Application of Michaelis-Menten Rational Function Models, Parametric Calculations, and Differential Equations to Determine the Most Influential Factor on Histamine Levels

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Allergies affect 220 million people globally, placing a significant population at risk of hypersensitivity, chronic inflammation, and infection. Even for the population that is not affected by such conditions, rhinitis and congestion from allergies greatly decrease the quality of life. It is, therefore, urgent that allergies be resolved from the cause: histamine overload. The purpose of this experiment was to determine the compound in the histamine process that affects histamine levels the most, such that this information may be used in synthesizing compound-specific remedies. Blood histidine (bHT), cellular histidine (cHT), cellular histamine (cHA), and extracellular histamine (eHA) were considered. The independent variables were narrowed down with rational equation analysis (Michaelis-Menten model): cHA was found to be the initial influential variable. Parametric and differential equation analyses were then used to observe changes relationship between cHA, cHT, and eHA. Change in cHA divided by cHT was graphed as a derivative. eHA was initially stabilized, but then it was observed that the derivative of cHA with respect to cHT changed more when eHA changed than when cHT changed. eHA was concluded to be the most influential variable in the histamine process. A molecular docking pilot test confirmed the potential of remedies such as blood plasma apolipoproteins to decrease eHA. This study has yet to provide empirical evidence, but it specifies the target from a mathematical model, which can be used for further experimentation. The determination of the targeted molecule for lessening allergy effects can be used to pinpoint more compound-precise, effective treatments.

Awards Won:

Fourth Award of $500

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