A mathematical model of the immuno-pathogenesis of the within human-host dynamics of the *Plasmodium falciparum* parasite

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A mathematical model involving a system of nonlinear ordinary differential equations that describe the within human-host dynamics of the malaria parasite is developed. The model integrates known major parasite form actors-the blood stage pathogenic asexual forms and the blood stage transmissible sexual forms, involved in the development and progression of the malaria disease within the human body. It also incorporates the mechanisms involved in the activation of the human immune response in inhibiting and diminishing the success of the malaria parasite within the human. We evoke some assumptions on the rate of production and depletion of healthy red blood cells in the presence and absence of innate and adaptive immunity in the formulation of our model. Basic mathematical properties of boundedness, existence and uniqueness of solutions for our model are established. Our analysis reveals the existence of a threshold parameter that determines the existence of a non-trivial steady state solutions which can be driven to oscillatory solutions that are reminiscent of malaria parasitemia in humans. The existence of a positive merozoite parasite form that leads to the depletion of the humans healthy red blood cells in an immune-suppressed model allows for us to investigate the role of immunity in in habiting parasite success. A sensitivity analysis is done to reveal the parameters that are necessary for control. Conditions for the onset of sexual forms of the malaria parasites that can be infective to mosquitoes and consequent control measures are discussed.