Modeling the transmission of dengue with varying extrinsic incubation period of mosquitoes

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Dengue has become a global threatening disease. In Sri Lanka, it usually occurs as an epidemic following a monsoon period. Since no specific medical treatment or vaccine is available, it is essential to control the transmission of dengue and reduce its spread. To understand its propagation, scientists have studied many mathematical models of dengue transmission and one of them is the SIR-model which is the focus of this paper. The effect of the time delay on the transmission of dengue fever was studied. The time delay is due to the presence of an incubation period (IP) during which the virus replicates enough in the mosquito so that it can be transmitted by the mosquito to a human. We modelled the incubation period using climatic data collected from urban Colombo and used it to modify the SIR-model. In this paper, the SIR-model with fixed and varying incubation periods was analyzed. When the SIR-model with fixed IP was used, the simulation showed that the trajectory of the infectious human population is convergent to the equilibrium point (0.000337). The trajectory of the infectious human population of the SIR-model with varying IP is also convergent not to the equilibrium points, but towards oscillations within an interval. In this study, it was observed that the approach with fixed parameters is not suitable for decision makers to control the disease. This is because parameters vary with climatic factors. Our preliminary simulation using the SIR-model was therefore different from reality since the IP was considered as a fixed parameter.