Impact of mortality of obese people infected with Covid-19 on the dynamic behavior of the Covid-19 model

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In this work, we propose a mathematical model that highlights the narrow link between obesity and the mortality due to COVID-19, as well as patients admitted to the ICU for COVID-19 acute respiratory distress syndrome (ARDS) [2]. This model takes into account different disease states and is represented mathematically by a nonlinear temporal system of ordinary differential equations [1]. An analysis of the stability of different equilibrium states is also obtained to theoretically confirm the mathematical realism. Numerical simulations are presented to explain the usefulness of the proposed model.

Theorem 1. *The system has a disease-free equilibrium point* $E_0 = \left(\frac{\mu}{(\mu+\eta)}, 0, 0, 0, 0, \frac{\eta}{(\mu+\eta)}, 0, 0, 0\right)^T$ *whatever the values of the parameters of the system, whereas, only if* $R_0 > 1$*, there is an endemic equilibrium point* $E_1 = (S^*, E^*, I_a^*, I_s^*, I_h^*, O^*, E_h^*, I_{Oh}^*, R^*)$ *[5].*

Theorem 2. *[5] The disease-free equilibrium* $E_0 = \left(\frac{\mu}{(\mu+\eta)}, 0, 0, 0, 0, \frac{\eta}{(\mu+\eta)}, 0, 0, 0\right)^T$ *is locally asymptotically stable if* $R_0 \leqslant 1$ *and unstable if* $R_0 > 1$.

Theorem 3. *The end equilibrium* $E_1 = (S^*, E^*, I_a^*, I_s^*, I_h^*, O^*, E_h^*, I_{Oh}^*, R^*)$ *is locally asymptotically stable if* $R_0 > 1$ *and unstable if* $R_0 \leqslant 1$.

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