Analysis of Anti-Inflammatory Compounds in Drug Absorption and Calculated Transdermal Permeability Utilizing the Parallel Artificial Membrane Permeability Assay (PAMPA)

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Determining transdermal permeability of compounds facilitates an understanding of drug distribution, improving quality of medical care. The study's purpose was to analyze transdermal drug absorption of anti-inflammatory compounds at varying concentrations. The parallel artificial membrane permeability assay provided an in-vitro model for simulating passive transdermal absorption via a dodecane and polyvinylidene fluoride membrane. Due to its smaller particle size, capsaicin was hypothesized to be more permeable relative to hydrocortisone and menthol. It was also hypothesized that a direct relationship between drug concentration and permeability would exist. Serial dilutions were undergone for each compound to create the desired concentrations (1mM, 0.1mM, 0.01mM, 1μM). Each compound and its associated concentration was transferred to the assay's donor plate (n=3). Blank controls were added separately to account for the presence of DMSO and PBS. Following incubation, UV-Vis spectrophotometry analysis was performed. Capsaicin had the highest UV absorbance at all concentrations. Two-factor ANOVA testing with replication revealed a statistically significant difference in UV absorbance between compounds (1mM: p=1.40E-17, 0.1mM: p=2.31E-26, 0.01mM: p=4.47E-11, 1μM: p= 4.89E-23). UV absorbance values were utilized to calculate permeability rate. At 1mM, hydrocortisone (4.84E-5 cm/s) and menthol (8.08E-6 cm/s) experienced a higher permeability rate than capsaicin (6.61E-6 cm/s), refuting the hypothesis. This relationship was noted at all concentrations, implying a direct relationship between particle size and transdermal permeability. Increased concentrations were generally associated with concurrent increases in permeability rate, supporting the initial hypothesis.

Awards Won:

Third Award of $1,000

Westlake University: A summer camp scholarship to Westlake University, covering the roundtrip international airfare, room and board, insurance, program fee, and excursions in Hangzhou, Beijing, and Shanghai

Long Island University: Presidential Scholarships