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Formulation and Evaluation of Dental Gel by using Moringa Leaves

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Abstract: *This study aimed to formulate and Evaluate a dental gel utilizing the anti- Inflammatory properties of Moringa Oleifera leaves extract. The gel was Prepared using a simple method, Incorporating various concentrations of Moringa extract to determine the Optimal formulation. Evaluation Parameters included pH, viscosity, Spreadability, and in vitro release Kinetics.*
Additionally, the anti- Inflammatory activity of the formulated Gel was assessed using an in vitro Model. Moringa oleifera is a highly potent medicinal plant that has anti-inflammatory and immuno-modulatory properties. In our study, we aim to design, formulate, and evaluate the antibacterial efficacy of M. oleifera extract for local drug delivery (LDD) as periodontal treatment.Moringa oleifera, known as the "drumstick" or "horseradish" tree, is believed to have medicinal properties regarding a range of medical conditions, though there is limited information on its use in oral medicine. This narrative review focuses on the use of Moringa extracts in the management of oral conditions, including oral infections, inflammatory conditions, the remineralization of hard tissues, oral wound healing, and tissue regeneration, drawing from both in vitro and in vivo studies which indicate that the potential of Moringa extracts isupporting dentin-pulp regeneration after caries or trauma is worthy of more careful consideration.

Keywords: dental gel

I. INTRODUCTION

Moringa oleifera L. comes from the Moringaeceae family and is commonly known as Kelor in Indonesia, It is also described as a miracle tree due to its nutritional value, diverse functions, and medicinal properties. M. oleifera can grow up to 12 m in tropical and subtropical environments.Moringa oleifera (M. oleifera) is a mineral and vitamin rich, nutritious, and medicinally important tree species,belonging to the family Moringaceae. Common names include drumstick, ben oil, or horseradish tree . Its cultivation is widespread in the Himalayan foothills, with subsequent introduction to south east and west Asia, Arabian lands, east and west Africa, some states of the USA, and South America .

M. oleifera is considered to be a "super" plant by virtue of its exceptional properties to combat various illnesses in the human body Traditionally, M. oleifera has been used in medicine, skincare, breastmilk production, and even food.

Almost all parts of M. oleifera can be useful.In recent years, natural remedies have gained considerable attention for their potential therapeutic benefits, particularly in the realm of oral healthcare. Moringa oleifera, commonly known as the moringa tree, has emerged as a promising source of bioactive compounds with diversePharmacological properties. Among its numerous health benefits, moringa leaves have been recognized for their anti-inflammatory potential, making them an attractive candidate for oral health formulations. Dental inflamation whether resulting from periodontal disease, gingivitis, orOther oral conditions, presents a significant health concern globally. Conventional treatments often involve the use of synthetic drugs with potential side effects, driving the search for safer and more effective alternatives.

Moringa leaves, rich in bioactive compounds such as flavonoids, polyphenols, and vitamins, exhibit antiinflammatory properties that make them a compelling candidate for oral healthcare formulations.

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The phytochemistry of M. oleifera reveals different classes of compounds with the potential to confer health benefits. The presence and amount of these compounds vary according to the geographical location of cultivation, soil type, climatic conditions, and sun exposure .

Derivatives of this plant may also vary according to extraction methods, especially the use of different solvents including methanol, ethanol, and water . Numerous bioactive compounds can be extracted from this plant: flavonoids, phenolic acids, glucosinolates, saponins, tannins, steroids, alkaloids, and terpenes . The flavonoids present include rutin, quercetin, rhamnetin, kaempferol, apigenin, and myricetin and these compounds have numerous therapeutic effects including anti-inflammatory, antioxidant, antibacterial, and hypoglycemic and help in wound healing and tissue regeneration .. In addition, numerous phenolic acids are present in leaves, including caffeic acid, chlorogenic acid, gallic acid, and others Furthermore, all parts of the M. oleifera plant contain glucosinolates, giving the plant its potential cancer chemopreventive [, hypotensive and antibacterial , and potential activities against neurodegenerative diseases .

Tannins are proposed to contribute to anticancer, antimicrobial, and antihepatoxic activities]. Moringa also contains alkaloids with calcium-channel blocking activity used in antihypertensive therapy Moreover, the plant leaf and seed extracts were reported to be potent natural coagulants in the water purification process . Examples of such products include the nanomicelle of seed oil to treat cancer.

herbal nasal gels for the treatment of allergic rhinitis , alginate-pectin film dressing containing extracts of M. oleifera for wound healing application seed oil cream with anti-inflammatory properties and granules of Moringa extract as antiarthritic therapy .Recently, active molecules have been incorporated into dental materials with the objective of simulation of the dentin-pulp complex behavior to promote repair and regeneration and manage the inflammatory process and the deposition of mineralized tissue [34]. Therefore, the purpose of this narrative review is to present a comprehensive summary of the properties of M. oleifera extracts which may be beneficial in the regeneration of tissues and specifically in the damaged dental pulp.

