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Research Article

Formulation And Optimization Of Polyherbal Gel For Management Of Aphthous Stomatitis

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ABSTRACT

Aphthous stomatitis is the most common condition we encounter. Clinically, the lesions are simple or multiple superficial and deeply sealed and are associated with microbial invasions. This study was conducted to evaluate the efficacy of herbal medicines in the treatment of Aphthous stomatitis. In research work, oral ulcer gels containing extracts of Psidium guajava, Ocimum tenuiflorum, and Azadirachta indica were formulated using Carbopol 934 as a gelling agent. Seven batches were formulated by varying the concentration of herbal ingredients (F1 to F7). The prepared preparations were evaluated for various parameters such as physical appearance, pH, Spreadability, homogeneity, and antimicrobial activity against fungi and bacteria. Antimicrobial activity was also compared with a gel formulation on the market. All prepared formulations using different concentrations of plant extract showed pH values between 6.1±0.2 to 7.0±0.1. Spreadability values ranged between 5.0 and 8.0 cm. Of all the preparations, the F7 preparation containing all three herbal extracts showed good Spreadability and very promising antimicrobial activity comparable with the marketed gel.

INTRODUCTION

Aphthous stomatitis or mouth ulcer is an ulcerative condition that is related to the oral mucosa and is characterized by recurrent sores in the throat and oral cavity.1 Mouth ulcers are usually caused by several causes, such as biting the inner layer of the cheek, food allergies, harsh tooth brushing, hormonal changes, vitamin deficiencies, bacterial infections, and disease.2 Treatment of mouth ulcers may include soothing/antiseptic mouthwashes such as chlorhexidine mouthwash or povidone-iodine mouthwash or the use of antibiotic or anesthetic gel formulations.3

Semi-solid formulations include a gel with a liquid phase, which is then thickened with other ingredients. Topical gels are intended to be applied

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to the skin or certain mucosal surfaces for local action or percutaneous penetration of medicinal products.4 A large number of Indian medicinal plants are attributed to various pharmacological activities because they contain different classes of phytochemicals. As conventional synthetic drugs suffer from numerous side effects, these herbal ingredients are a good alternative.5 Psidium guajava is an evergreen shrub that belongs to the Myrtaceae family. Alkaloids, carotenoids, phenols, and flavonoids are found in this plant, quercetin in particular is the main component. It has demonstrated several activities including antibacterial, anti-diarrheal, and anti-ulcer properties. Guava leaves contain essential oils such as isopropyl alcohol, menthol, α-pinene, terphenyl acetate, limonene, β-pinene, caryophyllene, and β-bisabolene. Oleanolic acid is also found in guava leaves. The leaves are high in limonene about 42.1% and caryophyllene about 21.3%. Guava leaves contain many volatile compounds. The present research deals with a gel formulation using ethanol extract of guava leaves for the treatment of mouth ulcers.6 Azadirachta indica, commonly called neem, belonging to the Meliaceae family, is rich in several phytoconstituents such as nimbin, nimbidin, nimbolide, and limonoids, quercetin and sitosterols. They have very strong antibacterial, antifungal, and anti-inflammatory activity7 and are quite commonly used for oral and dental treatments. The leaves of Ocimum tenuiflorum, called tulsi, belonging to the Lamiaceae family, is a common herb known for its wide range of pharmacological activities such as antimicrobial, antioxidant, anti-inflammatory, analgesic, antipyretic, immunomodulatory, hepatoprotective and neuroprotective effects. The pharmacological activities of Ocimum tenuiflorum can be attributed to the presence of phytoconstituents such as eugenol, methyl eugenol, carvacrol, sesquiterpene, apigenin, luteolin, and ursolic acid.8 Thus, in this research work, ethanolic extracts of these plants were incorporated into gel formulations that could be used for the treatment of mouth ulcers, a condition that is associated with microbial invasion.

