Vol. 2 No. 3 (2025)

ONLINE ISSN :3007-309X
PRINT ISSN :3007-3081

Journal of Medical & Health Sciences Review

Prevalence of *Toxoplasma gondii* in Pregnant Women's Population in District Karak of Khyber Pakhtunkhwa, Pakistan

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ARTICLE INFO:

Keywords:
Toxoplasma gondii, Prevalence, Risk Factors, Infertile Female, Karak.

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Article History:
Published on 25 July 2025

ABSTRACT

About 30–50% of the global human population is infected with toxoplasmosis, which is caused by the protozoan parasite Toxoplasma gondii. The aim of this study was to determine the prevalence of Toxoplasma gondii and its associated risk factors among pregnant women in District Karak. A total of 300 blood samples were collected from pregnant women in different areas of District Karak between September 2023 and December 2023 using the Onsite Toxo IgG/IgM Rapid Test Kit. Demographic information, risk factors, and toxoplasmosis-related symptoms were analyzed. The overall prevalence of T. gondii was 22.67% for toxo-IgG and 20.33% for toxo-IgM, which was not statistically significant (p=0.4867). The highest prevalence was recorded in the 20–30-year age group (26.26% for toxo-IgG and 23.23% for toxo-IgM), while the lowest prevalence was observed in women under 20 years (18.33% and 16.66% respectively). Tehsil Banda Daud Shah showed the highest prevalence, while Tehsil Karak had the lowest. Lower-class families exhibited higher prevalence rates (28.57% for toxo-IgG and 26.43% for toxo-IgM) than upper-class families (13.33% and 10% respectively). The presence of cats in households was associated with the greatest prevalence rates (30% for toxo-IgG and 28% for toxo-IgM). Miscarriages were reported in 30/100 (30%) for toxo-IgG-positive and 27/100 (27%) for toxo-IgM-positive pregnant women. In conclusion, the present study highlights the need for special control measures and increased public awareness to minimize the spread of Toxoplasma gondii in the area.

1. Introduction

Toxoplasma gondii is a harmful protozoan that occurs in the cells of a variety of animals. This microbe is a member of the Apicomplexa phylum, Sporozoasida class, Coccidiasina subclass, Eimeriida order and Toxoplasmatidae family. The organism is thought to be capable of infecting all warm-blooded animals including humans and can be found in most regions of the world (Innes, 2010).

Toxoplasma gondii was initially discovered by accident, in 1908, by a scientist, Charles Nicolle, who was working in North Africa and searching for a reservoir of Leishmania in a native rodent, *Ctenodactylus gundi* (Innes, 2010).The gundis, found in the foothills and mountains of Southern Tunisia, were commonly studied for Leishmania at the Pasteur Institute in Tunis. Toxoplasma, meaning 'arc form' in Greek, got its name from the crescent-shaped morphology of its tachyzoite and bradyzoite stages. Concurrently, Alfonso Splendore in Sao Paulo discovered a similar parasite in rabbits. Subsequent reports led to the naming of Toxoplasma species based on the host species. However, further research on biological and immunological characteristics revealed that various Toxoplasma isolates from animals and humans were identical to *T. gondii* (Innes, 2010). Toxoplasmosis was established as a human disease after observation of a case of congenital transmission in 1939 and from this experimental transmission to animals was demonstrated.

Toxoplasma gondii can result in toxoplasmosis. It affects many hosts.This obligate intracellular coccidian parasite has an indirect life cycle, with the sexual reproduction occurring only in the small intestine of Felidae (definitive hosts) and asexual multiplication taking place extra-intestinally into the tissues (tissue cysts) of all warm-blooded animals, including humans (intermediate hosts) (J. P. Dubey & J. L. Jones, 2008).

In addition, humans acquire *T. gondii* by ingesting undercooked meat containing viable tissue cysts or unpasteurized milk and dairy products containing tachyzoites. Toxoplasmosis is also an occupational disease for hunters, butchers, and slaughterhouse workers who may become infected during evisceration (Halová et al., 2013).

