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# Non-invasive Anti-Wrinkle Electrospun Nanofiber Patch Containing Physalis Stem Cells Extract and Liposomal Vitamin C

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## INTRODUCTION & AIM

Wrinkles, defined as creases that develop on the skin, are among the major visible signs of aging, which directly affect youthful appearance. Their formation is largely driven by oxidative stress through various biological mechanisms. Therefore, anti-wrinkle agents should include effective antioxidants to prevent or reduce their formation. Over the years, plant-derived antioxidants have been recognized to play a critical role in protecting the skin from aging-related oxidative damage; however, their therapeutic use remains limited by instability, low absorption, reduced bioavailability, and restricted skin penetration. Nanocarriers, such as coaxial electrospun nanofibers, provide a promising delivery system, enhancing stability and penetration while enabling synergistic effects. Vitamin C, a potent antioxidant, plays a crucial role in skin protection, ranging from scavenging free radicals to stimulating collagen synthesis and preventing its degradation. Physalis, a medicinal plant with enhanced secondary metabolite production via tissue culture techniques, known for its antioxidants and anti-inflammatory activities, may offer additional therapeutic potential. It has been shown that incorporating additional antioxidants into the skin can improve its appearance and delay the aging process. This study aims to evaluate the synergistic combination of liposomal vitamin C with Physalis extract prepared in a coaxial electrospun nanofiber system as a novel Non-invasive anti-wrinkle strategy

## METHOD

Vitamin C-loaded liposomes were prepared using the thin-film hydration method and combined with *Physalis peruviana* extract obtained via solvent extraction. The formulations were evaluated for stability, particle size, and encapsulation efficiency. Particle size and zeta potential were determined by dynamic and electrophoretic light scattering using a Zeta sizer Nano ZS (Malvern Instruments, UK), revealing uniform nanosized vesicles with good colloidal stability (PDI < 0.2). Antioxidant efficacy was assessed through DPPH radical scavenging and enzyme activity assays under UV-induced oxidative stress. Comparative evaluation of liposomal formulations with and without *Physalis* extract demonstrated a synergistic enhancement of antioxidant capacity, confirming the efficiency of co-formulation in improving oxidative stress resistance.

