenol, eugenyl acetate, caryophyllene, and other minor components make about 60–90% of its composition.

Leaf oil- *S. aromaticum*'s leaves are the source of leaf oil. It has a concentration of 82–88% eugenol and contains only tiny amounts of eugenyl acetate.

Stem oil- *S. aromaticum* twigs are the source of stem oil. Eugenol makes about 90–95 percent of it, with a few additional trace amounts. [20]

FORMS OF CLOVE

Three different forms of clove are been in use:

1. Grounded cloves will be less potent than the other two since practically all of the oil content has been gone. [20]



GROUNDING CLOVES

2. Whole cloves: Due to the presence of some oil, these cloves have a medium strength. [26]



WHOLE CLOVE

3. Clove oil—the type with the most potency, which may be diluted with carrier oils for improved results—is the only one that is available. [20]



CLOVE OIL

PHARMACOLOGICAL ACTIVITY

Antimicrobial activity- When oral infections arise, clove oil is utilized as an antiseptic. Mold, yeast, and bacterial development have all been said to be inhibited by this essential oil. The potent biological and antibacterial properties of clove essential oil are due to the high amounts of eugenol it contains. According to research, cloves contain antibacterial characteristics that can inhibit the growth of bacteria and other microbes [17].

Antioxidant activity- High antioxidant activity was shown by the clove oil due to the presence of phenolic compounds like eugenol, thymol, and eugenol acetate. Clove has the capacity to give off hydrogen and reduce lipid peroxidation. With respect to lipid peroxidation, the inhibiting activity of clove oil is determined by using a linolenic acid emulsion system indicated a higher antioxidant activity than the standard BHT (Butylated hydroxyl toluene). [2]

Antibacterial activity- Clove's antibacterial properties have been demonstrated against a number of bacterial and fungi species. Clove extract, which has historically had a strong inhibitory effect, was studied by Sofia et al. It was discovered that clove oil was highly efficient against Staphylococcus species. between the fungus. Clove essential oil showed a germicidal impact on a variety of bacteria, including Aureus, Klebsiella pneumoniae, Pseudomonas aeruginosa, etc. when it was disseminated (0.4% v/v) in a concentrated sugar solution. [9]

Antifungal activity- The antifungal activity of the essential oil was studied and inhibition of growth was found against Alternaria alternate, Aspergillus flavus, Aspergillus versicolor, Fusarium culmorum, Fusarium oxysporum, Penicillium spp., Rhizopus spp., Rhizoctonia solani, Monilia fructicola, Trichophyton rubrum, Trichophyton mentagrophytes, Microsporum canis, Sclerotinia sclerotiorum, and Sclerotinia minor. According to the authors of this study, S. hortensis essential oil has more antifungal efficacy than amphotericin. [12]

Analgesic activity- Rabbits were given eugenol intravenously and intragastrically to test its analgesic effects. It was commonplace to use paracetamol. Compared to paracetamol, eugenol demonstrated more potential for lowering fever. [24]

Anaesthetic activity- The topical anesthetic eugenol is affordable and widely accessible. Compared to other local anaesthetics, it is relatively user-friendly and effective at lower dosages. There is no need for a withdrawal period because it is quickly digested and eliminated.

On inflamed pulpal tissues, eugenol has excellent anesthetic properties. [22]

Clove used as Mouthwash-

As a carminative, cloves are used to stimulate peristalsis and raise stomach acid levels. According to legend, cloves are a natural anthelmintic. [13] When stimulation and warmth are required, especially for issues with the gastrointestinal system, the essential oil is utilized in aromatherapy. The canal is claimed to warm when applied topically to the stomach or belly.

Using clove oil to fill a cavity in a rotting tooth also eases dental pain. [27]

Harvesting and processing: -

In 6 years, the trees start to blossom. The innovation lasts for at least 80 years after reaching full bearing, which takes around 20 years. The difference in bearing between years is significant. When the buds are fully grown and turn pink but before they open, that is when clove clusters are chosen. They are less than 2 cm long at this point. They are spread thinly on mats and often swirled for uniform drying. Well-dried cloves weigh roughly one-third as much as fresh ones and will snap with a light, sharp click over the thumb nail. As a spice, the opening blossoms are disliked. The twigs must not be damaged while harvesting since this would negatively impact the plants' subsequent growth. A clove tree typically generates between 3.5 and 7.0 kg each year, depending on the age, size, and health of the tree. [7]

