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Design and Evaluation of Anti-Inflammatory Transdermal Patches Containing Origanum Vulgare

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Abstract: *Transdermal drug delivery systems are self-contained dosage forms that deliver drug through skin into systemic circulation at a controlled rate. Origanum vulgare L., family Lamiaceae, contains carvacrol and thymol which exhibit potent anti-inflammatory activity by inhibiting COX-2 and inflammatory cytokines. This review compiles the design, formulation, and evaluation aspects of herbal transdermal patches containing O. vulgare leaf extract for anti-inflammatory therapy. Matrix-type patches prepared by solvent casting using HPMC, ethyl cellulose, PEG, and dibutyl phthalate show acceptable physicochemical properties and stability, providing a natural alternative to synthetic NSAIDs with reduced gastricside effects.This review highlights the desrign formulation startigies,evaluation parameters,therapeutic potential,and future prospects of anti-inflammantory transdermal patches containing containing origanum vulgare.the interagation of herbal medicine with transdermal technology represents a promising approach for safer and more effective management of inflammatory disorders.*

Keywords: Transdermal patch, Origanum vulgare, Oregano, Anti-inflammantory, Herbal drug delivery, TDDS

I. INTRODUCTION

Transdermal drug delivery system is a medicated adhesive patch placed on skin to deliver a specific dose of drug into blood circulation. It promotes healing by maintaining drug concentration within the therapeutic window without peaks and troughs. Major advantages over oral route include avoidance of first-pass hepatic metabolism, decrease in dosing frequency, reduction in gastrointestinal side effects, and improved patient compliance.

Herbal medicine has been the backbone of human healthcare since ancient times. However, traditional herbal preparations suffer from slow onset and require large doses. Novel drug delivery systems like TDDS overcome these limitations. Origanum vulgare, commonly called “ajwain ki pattiya” or oregano, is an aromatic perennial herb used traditionally for inflammation, asthma, bronchitis, and menstrual disorders. Its essential oil contains carvacrol, thymol, γ-terpinene, and p-cymene which show anti-inflammatory activity. Formulating it as a transdermal patch combines benefits of herbal therapy with controlled drug delivery.

II. HISTORICAL BACKGROUND OF TDDS

1. First transdermal patch approved in 1981 for motion sickness – scopolamine.
2. FDA approved >20 patch products till 2003 spanning 13 molecules including fentanyl, nitroglycerin, estradiol, nicotine, lidocaine.
3. US transdermal market reached $1.2 billion in 2001.
4. Recent approvals include contraceptive patch with ethinyl estradiol + norelgestromin and oxybutynin patch for overactive bladder.

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III. TYPES OF TRANSDERMAL PATCHES

Five main types are reported:

1. Single-layer drug-in-adhesive: Drug dispersed in adhesive layer which serves both adhesion and drug release.
2. Multi-layer drug-in-adhesive: Similar to single-layer but with multiple adhesive layers for immediate and controlled release.
3. Reservoir: Separate drug layer of liquid/suspension between backing and rate-controlling membrane.
4. Matrix: Drug dispersed in semisolid polymeric matrix. Adhesive surrounds the matrix. Most suitable for herbal extracts due to ease of fabrication.
5. Vapour patch: Releases essential oils for 6 hrs, mainly used for decongestion.

For O. vulgare, matrix type is preferred due to compatibility with crude extracts and prevention of volatile oil loss.

IV. MECHANISM OF TRANSDERMAL PERMEATION

Patch acts as drug carrier. On application, adhesive secures patch to skin and drug permeates stratum corneum, then passes through deeper epidermis and dermis to dermal microcirculation for systemic absorption. No drug accumulation occurs in dermal layer. This provides constant blood levels for prolonged period.

Advantages:

1. Avoids first pass hepatic metabolism.
2. Maintains constant blood levels for longer period of time.
3. Decrease the dose of administration.
4. Decrease unwanted/ side effects.
5. Decreases gastro-intestinal side effects.
6. Easy to discontinue in case of toxic effects.
7. Increased patient compliance.
8. Great advantage for patients who are unconscious.
9. Provides an ability to modify the properties of biologicalbarriers to improve absorption.
10. Relatively large area of application in comparison to buccal/nasal cavity.

Disadvantages:

1. Drug must have some desirable physico-chemical properties to penetrate through stratum conium.
2. Drugs for daily dose less than 5 mg/day are preferred, If drugdose is more than 10-25 mg/day the TDD will be difficult.
3. Local irritation at the site of administration may be caused by drug, adhesive/other excipients in patch.
4. Clinical need must be clearly established.