2. Review of Literature

Healthy people may have mild infections, pregnant women, unborn infants, and others with impaired immune systems are at risk for severe complications. The common symptoms include low fever, weakness, headache, myalgia, generalized lymphadenopathy, and serious defects such as chorioretinitis, pneumonia, and encephalitis. Toxoplasmosis can transmit from mother to child during pregnancy, risking stillbirth, miscarriage, or congenital impairments. Typically, toxoplasmosis is asymptomatic in infants at birth but later causes serious illness, ocular manifestation, headache, and other symptoms. Globally, around 6 billion people have *T. gondii* infections, resulting in a high seroprevalence in developing countries compared to developed ones. The prevalence of toxoplasmosis ranges between 30 and 60% in both developed and developing nations. Furthermore, the seroprevalence of *T. gondii* in pregnant women varies; Punjab province reported the highest seroprevalence (63%), followed by Khyber Pakhtunkhwa (KPK, 38%) and Azad Jammu and Kashmir (AJK, 48%). In recent years, Nucleic acid vaccines, recombinant protein vaccines and cocktail antigen vaccines have been developed to prevent *T. gondii* infection; however, no existing methods offer sufficient protection. The most promising approach for an effective Toxoplasma vaccine involves live attenuated vaccines, capable of eliciting robust and lasting cellular and humoral immune

responses to prevent infection. Currently, Toxoplasma gondii, a protozoan parasite, holds clinical significance for pregnant women. If left undiagnosed and untreated, it can lead to various medical complications and severe adverse outcomes for both the fetus and the newborn.

3. Materials and Methods

3.1. Study area

Karak District is located in Kohat Division of Khyber Pakhtunkhwa province of Pakistan. It is situated to the south of Kohat and on the north side of the Bannu and Lakki Marwat on the main Indus highway between Peshawar and Karachi. It is 131 Km away from the provincial capital Peshawar. Karak District is subdivided in three Tehsils; Tehsil Karak, Tehsil Takht-e-Nasarati and Tehsil Banda Daud Shah. It is natively inhabited by the khattak Pashtun tribe who make the majority of the population. In Karak, the summers are long, sweltering, humid and clear while winters are short, cold, dry and mostly clear. Over the course of the year, the temperature typically varies from 39ºF to 103ºF and is rarely below 34ºF or above 110ºF.

3.2. Study population

In the study population, pregnant women of all ages were included. The samples were collected from three tehsils of District Karak including Takht-e-Nasarati, Banda Daud Shah and Karak.

3.3. Data Collection

A cross-sectional survey was undertaken, with a questionnaire providing demographic information, including age, residential place, gravid status, educational level and gestation trimester, as well as clinical data including previous history of stillbirths and miscarriages and also data about risk factors like cat owning, cattle owning and habits of eating undercooked meat, eating unwashed fruits and vegetables from all the participants. Informed consent was duly signed by the participants in which the use of data obtained only research purpose and maintenance of participants privacy were clearly mentioned. Ethical approval for obtaining blood samples for test purpose was also obtained from College ethical committee. The participants were informed of the use of blood samples and the harm of syringe pricking after collection of sample.

3.4. Samples Collection

A total of 300 blood samples were collected by trained technician from pregnant women in different areas within District Karak during September 2023 to December 2023 and were brought in vacuum blood collection tubes to the Karak Medical Complex (KMC) laboratory.

3.5. Serological Test

The samples (2-3 µL each) were centrifuged to separate the serum, and the parasite was identified using the Onsite Toxo IgG/lgM Rapid Test Kit.

