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Analytical Simulation to Study the Behavior of Cancerous Tumors by Using Shehu Transformation-Akbari-Ganji's Method with the Padé Approximation

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Abstract: This paper presents an approximate analytical study of the dynamic model of the interaction between lymphocytes and tumor cells in the presence of cytokines. A new method that combines the Shehu transformation and Akbari-Ganji method with the Padé approximation was applied. The accuracy and high efficiency of this method were demonstrated by error tables and graphs. The study found that the rate and duration of treatment had a significant effect on preventing the growth of cancer cells and improving the function of cancer-fighting lymphocytes, confirming the importance of studying and determining the optimal concentrations of cytokines that contribute to inhibiting the growth of cancer cells and improving the function of lymphocytes in fighting cancer.

Keywords: Shehu transformation, Akbari -Ganji's method, Padé approximation, Tumors, Immunotherapy, Cytokine, Stability.

1. Introduction

Cancer is currently one of the most malignant and fatal diseases facing humans, and it is known that the currently available cancer treatments mainly use toxic chemicals and harmful radiation, which leads to dangerous side effects for patients. However, with the advancement of research and technology. Cancer treatments have recently undergone significant development to create a treatment that can rapidly dissolve a tumor without endangering nearby healthy tissue. Nani and Freedman investigated a general mathematical model of immunotherapy as a cancer treatment [1]. Sotolongo-Costa et al. [2] studied the behavior of tumors under unstable therapy using doses of cytokines. They discussed the model equations and hypotheses as well as general concepts of cancer immunotherapy. Tumor immune interactions were also researched by Banerjee and Sarkar [3]. To illustrate the immune system's basic defense mechanism, they divided the immune system into two subclasses: hunting cells (cytotoxic T lymphocytes) and the resting cells (T helper cells). Fukuhara et al. [4] discovered a new treatment for cancer using genetically modified viruses. Kumar et al. [5] studied the interactions between cancer cells and the immune architecture using a partial tumor model. Nave and Sigron presented a mathematical model for the treatment of melanoma with the BRAF/MEK inhibitor and anti-PD-1 [6]. Aljahdaly and Almushaity studied the immune response to a model of metastatic cancer with virotherapy [7]. In this paper, we will highlight the use of cytokines as a treatment for cancer. Cytokines are protein hormones that play a role in activating the immune system and enhancing its response to attack cancer cells [2]. What has just been discussed shows the importance of research in this field and its treatment using various simulation techniques. The