REFERENCES

Abdelbary, A. A., and Aboughaly, M. H., (2015), "Design and Optimization of Topical Methotrexate Loaded Niosomes for Enhanced Management of Psoriasis: Application of Box–Behnken Design, In-Vitro Evaluation and In-Vivo Skin Deposition Study," Int. J. Pharm., 485(1-2), Pp.235-243.

Abraham Lingan, M. (2008). Formulation and Evaluation of Topical Drug Delivery System Containing Clobetasol Propionate Niosomes. Madurai Medical College, Madurai.

Afifi, T., De Gannes, G., Huang, C., and Zhou, Y., (2005), "Topical Therapies for Psoriasis: Evidence-Based Review," Can. Fam. Physician, 51(4), Pp.519-525.

Agarwal, R., Katare, O., and Vyas, S., (2001), "Preparation and In Vitro Evaluation of Liposomal/Niosomal Delivery Systems for Antipsoriatic Drug Dithranol," Int. J. Pharm., 228(1-2), Pp.43-52.

Agrawal, U., Gupta, M., and Vyas, S., (2015), "Capsaicin Delivery into the Skin with Lipidic Nanoparticles for the Treatment of Psoriasis," Artif. Cells Nanomed. Biotechnol., 43(1), Pp.33-39.

Aithal, G. C., Narayan, R., and Nayak, U. Y., (2020), "Nanoemulgel: A Promising Phase in Drug Delivery," Curr. Pharm. Des., 26(2), Pp.279-291.

Alam, M. S., Ali, M. S., Alam, N., Siddiqui, M. R., Shamim, M., and Safhi, M., (2013), "In Vivo Study of Clobetasol Propionate Loaded Nanoemulsion for Topical Application In Psoriasis and Atopic Dermatitis," Drug Invent. Today, 5(1), Pp.8-12.

Aljuffali, I. A., Sung, C. T., Shen, F.-M., Huang, C.-T., and Fang, J.-Y., (2014), "Squarticles as a Lipid Nanocarrier for Delivering Diphencyprone and Minoxidil to Hair Follicles and Human Dermal Papilla Cells," The AAPS Journal, 16(1), Pp.140-150.

Alsenz, J., and Kansy, M., (2007), "High Throughput Solubility Measurement In Drug Discovery and Development," Adv. Drug Del. Rev., 59(7), Pp.546-567.

Baboota, S., Alam, M. S., Sharma, S., Sahni, J. K., Kumar, A., and Ali, J., (2011), "Nanocarrier-Based Hydrogel of Betamethasone Dipropionate and Salicylic

Acid for Treatment of Psoriasis," Int. J. Pharm. Investig., 1(3), Pp.139.

Badıllı, U., Şen, T., and Tarımcı, N., (2011), "Microparticulate Based Topical Delivery System of Clobetasol Propionate," AAPS PharmSciTech, 12(3), Pp.949-957.

Barea, M., Jenkins, M., Gaber, M., and Bridson, R., (2010), "Evaluation of Liposomes Coated with A Ph Responsive Polymer," Int. J. Pharm., 402(1-2), Pp.89-94.

Baroli, B., López-Quintela, M. A., Delgado-Charro, M. B., Fadda, A. M., and Blanco-Méndez, J., (2000), "Microemulsions for Topical Delivery of 8-Methoxsalen," JCR , 69(1), Pp.209-218.

Basse, L. H., Groen, D., and Bouwstra, J. A., (2013), "Permeability and Lipid Organization of A Novel Psoriasis Stratum Corneum Substitute," Int. J. Pharm., 457(1), Pp.275-282.

Battaglia, L., Peira, E., Sapino, S., and Gallarate, M., (2012), "Lipid Nanosystems in Topical Puva Therapy," J Dispers Sci Technol, 33(4), Pp.565-569.

Behera, J., Keservani, R. K., Yadav, A., Tripathi, M., and Chadoker, A., (2010), "Methoxsalen Loaded Chitosan Coated Microemulsion for Effective Treatment of Psoriasis," Int. J. Drug Deliv, 2(2).

Bernardi, D. S., Pereira, T. A., Maciel, N. R., Bortoloto, J., Viera, G. S., Oliveira, G. C., and Rocha-Filho, P. A., (2011), "formation and Stability of Oil-in-Water Nanoemulsions Containing Rice Bran Oil: In Vitro and In Vivo Assessments," J Nanobiotechnol, 9(44), Pp.1-9.

Bhardwaj, S., and Tiwari, A., (2021), "Nanoemulgel: A Promising Nanolipoidal-Emulsion Based Drug Delivery System in Managing Psoriasis," Dhaka Univ. J. Pharm. Sci., 20(2), Pp.235-246.

Bhatia, A., Kumar, R., and Katare, O. P., (2004), "Tamoxifen in Topical Liposomes: Development, Characterization and In-Vitro Evaluation," J. Pharm. Sci., 7(2), Pp.252-259.

Bhushan, M., Mclaughlin, B., Weiss, J., and Griffiths, C., (1999), "Levels of Endothelial Cell Stimulating Angiogenesis Factor and Vascular Endothelial

Growth Factor are Elevated in Psoriasis," Br. J. Dermatol., 141(6), Pp.1054-1060.

Bhoir, S. S., Vishwapathi, V., and Singh, K. K., (2019), "Antipsoriatic Potential of Annona Squamosa Seed Oil: An In Vitro and In Vivo Evaluation," Phytomedicine, 54, Pp.265-277.

Bikkad, M. L., Nathani, A. H., Mandlik, S. K., Shrotriya, S. N., and Ranpise, N. S., (2014), "Halobetasol Propionate-Loaded Solid Lipid Nanoparticles (Sln) for Skin Targeting by Topical Delivery," J. Liposome Res., 24(2), Pp.113-123.

Bracke, S., Carretero, M., Guerrero-Aspizua, S., Desmet, E., Illera, N., Navarro, M., Lambert, J., and Del Rio, M., (2014), "Targeted Silencing of DEFB 4 in A Bioengineered Skin-Humanized Mouse Model for Psoriasis: Development of Si RNA SEC Osome-Based Novel Therapies," Exp. Dermatol., 23(3), Pp.199-201.

Brülls, M., and Rasmuson, A., (2002), "Heat Transfer in Vial Lyophilization," Int. J. Pharm., 246(1-2), Pp.1-16.

Cavalli, R., Peira, E., Caputo, O., and Gasco, M. R., (1999), "Solid Lipid Nanoparticles as Carriers of Hydrocortisone and Progesterone Complexes with B-Cyclodextrins," Int. J. Pharm., 182(1), Pp.59-69.

Cevc, G., (1996), "Transfersomes, Liposomes and other Lipid Suspensions on the Skin: Permeation Enhancement, Vesicle Penetration, and Transdermal Drug Delivery," Crit. Rev. Ther. Drug Carrier Syst., 13(3-4).

Cevc, G., and Blume, G., (1992), "Lipid Vesicles Penetrate Into Intact Skin Owing To The Transdermal Osmotic Gradients and Hydration force," Biochim. Biophys. Acta Biomembr., 1104(1), Pp.226-232.

Cevc, G., and Blume, G., (2004), "Hydrocortisone and Dexamethasone in very Deformable Drug Carriers have Increased Biological Potency, Prolonged Effect, and Reduced Therapeutic Dosage," Biochim. Biophys. Acta Biomembr., 1663(1-2), Pp.61-73.

Cevc, G., Blume, G., and Schätzlein, A., (1997), "Transfersomes-Mediated

Transepidermal Delivery Improves the Regio-Specificity and Biological Activity of Corticosteroids In Vivo," JCR, 45(3), Pp.211-226.

Chen, X., Yang, M., Cheng, Y., Liu, G. J., and Zhang, M., (2013a), "Narrow-Band Ultraviolet B Phototherapy Versus Broad-Band Ultraviolet B or Psoralen-Ultraviolet A Photochemotherapy for Psoriasis," Cochrane Database Syst. Rev..

Chen, X., Yang, M., Cheng, Y., Liu, G. J., and Zhang, M., (2013b), "Narrow-Band Ultraviolet B Phototherapy Versus Broad-Band Ultraviolet B or Psoralen-Ultraviolet A Photochemotherapy for Psoriasis," Cochrane Database Syst. Rev., (10).

