WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 9, Issue 14, 1400-1409. Research Article ISSN 2277– 7105

FORMULATION AND EVALUATION OF HERBAL LOZENGES FOR PHARYNGITIS

Chaithanya A. P.*[1], Prothibha Das[1], Ajith Babu T. K., Adila K. K.[1], Ansifa[1], Ansiya Salim[1] and Mohammed Hafiz K. M.[1]

Dept. of Pharmaceutics, Malik Deenar College of Pharmacy, Kasaragod.

Article Received on
21 Sept. 2020,

Revised on 11 Oct. 2020,
Accepted on 31 Oct. 2020

DOI: 10.20959/wjpr202014-19185

***Corresponding Author**
Chaithanya A. P.
Dept. of Pharmaceutics,
Malik Deenar College of
Pharmacy, Kasaragod.

ABSTRACT

The *Plectranthus amboinicus*, traditionally has been used to treat malarial fever, renal and vesical calculi, cough, chronic asthma, bronchitis. The juice of *Plectranthus amboinicus* leaves with honey is helpful in cold and cough, the concentrated decoction consumed while warm is effective in respiratory and throat infections. The juice is mixed with sugar is a powerful carminative. Pharyngitis is an inflammation of pharynx, which is in the back of the throat. It is most often referred to simply as "sore throat". Pharyngitis can also cause scratchiness in the throat and difficulty for swallowing. These are caused by both bacteria and virus. A lozenge is small usually sweetened and flavoured medicated material that is designed to be held in mouth for slow dissolution. They are used to soothen & lubricate irritated tissues of the throat. The present study is to prepare herbal lozenge of leaf extract of *Plectranthus amboinicus* by using liquorice syrup as vehicle. The target is to attain a formulation for pediatric and diabetic patients.

KEYWORDS: *Plectranthus amboinicus*, pharyngitis, liquorice, lozenges.

INTRODUCTION

Over the last decade the treatment of illness has been accomplished by administrating drug to human body via various routes namely oral, parenteral, topical, inhalation etc. Every medical condition demands an accurate and appropriate treatment. As a matter of fact, the thought of resolving patient's disease with least harm done to the patient's health is said to be the basic goal of any therapy. More over a good treatment technique necessitates through knowledge of pharmacokinetics and pharmacodynamics of the intended drug. Hence we struggle day today

relentlessly to research and better techniques and technology to develop with best mode of treatment ensuring as well as assuring safety of patient.[1] Herbal drugs having advantages over allopathic drug, side effects of herbal drugs are less when compared to that of allopathic drug. By the use of herbal drugs the disease can be completely cured.

A sore throat, due to pharyngitis or tonsillitis is common complaint among children, adolescents and adults. It could be an early symptom of another medical problem, such as cold and flu or something more substantial such as tonsillitis.[2] The leave extract of *Plectatranthus ambonicus* is conventionally used in case of fever, flu, sore throat, influenza etc. It is mainly used in infants and children for throat infection along with honey.[3]

Lozenges are solid preparations that contain one or more medicaments, usually in a flavoured, sweetened base that are intended to dissolve or disintegrate slowly in the mouth they can be prepared by molding or by compression of sugar based tablets.[4] They are used for patients who cannot swallow solid oral dosage forms as well as for medication designed to be released slowly to yield a constant level of drug in the oral cavity or bathe the throat tissues in a solution of the drug. Lozenges historically have been used for the relief of sore throat pain and irritation and have been used extensively to deliver topical anesthetic and antibacterial effects.[5]

The volatile oil obtained from *Plectranthus amboinicus* leaves having antibacterial and anti-inflammatory effects. This oil can be easily in cooperated with the syrup base to form lozenge. It produce an effective anti-microbial action.[6]

Liquorice contain saponin glycoside obtained from *Glycirrhiza glabra* which is commonly used as an anti-inflammatory agent in throat widely used in throat infection. It also has anti diabetic activity. These are converted into syrup form and can be easily molded into the lozenge form. It is effectively used in the treatment of sore throat.[7]

Advantage of liquorice base over sugar syrup base

Sugar syrup being contain sucrose as its main constituent, may be the risk factor for diabetes. Since the anti-diabetic activity of liquorice has been proven, these may be used as the base which can be administered effectively by diabetic patient as well as elderly who are at high risk of diabetes. Moreover, the formulation contains volatile oil which has an anti-bacterial activity and the base liquorice has anti-inflammatory activity. That is the drug inhibit the

growth of microorganism and the base aid in healing of throat infection. Combined action of drug and base is effective in treatment of pharyngitis.

