

The prevalence of *Toxoplasma gondii* infection in psychiatric patients in Tripoli, LibyaElsaid M. M. A.,¹ Azbedah A. G.,² Dia Eddin E. EL-Alem¹ and Alkout A.¹¹Faculty of Medical Technology, Tripoli University - Libya²Academy of Graduate Studies, Tripoli-Libyadr.elsaid@hotmail.com

Abstract: Background and objective: Toxoplasmosis is a disease caused by coccidian parasite *Toxoplasma gondii*. The infection by *T. gondii* is widespread through the world in many species of mammals including humans and in birds. Patients with psychiatric disorders were found to be high Seroprevalence of toxoplasmosis. There is no information about epidemiology of *T. gondii* in psychiatric patients in Libya. Therefore we investigate the seropositivity rate for anti-*Toxoplasma* IgG in psychiatric patients in Alrazi Neuropsychiatry hospital, Tripoli – Libya by using enzyme linked-immunosorbent assay (ELISA), to detect the relationship between *T. gondii* and psychiatric diseases, and to compare toxoplasmosis rate in patients with control population. **Methods:** serum samples of 300 psychiatric patients and 300 of control volunteers were examined for the presence of anti *T. gondii* IgG antibodies by latex and ELISA. **Results:** The seropositivity rate of *T. gondii* IgG antibodies by latex was 61.7% in patients and 46.7% in control samples, while by ELISA was 50.3% in patients and 33% in control samples. **Conclusions:** In this study, psychiatric patients had a significantly higher prevalence of *T. gondii* IgG antibodies than the control group ($p=0.000$). Thus, there might be a casual relationship between toxoplasmosis and the etiology of psychiatric diseases.

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1- Introduction

Toxoplasmosis is a zoonotic disease caused by the protozoan parasite *Toxoplasma gondii* of member of the phylum Apicomplexa (Singh, 2003). *T. gondii* is one of the most common parasitic infections of man and other warm-blooded animals. It has been found worldwide in nearly one-third of the human population. The incidence of infection may vary in different parts of a world. The causes for these variations are environmental conditions, cultural habits, and animal species. Infections with *T. gondii* occur worldwide, but are especially prevalent in Europe, South America and Africa (Montoya and Liesenfeld, 2004; Burton *et al.*, 2005 and Hill *et al.*, 2005).

Primary infection acquired during pregnancy may result in severe damage to the fetus (Montoya and Liesenfeld, 2004 and Kravetz and Federman, 2005), and may cause mental retardation, seizures, blindness, and death (Jones, *et al.*, 2001) For its part, acquired infections in humans are usually asymptomatic, but in some infected persons cervical lymphadenopathy or ocular disease may occur (Montoya and Liesenfeld, 2004) and (Alvarado-Esquivel, 2006). Acquired *T. gondii* infection in immunocompetent patients may also cause central nervous system manifestations as Guillain-Barré syndrome (Bossi *et al.*, 1998), or cause a brain abscess (Silva *et al.*, 2001). In addition, acquired

acute toxoplasmosis may be associated with psychiatric manifestations (Kramer, 1966) . Yolken *et al.* (2001) have shown that individuals with first-episode schizophrenia had significantly increased levels of antibodies against *T. gondii* as compared with control subjects. The risk factors for *T. gondii* infection in psychiatric patients have been poorly explored. Due to the limited number of recent epidemiological studies in psychiatric patients in general, and a lack of them in Tripoli-Libya in particular, we have performed a cross-sectional study in order to determine the prevalence of *T. gondii* infection in psychiatric patients of Tripoli City, Libya. We also included in our study investigations about the association between infection and the patient characteristics including sociodemographic and risk factors for infection. Results obtained were compared to a control group of and control group of random, normal volunteers.