3.6. Laboratory Procedure

The detection of *T. gondii* in present research was done by on-Site Toxo IgG/IgM rapid test, Toxo IgG/IgM rapid test is a lateral flow chromatographic immunoassay that is used for qualitative detection of *T. gondii* specific antibodies (IgG and IgM) in patient sera. The test rapidly diagnoses Toxoplasma infection. About 10µL serum was transferred to the "S" well of test cassete and 2 drops buffer (about 70µ) was mixed with serum in the test cassette and was left at room temperature for 15 minutes until colored lines appeared in the test cassette. The presence of only single pink-purple colored band in the control area marked "C", indicated the negative result. In addition to the control band, appearance of two pink-purple bands in the test region 'M' and region 'G', indicated the presence of both *T. gondii* specific IgM and IgG antibodies. In addition to the control band, the appearance of pink-purple band in the test region 'M'

indicated the presence of *T. gondii* specific IgM antibodies. In addition to control band, the appearance of pink-purple colored band in the test region 'G' indicated the presence of *T.gondii* specific IgG antibodies. Data collected was distributed tehsil based and then age based and after that was arranged along with the demographic details.

3.7.Statistical Analysis

Statistical analysis was done using statistics 9 program. Chi-squared test was used to assess association. P value < 0.05 was used to indicate statistical significance.

4. Results

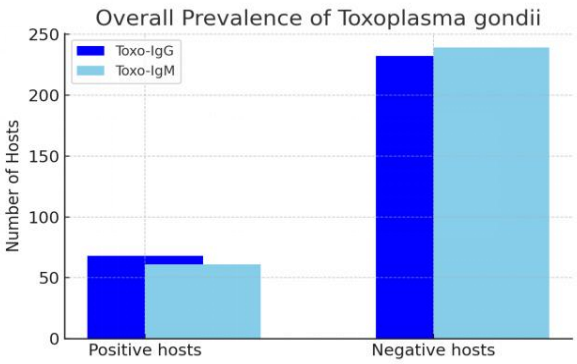
Overall Prevalence of *Toxoplasma gondii* in pregnant women in District Karak

The present studies shows the overall seroprevalence of Toxoplasmosis in pregnant women in District Karak. Total 300 pregnant women were enrolled and screened for the presence of anti−toxoplasma IgG and IgM antibodies from different tehsils of District Karak. The results revealed that overall prevalence of *T. gondii* among females in Karak District was 68/300 (22.67%) for toxo-IgG and 61/300 (20.33%) for toxo-lgM, with a p-value of 0.4867, such as given in table 1.

Table 1:Overall Prevalence of *Toxoplasma gondii* in pregnant women in District Karak.

Results	Prevalence of Toxo−IgG		Prevalence of Toxo−IgM		Chi-square Test (P-value)
	No	%	No	%	
Positive hosts	68	22.67	61	20.33	0.4867
Negative hosts	232	77.33	239	79.67	
Total examined hosts	300	100	300	100	

Figure. 1: *Overall Prevalence*



Prevalence of *toxoplasma gondii* in different Tehsils of district Karak

Tehsil wise prevalence was also observed. Tehsil Banda Daud Shah had the highest prevalence, with rates of 26/100 (26%) for toxo-lgG and 24/100 (24%) for toxo-lgM, followed by Tehsil Takht−e−Nasarati having 22/90 (24.44%) for IgG and 20/90 (22.22%) for IgM while Tehsil Karak had the lowest prevalence, 20/110 (18.18%) for toxo-IgG and 17/110 (5.45%) for toxo-lgM as shown in table 2

Table 2: *Prevalence of Toxoplasma gondii in different Tehsils of District Karak*

Name of Tehsil	No of hosts examined	Prevalence of toxo−IgG		Prevalence of toxo−IgM	
		No of infected hosts	%	No of infected hosts	%
Karak	110	20/110	18.18	17/110	15.45
Takhte Nasarati	90	22/90	24.44	20/90	22.22
Banda Daud Shah	100	26/100	26.00	24/100	24.00
Total	300	68/300	22.67	61/300	20.33

