PP-01: Formulation and Evaluation of Luteolin-loaded Nanogel: A Promising Nanomaterials Platform for Skin Regeneration

Nouran M. Atia*[1], Mona A. Moustafa[1], Yasmine M. Shahine[2], Mohamed S. Abdel Ghany[3], Ossama Y. Abdallah[4]

[1]Department of Pharmaceutics and Pharmaceutical Technology, Faculty of Pharmacy Pharos University in Alexandria, Alexandria, Egypt.

[2]Department of Microbiology & Immunology, Faculty of Pharmacy, Pharos University in Alexandria, Egypt

[3]Department of Basic Science, Faculty of Physical Therapy, Pharos university in Alexandria, Alexandria, Egypt.

[4]Department of Pharmaceutics, Faculty of Pharmacy, Alexandria University, Alexandria, Egypt.

Introduction

A wound is an injury; it is the visible outcome of individual cell death, which may result in a loss of skin integrity, impairing the tissue's physiological function. Wound healing is a multi-phased process, inflammation, granulation, wound shrinking, collagen creation, epithelial closure and scar formation are all part of the process.

The best wound-healing treatment includes surgical, non-surgical and drug treatments as non-steroidal anti-inflammatory, corticosteroids, nicotine and adrenaline. However, most of these drugs have many drawbacks. Therefore, natural-product-based treatments have been extensively explored for their ability to serve the optimum effects of wound healing to patients. Flavonoids, which are prominently known for their wound-healing properties, have recently been reported to be implemented in numerous formulations. Flavonoids for wound healing have been thoroughly discussed and reported through various pathways. Despite the strong wound healing properties for these compounds their bioavailability and skin penetration is very low, which is mainly attributed to their chemical structure, molecular weight and relatively low hydro-solubility. Consequently, conventional topical administration of flavonoids seems to be inefficient. In order to overcome these challenging physicochemical properties, nanoparticle-based delivery systems have been developed. Therefore, The aim of this work is to improve the physicochemical properties of flavonoidal compound called luteolin via development of promising safe and effective topical nano-based delivery system to evaluated for its wound healing properties.

Materials and Methods

Luteolin nanogel was prepared using simple precipitation technique. Different formulations were prepared and optimized in terms of polymer type and its concentration. In-vitro evaluation was carried out in terms of particle size, PDI, zeta potential, scanning electron microscopy and transmission electron microscopy. In addition assessment was carried out for the selected formulation in a gel form, dried form, Placebo gel, drug powder gel and positive control. The in-vivo evaluation was to assess the effect of luteolin on the modulation of the immune wound niche and wound healing promotion. ELISA investigations were carried out for IL-17A, IL-13, and VEGF serum parameters as well as PCR quantification for miR-223

Results

Optimization and characterization

Table 1: Composition and colloidal properties of different mebendazole nanocrystal formulations measured by Malvern Zetasizer

Formulation Code	Polymer in solvent phase	Concentration of Polymer in solvent phase (gm%)	Particle size (nm) ± SD	PDI ± SD	Zeta potential (mV) ± SD
F1	No polymer	----	689±12.81	0.620	-21.10± 5.95
F2	SA	0.5	374.20±31	0.431	-34.4± 4.94
F3	SA	1	295.31±12	0.400	-39.6±7.45
F4	SA	2	286.70±14	0.320	-40.20±0.31
F5	HPMC	1	306.87±20	0.400	-34.94±3.54
F6	HA	1	318.47±18	0.322	-32.61±4.20
F7	HA: SA	1 (4:1)	240.00±9.0	0.30	-38.20±4.45
F8	HA: SA	1 (1:4)	267.00±8.9	0.33	-37.50±2.47
F9	HA: SA	1 (1:1)	254.60±12.	0.30	-38.20±3.50