2-Material and Methods**Samples of the study:**

The population in this study was 300 psychiatric patients (outpatient or inpatient) in Alrazi Neuropsychiatry hospital in Tripoli – Libya, and control group of 300 random normal volunteers. Questionnaire forms was designed to assess some of the main risk factors which may influence the prevalence of *Toxoplasma* infection among the

patients and volunteers, filled out pertaining each identity, source of drinking water, eating habits, contact with animals (especially cats and dogs). The ages of study samples were divided into three age groups (≤ 20 years, 21-40 years and ≤ 41 years).

Collection of blood samples:

5ml of venous blood were collected under sterile conditions from each individual, and then carried to the laboratory of NCIDPC, where centrifuged at 3000 r. p. m for 5 min to separate the serum, which divided into three parts and stored immediately at -20°C in a single repository until the analysis.

Laboratory Assay:

The serum obtained was screened for anti-*T. gondii* antibodies (IgG) by using ELISA (Biochehk, Inc)

Statistical analysis:-

The Statistical Package for Social Science version 10 (SPSS), software for biostatic analysis was used to achieve valid and reliable results obtained in this study. *P* values (< 0.05 were considered significant). Data were then presented in tables and figures.

3-Results

The results of the serological analysis showed that 151 (50.3%) of patient samples and 99 (33%) of 300 control were tested positive by ELISA IgG. This results was statistically significant ($p = 0.000$), (Table 1). Table 1 shows the seroprevalences of Toxoplasmosis in the populations studied according to age groups. Seroprevalence in patients and controls increased with age (Table 1). However, patients in most age groups showed higher rates of seroprevalence; This results was statistically significant ($p = 0.030$).

Distribution of *T. gondii* results among types of neuropsychiatric disorders:-

The serological analysis by ELISA showed that positive results were, in schizophrenia 85 (53.4%), in

psychosis 26 (41.3%), in epilepsy 4 (66.7%), in mania 1 (100%), in anorexia nervosa 1 (100%), in obsession 1 (100%), in mental illness 30 (52.6%), in mental illness + mental retardation 1 (100%), in psychosis + epilepsy 1 (25%) and in epilepsy+mental retardation 1 (52.6%), (Table 2). The was no statistically significant ($p = 0.345$).

Table 1:- Seroprevalence of anti-*T. gondii* IgG antibodies in psychiatric patients and controls by ELISA.

Cases	Total	Positive	Negative
Patient	300	151 (50.3%)	149 (49.7%)
Control	300	99 (33.0%)	201 (67.0%)
Total	600	250 (41.7%)	350 (58.3%)

Table 2:- Clinical diagnosis and seroprevalence of anti-*T. gondii* IgG antibodies in 300 psychiatric patients.

Clinical cases	Total No	Positive	Negative
Schizophrenia	159	85 (53.4%)	74 (29.6%)
Psychosis	63	26 (41.3%)	37 (58.7%)
Mental retardation	1	—	1 (100%)
Epilepsy	6	4 (66.7%)	2(33.3%)
Mania	1	1 (100%)	—
Parkinsonism	2	—	2 (100%)
Anorexia nervosa	1	1 (100%)	—
Anxiety	1	—	1 (100%)
Obsession	1	1 (100%)	—
Mental illness	57	30 (52.6%)	27 (47.4%)
Psychosis mental retardation	1	—	1(100%)
Schizophrenia mental retardation	1	—	1 (100%)
Mental illness and mental retardation	1	1 (100%)	—
Psychosis and Epilepsy	4	1 (25%)	3 (75%)
Epilepsy and mental retardation	1	1 (100%)	—
Total	300	151 (50.3%)	149 (49.7%)

Table 3:- Seroprevalence of anti-*T. gondii* IgG antibodies in psychiatric patients and controls according to age groups.