Climate and soil: -

Clove trees thrive in the rich, loamy soils of the humid tropics and may also be cultivated effectively in the red soils of Kerala's midlands, the mountainous Western Ghats region of Tamil Nadu, and higher elevations of Karnataka. For flowering, a colder climate with evenly spaced rainfall is desirable; it does best in regions with annual precipitation of 150–300 cm. Clove growing requires a spot with sufficient drainage since the crop cannot endure standing water. [7] Since cloves are primarily tropical plants, they require a hot, humid atmosphere with temperatures between 20 and 30 °C. A humid environment with 150–250 cm square meters of evenly distributed yearly precipitation are necessary. It does well anywhere combined, from the water's edge up to a height of 1500 meters, as well as in areas near and far from the ocean. Clove cultivation is best suited to the deep black soil with high humus content found in the woodland inside the forest area. On dirt soils, clay loams, and made-black soils with good drainage, it grows successfully. Sandy soil is inappropriate. For growth, clove needs humid tropical and subtropical settings. It has been grown in the nations listed below, including

Indonesia. India and Sri Lanka Madagascar, Tanzania, Malaysia, etc. [2]

Post-harvest technology-

Clove trees start to blossom after four years, but it takes them 15 years to reach the full bearing stage. Depending on the tree's location, the flowering season ranges from September to October through December to January. On young branches, clove buds develop and need 4-6 months to mature enough to be harvested. When the petals' colour shifts from green to golden pink on the buds, they should be picked. You may harvest by hand or on a stepladder. To avoid branch breaking during harvest, care must be taken. The typical 15–20-year-old tree produces 3–4 kilogram of dried clove buds. 75 to 90 days following fruit set is the ideal period to gather clove seeds. Clove buds are hand-detached from their stalks after harvesting, then spread out on mats to dry. The drying process may take 4 to 5 days. Buds that have been thoroughly dried are firm, crisp, and dark brown with a moisture level of only 12%, and they may be kept in gunny bags for one to two years. The production of volatile oil from dried buds might range from 15 to 20 percent. [24]

Marketed products of clove- Dabur Herbal Clove

Toothpaste:



CLOVE TOOTHPASTE

USES

An excellent tasting toothpaste composed entirely of natural components is Dabur Toothpaste with Cloves. Cloves, which are recognized for their antibacterial and analgesic characteristics, are combined with natural extracts. It aids in the battle against germs, guards against tooth decay and cavities, and has analgesic properties that lessen toothaches. [7]

Herbin Clove Oil:-



HERBIN CLOVE OIL

Uses of Herbin Clove Oil-

- As an antibacterial, to aid in bacterial eradication.
- As a painkiller for ailments including toothaches and muscular discomfort.
- For unsettled digestion.
- To treat breathing disorders including asthma and cough.

Clove Powder-



CLOVE POWDER

Uses of Clove Powder:

1. Contain important nutrients....
2. High in antioxidants....
3. May help protect against cancer
4. Can kill bacteria. ...
5. May improve liver health....
6. May help regulate blood sugar....
7. May promote bone health....
8. May reduce stomach ulcers.

CLOVE SHAMPOO



CLOVE SHAMPOO

USES

Eliminates Dandruff: One of the many benefits of using clove oil on hair is its capacity to eliminate dandruff and calm irritated, dry scalp conditions. You can wash your hair with 8 ounces of your normal shampoo and 10 to 12 drops of clove oil to cure dandruff. [7]

