INCIDENCE OF TOXOPLASMA ANTIBODIES AMONG WO BENJAWAD, LIBYA

[1]SALIMAOMRAN BOSHAPOR, [2]HAMED H. KASSEM

Abstract- The present study was conducted in Benjawad , Libya. It is the first study on the incidence of T.gondii among women from Benjawad region . Blood samples were collected from participants including 280 pregnant and 250 non-pregnant women . The samples (anti-Toxoplasma IgGandIgM antibodies)were tested by using ELISA Kits . Information and data on women were obtained using questionnaire . Overall incidence rates of T.gondiiantibodies,were 37.17% and 3.58% for IgG and IgM positive , respectively . The study revealed that 37.14% and 3.57% were positive for IgG and IgM anti- T.gondii among pregnant women while the incidence rates were 37.20% and 3.60% for anti-T.gondiiIgG and IgM antibodies among non- pregnant women.According to the results,there was no significant association between incidence of T.gondiiand the age . The results also revealed that incidence rates of T.gondiiIgG antibody associated with symptoms were 7.1% repeated abortion, 3.0% forstill birth and asymptomatic was 89.8%. This association was no statistically significant. No statistically significant relation was observed between incidence T.gondii antibodies and the other variable factors studied. Transmission of T.gondii in this study is possible by containers, knives or cutting boards or other preparation surfaces contaminated with raw meat. This study indicates that there is a considerable rate of T.gondiiIgG and IgMantibodies infection among women in Benjawad and village near it. Moreover, it shows the need to provide health education to pregnant women in order to prevent primary infection during pregnancy .

Keywords- Toxoplasma, Anti-Toxoplasma Antibodies, ELISA, IGG,IGM.

INTRODUCTION

Toxoplasma gondii is an obligatory intracellular a picomplexan protozoan parasite with a heterogeneous life cycle in humans and other vertebrates animals . This parasite can infect all mammal and bird species .Members of the family Felidae are the only known definitive hosts for T.gondii. Toxoplasmosis is one of the most common human infections throughout the world. Most infections in humans are asymptomatic but at times the parasite can produce devastating disease. It has been estimated that up to one billion people have been exposed to this parasite worldwide. In adults, most Toxoplasma infections are subclinical, but severe infection can occur inimmune compromise patients (El-Awadyet al., 2000) .

Humans are infected with T.gondii by four major routes: ingesting food or water contaminated with the faeces of infected cat ingesting or handling undercooked or raw of meat contains tissue cysts, receving organ transplants or blood products from donors with acute or latent toxoplasmosis. However, infected fetuses and immunodeficient individuals may present with serious or even fatal clinical outcomes(Ribeiroetal ., 2008).

Toxoplasmosis maybe more sever in pregnant women and can lead to fetal abortion or congenital malformation. Person to person spread has not been described, but chronic sub clinical human infection become activated if the immune system becomes weakened.

Most healthy people who acquire Toxoplasma infection do not experience any significant symptoms, but often give flu-like symptoms in the acute stages. Lymphadenopathy is the most common manifestation. Toxoplasma gondii has emerged as one of the most common opportunistic infections in patients with AIDS. Toxoplasmosis in AIDS patients is considered to be a result of reactivation of latent infection, but the mechanisms of reactivation are unknown .

Toxoplasma gondii is responsible for the toxoplasmosis disease. Toxoplasma infects a host but keeps the host alive so it can use their immune system andthere by keep it self-alive. It does this by releasing a molecule that increases the number ofT-cells.An increased number ofT-cellresults in a massive elimination ofT.gondiicells.Parasitic cells that are encased in a tougher outer cyst are able to evade destruction bythe immune systemsmacrophages. The ability of the tachyzoite stage to invade any nucleated cell, replicate and then lyse the host cell before invading neighbouring cells is an important element that underlies the pathogenesis of this cytolytic infection. In the absence of aprotective immune response, the parasite will replicate and destroy infectedtissues(Hunter and Reichmann,2001 and Vyas and Sapolsky,2010).Most patients who become infected with T.gondii and develop toxoplasmosis do not know it. In some immunocompetent patients, the infection enters a latent phase, during which only bradyzoites are present, forming cysts in nervous and muscle tissue. Most infants who areinfected while in the uterus have no symptoms at birth but may develop symptoms later in life .

