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Serological Detection of Anti *Toxoplasma* Antibodies Among Pregnant Diabetic Women in Amedi – Kurdistan Region

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Abstract

This study investigated the presence of specific antibodies against Toxoplasma gondii among pregnant diabetic women in comparison with healthy pregnant non diabetic women in Amedia. Overall, 300 pregnant women were enrolled in this study. The studied women were divided in to 2 groups, the first group included 200 pregnant diabetic women. The second group (control group) included 100 healthy pregnant non diabetic women. Diabetes is an important factor that increases susceptibility and risk of various infections in the host. Seropositivity of anti-IgG T. gondii recorded 24.8% among pregnant female with HBA1C ≥ 7 and 15.2% among pregnant female with < 7 while rate of anti-IgM T. gondii showed as 2.5% between pregnant with ≥ 7, moreover rate of anti-IgG T. gondii among healthy pregnant women recorded as 50% with HBA1C ≥ 7 ,10.4% with HBA1C < 7 and 1% seropositive for anti-IgM T.gondii between control group with HBA1C ≥ 7. In present study rate of anti-IgG T. gondii higher in age group <30 compared with age ≥ 30 while rate of anti-IgM T. gondii were higher in age ≥30 compared with age <30 year. Higher rate of infection found in urban area compared with rural area in both groups. Own - Cat another parameter that showed that most infection occur between patients who have contact or own cat which the main source of infection with toxoplasmosis. Regarding exposure to soil 24% where seropositive for anti-IgG T. gondii and 19,2% where positive among patients no exposure to soil and the results not significant, while anti-IgM T. gondii found 2.7% patients were exposure to soil and 0.8% were seropositive between patients have no exposure to soil and the results statistically significant. Results related to good washing of the vegetables showed that 13% were seropositive for anti-IgG T. gondii and statistically the results were not significant. In the current study the seropositivity of anti-IgG T. gondii between patients who meat consumption half cooked were 11.1% and 12.1% among patients who meat consumption good cooked, also 1.2% seropositive for anti-IgM T. gondii among patients who meat consumption good cooked and results not significant statistically. The rate of seropositive of anti-IgG T. gondii among patients with miscarriage and without miscarriage reported as 7.1%, 12.8% respectively. The statistical difference was not significant, while the rate of seropositive of anti-IgM T. gondii among patients without miscarriage reported as 1.2% and statistically the difference was not significant. It is clear that the rate of seropositivity of anti-IgG T. gondii among illiterate patients were higher (15.4%), while among literate patients were 1.1% and this result was not significant. The rate of seropositive of anti-IgG T. gondii according to occupation which divided in to employee and unemployed showed that 19%, 10 % respectively, the rate of seropositivity of anti-IgM T. gondii among unemployed reported as 1.3% with no significance difference statistically. In conclusion, in the present study some lifestyle variable of patients had a p value < 0.05, including HBA1C ≥7, age, own cat and exposure of soil. This study provided serological evidence of an association between T. gondii infection and pregnant diabetes mellitus., which may help to guide future research, further studies should be conducted to elucidate the role of T. gondii in diabetes mellitus.

Keywords: *Toxoplasma gondii, Diabetes, HbA1C, pregnant, IgG, IgM Duhok, Iraq*

1. Introduction

Toxoplasma gondii is an obligatory intracellular protozoan parasite which appears to have a broad host specificity. Cat and wild felines are the only final hosts, while humans and all other warm-blooded animals are intermediate hosts {10}. *Toxoplasma* was first described in 1908 by a French parasitologists Charles Nicolle and Herbert Manceaux. Infection with the protozoan *Toxoplasma gondii* is one of the most common parasite infections of man and other warm -blooded animals. It has been found worldwide in nearly one-third of the human population {20}.

The intrauterine transmission of *Toxoplasma* infection results in miscarriage, stillbirth or prematurity or it can cause congenitally infected symptomatic newborn or asymptomatic child who develops illness later in life {44}.

In congenital toxoplasmosis approximately 10-20% of pregnant women infected with *T. gondii* become symptomatic {46}.