CONCLUSION

According to the data provided, Clove flower buds had the maximum production, eugenol concentration, and refractive index at the blooming stage. In clove essential oils, eugenol, betacis-caryophyllene, and eugenol acetate were the primary ingredients. Developing a superior distillation technique to enhance oil quality and using clove essential oil as a natural antioxidant are two more crucial steps. According to the study, herbal toothpaste has received greater attention and acceptance in dental research and is safer and has less side effects than synthetic formulations. The toothpaste and oral hygiene can be used to demonstrate the antibacterial activity of the toothpaste against microorganisms. The anti-inflammatory, anti-pyretic, anticarcinogenic, aphrodisiac, and stress-relieving characteristics of clove are only a few of its notable systemic effects. It also has aampachaka, krumighna, sheer shool nashak, and kapha chedana activity because to its unique rasa panchak. Clinical trials on potential therapeutic effects must be conducted in the future for us to be able to confirm their usefulness in patient care. Clove has several significant systemic effects, including anti-inflammatory, anti-pyretic, anti-carcinogenic, aphrodisiac, and stress-relieving properties. Due to its special rasa panchak, it also possesses aampachaka, krumighna, sheer shool nashak, and kapha chedana activity. For future research, it is crucial to conduct some clinical trials on hypothesized medicinal activities. so that it will assist us in confirming its value in patient treatment. Clove oil is therefore included in a variety of dental goods and treatments, such as mouthwashes and tooth pastes. As a temporary replacement for root canal therapy, dentists also combine clove oil with zinc oxide and create a white filling substance.

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REFERENCE

- 1) Dr. Nidhi Garg and Dr. Akhil Jain (2019) THERAPEUTIC AND MEDICINAL USES OF LAVANGA-A REVIEW. International Journal of scientific research. 8 (10); 2277-8179.
- 2) Jaiswal Sangeeta Manbodh, Choudhary Suhail Ahmed, Choudhary Sidra Eram (2021) Clove: A Champion Spice and it's multiple Uses. An official publication of Human Journals. 22 (1); 432-442.
- 3) Brian P. Baker, Jennifer A. Grant, and Raksha Malakar-Kuenen. Cloves and Clove oil Profile. Journal of Cornell Cooperative Extension. (1); 1-15.
- 4) D. Saikumari, S.K. Shiva Rani and Neeti Saxena (2016) Antibacterial Activity of Syzygium aromaticum L. (Clove). International Journal of Current Microbiology and Applied Sciences. 5 (11); 484-489.
- 5) Marwa Abd Elmonem SULIMAN, Fatma Galal AHMED, Khaled Fahmy EL-KHOLY, Rehab Abd elhay MOHAMED and Lamiaa Fahmy ABDEL-MAWLA (2023) EFFECTS OF CLOVE (*Syzygium aromaticum*) ON PRODUCTIVE PERFORMANCE, NUTRIENTS VALUE AND DIGESTIBILITY, BLOOD LIPID PROFILE, ANTIOXIDANT STATUS AND IMMUNE RESPONSE OF GROWING RABBITS. Online Journal of Animal and Feed Research. 13 (1); 01-09.
- 6) José Nabor Haro-González, Gustavo A. Castillo-Herrera, Moisés Martínez-Velázquez, Hugo Espinosa-Andrews (2021) Clove Essential Oil (*Syzygium aromaticum* L. Myrtaceae): extraction, chemical composition, food applications and essential bio- activities for human health. Journal of Preprints. 1; 1-25.
- 7) Nitin S Gosavi, Swapnil S Koli, Davesh S Jire, Azam Z. Shaikh. (2020) Clove (*Syzygium Aromaticum*): A Miraculous Spice. AMERICAN JOURNAL OF PHARMACY AND HEALTH RESEARCH. 8 (5); 1-17.
- 8) B. Pavithra (2014) Eugenol-A Review. Journal of Pharmaceutical Sciences and Research. 6 (3); 153-154.
- 9) Vitthal B. Nigude, Saurav L. Shinde and Ishwar B. Rathod (2022) A review on - The medicinal uses of CLOVE. INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT. 7 (11); 2456-4184.