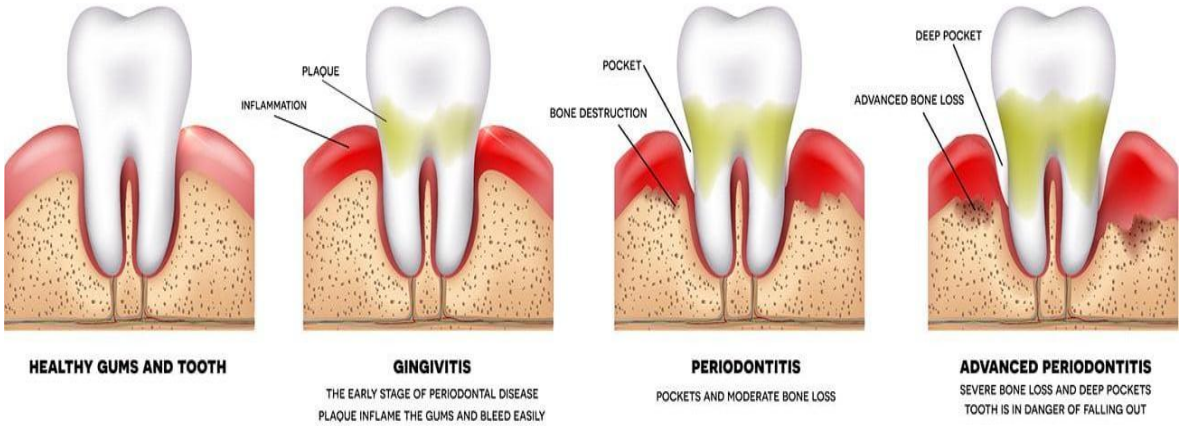

Fig. 1: Dental gingivitis and periodontitis

Aim and objective :- Aim :-

Formulation and evaluation of dental gel by using moringa leaves

Objective :-

- Screening of natural compounds to observe their potential against gingivitis and peridontitis
- Learn more about tooth inflammation
- Improve the quality of life for the person suffering from gingivitis
- Increase therapeutic action against inflammation of tooth by using herbal plant.

Determine the effectiveness of moringa leaf in influencing the anti-inflammatory cytokin analysis

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Future scope :-

- Selection of drug having anti-inflammatory and analgesic activity.
- Extraction of phytochemical constituent.
- Phytochemical screening.
- Formation of convenient dosage form.
- Analysis of antiinflammatory activity

Literature Review

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10) Pereira et al. (2019)
demonstrated that Moringa leaf extract exhibited significant anti-inflammatory activity by inhibiting the expression of pro-inflammatory cytokines and enzymes in oral tissues.

11) Gupta et al. (2017)
reported that Moringa leaf extract showed promising anti- inflammatory effects in a rat model of periodontitis, reducing gingival inflammation and bone loss.

12). Ahmed et al. (2020)
developed a Moringa leaf extract-based dental gel and found that it effectively reduced inflammation and improved periodontal health in patients with gingivitis.

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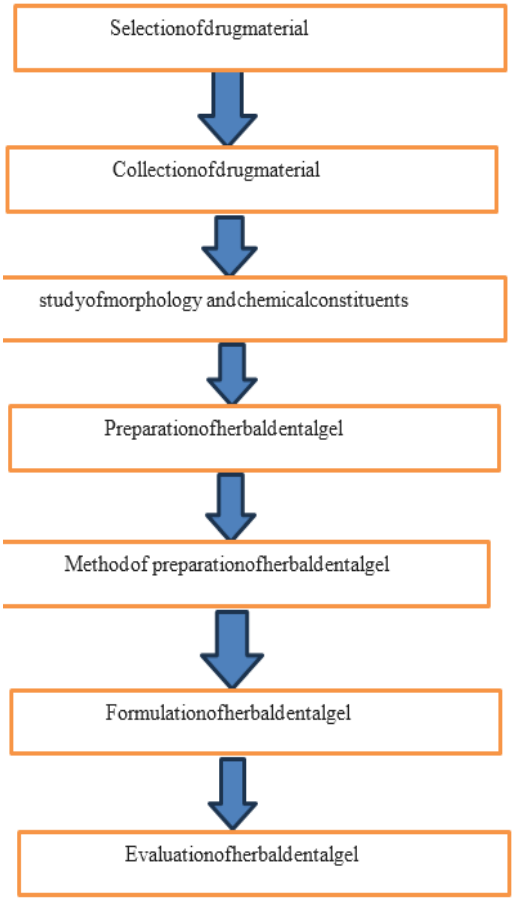
Plan of work