Age group	Control			Patient samples		
	Positive	Negative	Total	Positive	Negative	Total
≤ 20	9 (20.5%)	35 (79.5%)	44	2 (40%)	3 (60%)	5
21- 40	75(33.3%)	150(66.7%)	225	99 (50.3%)	98 (49.7%)	197
≥ 41	15 (48.4%)	16 (51.6%)	31	50 (51%)	48 (49%)	98
Total	99 (33%)	201 (67%)	300	151 (50.3%)	149 (49.7%)	300

Factors associated with seropositivity

In the bivariate analysis, four variables were identified as possible risk factors associated with *T. gondii* infection:

1) Source of drinking, the results was no statistically significant ($p = 0.363$) for total cases in

general, but separated test for each source of drinking water showed that there was a statistically significant;

2) Washing of eating fresh vegetables and fruits, there was no statistically significant ($p = 0.243$)

3) Contact with animals, the results was no statistically significant ($p = 0.240$) in general, but

separated test for each animals showed that there was a statistically significant; (Table 4); and 4) blood

transfusion ($p = 0.157$).

Table 4:-Multivariate analysis of characteristics of the psychiatric patients and control and their association with *T. gondii* infection.

Risk factors	N	<i>Toxoplasma</i> IgG		P value
		Positive	Negative	
Source of drinking water	599			
Well	156	59 (37.8%)	97 (62.2%)	0.000
Water supply system	360	149 (41.4%)	211 (58.6%)	0.001
Rain water	83	41 (49.4%)	42 (50.6%)	0.044
Eating fresh vegetables and fruits	600			
well washed	435	177 (40.7%)	258 (59.3%)	0.243
Unwashed	165	73 (44.2%)	92 (55.8%)	
Contact with cats and dogs	600			
Contact with cats	130	55 (42.3%)	75 (57.7%)	0.693
Contact with dogs	16	8 (50%)	8 (50%)	0.001
Contact with cats and dogs	73	33 (45.2%)	40 (54.8%)	0.002
No animal contact	381	154 (40.4%)	227 (59.6%)	
Blood transfusion	599			
Received blood	21	6 (28.6%)	15 (71.4%)	0.157
Don't received	578	243 (42%)	335 (58%)	

4-Discussion

This is the first study of prevalence of *T. gondii* infection in psychiatric patients in Libya. Most of the previous studies in Libya have concentrated on the prevalence of *T. gondii* infection among pregnant women. We found that the seropositivity rate for anti *T. gondii* IgG antibodies in psychiatric patients was (50.3%), these results indicate that the chronic *T. gondii* infection in psychiatric patients were highest than in control volunteers (33%), this results considers to be high in the studied samples and statistically significant ($p = 0.000$).

This findings appear to be in accordance with the high prevalence rates of toxoplasmosis which reported by most of the previous studies e.g. **Roch and Varela, (1953)** in Mexico showed that the schizophrenia patients had a significantly higher prevalence of *T. gondii* infection (86%) than samples of the general population (30%) and in Poland, **Kozar, 1953** found that seropositivity was (52%) of psychiatric patients and (25%) of control case. **Garcia, (1979)** in Havana city in Cuba found that (30%) among healthy samples and (45.9%) among mentally handicapped patients were seropositive, and (55%) in France by **Ancelle et al., 1996**, **Spalding (2000)** in Brazil showed that the rate was (74.5%), in China the seropositivity was (29.3%) in mental patients and (6.9%) in healthy cases by **Li et al., 2000** and in Turkey, **Harma et al., 2004** found that (60.4%) was seropositive.

In Libya many studies done to detect the prevalence of *Toxoplasma* antibodies and show high prevalence rates in that studied, **Legnain and Prawecka (1983)** found the seropositive was

(45.8%), **Khader and Nageh (1987)** was (51.6%) of adult male, (43.4%) of adult female was (43.7%) of school children, **Kassem and Morsy, 1991** was (47.4%), **Magrhi et al., 2003** was (44%), **Alkateb et al., 2007** was (69%), **Alzaidy, 2007** was (30.7%). However, the main reasons for this pattern of high prevalence rate of toxoplasmosis in Libya is yet unclear as no adequate studies regarding transmission modes were available.

Our results are not consistent with low prevalence rate was found in some previous studies e.g. (10%) in the United Kingdom by **Allain et al., 1998**, in Mexico was (18.2%) in psychiatric inpatients of Durango City, Mexico and (8.9%) in control population by **Esquivel et al., 2006** and (18.14%) by **Abu Setta and Yamani, 2008** in Libya.

