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Cattle toxoplasmosis in Iran: a systematic review and meta-analysis

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ABSTRACT

Objective: To analyze and review the overall seroprevalence rate of *Toxoplasma gondii* (*T. gondii*) infection in cattle from Iran. **Methods:** In the current study, data collection (published and unpublished papers, abstracts of national scientific congresses and dissertations) using particular terms was carried out systematically on the following electronic databases like PubMed, Google Scholar, Ebsco, Science Direct, Scopus, Magiran, Irandoc, IranMedex and SID (Scientific Information Database). **Results:** A total of 22 studies since 1983 to 2012 reporting the seroprevalence of toxoplasmosis in cattle from different regions of Iran met our eligibility criteria. The pooled proportion of toxoplasmosis, using random effect model, among cattle in Iran from over the 30-year period was estimated 18.1% (95% *CI:* 9.9% to 28.2%) . **Conclusions:** This study firstly establishes a crude seroprevalence rate of *Toxoplasma* infection in cattle which can lead us to understand the condition of cattle toxoplasmosis, which have to take into accounted for an appropriate and effective prevention and controls. Secondly, it compares and discusses elaborately the role of risk factors including sex, age and breed in the epidemiology of the disease. Thus, it determines gaps and drawbacks in the prior studies which are greatly useful to design more accurate investigations in the future.

1. Introduction

Toxoplasma gondii (*T. gondii*) is a causative agent of toxoplasmosis which was first described by Nicolle and Manceaux in 1908 from North African rodent (*Ctenodactylus gondii*)[1]. This cosmopolitan parasite is considered as an obligatory intracellular protozoan infecting a wide variety of blood warmed vertebrates including human being and cattle as intermediate hosts. First case of *Toxoplasma* infection in cattle occurred in Ohio, U.S.A. in 1953[2]. Felids play a major role in epidemiology of this zoonotic disease as final hosts. Felids are the solely definitive hosts which excrete oocysts in their feces. It was mentioned that newborn kittens are more dangerous compared to adult cats for transmission of this infectious disease[3,4].

Toxoplasmosis is an important matter not only in medical but also in veterinary field. It is estimated that approximately one- third of the human globe population is infected with *T. gondii*[5]. The overall seroprevalence rate of toxoplasmosis among the general population in Iran was 39.3% (95% *CI*=33.0%-45.7%)[6]. Toxoplasmosis causes significant economical losses and damages in animal husbandry. This parasite achieved veterinary importance when it was found to induce abortion storms in sheep in Australia, 1957 and also other economical damages due to stillbirth and neonatal mortality in sheep and goats in other parts of the world[7,8]. *Toxoplasma* is considered as a foodborne risk and in Iran, infection is observed in many domesticated animals including cattle, lambs and goats which are used as food material sources. Aside from

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consuming food or drink contaminated with oocysts of *T. gondii*, either eating undercooked or raw meat of ruminants are evidently being a prime source of infection for human and ingestion of under-cooked beef is considered as a risk factor for human toxoplasmosis[5].

Though numerous and various studies have been undertaken, the relative contribution of foodborne (meat) sources against oocyst transmission of *Toxoplasma* infection to human is still remained unknown. This point is worthwhile to mention that epidemiological investigations still are the most useful methods for evaluating the relative importance of different sources of *Toxoplasma* infection in humans. To the best of our knowledge, despite of a large number of epidemiological surveys on animal toxoplasmosis in Iran, there is not any comprehensive and documented systematic review and meta-analysis on seroprevalence of toxoplasmosis in cattle.

Therefore, the objective of the current systematic review and meta-analysis was to determine the weighed seroprevalence of *T. gondii* infection and describe the epidemiological transmission of infection in cattle of Iran.

2. Materials and methods

2.1. Database search

For the purpose of gathering information, a precise and comprehensive search was performed on all scientific publications (full texts and abstracts) from October to December in 2012 and all process was presented in Figure 1. Nine included databases were as following: five English databases (PubMed, Google Scholar, Ebsco, Science Direct and Scopus) and 4 Persian databases (Magiran, Irandoc, IranMedex and SID). In addition, dissertations and all abstract books of scientific congresses in Iran from 1983 to 2012 were evaluated carefully. In order to avoid missing any articles, whole references of papers were meticulously checked as well.

The search terms which were used alone or combined were "*T. gondii*", "toxoplasmosis", "*Toxoplasma* infection", "animal toxoplasmosis", "cattle", "buffalo", "epidemiology", "seroprevalence", "Iran", "meat producing animal" and "anti-*Toxoplasma* antibodies". Moreover, Language of data collection was limited to Persian and English.

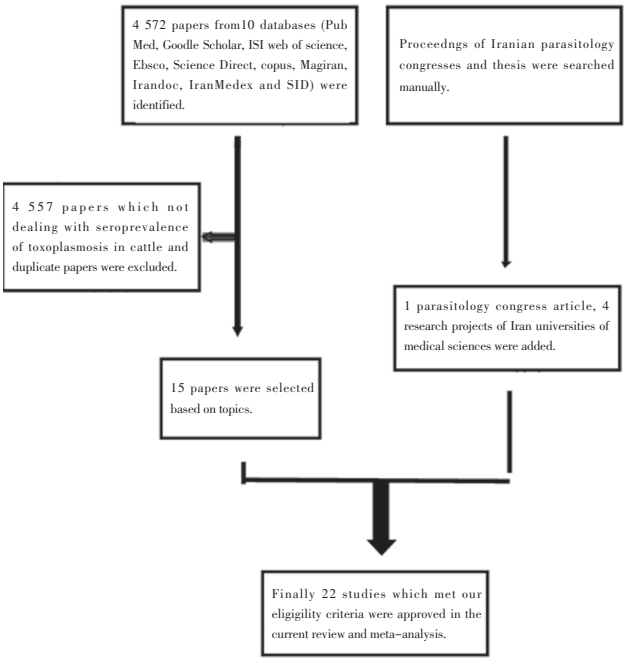

Figure 1. Flowchart describing the study design process.

2.2. Data collection

All cross-sectional studies that were carried out to estimate the prevalence of toxoplasmosis, diagnosed by serological methods, on cattle (alive, slaughtered, aborted or meat products) were included. Repetitive papers were excluded. Furthermore, the collected data for the current study were as follows: year of publication, first author, study areas, sample size, number of males and females, prevalence, age of samples, diagnostic test and time of conducting study. For this purpose a data extraction form was used.

2.3. Statistical methods

Both the crude and the weighted prevalence estimate and their 95% confidence interval for each included study were calculated. Forest plot was used to visualize the heterogeneity among studies. The heterogeneity was expected in advance and statistical methods, I^2 and Cochrane Q statistics (with significance of $P<0.1$) were used to quantify the variations. For the purpose of meta-analysis we assumed that the included studies are a random sample from a population of studies and a random effect model was employed. Proportions of individual studies and overall prevalence were presented by forest plot. The meta analysis was performed with the trial version of StatDirect statistical software (http://statdirects.com).