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Plant profile :-
Synonym :- Ben oil tree , Miracle tree ,Tree of leaf
Biological Source :- It is leaves of plant species Moringa Olifera ,also called as drumstic ktree . Cemical Constituent :- chemical constituents, including vitamins, minerals, amino acids, and various bioactive compounds like flavonoids, phenolic acids, and glucosinolates. These constituents contribute to the plant's numerous health benefits.
Key Chemical Constituents:
Vitamins:Moringa leaves are rich in vitamins A, C, B1, B2, B3, and E.
Minerals:They contain essential minerals such as calcium, iron, magnesium, potassium, and zinc.
Amino Acids:Moringa leaves are a good source of essential amino acids like lysine, serine, glycine, alanine, and tyrosine.
Bioactive Compounds:
Flavonoids: These include quercetin, kaempferol, and myricetin, known for their antioxidant properties.
Phenolic Acids: Compounds like gallic acid, chlorogenic acid, and coumaric acid contribute to the plant's antioxidant and antimicrobial activities.
Glucosinolates: These compounds, particularly in the Moringa oleifera species, have been linked to anti-inflammatory, antioxidant, and anticancer properties.
Other Bioactive Compounds: Moringa leaves also contain alkaloids, saponins, tannins, steroids, terpenes, and phytosterols, each contributing to the plant's diverse medicinal uses.
Moringa leaves also contain carbohydrates, crude proteins, ash, fatty acids, and crude fiber. Common names
Moringa, drumstick tree, ben oil tree, benzolive tree, benzoil tree, horse-radish tree, horseradish tree, West Indian ben [English]; ben oléifère, ben ailée, moringa ailée, pois quénique [French) Moringa (Moringa oleifera Lam.) is a multipurpose tropical tree. It is mainly used for food and has numerous industrial, medicinal and agricultural uses, including animal feeding. Nutritious, fast-growing and drought-tolerant, this traditional plant was rediscovered in the 1990s and its cultivation has since become increasingly popular in Asia and Africa, where it is among the most economically valuable crops. It has been dubbed the “miracle tree” .

Morphology :-
Moringa is a small to medium evergreen or deciduous tree that can grow to a height of 10-12 m. It has a spreading open crown, typically umbrella- shaped. The roots are deep. The bole is crooked, generally onestemmed but sometimes forked from the base. The bark is corky and grey. The branches are fragile and drooping, with a feathery foliage. Young twigs and shoots are covered in short dense hairs, purplish or greenish white in colour.
Moringa leaves are alternate, 7-60 cm long, tripinnately compound with each pinnate bearing 4- 6 pairs of leaflets that are dark green, elliptical to obovate, and 1-2 cm in length. The inflorescences are 10-20 cm long, spreading panicles bearing many fragrant flowers. Moringa flowers are pentamerous, zygomorphic, 7-14 mm long and white to cream in colour. The fruit is a typically 3-valved capsule, 10 to 60 cm in length, often referred to as a “pod” and looking like a drumstick (hence the name “drumstick tree”). The fruit is green when young and turns brown at maturity. The mature fruit splits open along each angle to expose the seeds. The capsule contains 15-20 rounded oily seeds, 1-1.5 cm in diameter surrounded by 3 papery wings, up to 2.5 cm long. Moringa seeds contain a large amount of oil.
Different parts of the MO tree have been established as being good sources of unique glucosinolates, flavonoids and phenolic acids (Amaglo et al. 2010; Coppin et al. 2013), carotenoids (Saini et al. 2014c), tocopherols (Saini et al. 2014e), polyunsaturated fatty acids (PUFAs) (Saini et al. 2014d), highly bioavailable minerals (Saini et al. 2014a), and folate (Saini et al. 2016). Among glucosinolates, 4-O-(a-L-rhamnopyranosyloxy)-benzylglucosino- late (glucomoringin) is the most pre- dominant in the stem, leaves, flowers, pods and seeds of M. oleifera (Amaglo et al. 2010). Although in the roots, ben- zyl glucosinolate (glucotropaeolin) is the most prominent. The highest content of glucosinolate is found in the leaves and seeds.
Although in the roots, ben- zyl glucosinolate (glucotropaeolin) is the most prominent. The highest content of glucosinolate is found in the leaves and seeds. The enzymatic catabolism of glucosinolates by the endogenous plant

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enzyme myrosinase produces isothio- cyanates, nitriles, and thiocarbamates that are known for strong hypotensive (blood pressure lowering) and spas- molytic (muscle relaxant) effects (Anwar et al. 2007).