ADVANTAGES

It is easy to administer in both pediatric and geriatric patients.

It can be prepared with minimal equipment.

It extends the time of drug in the oral cavity to elicit a specific effect.

Systemic absorption as well as topical actions of drug can be possible in buccal cavity.[8]

MATERIALS AND METHODS

Materials

Plectranthus amboinicus leaves, Liquorice powder, Distilled water was obtained. All chemicals and solvents used were of analytical grade.

METHODS

Preformulation studies Extraction of Volatile Oil[9]

Dried leaves of Plectranthus amboinicus were submitted to hydro distillation using a Clevenger type apparatus according to the method recommended in British Pharmacopoeia. The film floating essential oil on the surface of the water was collected stored in a refrigerator at 2-4°C until used.

FOURIER TRANSFORM INFRARED (FT-IR) SPECTROSCOPY

The stability of a formulation primary depends on the compatibility of the drug and the excipients. Hence, it is important to detect any possible chemical/physical interaction since they can affect bioavailability and stability of the drug. FT-IR analysis of pure drug was carried out individually. The peaks obtained in the spectrum were compared with reference spectrum.

PREPARATION OF LOZENGE BASE

Liquorice syrup was prepared by dissolving 170g of liquorice in 450 ml of water and heated at a temperature of 100°C. It is then filtered by using muslin cloth and further concentrated by using heat in a china dish and stirred well and syrup is formed.

FTIR OF DRUG AND BASE

The compatibility studies were carried out at room temperature using FTIR spectroscopy to determine the interaction of drug with other excipients used in the formulations. The IR

spectrum of drug alone was taken. Physical mixtures of the drug with excipients in the ratio of 1:1 were prepared and the samples were analyzed in Shimadzu IR spectra analyzer.

FORMULATION OF LOZENGE

The lozenges were prepared by incorporating volatile oil of *Plectranthus amboinicus* in the prepared liquorice base. The lozenges were prepared by moulding method. Different concentration of base was prepared using dried powdered liquorice. Then hot mixture was cooled to room temperature, followed by the addition of volatile oil. Then the warm mixture was poured in to a previously lubricated mould of suitable size. It was kept in a refrigerator for 30 minutes. The formed lozenges were collected and stored in desiccators.

OPTIMIZATION OF VARIABLES[10]

From the preliminary studies, it was found out that the two most important factors affecting the dissolution time for drug release from the lozenges were concentration of lozenge base and amount of volatile oil extract. Hence these 2 factors were selected as the independent variables. All other factors were kept constant throughout the study. To elucidate the influences of the decision variables on the response variables, a two- factor, two – level, four runs '2^2 factorial design' was employed using statistical software.

Table 1: The list of factors and levels used for 2^2 factorial experimental design.

Factors	**Levels used**	
	-1	+1
X1= concentration of lozenge base (%)	60	75
X2= Amount of volatile oil extract (ml)	0.15	0.30
Responses	**Constraints**	
Y1= Hardness	4-6 kg/cm^2	
Y2= Antimicrobial activity	20-35mm	

EVALUATION OF LOZENGES

Physical Appearance and Surface Texture[11]

Physical Appearance and Surface Texture includes visual inspection of lozenges and evaluation of texture by feel or touch.

Hardness

Hardness of lozenge was determined by Pfizer tester. This tester operates on the same mechanical principle as a pair of pliers. As the pliers handles are squeezed, the lozenge is compressed between a holding anvil and a piston connected to a direct force reading gauge.