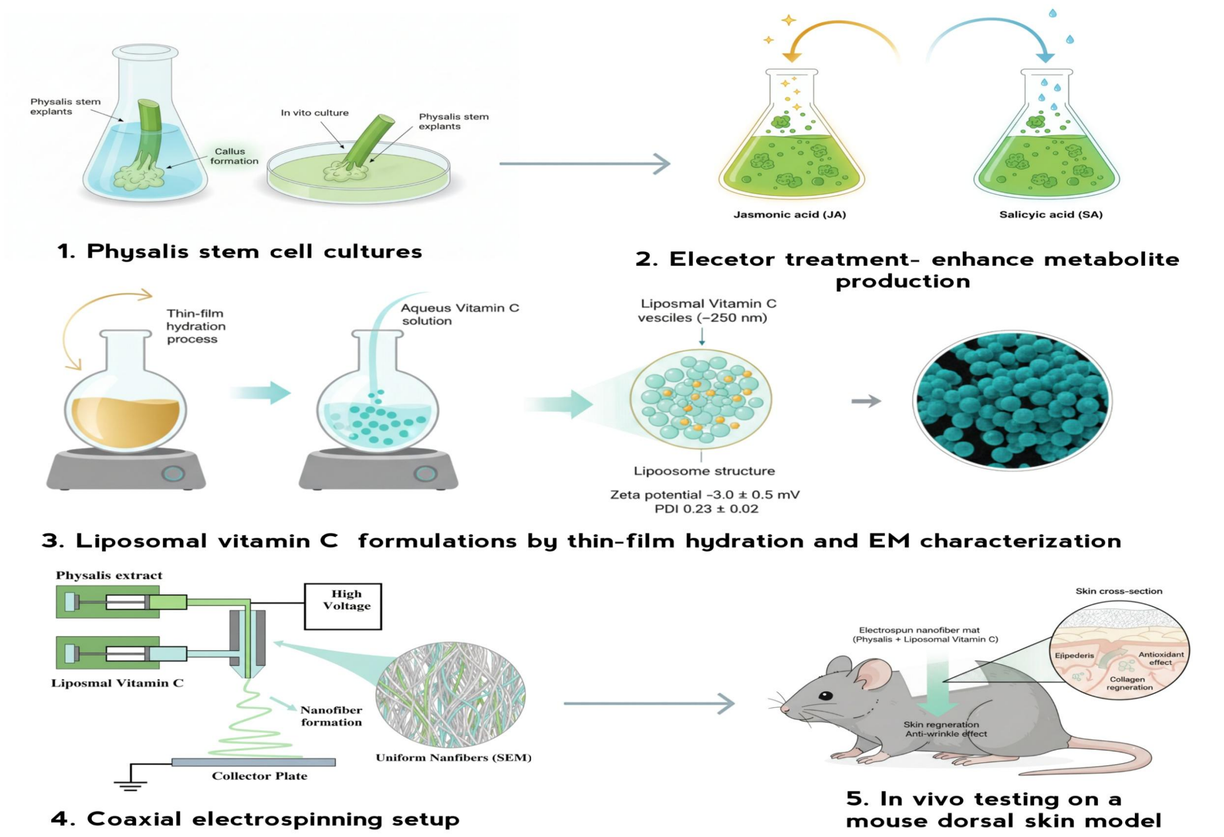


Fig.1. Integrated workflow showing *Physalis* stem cell culture, elicitor-induced metabolite enhancement, liposomal vitamin C formulation, electrospinning, and in vivo skin regeneration testing.

## RESULTS & DISCUSSION

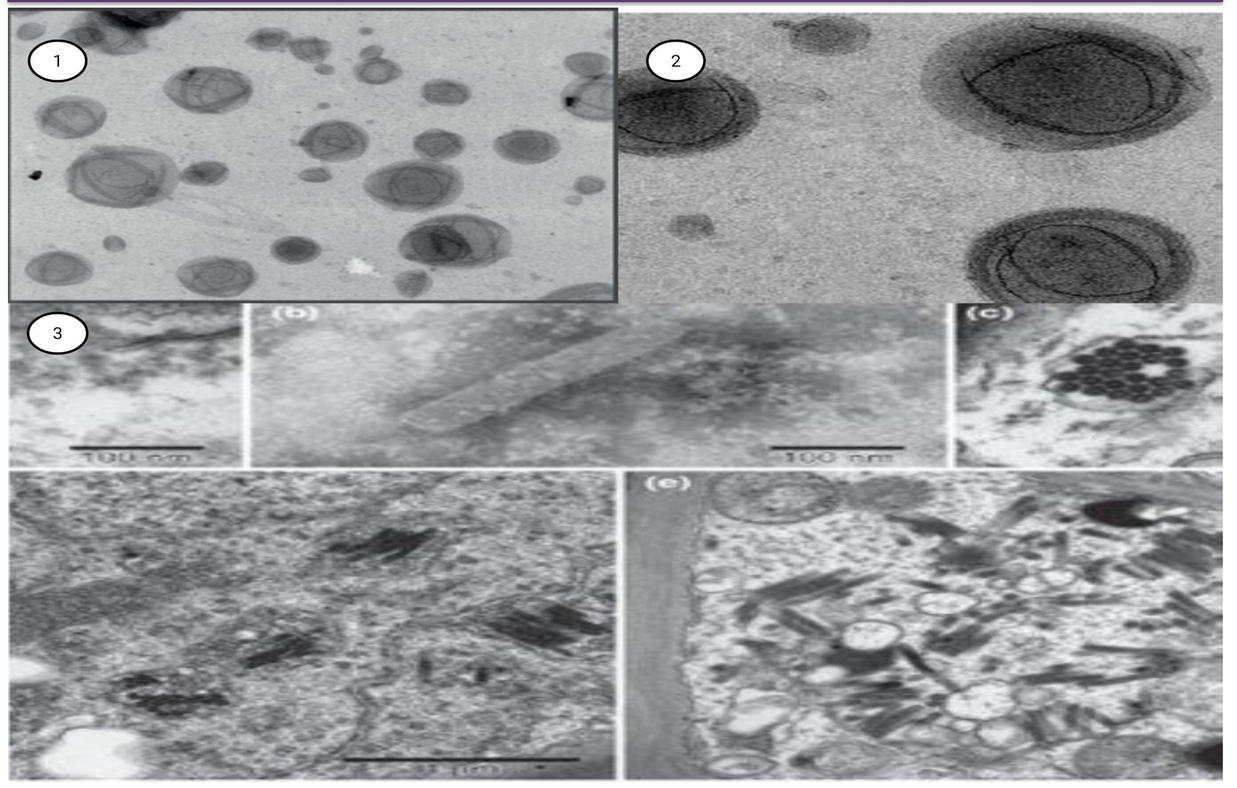


Fig.1. Transmission Electron Microscopy (×15,000) Liposomal Vitamin C showing spherical nanosized vesicles with smooth morphology.