Congenital infection results from a primary infection of the mother during pregnancy, T.gondii and congenital form is one of the most important clinical aspects of this disease (Fouladvandet al., 2010).

Congenital toxoplasmosis is a special form in which an unborn child is infected via the placenta. A cquired during pregnancy can lead to placental infection and have profound effects on the mother-to-child relationship and the success of pregnancy (Esquivel et al., 2007 ; Robert-Gangneuxet al .,2011 and Hide et al ., 2010).Toxoplasmagondii infection that can be acquired orally transplacentally, parent rally by transfusion or from a transplanted organ in normal children, infection maybe asymptomatic, or lead to lymphadenopathy or damage any organ. Congenital transmission occurs when immunologically susceptible mother acquires infection during gestation. Fetal infection is very uncommon in such a situation, and mostly associated with fetal damage (El-Awadyet al.,2000andRobert-Gangneux et al.,2009).Toxoplasmagondii has a worldwide distribution in human populations infecting up to one third of the global population and a wide range of other mammalian and avian species. This single-celled protozoan is arguably the most successful protozoan parasite on Earth (Saeij et al.,2005; Abu-Madi etal.,2008;Ribeiroetal.,2008 and Atallah,2010). Toxoplasma has worldwide distribution and 20%-75% of the populationissero positive without any symptomatic episode (Correa et al.,2007)

Toxoplasmosis in Libya:

InTripoliKhadreandEl- Nageh (1987) revealed that Toxoplasma antibodies were found at a titer of 1:16 or above in 51.6% of 2000 adult males, in 43.4% of 300 adult females, and in 43.7% of 1980 schoolchildren (7-18 years of age) , Abu Setta and Yamani (2008) The seroprevalance rate of toxoplasmosis was 18.14% among non-pregnant women and Gashout et al. (2008) recorded that 45% and 17.6% of chronic and acute toxoplasmosis .

Materials and Methods

-Place of study :

Benjawad area located on the Gulf at east of Sirt city, away from it 150 Km² and distance away from Benghazi approximately 450Km² having a population of about 9482 andconsistingofpatches of agricultural land. The subjects for this study were women , these women were came to laboratory of QarwiBenjwad hospital for boold analysis. This hospital accept cases from Benjwad, Raslanuf to villages near by Sirt. Benjawad has a high density of feral cats and the population in these areas consumpe sheep and goat meat that may be infected with toxoplasmosis and consider as a source of human infection .

Collection of Samples:

Blood samples were obtained from 530 women, including 280 pregnant and 250 non-pregnant women were randomly collected of patient and outpatient during routine serological tests. Blood samples were collected in a labeled 5mlplain tubes by venipuncture and allowed to clot at room temperature. After centrifuged for 5 minutes, serum can be stored in eppendorf tubes at -20ºC till testing, for longer periods samples should be frozen at -20 ºC. Data of tested women was collected by a questionnaire were including age and nationality ,

Serological testing: Serum specimens were tested by ELISA to detect anti-Toxoplasma IgG and IgM antibodies using bioelisa TOXO IgG and IgM (biokit , Spain)according to manufacturer's instructions for detecting IgG and IgMT. gondiifor both analytical parameters forIgGT. gondii. Existence of IgM Antibody indicates the acute infection while increasingIg Gantibody indicates the chronic Toxoplasma infection .(Fouladvandet al ., 2010).

Statistical analysis :A descriptive statistical analysis of the serological data in relation to the epidemiological variables, used in the study, was done. Chi-square test was used and appropriate p values of <0.05 was considered significant. Data were analyzed using SPSS version 8.0 soft ware . The results were then presented in tables.