Figure 2: ***Prevalence by Tehsil***

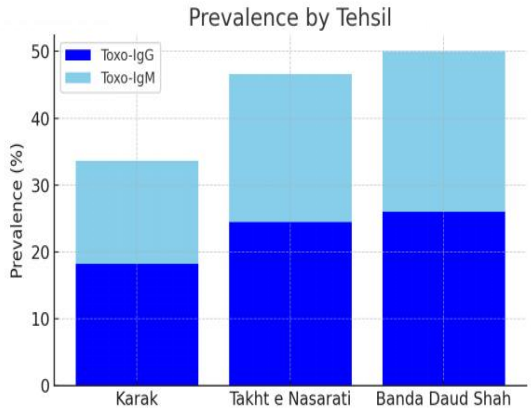
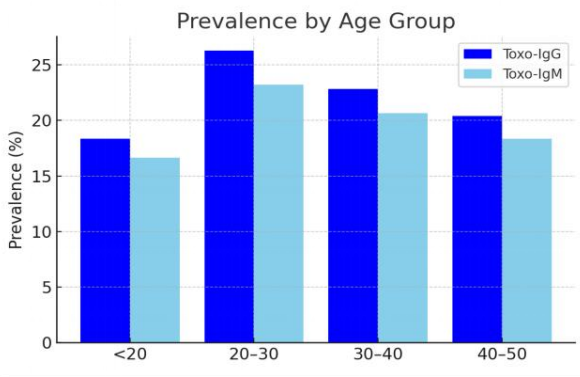


Figure 3: ***Prevalence by Age Group***



Prevalence of *Toxoplasma gondii* in different age groups

Age wise prevalence of *T.gondii*was also observed. The prevalence of *T.gondii* was highest in the 20-30 age group, 26/99 (26.26%) for toxo-lgG and 23/99 (23.23%) for toxo-lgM, followed by the age group 30−40years, 21/92(22.82%) for toxo−IgG and 19/92 (20.65%) for toxo−IgM while the lowest prevalence was observed in the under-20 age group, 11/60 (18.33%) for toxo IgG and 10/60 (16.66%) for toxo-IgM, followed by the age group 40−50years 10/49 (20.41%) for toxo−IgG and 9/49 (18.36%) for toxo−IgM, as shown in table 3.

Table 3: Prevalence of Toxoplasma gondii in different age groups:

Age groups(years)	Total examined hosts	Prevalence of Toxo−IgG			Prevalence of Toxo−IgM		
		Normal hosts	Infected hosts	%	Normal hosts	Infected hosts	%
Below 20	60/300	49/60	11/60	18.33	50/60	10/60	16.66
20−30	99/300	73/99	26/99	26.26	76/99	23/99	23.23
30−40	92/300	71/92	21/92	22.82	74/92	19/92	20.65
40−50	49/300	39/49	10/49	20.41	39/49	9/49	18.36

Relationship of *toxoplasma gondii* with different variables

Various socio−demographic data including residence type, financial status, educational background, gestational age, marriage category and previous history were obtained from study population of pregnant women separately for anti−toxoplasma IgG and IgM to find out relationship of *Toxoplasma gondii* with different variables. A higher seroprevalence was observed in 3rd trimester (25% for toxo−IgG and 22.5% for toxo−IgM), followed by second trimester (23% for toxo−IgG and 20% for toxo−IgM) and then 1st trimester (18.75% for toxo−IgG and 17.5% for toxo−IgM). The results showed that lower-class families had a higher prevalence rate of 40/140 (28.57%) for toxo-lgG and 37/140 (26.43%) for toxo-IgM than upper-class families, which had a prevalence of 8/60 (13.33%) for toxo-lgG and 6/60 (10%) for toxo-IgM. A difference was observed in seroprevalence *Toxoplasma gondii* of in uneducated women (38.18% for toxoIgG and 36.36% for toxo IgM), educated women upto school level (15% for toxo−IgG and 12.5% fortoxo−IgM) and graduated women(11.42% for toxo−IgG and 8.57 % for Toxo−IgM). A difference was observed in the seroprevalence of *Toxoplasma gondii* in the women with no children (29.23% for toxo IgG and 26.92% for toxo IgM), followed by the women having

