



# Toxoplasmosis in rodents: A systematic review and meta-analysis in Iran



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## ABSTRACT

During recent years, implication of rodents in the epidemiology of *Toxoplasma gondii* is overlooked in Iran; thus, we performed a systematic review and meta-analysis to evaluate the prevalence of toxoplasmosis in rodents of Iran. For this purpose, following the general methodology recommended for systematic reviews and meta-analysis, 5 English and 3 Persian databases were explored from 1 January 2000 till 10 September 2016 using related keywords. Finally, 9 out of 291 citations were met to be included in this study. Due to significant heterogeneity, the random-effects model was conducted ( $I^2 = 93.55\%$ ). During the years, 661 rodents were trapped, and 121 of them were identified positive for *T. gondii* 15% (95% CI = 5–27). Moreover, overall prevalence using direct microscopic examination (1/230), PCR-based techniques (41/246) and serological tests (83/437) was obtained 0.1% (95% CI = 0.0–1.5), 18% (95% CI = 4–39) and 15% (95% CI = 3–33), respectively. Our study revealed the prevalence of toxoplasmosis in rodents is remarkable. Considering this fact, they play a key role in the life cycle of *T. gondii* and should not be neglected. Further surveys is needed to better recognize the role of various rodent species in distribution of toxoplasmosis.

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## Introduction

*Toxoplasma gondii* is an obligate intracellular member of phylum *Apicomplexa* which is the most prevalent parasitic infection in humans and many warm blooded animal species that involves one third of the world's population specifically in developing countries [1,2]. Many years have passed since the discovery of this protozoan