Among flavonoids, flavonol glycosides (glucosides, rutinosides, and malonyl glucosides) of quercetin > kaempferol > isorhamnetin are predominantly found in various parts of the tree, except in the roots and seeds. In the leaves, the amount of quercetin and kaempferol was found to be in the range of 0.07-1.26 and 0.05-0.67%, re- spectively. Also, among different vari- eties, the Indian varieties (PKM-1 and PKM-2) have shown a higher total con- tent of quercetin and kaempferol, com- pared to the African indigenous samples. *The phytochemistry of M. oleifera reveals different classes of compounds with the potential to confer health dge benefits. The presence and amount of these compounds vary according to the geographical location of cultivation, soil type, climatic conditions, and sun exposure . Derivatives of this plant may also vary according to extraction methods, especially the use of different solvents including methanol, ethanol, and water . Numerous bioactive compounds can be extracted from this plant:

flavonoids, phenolic acids, glucosinolates, saponins, tannins, steroids, alkaloids, and terpenes

.The flavonoids present include rutin, quer- cetin, rhamnetin, kaempferol, apigenin, and myricetin , and these compounds have numerous therapeutic effects including anti-inflammatory, antioxidant, antibacterial, and hypoglycemic and help in wound healing and tissue regeneration . In addition, numerous phenolic acids are present in leaves, including caffeic acid, chlorogenic acid, gallic acid, and others . Furthermore, all parts of the M. oleifera plant contain glucosinolates, giving the plant its potential cancer chemopreventive , hypotensive and antibacterial , potential activities against neurodegenerative diseases . Tannins are proposed to contribute to anticancer, antimicrobial, and antihepatoxic activities . Moringa also contains alkaloids with calcium- channel blocking activity used in antihypertensive therapy . Moreover, the plant leaf and seed extracts were re- ported to be potent natural coagulants in the water purifi- cation process . extracts of M. oleifera for wound healing application ; seed oil cream with anti-inflammatory properties , and granules of Moringa extract as antiar- thritic therapy . Recently, active molecules have been incorporated into dental materials with the objective of simulation of the dentin-pulp complex behavior to promote repair and re- generation and manage the inflammatory process and the deposition of mineralized tissue [34]. Therefore, the purpose of this narrative review is to present a comprehensive summary of the properties of M. oleifera extracts which may be beneficial in the regeneration of tissues and specif the damaged dental pulp.

Fig. 2 : Moringa plant

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Fig . 3 : Moringa leaves

Material and method :-

Plant material :-

The leaves of moringa oleifera was collected from the residential area of dental collage near nalwandi naka ,Beed Maharashtra India

Preparation of plant extract :-

Shade drying was done for almost a month as to avoid chemical degradation due to sunlight. Grinding of the dried material was done, with the aid of a grinder and converted into coarse powder.

The powder was sieved. 50 gm defatted powdered; material was extracted in methanol 100 ml by maceration process

Chemicals :-

Carbapol, Polyethylene glycol, Glycerine, Methyl Paraben, Propyl Paraben, Honey, Distilled Water.

Apparatus :-

Apparatus such as beaker, glass slide, measuring cylinder, test tube, volumetric flask

Instruments :-

pH meter, Mechanical stirrer, Viscometer.

Phytochemicals screening Alkaloids :-

(1)Dragendroffs test :-

few drops of dragendroff reagent (a mixture of potassium bismuth iodide & tartaric acid) +

Sample →

reddish brown precipitat

ii) Mayers test :-

potassium mercuric iodide + sample → creamy precipitate

iii) Wagners test :-

Wagners reagent (a solutions of iodine in potassium iodide) + sample → reddish brown precipitate

iv) Hagers test :-

Hagers regent (solutions of picric acid + Hcl → yellow precipitate

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Flavonoids

i) Shinoda test

Few drop of conc. HCl + sample piece of magnesium ribbon → pink , red or voilet colour

ii) Alkaline reagent test

few drop of dilute alkaline solutions (Sodium Hydroxide / potassium hydroxide) Sample → Yellow Colour → turn colour less upon add dilute acid.

iii) lead acetalu test

Jead acetate soln + sample followed by dilute HCI → yellow ppt or colour change

iv) ferric chloride test

Ferric Chloride soln + sample → green / blue / purple.