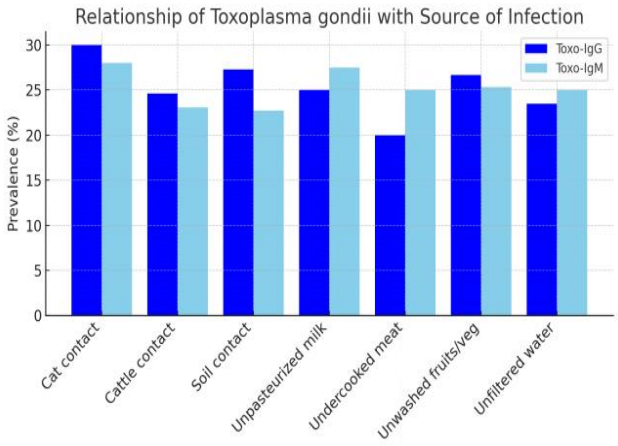
one child (20.95% for toxo IgG and 19.05% for toxo IgM) and then the women having more than one child (12.31% for toxo IgG and 9.23% for toxo IgM). The prevalence of *Toxoplasma gondii* on the basis of residence type was also observed. Highest prevalence was observed in rural area (25.88% for toxo IgG and 23.52% for toxo IgM). The prevalence of *Toxoplasma gondii* in the urban area was 18.46% for toxo IgG and 16.15% for toxo IgM). A higher rate of seropositivity of *Toxoplasma gondii* was detected in women, married within the families (cousin marriage) (25.81% for toxo IgG and 23.87% for IgM), compared to women,married out of families (19.31% for toxo IgG and 16.55% for toxo−IgM). The previous history of the examined 300 women was also recorded, among them miscarriages occurred at a rate of 30/100 (30%) for toxo-IgG and 27/100 (27%) for toxo-lgM among pregnant women. A total of 100 women were reported to have history of miscarriage. Out of thes 100, 30 women were reported positive for toxo IgG (30%) and 27 women were positive for Toxo−IgM(27%). 95 women out of 300 were reported to have previous history of stillborns, among those 95, 22 were positive for toxo IgG (23.15%) and 20 women were positive for toxo IgM(21.05%). 55 among the 300 women studied, were reported that their previous babies suffered from various infections, out of these 55, 10 were positive for toxo IgG (18.18%) and 9 women were positive for toxo IgM (16.36%). 50 women out of those 300, delivered their previous babies without any infection. Out of these 50, 6 women were positive for toxo IgG (12%)and 5 women were positive for toxo IgM (10%).All these relationship of *Toxoplasma gondii* with various variables is shown in table 4

Table 4: Relationship of Toxoplasma gondii with different variables.

Variables	Categories	No of hosts examined	Prevalence of toxo−IgG		Prevalence of toxo−IgM	
			Infected hosts	%	Infected hosts	%
Gestational age	1st Trimester	80	15	18.75	14	17.5
	2ndTrimester	100	23	23	20	20
	3rd Trimester	120	30	25	27	22.5
Financial class	Lower	140	40	28.57	37	26.43
	Middle	100	20	20	18	18
	Upper	60	8	13.33	6	10
Educational−	Uneducated	110	42	38.18	40	36.36
Background	School level	120	18	15	15	12.5
	Graduate	70	8	11.42	6	8.57
No of childrens	None	130	38	29.23	35	26.92
	One	105	22	20.95	20	19.05
	More than one	65	8	12.31	6	9.23
Residence type	Urban	130	24	18.46	21	16.15
	Rural	170	44	25.88	40	23.52
Marriage	Family marriage	155	40	25.81	37	23.87

category						
	Non –family marriage	145	28	19.31	24	16.55
Previous history	Miscarriage	100	30	30	27	27
	Still birth	95	22	23.15	20	21.05
	Baby with infection	55	10	18.18	9	16.36
	Baby with no infection	50	6	12	5	10