Colombo, D., Cassano, N., Bellia, G., and Vena, G. A., (2014a), "Gender Medicine and Psoriasis," WJD, 3(3), Pp.36-44.

Colombo, D., Cassano, N., Bellia, G., and Vena, G. A., (2014b), "World Journal of," World, 3(3), Pp.36-44.

Cox, N., Jorizzo, J., Bourke, J., and Savage, C., (2010a), "Vasculitis, Neutrophilic Dermatoses and Related Disorders," Rook's Textbook of Dermatology, 1, Pp.1-95.

Cox, N., Jorizzo, J., Bourke, J., and Savage, C., (2010b), "Vasculitis, Neutrophilic Dermatoses and Related Disorders," Rook's Textbook of Dermatology, Eighth Edition, Pp.1-95.

Creamer, D., Allen, M., Jaggar, R., Stevens, R., Bicknell, R., and Barker, J., (2002), "Mediation of Systemic Vascular Hyperpermeability In Severe Psoriasis By Circulating Vascular Endothelial Growth Factor," Arch. Dermatol., 138(6), Pp.791-796.

Creamer, D., Allen, M., Sousa, A., Poston, R., and Barker, J., (1997), "Localization of Endothelial Proliferation and Microvascular Expansion In Active Plaque Psoriasis," Br. J. Dermatol., 136(6), Pp.859-865.

Crovini, L., Marcarino, P., and Milazzo, G., (1981), "Apparatus for Accurate Determination of Melting and Freezing Points," Anal. Chem., 53(4), Pp.681-

686.

Crozier, R., (1968), "An Acetic Acid Dissociation, Air-Drying Technique for Insect Chromosomes, With Aceto-Lactic Orcein Staining," Stain Technol., 43(3), Pp.171-173.

Dar, M. J., Khalid, S., Varikuti, S., Satoskar, A. R., and Khan, G. M., (2020), "Nano-Elastic Liposomes as Multidrug Carrier of Sodium Stibogluconate and Ketoconazole: A Potential New Approach for the Topical Treatment of Cutaneous Leishmaniasis," European J. Pharm. Sci., 145, Pp.105256.

De Carvalho Vicentini, F. T. M., Depieri, L. V., Polizello, A. C. M., Del Ciampo, J. O., Spadaro, A. C. C., Fantini, M. C., and Bentley, M. V. L. B., (2013), "Liquid Crystalline Phase Nanodispersions Enable Skin Delivery of Sirna," Eur. J. Pharm. Biopharm., 83(1), Pp.16-24.

Decroix, J., Pres, H., Tsankov, N., Poncet, M., and Arsonnaud, S., (2004), "Clobetasol Propionate Lotion In The Treatment of Moderate To Severe Plaque-Type Psoriasis," Cutis, 74(3), Pp.201-206.

Despotopoulou, D., Lagopati, N., Pispas, S., Gazouli, M., Demetzos, C., and Pippa, N., (2021), "The Technology of Transdermal Delivery Nanosystems: From Design and Development to Preclinical Studies," Int. J. Pharm., Pp.121290.

Duangjit, S., Opanasopit, P., Rojarata, T., Obata, Y., Oniki, Y., Takayama, K., and Ngawhirunpat, T. (2013). The Role of Deformable Liposome Characteristics on Skin Permeability of Meloxicam: Optimal Transfersome as Transdermal Delivery Carriers. Paper Presented at the Open Conference Proceedings Journal.

Dubey, V., Mishra, D., Dutta, T., Nahar, M., Saraf, D., and Jain, N., (2007), "Dermal and Transdermal Delivery of An Anti-Psoriatic Agent Via Ethanolic Liposomes," JCR, 123(2), Pp.148-154.

Ellis, C. N., and Krueger, G. G., (2001), "Treatment of Chronic Plaque Psoriasis By Selective Targeting of Memory Effector T Lymphocytes," NEJM, 345(4), Pp.248-255.

Elsayed, M. M., Abdallah, O. Y., Naggar, V. F., and Khalafallah, N. M., (2007), "Lipid Vesicles for Skin Delivery of Drugs: Reviewing three Decades of Research," Int. J. Pharm., 332(1), Pp.1-16.

Essaghraoui, A., Belfkira, A., Hamdaoui, B., Nunes, C., Lima, S. A. C., and Reis, S., (2019), "Improved Dermal Delivery of Cyclosporine a Loaded in Solid Lipid Nanoparticles," Nanomaterials, 9(9), Pp.1204.

Fang, C.-L., Aljuffali, I. A., Li, Y.-C., and Fang, J.-Y., (2014), "Delivery and Targeting of Nanoparticles into Hair Follicles," Ther. Deliv., 5(9), Pp.991-1006.

Fang, J.-Y., Fang, C.-L., Liu, C.-H., and Su, Y.-H., (2008), "Lipid Nanoparticles as Vehicles for Topical Psoralen Delivery: Solid Lipid Nanoparticles (Sln) Versus Nanostructured Lipid Carriers (Nlc)," Eur. J. Pharm. Biopharm., 70(2), Pp.633-640.

Feldman, S. R., (2005), "Relative Efficacy and Interchangeability of various Clobetasol Propionate Vehicles in the Management of Steroid-Responsive Dermatoses," CTR, 66(3), Pp.154-171.

Feldman, S. R., and Yentzer, B. A., (2009), "Topical Clobetasol Propionate in the Treatment of Psoriasis," Am. J. Clin. Dermatol., 10(6), Pp.397-406.

Ferreira, H., Ribeiro, A., Silva, R., and Cavaco-Paulo, A., (2015), "Deformable Liposomes for the Transdermal Delivery of Piroxicam," J Pharm Drug Deliv Res, 4(4).

Fesq, H., Lehmann, J., Kontny, A., Erdmann, I., Theiling, K., Rother, M., Ring, J., Cevc, G., and Abeck, D., (2003), "Improved Risk–Benefit Ratio for Topical Triamcinolone Acetonide In Transfersome® In Comparison With Equipotent Cream and Ointment: A Randomized Controlled Trial," Br. J. Dermatol., 149(3), Pp.611-619.

Fiorentino, D. F., (2007), "The Yin and Yang of Tnf-A Inhibition," Arch. Dermatol., 143(2), Pp.233-236.

Fisher, V. S., (2004), "Clinical Monograph for Drug formulary Review: Systemic

Agents for Psoriasis/Psoriatic Arthritis," JMCP, 11(1), Pp.33-55.

Fisher, V. S., (2005), "Clinical Monograph for Drug formulary Review: Systemic Agents for Psoriasis/Psoriatic Arthritis," JMCP, 11(1), Pp.33-55.

Friedrich, R. B., Fontana, M. C., Beck, R. C. R., Pohlmann, A. R., and Guterres, S. S., (2008), "Development and Physicochemical Characterization of Dexamethasone-Loaded Polymeric Nanocapsule Suspensions," Quím. Nova, 31, Pp.1131-1136.

Gambhire, M. S., Bhalekar, M. R., and Gambhire, V. M., (2011), "Statistical Optimization of Dithranol-Loaded Solid Lipid Nanoparticles Using Factorial Design," Braz. J. Pharm. Sci., 47(3), Pp.503-511.

Ganesan, M. G., Weiner, N. D., Flynn, G. L., and Ho, N., (1984), "Influence of Liposomal Drug Entrapment on Percutaneous Absorption," Int. J. Pharm., 20(1), Pp.139-154.

Ghasemiyeh, P., and Mohammadi-Samani, S., (2018), "Solid Lipid Nanoparticles and Nanostructured Lipid Carriers as Novel Drug Delivery Systems: Applications, Advantages and Disadvantages," Res. Pharm. Sci., 13(4), Pp.288.

Gómez-Gaete, C., Tsapis, N., Besnard, M., Bochot, A., and Fattal, E., (2007), "Encapsulation of Dexamethasone into Biodegradable Polymeric Nanoparticles," Int. J. Pharm., 331(2), Pp.153-159.

Gordon, M. L., (1998), "The Role of Clobetasol Propionate Emollient 0.05% In the Treatment of Patients with Dry, Scaly, Corticosteroid-Responsive Dermatoses," Clin. Ther., 20(1), Pp.26-39.