When specific diagnosis of psychiatric diseases were analyzed individuals with respect to the prevalence of *T. gondii* infection, we found no statistically significant results ($p = 0.345$). **Yolken et al., 2001** found that individuals with first-episode schizophrenia had significantly increased levels of antibodies against *T. gondii* as compared with control samples. **Wang et al., 2001**, showed that the seroprevalence of toxoplasmosis in schizophrenia patients were higher than the seroprevalence in control groups.

The relationship between *T. gondii* seropositive and age may not be representing the population as the studied sample was based randomly on out and inpatients from Alrazi Neuropsychiatry hospital, Tripoli – Libya, however, patients age group of ≥ 41 years old was more affected (51%) than other age groups in the study, (the prevalence of anti-*T. gondii*

antibodies are increases with age), this results was statistically significant ($p = 0.030$). Other studies in Libya showed analogous results such as **Legnain and Prawecka (1983)**, **Kassem and Morsy (1991)**, **Magrhi et al. (2003)**, **Alkhunfas (2008)** and **Aljabali (2008)**. also analogous result showed by study in Jordan by **Jumania (2005)**.

On contrary, results of **Al-Qurashi et al., 2001** in Saudi Arabia showed a clear declination of seropositivity with age, similar results showed in Tunisia by **Burathine et al., 2001**.

Regional variations in the incidence of *T. gondii* infection rates from one country to another or even within the same country, has been well documented. This variation has been attributed to climate, cultural differences regarding hygienic and feeding habits (**Jeffrey et al., 2001** and **Remington et al., 2001**). Current study found no significant statistical difference ($p = 0.145$) with prevalence rate in living area, this findings was different with **Alkhunfas (2008)** results, also with **Dar et al., 1997**, and **Bouratbine et al., 2001**. Our study showed that no statistically significant ($p = 0.157$) between *T. gondii* seropositive and blood transfusion.

The infection can occur by contact with cats, drinking water or eating food that contaminated with cat's faeces or by oocyst from the dust (**Magrhi et al., 2003**). We found that the highest rate of infection was in cases that drinking rain water (49.4%), this results was statistically significant ($p = 0.44$), other statistically significant results were found also in cases that drinking home water ($p = 0.001$) and in cases that drinking wells water ($p = 0.000$). This findings appear to be in accordance with the findings of **Rawal (1959)** which reported that the main source of the infection in India is water and vegetables contaminated with oocyst. Our study showed no statistically significant ($p = 0.243$) between *T. gondii* seropositive and eating fresh (vegetables and fruits).

Theoretically, infected cats play a major role in contaminating soil; therefore persons living in a house with soil floors need to have a cat or have contact with it to become infected by this route. The fact that in this study the variable "contact with cats" was not associated with infection ($p = 0.693$). A contrast, contact with dogs show significant associated with transmission ($p = 0.001$).

These findings appear to be in accordance with other previous studies in Libya by **Magrhi et al., 2003**, and by **Alkhunfas (2008)** that found no statistically significant between prevalence of *T. gondii* and contact with cats, but not consistent with results by **Kassem and Morsy (1991)**, and **Jumaian (2005)** in Jordan, those found relationship between cats and the prevalence of toxoplasmosis. The cats considered the main source of *T. gondii* infection

especially in population that not eating undercooked meat (**Alvarado et al., 2006**). Other questionnaire parameters in this study that include questions for using drugs and consumption of raw or undercooked meat, give no indication for the study because the answers wear seam by all population.

Conclusion

In the present study, the psychiatric patients in Alrazi Neuropsychiatry hospital, Tripoli – Libya, had a significantly higher prevalence of *T. gondii* infection than the control group. Thus, there might be a casual relationship between toxoplasmosis and the etiology of psychiatric diseases. Results suggest that drinking untreated rain water (Majen) and contact with dogs might be the most important routes of *T. gondii* transmission in our psychiatric patients.

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