Figure 4: Relationship with Different Variables



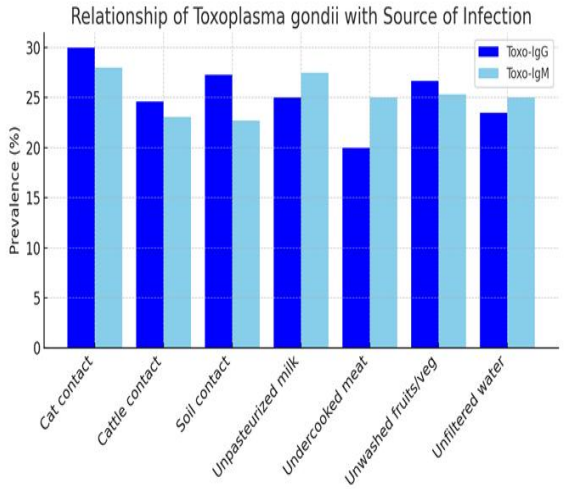
Relationship of *toxoplasma gondii* with source of infection

The risk factors or sources of infection were also analyzed for the association with toxoplasma infection. The prevalence of *Toxoplasma gondii* due to various sources of infections was observed. The prevalence due to domestic cats contact (30% for toxo−IgG and 28% for Toxo−IgM), cattle contact (24.61% for toxo−IgG and 23.07% for Toxo−IgM), soil contact (27.27% for Toxo−IgG and 22.72 for Toxo−IgM), use of unpasteurized milk (25% for Toxo IgG and 27.5% for Toxo IgM), use of undercooked meat (20% for Toxo IgG and 25% for Toxo IgM), use of unwashed fruits and vegetables (26.66% for Toxo IgG and 25.33% for Toxo IgM), and use of unboiled or unfiltered water (23.5% for toxo IgG and 25% for Toxo IgM) was seen in pregnant women.

Table 5: Relationship of *Toxoplasma gondii* with source of infection

Source of infection	No of hosts examined	Prevalence of Toxo-IgG		Prevalence of Toxo-IgM	
		Infected hosts	%	Infected hosts	%
Cat contact	100	30	30	28	28
Cattle contact	130	32	24.61	30	23.07
Soil contact	110	30	27.27	25	22.72
Using unpasteurized milk	80	20	25	22	27.5
Using undercooked meat	60	12	20	15	25
Using unwashed fruits/veg	150	40	26.66	38	25.33
Using unfiltered water	200	47	23.5	50	25

Figure 5 :Relationship of Toxoplasma gondiiwith source of infection



5. Discussion

Toxoplasma gondii is a harmful protozoan that occur in the cells of a variety of animals. This microbe is a member of the Apicomplexa phylum, Sporozoasida class, Coccidiasinna subclass ,Eimerioreena order and Toxoplasmatidae family. The organism is thought to be capable of infecting all warm-blooded animals including humans and can be found in most regions of the world.(Innes, 2010). *Toxoplasma gondii* can result in toxoplasmosis. It affects many hosts. This obligate intracellular coccidian parasite has an indirect life cycle, with the sexual reproduction occurring only in the small intestine of Felidae (definitive hosts) and asexual multiplication taking place extra-intestinally into the tissues (tissue cysts) of all warm-blooded animals, including humans (intermediate hosts).

There are three different infectious stages: sporozoites in oocysts, tachyzoites, usually in secretions, and bradyzoites in tissue cysts. When hosts get infected, tachyzoites quickly proliferate inside different cells. Consequently, tachyzoites form cysts in different tissues and develop into bradyzoites. These tissue cysts survive throughout the host's lifetime and can infect any human or animal that consumes them.