Guerra, I., and Gisbert, J. P., (2013a), "Onset of Psoriasis in Patients with Inflammatory Bowel Disease Treated with Anti-Tnf Agents."

Guerra, I., and Gisbert, J. P., (2013b), "Onset of Psoriasis In Patients with Inflammatory Bowel Disease Treated with Anti-Tnf Agents," Expert Rev. Gastroenterol. Hepatol., 7(1), Pp.41-48.

Guo, J., Ping, Q., Sun, G., and Jiao, C., (2000), "Lecithin Vesicular Carriers for Transdermal Delivery of Cyclosporin A," Int. J. Pharm., 194(2), Pp.201-207.

Gupta, V., Rathore, D., Kansara, N. P., and Badiger, A., (2013), "Dataset Paper In Vivo Antioxidant Activity of Topical Cream of Cassia Tora L. Leaves Extract."

Hadgraft, J., (1996), "Recent Developments in Topical and Transdermal Delivery," Eur. J. Drug Metab., 21(2), Pp.165-173.

Han, I., Kim, M., and Kim, J., (2004), "Enhanced Transfollicular Delivery of Adriamycin with A Liposome and Iontophoresis," Exp. Dermatol., 13(2), Pp.86-92.

Hashim, I. I. A., El-Magd, N. F. A., El-Sheakh, A. R., Hamed, M. F., and Abd El, A. E.-G. H., (2018), "Pivotal Role of Acitretin Nanovesicular Gel for Effective Treatment of Psoriasis: Ex Vivo–In Vivo Evaluation Study," Int. J. Nanomedicine, 13, Pp.1059.

Herbig, M. E., and Evers, D.-H., (2013), "Correlation of Hydrotropic Solubilization by Urea with Log D of Drug Molecules and Utilization of this Effect for Topical Formulations," Eur. J. Pharm. Biopharm., 85(1), Pp.158-160.

Hern, S., Allen, M., Sousa, A., Harland, C., Barker, J., Levick, J., and Mortimer, P., (2001), "Immunohistochemical Evaluation of Psoriatic Plaques Following Selective Photothermolysis of the Superficial Capillaries," Br. J. Dermatol., 145(1), Pp.45-53.

Hsu, L., and Armstrong, A. W., (2014), "Jak Inhibitors: Treatment Efficacy and Safety Profile in Patients with Psoriasis," J. Immunol. Res., 2014.

Huang, Z.-R., Lin, Y.-K., and Fang, J.-Y., (2009), "Biological and Pharmacological Activities of Squalene and Related Compounds: Potential Uses In Cosmetic Dermatology," Molecules, 14(1), Pp.540-554.

Hussain, A., Samad, A., Singh, S., Ahsan, M., Haque, M., Faruk, A., and Ahmed, F., (2016), "Nanoemulsion Gel-Based Topical Delivery of an Antifungal Drug: In Vitro Activity and In Vivo Evaluation," Drug Deliv, 23(2), Pp.642-657.

Ishihara, T., Izumo, N., Higaki, M., Shimada, E., Hagi, T., Mine, L., Ogawa, Y., and Mizushima, Y., (2005), "Role of Zinc in formulation of Plga/Pla Nanoparticles

Encapsulating Betamethasone Phosphate and its Release Profile," JCR, 105(1-2), Pp.68-76.

Jain, S. (2012). *Dermatology: Illustrated Study Guide and Comprehensive Board Review*: SSBM.

Jain, S. (2017). *Dermatology: Illustrated Study Guide and Comprehensive Board Review*: SSBM.

Jain, S., Mittal, A., and K Jain, A., (2011), "Enhanced Topical Delivery of Cyclosporin-A using Plga Nanoparticles as Carrier," Curr.Nanosci., 7(4), Pp.524-530.

James, W., Berger, T., and Elston, D. (2015). andrews' Diseases of the Skin: Clinical Dermatology. Philadlephia: Pa, Usa: Elsevier Sci..

James, W. D., Berger, T., and Elston, D. (2015). *Andrews' Diseases of the Skin: Clinical Dermatology*: Elsevier Sci..

Johnston, A., Xing, X., Guzman, A. M., Riblett, M., Loyd, C. M., Ward, N. L., Wohn, C., Prens, E. P., Wang, F., and Maier, L. E., (2011), "Il-1f5,-F6,-F8, and-F9: A Novel Il-1 Family Signaling System That is Active in Psoriasis and Promotes Keratinocyte Antimicrobial Peptide Expression," J. Immunol, 186(4), Pp.2613-2622.

Jones, D. S., Woolfson, A. D., and Brown, A. F., (1997), "Textural Analysis and Flow Rheometry of Novel, Bioadhesive Antimicrobial Oral Gels," Pharm. Res., 14(4), Pp.450-457.

Kalariya, M., Padhi, B. K., Chougule, M., and Misra, A., (2005), "Clobetasol Propionate Solid Lipid Nanoparticles Cream for Effective Treatment of Eczema: formulation and Clinical Implications."

Katare, O., Raza, K., Singh, B., and Dogra, S., (2010), "Novel Drug Delivery Systems In Topical Treatment of Psoriasis: Rigors and Vigors," Indian J. Dermatol., 76(6), Pp.612.

Katare, O. P., Raza, K., Singh, B., and Dogra, S., (2010), "Novel Drug Delivery Systems In Topical Treatment of Psoriasis: Rigors and Vigors," Indian J.

Dermatol., 76(6), Pp.612.

Kato, A., Ishibashi, Y., and Miyake, Y., (1987), "Effect of Egg Yolk Lecithin On Transdermal Delivery of Bunazosin Hydrochloride," J. Pharm. Pharmacol., 39(5), Pp.399-400.

Kasper, M., Gabriel, D., Möller, M., Bauer, D., Wildschütz, L., Courthion, H., Böhm, M. R., Busch, M., Loser, K., and Thanos, S., (2018), "Novel Everolimus-Loaded Nanocarriers for Topical Treatment of Murine Experimental Autoimmune Uveoretinitis (EAU)," Exp. Eye Res., 168, Pp.49-56.

Khandavilli, S., and Panchagnula, R., (2007), "Nanoemulsions As Versatile formulations for Paclitaxel Delivery: Peroral and Dermal Delivery Studies In Rats," J. Investig. Dermatol., 127(1), Pp.154-162.

Khurana, B., Arora, D., and Narang, R., (2018), "Topical Delivery of Nanoemulsion for Antipsoriatic Drugs," JDDT, 8(5-S), Pp.1-11.

Kierstead, P. H., Okochi, H., Venditto, V. J., Chuong, T. C., Kivimae, S., Fréchet, J. M., and Szoka, F. C., (2015), "The Effect of Polymer Backbone Chemistry on the Induction of the Accelerated Blood Clearance In Polymer Modified Liposomes," JCR, 213, Pp.1-9.

Kim, E. S., and Frampton, J. E., (2016), "Calcipotriol/Betamethasone Dipropionate Foam: A Review in Plaque Psoriasis," Drugs, 76(15), Pp.1485-1492.

Kim, M.-K., Chung, S.-J., Lee, M.-H., and Shim, C.-K., (1998), "Delivery of Hydrocortisone From Liposomal Suspensions to the Hairless Mouse Skin Following Topical Application under Non-Occlusive and Occlusive Conditions," J. Microencapsul. 15(1), Pp.21-29.

Kim, S. T., Jang, D.-J., Kim, J. H., Park, J. Y., Lim, J. S., Lee, S. Y., Lee, K.-M., Lim, S.-J., and Kim, C.-K., (2009), "Topical Administration of Cyclosporin A in A Solid Lipid Nanoparticle formulation," Die Pharmazie- Int. J. Pharm. Sci., 64(8), Pp.510-514.

Kjær, T. N., Thorsen, K., Jessen, N., Stenderup, K., and Pedersen, S. B., (2015), "Resveratrol Ameliorates Imiquimod-Induced Psoriasis-Like Skin

Inflammation in Mice," Plos One, 10(5), Pp.E0126599.

