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Fractional-Order Mathematical Model of Genetically Predisposed Diabetes Mellitus and Graphical Representation of Model Classes

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Abstract

Diabetes is a chronic metabolic disease whose prevalence is rapidly increasing worldwide and significantly affects the quality of life of individuals. Genetic predisposition is considered an important risk factor in the development of the disease. Genetic predisposition is defined as an increased risk of developing diabetes due to an individual's inherited characteristics. Diabetes is not a disease that develops suddenly, but rather the result of changes that accumulate over many years. This shows that an individual's past health status and genetic risks have an impact on the current disease process. While mathematical models created with classical derivatives take into account the instantaneous change in the system, fractional derivatives can also model the impact of past conditions on current dynamics. This feature provides a significant advantage in terms of being able to evaluate effects such as genetic predisposition cumulatively over time.

This study will employ a fractional-order mathematical model to examine the effect of genetic predisposition on the development of diabetes. In the model, genetic predisposition will be considered one of the key factors influencing the transition to prediabetes, and the effects of this process on diabetic patients and those with complicated diabetes will be investigated. Figures obtained for different values of parameters representing genetic predisposition will show the time-dependent changes in diabetes and complicated diabetes classifications.

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Keywords: Diabetes, mathematical modeling.

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