Development and Characterization of Caffeine Loaded Nanoparticles in Treatment of Gynoid Lipodystrophy

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Gynoid lipodystrophy (GLD), commonly known as “cellulite” is a structural, inflammatory, and biochemical disorder of the subcutaneous tissue causing topographical skin alterations. GLD affects up to 90% of women, beginning in puberty. According to American Academy of Dermatology Association (AAD), no current treatment of cellulite is completely effective, and most improvements from currently available treatments are not long-lasting. One current treatment for cellulite is mesotherapy, which injects compounds like methylxanthines, such as caffeine, into the subcutaneous fat. Because mesotherapy is invasive, this study aimed to develop topical caffeine formulations and investigate the role of different nanocarriers and types of phospholipids in caffeine entrapment efficiency and formulation stability. Liposomes of phosphatidylcholine and cholesterol loaded with four different caffeine concentrations were prepared by thin film hydration technique and ethosomal formulations were prepared according to the ethanol injection method. Our results showed that the percentage of caffeine loaded in all liposomal formulations varied between 91% to 94%, and the percentage of caffeine loaded in all ethosomal formulations varied between 97% to 99%. Among our two tested phosphatidylcholines, Lipoid 75S showed higher zeta potential values compared to Lipoid 90G. Also, the particle size of ethosomal formulations was found to be lower than that of liposomal formulations. Our findings suggest that the high entrapment efficiency of liposomal and ethosomal formulations could enhance the penetration of hydrophilic substances such as caffeine. However, to see caffeine’s anti-cellulite effect, further in-vitro permeation assays and clinical studies need to be conducted. Supported by the Rutgers University Center for Dermal Research, NIH R25ES20721 and the SURF program.