Knudsen, N. Ø., Rønholt, S., Salte, R. D., Jorgensen, L., Thormann, T., Basse, L. H., Hansen, J., Frokjaer, S., and Foged, C., (2012), "Calcipotriol Delivery into the Skin with Pegylated Liposomes," Eur. J. Pharm. Biopharm., 81(3), Pp.532-539.

Körbel, J., Sebök, B., Kerenyi, M., and Mahrle, G., (2001), "Enhancement of the Antiparakeratotic Potency of Calcitriol and Tacalcitol in Liposomal Preparations in the Mouse Tail Test," Skin Pharmacol. Physiol., 14(5), Pp.291-295.

Krueger, G., and Ellis, C. N., (2005), "Psoriasis—Recent Advances In Understanding its Pathogenesis and Treatment,"JAAD, 53(1), Pp.S94-S100.

Kumar, R., Deep, G., and Agarwal, R., (2015), "An Overview of Ultraviolet B Radiation-Induced Skin Cancer Chemoprevention by Silibinin," Curr. Pharmacol. Rep., 1(3), Pp.206-215.

Lapteva, M., Mondon, K., Mo□Ller, M., Gurny, R., and Kalia, Y. N., (2014), "Polymeric Micelle Nanocarriers for the Cutaneous Delivery of Tacrolimus: A Targeted Approach for the Treatment of Psoriasis," Mol. Pharm., 11(9), Pp.2989-3001.

Lapteva, M., Santer, V., Mondon, K., Patmanidis, I., Chiriano, G., Scapozza, L., Gurny, R., Möller, M., and Kalia, Y. N., (2014), "Targeted Cutaneous Delivery of Ciclosporin A Using Micellar Nanocarriers and the Possible Role of Inter-Cluster Regions As Molecular Transport Pathways," JCR, 196, Pp.9-18.

Lakshmana Prabu, S., Sharvanan, S., Aravindan, S., Bhuvaneswari, A., and Manikandan, V., (2017), "Nanoemulgel for Transdermal Delivery of Cyclobenzaprine Hydrochloride: Design, Characterization and In-Vitro Studies," NAPDD, 1(5), Pp.87-92.

Lampis, S., Carboni, M., Steri, D., Murgia, S., and Monduzzi, M., (2018), "Lipid Based Liquid-Crystalline Stabilized Formulations for the Sustained Release of

Bioactive Hydrophilic Molecules," Colloids and Surfaces B: Biointerfaces, 168, Pp.35-42.

Li, G., Fan, Y., Fan, C., Li, X., Wang, X., Li, M., and Liu, Y., (2012), "Tacrolimus-Loaded Ethosomes: Physicochemical Characterization and In Vivo Evaluation," Eur. J. Pharm. Biopharm., 82(1), Pp.49-57.

Lin, Y.-K., Huang, Z.-R., Zhuo, R.-Z., and Fang, J.-Y., (2010), "Combination of Calcipotriol and Methotrexate In Nanostructured Lipid Carriers for Topical Delivery," Int. J. Nanomedicine, 5, Pp.117.

Lowes, M. A., Bowcock, A. M., and Krueger, J. G., (2007), "Pathogenesis and Therapy of Psoriasis," Nature, 445(7130), Pp.866-873.

Madan, J. R., Khude, P. A., and Dua, K., (2014), "Development and Evaluation of Solid Lipid Nanoparticles of Mometasone Furoate for Topical Delivery," Int. J. Pharm. Investig., 4(2), Pp.60.

Manconi, M., Sinico, C., Caddeo, C., Vila, A. O., Valenti, D., and Fadda, A. M., (2011), "Penetration Enhancer Containing Vesicles as Carriers for Dermal Delivery of Tretinoin," Int. J. Pharm., 412(1-2), Pp.37-46.

Marepally, S., Boakye, C. H., Patel, A. R., Godugu, C., Doddapaneni, R., Desai, P. R., and Singh, M., (2014), "Topical Administration of Dual Sirnas Using Fusogenic Lipid Nanoparticles for Treating Psoriatic-Like Plaques," Nanomedicine, 9(14), Pp.2157-2174.

Masini, V., Bonte, F., Meybeck, A., and Wepierre, J., (1993), "Cutaneous Bioavailability In Hairless Rats of Tretinoin in Liposomes Or Gel," J. Pharm. Sci., 82(1), Pp.17-21.

Mazzotta, A., Esposito, M., Carboni, I., Schipani, C., and Chimenti, S., (2007), "Clobetasol Propionate Foam 0.05% As A Novel Topical formulation for Plaque-Type and Scalp Psoriasis," J. Dermatol. Treat., 18(2), Pp.84-87.

Mehnert, W., and Mäder, K., (2001), "Solid Lipid Nanoparticles: Production, Characterization and Applications," Adv. Drug Del. Rev., 47(2), Pp.165-196.

Menter, A., Gottlieb, A., Feldman, S. R., Van Voorhees, A. S., Leonardi, C. L.,

Gordon, K. B., Lebwohl, M., Koo, J. Y., Elmets, C. A., and Korman, N. J., (2008), "Guidelines of Care for the Management of Psoriasis and Psoriatic Arthritis: Section 1. Overview of Psoriasis and Guidelines of Care for the Treatment of Psoriasis With Biologics,"JAAD, 58(5), Pp.826-850.

Mishra, N., Yadav, K. S., Rai, V. K., and Yadav, N. P., (2017), "Polysaccharide Encrusted Multilayered Nano-Colloidal System of andrographolide for Improved Hepatoprotection," Aaps Pharmscitech, 18(2), Pp.381-392.

Moghimi, S., and Patel, H., (1993), "Current Progress and Future Prospects of Liposomes in Dermal Drug Delivery," J. Microencapsul. 10(2), Pp.155-162.

Morganti, P., Ruocco, E., Wolf, R., and Ruocco, V., (2001a), "Percutaneous Absorption and Delivery Systems," Clin. Dermatol., 19(4), Pp.489-501.

Morganti, P., Ruocco, E., Wolf, R., and Ruocco, V., (2001b), "Percutaneous Absorption and Delivery Systems3," Clin. Dermatol., 19(4), Pp.489-501.

Müller, R., Petersen, R., Hommoss, A., and Pardeike, J., (2007), "Nanostructured Lipid Carriers (Nlc) In Cosmetic Dermal Products," Adv. Drug Del. Rev., 59(6), Pp.522-530.

Mura, S., Manconi, M., Valenti, D., Sinico, C., Vila, A. O., and Fadda, A. M., (2011), "Transcutol Containing Vesicles for Topical Delivery of Minoxidil," J. Drug Target., 19(3), Pp.189-196.

Mus, A.-M., Florencia, E., Prens, E. P., Kant, E. M., Boon, L., Laman, J. D., Cornelissen, F., Van Der Fits, L., Mourits, S., and Voerman, J. S., (2009), "Imiquimod-Induced Psoriasis-Like Skin," J. Immunol, 182, Pp.5836-5845.

Na Takuathung, M., Wongnoppavich, A., Panthong, A., Khonsung, P., Chiranthanut, N., Soonthornchareonnon, N., and Sireeratawong, S., (2018), "Antipsoriatic Effects of Wannachawee Recipe on Imiquimod-Induced Psoriasis-Like Dermatitis In BALB/C Mice," Evid. Based Complementary Altern. Med., 2018.

Nagle, A., Goyal, A. K., Kesarla, R., and Murthy, R. R., (2011), "Efficacy Study of Vesicular Gel Containing Methotrexate and Menthol Combination on

Parakeratotic Rat Skin Model," J. Liposome Res., 21(2), Pp.134-140.

Nakaguma, H., Kambara, T., and Yamamoto, T., (1995), "Rat Ultraviolet Ray B Photodermatitis: An Experimental Model of Psoriasis Vulgaris," Int. J. Exp. Pathol., 76(1), Pp.65.

Naldi, L., and Gambini, D., (2007), "The Clinical Spectrum of Psoriasis," Clin. Dermatol., 25(6), Pp.510-518.

Nam, S.-H., Ji, X. Y., and Park, J.-S., (2011), "Investigation of Tacrolimus Loaded Nanostructured Lipid Carriers for Topical Drug Delivery," Bull. Korean Chem. Soc., 32(3), Pp.956-960.