In present study 300 pregnant women were screened for the presence of anti-toxoplasma IgG and IgM antibodies. In this study the overall prevalence of IgG specific antibodies (recent infection) and IgM specific antibodies (latent infection) against Toxoplasma gondii was found 22.67% and 20.33% respectively. This result is in agreement with the study conducted at Swabi, Pakistan, where seroprevalence was found 19.25% (Faisal et al., 2014) and 21.6% in Thailand (Nissapatorn, Suwanrath, Sawangjaroen, Ling, & Chandeying, 2011). The seroprevalence studies against *T.gondii* in Pakistan show diversity. From Punjab toxoplasmosis was reported 63%, followed by Azad Kashmir (48%) and 14.4% from Kohat, khyber Pakhtunkhwa (Khan et al., 2011). Many other studies also reported higher rate of prevalence of toxoplasmosis such as in Nigeria 32.6% (Akinbami, Adewunmi, Rabiu, & Wright, 2010), Colombia 45.8% (Rosso et al., 2008) and south Western Ethopia 81.1% (Zemene et al., 2012). Because of difference in eating habits, geography, level of exposure, educational level, the prevalence of *Toxoplasma gondii* varies around the world. The variation in prevalence rates between countries can be explained by differences in geographical and climatic conditions,as oocyst sporulation is more effective in hotter and wetter region(Iqbal & Khalid, 2007).

In this study, the highest prevalence of *T.gondii* is recorded in Tehsil Banda Daud Shah (26% for Toxo-IgG and 24% for toxo-IgM), followed by Tehsil Takht-e-Nasarati and Tehsil Karak. High prevalence in Tehsil Banda Daud Shah may be due to multiple reasons, as this area is rural and mountainous, climate is best for sporulation of oocyst, majority of them belong to poor and middle class families and living in muddy houses, poor sanitation system, low level of education

and contact of people with animal is frequent. Various studies have reported that *Toxoplasma gondii* infection increases with age. This increase might be correlated with the risk of exposure of individuals to the infection with the increase in age. During the current investigation the highest seroprevalence (26.26% for toxo-IgG and 23.23% for toxo-IgM) was observed in age group of 20-30 years, followed by the age group of 30-40 years (22.82% for toxo-IgG and 20.65% for toxo-IgM).

Seroprevalence of antitoxoplasma antibodies was reported high in age groups 21 to 40 years (60%) from karachi, Pakistan (Ally & Idris, 2004),35-45 years (48.8%) from Japan (Sakikawa et al., 2012) and 30-39 years (55.3%) from Colombia (Rosso et al., 2008). Gestational age is also reported to have relation with the prevalence of infection. In the present study high percentage of infection is reported in the third trimester (25% for toxo-IgG and 22.5% for toxo-IgM), followed by the second and first trimester. This result agrees with reports from Nigeria, where high prevalence was detected in third trimester of pregnancy (46.7%) (Deji-Agboola, Busari, Osinupebi, & Amoo, 2011) and a study from south-western Ethiopia also reported high prevalence of infection in the third trimester of pregnancy (86.8%) (Zemene et al., 2012). In other study conducted at Kohat, pakistan, quite opposite results were recorded such as prevalence was 29% at the first trimester, 19% at the second trimester and only 2% at last trimester.

The present study indicates that infection is more prevalent in women belong to lower and middle class regarding socioeconomic factors. The results show that lower class families (28.57% for toxo-IgG and 26.43% for toxo-IgM) were greatly affected as compare to middle and upper class families. These findings are similar with the findings of study from Mwanza, Tanzania, which reported that high prevalence is observed in women with low income (19%) (Mwambe et al., 2013). The present study concluded that uneducated women are at high risk of acquiring *T.gondii* infection. *Toxoplasma gondii* is found high (38.18% for Toxo-IgG and 36.36% for Toxo-IgM) in uneducated women. Many researches around the world pointed out that low level of education increases the risk of acquiring the parasite (Deji-Agboola et al., 2011). Miscarriage and still birth are common consequences among pregnant women infected with *toxoplasma gondii* during pregnancy. In this study, high prevalence (30% for toxo-IgG and 27% for toxo-IgM)is found in pregnant women with a previous history of miscarriage. These findings are similar with the reports, indicating that 44.9% of women with a history of habitual miscarriage from central Mexico and 47% women with history of spontaneous miscarriage from south Mexico were seropositive for t.gondii antibodies (Alvarado-Esquivel et al., 2009).

