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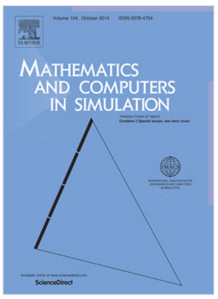

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Dynamics of a model of Toxoplasmosis disease in cat and human with varying size populations *†

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Abstract A mathematical model with varying human population size and vertical transmission for the transmission of Toxoplasmosis disease in human and cat populations is proposed. By the basic reproductive number, the stabilities of equilibria are analyzed. If the basic reproduction number is less than one, then the disease-free equilibrium is globally asymptotically stable. If the basic reproduction number is larger than one, then the endemic equilibrium point is globally asymptotically stable. Our results indicate that the introduction of varying human population size does not modify the conclusions from a model with human constant population size. Additionally, the introduction of the vertical transmission in human lowers the level of infected individuals, but does not affect the extinction of the disease.

MSC: 92D25

Keywords: Toxoplasmosis disease; Varying human population size; Vertical transmission; Horizontal transmission rate; Global stability.

1. Introduction

Toxoplasmosis is a disease caused by the protozoan parasite Toxoplasma gondii and is one of the most common parasitic infections of man and other warm-blooded animals such as sheep, cattle, pigs, sea mammals, birds, and horses [12,13]. Its causative agent, Toxoplasma gondii, is a facultatively heteroxenous, polyxenous protozoon that has developed several potential routes of transmission within and between different host species [21]. The three means by which it is mainly spread are transplacental transmission, ingestion of infective tissues, and ingestion of food or water contaminated with infective feces. Cats, including wild Felidae, are the only definitive hosts while human beings and other animals are intermediate hosts [13,11]. The clinical signs include: abortion, stillbirth, fever, encephalomyelitis, etc. [1,5,19]. If first contracted during pregnancy, T. gondii may be transmitted vertically by tachyzoites that are passed to the foetus via the placenta [21]. Usually, toxoplasma antibodies are found in the serum and aqueous humor and its organisms are found in the eyes, brain, heart, cerebrospinal fluid, liver, etc. [5,2,6,22].

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