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ORIGINAL ARTICLE

Anti-Toxoplasma Gondii Antibody Seroprevalence Among Pregnant Women in Baghdad

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ABSTRACT
Millions of pregnancy abnormalities occur throughout the world every year, many of which go unnoticed or untreated. The parasite Toxoplasma gondii (T. gondii) causes sometimes this infection among expectant mothors. So, the current study's goals are to evaluate the the anti-Toxoplasma IgG seroprevalence and anti-Toxoplasma IgM antibodies in pregnant women in Baghdad, as well as environmental, psychological, and behavioural factors associated with infection in women. A total of two hundred and twelve (212) pregnant Iraqi women who visited personal laboratories in Baghdad were collected. Their ages ranged from 18 to 33 years. They have all had repeated spontaneous miscarriages in the past. Sera samples were collected, and IgG and IgM levels were estimated for the study participants. 61 samples out of 212 sera examined were IgG-positive (28.8%), whereas 19 tested IgM-positive(42.4%). In (54%) of the IgG-positive patients and (3 % of the IgM cases), a history of spontaneous abortion was mentioned.while there was no significant difference in the seroprevalence of Toxoplasma IgM levels according to maternal age,the IgG levels were considerably higher(p 0.05) in older age groups.the findings showed that IgG seroprevalence tended to be lower in educated participants(11.8%) compared to the uneducated group(17%) (from primary school education up to university graduates). The majority of the study's risk factors did not significantly correlated with the seroprevalence of anti-Toxoplasma IgG and IgM antibodies, However, there was a positive coerelation between untreated water sources, cat exposure and undercooked meat with the anti-Toxoplasma IgG and IgM antibodies. A conclusion can be made that untreated water, cat handling and undercooked meat increase the seroprevalence of anti- toxoplasma antibodies as the correlation reveals a positive relation between these parameters and the anti- toxoplasma antibodies.
Keywords: anti- toxoplasma antibodies, IgM, IgG, Iraq.

INTRODUCTION
Every year, millions of pregnancy abnormalities occur worldwide, many of which go unnoticed or untreated, resulting in difficulties such as miscarriage, stillbirth, neurologic and neurocognitive impairments, and infant disability (Organization, 1987). The parasite Toxoplasma gondii (T. gondii) causes sometimes this infection among expectant mothors; transmission happens when a person consumes tissue cysts in infected animal flesh or parasite oocysts cats have shed, as well as eating unwashed vegetables and fruits, drinking water containing oocytes excreted in faeces, and even contact with cat litter or soil (Abdul Hafeez et al., 2022; Dubey, 2011). This parasite infects one-third of all people on the planet, which is particularly prevalent in low-income and developing nations (Hill and Dubey, 2002). To complete its environmental life cycle, T. gondii requires two hosts. The final hosts are cats (family: Felidae), while most warm-blooded animals serve as intermediate hosts (Tenter et al., 2000). The rate of transmission is low if the infection occurs early in pregnancy, however if the fetus is infected,the severity issignificant; however, if the infection occurs later in pregnancy, the transmission rate is greater, but the severity is low (Hill and Dubey, 2002).

On the other hand, T. gondii infections that arise after birth are normally asymptomatic, but the parasite can cause serious illness in immunocompromised persons (Dubey and Jones, 2008A). The capacity to diagnose T. gondii infection still largely relies on the detection of IgM, IgG, and IgA levels in serological assays. IgM antibodies are the first to develop following an infection, generally a few days later. Their levels climb for 1–3 months before peaking. Over the next nine months, the amount will gradually diminish until it vanishes. Instead, a subset of patients has been discovered to have a long-lasting IgM antibody response that can last up to two years **(**Dubey and Jones, 2008A; Jones et al., 2009). IgG emerges two weeks following infection, with a three months peak, then remain steady for six months before slowing down after a year. During the first four months, the antigen-binding avidity of these igg antibodies gradually rose. IgA has a comparable kinetic to IgM in that it reaches its peak later than IgM. IgA antibodies might persist for up to four months following infection (Dubey and Jones, 2008A; Jones et al., 2009; Montoya, 2002). So, the current study's goals are to assess the seroprevalence of anti-Toxoplasma IgG and anti-Toxoplasma IgM antibodies in pregnant women in Baghdad, as well as environmental, psychological, and behavioural factors associated with infection in women.