Other complication of toxoplasmosis are still birth, hydrocephalus and neurological abnormalities. In the present study, high prevalence is found in pregnant women with previous history of still birth (22% for toxo-IgG and 21.05% for toxo-IgM). This result is supported by other study mentioning that 5.8% of the women with abortion had a history of congenital malformation that ranged between a hydrocephalus and abnormal while the still birth is recorded 41.7% from 312 pregnant women with abortion (Al Hindi & Lubbad, 2009). A study from kohat, Pakistan reported that toxoplasmosis leads to still birth, abortion, anaemia, anorexia etc (Khan et al., 2011). Another study from Khartoum state also determined that toxoplasmosis can cause still birth and abortion (Elhag, Elturabi, Bahaeldin, & Elturabi, 2015).

In the present study high prevalence of Toxoplasmosis (25.88% for toxo-IgG and 23.52% for toxo-IgM) is observed in pregnant

women in rural area. These findings are similar to findings of study, conducted at Duhok, Iraq, mentioning 26.5% of pregnant women in rural area. The high prevalence in rural area may be because of the poor hygienic conditions, more interaction with animals and pets, unavailability of filtered water, frequent contact with soil or sand.

Seroprevalence of *Toxoplasma gondii* is associated with various risk factors like contact with cats and cattles, water sources, consumption of unpasteurized milk, consumption of undercooked meat, consumption of raw vegetables and use of unwashed fruits and vegetables.

In present study, highest prevalence (30% for toxo-IgG and 28% for toxo-IgM) is observed in the pregnant women having contact with cats. A study conducted in Debre Tabor, north west Ethiopia determined that cat is major risk factor for toxoplasmosis (Agmas, Tesfaye, & Koye, 2015). The possible reason for more infection due to cat presence in the homes may be due to the access of cat feces(which contain oocyst) to drinking and eating materials. But another study conducted in Almadinah Almunawwarah KSA showed that there is no significant relation between toxoplasmosis prevalence and the risk factor of having cats at home (Imam, Esra'a, & Attia, 2016).

The present study revealed that highest prevalence (24.61% for toxo-IgG and 23.07% for toxo-IgM) is observed in pregnant women having cattle in their homes. Another study by Bradon Mong, et al (Brandon-Mong et al., 2015)revealed that people having more contact with animals are at higher risk of toxoplasmosis. Prevalence rate is higher (20% for toxo-IgG and 25% for toxo-IgM) in pregnant women who uses undercooked meat. This result is supported by a study from Nazareth town, Ethopia showed that who have consumed raw or poorly cooked meat were at higher risk of infection (Negash, Tilahun, & Medhin, 2008). Prevalence is also higher (26.66% for toxo-IgG and 25.33% for toxo-IgM) in pregnant women who have used unwashed fruits and vegetables. Similar results were also found out by Majid, et al (Majid et al., 2016). The present study observed higher prevalence (25% for toxo-IgG and 27.5% for toxo-IgM)in the women who have consumed unpasteurized milk than women who have used pasteurized milk.

Conclusion and Recommendations

The present study concluded that in District Karak, *Toxoplasma gondii* is prevalent in females which lead to complications such as still birth and abortions. It is also concluded that most of the people are unaware from the infections, their risk factors and complications. So, it is recommended that public awareness is necessary to minimize the infection in Karak.

6. References

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