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Evaluation of feasibility of modified phospholipid vesicles loading *Cardiospermum halicacabum* extract for nasal delivery.

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Introduction. Extract of *Cardiospermum halicacabum* (*C. halicacabum*) was incorporated into modified phospholipid vesicles to obtain nasal formulations for the treatment of nasopharyngeal diseases.

Materials and methods. Liposomes and hyalurosomes loading *C. halicacabum* were prepared and modified by adding a commercial fish gelatin or chondroitin sulfate from *Scyliorhinus canicula* cartilage. Vesicle structure and morphology were observed using a cryogenic transmission electron microscope (cryo-TEM); mean diameter, polydispersity index and zeta potential were measured using a Zetasizer nano (Malvern Instruments, Worcestershire, UK). Biocompatibility and protective activity of formulations against oxidative damage were evaluated using human keratinocytes. The droplet size distribution after nebulization was assayed by laser diffraction with the Malvern Spraytec®. Spray plume was calculated after manual nebulization to predict the deposition of the dispersions in the nasal area.

Results and discussion. All the vesicles were sized around 100 nm, negatively charged, mostly spherical and unilamellar. The size of droplets generated by the dispersions of *C halicacabum* loaded vesicles was suitable for nasal delivery and the spray plume showed an efficient particle dispersion with a narrow angle for each formulation (<60°), suggesting a good deposition in the nasal cavity. Moreover, formulations were highly biocompatible and were also able to protect the epithelial cells against oxidative damage induced by hydrogen peroxide.

Conclusion. Results suggest the feasibility of formulations as nasal delivery systems thus promoting their use for the treatment of nasopharyngeal disorders associated with oxidative stress.

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