The dial indicator remains at the reading where the lozenge breaks and is returned to zero by depressing a reset button. Six lozenges from each batch were selected and evaluated, and the average value with standard deviation was recorded. The hardness is expressed in kg/cm^2.

Friability

Friability of lozenge was performed in a Roche friabilator. It consists of a plastic chamber that revolves at 25 rpm. Twenty lozenges were weighed together and then placed in the chamber. The friabilator was operated for 100 revolutions and the lozenges were subjected to the combined effects of abrasion and shock because the plastic chamber carrying the lozenges drops them from a height of six inches with each revolution. The tablets were then de-dusted and re- weighed and the percentage friability was calculated. The value should not be more than 1.5%.

Weight variation test[12]

Weight variation test as described in the USP NF2009 was carried out on lozenges. Twenty lozenges were selected randomly and average weight was determined. Then individual lozenges were weighed and the differences of individual weights from the average weight were determined. The percentage deviation was calculated. The tablets meet the USP NF2009 test requirement if no more than 2 lozenges are outside the percentage limit allowed and no lozenge differs by more than 2 times the permitted percentage limit. Using this procedure weight variation range of all batches of formulations were determined and recorded.

Drug content uniformity[13]

The lozenge of known weight was extracted with 100 ml of phosphate buffer by shaking. The solution was filtered through Whatman filter paper. After proper dilution, absorbance was measured in UV-spectrophotometer at 277nm.

In-vitro dissolution study[14]

The United States Pharmacopeia (USP) XXIII-B rotating paddle method is used to study the drug release from the lozenge. The dissolution medium consisted of phosphate buffer pH 6.8. The release is performed at 37°C ± 0.5°C, with a rotation speed of 50rpm. The lozenge is allocated to the bottom of the dissolution vessel. Samples (5ml) are withdrawn at predetermined time intervals and replaced with fresh medium. The samples filtered through whatmann filter paper and analyzed for drug release after appropriate dilution.

Anti-microbial activity[15]

The Anti-microbial activity of lozenge was determined by swab plate method using Staphylococcus aureus in nutrient agar medium. In this technique the mixed culture is not diluted. The bacterial suspension is diluted in series of tube containing sterile water or saline. Sample is removed from each dilution tube and placed on to the surface of agar plate. The culture is spread by using a sterile cotton swab on the surface of agar plate. The lozenge to be evaluated is placed at the center of plate. The plates were incubated at 37°C for 24hrs. Zone of inhibition is measured.

Stability study

In any rational drug design or evaluation of dosage forms for drugs, the stability of the active component must be a major criterion in determining their acceptance or rejection. Stability of a drug can be defined as the time from the date of manufacture and the packaging of the formulation, until its chemical or biological activity was not less than a pre-determined level of labeled potency and its physical characteristics have not changed appreciably or deleteriously.

The optimized lozenges were placed in room temperature for 30 days. Batches were evaluated for the above-mentioned parameters to check whether the lozenge shows any significant changes or not.

RESULT AND DISCUSSIONS PREFORMULATION STUDIES

FOURIER TRANSFORM INFRARED (FT-IR) SPECTROSCOPY

The stability of a formulation primary depends on the compatibility of the drug and the excipients. The peaks obtained in the spectrum were compared with reference spectrum. The peaks obtained were found to be similar with that of reference indicating the identity of the drug.

FORMULATION OF LOZENGE

The lozenges were prepared by incorporating volatile oil of Plectranthus amboinicus in the prepared liquorice syrup base.

OPTIMISATION OF VARIABLES

In the preliminary studies, it was found out that the two most important factors affecting the anti-microbial activity are concentration of lozenge base and amount of volatile oil extract.

Hence these three variables were selected as the independent variables. The levels of these parameters were determined from the preliminary studies. All other factors were kept constant throughout the present study. To elucidate the influences of the decision variables on the response variables, a two-factor, and two-level four run '2^2 factorial' design was employed. Design Expert software 12 (Statease, Minneapolis USA) trial package was used for the generation and evaluation of the statistical experimental design. The response variables were hardness and antimicrobial activity of the lozenge.

