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Formulation And Evalution Of Transdermal Patches Of Metformin Hydrochloride

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Abstract :

The primary goal of this study was to create, develop, and test a transdermal drug delivery system containing Metformin hydrochloride to address the key issues associated with the oral route. Metformin hydrochloride transdermal patches were manufactured utilizing the solvent evaporation process. Different formulation trials were conducted by varying the polymer ratios. The thickness, weight fluctuation, and percentage of transdermal patch compositions were all measured. Moisture content, research, and metformin transdermal patches provide a simple and effective means of regulating blood glucose levels in people with type 2 diabetes. Type 2 diabetes can be managed using transdermal metformin patches.

The main objective of the this study was to formulate, develop and evaluate a Transdermal drug delivery system containing Metformin hydrochloride to overcome the critical problems related with oral route. Transdermal patch of Metformin hydrochloride were prepared using solvent evaporation technique. Different trial of formulation were carried out by changing the polymer ratio. Transdermal Patch formulations were characterized for Thickness, weight variation.

The present study was investigated to transdermal patch formulation of Metformin hydrochloride. Preformulation study was successfully performed in which I drawn the calibration curve in different subvents after solubility study bulk density tapped density was calculated after complex formulation evaluated the uniformity of thickness, folding endurance, weight variation stay moisture content, % swellability, Drug content.

Keywords : Transdermal Delivery, Metformin Hydrochloride,Antidiabetic Therapy,Thickness uniformity,Type 2 Diabetes mellitus.

Introduction:

Metformin is a commonly used diabetes medication. Metformin is a frequently used medicine for controlling type 2 diabetes that improves insulin sensitivity and reduces glucose synthesis in the liver. Traditionally, it is given orally in tablet form, but recent advances have resulted in the introduction of transdermal patches as an alternative delivery technique. Metformin transdermal patches are adhesive patches that are put to the skin and gradually deliver the medicine into the bloodstream. This approach skips the digestive system. Potentially minimizing typical adverse effects such as stomach pain.A transdermal patch is a sticker that you apply to your skin. The drug slowly goes through the skin and into the bloodstream.

Metformin hydrochloride is a first-line oral antidiabetic drug commonly used in the treatment of type 2 diabetes mellitus. Despite its efficacy, conventional oral administration is often associated with gastrointestinal side effects, variable absorption, and reduced patient compliance due to frequent dosing requirements.

Figure No 1: Transdermal patches

Transdermal drug Telivery systems

(TDDS) offer an innovative approach to overcoming these limitations. By delivering metformin through the skin directly into systemic circulation, transdermal patches can bypass the gastrointestinal tract and first-pass hepatic metabolism. This can result in improved bioavailability, reduced side effects, and sustained drug release, enhancing therap patient adherence efficacy.

This strategy may be helpful because:

1. It prevents stomach disorders, such as nausea.
2. The drug is absorbed more evenly over time.

Benefits of Transdermal Patches:

1. Improved Absorption- Reduces breakdown in the stomach, resulting in higher bioavailability.

2. Reduced Side Effects - Reduces digestive problems including nausea and diarrhea.

Objectives :

- To improve patient compliance.
- To evaluate patch safety and efficacy.
- To evaluate the physical and mechanical properties of the patches (e.g., thickness, tensile strength, folding endurance).

Material and methods :

Material :-

The pharmaceuticals including Metformin Hydrochloridewas received from Samarth Institute of Pharmacy Belhe, Pune.Polyethylene Glycol,Polyvinyl Alcohol were also obtained from store S.I.O.P. Belhe Pune.