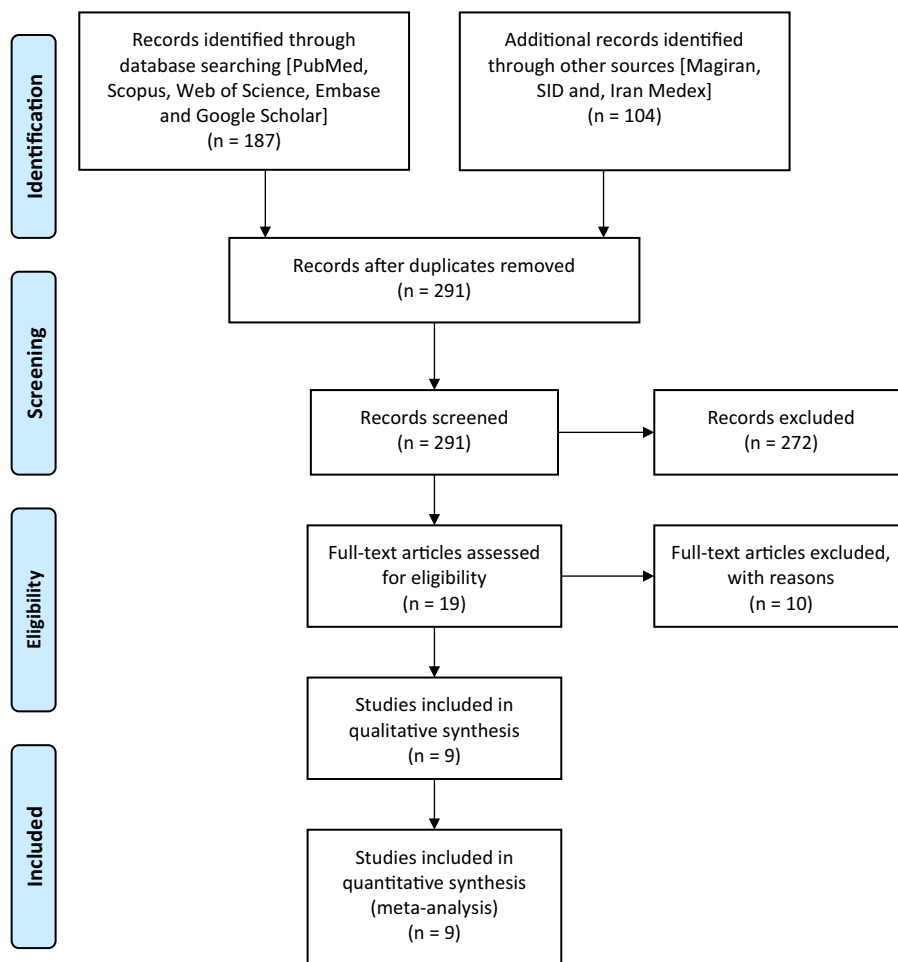


Fig. 1. PRISMA flowchart describing the study design process.

by Nicolle and Manceaux in the smears of liver and spleen of a North African rodent named *Ctenodactylus gondii* in 1908 [3]. *T. gondii* to complete asexual and sexual replication stages in life cycle, needs both intermediate and definitive hosts (Felidae family as definitive host) [1,4]. Toxoplasmosis cases are more dominant in tropical and sub-tropical regions and it has been shown that global warming dilemma has a crucial role in disease distribution [2]. *T. gondii* is mainly transmitted through ingestion of undercooked meat contaminated by cysts or drinking water contaminated by oocyst and congenitally [5–9]. However, transmission via organ transplantation and blood transfusion is less common [10–13]. *T. gondii* in immunocompetent persons is mostly asymptomatic, although in immunocompromised cases such as transplant recipients, HIV<sup>+</sup> individuals, cancer patients, etc. early acute phase of toxoplasmosis would occur or reactivate and causes some complications with poor prognosis including: encephalitis, brain abscess, myocarditis, and chorioretinitis [14,15]. Moreover, chronic toxoplasmosis is strongly correlated to neurodegenerative disorders and autoimmune diseases [16–19]. Previous papers were indicated high morbidity and prevalence of this opportunistic protozoa in variety of hosts in Iran [4,8,11,12,14,20–23].

Rodents are small mammals with short period of maturation and high adaptations ability in terms of biological and morphological features to survive in arboreal, aquatic and terrestrial environments [24]. Role of rodents in spread and transfer of infectious agents is clearly evident. They considered as carrier or reservoir for several infectious agents such as bacteria, virus, fungi and parasites, and transmitted the pathogens through different

routes. For instance, they acts as carrier or reservoir for parasitic disease such as: toxoplasmosis, babesiosis, neosporosis, cryptosporidiosis, leishmaniasis, giardiasis, amoebic dysentery, chagas disease; Trematoda (schistosomiasis, echinostomiasis, brachylaimiasis, alariasis and human fasciolosis), Cestoda (taeniasis, echinococcosis and rodentolepiasis) and Nematoda (trichinosis, capillariasis, angiostrongylosis, toxoscariasis, aelurostrongylosis and baylisascariasis) [24–27].

Several species of rodents have been identified throughout Iran that probably play a potential role in establishment and maintenance of *T. gondii* life cycle in rural and urban regions [25]. Due to lack of a comprehensive report about the prevalence of *T. gondii* in rodents of Iran, this study was aimed to systematically assess the rate of *Toxoplasma* infection in this overlooked hosts.

## Methods

To evaluate the prevalence of toxoplasmosis in rodents of Iran, five English databases (PubMed, Scopus, Web of Sciences, Embase, and Google Scholar) and three Persian databases (Magiran, Scientific Information Database, and Iran Medex) were browsed from 1 January 2000 to 10 September 2016. For this purpose, the present systematic review was done using medical subject headings (MeSH) terms and a combination of several keywords including: “*Toxoplasma*”; “*T. gondii*”; “Toxoplasmosis”; “Prevalence”; “Epidemiology”; “Rodents”; “Rodentia”; “Rat”; “Mouse”; and “Iran”. After database searching; the reference list of relevant articles were screened manually. Initially all relevant papers were

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