Fig.2. Transmission Electron Microscopy (×40,000) High-magnification TEM image of Liposomal Vitamin C confirming uniform size distribution and integrity of vesicles.

Fig.3. Transmission Electron Microscopy (Physalis extract) TEM micrograph of Physalis stem cell extract exhibiting nanoparticulate structure and homogenous texture.

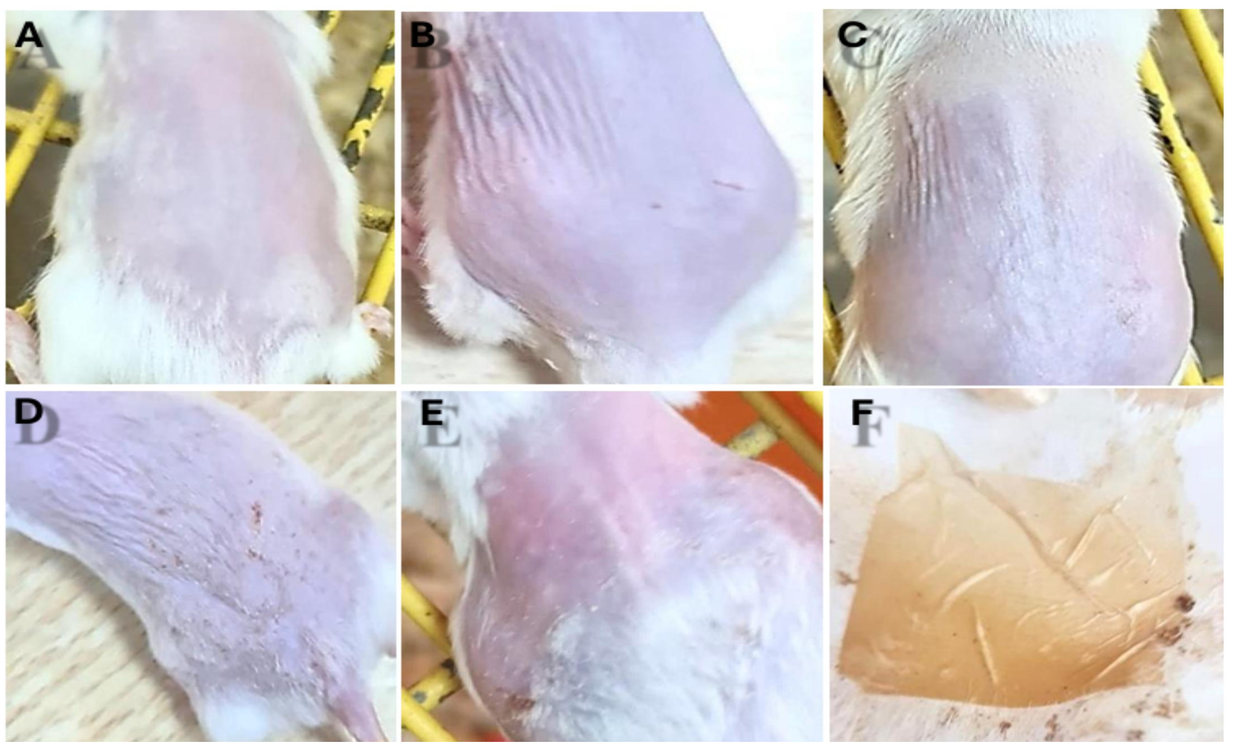


Fig.3. Photograph of a sample of the mice's back at the completion of the treatment period. (A) Normal Control (NC) group, (B) Positive Control (PC) group, (C) Nanofiber carrier patch (Free-P) treated group, (D) Liquid Formula treated group, (E) Medicated nanofiber patch treated group, (F) The application of the electrospun nanofiber Anti-wrinkle patch

## CONCLUSION

The developed Physalis–Vitamin C nanofiber patch demonstrated enhanced antioxidant performance and protection against oxidative damage. The synergistic combination of JA-elicited Physalis metabolites and liposomal vitamin C in a nanofiber matrix represents a novel, non-invasive strategy for anti-wrinkle skin therapy.

## FUTURE WORK / REFERENCES

Future studies will aim to optimize nanofiber formulation for controlled release and extend evaluation to clinical trials to confirm long-term safety and efficacy. Further work will explore additional natural antioxidants and synergistic combinations for enhanced anti-aging potential.

References:Kim *et al.* (2021); Elsis *et al.* (2023); Serra *et al.* (2024); San Hussen *et al.* (2023); Vicas *et al.* (2020); Hussen *et al.* (2025).