Figure No 2 : Metformin Hydrochloride Drug

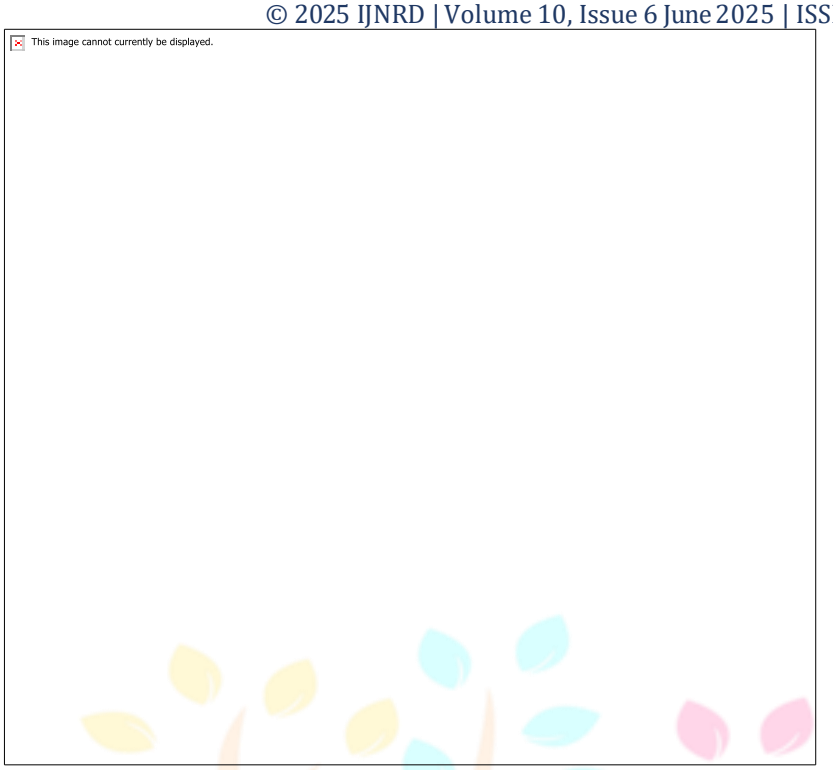

Figure No 3: Formulated Patches

Table :-

Table No. 1 :- Formulation Table

Formulation batches	Metformin Hydrochloride	Polyethylene glycol	Pthalic Unhydride	Polyvinyl alcohol	Gelatin	Distilled water
F1	0.5 gm	0.3ml	0.1 gm	0.4 gm	0.3 gm	5ml
F2	0.5 gm	0.3ml	0.1 gm	0.4gm	0.3 gm	5ml
F3	0.5 gm	0.3ml	0.1 gm	0.4 gm	0.3 gm	5ml

Procedure: -

1.Solvent evaporation was applied to create nine different formulations of transdermal patches, each with different quantities of Gelatin PVA, PEG & drug.

2.10 ml of hot water was used to dissolve PVA after it was accurately weighed.

3. The several formulations were supplemented in 1.5% acetic acid, and everything was thoroughly mixed.

4.Drop by drop, maleic anhydride solution was added.

5. The mixture was then thoroughly stirred for 30 minutes.

6.polyethylene glycol was utilized as a plasticizer.

7. pour the solution into Petri plates.

8. Cover the Petri plate with an inverted funnel to avoid evaporation, dry the patches for 24 hrs and dry patches.

Evaluation :

1) Physical appearance

The prepared rasagiline tarterate patches were evaluated visually for physical appearance like Colour, clarity, smoothness, and flexibility.

2) Thickness

The thickness of the prepared patches was measured using vernier caliper with a least count 0.01 mm at different spot of the patch. The thickness was measured at the least spot of the patches and average was taken and final thickness is note down.

3) Weight uniformity

Weight variation study is carried out by selection of randomly 10 patches, with a size of 2cm Weight an individual patch in digital balance and calculate the average weight. The individual weight of the patches should not deviate significally from the average weight.

4) Folding endurance

The folding endurance also called as the number of folds. (Number of the folds given to the patch at the same time) for the break the preparation or create the visible crack. This test is performed for to check the stability of the formulation. Folding endurance performed by repetitively folding a small strip of patch (2 x 2 cm) at the same place till it broken or make visible crack. The number of time patches fold at the same place gave the value of folding endurance and it was note down.

5) Moisture uptake

In this study, initially weighed patches were placed in the desiccators for 24 hrs. Which contain saturated solution of potassium chloride to maintained humidity inside at 80% relative humidity (RH) after completion of study, the patches were take-out side and once again weighed.

6) Surface pH

The patches were placed in glass tubes and allowed to swell for one hour by using contact with 0.5 ml of double-distilled water. After that, the surface pH was measured by placing.

Results And Discussion :

The Preformulation study of drug was studied by organoleptic properties.

Preformulation parameter

Description: Crystalline

Odor: Odourless

Color: white to nearly white

Taste: Bitter taste

Solubility:

Soluble in methanol- soluble

Soluble in Acetonitrile-soluble

Soluble in water - Freely soluble

Soluble in 1.1 NaoH-soluble

Figure No 4 : Solubility Determination

The present study was aimed at formulating and evaluating transdermal patches of Metformin Hydrochloride to overcome the limitations of oral administration such as gastrointestinal side effects, poor bioavailability due to extensive first-pass metabolism, and frequent dosing.

Transdermal patches were successfully prepared using the solvent casting method employing various polymers such as HPMC, PVP, and plasticizers like PEG 400 to enhance flexibility. The prepared patches were smooth, uniform, and showed no visible signs of cracking or brittleness, indicating good fining properties.

The physicochemical evaluations such as thickness, weight uniformity, folding endurance, moisture content, and surface pH were found to be within acceptable limits. The patches maintained their integrity and flexibility, and surface pH was close to that of the skin (around 6.5), suggesting good skin compatibility.

Conclusion :

The present study successfully demonstrated the formulation and evaluation of transdermal patches containing Metformin Hydrochloride as a potential alternative to conventional oral therapy. The patches were prepared using the solvent casting method with various polymers and plasticizers, resulting in flexible, smooth, and stable films.

Physicochemical evaluation confirmed that all formulations were within acceptable limits, indicating good quality and consistency.

The optimized formulation followed diffusion-controlled release kinetics, suggesting its suitability for maintaining consistent drug levels through transdermal absorption. Additionally, the absence of skin irritation (if evaluated) and favorable surface pH values further support the suitability of these patches for topical application.

Thus, transdermal delivery of Metformin Hydrochloride represents a promising approach to enhance bioavailability, reduce dosing frequency, and minimize gastrointestinal side effects associated with oral administration.

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