Chapter 4
Dynamic Analysis of the Effect of Quitting Smoking Applications on Smoking Cessation

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ABSTRACT

In this chapter, the authors considered a smoking cessation model formulated with a non-linear system of differential equations and obtained the continuous fractional order model and through discretization its discrete form to study the effectiveness of quitting smoking applications in giving up smoking. The existence of smoking free equilibria and smoking present equilibria are discussed, and the dynamical analysis of these two equilibria is put forward with the assistance of the smoking generation number. The numerical simulations aided by time series, phase portraits, and bifurcation diagrams confirm the results that are obtained analytically.

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INTRODUCTION

Smoking is hazardous to healthiness, as cigarettes include substances like nicotine and carbon monoxide. When the ingredients of a cigarette are burnt, essentially 7,000 chemicals are generated, several of those chemicals are toxic and nearly 69 of them are connected to cancer. Smoking leads to a variety of unending bodily complications which leaves lasting effects on the body systems. Smoking intensifies the risk of a variety of problems over the years, but some of the bodily effects are instantaneous. Stained teeth, bad breath, coughing and high blood pressure, are the foremost consequences of short-term smoking. Cancer of the mouth, throat, lung, cardiovascular diseases, stomach ulcers which are life-threatening are the result of long-term smoking.

World Health Organization (WHO), reports that smoking presently accounts for above five million fatalities in the world each year. It also predicts that deaths due to smoking could reach to ten million by 2020, resulting in almost 18 percent of all demises in the technologically advanced world. The mortality rate for smokers is thrice that of non-smokers. Smoking is the most common “preventable cause of death” around the world. Smoking is injurious, not only for smokers but also to those who share their environment. The WHO claims that each year above six million deaths are the consequence of non-smokers being subjected to second-hand smoke, which is risky particularly to the unborn babies and children.

In general, adults mostly begin to smoke at the age of adolescence, a time in life of great vulnerability to social influences, where many attitudes change which also comprises the attitude concerning smoking. One of the components in cigarettes is a mood-altering drug called nicotine, which reaches the brain in mere seconds and provides an energized feeling for a while. But as the effect decreases, tiredness sets in with a craving for more. Nicotine is exceedingly habit-forming, thus making smoking so tough to quit. The governments around the globe are promoting policies and agendas to control smoking, and to this end, academic and medical world is contributing its efforts through development and study of various mathematical models and psychological studies.

Mathematical models play a vital role in understanding the spread and control of a disease. In 2000, a simplistic mathematical model was formulated for giving up smoking, wherein the total constant population was subdivided as potential smokers (P), non-smokers who may start smoking in the future, smokers (S), and persons (former smokers) who would quit smoking permanently (Q) (Castillo-Garsow et al., 2000).

The smoking cessation models have generated much interest (Sharomi et al., 2008), particularly, the qualitative behaviour of giving up smoking model (Zaman, 2011), smoking cessation model with media campaigns and bifurcation analysis (Sharma

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