Diabetes mellitus (DM) is one of the major worldwide public health concerns of the 21st Century. It is estimated that the number of persons suffering from DM will increase to 552 million (7.7%) in 2030{28}. Diabetic patients have suppressed immune systems, potentially indicating that these subjects may be more susceptible to acquire *T. gondii* {29}. Type 1 diabetes mellitus (T1DM) is characterized by hyperglycemia due to the deficiencies in insulin hormone release, while type 2 diabetes mellitus (T2DM) is hallmarked by the failure to properly respond to insulin {34}.

Diabetes increases the host's sensitivity and risk of susceptibility to various infections {38}. The present study shows correlation diabetes and toxoplasmosis. Currently, the levels of IgG and IgM antibodies in serum can easily be measured using available techniques {39}. Serologic methods are techniques used to measure the level of infection to *Toxoplasmosis* in humans and animals {41}. Amongst these methods, the most common techniques are ELISA and IFA or indirect immuno-florescence {45}.

Moreover, based on results of many studies, latent toxoplasmosis seems to play an important role in the occurrence of a spectrum of neurological disorders, such as personality disorder, Parkinson disease, Alzheimer disease, and cryptic epilepsy {44}. The periodic rupture of tissue cysts is considered to be a source for release of specific cytokines and antibodies due to *Toxoplasma* infection {27}. *T. gondii* can reach many organs of the host after infection, including the pancreas {28}. Diabetes mellitus is a common chronic metabolic disease and more than 300 million persons worldwide are projected to be affected by this disease in 2030 {25}.

2. Materials And Methods

During the period from February to July 2023, a total of 300 blood samples were collected randomly from pregnant women age for screening anti-*Toxoplasma* specific antibodies who attended the General Amedia Hospital, antenatal clinic in Sheladieza, Deroluak, Sersaing and Kadash. The

data for each were recorded on a special questionnaire including age, residency, educational status, family history of diabetics, miscarriage, exposure to soil, washing the hands before meals, washing the vegetables, own cat and meat consumption.

From each women of diabetic group and healthy group, a 5 mml of venous blood samples was collected, the blood were divided in two parts, first parts of blood was collected in gel tube to separate the serum for detection of IgG and IgM antibodies against Toxoplasma, the blood was centrifuged at 3000 rpm for about 5 minutes, the separated serum was aspirated and poured into a sterile Eppendorf tube and kept at -20 °C to detection of anti IgG and IgM Abs level using a commercial ELISA Kits (demeditec EN ISO 9001; BioCheck, Inc.)/ Germany. The second part of blood was collected in EDTA tube for estimation of HbA1C level.

Statistical Analysis

Analysis of data was carried out using the Statistical Package for Social Science (SPSS). Chi-square test, T test were used to test statistically significant differences. Differences between 2 groups were considered significant if P value < 0.05.

3. Results and Discussion

During this study, 300 pregnant women were screened for anti- *Toxoplasma* specific antibodies, women involved in the current study were from population in Amedia and some nearby villages, the samples were tested for HbA1C and both immunoglobulin types IgG, IgM of *Toxoplasma* by using ELISA.

It is obvious from the table (1) that the seropositivity of toxoplasmosis infections among examined pregnant women with diabetics and healthy without diabetic's pregnant women a total of 54 (27 %) were positive for anti IgG *T.gondii* Ab while only 4 (3 %) were positive for anti IgM *T.gondii* Abs.

