A mathematical model to study herbal and modern treatments against COVID-19 BIOMATH 2024

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In this paper, we propose a two-group deterministic COVID-19 model which takes into account educational campaigns and the fact that people infected with COVID-19 may choose either modern (allopathic) medicine, traditional medicine or may combine the two modes of treatment. The model is analyzed in the case where modern medicine is the only mode of treatment and when traditional medicine is taken as an adjuvant (or another mode of treatment). We prove in the first case that the model has a disease-free equilibrium (DFE), globally asymptotically stable when the control reproduction number is less than one and whenever it is greater than one, we prove the local asymptotic stability of the endemic equilibrium. In the second case, we prove that, misconceptions in the population lead to a backward bifurcation phenomenon, which makes the control of the disease more difficult. We derive using the Lyapunov method that a threshold \mathcal{T} ensures the global asymptotic stability of the DFE in some cases when its value is less than one. Both models are fitted using daily COVID-19 cumulative cases reported from January to February 2022 in South Africa. We found a control reproduction number less than one, meaning that COVID-19 will be eliminated. Comparison of the two models fits highlights that misconceptions should be taken into account to accurately describe the dynamics of COVID-19. Numerically, we prove that educational campaigns should focus on preventive measures, and traditional medicine and allopathic medicine health care systems should complement each other in the fight against COVID-19.

Keywords: COVID-19, Modern medicine, Herbal/Traditional medicine, Stability of equilibria, Bifurcation analysis, Educational campaigns, Preventive measures.