Abstract

Immunotherapy is one of the treatments that are used to treat tumors and cancer effectively, but further research are needed because the treatment doesn't work optimally in all patients. So in this study, a simulation towards immunotherapy treatment was done by using an ODE (Ordinary Differential Equation) model to describe how the immune system and tumor response to the treatment. The three-component tumor-immune ODE model was built by combining the theory where tumor is divided into three phases with the tumor-immune model, which is a model that describes the interaction of tumors with the immune system against chemotherapy and immunotherapy treatment. In the simulation results of the three-component tumor-immune ODE model, there is a difference in the growth value of the components of the ODE model system with the reference model when not given treatment. This is shown by the RMSE error test value obtained on tumor cell growth is 0.218 cm^3, on NK cells is 1.058 x 10^{-6} cm^3, on CD8+T cells is 2.476 x 10^{-6} cm^3, and on lymphocyte circulation is 1.945 x 10^{-5} cm^3 and also, for the MAPE value obtained is 0.55 for tumor cell growth, 1.953 for NK cells, 0.014 for CD8+T cells and 1.774 x 10^{-6} for lymphocyte circulation. Meanwhile, the simulation results of the three-component tumor-immune ODE model for the treatment scenario gets an RMSE error test value for tumor cell growth is 0.006 cm^3, for NK cells 9.829 x 10^{-6} cm^3, for CD8+T cells is 0.009 cm^3, and for lymphocyte circulation is 0.0004 cm^3 and also, for the MAPE value obtained is 147 x 10^{10} for tumor cell growth, 0.469 for NK cells, 5.861 for CD8+T cells and 4.504 for lymphocyte circulation.

Keywords: tumor, immunotherapy, ODE (ordinary differential equation)