

# Immunological Evidence between Schizophrenia and Toxoplasmosis: an Overview

COMMENTARY

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## Abstract

**Background:** Recent studies have corroborated the hypothesis that *T. gondii* is a prime candidate in etiology of Schizophrenia, and it is now considered a possible cause of this pathology.

**Results:** Studies have shown that patients with schizophrenia have significantly increased levels of antibodies to *T. gondii* compared with healthy controls. Previous research has shown an increase in the antibody response to Toxoplasma proteins in schizophrenia and bipolar disorders. CD8 immunity is reduced in schizophrenic patients, it is conceivable that a partial loss of CD8 functionality could result in periodic reactivation of the quiescent *T. gondii* parasites, resulting in focal necrosis and localized inflammation (contributed by innate immune cell-produced cytokines).

**Conclusion:** It will be necessary more experimental researches and clinical trials giving emphasis on these correlations between Schizophrenia and Toxoplasmosis. Then design effective public policies and protocols tracking for Schizophrenia it might be a possible reality.

## Keywords

Immunological Findings; Toxoplasmosis; Schizophrenia.

## Background

Schizophrenia is a complex neuropsychiatric disorder and a challenging mental illness, with an uncertain etiology. Recent studies have corroborated the hypothesis that *T. gondii* is a prime candidate in

etiology of Schizophrenia, and it is now considered a possible cause of this pathology. Transient symptoms of acute toxoplasmosis sometimes resemble the clinical picture of paranoid schizophrenia and studies have shown that patients with schizophrenia have significantly increased levels of antibodies to *T. gondii* compared with healthy controls.

## Results

Previous research has shown an increase in the antibody response to *Toxoplasma* proteins in schizophrenia and bipolar disorders [1]. A study performed on US soldiers found that the first occurrence of anti-*Toxoplasma* antibodies was detected in frozen blood samples collected from subjects that were later demilitarized because of their psychiatric disease 6 months and often even 2-3 years before the onset of the schizophrenia [2]. Experimental study demonstrated that Psychiatric patients have increased rates of toxoplasma antibodies, the differences between cases and controls being greatest in individuals who were assayed near the time of the onset of their symptoms [3]. Of the 192 individuals examined, patients with schizophrenia had significantly increased levels of serum IgG antibodies to *T. gondii* (57.1%) as compared to controls (29.2%) ( $p < 0.05$ ). The OR for this association was 2.99 with 95% CI = 1.65–5.41 [4].

Emelia et al. [5] found, after an analysis of 288 serum samples from schizophrenic patients ( $n=144$ ) and psychiatrically healthy volunteers ( $n=144$ ), a significant result in the sero intensity rate of anti-*T. gondii* IgG antibody ( $> 60$  IU/mL) in schizophrenic patients (61.1%) as compared to psychiatrically healthy volunteers (40.8%) ( $X^2 = 4.236$ ,  $p < 0.050$ ). Pedersen et al. [6] found a significant positive association between *T. gondii* IgG antibody level and schizophrenia spectrum disorders. For the authors the mothers with the highest IgG level had a relative risk of 1.73 (95% confidence interval [CI]=1.12–2.62) compared with mothers with the lowest IgG level.

For schizophrenia, the relative risk was 1.68 (95% CI=0.77–3.46).

Studies of schizophrenic patients have revealed dampened CD8 T-cell immunity in such subjects [7]. Memory CD8 T cells are believed to persist life long, and reencounter with the pathogen can mediate protective responses in self-resolving infectious diseases. However, recent laboratory studies have reported progressive loss of CD8 T cell functionality (dysfunction in terms of proliferation, cytotoxicity, cytokine production, and survival) during chronic toxoplasmosis in certain strains of mice [8]. For Bhadra et al. [9] as CD8 immunity is reduced in schizophrenic patients, it is conceivable that a partial loss of CD8 functionality could result in periodic reactivation of the quiescent *T. gondii* parasites, resulting in focal necrosis and localized inflammation (contributed by innate immune cell-produced cytokines). Such accrued damage of nervous system potentially over time could result in some of the various forms of mental impairment [9].

Besides, *T. gondii* can invade and multiply inside any nucleated cell type including epithelial cells and blood leukocytes. Studies in mice indicate that the dendritic cells as well as monocytes/macrophages function as systemic parasite transporters (“Trojan horses”) during infection [10].

## Conclusions

Therefore, although there were varied theoretical models that aim to explain the pathogenic mechanism of *Toxoplasma* infection in the brain, your correlation with Schizophrenia it’s difficult to establish. It will be necessary more experimental researches and clinical trials giving emphasis on these correlations. Then design effective public policies and protocols tracking for Schizophrenia it might be a possible reality.

## Authors' contribution

Maria do Socorro Vieira dos Santos and Cláudio Gleidston Lima da Silva were responsible for the design of the study. Jucier Gonçalves Júnior, João Vitor Cândido Pimentel, Cláudio Gleidston Lima da Silva and Modesto Leite Rolim Neto were responsible for conducting and systematization of perspective.

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## Conflict of interest

The authors declare that they have no competing interests.

## References

1. Tamer GS, Dundar D, Yalug I, Caliskan S, Yazar S, Aker A: The schizophrenia and *Toxoplasma gondii* connection: infectious, immune, or both? *Adv Ther* 2008; 25: 703-709.
2. Niebuhr DW, Millikan AM, Cowan DN et al. Risk of schizophrenia and antibodies to *Toxoplasma gondii* among U.S. military personnel. *Schizophr. Bull.* 2007; 33: 243-244.
3. Fond G, Capdevielle D, Macgregor A. *Toxoplasma gondii*: a potential role in the genesis of psychiatric disorders. *Encephale*. 2013; 39(1): 38-43.
4. Hamidinejat H, Ghorbanpoor M, Hosseini H et al. *Toxoplasma gondii* infection in first-episode and inpatient individuals with schizophrenia. *Int. J. Infect. Dis.* 2010; 14(11): e978-81.
5. Emelia O, Amal RN, Ruzanna ZZ et al. Seroprevalence of anti-*Toxoplasma gondii* IgG antibody in patients with schizophrenia. *Tropical Biomedicine*. 2012; 29(1): 151-159.
6. Pedersen MG, Stevens H, Pedersen CB et al. *Toxoplasma* Infection and Later Development of Schizophrenia in Mothers. *Am. J. Psychiatry*. 2011; 168(8): 814-21.
7. Steiner J, Jacobs R, Panteli B, et al. Acute schizophrenia is accompanied by reduced T cell and increased B cell immunity. *Eur Arch Psychiatry Clin Neurosci*. 2010; 260: 509-518.
8. Bhadra R, Gigley JP, Weiss LM, Khan IA. Control of *Toxoplasma* reactivation by rescue of dysfunctional CD8+ T-cell response via PD-1-PDL-1 blockade. *Proc Natl Acad Sci USA*. 2011; 108: 9196-9201.
9. Bhadra R, Cobb DA, Weiss LM et al. Psychiatric Disorders in *Toxoplasma* Seropositive Patients-The CD8 Connection. *Schizophr Bull.* 2013; 39(3): 485-489.
10. Lambert H, Vutova PP, Adams WC, Lore K, Barragan A. The *Toxoplasma gondii*-shuttling function of dendritic cells is linked to the parasite genotype. *Infect Immun*. 2009; 77: 1679-1688.

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