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Design, formulation and evaluation of transdermal patch of Propranolol using chamomile essential oil as permeation enhancer: *In vitro in vivo* chapter

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Statement of the Problem: Skin permeation enhancement technology is a rapidly emerging field which would expressively increase the number of drugs which is suitable for transdermal drug delivery. Transdermal drug administration route offers many benefits over oral administration of drugs and has stimulated research to find ways to overcome the barrier function of the skin by use of various enhancers' approaches. The exploration for the ideal skin penetration enhancer has been the emphasis of significant research effort over a number of eras. Many potent enhancers have been revealed, but in most of the cases, their effects are associated with toxicity.

Methodology: Physicochemical evaluations like majorly, drug content and aging, moisture uptake and thickness were performed to rationalize the suitability and pertinence of the formulation. *In vitro* and *ex vivo* and *in vivo* studies were carried out using Franz diffusion cell using albino rabbits (pharmacokinetics). *In vitro* permeation studies demonstrated a significant enhancement with chamomile essential oil.

Findings: Formulation with 10% chamomile essential oil exhibited the best permeation of the model drug evidenced by kinetic parameters. The pharmacokinetic parameters, such as the C_{max} , T_{max} , MRT, AUC_{0-t} and T1/2 derived from transdermal administration differed significantly ($p < 0.05$) from those estimated from oral administration. The C_{max} of model drug after transdermal administration of optimized patch formulation was found to be 88.37 ± 2.3 $\mu\text{g/ml}$ and the plasma concentration was maintained for 36 hours which was in good agreement with the reported plasma levels of model drug reported in published clinical studies. In variance to oral delivery well sustained activity was observed over a period of 24 hours after transdermal administration.

Conclusion & Significance: Taking together, the transdermal patch using indigenous natural chamomile essential oil can be successively used to achieve better patient compliance in contrast to the oral conventional tablets in pharmaceutical industries.

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