DRUG-BASE INTERACTION STUDY (FTIR STUDY)

The compatibility studies were carried out at room temperature using FTIR spectroscopy to determine the interaction of drug with liquorice syrup base used in the formulations.

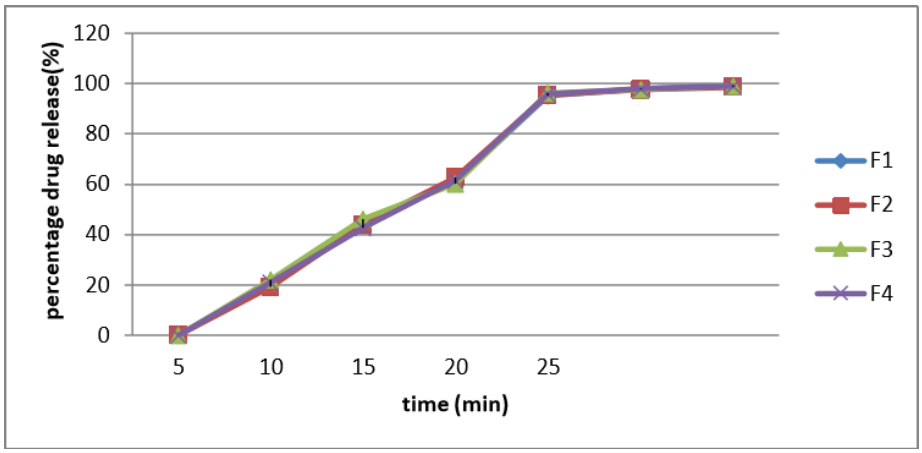
EVALUATION OF LOZENGES

Physical appearance and surface texture are visually inspection of prepared all lozenges were done and recorded. The hardness values were measured for all the formulation using Monsanto hardness tester. Friability determines the strength of the lozenges. And it was done using Roche friabilator. Twenty lozenges were randomly selected from each formulation and evaluated for weight variation. The % drug content of all the formulated tablets were found within the limit. And all the results of the evaluated parameters are given in the table.

Table 2: Shows the results of the preformulation studies.

