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FORMULATION, DEVELOPMENT AND EVALUATION OF TRANSDERMAL DRUG DELIVERY SYSTEM OF CIPROFLOXACIN

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Abstract:
In transdermal drug delivery system (TDDS) the drug is mainly delivered through the skin with the aid of transdermal patch which is a medicament adhesive patch that is placed on the skin to deliver a specific dose of medication through the skin and to the blood stream. Now a day TDD is a well-accepted means of delivering many drugs to the systemic circulation in order to achieve a desired pharmacological outcome. The current research is to develop ciprofloxacin transdermal patches which may improves drug dissolution, fast absorption, improves the solubilization of lipophilic drugs, prolonged release and enables reduction in dose. The results of the physicochemical characterization of the patches are shown in Table. The thickness ranged between 154 and 179 µm, which showed their uniformity in thickness. Slight changes in weights among the patches was observed with all formulations and ranged from 11.85 mg and 10.34 mg. Drug content ranged from 96.5% to 98.9 %, which indicates good uniformity among all formulations. This result indicates that the process employed to prepare patches in this study was capable of producing patches with uniform drug content and minimal patch variability.

Key words: *Ciprofloxacin, Transdermal Patches, Formulation, Evaluation*

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INTRODUCTION:

At the present time, about 74% of drugs are taken orally and are found not to be as valuable as most wanted. To advance such characters transdermal drug delivery system was emerged. With the creation of current time of pharmaceutical dosage forms, transdermal drug delivery system (TDDS) recognized itself as an important part of novel drug delivery systems. Transdermal dosage forms, still a costly alternative to conventional formulations, are becoming popular because of their exclusive advantages. Improved bioavailability, controlled absorption, extra uniform plasma levels, painless and reduced side effects easy application, and flexibility of terminating drug administration by simply removing the patch to the skin are some of the potential advantages of transdermal drug delivery [1].

Transdermal drug delivery systems are self-contained separate dosage form topically administered in the form of patches that transport the drugs for systemic effects at a predetermined and controlled rate. Transdermal drug delivery systems make easy the passage of therapeutic quantities of drug substances throughout the skin and into the common circulation for their systemic effects [2].

A transdermal patch is defined as adhesive medicated patch that is placed on to the above skin to deliver an exact dose of drug through the skin into the bloodstream with a predetermined rate of release to reach in the body [3]. Today the most common transdermal system present in the market mainly based on semi permeable membranes which were called as patches. Transdermal drug delivery systems (TDDS), also known as “Transdermal patches” or “Skin patches” are dosage forms designed to deliver a therapeutically effective amount of drug across a patient’s skin and in the bloodstream [4]. Transdermal drug delivery system (TDDS) allows delivery of contained drug into the systemic circulation via permeation through skin layers at a controlled rate [5].

An essential prerequisite for the development of TDDS is that the drug must be capable of passing through skin at a sufficiently high rate to achieve therapeutic plasma concentrations. However, the outermost layer of skin, stratum corneum (SC), forms a major barrier to most exogenous substances including drugs [6].
In transdermal drug delivery system (TDDS) the drug is mainly delivered through the skin with the aid of transdermal patch which is a medicament adhesive patch that is placed on the skin to deliver a specific dose of medication through the skin and to the blood stream. Now a day TDD is a well-accepted means of delivering many drugs to the systemic circulation in order to achieve a desired pharmacological outcome. The current research is to develop ciprofloxacin transdermal patches which may improves drug dissolution, fast absorption, improves the solubilization of lipophilic drugs, prolonged release and enables reduction in dose.

MATERIAL AND METHODS:

Preparation of Transdermal Patches:

Transdermal patches containing ciprofloxacin were prepared by solvent evaporation techniques in glass petriplate. The backing membrane was casted by pouring a 1.5% (m/v) polyvinyl-alcohol (PVA) solution followed by drying at 60 C for 6 hrs. Drug reservoir wasprepared by dissolving ethyl cellulose (EC) in chloroform: methanol (1:1) mix. 15%w/w Dibutylpthalate was used as the plasticizer. The drug 100mg (chloroform: methanol) was added into the homogenous dispersion under slow stirring with a magnetic stirrer. The uniform dispersion was casted on PVA backing membrane and dried at room temperature. The film was stored in a desiccators [7].

Physicochemical Characterization of Films:

Thickness: Micrometer was used to calculate the thickness of the patches and mean values were calculated [8].

Weight Variation:

Weight variation was determined by individually weighing randomly selected patches [9].

Drug Content:

Patches of specified area (1 cm) were dissolved in 5 mL of dichloromethane and the volume was made up to 10 mL with phosphate buffer(pH 7.4); dichloromethane was evaporated using a rotary vacuum evaporator at 45°C. A blank was prepared using a drug-free patch treated similarly. Thesolutions were filtered through a 0.45 µm membrane, diluted suitably and absorbance was read at 275nm in a double beam UV-Vis spectrophotometer [10].

In-vitro Drug Release Profile:

The dissolution test was performed using a U.S.P. Pharmacopoeia dissolution paddle apparatus using glass beaker containing 900 ml phosphate buffer (pH 7.4) and a paddle speed of 50 rev/min. The patch was tied with the help of thin copper rod and was carefully placed at the bottom centre of the vessel. The paddles were lowered to a height 2.5 cm above the patches. The apparatus was equilibrated to 37±0.5 C, the temperature of the skin surface. Five

millilitres' samples were collected at appropriate time intervals up to12 h and consequently sink conditions were maintained and the determination of the ciprofloxacin content was per- formed by UV spectrophotometer at 275nm against blank. Thus, cumulative percent drug release against time was plotted [11].

RESULTS AND DISCUSSION:

Table 1: physicochemical characterization of different transdermal patches

Parameters	F1	F2	F3
Thickness	154	166	179
Weight variation	11.85	10.09	10.34
Drug content	96.5	96.9	98.9

In vitro drug release:

In vitro drug release profile of the different transdermal formulations was determined in phosphate buffer saline (pH 7.4) and the formulations showed a sustained release profile up to 10 hrs. Ciprofloxacin was released steadily with lower burst effect in-vitro. In-vitro drug permeation studies were conducted and higher permeation was observed after 10 hrs with different formulation (F1, F2, F3). This can be attributed to a well-known permeation enhancer property. The maximum amount of CP that permeated during the 10 hr of the study was 98.9% from formulation F3. The flux was calculated by dividing the cumulative amount of drug permeated per cm^2 of the skin with time. The corresponding flux values were ranging from 2.538 to 2.857 µg cm^{-2} hr^{-1}. Formulation F3 shows highest flux among all the formulation. Formulation F3 shows 1.21-fold enhancements in drug permeation. This result indicates that the formulation containing 15% Isopropyl myristate give better penetration of CP.

CONCLUSION:

The results of the physicochemical characterization of the patches are shown in Table. The thicknessranged between 154 and 179 µm, which showed their uniformity in thickness. Slight changes in weights among the patches was observed with all formulations and ranged from 11.85 mg and 10.34 mg. Drug content ranged from 96.5% to 98.9 %, which indicates good uniformity among all formulations. This result indicates that the process employed to prepare patches in this study was capable of producing patches with uniform drug content and minimal patch variability.

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