Results:

The sera of five hundred and thirty women including 280 pregnant and 250 non-pregnant women from Benjawade were tested by ELISA test to determine the T. gondii specific antibodies (IgG and IgM antibodies for T. gondii). The results showed that overall incidence rates of T.gondii antibodies , 197 (37.17 %) were positive for anti - T.gondiiIgG antibodies and 19 (3.58%) were positive for anti-T.gondiiIgM antibodies (Table1) .The results showed that , 37.14% (104) and 3.57 % (10) of T.gondiiIgG and IgM antibodies among pregnant women . Incidence rates among non- pregnant women 37.20% (93) and 3.60% (9) were anti-T.gondiiIgG and IgM respectively (Table 2) .

Comparison of results of IgG and IgM by ELISA test positive T.gondiiIgG antibodies (n= 197) and positive for T.gondiiIgM antibodies (n=19). The results revealed that IgGT. gondii were 77.66 % (153) strong positive and 22.33% (44) weak positive andwere 15.78% (3) , 84.21% (16) of strong and weak positive of T.gondiiIgM (Table 3) .

Table(1) : Sero- incidence of anti -T.gondiiIgG and IgM antibodies:

Antibodies	Positive		Negative		Total
	No.	%	No.	%	
IgG	197	37.17 %	333	62.83%	530
IgM	19	3.58 %	511	96.41%	530

Table(2):Sero-incidence of *T. gondii*infection among pregnant and non-pregnant women .

Antibodies	Total Examined	No.pos.IgG	%	No.Pos.IgM	%
Pregnant women	280	104	37.14%	10	3.57%
Non-pregnant women	250	93	37.20 %	9	3.60%
Total	530	197	37.16%	19	3.58 %

Table (3): The intensity of ant-*T.gondii* in the test specimen.

ELISA results	Strong positive(%) ≥1.o	Weak positive(%) ≤0.99	Total
Chronic (IgG +)	77.66 % (153)	22.33 %(44)	197
Acute (IgM +)	15.78% (3)	84.21% (16)	19

Incidence and age groups:

The results revealed that high sero-incidence of rate T.gondiiIgG was detected among age groups 46-60 (43.4 %) followed by age groups 36- 45 (40.7 %) , 26-35 (38.1%) and 15-25 (29.8%) , and sero-incidence rate of T.gondiiIgM was (4.2%)in agegroup(26-35). The results showed that high incidence rate of IgG increased with age. The relationship between incidence and different age groups was not statistically significant ($\chi^2 = 4.313$,p-value = 0.230) (Table 4)

Table(4) : Sero-incidence of T. gondiiIg G seropositive and IgM seropositive among age groups (years) .

Age groups	No . tested	No. IgG+ (%)	No. IgM+(%)
15 – 25	124	29.8% (37)	3.2% (4)
26 - 35	257	38.1% (98)	4.2% (11)
36 - 45	103	40.7% (42)	2.9% (3)
46 - 60	46	43.4% (20)	2.1% (1)
	X^2 =4.313, df=3, p > 0.05 p-value=0. 230 (non –sig.)		X^2= 0.805, df= 3 p > 0.05 , p-value =0. 848 (non sig.)

Discussion:

To our knowledge, this is the first study to be carried out on the incidence of T.gondiiinfectionamong women from Benjawad region and villages near by it, and considered one of a few studies carried out in Libya on T.gondiiinfection.

Toxoplasma gondii, is estimated that 20-90% of adults throughout the world have come into contact with the parasite during their lifetime (Galvan-Ramirez et al.,1998).dependingon the sanitary conditions of the countryconsidered. Infact, Toxoplasma infection is related to several factors including socioeconomic level, nutritional habits, ageand rural or urban setting (Spalding et al .,2005) .

The present study included 530cases of which 280 were pregnant women ,250 non-pregnant women. The results revealed thatsero-incidenceT.gondiiantibodieswasdetectedinboth pregnant and non-pregnant women. This finding is in agreement withfindingsin reported previously from Libya (Khadre and El-Nageh,1987;KassemandMorsy 1991; Swalem and Feturi, 1994; Bader,2002; AL-Ghariane, 2006; El-Zaidi ,2007; Abu seta and Yamani, 2008 and Gashoutet al., 2008), as well as from different countries oftheworld (AL-Harthiet al.,2006;Bouhamdanet al.,2010;Emeliaet al.,2010 and Fouladvand.,2010).