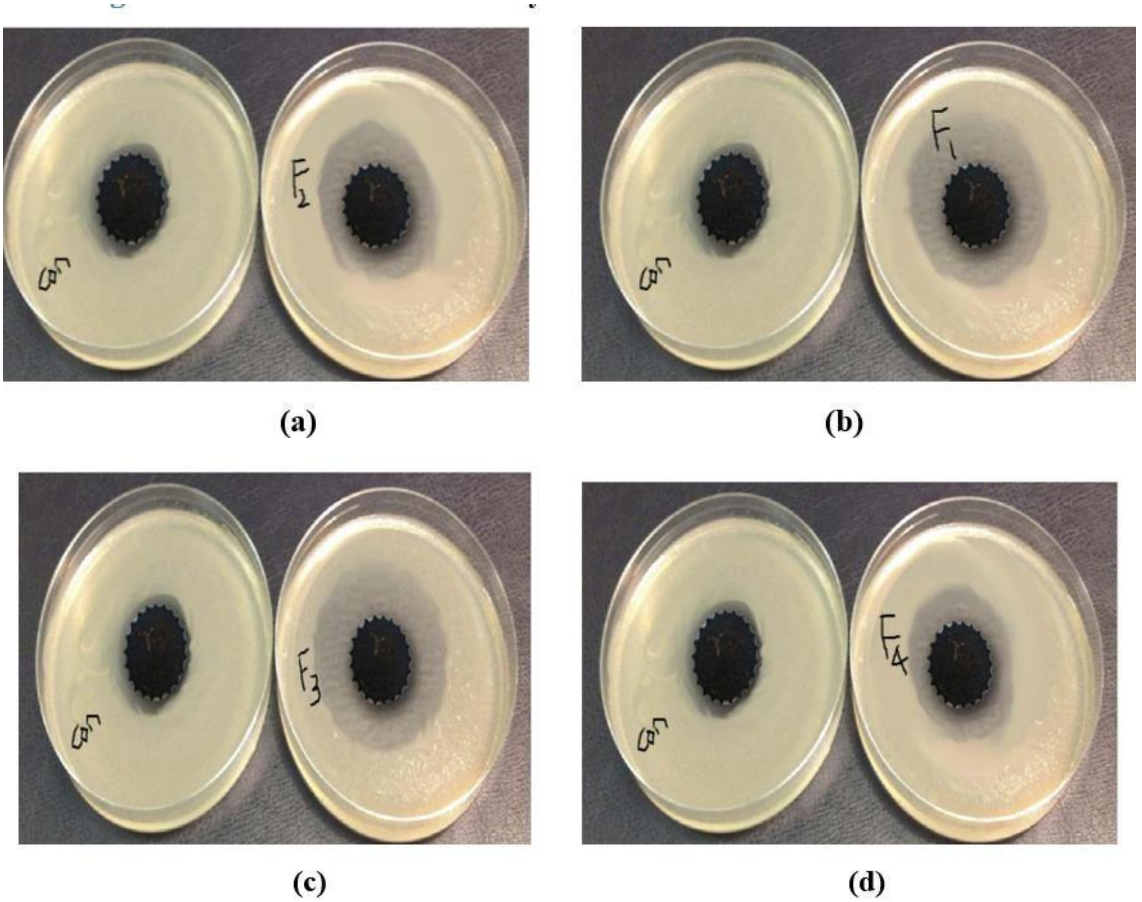
EVALUATION	F1	F2	F3	F4
SHAPE	Round	Round	Round	Round
COLOUR	Brownish	Brownish	Brownish	Brownish
	black	black	black	black
ODOUR	Characteristic	Characteristic	Characteristic	Characteristic
SURFACE	Rough	Rough	Rough	Rough
HARDNESS(Kg/Cm^2)	5.2±0.2%	5.2±0.2%	5.2±0.2%	5.2±0.2%
FRIABILITY (%)	0.68%	0.68%	0.68%	0.68%
WEIGHT VARIATION(%w/w)	2.0±.5%	2.5±.5%	2.5±.5%	2.0±.5%
CONTENT UNIFORMITY	98.3±0.5%	99.5±0.2%	99.2±0.5%	98.7±0.6%
ZONE OF INHIBITION (mm)	31.9	24.3	37.2	23.9

INVITRO DISSOLUTION STUDIES



ANTI MICROBIAL ACTIVITY

The Anti-microbial activity of lozenge was determined by swab plate method using Staphylococcus aureus in nutrient agar medium.



(a) Anti microbial activity of F1 against Staphylococcus aureus. Zone of inhibition 31.9mm

(b) Anti microbial activity of F1 against Staphylococcus aureus. Zone of inhibition 24.3mm

(c) Anti microbial activity of F1 against Staphylococcus aureus. Zone of inhibition 37.2mm

(d) Anti microbial activity of F1 against Staphylococcus aureus. Zone of inhibition 23.9mm

PREPARATION OF OPTIMIZED BATCH

The optimized batch of lozenge was prepared and evaluated for its anti-microbial activity.

Table 3: Shows the evaluation result of optimized lozenge.

Optimized batch	Concentration of base (%)	Amount of volatile oil (ml)	Hardness (kg/cm^2)	Antimicrobial activity (mm)
	68.77	0.28	6	34

STABILITY STUDIES

10 lozenges from optimized batch were kept at room temperature for 30 days. After 30 days prepared lozenges were evaluated for the above-mentioned parameters. All parameters were within range even after 30 days of study.

CONCLUSION

Liquorice root has various pharmacological activities like gastrointestinal smoothening property, anti-inflammatory, immune boosting action, heart burn, stomach ulcers, etc. Here we used liquorice extract as the lozenge base. Lozenge will be an ideal dosage form for geriatric diabetic patient having sore throat. Because the lozenge containing liquorice extract as base and volatile oil as drug has anti-inflammatory and antibacterial activity. So, the synergetic action will reduce the throat pain effective with in short duration of period.