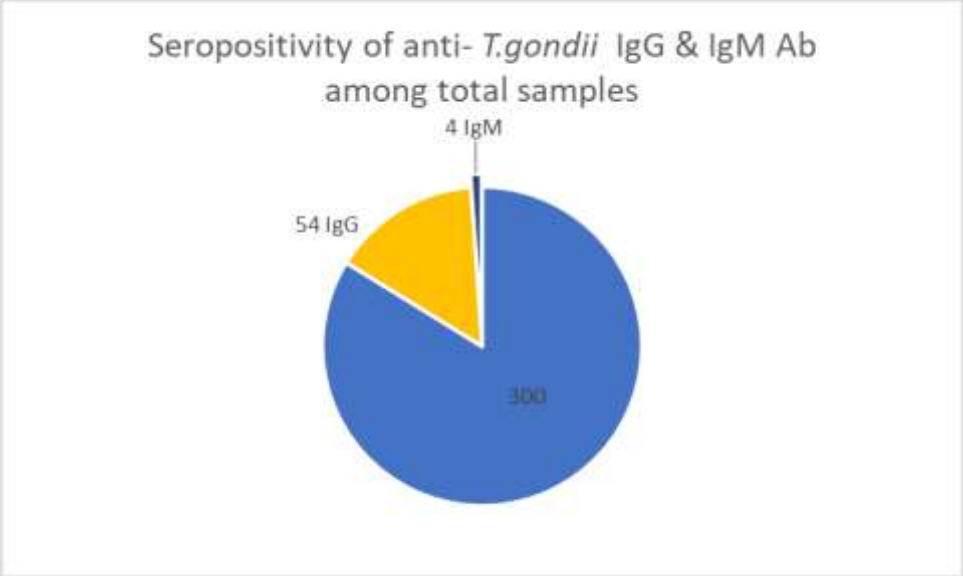

Figure (1) Seropositivity of anti- *T. gondii* IgG and IgM Abs. among total samples (n=300).

Table (2) shows the seropositivity of anti-*T.gondii* Abs. between two groups.

Groups	No. examined	Seropositive of *Toxoplasma*		P Value
		+ IgG No. & Percentage	+ IgM No. & Percentage	
Diabetic	200	42 21%	3 1.5%	0.025
Non-Diabetic	100	12 12%	1 1%	0.003
Total	300	54	4	

** Highly significant

The results showed from table (2), that 200 pregnant with diabetics were included in this study that 42 (21%) were seropositive for ant-IgG *T. gondii* and 3(1,5%) seropositive for anti-IgM *T. gondii*, the results of anti-IgG, IgM *T. gondii* were statistically significant: P Value= (0.025). In the same table showing the seropositivity among healthy group which including 100 non diabetic pregnant that 12 % were seropositive for anti-IgG *T. gondii* and 1% were seropositive for anti-IgM *T. gondii* and these results were statistically significant :P Value= (0,003).

Table (3) Relation between HbA1C level and seropositivity among group of diabetic's pregnant women (n=200)

HbA1C %	No & %	+ Toxoplasmosis			
		+ IgG No & %	P. value	+ IgM No & %	P. value
< 7	79 (39.5%)	12 (15,2%)	0,052	0	0.080
≥ 7	121 (60.5%)	30 (24.8%)		3 (2.5%)	
Total	200	42 (%)		3 (%)	

Non-significant

It is obvious from table (3) that 79 pregnant had HbA1C less than 7% in this groups showed that 12 (15.2 %) where seropositive for anti-IgG *T. gondii* , and 121 pregnant had equal or more 7% showing that 30(24,8 %) seropositive for anti-IgG *T. gondii* and 3 (2,5%) were seropositive for anti-IgM *T. gondii* . It was clear there were no significant difference between anti-*T. gondii* IgG, IgM and HbA1C level among the group of diabetic pregnant women.

Table (4) Relation between HbA1C level and Seropositivity among non-Diabetic pregnant women (n=100)

HbA1C %	No	+ Toxoplasmosis			
		+ IgG No & %	P. value	+ IgM No & %	P. value
< 7	96	10 (10.4%)	0.008	0	0.000
≥7	4	2 (50%)		1(%)	
Total	100	12 (%)		1	

** Highly significant

Table (4) shows the seropositivity of anti-IgG, IgM *T. gondii* among healthy pregnant women were 10(10.4%)from96 with HBA1C < 7 positive for anti-IgG *T. gondii* and 2 (50%) from 4 with HBA1C ≥ 7 positive for anti-IgG *T. gondii* and 1positive for anti-IgM *T. gondii*. The results of IgG and HbA1C were significant statistically (P Value =0.008) and the results of IgM with HbA1C were highly significant (PV=0.000).