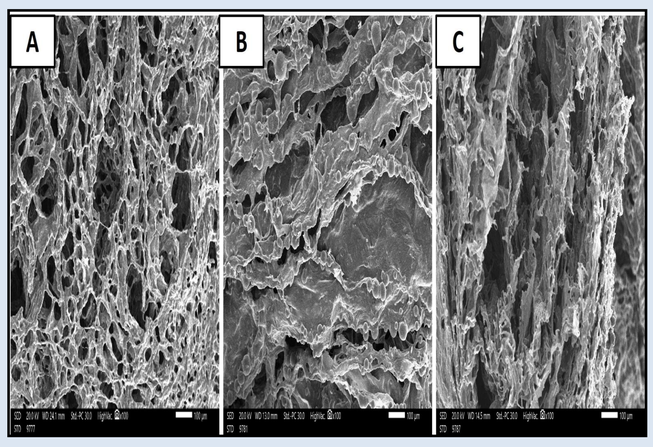

Figure 2: SEM micrographs of cross section in A)F7, B)F8 and C)F9

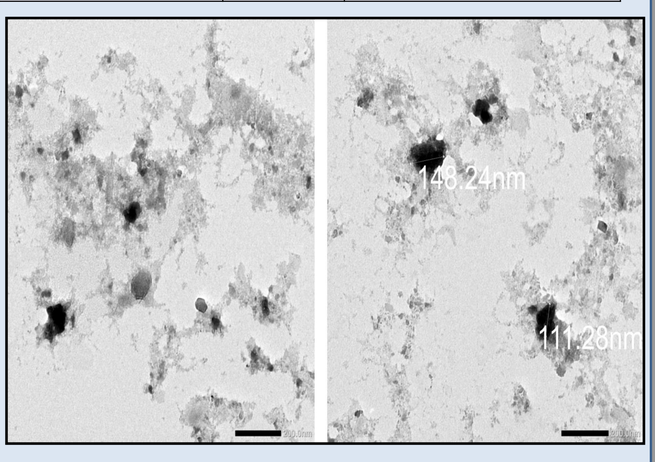

Figure 3: TEM micrograph of luteolin nanogel

In vivo examination

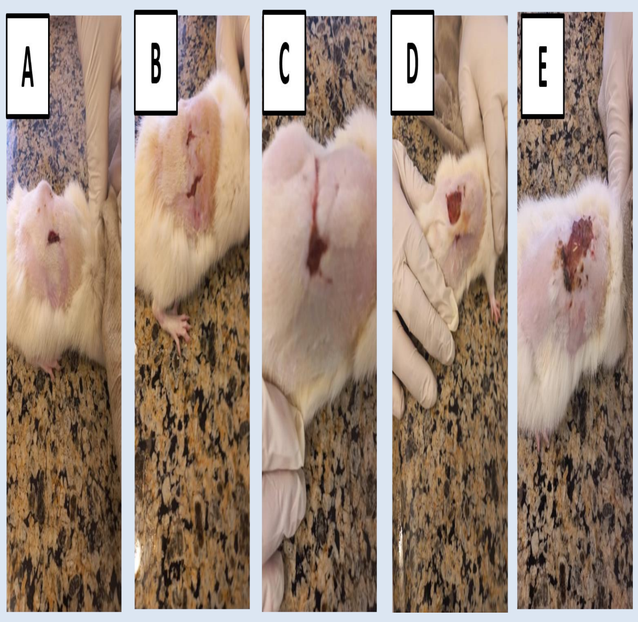

Figure 4: Representative photos of skin for different groups at the end of the experiment

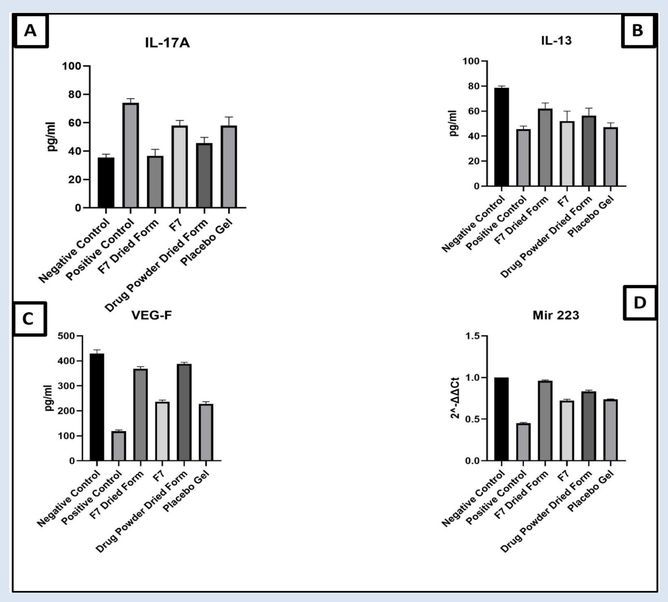

Figure 5: Change in IL-17A, IL-13, and VEGF, PCR quantification for miR-223 level in different treated groups at the end of the experiment,

Conclusions

Novel luteolin nanogel was successfully prepared using simple precipitation technique. The in-vivo results confirmed the superiority of hyaluronic based luteolin nanogel in wound healing and skin regeneration by modulation of cytokines and growth factors involved in inflammatory and proliferative phases of skin regeneration.

References

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