Review of literature

Jadhav R.T. et Al[1]

The aim of present study was develope different transdermal matrix film with varid ratios of hydrophilic and hydrophic. Lipophilic combination containing the drug to perform the physiochemicals and vitro evaluation.(2009)

Kajal Ghosal et al[2]

Hydroxypropyl methyl cellulose is an oderless testless white firbous or granular free folwing powder this is the synthetic modification of natural polymer. (2011)

Anusha Gundeti et Al[3]

The objective of the present work to Formulate Transdermal drug delivery systems. transdermal patch can be prepared from solvent casting method. By using combination of HPMC PVP:PEG, DMSO. Transdermal patch can be evaluated

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by using thicknes, weight variation, folding insurance,percentage moisture absorption, percentage moisture loss. Year (2015)

Swati Hardainiyan et Al[4]

The matrix system consist a medicament layer of a semisolid matrix that contains a drug as a solution or suspension; that is direct contact with the liner layer. In this device the adhesive layer surrounds the drug layer partially overlaying it. Year (2014)

Keith W Singletary et Al[5]

A variety of health benefits of oregano or its individual constituents have been the subject of scientific study. Oregano contains several potent antioxidants that may partly contribute to findings in preliminary studies in which oregano exhibits benefits toward the cardiovascular and nervous systems, relieves symptoms of inflammation, and modulates blood glucose and lipid levels. Year (2016)

V. AIM AND OBJECTIVES

Aim

Aim: "Preparation and evaluation of herbal transdemal patches containing origanum vulgare."

Preparation of patches from origanum vulgare leaf

Evaluation of patch as per standards

Objectives

1. To formulate and develop a herbal transdermal patch containing extract of Origanum vulgare.
2.To provide controlled and sustained release of active constituents through the skin.
3.To improve the bioavailability of herbal constituents by avoiding first-pass metabolism.
4.To evaluate the anti-inflammatory activity of the formulated patch.
5. To reduce gastrointestinal side effects compared to oral administration.
6. To improve patient compliance by providing an easy and convenient dosage form.
7.To study the physicochemical properties of the patch such as thickness, weight variation, folding endurance, moisture content, and drug content uniformity.
8.To evaluate the in vitro drug diffusion/permeation of active constituents through the membrane.
9.To assess the stability of the transdermal patch under different storage conditions.
10.To determine the overall effectiveness of Origanum vulgare as a natural therapeutic agent in transdermal drug delivery.

VI. PLAN OF WORK

The present work was planned in the following manner:

1. Literature Review
2. Selection of drug and excipients
3. Drug and excipients profile
4. Formulation of Experimental work
5. Evaluation Tests

a) Folding Endurace
b) Percentage Moistrue
c) Percentage Moisture Loss.
d) Stability test

6. Result and discussion
7. Conclusion
8. Summary

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9. Reference

VII. DRUG PROFILE

Drug profile:-

1. Botanical Classification
Kingdom: Plantae
Family: Lamiaceae
Genus: Origanum
Species: Origanum vulgare
2. Common Names Oregano
Wild marjoram
3 .Phytochemical Constituents
Carvacrol
Thymol
Rosmarinic acid
p-cymene
γ-terpinene
Caryophyllene
4. Pharmacological Activities
Anti-inflammatory
Antioxidant
Antimicrobial
Analgesic
Hepatoprotective
Immunomodulatory
5.Anti-InflammatoryMechanism
Carvacrol and thymol inhibit inflammatory mediators such as prostaglandins, cytokines, and reactive oxygen species. Rosmarinic acid reduces oxidative stress and tissue inflammation.

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Materials and methods

MATERIALS AND INSTRUMENTS

Table No. 1: List of ingredients used in formula

Sr.no	Materials	Functions
1	Leaf of origanum vulgare	Anti-inflammatory agent
2	Hydroxy proply methyl cellulose	Plastisizers
3	Ethyl cellulose	Thicking Agent
4	Polyethylene glycol	Plastisizers
5	Dibtyl pthalate	Plastisizers & Thicking Agent
6	Polypropylene glycol	Permeation enhancer
7	Methanol	Solvent

Table No. 2:- List of Equipments and Instruments used in Formula

Sr no	Equipments And Instruments	Model Numbers
1	Weighing balance	Code 1094, Dolphin, Mumbai.
2	Petridish	Rajesh Chemicals, Mumbai.
3	Desiccator	Rajesh Chemicals, Mumbai.
4	Stirrer	Rajesh Chemicals, Mumbai.
5	Heating mental	Sr.1042 Model BTI (BioTechnics India), Dolphin,Mumbai.

EXPERIMENTAL WORK

COLLECTION OF SAMPLE

Collection of plant origanum vulgare was done from the areas Plot no 17,18 taichok mumtaz nagar solapur. The identification if whole plantand it's parts were done. Leaf was collected from the plant O. vulgare. The obtained leaf was directly used in Formulation. pollymers are used i.e Hydroxy propyl methyl cellulose, Ethyl cellulose, Polyethylene glycol, Dibtyl pthalate, polypropylene glycol, methanol can be collected from laboratory

FORMULA FOR TRANSDERMAL PATCH

Table No-3.