PATIENTS AND METHODS
Research Group: A total of two hundred and twelve (212) pregnant Iraqi women who visited personal laboratories in Baghdad were collected. Their ages ranged from 18 to 33 years. They have all had repeated spontaneous miscarriages in the past. The study was conducted according to the ethical approval of the local ethics board. All of the study participants were informed of the study proposal personally.

Epidemiological assessment:to analyze some of the major risk variables that may impact the likelihood that pregnant women will contract Toxoplasma who have repeated abortions, a questionnaire sheet was created. Intreviews whith each participant were to be conducted during her hospital stay, followed by home visits to the central health laboratory to confirm the answers to questions about environmental factors,.Maternal age , gestation length, having cats,water sources and type of cooking and eating behaviors, such as consuming raw or undercooked meat and dining out ,are some of the sjgnificant risk variables taken into account in the study.

Samples: each pregnant woman had her blood drawn twice. all patients' samples were gathered throughout a six-month period ,from January to March 2022. 10 ml tubes were used to collect blood samples.centerfugation was used to separate the samples (sera), which were then kept in tiny tubes at - 20°C untill testing.

Serological testing: serum samples were examined by ELISA utilizing Euroimmun to identify anti-Toxoplasma IgG and IgM antibodies in accordance with the manufacturer's recommendation (U.K.).when the index fell below 0.8,the test was deemed negative; when if fell between 0.8 and 1.1 , the results was inconclusive; and when it fell below 1.1 ,the test was deemed positive, Negative reactions show that there are no detectable Toxoplasma antibodies ..A current or past infection was assumed to be indicated by a positive Toxoplasma IgG reactin

Statistical analysis: the epidemiological variables utilized in the study's serological data were subjected to a descriptive statistical

analysis. the correlation between variables was assessed by using a person's correlation test . A P- value of 0.05 or less was regarded as significant when using chi-square test to assess the significance level between variables. Software called SPSS version 22 was used to examinthe data .

RESULTS

Out of 212 sera tested, 61 samples were IgG-positive (28.8 %), while 19 were IgM-positive (42.4%). A history of spontaneous abortion was reported in (54 %) of the IgG-positive cases and (3 %) of the IgM cases. There was no statistically significant correlation between IgG or IgM seropositivity and the fetus's gestational age. Comparable results of seropositivity of both IgG and IgM were obtained in both first trimesters (Table 1).

Table 1: seropositivity of anti-toxoplasma IgG and IgM related to trimester.

Antibody	First trimester		Total (%)	P- value
	Positive (%)	Negative (%)		
IgG	61 (28.8)	90 (42.4)	151 (71.2)	0.2 31
IgM	19 (9)	42 (19.8)	61 (28.8)	
Total	80 (37.8)	132 (62.2)	212 (100)	

While there was no significant difference in the seroprevalence of Toxoplasma IgM levels according to maternal age, the IgG levels were considerably higher (p0.05) in older age groups. Among pregnant women aged (26 - 33 years the rate was 14.6%, compared to 14.2% for the younger age group of those aged 18-25. .Although IgM seropositivity decreased with age ,reaching its lowest levels (14.2%) in the oldest age group(26 - 33 years),there was no statistically significant link between the different age groups (Table 2).

Table 2: seropositivity of anti-toxoplasma IgG and IgM related to age.

Age group	IgG		IgM		Total (%)	P- value
	+ve (%)	-ve (%)	+ve (%)	-ve (%)		
18-25	30(14.2)	48(22.7)	10(4.7)	25(11.8)	113(53.4)	0.171
26 -33	31(14.6)	42(19.8)	9(4.2)	17(8)	99(46.6)	
Total (%)	61(28.8)	90(42.5)	19(8.9)	42(19.8)	212(100)	

Seroprevalence of educational background: IgG seroprevalence was found to be generally lower among those who had a college education (from primary school education up to university graduates) (11.8 %) compared to the uneducated group (17%). However, this tendency falls short of being statistically significant. On the other hand, the IgM seropositivity levels were 3.8% and 5.1% respectively in comparison between educated and uneducated groups (Table 3).

Table 3: seropositivity of anti-toxoplasma IgG and IgM related to educational background

Educational background	IgG		IgM		Total (%)	P- value
	+ve (%)	-ve (%)	+ve (%)	-ve (%)		
Educated	25(11.8)	40(18.9)	8(3.8)	20(9.4)	93(43.9)	0.271
Not educated	36(17)	50(23.6)	11(5.1)	22(10.4)	119(56.1)	
Total (%)	61(28.8)	90(42.5)	19(8.9)	42(19.8)	212(100)	

Seroprevalence about other influence factors: The majority of the study's risk factors did not significantly correlate with the seroprevalence of anti-Toxoplasma IgG and IgM antibodies. However, there was a positive correlation between untreated water sources, cat exposure and Undercooked meat with the anti-Toxoplasma IgG and IgM antibodies. (Table 4).