Naseri, N., Valizadeh, H., and Zakeri-Milani, P., (2015), "Solid Lipid Nanoparticles and Nanostructured Lipid Carriers: Structure, Preparation and Application," Adv. Pharm. Bull., 5(3), Pp.305.

Nickoloff, B. J., (1999), "The Immunologic and Genetic Basis of Psoriasis," Arch. Dermatol., 135(9), Pp.1104-1110.

Nimisha, D. A. R., Fatima, Z., and Neema, C. D. K., (2017), "Antipsoriatic and Anti-Inflammatory Studies of Berberis Aristata Extract Loaded Nanovesicular Gels," Pharmacogn. Mag., 13(Suppl 3), Pp.S587.

Özcan, İ., Azizoğlu, E., Şenyiğit, T., Özyazıcı, M., and Özer, Ö., (2013), "Comparison of Plga and Lecithin/Chitosan Nanoparticles for Dermal Targeting of Betamethasone Valerate," J. Drug Target, 21(6), Pp.542-550.

Padhy, S., Sahoo, B. M., Kumar, B. V., and Patra, C. N., (2021), "Development, Characterization and Evaluation of Nanoemulgel used for the Treatment of Skin Disorders," Curr. Nanomaterials, 6(1), Pp.43-57.

Pappas, A., (2009), "Epidermal Surface Lipids," Dermato-Endocrinology, 1(2), Pp.72-76.

Patel, D., Dasgupta, S., Dey, S., Roja Ramani, Y., Ray, S., and Mazumder, B., (2012), "Nanostructured Lipid Carriers (Nlc)-Based Gel for the Topical Delivery of Aceclofenac: Preparation, Characterization, and In Vivo Evaluation," Sci. Pharm., 80(3), Pp.749-764.

Patel, S., Patel, M., Salampure, S., Vishwanath, B., and Patel, N., (2010), "Development and Evaluation of Liposomes for Topical Delivery of Tacrolimus (Fk-506)," J. Sci. Res., 2(3), Pp.585.

Peeters, P., Ortonne, J.-P., Sitbon, R., and Guignard, E., (2005), "Cost-Effectiveness of once-daily Treatment with Calcipotriol/Betamethasone Dipropionate Followed by Calcipotriol Alone Compared with Tacalcitol in the Treatment of Psoriasis Vulgaris," Dermatol., 211(2), Pp.139-145.

Petrilli, R., Eloy, J., Praça, F., Del Ciampo, J., Fantini, M., Fonseca, M., and Bentley, M., (2016), "Liquid Crystalline Nanodispersions Functionalized with Cell-Penetrating Peptides for Topical Delivery of Short-Interfering Rnas: A Proposal for Silencing A Pro-Inflammatory Cytokine in Cutaneous Diseases," J. Biomed. Nanotech., 12(5), Pp.1063-1075.

Pinto, M. F., Moura, C. C., Nunes, C., Segundo, M. A., Lima, S. A. C., and Reis, S., (2014), "A New Topical formulation for Psoriasis: Development of Methotrexate-Loaded Nanostructured Lipid Carriers," Int. J. Pharm., 477(1-2), Pp.519-526.

Pradhan, M., Singh, D., Murthy, S. N., and Singh, M. R., (2015), "Design, Characterization and Skin Permeating Potential of Fluocinolone Acetonide Loaded Nanostructured Lipid Carriers for Topical Treatment of Psoriasis," Steroids, 101, Pp.56-63.

Pradhan, M., Singh, D., and Singh, M. R., (2015), "Development Characterization and Skin Permeating Potential of Lipid Based Novel Delivery System for Topical Treatment of Psoriasis,"Chem. Phys. Lipids, 186, Pp.9-16.

Pradhan, M., Singh, D., and Singh, M. R., (2016), "Influence of Selected Variables on Fabrication of Triamcinolone Acetonide Loaded Solid Lipid Nanoparticles for Topical Treatment of Dermal Disorders," Artif. Cells Nanomed. Biotechnol, 44(1), Pp.392-400.

Pradhan, M., Yadav, K., Singh, D., and Singh, M. R., (2021), "Topical Delivery of Fluocinolone Acetonide Integrated Nlcs and Salicylic Acid Enriched Gel: A

Potential and Synergistic Approach in the Management of Psoriasis," J. Drug Deliv. Sci. Technol., 61, Pp.102282.

Prieto-Pérez, R., Cabaleiro, T., Daudén, E., Ochoa, D., Roman, M., and Abad-Santos, F., (2013), "Genetics of Psoriasis and Pharmacogenetics of Biological Drugs," Autoimmune Dis., 2013.

Priprem, A., Limsitthichaikoon, S., and Thappasarapong, S., (2015), "Anti-Inflammatory Activity of Topical Anthocyanins by Complexation and Niosomal Encapsulation," Int. J. Chem. Mol. Eng., 9(2), Pp.142-146.

Proksch, E., (2008), "The Role of Emollients in the Management of Diseases with Chronic Dry Skin," Skin Pharmacol. Physiol., 21(2), Pp.75-80.

Rai, V. K., Yadav, N. P., Sinha, P., Mishra, N., Luqman, S., Dwivedi, H., Kymonil, K. M., and Saraf, S. A., (2014), "Development of Cellulosic Polymer Based Gel of Novel Ternary Mixture of Miconazole Nitrate for Buccal Delivery," Carbohy Polym., 103, Pp.126-133.

Rao, G., and Murthy, R. R., (2000), "Evaluation of Liposomal Clobetasol Propionate Topical formulation for Intra-Dermal Delivery," Indian J. Pharm. Sci., 62(6), Pp.459.

Rapalli, V. K., Kaul, V., Waghule, T., Gorantla, S., Sharma, S., Roy, A., Dubey, S. K., and Singhvi, G., (2020), "Curcumin Loaded Nanostructured Lipid Carriers for Enhanced Skin Retained Topical Delivery: Optimization, Scale-Up, In-Vitro Characterization and Assessment of Ex-Vivo Skin Deposition," Eur. J. Pharm. Sci., 152, Pp.105438.

Rapoport, N., Gupta, R., Kim, Y.-S., and O'Neill, B. E., (2015), "Polymeric Micelles and Nanoemulsions as Tumor-Targeted Drug Carriers: Insight Through Intravital Imaging," JCR, 206, Pp.153-160.

Raza, K., Singh, B., Singla, S., Wadhwa, S., Garg, B., Chhibber, S., and Katare, O. P., (2013), "Nanocolloidal Carriers of Isotretinoin: Antimicrobial Activity Against Propionibacterium Acnes and Dermatokinetic Modeling," Mol. Pharm., 10(5), Pp.1958-1963.

Raza, K., Katare, O. P., Setia, A., Bhatia, A., and Singh, B., (2013), "Improved Therapeutic Performance of Dithranol against Psoriasis Employing Systematically Optimized Nanoemulsomes," J. Microencapsul. 30(3), Pp.225-236.

Raza, K., Negi, P., Takyar, S., Shukla, A., Amarji, B., and Katare, O., (2011), "Novel Dithranol Phospholipid Microemulsion for Topical Application: Development, Characterization and Percutaneous Absorption Studies," J. Microencapsul. 28(3), Pp.190-199.

Raza, K., Singh, B., Lohan, S., Sharma, G., Negi, P., Yachha, Y., and Katare, O. P., (2013), "Nano-Lipoidal Carriers of Tretinoin with Enhanced Percutaneous Absorption, Photostability, Biocompatibility and Anti-Psoriatic Activity," Int. J. Pharm., 456(1), Pp.65-72.

Reddy, M. S., Mutalik, S., and Rao, G. V., (2006), "Preparation and Evaluation of Minoxidil Gels for Topical Application In Alopecia," Indian J. Pharm. Sci..

Reygagne, P., Mrowietz, U., Decroix, J., De Waard-Van Der Spek, F., Olmos Acebes, L., Figueiredo, A., Caputo, R., Poncet, M., and Arsonnaud, S., (2005), "Clobetasol Propionate Shampoo 0.05% and Calcipotriol Solution 0.005%: A Randomized Comparison of Efficacy and Safety in Subjects with Scalp Psoriasis," J. Dermatol. Treat., 16(1), Pp.31-36.