Table (5) Demographic Characteristics of pregnant women with Diabetes and seropositivity of *Toxoplasma gondii* (n=200)

Characteristics	**No**	**Diabetic with Anti-*T.gondii***			
		IgG + No & %	**P. value**	**IgM +** No & %	P .value
Age					
< 30	108 (54%)	30 27,8%	0.005	1 0,9 %	0,030
≥30	92 (46%)	12 26,1%		2 2.3 %	
Residency			0.068		0.465
Urban	138 (69%)	24 (17.4 %)		1 (0.72 %)	
Rural	62 (31%)	18 (29 %)		2 (3.2 %)	
Own cat			0.336		0.025
Yes	109 (54.5%)	23 (21.1 %)		2 (1.8%)	
NO	91 (45.5%)	19 (20.9 %)		1 (1.1%)	
Exposure to soil			.,211		.,012
Yes	75 (37.5%)	18 (24 %)		2 (2.7 %)	
No	125 (62.5%)	24 (19.2 %)		1 (0.8 %)	
Washing the vegetables good			0.236		0.196
Yes	169 (84.5%)	37 (21.9 %)		2 (1.2%)	
No	31 15.5%	5 16.1 %		1 3,2%	
Meat consumption			0,335		0,386
Half -cooked	52 26%	12 23.1 %		1 1.9%	
Boiled-cooked	148 74%	30 20.3 %		2 1,4%	
Miscarriage			0,309		0,167
Yes	79 39.5%	18 22.8 %		2 2,5 %	
No	121 60.5%	24 19,8 %		1 0.8 %	
Education			0,130		0,465

Literate	138 69%	32 23,2%		2 1,4%	
Illiterate	62 31%	10 16.1%		1 1.6%	
Job					
Employee	67 33.5%	17 25,4 %	0,142	1 1.5%	0.498
Unemployed	133 66.5%	2ه 18,8 %		2 1.5%	
Total	200	42 21 %		3	

Age, own cat and exposure to soil significant

Demographic characteristics of patients with diabetics subjects ,such as age group ,residence, exposure to soil, washing the vegetables, meat consumption, abortion ,education and job are presented in Table (5).Patients in the age group of < 30years 108 (54%) showed that 30 (37,8%) were positive for anti-IgG *T.gondii* and age group of ≥30 that93 (46%)showed that 12 (26,1%) were positive for anti-IgG *T.gondii* this results statically was significant P Value=0,005.In same table and according to the age group < 30 only 1 (0.9%) were positive for anti-IgM *T.gondii* and 2 (2,3%) were positive from age ≥ 30 this results were significant statistically P Value=0,030.Acording to the residency 138 (69%)patients were live from the urban showed 24 (17,4%) were positive for anti-IgG *T. gondii*, and 1(0,72%)were positive for anti-IgM *T. gondii* respectively. While 62(31%) were live in the rural showed 18 (29%) positive for anti IgG *T. gondii* and 2(3,2%) positive for anti-IgM *T. gondii* respectively, but no statistically significant difference was observed. It was also found that seropositivity of anti-IgG *T. gondii* between patients who own cat were 23 (21,1%), and 19 (20,9%) among patients who not own cat respectively with no significant statistically. Also, seropositivity of anti-IgM *T. gondii* showed 2 (1.8%) among patients who own cat while 1(1.1%) where positive among patients who not own cat and statistically this result was significant P Value =0.025. Regarding exposure to soil 18 (24%) where positive for anti-IgG *T. gondii* and 24 (19.2%) where positive among patients no exposure to soil and the results not significant, while anti-IgM *T. gondii* found seropositive in 2 (2,7%) patient's exposure to soil and 1 (0.8%) were positive between patients have no exposure to soil and the results statistically significant at P Value 0.025.