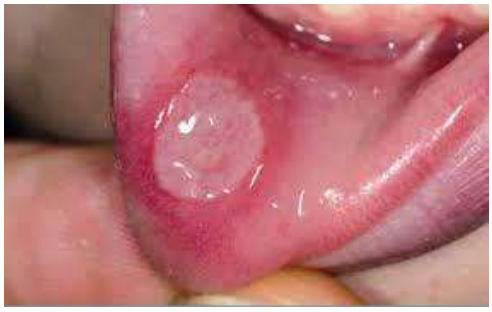

Fig.1: Aphthous stomatitis

MATERIALS AND METHODS

Collection of materials

Azadirachta indica, Ocimum tenuiflorum and Psidium guajava leaves were collected from medicinal garden and authenticated by Department of Botany, RTMNU, Nagpur. Carbopol 934 was purchased from Colorcon in Asia. All other solvents were of analytical grade.

Preparation of extracts

Preparation of psidium guajava leaves extract:

A Soxhlet extractor was set up to obtain the ethanolic extract of Psidium guajava leaves. 100 g of coarsely ground Psidium guajava leaves were placed in the thimble and the thimble was placed in the main chamber of the Soxhlet extractor. 500 mL of ethanol was added to a round bottom flask and placed on a heating mantle. A Soxhlet extractor was attached to a round bottom flask. A return cooler was connected above the extractor with the cold water inlet connected at the lower end and the outlet at the top. The solvent was heated to reflux and extracted until the resulting extract was colorless.

Preparation of Azadirachta indica and Ocimum tenuiflorum leaves extract:

The leaves of Azadirachta indica and Ocimum tenuiflorum were dried to preserve the phytoconstituents and separately macerated with ethanol and separated by centrifugation to obtain

ethanolic extract of Ocimum tenuiflorum and ethanolic extract of Azadirachta indica, respectively. All extracts were stored at room temperature.

Phytochemical screening9,10

All the extracts prepared above were subjected to preliminary phytochemical screening tests to identify the presence of different components, using different tests and reagents.

Formulation of gel

A sufficient amount of Carbopol 934 was soaked overnight inA distilled water and then mixed with distilled water with constant stirring using a mechanical stirrer.11 Another solution containing various concentrations of the extract and the desired amount of methylparaben and propylparaben was added while stirring. Propylene glycol was also added to the solution. The solution thus prepared was then thoroughly mixed with the Carbopol 934 solution with constant stirring, the volume was made up to 30 ml with water, and the pH was adjusted by adding triethanolamine to obtain a gel of the desired consistency. Seven formulations (F1 to F7) of herbal gel were prepared.

Table 1: Formulation of herbal gels

Sr. No	Ingredients	F1	F2	F3	F4	F5	F6	F7
1	Extract of Psidium guajava (ml)	4	-	-	4	4	-	4
2	Ethanolic extract of Azadirachta Indica leaves (ml)	-	3	-	3	-	3	3
3	Ethanolic Extract of Ocimum sanctum leaves (ml)	-	-	3	-	3	3	3
4	Carbopol 934 (gm)	20	20	20	20	20	20	20
5	Methyl Paraben (gm)	0.2	0.2	0.2	0.2	0.2	0.2	0.2
6	Propyl Paraben (gm)	0.1	0.1	0.1	0.1	0.1	0.1	0.1
7	Propylene Glycol (ml)	2	2	2	2	2	2	2
8	Water upto (ml)	30	30	30	30	30	30	30

EVALUATION OF GEL 11–14

Visual appearance

The prepared gels were tested for color, clarity, texture, transparency, and the presence of any coarse particles.

Measurement of pH

The pH value of the herbal gel preparations was determined using a digital pH meter. 1 g of gel was taken and dispersed in 10 ml of distilled water and kept aside for two hours. The pH of the formulation was measured three times and the average values are shown. The pH of the gel formulation was reported.

Homogeneity

All developed gel formulations were tested for homogeneity by visual inspection after the gels had been set into the container. They were tested for their presence and appearance of any aggregates.

Spreadability

Spreadability is expressed in terms of time in seconds taken by two slides to slip off from gel that is placed in between the slides under the direction of a certain load. If the time taken for the separation of two slides is less than the spreadability.

Spreadability is calculated by using the formula:

$$S = M \times L / T$$

Where,

M = weight tied to upper slide

L = length of glass slides

T = time taken to separate the slides

3.5. Viscosity

The viscosity of all the prepared formulations was analyzed by the Brookefields viscometer LVDVE with helipath, using spindle number 96 at 10 rpm.