The study showed that overall incidence rates of T.gondiiIgGandIgM antibodies by ELISA among the women from Benjawadwere 37.16% and 3.5% respectively. This result is comparable toresults previously reported in Libya as follows: from Tripoli were 43.4 % , 18.14%, 45%and 17.6% of chronic and acuteinfections(Khadre and El-Nageh,1987;Abu-Settaand Yamani,2008 and Gashoutet al., 2008); and other reports from from Benghazi, the infection rates of Toxoplasma infection range from 37.75% to 53 % (KassemandMorsy 1991 ;Swalem and Feturi ,1994 ; Bader,2002 and AL-Ghariane,2006) and 30.7% and 25.6 %from El-Jabal El- Akhdar district (El-Zaidi, 2007) .

Such variation in the obtains data may due to the differences in environmental conditions and lifestyle of population. The prevalence of toxoplasmosis inArab countries Like Abha, Saudia Arabia , in pregnant women was 31.6%, Makkah was 29.4% (El-Hady,1991 and Al-Harthi et al.,2006), in Beiruttheseropositivity of IgG and IgM was 62.2% and 6.8% (Bouhamdanet al .,2010) .

Several studies in different countries and cities around the world have indicated that seroprevalencerate of Toxoplasma antibodies have a wide range asin India 36.8%, Krowasi36.4%, Ireland 12.8%,Thailand21.7%, Turkey 49.4%, Paris83%andUSA31.7%(Fouladvandet al .,2010).The average prevalence rate of T.gondiiin

most parts of the worldwhichis20-30%.Lowprevalence rates of 10% were reported in the United Kingdom and Norway(ALHarthiet al., 2006); from Zair at29.1% and 0.8% among chronic and a cuteinfection(Ishakuet al.,2009); Malaysia at 28% and 11% of active and chronic toxoplasmosis (Emeliaet al.,2010). These difference in results may be due to sensitivity of the different test methods used in seroprevalencestudies or to the size of tested individuals (Naotet al .,1981) .

These differences of infection may be due to the variation in the prevalence of human Toxoplasma infection among different regions, countries and populations worldwide These include: consumption of raw or undercooked meat (e.g. lamb & beef), having a pet cat at home or living in an area with stray cats living in close proximity, inadequate hand washing after handling contaminated garden soil or kitty litter, frequent consumption of raw vegetables outside the home, unsanitary feeding habits, climatic conditions, poor sanitation and hand hygiene, and increased age (Cook et al .,2000; Fayeretal,. 2004 and Montoya and Liesenfeld, 2004;Nash etal.,2005;Elsheikha,2008and Elmore etal ., 2010).

Consumption of under cooked meat remains the major risk factor for acute infection in women in Serbia (Bobic et al .,2007). T.gondii infection from ingested tissue cysts in undercooked meat. For example, in France the prevalence of antibody to T.gondii is very high in humans. Though 84% of pregnant women in Paris have antibodies to T. gondii, only 32% in New York City and 22% in London have such antibodies. The high incidence of T.gondiiinfection in humans in France appears to be related in part to the French habit of eating some meat products raw or undercooked. In contrast, the high prevalence of T.gondii infection in Central and South America is probably due to high levels of contamination of the environmentoocysts (Hill and Dubey,2002).

An increased prevalence of T.gondiiwas(40.7%) observed in women who consume raw meat, vegetables, reported from Slovakia (Studenicova et al .,2006).

On the other hand transmission of T.gondii infection through uncooked meat in Libya is uncommon because most people prefered to eat will cooked meat (Swalem and Feturi,1994 and Bader,2002). The same observations was previously reported from other countries (Todd etal., 1980 and Ramirez etal., 1999).

