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## Experimental design and optimization of raloxifene hydrochloride loaded nanotransfersomes for transdermal application (Article)

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### Abstract

Raloxifene hydrochloride, a highly effective drug for the treatment of invasive breast cancer and osteoporosis in post-menopausal women, shows poor oral bioavailability of 2%. The aim of this study was to develop, statistically optimize, and characterize raloxifene hydrochloride-loaded transfersomes for transdermal delivery, in order to overcome the poor bioavailability issue with the drug. A response surface methodology experimental design was applied for the optimization of transfersomes, using Box-Behnken experimental design. Phospholipon(®) 90G, sodium deoxycholate, and sonication time, each at three levels, were selected as independent variables, while entrapment efficiency, vesicle size, and transdermal flux were identified as dependent variables. The formulation was characterized by surface morphology and shape, particle size, and zeta potential. Ex vivo transdermal flux was determined using a Hanson diffusion cell assembly, with rat skin as a barrier medium. Transfersomes from the optimized formulation were found to have spherical, unilamellar structures, with a homogeneous distribution and low polydispersity index (0.08). They had a particle size of 134±9 nM, with an entrapment efficiency of 91.00%±4.90%, and transdermal flux of 6.5±1.1 µg/cm(2)/hour. Raloxifene hydrochloride-loaded transfersomes proved significantly superior in terms of amount of drug permeated and deposited in the skin, with enhancement ratios of 6.25±1.50 and 9.25±2.40, respectively, when compared with drug-loaded conventional liposomes, and an ethanolic phosphate buffer saline. Differential scanning calorimetry study revealed a greater change in skin structure, compared with a control sample, during the ex vivo drug diffusion study. Further, confocal laser scanning microscopy proved an enhanced permeation of coumarin-6-loaded transfersomes, to a depth of approximately160 µM, as compared with rigid liposomes. These ex vivo findings proved that a raloxifene hydrochloride-loaded transfersome formulation could be a superior alternative to oral delivery of the drug.

### Author keywords

Box-Behnken raloxifene hydrochloride RSM transdermal flux transfersomes

### Indexed keywords

EMTREE drug terms: drug carrier nanomaterial phospholipid raloxifene surfactant

EMTREE medical terms: animal biological model chemistry drug effects intradermal drug administration methodology particle size rat reproducibility skin skin absorption Wistar rat