Pharmacokinetics and Pharmacodynamics Models of Tumor Growth and Anticancer Effects in Discrete Time

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We study the h-discrete and h-discrete fractional representation of a pharmacokinetics-pharmacodynamics (PK-PD) model describing tumor growth and anticancer effects in continuous time considering a time scale $h\mathbb{N}_0$, where $h > 0$. Since the measurements of the drug concentration in plasma were taken hourly, we consider $h = 1/24$ and obtain the model in discrete time (i.e. hourly). We then continue with fractionalizing the h-discrete nabla operator in the h-discrete model to obtain the model as a system of nabla h-fractional difference equations. In order to solve the fractional h-discrete system analytically we state and prove some theorems in the theory of discrete fractional calculus. After estimating and getting confidence intervals of the model parameters, we compare residual squared sum values of the models in one table. Our study shows that the new introduced models provide fitting as good as the existing models in continuous time.