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Comparative Human Skin Permeation Study on Nanocarriers for Potential Transdermal Delivery of Progesterone

Nazik A. Elgindy, Salma M. Mohyeldin, Mohamed M. Mehanna
Department of Industrial Pharmacy, Faculty of Pharmacy, Khartoom Square, Azarita,
P.O.B. 21521, Alexandria University, Alexandria, Egypt.
d_nazik4@yahoo.com, salma_mohyeldin@hotmail.com, dr_mehanna@yahoo.com

Extended Abstract

This study is the first attempt to directly compare the ability of several nanocarrier formulations to deliver progesterone into the skin. Four progesterone-loaded nanocarriers; cubosomes [1], nanoliposomes [2], nanoemulsions [3] and polymeric nanomicelles [4] were formulated and characterized regarding particle size, zeta potential, % drug encapsulation, loading capacity and in-vitro release. The aim of the current investigation is to explore the feasibility of various nanocarriers to enhance the penetration of progesterone via the full thickness of human abdominal skin. Structural elucidation of each nanoplatform was performed using the Transmission electron microscope. Each nanocarrier was fabricated with a negative surface, nanometric size (≤ 270 nm), narrow size distribution and reasonable encapsulation capacity. The in-vitro progesterone release showed a sustained release pattern for 24 h following a non-fickian transport diffusion mechanism. Ex-vivo skin permeation, deposition ability and histopathological examination were evaluated using Franz diffusion cells.

All nanocarriers exhibited higher transdermal flux value relative to free progesterone. Cubosomes revealed a higher skin penetration with transdermal steady flux of 48.57.10-2 µg/cm2 h. Nanoliposomes offered a significant increase in the % skin deposition compared to other carriers. Based on the histopathological examination, cubosomes and nanoliposomes were found to be biocompatible for skin application. Confocal laser scanning microscopy confirmed the ability of fluorolabeled cubosomes to penetrate deeply through the whole skin layers. The novel elaborated cubosomes were proved to be a promising non-invasive nanocarrier for transdermal hormonal delivery without causing any sign of irritation.

References

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