Results obtained from washing the vegetables good showed that 37 (21.9%) were positive for anti-IgG *T. gondii* and 5 (16.1%) were seropositive among patients which washing vegetables not good and statistically the results were not significant, it was also found that 2 (1.2%) were positive for anti-IgM *T. gondii* among patients washing vegetables good and 1 (3.2%) among patients not washing vegetables good and statistically this results not significant. In the current study the seropositivity of anti-IgG *T. gondii* between patients who meat consumption half cooked were 12 (21.9%) and 30 (20.3 %) among patients who meat consumption boiled cooked and results not significant statistically, also 1 (1.9%) seropositive for anti IgM- *T. gondii* among patients who meat consumption half cooked and 2 (1.4%) were positive among patients who meat consumption boiled cooked and results not significant statistically. The rate of seropositive of anti IgG- *T. gondii* among patients with abortion and without abortion reported as 18 (22.8%), 24 (19.8%) respectively statistically this difference was not significant .On the other hand the rate of seropositive of anti-IgM *T. gondii* among patients with abortion and without abortion reported as 2 (2.5%),1 (0.8%) respectively statistically this difference was not significant .It is clear that the rate of anti-IgG *T. gondii* among literate and illiterate patients were 32 (23,2%),10 (16.1%) respectively and this results was not significant, also the rate of anti-IgM *T. gondii* among literate and illiterate patients were 2(1,4%),1 (1,6%) respectively and this results was not significant. The rate of seropositive of anti-IgG *T. gondii* according to job which divided in to employee and unemployed showed that 17 (25.4%), 25 (18.8%) respectively and there was no significance difference statistically, the rate of seropositive of anti-IgM *T. gondii* among employee and unemployed reported as1 (1.5%), 2 (1.5%) respectively also the results were not significance.

Table (6) Demographic Characteristics of pregnant women without Diabetes and seropositivity of *Toxoplasma gondii* (n=100)

Characteristics	**No**	**Diabetic with Anti-*T. gondii* Antibodies**			
		IgG +	**P. value**	**IgM +**	**P. value**
Age					
< 30	87	11 12.6%	0.306	1 1.1%	0.351
≥30	13	1 7.7%			
Residency			0.001		0.059

Urban	71	4 5.6 %			
Rural	29	8 27.6 %		1 3.4 %	
Own cat					
Yes	42	٨ 19 %	0,033	1 2,4 %	0,121
NO	58	٤ 6,9 %			
Exposure to soil					
Yes	20	١ 5 %	0,143	`	0,310
No	80	١١ 13,8%		١ 1,3 %	
Washing the vegetables good			0,140		0,385
Yes	92	١٢ 13 %		1 1,1 %	
No	8	٠			
Meat consumption					
Half -cooked	18	2 11,1 %	0,450		0,321
Boiled-cooked	82	١٠ 12,1 %		١ 1,2 %	
Abortion					
Have	14	١ 7,1 %	0,276		0,344
Don't have	86	١١ 12,8 %		١ 1,2 %	
Education					
Literate	87	١٠ 11,5 %	0,345	١ 1,1 %	0,351
Illiterate	13	٢ 15,4 %			
Job					
Employee	21	٤ 19 %	0,134		0,304
Unemployed	79	٨ 10 %		1 1,3 %	
Total	100	١٢		١	

Residency and own cat significant

According to table (6) the rate of seropositive of anti-IgG *T. gondii* among healthy pregnant women without diabetes in both group of age <30and ≥30 was 11 (12,6%) and 1 (7.7%) respectively and this results statistically not significance, while the rate of seropositive of anti-IgM *T. gondii* among healthy pregnant women without diabetes in both group of age <30and ≥30 was 1 (1,1%) and 0 respectively and this results statistically not significance.

According to the residency 71 patients were live from the urban showed 4 (5,6%) were positive for anti-IgG *T. gondii*, while 29 were live in the rural showed 8 (27,6%) positive for anti-IgG *T. gondii* this result statically highly significance P Value=0,001, while 1(3,4%) positive for anti-IgM *T. gondii* were live in rural, but no statistically significant difference was observed. It was also found that seropositivity of anti-IgG *T. gondii* between patients who own cat were 8 (19%), and 4 (6,9%) among patients who not own cat respectively with significant statistically observed P Value0,033. Also, seropositivity of anti-IgM *T. gondii* showed 1 (2,4%) among patients who own cat while no cases where positive among patients who not own cat and statically these results were not significant. Regarding exposure to soil 1 (5%) where positive for anti-IgG *T. gondii* and 11 (13,8 %) where positive among patients no exposure to soil and the results not significant, while anti-IgM *T. gondii* found seropositive in 1 (1,3%) patient's exposure to soil only and the results statistically not significant.

