Mathematical model for the infectiology of Brucellosis with some control strategies

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Brucellosis is a zoonotic infection caused by gram-negative bacteria of genus brucella. In this paper, a deterministic mathematical model for the infectiology of brucellosis with vaccination of ruminants, culling of seropositive animals through slaughter, and proper environmental hygiene and sanitation is formulated and analyzed. A positive invariant region of the formulated model is established using the Box Invariance method, the effective reproduction number, Re of the model is computed using the standard next generation approach. We proved that the brucellosis free equilibrium exists, locally and globally asymptotically stable if $Re < 1$ while the endemic equilibrium point exists, locally and globally asymptotically stable if $Re > 1$. Sensitivity analysis of the effective reproductive number shows that, natural mortality rate of ruminants, recruitment rate, ruminant to ruminant transmission rate, vaccination rate, and disease induced mortality rate are the most sensitive parameters and should be targeted in design of the control strategies for the disease. Numerical simulation shows that the combination of more than two control strategies reduces/eliminates the disease from the livestock population.

Keywords: Brucellosis; Mathematical model; Infectiology; Control Strategies.