In Humans Systematic Review and Modelling of Toxoplasma Gondii Seroprevalence

Researchers analyzed the seroprevalence of Toxoplasma gondii in Europe.

T. gondii is a zoonotic protozoan parasite that infects humans and warm-blooded vertebrates, with felids as its definitive host. When ingested, it replicates in the felid's intestine and sheds oocysts into the environment via feces, which can sporulate and survive for prolonged periods. Ingestion of sporulated oocysts can lead to the formation of tissue cysts in susceptible hosts.

Bradyzoites in tissue cysts are infectious, allowing transmission from infected hosts through the consumption of raw or undercooked meat. Humans can acquire infections via the consumption of raw/undercooked meat or through environmental exposure. Besides, placental transmission to the fetus is another route, causing congenital infection leading to stillbirth or abortion. Organ transplantation and blood transfusion also transmit T. gondii.

T. gondii infection is usually asymptomatic or causes non-specific, self-limiting symptoms in humans, but it can also manifest as ocular toxoplasmosis. Although severe acute toxoplasmosis is rare, it can present as polymyositis, retinitis, myocarditis, encephalitis, pneumonitis, or hepatitis, and occurs in individuals with weakened immunity.

Study

In the present study, researchers analyzed the seroprevalence of T. gondii in Europe. First, a literature search was conducted within the Embase database using relevant terms that covered human seroprevalence and risk factors of T. gondii infection in 41 European countries, with a publication period ranging from January 2000 to May 2021.

Studies were eligible if they reported original data and evaluated risk factors and/or seroprevalence of T. gondii infection. Meta-analyses, reviews, studies not reporting original data, and those evaluating T. gondii prevalence in specific risk groups were excluded from the analysis. Identified records were assessed for eligibility by 17 scientists from 12 countries.

Titles and abstracts were screened, followed by full-text analysis and data extraction. Extracted data included study design, population, period, serological tests, and results. Seroprevalence data were harmonized and categorized for modeling, and countries were stratified into northern, eastern, western, southwestern, and southeastern European regions.

The team developed a Bayesian hierarchical model to estimate the age-dependent seroprevalence of T. gondii. The susceptible-infected-susceptible framework was adopted,

wherein individuals transition from the seronegative (susceptible) to the seropositive (infected) state, with reversion to the seronegative status also possible.

The authors noted that partial pooling across countries was used to compensate for sparse data in some regions, which increased uncertainty in those estimates.

Results

In total, the literature search yielded 1,822 records. Following deduplication and title/abstract screening, full texts of 367 publications were analyzed. Of these, 69 studies reported seroprevalence data and 22 provided risk factor data. Seroprevalence data were obtained for 25 countries. The United Kingdom (UK) was analyzed separately due to its markedly lower seroprevalence compared to Western Europe, and its estimates were based on only three studies.

Eastern Europe had the highest mean T. gondii seroprevalence at 50%, followed by western, southeastern, and southwestern regions at 48%, 45%, and 38%, respectively. The UK and northern Europe had markedly lower seroprevalence (18%).

Seroprevalence estimates increased with age, from approximately 13%–16% in people aged ≤25 to 52–68% in those aged >50 in eastern to southwestern Europe. In the UK and northern Europe, estimates rose from 4% to 26–27%.

The UK and northern Europe had the lowest force of infection, i.e., the rate at which infection is acquired, followed by southwestern and southeastern Europe. The western and eastern regions had the highest forces of infection.

The median age at infection was 44 years in Eastern Europe, meaning that half the population had become infected by that age, while the corresponding figure in Western Europe was 47 years. In contrast, the mean waiting time to infection was 64 years in Eastern Europe, but exceeded 250 years in the UK and Northern Europe. However, the distribution was skewed, and about 10% of individuals were already infected by their mid-twenties in these low-force-of-infection regions.

Although the estimated rate of reversion was extremely low (9×10^{-4}), the wide uncertainty interval suggests that some individuals may lose detectable antibodies within decades, indicating that infection does not always guarantee lifelong protection.

Conclusion

In summary, the study modeled age-dependent prevalence of T. gondii in the European population. The findings highlight substantial differences in seroprevalence across geographic regions in Europe. Seroprevalence was highest in the eastern, western, and southeastern regions, and lowest in northern Europe and the UK. The prevalence ranged from 13% to 43% in people aged 25–50, with notable regional differencesv.

Eastern and Western Europe had the highest rates of infection, implying that individuals became infected at a younger age compared to other regions. This meant that half of Western and Eastern Europe's population was expected to be infected by age 47, compared to unreachable ages exceeding 170 years in the UK and northern Europe.

The authors emphasized that estimates may be affected by heterogeneity in diagnostic test performance and unmeasured factors, such as sex, which were not accounted for in the model. They also noted that 16 countries lacked eligible data, that regional differences may reflect cultural habits such as consumption of raw or undercooked meat and varying environmental exposures (e.g., soil or unwashed produce), and that human infection trends parallel those seen in animals, supporting a "One Health" perspective.

The authors suggested that regional differences might stem from cultural practices, such as eating raw or undercooked meat, and environmental exposures like contact with contaminated soil or unwashed produce. They also observed that human infection patterns mirror those seen in animals, emphasizing a 'One Health' connection between the environment, livestock, and people.

The paper concluded with a recommendation to adopt standardized templatess for reporting seroepidemiological data to improve comparability and future meta-analyses.

Source:

https://www.news-medical.net/news/20250901/Review-maps-Toxoplasma-hotspots-Half-in-Eastern-Europe-infected-by-age-44.aspxssssss