Both the concentration of lozenges base and amount of volatile oil were optimized using a statistical programme, Design expert version 12 stat ease. The optimization was carried out on the basis of pre optimization screening results. From the results of screening studies, it was clear that the hardness and dissolution rate depends on the concentration of the lozenge base. And the anti-microbial activity of the lozenge is clearly based on the amount of volatile oil extract. So these two independent variables were optimized using 2^2 factorial design.

The optimized batch (F5) was prepared and it shows hardness of 5.kg/cm^2, dissolution rate is 98.99% at 30 minutes and give effective anti-microbial activity. This study reveals that liquorice lozenge containing *Plectranthus amboinicus* volatile oil will be a promising dosage form for sore throat.

REFERENCES

1. Dasharath M Patel, Rahul J. Patel, Hardik R. Shah and Chhagan N. Patel, formulation and evaluation of diphenhydramine hydrochloride lozenges for the treatment of cough, world journal of pharmacy and pharmaceutical sciences, 2014; III: 822- 834.
2. Bartlett JG. Patient information: sore throat in adults, 2011.
3. Fleisher GR. Evaluation of sore throat in children, 2011.
4. Suchitra Pundir, Abhay Murari Lal Verma, A review on lozenges, Journal der Pharmazie Forschung, 2014; 2: 1- 10.
5. Rachana Maheshwari, Vikas Jain, Rehana ansari, S.c. Mahajan, Garvita joshi, A Review On Lozenges, British Biomedical Bulletin, 2013; 1: 35-43.
6. Kumar, A.; Elango, K.; Markanday, S.; Undhad, C.V.; Kotadiya, A.V.; Savaliya, B.M.; Vyas, D.N.; Datta, D. Mast cell stabilization property of Coleus aromaticus leaf extract in rat peritoneal mast cells. Indian J. Pharmacol, 2007; 39: 117118.
7. Lutomski J, Niemann and GR Fenwick, liquorice, glycirrhiza glabra composition use and analysis, food chem, 1990; 38: 119.
8. Shinde G, Kadam V, Kapse GR, Jadhav SB, Zameeruddin Md, Bharkad BA. Review on lozenges. Indo American Journal of Pharmaceutical Research, 2014; 4(1): 566-571.
9. Binu A., Irene T., Beena P., Eleesey A., Formulation and Evaluation of Herbal Lozenges Containing Eucalyptus Oil and Coleus Aromaticus Oil, American Journal of Pharmatech Research, 2018; 8(1): 2249-3387.
10. M Manohar, Jomy Joseph TS. Application of Box Behnken design to optimize the parameters for turning Inconel 718 using coated carbide tools. Int J Sci Eng Res [Internet], 2013; 4(4): 620–42. Maheshwari R, Jain V, Ansari R, Mahajan SC, Joshi.
11. G. A Review on lozenges. British Biomedical Bulletin, 2013; 1(1): 35-43.
12. Shinde SG, Kadam V, Kapse GR, Jadhav SB, Zameeruddin, Bharkad VB, A review on lozenges, IAJPR, 2014; 4: 567-570.
13. Harikrishna Boyapally, Ravi Kumar Nukala, Pranav Bhujbal, Dennis Douroumis. Controlled release from directly compressible theophylline buccal tablets. Colloids and Surfaces B: Biointerfaces, 2010; 77: 227-233.
14. Maheshwari R, Jain V, Ansari R, Mahajan SC, Joshi G, A review on lozenges, BBB, 2013; 1- 9.
15. Gautam Singhvi, Mahaveer Singh. Review: In-vitro Drug Release Characterization Models. International Journal of Pharmaceutical Studies and Research, 2011; 2(1): 77-84.
16. Bharkad V. B., Formulation and Evaluation of Lozenges Tablet of Fluconazole, Indo American Journal of Pharma Research, 2015; 5(1): 354-363.