Antimicrobial activity

The antimicrobial activity of all seven gel formulations and the sold mouth ulcer gel was performed by the well diffusion method.15 Two microbial cultures of Candida Albicans (fungi) and E. coli (bacteria) were used. The antibacterial activity of the prepared gel formulations was performed using the agar well diffusion method. Nutrient agar medium plates were prepared. Each plate was inoculated with an aliquot (0.1 ml) of the bacterial suspension, which was spread evenly over the surface of the plate medium. After 15 minutes, 6 mm diameter wells were made using a sterile cork borer in the solid medium and filled with 0.5 g of gel. All plates were incubated at 37°C for 24 hours. Antibacterial activity was evaluated by measuring the diameter of the zone of inhibition (ZOI) in mm. Triplicates were performed for each extract against each of the test organisms. Plates with Sabouraud dextrose agar medium were prepared for antifungal activity. Each plate was inoculated with an aliquot (0.1 ml) of the fungal suspension which was spread evenly on the solid medium. After 15 minutes, wells with a diameter of 6 mm were made using a sterile corkscrew and filled with 0.5 g of gel preparations. All plates were incubated at 27°C for 5-7 days and then the mean of the inhibition zone was recorded. Triplicates were performed for each extract against each of the test organisms.

RESULT AND DISCUSSION

Collection and authentication of plant

The collected leaves of Azadirachta indica, Ocimum tenuiflorum, and Aloe barbadensis were identified and authenticated by Dr. N. M. Dongarwar Department of Botany, authentication number 1033010332 and 10333 respectively.

Phytochemical screening

Preliminary quantitative phytochemical investigations of plant extracts are presented in the table. Thus, the three extracts contain different types of phytoconstituents that may be responsible for their antimicrobial activity.

Table 2: Phytochemical Investigation of Extracts

Sr. No	Phytochemical Constituents	Psidium guajava	*Azadirachta Indica*	*OcimumSanctum*
1	Carbohydrates	-	-	-
2	Protein	+	-	-
3	Amino Acids	+	-	-
4	Glycoside	-	-	+
5	Flavonoids	-	+	+
6	Alkaloids	-	+	+
7	Tannins	-	+	+
8	Saponin	+	+	+
9	Phenolic Compounds	+	+	+
10	Steroids	+	+	+

Formulation of herbal gel

Seven herbal gel formulations were formulated by varying the herbal ingredients in each of the formulations as shown in table 1.

Evaluation of gel

All prepared gel formulations were evaluated for parameters such as physical appearance, pH, homogeneity, spreadability, and viscosity.

Observation shows that the gels had a smooth texture and an elegant appearance. It was found that the pH of all prepared gels is in the range of 6.5-7.0. All gels showed good spreadability. Also from the above data, it was observed that increasing the concentration of the plant extract increases the spreadability. All prepared gels showed good homogeneity with no lumps. The developed preparations were much clearer and more transparent. The viscosity of all developed gels was found to be excellent and within the given range.

Table 3: Various parameters of prepared gel formulations

Formulation	Physical Appearance			pH	Homogeneity	Spreadability (cm)
	Colour	Texture	Clarity			
F_1	Green	Smooth	Clear	6.20	Homogenous	6.35
F_2	Greenish Brown	Smooth	Clear	6.84	Homogenous	6.95
F_3	Slightly Yellow	Smooth	Clear	6.80	Homogenous	7.12
F_4	Greenish Brown	Smooth	Clear	7.00	Homogenous	7.21
F_5	Green	Smooth	Clear	6.87	Homogenous	7.53
F_6	Green	Smooth	Clear	6.72	Homogenous	7.97
F_7	Greenish Brown	Smooth	Clear	6.77	Homogenous	8.17

Antimicrobial activity

The antimicrobial activity was studied using the well diffusion method. Out of all the formulations, the F7 gel containing all three ethanolic extracts showed the highest zone of inhibition and it was comparable with the marketed gel formulation, both against C. albicans and E. coli.