Results obtained from washing the vegetables good showed that 12 (13%) were positive for anti-IgG *T. gondii* and statistically the results were not significant, it was also found that 1 (1,1%) were positive for anti-IgM *T. gondii* among patients washing vegetables good and statistically this results not significant. In the current study the seropositivity of anti-IgG *T. gondii* between patients who meat consumption half cooked were 2 (11,1%) and 10 (12.1 %) among patients who meat consumption good cooked and results not significant statistically, also 1 (1,2%) positive for anit- IgM *T. gondii* among patients who meat consumption good cooked and results not significant statistically. The rate of seropositive of anti-IgG *T. gondii* among patients with abortion and without abortion reported as 1 (7,1%) ,11 (12,8%) respectively statistically this difference was not significant .while the rate of seropositive of anti-IgM *T. gondii* among patients without abortion only reported as 1 (1,2%) statistically this difference was not significant .It is clear that the rate of anti-IgG *T. gondii* among literate and illiterate patients were

10 (11,5%),2 (15.4%) respectively and this results was not significant, also the rate of anti-IgM *T. gondii* found only among literate patients were 1(1,1%) and this results was not significant. The rate of seropositive of anti-IgG *T. gondii* according to job which divided in to employee and unemployed showed that 4 (19%) ,8 (10 %) respectively and there was no significance difference statically, the rate of seropositive of anti-IgM *T. gondii* among unemployed reported as1 (1,3) also the results were not significance.

Discussion

Many parameters were studied in this work and the discussion of the results concentrated on the main and important finding. Immunocompromised patients such as diabetes the most vulnerable to infection. The main objective of this research is to detect the infection with *T. gondii* among diabetic patients by serological method (ELISA) to measure the level of IgG and IgM for 200 of diabetic pregnant and 100healthy pregnant control. In current study ,the infection rate were 21% seropositive for anti-IgG *T.gondii* and 1,5% seropositive for anti-IgM *T. gondii* among diabetics pregnant which included 200 ,the results of anti-*IgG ,IgM T. gondii* were statistically significant, also the seropositivity among healthy group which including 100 pregnant without diabetics that 12 % were seropositive for anti-IgG *T. gondii* IgG and 1% were seropositive for anti-IgM *T. gondii* and this results were statistically significant .The results agree with results of {11} were 37.7% IgG,2.5% IgM in Duhok province. These results agree with those obtained by {5} which found 27.7% IgG 0.45% of IgM, {9} found 65% of IgG and 25% IgM, {35} reported 1% IgM only, {37} found the 41.9% of IgG, and 0,43% of IgM in Duhok province, also similar results found in Erbil city by {48} were reported 43% for IgG and 4.7 % for IgM. {16} in Zakho District reported that 13,8% positive for IgG and 3,4% IgM. In current study 79 pregnant had HBA1C less < 7 in this groups showed that 12 (15,2 %) where seropositive for anti- IgG *T. gondii* and 121 pregnant had ≥ 7 showing that 30(24,85 %) seropositive for anti-IgG *T. gondii* and 3 (2,5%) were seropositive for anti-IgM *T. gondii*. It was clear there were no significant difference between anti-IgG, IgM *T. gondii* and HBA1C level among the group of diabetic's pregnant women these results agree with {13} in Egypt who found 70% IgG among group of HBA1C ≤ 7 and 30% positive of IgG among group of HBA1C > 7. According age group most infection found in age group of < 30years (37,8%) IgG and age group of ≥30 (26,1%) were positive for anti-IgG *T. gondii* this results statically was significant P Value=0,005 and according to the age group < 30 only 1 (0.9%) were positive for anti-IgM *T. gondii* and 2 (2,3%) were positive from age ≥ 30years,this results were significant statistically P Value=0,030, this results agree with the results of {26} in Karbala who found 94% IgG ,33%IgM. {31} showing in Zahedan Irian that 84% were positive for IgG and 2% for IgM {36} in Thi-Qar Province reported that 11.6% were positive for IgG in age ≥ 30years and 8.3% in age <30 years. The age group 36-45 years showed the highest seropositive rate for both IgG and IgM Abs which were 41.02% and 1.28%, respectively, which reported by {37} in Duhok.

