Abstract

Trypanosomiasis is a debilitating disease which is a major constraint to livestock production in sub-Saharan Africa. It leads to loss of productivity in animals and without treatment it is frequently fatal. The economic and social repercussions it causes in areas where it is endemic, makes its control a priority operation. In this study we formulate three models; a basic model to understand the transmission dynamics of the trypanosomiasis in a cattle population, a model with treatment to evaluate the role of treatment and a model to assess the impact of preventive and treatment control measures in a cattle population. The basic model and the model with treatment show that the global dynamics of the disease are completely determined by the threshold values: the basic reproduction number, R_0, and the effective reproduction number, R_{eff}, respectively. The parameters that have the greatest influence on R_0 are the rate at which the vectors bite the wild animal population and the vector survival rate which both increase endemicity of the disease while the vector death rate decreases disease prevalence. Treatment of a proportion of the infected cattle decreases disease prevalence. The proportion of cattle treated is an important parameter when treatment is used as an intervention strategy. We show that treating 0.5 - 0.75 of the infected cattle population is enough to eradicate the disease in the population. In the optimal control model, the existence of the optimal control is established, it is characterized using the *Maximum Principle* and solved numerically using a combination of forward and backward difference approximations. Numerical simulations and optimal analysis of the model show that the preventive and treatment control strategies help to reduce the number of infected cattle, however the net effect on disease prevalence when both strategies are used is greater than when they are used singly.