Richard, M. A., Barnetche, T., Horreau, C., Brenaut, E., Pouplard, C., Aractingi, S., Aubin, F., Cribier, B., Joly, P., and Jullien, D., (2013a), "Psoriasis, Cardiovascular Events, Cancer Risk and Alcohol Use: Evidence-Based Recommendations Based on Systematic Review and Expert Opinion," J. Eur. Acad. Dermatol., 27(S3), Pp.2-11.

Richard, M. A., Barnetche, T., Horreau, C., Brenaut, E., Pouplard, C., Aractingi, S., Aubin, F., Cribier, B., Joly, P., and Jullien, D., (2013b), "Psoriasis, Cardiovascular Events, Cancer Risk and Alcohol Use: Evidence-Based Recommendations Based On Systematic Review and Expert Opinion," J. Eur. Acad. Dermatol., 27, Pp.2-11.

Rosado, C., Silva, C., and Reis, C. P., (2013), "Hydrocortisone-Loaded Poly (E-Caprolactone) Nanoparticles for Atopic Dermatitis Treatment," Pharm. Dev. Technol., 18(3), Pp.710-718.

Sah, A. K., Jain, S. K., and Pandey, R. S., (2011), "Microemulsion Based Hydrogel formulation of Methoxsalen for the Effective Treatment of Psoriasis," Asian J. Pharm. Clin. Res., 4(4), Pp.140-145.

Sathe, P., Saka, R., Kommineni, N., Raza, K., and Khan, W., (2019), "Dithranol-Loaded Nanostructured Lipid Carrier-Based Gel Ameliorate Psoriasis in Imiquimod-Induced Mice Psoriatic Plaque Model," Drug Dev. Ind. Pharm., 45(5), Pp.826-838.

Satturwar, P. M., Fulzele, S. V., and Dorle, A. K., (2005), "Evaluation of Polymerized Rosin for the formulation and Development of Transdermal Drug Delivery System: A Technical Note," Aaps Pharmscitech, 6(4), Pp.E649-E654.

Schäfer-Korting, M., Kleuser, B., Ahmed, M., Höltje, H.-D., and Korting, H. C., (2005), "Glucocorticoids for Human Skin: New Aspects of the Mechanism of Action," Skin Pharmacol. Physiol., 18(3), Pp.103-114.

Schlupp, P., Blaschke, T., Kramer, K., Höltje, H.-D., Mehnert, W., and Schäfer-Korting, M., (2011), "Drug Release and Skin Penetration from Solid Lipid Nanoparticles and A Base Cream: A Systematic Approach From A Comparison of three Glucocorticoids," Skin Pharmacol. Physiol., 24(4), Pp.199-209.

Schmid, M.-H., and Korting, H., (1996), "Therapeutic Progress with Topical Liposome Drugs for Skin Disease," Adv. Drug Del. Rev., 18(3), Pp.335-342.

Şenyiğit, T., Sonvico, F., Barbieri, S., Özer, Ö., Santi, P., and Colombo, P., (2010), "Lecithin/Chitosan Nanoparticles of Clobetasol-17-Propionate Capable of Accumulation In Pig Skin," JCR, 142(3), Pp.368-373.

Sharma, A., Upadhyay, D. K., Sarma, G. S., Kaur, N., Gupta, G. D., Narang, R. K., and Rai, V. K., (2020), "Squalene Integrated NLC Based Gel of Tamoxifen Citrate for Efficient Treatment of Psoriasis: A Preclinical Investigation," J.

Drug Deliv. Sci. Technol., 56, Pp.101568.

Shinde, G., Rajesh, K., Prajapati, N., and Murthy, R., (2013), "Formulation, Development and Characterization of Nanostructured Lipid Carrier (Nlc) Loaded Gel for Psoriasis," Der Pharm. Lett., 5(4), Pp.13-25.

Silva, L. A. D., Taveira, S. F., Lima, E. M., and Marreto, R. N., (2012), "In Vitro Skin Penetration of Clobetasol from Lipid Nanoparticles: Drug Extraction and Quantitation in Different Skin Layers," Braz. J. Pharm. Sci., 48, Pp.811-817.

Singh, P., Sihorkar, V., Jaitely, V., Kanaujia, P., and Vyas, S., (2000), "Pilosebaceous Unit: Anatomical Considerations and Drug Delivery Opportunities," Indian J. Pharmacol., 32(5), Pp.269.

Singka, G. S. L., Samah, N. A., Zulfakar, M. H., Yurdasiper, A., and Heard, C. M., (2010), "Enhanced Topical Delivery and Anti-Inflammatory Activity of Methotrexate from An Activated Nanogel," Eur. J. Pharm. Biopharm., 76(2), Pp.275-281.

Sinha, P., Srivastava, N., Rai, V. K., Mishra, R., Ajayakumar, P., and Yadav, N. P., (2019), "A Novel Approach for Dermal Controlled Release of Salicylic Acid for Improved Anti-Inflammatory Action: Combination of Hydrophilic-Lipophilic Balance and Response Surface Methodology," J. Drug Del. Sci. Technol., 52, Pp.870-884.

Smith, C. H., and Barker, J., (2006a), "Psoriasis and its Management," BMJ, 333(7564), Pp.380-384.

Smith, C. H., and Barker, J., (2006b), "Psoriasis and its Management," BMJ, 7564, Pp.380.

Solans, C., Izquierdo, P., Nolla, J., Azemar, N., and Garcia-Celma, M., (2005), "Nano-Emulsions," COCIS, 10(3), Pp.102-110.

Sonawane, R., Harde, H., Katariya, M., Agrawal, S., and Jain, S., (2014), "Solid Lipid Nanoparticles-Loaded Topical Gel Containing Combination Drugs: An Approach to offset Psoriasis," Expert Opin. Drug Deliv., 11(12), Pp.1833-1847.

Sousa, C., Gouveia, L. F., Kreutzer, B., Silva-Lima, B., Maphasa, R. E., Dube, A., and Videira, M., (2019), "Polymeric Micellar Formulation Enhances Antimicrobial and Anticancer Properties of Salinomycin," Pharm. Res., 36(6), Pp.1-16.

Srisuk, P., Thongnopnua, P., Raktanonchai, U., and Kanokpanont, S., (2012), "Physico-Chemical Characteristics of Methotrexate-Entrapped Oleic Acid-Containing Deformable Liposomes for In Vitro Transepidermal Delivery Targeting Psoriasis Treatment," Int. J. Pharm., 427(2), Pp.426-434.

Srivastava, N., Patel, D. K., Rai, V. K., Pal, A., and Yadav, N. P., (2018), "Development of Emulgel formulation for Vaginal Candidiasis: Pharmaceutical Characterization, In Vitro and In Vivo Evaluation," J. Drug Del. Sci. Technol., 48, Pp.490-498.

Staidle, J. P., Dabade, T. S., and Feldman, S. R., (2011), "A Pharmacoeconomic Analysis of Severe Psoriasis Therapy: A Review of Treatment Choices and Cost Efficiency," Expert Opin. Pharmacother., 12(13), Pp.2041-2054.

Sun, J., Zhao, Y., and Hu, J., (2013), "Curcumin Inhibits Imiquimod-Induced Psoriasis-Like Inflammation by Inhibiting Il-1beta and Il-6 Production In Mice," Plos One, 8(6), Pp.E67078.

Suresh, P. K., Singh, P., and Saraf, S., (2013a), "Novel Topical Drug Carriers as A Tool for Treatment of Psoriasis: Progress and Advances," Afr. J. Pharm. Pharmacol., 7(5), Pp.138-147.

Suresh, P. K., Singh, P., and Saraf, S., (2013b), "Novel Topical Drug Carriers as A Tool for Treatment of Psoriasis: Progress and Advances," Afr. J. Pharm. Pharmacol., 7, Pp.138-147.

Swanson, D. L., Barnes, S. A., Mengden Koon, S. J., and El-Azhary, R. A., (2007), "Caffeine Consumption and Methotrexate Dosing Requirement in Psoriasis and Psoriatic Arthritis," Int. J. Dermatol., 46(2), Pp.157-159.

Thapa, R. K., and Yoo, B. K., (2014), "Evaluation of the Effect of Tacrolimus-Loaded Liquid Crystalline Nanoparticles on Psoriasis-Like Skin Inflammation," J.

