ISSN: 1391-8796
Proceedings of 9th Ruhuna International Science & Technology Conference
University of Ruhuna, Matara, Sri Lanka
January 19, 2022

Local stability properties of a delayed HIV-I virus dynamic model with saturation infection rate

Silva P.D.N.*, Pradeep B.G.S.A.
Department of Mathematics, Univrsity of Ruhuna, Matara, Sri Lanka.

This study investigates the local stability properties of a virus dynamic model for HIV-I virus infection including saturation infection rate. The novel feature is that both the absorption effect and the cure rate are incorporated into the model with the intracellular time delay. This study was undertaken to present the local stability and how the basic reproduction number influences the local stability of the model. We included four significant and distinctive aspects in the proposed model compared to the usual HIV-I mathematical models available in the literature. To make the processes more biologically realistic, the saturation infection rate and absorption effect were incorporated into this dynamic model. We included the cure rate because by improving the cure rate, it allows the disease to be controlled more effectively. As the facts surrounding delayed processes are biologically more crucial, intracellular time delay was incorporated into this dynamic model to provide a more extended and specific infection process. In the presence and absence of time delays, the model's characteristic equations were utilized by considering the Jacobian matrix of the model. To evaluate the local stability behaviors of both the infection-free and chronic infection equilibriums, the characteristic equations are analyzed separately. The mathematical analysis using the Routh Hurwitz stability criterion revealed that the basic reproduction number was exclusively accountable for the stability properties of the model when the delays were not present. Furthermore, correlations were established between the basic reproduction number and time delay. The numerical simulations were also illustrated in order to verify the theoretical results, which concluded that the basic reproduction number was directly involved in determining whether the virus in the host persist or die.

Keywords: Absorption effect, Cure rate, HIV infection, Mathematical modelling, Time delay

*Corresponding author: silva9738@usci.ruh.ac.lk