Table 1:-List of material

Sr No.	Material Name	Quantity (f1)	Quantity (F2)	Quantity (F3)
1	Moringa extract pharmaceutical (active component)	1 ml	2ml	3ml
2	Carbapol 940 (Gelling agent)	0.3gm	0.4gm	0.5gm
3	Methyl paraben (Preservative)	0.18gm	0.20gm	0.21gm
4	Propyl paraben (Preservative)	0.02gm	0.04gm	0.05gm
5	Propylene glycol (Cosolvents)	5ml	6ml	7ml
6	Glycerine (Drug solubilizer)	5ml	6ml	7ml
7	Triethanolamine (Neutralizer)	0.5 ml	0.6ml	0.7ml
8	Honey (Sweetner)	1ml	2ml	3ml
9	Distilled water	q.s	q.s	q.s

Procedure :-

Procedure for preparation of herbal dental gel

1) Soaking: soaked carbapol 940 in water.

2) Neutralization: Neutralize with triethanolamine to pH 9.4.

3) Addition of preservative: Addition of propyl and methyl Paraben.

4) Addition of co-solvent and API: Addition of propylene glycol and MOE in another test tube.

5) Addition of sweetener: Finally, honey is added.

6) Stirring: Stirring is done until a homogeneous product is formed.

Evaluation of parameters 1)Appearance:

All the formulations of lantana gel were pale yellow in colour.

2) Consistency:

The consistency was checked by applying on skin.

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3) Greasiness:
The greasiness was assisted by the application on to the skin.

4) Determination of pH:
pH of gel was determined using digital pH meter by dipping the glass electrode completely into the gel system.

5) Determination of viscosity:
Viscosities of the formulated gels was determined using Brooke field viscometer, spindle no. 7 and spindle speed 60 rpm at 25-C was used gels, the corresponding dial reading on the viscometer was noted.

6) Determination of spreadability:
Spreadability was measured by this method on the basis of the slip and the drug characteristics of the gel Put on the ground slide and the excess gel (approximately 2 g) under analysis. The gel was then placed Between the slides and 200 g weighted for 5 minutes wasPlaced on the top of 2 slides to expel air to Provide a uniform gel film between the slides where excess gel was scrapped off the edges. The time noted By the top slide (in seconds) to cover a distance of 7.5 cm must be noted. Spreadability was determined
Using following formula, S=M. L / T

Fig. Spreadability of Dental Gel

Table 2 :- The physical characteristics of herbal dental gel

Sr.No.	Evaluation parameters	Observation
1	Appearance	Pale yellow
2	Odour	Fresh natural odour
3	Test	Sweet
4	PH	6.12
5	Spreadability	17.30g_cm
6	Extrudability	93.40%
7	Homoginisity	Very good

`Table 3 :- Stability study after one week

Sr.No	Evaluation parameters	Observation
1	Appearance	Pale yellow
2	Odour	Fresh natural odour

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3	Test	Sweet
4	PH	6.12
6	Spreadability	17.30g_cm
7	Extrudability	93.40%
8	Homoginisity	Very good

RESULT AND DISCUSSION

Evaluation of Herbal gel:

All results of different parameters of evaluation are recorded. The physical parameter such as color, Appearance, feel on application are observed and shown in Table4. The color of prepared herbal gels was Yellowish. The color of extracts was greenish yellow. Appearance of gel was translucent and it was smooth On application. So it shows significant physical evaluation parameters. The subjective properties mention in

Table 2 such as consistency was good and texture of prepared herbal gel was found to be smooth. All the Prepared herbal gel formulations show desirable spreadability values.

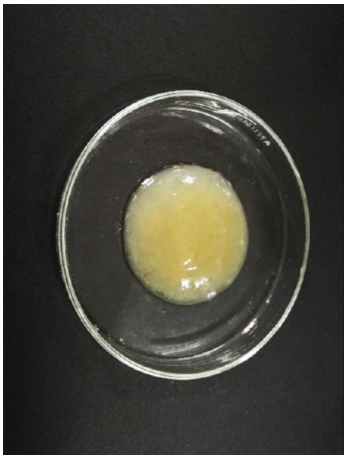

Fig. Dental gel

II. CONCLUSION

It is concluded, on the basis of the results obtained in the present analysis, that the herbal formulation of Moring extracts gel shows satisfactory physicochemical parameters. Herbal products are assumed to be safe For longer periods of time. However, quality control for efficacy and safety of herbal products is of paramount Importance; and quality control tests must therefore be carried out for these preparations. The extract of this Plant shows analgesic as well as anti- inflammatory properties. A study on the effects of formulated gels has Shown that further studies are needed to confirm the role of each of these phytoconstituents activity. Thus, Our research shows that herbal gel have good analgesic and anti- inflammatory activity.

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