Dermatol. Treat., 25(1), Pp.22-25.

Trapasso, E., Cosco, D., Celia, C., Fresta, M., and Paolino, D., (2009), "Retinoids: New use by Innovative Drug-Delivery Systems."

Trotta, M., Peira, E., Carlotti, M. E., and Gallarate, M., (2004), "Deformable Liposomes for Dermal Administration of Methotrexate," Int. J. Pharm., 270(1-2), Pp.119-125.

Van Der Fits, L., Mourits, S., Voerman, J. S., Kant, M., Boon, L., Laman, J. D., Cornelissen, F., Mus, A.-M., Florencia, E., and Prens, E. P., (2009), "Imiquimod-Induced Psoriasis-Like Skin Inflammation in Mice is Mediated Via the IL-23/IL-17 Axis," J. Immunol., 182(9), Pp.5836-5845.

Varshosaz, J., Ghaffari, S., Khoshayand, M. R., Atyabi, F., Dehkordi, A. J., and Kobarfard, F., (2012), "Optimization of Freeze-Drying Condition of Amikacin Solid Lipid Nanoparticles using D-Optimal Experimental Design," Pharm. Dev. Technol., 17(2), Pp.187-194.

Verma, D., and Fahr, A., (2004), "Synergistic Penetration Enhancement Effect of Ethanol and Phospholipids on the Topical Delivery of Cyclosporin A," JCR, 97(1), Pp.55-66.

Verma, S., Singh, A. K., and Mukharjee, A., (2016), "Formulation and Evaluation of Ketoconazole Nanoemulgel," World J. Pharm. Pharm. Sci., 5(2), Pp.899-911.

Walunj, M., Doppalapudi, S., Bulbake, U., and Khan, W., (2020), "Preparation, Characterization, and In Vivo Evaluation of Cyclosporine Cationic Liposomes for the Treatment of Psoriasis," J. Liposome Res., 30(1), Pp.68-79.

Warino, L., Balkrishnan, R., and Feldman, S. R., (2006), "Clobetasol Propionate for Psoriasis: are Ointments really more Potent?," Journal of Drugs In Dermatology: JDD, 5(6), Pp.527-532.

Wang, R., Li, L., Wang, B., Zhang, T., and Sun, L., (2012), "Fk506-Loaded Solid Lipid Nanoparticles: Preparation, Characterization and In Vitro Transdermal Drug Delivery," African J. Pharm. Pharmacol., 6(12), Pp.904-913.

Wertz, P. W., Madison, K. C., and Downing, D. T., (1989), "Covalently Bound Lipids

of Human Stratum Corneum," J. Investig. Dermatol., 92(1), Pp.109-111.

Wohlrab, J., Goebel, A., and Sherer, D., (2012), "A Topical Tacrolimus Microemulsion for Plaque-Type Psoriasis Therapy," Drug Dev. Deliv., 12, Pp.43-46.

Xia, Y.-P., Li, B., Hylton, D., Detmar, M., Yancopoulos, G. D., and Rudge, J. S., (2003), "Transgenic Delivery of Vegf to Mouse Skin Leads to an Inflammatory Condition Resembling Human Psoriasis," Blood, 102(1), Pp.161-168.

Yu, H.-Y., and Liao, H.-M., (1996), "Triamcinolone Permeation from Different Liposome formulations through Rat Skin In Vitro," Int. J. Pharm., 127(1), Pp.1-7.

Yuan, H., Wang, L.-L., Du, Y.-Z., You, J., Hu, F.-Q., and Zeng, S., (2007), "Preparation and Characteristics of Nanostructured Lipid Carriers for Control-Releasing Progesterone By Melt-Emulsification," Colloids Surf. B, 60(2), Pp.174-179.

Zhang, J., and Smith, E., (2011), "Percutaneous Permeation of Betamethasone 17-Valerate Incorporated In Lipid Nanoparticles," J. Pharm. Sci., 100(3), Pp.896-903.

Zhang, Y.-T., Shen, L.-N., Zhao, J.-H., and Feng, N.-P., (2014), "Evaluation of Psoralen Ethosomes for Topical Delivery in Rats by Using In Vivo Microdialysis," Int. J. Nanomedicine, 9, Pp.669.

Zhang, Y., Gao, J., Zheng, H., Zhang, R., and Han, Y., (2011), "The Preparation of 3, 5-Dihydroxy-4-Isopropylstilbene Nanoemulsion and In Vitro Release," Int. J. Nanomed., 6, Pp.649-657.

Zhang, Z., Tsai, P. C., Ramezanli, T., and Michniak-Kohn, B. B., (2013), "Polymeric Nanoparticles-Based Topical Delivery Systems for the Treatment of Dermatological Diseases," Wiley Interdiscip. Rev. Nanomed. Nanobiotechnol., 5(3), Pp.205-218.

APPENDIX

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REVIEW ARTICLE

Novel Topical Nanocarriers for Treatment of Psoriasis: An Overview

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ARTICLE HISTORY

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Abstract: ***Background:*** Psoriasis is an autoimmune disease of the skin with lapsing episodes of hyperkeratosis, irritation and inflammation. Numerous methodologies and utilization of different antipsoriatic drugs with various activity methods and routes of administration have been investigated to treat this terrifying sickness. In any case, till date, there is no remedy for psoriasis because of the absence of an ideal carrier for effective and safe delivery of antipsoriatic drugs.

Objective: Among the different methods of medications for psoriasis, in the greater part of patients, topical treatment is most commonly utilized. For topical formulations, utilization of conventional excipients could fill the need just to a restricted degree. With the revelation of more up to date biocompatible and biodegradable materials like phospholipids, and Novel drug delivery technologies like liposomes, solid lipid nanoparticles (SLNs), microemulsions, and nanoemulsions, the possibility to enhance the efficiency and safety of the topical products has expanded to a great extent. Understanding the topical delivery aspects and that of outlining and creating different carrier systems have been enhanced that got further novelty to this approach.

Conclusion: Present review is an attempt to contemplate on psoriasis as far as improved comprehension of the dermal delivery perspectives and at present accessible treatment alternatives, significant preventions in psoriasis treatment, late advancements in the conveyance of different antipsoriatic drugs through novel colloidal drug transporters.

Keywords: Dermal drug delivery, liposomes, microemulsions, nanoemulsion, nanoparticles, phospholipids.

1. INTRODUCTION

Psoriasis is a psychosocially, and on occasion therapeutically, weakening issue that influences 1 to 3% of the populace all around. It is an immune-mediated disorder with hyperkeratosis and other inflammatory reactions. It essentially includes deviant differentiation and exorbitant growth of keratinocytes. Infections including T helper 1 (Th1) and T helper 17 cells (Th17) are closely linked with the pathogenesis of psoriasis. Around 80% of patients who are suffering from psoriasis vulgaris are topically treated [1]. Psoriasis can be categorized as mild, moderate and severe conditions. Mild psoriasis leads to the formation of rashes, and when it becomes moderate, the skin turns into scaly. In severe conditions, red patches may be present on the skin surface and become itchy. With the discovery of novel carriers, limitation that arises in the traditional topical pharmaceuticals for the treatment of psoriasis is bypassed with protected and long-term utilize [2]. Novel carriers, for example, liposome, niosome, nanoemulsion, nanostructured lipid carriers (NLCs), microemulsion, emulsomes, invasomes, dendrimers, nanoparticles, hydrogel and ethosomes have for sure conveyed us nearer to the objective of safe and effective treatment of the disease [3]. Stratum conium (SC) is the major challenge for the drug to get into the target tissues, via skin layers. Penetration enhancers added in the drug carriers help to increase the penetration capacity of drug through the outermost layer of the skin. The most favorable drug delivery should provide high penetration through SC and should not cause any irreversible changes to the skin barrier. There are many challenges in the transdermal delivery of drugs. There will be variability in percutaneous absorption due to the site, disease, age, etc. Skin irritation may happen and if the toxicities due to drug are more, the skin gets damaged. The *first pass* metabolic effect of skin is also one of the challenges for topical delivery. Novel drug delivery systems have a lot of advantages. They increase safety and efficacy levels. Drug targeting specificity and lowering systemic drug toxicity are the important merits of NDDS. Moreover, they have the ability to improve absorption rates and will prevent the biochemical degradation of pharmaceuticals.