Table 4: Antimicrobial activity of prepared gel formulations

Formulations	Zone of Inhibition	
	Candida Albicans	E-Coli
F1	14±0.5	16±0.5
F2	16±0.6	15±0.7
F3	17±0.5	18±0.9
F4	16±0.6	19±0.6
F5	15±0.8	18±0.4
F6	18±0.4	20±0.2
F7	19±0.5	20±0.5

CONCLUSIONS

Currently, herbal formulations are in high demand in the market due to their cost-effectiveness and absence of any side effects. From the above experimental data, it is clear that the gel formulation with plant ingredients such as Psidium guajava, Neem, and Tulsi has good properties and viscosity and also has good antimicrobial activity which is essential in the treatment of Aphthous stomatitis.

REFERENCES

1. Charde K, Upadhye KP, Gholse YN, Chaple DR. Current updates on recurrent aphthous stomatitis: etiology, pathogenesis and management. World J Pharm Pharm Sci. 2020;9(5):448–462.

2. Deshmane S. A review on oral mouth ulceration. Int J Pharm. 2014;1(1):216–29.
3. Mohd, Ad, Sakarkar DM, Kosalge SB, Shafiq S. " Formulation Development and Evaluation of Unit Moulded Herbal Semisolid Jelly useful in treatment of Mouth Ulcer. J Pharma Biomed Anal. 2011;3:1705–13.
4. Misal G, Dixit G. Formulation and evaluation of herbal gel. Indian J Nat Prod Resour. 2012;3(4):501–6.
5. Teresa A. Herbal Remedies for Mouth Ulcer: A Review. J Bio Innov. 2017;(4):521–7.
6. Sharma TR, Shilpi A. Multiple biological activities of aloe barbadensis (aloe vera): an overview. Asian J Pharm Life Sci. 2011;1(2):268–72.
7. Alzohairy MA. Therapeutics Role of Azadirachta indica (Neem) and Their Active Constituents in Diseases Prevention and Treatment. Evid Based Complement Altern Medicine. 2016;2016:7382506. doi:10.1155/2016/7382506.
8. Kumar A, Agarwal K, Maurya A, Shanker K, Bushra U, Tandon S, et al. Bawankule "Pharmacological and phytochemical evaluation of Ocimum sanctum root extracts for its anti-inflammatory, analgesic and antipyretic activities" Pharmacogn Mag. Pharmacogn Mag. 2015;11(1):217–24. doi:10.4103/0973-1296.157743.
9. Scully C, Felix DH. Oral Medicine Update for The Dental Practitioner Apthous and Other Common Ulcer. Br Dent J. 1999;1999(5):259–64. doi:10.1038/sj.bdj.4812649.
10. Manhar S, Suresh PK. Dilitiazem-Loaded Buccoadhesive Patches For Oral Mucosal Delivery: Formulation And In Vitro Characterization. J Appl Pharm Sci. 2013;3(8):75–9. doi:10.7324/JAPS.2013.3813.
11. Sing R, Bansal S, Mishra MK. Formulation and Evaluation of Herbal Oral Gel Containing Extracts of Powdered Psidium guajava LinnLeaves with Curcuma longa Linn Rhizomes to Treat Mouth Ulcer. Int J Drug Dev Res. 2020;12(2):1–7. doi:10.36648/0975-9344.12.2.150.
12. Rathod J, Mehta DP. A Review on Pharmaceutical Gel. Int J Pharm Sci. 2015;1(1):33–47.
13. Sheikh S. Studies on Inorganic Materials Based Antiulcer Pharmaceutical Gel for Oral Cavity. Formulation and Evaluation. Acta Scientific Pharmaceutical sciences. Acta Sci Pharm Sci. 2018;2(7):38– 44.
14. Shete S. Formulation and evaluation Pharmaceutical aqueous gel of powdered Guava leaves for Mouth Ulcer Treatment. Pharma Tutor. 2018;1(4):32–8.
15. Powar PV, Bhandari NR, Arya A, Sharma P. Formulation and evaluation of polyherbal antibacterial gel based hand wash". Int J Pharm Sci Rev Res. 2015;33(1):79–82.

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