

A Mathematical analysis of Local Stability and Optimal Control of Breast Cancer

S.I. Oke, M.B. Matadi

Department of Mathematical Sciences, University of Zululand, South Africa
segunoke2016@gmail.com

Keywords: Breast Cancer, Optimal control, Maximum principle, Chemotherapy.

In this paper, a mathematical model of (non-linear model) breast cancer governed by a system of ordinary differential equations in the presence of chemotherapy treatment and ketogenic diet is discussed. Comprehensive mathematical analysis was carried out using varieties of analytical methods to study the local stability of the breast cancer model[2]. Sufficient conditions on parameter values to ensure cancer persistence in the absence of anti-cancer drugs ketogenic diet and cancer emission when anti-cancer drugs, immune-booster, ketogenic diet are included were established [1]. Furthermore, optimal control theory is applied to find out the optimal drug adjustment as an input control of the system therapies to minimize the number of cancerous cells by considering different control combinations of administering the chemotherapy agent and ketogenic diet using the popular Pontryagin's Maximum Principle. Numerical simulations were presented to validate our theoretical results.

References

- [1] B.G. Allen., S.K. Bhatia., C.M. Anderson., J.M. Eichenberger-Gilmore., Z.A. Sibenaller., K.A. Mapuskar., J.D. Schoenfeld., J.M. Buatti., D.R. Spitz., M.A. Fath, *Ketogenic diets as an adjuvant cancer therapy: History and potential mechanism*, Redox Biology 2(2014) **1** 963–970.
- [2] C. Mufudza, W. Sorofa, and E.T. Chiyaka. Assessing the effects of estrogen on the dynamics of breast cancer. *Computation and mathematical methods in medicine*, 2012. **2** 1-14.