Another parameters were studied in this research was residency which divided in urban and rural, statistically there are no differences between residence of the participants prevalence rate and results of current study which recorded in the urban 24 (17,4%) were positive for anti-IgG *T. gondii*, and 1(0,72%) were positive for anti-IgM *T. gondii* respectively. While in the rural showed 18 (29%) positive for anti IgG *T. gondii* and 2(3,2%) positive for anti-IgM *T. gondii* respectively. This results disagree with {49} in China which showed the seroprevalence of *T. gondii* infection among the patients who lived in rural areas (20.20%) was slightly lower than those who lived in urban areas (22.28%),another study of {12} in Jazan Saudi showed seropositivity rate of *T. gondii* -specific antibodies was higher among pregnant women from the urban areas than those from rural (7.4% 0% and 21% 15.4% for IgM and IgG, respectively ,the discordance between studies could be explained due to the study area, number of patients, different type of sampling, environmental factors ,lifestyle and habits of people. The main risk factors of infection with *T. gondii* contact or own cats which recorded anti- IgG *T. gondii* between patients who own cat were 23 (21,1%),and 19 (20,9%) among patients who not own cat respectively with no significant statistically .Also seropositivity of anti-IgM *T. gondii* showed 2 (1,8%) among patients who own cat while 1(1,1%) where positive among patients who not own cat and statically this results was significant ,this results agree with the results of {30} in Saudia Arabia who found 5,6% for IgG among patients own cat and 37.8% of IgG among who not own cat this indicates that the contact with a cat was the main sources of acquiring the infection in diabetic patients. cat hygiene behavior of cat owners and in altering food hygiene behavior.

Regarding exposure to soil or garding18 (24%) where positive for anti- IgG *T. gondii* and 24 (19,2%) where positive among patients no exposure to soil and the results not significant, while anti-IgM *T. gondii* found positive in 2 (2,7%) patients exposure to soil and 1 (0.8%) were positive between patients have no exposure to soil and the results statistically significant this results agree with study of {22} in

Saudia were found 14.4% positive for IgG among patients with exposure to soil and 26% positive for IgG among patients who no exposure to soil. Contact with soil (garden at the house) sporulated oocyst can hold viable for a considerable length of time in moist soil, and poor sanitation.Therefore,it is essential that awareness of how *Toxoplasma* infections are caused is raised so that ladies can find a way to avoid contracting this parasitic infection.

Results obtained from washing the vegetables good showed that 37 (21,9%) were positive for anti-IgG *T. gondii* and 5 (16,1%) were seropositive among patients which washing vegetables not good and statistically the results were not significant, it was also found that 2 (1,2%) were positive for anti-IgM *T. gondii* among patients washing vegetables good and 1 (3,2%) among patients not washing vegetables good and statistically this results not significant. Same results observed by {21} (20%) of toxoplasma infection in Dharan Saudi, contaminated water and soil may act as vehicles for the transfer of oocysts to vegetables and fruit for human consumption. The eating of unwashed raw vegetables or fruits was associated with an increased risk of infection in previous studies.