1.1. Skin

A route for novel drug delivery skin is considered to be the largest and outermost organ of the human body. Among three important layers of skin, epidermis functions as a protective barrier of the body. There are a lot of blood vessels and layers present in the epidermis. Sublayers are also present in this outermost layer such as stratum lucidum, stratum corneum, stratum spinosum, stratum granulosum, and stratum germinativum. The dermis is present beneath the outermost layer, which is composed of connective tissues. The hypodermis is situated under the dermis layer. For the treatment of psoriasis, percutaneous absorption of drugs is one of the widely accepted ways of drug delivery. The challenge offered by topical treatment is the presence of SC as a barrier. Conventional forms of drug delivery through the skin have come across with many side effects and other application difficulties. Disruption of SC and targeting to the deeper layers of skin are not possible with ointments, creams etc. So, novel dermal delivery systems help to overcome these limitations, thereby enhancing the bioavailability and potential of drug and are widely used for the treatment for psoriasis recently. Importance of topical medication for the treatment of psoriasis, topical treatment is mostly prescribed method since transdermal delivery of drug is the first line of defence for the psoriatic skin. Psoriasis occurs when there is the excess growth of skin cells due to faulty signals produced by the immune system. These rapidly growing skin cells can be easily controlled by the novel topical medications which are meant for manipulating the functions of the skin barrier. Direct

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ORIGINAL ARTICLE

Development and characterisation of clobetasol propionate loaded Squarticles as a lipid nanocarrier for treatment of plaque psoriasis

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ABSTRACT

Aim: The aim of this project is to improve the therapeutic effectiveness, permeation and retention of clobetasol propionate in sebaceous glands by reporting the use of Squarticles as lipidic nanosystem.

Methods: Homogenisation method is used for the formulation of Squarticles (nanoemulgel) which was characterised on the basis of size, polydispersity index (PDI), viscosity, spreadability, DSC, % *in vitro* release, *in vitro* skin permeation deposition studies, and *in vivo* studies, scanning electron microscopic (SEM) and physical storage stability studies were done at different temperature conditions, i.e. 4 ± 2 °C, 25 ± 2 °C and 45 ± 2 °C for a period of 6 months for drug and formulation.

Result: The morphological characterisation of prepared nanoemulsion shows small spherical shape and uniform size distribution as observed in the Scanning electron microscopic (SEM), having mean size (240.5 ± 9.2) and mean size distribution (0.282 ± 0.03) and zeta potential (−51.21). The drug release from optimised nanoemulsion (F2) in PBS (pH 5.5) was approximately 84.24 ± 1.35%, nanoemulgel formulations showed the release of 66.83 ± 2.05% while marketed gel showed the release of 57.67 ± 1.63% after 24 h. The cumulative percentage retention of clobetasol propionate loaded nanoemulgel was 63 ± 1.28% which was more than the marketed formulation (23.12% ±0.54). Physical stability studies show that formulation is more stable in cold condition. Further, the stability of active ingredient in gel formulation was determined using HPLC which shows around 15 ± 0.84% of loss in its activity.

Conclusion: The present work has demonstrated the use of Squarticles as a novel carrier for treatment of plaque psoriasis by enhancing the better permeation, increasing skin retention, and enhances the effect of drug. The study also shows that the formulation is more stable in cold condition

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KEYWORDS
Nanoemulgel; nanoemulsion; sebaceous gland; Squarticles; permeation; deposition

1. Introduction

1.1. Psoriasis

Psoriasis is autoimmune disease of the skin with lapsing episodes of hyperkeratosis, irritation and inflammation. Numerous traditional and novel drug delivery systems have been used for better penetration through psoriatic barrier cells and also for retention in the skin. Only few effective remedy for better penetration and retention is there because of absence of an ideal carrier for effective and safe delivery of antipsoriatic drugs. Psoriasis is a psychosocially debilitating disorder that affects 1 to 3% of the population worldwide (Afifi *et al.* 2005; Boehncke 2015). It involves in excessive growth and deviant differentiation of keratinocytes. There is an increase in proliferation of epidermis with dilation of dermal capillaries, infiltration of inflammatory cells in skin layers (dermis, epidermis), and localised infiltration into skin layers. It leads to localised skin deregulation that plays a major role in the development of scaly erythematous plaques (Lowes *et al.* 2007). Other symptoms are swelling of the skin, pain, itching and skin flaking (Mazzotta *et al.* 2007).

Sebaceous glands are small oil (sebum) producing glands that are attached to hair follicles. These glands are unevenly distributed all over the skin but are more prevalent on the face, scalp, chest and neck. As our present study is on Plaque psoriasis which is most often found on the scalp, the lower back, the face, the

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RESEARCH ARTICLE

Development and Characterization of a Clobetasol Propionate Nanostructured Lipid Carrier-based Gel for the Treatment of Plaque Psoriasis

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Abstract: ***Background*:** Psoriasis is an autoimmune disease of the skin with lapsing episodes of hyperkeratosis, irritation, and inflammation. Numerous traditional and novel drug delivery systems have been used for better penetration through psoriatic barrier cells and also for retention in the skin. As there is no effective remedy for better penetration, and retention is there because of the absence of an ideal carrier for effective and safe delivery of antipsoriatic drugs.

***Objectives*:** The main objective of this project is to develop a Squalene integrated NLC based carbopol 940 gel to create a local drug depot in the skin for improved efficacy against psoriasis.

***Methods*:** Homogenization method is used for the formulation of Nanostructured Lipid Carrier, which was characterized on the basis of size, entrapment efficiency, polydispersity index (PDI), viscosity, spreadability, DSC, zeta potential, % *in vitro* release, *in vitro* skin permeation and retention studies, physical storage stability studies. I*n vivo* studies can use other alternative models for induction of psoriasis by severe redness, swelling macroscopically, and microvascular dilation edema lasting for 10 days. Furthermore, histopathology study was done to asses changes in the skin.

***Conclusion*:** The optimized formulation of nanostructured lipid carrier-based gel has shown significant and sustained release of clobetasol propionate. Furthermore, this formulation has also shown retention in skin because of squalene as it is a sebum derived lipid, which shows an affinity towards the sebaceous gland.

Keywords: Nanostructured lipid carrier, sebaceous gland, permeation, retention, gel.

1. INTRODUCTION

Psoriasis vulgaris is an autoimmune disease caused by inappropriate activation of the cellular immune system. Psoriasis is a psychosocially, and at times medically, debilitating disorder that affects 1 to 3% of the population worldwide [1]. It basically involves excessive growth and deviant differentiation of keratinocyte [2]. There is an increase in proliferation of epidermis with dilation of dermal capillaries, infiltration of inflammatory cells in skin layers (dermis, epidermis), and localized infiltration into skin layers. It leads to localized skin deregulation that plays a major role in the development of scaly erythematous plaques [2]. Other symptoms are swelling of skin, pain, itching, skin flaking [3].

Nanotechnology involves the fabrication of nanosystems that deliver drugs in a sustained and controlled manner. These nanodevices include colloidal carriers like lipid (solid lipid nanoparticles (SLN), nanoemulsions, liposomes, and nanostructured lipid carriers (NLC), *etc*.) and polymeric nanoparticles (chitosan nanoparticles, PLGA nanoparticles) [4]. SLNs are nanosystems with a solid lipid matrix. As compared to other lipid carriers like liposomes, emulsions, *etc*., the lipid matrix of SLN enables the controlled release of the drug due to slower degradation *in vivo.* SLNs has some drawbacks like limited drug loading due to drug expulsion during storage, which can be overcome by the newer generation of lipid nanoparticles 'NLC'. NLC comprises a mixture of solid lipids and liquid lipids, which creates a less perfect crystalline structure, thus offering more space for drug accommodation [5]. Epidermal targeting can be attained with SLN and NLC formulations [6], which could help in the prevention of distinct side effects during topical corticosteroid treatment like skin thinning [7] since they are involved with deeper layers of the skin. Moreover, the risk of systemic absorption could be eliminated. In fact, lipid nanoparticles have been reported as suitable colloidal carrier systems to control the penetration/permeation of drugs throughout the skin layers [8].

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