- 10) Nor Syakirah Binti Shahroom, Vishnu Priya V, Geetha RV (2016) In vitro Evaluation of Antibacterial Activity of Clove Bud Oil on Bacterial Pathogens. International journal of Pharma science research. 36 (2); 59-60.
- 11) Bijoy Kumar Dey and Suparna Sanyal Mukherjee (2021) Potential of clove and its nutritional benefits in physiological perspective: A review. International Journal of Physiology, Nutrition and Physical Education. 6(1); 103-106.
- 12) Kamal Nabhi, Bharti Sharma, Shujah Hussain Sheikh, Pooja Mehra and Anchal Sood. (2017) ROLE OF CLOVE, PIPER NIGRUM, CURCUMA LONGA & SAVORY IN DENTISTRY: A BOON IN HERBAL USAGE. International Journal of Recent Scientific Research. 8 (12); 22537-22545.
- 13) Aaditi R. Ingale, Vinayak M. Gaware, Rahul D. Khaire, Shraddha S. Bodke, Dr. Vivekanand A. Kashid. (2023) A Review On: Herbal Mouthwash an Effective Way for Oral Care. International Journal of Pharmaceutical Research and Applications. 8 (3); 25782583.
- 14) Dorsaf Ben Hassine, Salma Kammoun El Euch, Rami Rahmani, Nessrine Ghazouani, Rouguiata Kane, Manef Abderrabba and Jalloul Bouajila. (2021) Clove Buds Essential Oil: The Impact of Grinding on the Chemical Composition and Its Biological Activities Involved in Consumer's Health Security. Journal of Biomed Research International. 1; 1-11.
- 15) Shahid Hussain, Rafia Rahman and Ayesha Mushtaq, Asma El Zerey-Belaskri. (2017) Clove: A review of a precious species with multiple uses. International Journal of Chemical and Biochemical Sciences. 11 ;129-133.
- 16) Suraj Maurya, Shashikant Maury, Piyush Yadav, Manoj Kumar Yadav, Vishal Prajapati (2021) FORMULATION OF CLOVE TOOTH PASTE. Journal of Prasad institute of technology. 8 (5); 315-318.
- 17) Mukesh Yadav, Piyush Yadav, Shradha sahu, Vijay Yadav, Shyam Narayan Gupta (2021) Review Literature on Clove. INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS. 9 (1); 1883-1888.
- 18) Dr. Surendra Kumar Verma, Dr. Ayush Kumar Garg, Dr. Mangal Singh, Dr. Nikita Panwar, Dr. Manisha Meena and Dr. Chandan Singh (2018) EVALUATION OF ANALGESIC ACTIVITY OF SYZYGIUM AROMATICUM W.S.R. TO PAINFUL TOOTH. WORLD JOURNAL OF PHARMACEUTICAL RESEARCH. 7(5); 827-834.
- 19) Swayamprabha Pati, Scephali Sinha, Kajal, Sanyogita Shahi (2023) MEDICINAL VALUE OF CLOVE: REVIEW. Journal of Eur. Chem. Bull. 12(1); 171-177.
- 20) AISHWARYA. J, HARINI.N, KARTHIKEYAN.M (2014) CLOVE OIL AND ITS ROLE IN ORAL HEALTH- A REVIEW. International Journal of Pharmaceutical Science and Health Care. 3(4); 155-168.
- 21) Mayank Agrawal, Sonam Agrawal, Dr Radhika Rastogi, Dr Pallavi Singh, Dr Adyanthaya BR4, Dr Gupta H. L (2014) A review on uses of clove in oral and general health. Indian Journal of Research in Pharmacy and Biotechnology. 2(4); 1321-1324.
- 22) SJ Pulikottil, S Nath (2015) Potential of clove of Syzygium aromaticum in development of a therapeutic agent for periodontal disease. A review. Journal of SADJ. 70(3); 108-115.
- 23) Vinay Kumar Pandey, Rafeeya Shams, Rahul Singh, Aamir Hussain Dar, R. Pandiselvam,

- Alexandru Vasile Rusu and Monica Trif. (2022) A comprehensive review on clove (*Caryophyllus aromaticus* L.) essential oil and its significance in the formulation of edible coatings for potential food applications. *Journal of Frontiers in Nutrition*. (1); 1-24.
- 24) Shahid Hussain, Rafia Rahman' and Ayesha Mushtaq, Asma El Zerey-Belaskri (2017) Clove: A review of a precious species with multiple uses. *International Journal of Chemical and Biochemical Sciences*. (11);129-133.
- 25) Deepanjeet Kaur, Kaushal K Chandrul (2017) *Syzygium aromaticum* L. (Clove): A vital herbal drug used in periodontal disease. *Indian Journal of Pharmaceutical and Biological Research*. 5 (2); 45-51.
- 26) Daniel AN, Sartoretto SM, Schmidt G, Capatroz-assef SM, Bersani-Amado CA, Cuman RKN (2009) Anti-inflammatory and Antinociceptive activities A of eugenol essential oil in experimental animal modes. *Journal of Revista Brasileira de Farmacognosia*. 19; 212-217.
- 27) Balch Phyllis and Balch James (2000) Prescription for nutritional healing. *Journal of 3rd edn*. Avery publishing; 94p.