Sr No	**Ingredients**	**Quantities**
1	Drug (Origanum vulgare)sss (ml)	5 ml
2	HPMC (mg)	1 gm
3	EC (mg)	1 gm
4	PEG(%w/v)	3 ml
5	Dibutyl pthalate	1 ml
6	Polypropylene glycol	1 1ml
7	Methanol	1 ml

EXTRACTION

Maceration

This is an extraction procedure in which coarsely powdered drug material, either leaves or stem bark or root bark, is placed inside a container, the menstruum is poured on top until completely covered the drug material.

Procedure

1. Take 100gm fresh oregano leaves & wash it properly with H_2O
2. Then add water & Alcobol in the 1:4 proportion (means 20% Alcohol & 80% water).

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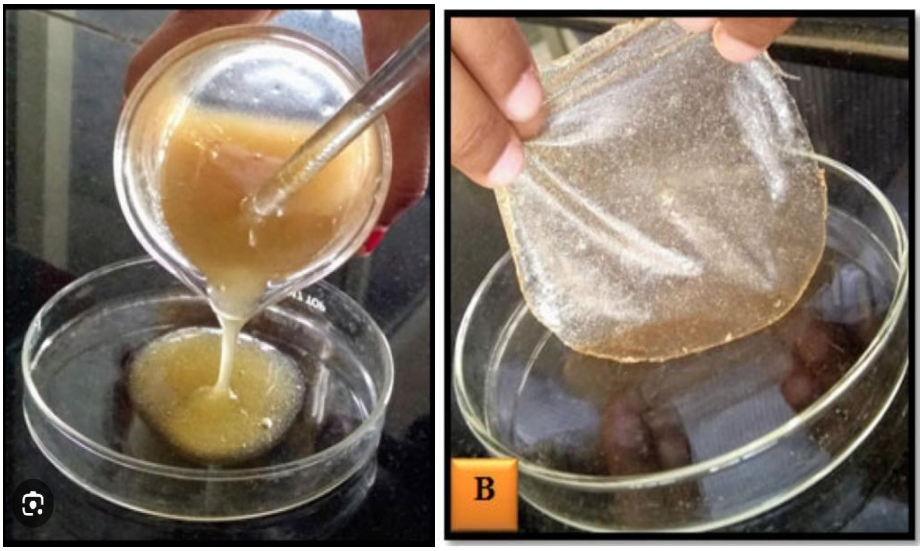
3. Now make a solution of 80ml Alcohol + 320 ml water.
4. Then add 100gm oregano leaves into above solution.
5. Stay aside for 4-5 days at room temperature.
6. After that triturate it into a mortar pistal.
7. Filter the sol to get residue.
8. Now, Boil filtrate (residue) at 40 C heating mentle 6-7 Hrs to evaporate the excessive alcohol.

METHOD OF PREPARATION OF PATCHES

Crude drug is loaded on matrix type transdermal patches of origanum vulgare were prepared by using solvent casting method. polymer were accurat weighted and dissolved in methanol solution and kept aside to form solution. Drug was dissolved in the above solution. dibutyl pthalate and HPMC was added as a plasticiser and ploye thylene glycol and ethyl cellulose as thicking agent, polypropylene glycol were added as permeation enhancers. The resultant mixture was cast on the patridish and dried at room temperature for 24 hrs, the dried patches were taken out and stored in a desiccator for further studies.



VIII. RESULT AND DISCUSSION

EVALUATION TESTS FOR TRANSDERMAL PATCHES

TABLE NO.1

SR NO	Evalution Tests	Results Obtained (%)	Standered value
1	Folding endurance	198	263
2	Percentage Moisture Absorption	5.9%	7.32 + 0.12
3	Percentage Moisture Loss	9.23%	9.31 + 0.27
4	Stability studies	40 + 0.5^0c 75 + 5%	-

1 Folding Endurances.

The film was taken and folded at the same place till it breaks. The number of times the film could be folded at the same place withouth breading gives the exact value of folding endurance is 198.

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2 Percentage Moisture Absorption.

The percentage mositure absorption in Transdermal patch is 5.9% can be calculated by using formula.

3 Percentage Moisture Loss

percentage mositure absorption in Transdermal patch is 9.23% can be calculated by using formula.

4 Stability studies

Stability studies are to be conducted according to the ICH guidelines by storing the TDDS samples at 40±0.5°c and 75±5% RH for 1 months. The samples were withdrawn at 0, 30, 60, 9.

IX. CONCLUSION

The patch was prepared by using origanum vulgare leaf extract shows good properties like folding endurace percentage moisture loss and percentage moisture absorption. The preliminary evaluation test are carried out which are posible in our lab noted in result the formulation found satisfactory results. This formulation has antinflamatory propertiy and hence used for the treatment of asthma, bronchitis, cough, diarrhoea, menstrual disorders, diabetes.