Table 4: seropositivity of anti-toxoplasma IgG and IgM correlation with risk factors.

Risk factors		IgG-R^2	IgM-R^2
Water source	Treated	0.16	0.12
	Untreated	0.78	0.61
Cat exposure	Yes	0.65	0.72
	No	0.37	0.26
Undercooked meat	Yes	0.71	0.51
	No	0.26	0.12
Previous miscarriages	Yes	0.15	0.23
	No	0.17	0.19

DISCUSSION

The frequency of Toxoplasma gondii infection in pregnant women has been the subject of numerous investigations in Baghdad. When a woman contracts T. gondii for the first time in her life while pregnant, she may infect her fetus, which could potentially result in extremely serious fetal harm. The majority of earlier research in Baghdad focused on the frequency of toxoplasma infection in the general population. The current study is also among the top ones that assess certain environmental and behavioral variables that could affect the prevalence of T. gondii infections in Baghdad. Pregnant women in Baghdad tested positive for toxoplasma at a higher rate than those in Makkah, where the seroprevalence was previously recorded at 35.6%, reflecting the disparities in the local environment and culture (Almushait et al., 2014).

According to the findings, Iraq has a low seroprevalence of T. gondii compared to other countries like France (Ancelle et al., 1996; Jeannel et al., 1988) and numerous nations in sub-Saharan Africa or Latin America (Frenkel et al., 1995; Ogabido et al., 2017). The relatively modest rise in seroprevalence with aging leads to the hypothesis that people in Iraq may not be primarily exposed to T. gondii through soil exposure, which is greatest during youth. As a result, a sizable number of toxoplasmosis cases in this country may be brought on by consuming contaminated meat that was either consumed whether the meat is uncooked, undercooked, or contaminated by other meats. The age patterns in the research cannot, however, be explained by a cohort effect because there was a higher risk for T. gondii infection in the past. Infection with T. gondii is thought to have been more widespread in the past due to the less common practice of freezing meat and the development of better methods for raising animals (Saadatnia and Golkar, 2012). Additionally, a number of risk variables that have previously been linked to T. gondii infection were also discovered in the current investigation, including consuming undercooked meat and untreated water (Cook et al., 2000; Hughes et al., 2000; Dubey and Jones, 2008b). Untreated water drinking must be relatively rare, though, as it was observed in the results that only a small percentage of the control patients said they had done so in the previous 12 months Jones and Dubey (2008) A lower likelihood of recent T. gondii infection was linked to microwave cooking of meat. Given that meat is not often evenly heated by microwave cooking, this may seem paradoxical (Mohammed, 2011; Nikbakht et al., 2022). But in the US, microwave cooking is frequently used for defrosting or cooking frozen meat as well as for reheating already-cooked meat (for example, TV dinners). Because deep freezing (12 °C or lower) usually kills T. gondii cysts in meat (Kotula et al., 1991; Hill et al., 2006; Opsteegh et al., 2020), People who routinely consume frozen meat heated in a microwave may be less likely to get T. gondii infection. T. gondii cysts, however, may stay viable if meat is not adequately frozen, as was mentioned above. It's intriguing that only those with three or more kittens were subject to the higher risk of exposure to kittens. This shows that the danger

might be caused by a litter of kittens. When they are weaned, get larger, and learn to hunt, kittens who have access to rodents and birds frequently contract T. gondii. A litter of kittens could pollute the environment by excreting millions of oocysts, which could endure in the soil for months or years (Joynson, 1992; Chaichan et al., 2017). Use a litter box and pick up feces every day, preferably by a non-pregnant, non-immunosuppressed human, to prevent environmental contamination (Joynson, 1992; Jones et al., 2009; EFSA, 2021). Due to the fact that the organism needs one or more days to sporulate and become contagious after being shed in the feces, daily litter box cleaning helps avoid T. gondii infection (EFSA and ECDC, 2019)

CONCLUSION

A conclusion can be made that untreated water, cat handling and undercooked meat increase the seroprevalence of anti-toxoplasma antibodies as the correlation reveals a positive relation between these parameters and the anti- toxoplasma antibodies..

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