The Propagations of Saturating Feedback Mechanism Colorectal Cancer Mathematical Model

Nurul Dayini Zulkifli[1], Nur Izzati Khairudin[2]
[1]*2019218962@student.uitm.edu.my*
[2]*zatkhairudin@uitm.edu.my*

ABSTRACT

A mathematical modelling of colorectal cancer is required to gain a better understanding of colorectal cancer and to provide insights into more effective early treatment strategies. Although the nature of cancer is complex, a mathematical model for tumour growth has assisted researchers in understanding and categorising the illness's behaviour. Therefore, this report studies the propagations of saturating feedback mechanism colorectal cancer mathematical model. Moreover, Euler's method is applied into the mathematical model to examine and to observe a system of ordinary differential equations as some parameters change. In this study, we used two mechanisms that could influence the growth of colon cancer. The first mechanism is saturating mechanism in which we vary parameter, $m_1 = 0.07$, $k_1 = 0.04$, $\gamma = 0.155$, and $\beta = 0.357$. Following that are the linear and saturating mechanism in which we only vary parameter $k_0 = 0.06$, $m_0 = 0.07$ and $\gamma = 0.1345$ while for m_1 , k_1 and β , as same as the value for saturating mechanism. By choosing these parameters, we able to obtain the behaviour of colorectal cancer. We observed that present study has escalation in N_2, while N_0 and N_1 stage as same as Johnston et al. (2006) and Khairudin and Abdullah (2013). For saturating feedback mechanism, we obtain $N_0^* = 4$, $N_1^* = 166$ and $N_2^* = 883$. As for linear and saturating mechanism, we obtain $N_0^* = 5$, $N_1^* = 168$ and $N_2^* = 1358$. This study shows that the exponential growth of tumour is faster than the previous studies. This will help oncologists to predict and detect the evolvement of tumour in one patient. By using this mathematical model, the oncologists can proceed the next process to give a better treatment to the cancer patients.

Keywords: Colorectal cancer, Euler's method, Feedback mechanism, Mathematical model, Ordinary Differential Equations