There is suggestive evidence that health education may help reduce risk of congenital toxoplasmosis. In the current study the seropositivity of anti-IgG *T. gondii* between patients who meat consumption half cooked were 12 (21,9%) and 30 (20.3 %) among patients who meat consumption boiled cooked and results not significant statistically, also 1 (1,9%) positive for ant-IgM *T. gondii* among patients who meat consumption half cooked and 2 (1,4%) were positive among patients who meat consumption boiled cooked and results not significant statistically. {31} in Iran found (44%), (52.1%) rate of IgG and IgM among patients used half cooked meat respectively, also found (20%),(19,2%) rate of IgG, IgM among patients used boiled meat,{5} in Duhok found (31%)(0.3%) anti- IgG, IgM *T. gondii* among women eating undercooked meat respectively, while among those who did not have this habit (26.5%)(0.4/5) respectively ,eating undercooked meat rare in some community as compared with other countries especially developed countries so {40}in Slovakia and {42} in Brazil ,{32} in USA,{14} in Ghana all those researchers reported presence of significant association between consumption of half or raw meat and seropositivity . Eating outside the home at restaurants, undercooked meat commonly served in restaurants includes fast food such as gyro, delis, burgers and other grills .The rate of seropositive of anti-IgG *T. gondii* among patients with abortion and without abortion reported as 18 (22,8%), 24 (19,8%) respectively statistically this difference was not significant .On the other hand the rate of seropositive of anti-IgM *T. gondii* among patients with abortion and without abortion reported as 2 (2,5%),1 (0.8%) respectively statistically this difference was not significant, this results agree with {11} in Duhok which found the seropositivity of anti-IgG, IgM *T. gondii* among pregnant women(28%) (2%) respectively, {5} in Duhok reported (40%)(0.7%) IgG, IgM respectively among aborted women and (29.3%)(0.3%) IgG, IgM among non-aborted women. While, {9} in Duhok did not found any relation between history of previous miscarriage and toxoplasmosis , as he found nearly similar seropositive rate of anti-*T.gondii* Abs among pregnant women with history of miscarriage and those without miscarriage which were (52%) and (62.5%) respectively, {24} in Iran found (36.8%)(38.4%) IgG, IgM among aborted women and (63,2%) , (6%) IgG, IgM among non-aborted women. In Mosul {8} recorded high rate of infection among aborted women (82.6%) as compared with (17.45%) among non-aborted women. This difference may be due to the difference in diagnostic method used, size of samples which were taken within limited age group as compared to random selection of the present study which included different ages, socioeconomic and educational status. It is clear that the rate of anti-IgG *T. gondii* among literate and illiterate patients were 32 (23,2%),10 (16.1%) respectively and this results were not significant, also the rate of anti-IgM *T. gondii* among literate and illiterate patients were 2(1,4%),1 (1,6%) respectively and this results were not significant. The rate of seropositive of anti-IgG *T. gondii* according to job which divided in to employee and unemployed showed that 17 (25,4%) ,25 (18,8%) respectively and there was no significance difference statistically, the rate of seropositive of anti-IgM *T. gondii* among employee and unemployed reported as1 (1,5%) ,2 (1,5%) respectively also the results were not significance.

These results agree with {37} in Duhok which found regarding to occupation, the highest rate for chronic toxoplasmosis was reported in housewives followed by employed and students at rates of (40.19%) (22.3%) and (14.0%) respectively. The age group 36-45 years showed the highest seropositive rate for both IgG and IgM Abs which were (41.02%) and (1.28%) respectively. According educational state same result shown by {6}in Makkah which found (27.8%) seropositivity of toxoplasmosis among educated women compared to uneducated women(42.8%),{5}in Duhok recorded high rate of infection among house wives, followed by employed (34.2%)(20.6%) respectively the reason of high rate of infection among the illiterate and house waive might be related to that this group of women were given more attention about disease ,more asking and attending medical clinics

periodically, more exposure of housewives to the source of infections and at risk factors during their home work at the day time.

4. Conclusion

The evidence from this study suggests that diabetic patient should avoid contact with cats and screen for anti *T. gondii* IgG to prevent the risk of ocular complication associated with toxoplasmosis. Diabetes and consumption of half-cooked meats increase the chance of toxoplasmosis. Thus, it is recommended to study the serum level of antibodies against toxoplasmosis in diabetic patients and repeat it periodically.

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