Thepresent study revealed that, high rate of positivity of T.godii was detected among the old age group (46-60 years). This is consistence with other results previously reported from Libya (Kassem and Morsy 1991 ; and Bader,2002) and othercountries(Ghorbanietal.,1978 ; Avelino et al.,2004 ;Gharavil et al .,2005; Jumaian , 2005; Al-Harthi et al ., 2006 ;Cavalcante et al.,2006 ; Ishakuetal., 2009 ;Lopes et al.,2009 ; Bouhamdanet al., 2010 and Solhjoo et al .,2010 and Sheet Saleh et al .,2010). Disagreement with results reported from Benghazi(AL-Ghariane ,2006) and other countries (Zardiuetal., 1980 and Griffin and Williams, 1983).

This differences may be due to wide variations in age groups used and these results reflected the contact with cats or infected materials and vegetables in these age groups.In addition , this may be due to decrease of immunity in old ages, and increase the chancefor more exposure to infection.

REFERENCES

[1] **Abu-Madi, M. A. ; Al-Molawi, N. and Behnke, J. M. (2008):** Seroprevalence and epidemiological correlates of *Toxoplasma gondii* Infections among patients referred for hospital-based serological testing in Doha, Qatar . *Journal parasites and vectors*.1:39.

[2] **Abu- Setta ,A.M. and Yamani , R. H. (2008):** Prevalence of Toxoplasmosis in non-pregnant women in Tripoli, Libya.*The Egyptian Journal of Hospital Medicine*. 31: 198– 202.

[3] **AL-Ghariane, N. J. (2006) :** The prevalence of *Toxoplasma gondii* Antibodies in women from Benghazi, Libya. M Sc.Thesis, Garyounis University , Benghazi , Libya

[4] **4- AL-Harthi , S. A ;Jamjoom ,M .B. and Ghazi .H .O . (2006) :** Seroprevalence of *Toxoplasma gondii* Among Pregnant Women in Makkah**,** Saudi Arabia **.** *Journal Science Medical Engineering* .18(2) : 217 -22 .

[5] **6- Atallah, D. (2010) :** *Toxoplasma*: Shutting the barn door after the horse ran Off .*Libanais Medical Journal* . 58 (1) : 1-2.

[6] **Avelino, M. M.; Junior, D. C.; De-Parado, J. B. and Castro, A. M.; (2004):**Risk factors for *Toxoplasma gondii* infection in women of childbearing age . *Brazilian Journal of Infectious* Diseases. 8 (4):1413-8670.

[7] **Bader, G. J. (2002):** Seroprevalence of *T. gondii* , Hepatitis BVirus and Hepatitis C Virus Infections during pregnancy. M.Sc. Thesis , university Garyounis, Benghazi, Libya

[8] **Bobic, B. ; Nikolic, A. ; Klun, I. ; Vujanic , M. and Djakovic, D. O. (2007):** Undercooked meat consumption remains the major risk factor *Toxoplasma* infection in Serbia . Parassitologia .Dec. 49 (4): 227-30.

[9] **Bouhamdan , S. F. ; Bitar, L. K. ; Saghir, H. J. ; Bayan , A. and Araj, G. F. (2010):** Seroprevalence of *Toxoplasma* antibodies among individualstested at hospitals and private laboratories in Beirut.*LibanaisMedicalJournal* .58(1): 8-11.

[10] **Cavalcante, G. T. ; Aguiar, D. M. ; Camargo, L. M. ; Labruna, M. B. ; Andrade, L. R. ; Meireles, L. R. ; Dubey, J. P. ; Thulliez, P. ; Dias, R. A. and Gannari, S. M . (2006) :** Seroprevalence of *Toxoplasma gondii* Antibodies in Humans From Rural Western Amazon , Brazil. *Journal of Parasitology* .92 (3): 647-649

[11] **Cook, A. ; Gilbert, R. ; Buffalano, W. ; Petersen, E. ; Jenum, P. ; Foulon , W. ; Semprini, A. and Dunn, D. (2000):** Sources of *Toxoplasma* infection in pregnant women : European multicenter case- Control study. *British Medical Journal* . 321(7254) : 142–147.

[12] **Correa, D. ; Canedo, S. I. ; Ortiz, A. B. ; Caballer , O. H. and Rico-Torres. C. P. (2007) :** Congenital and acquired toxoplasmosis: Diversity and role of antibodies in different compartments of the

[13] host.*Journal*Parasite Immunology . 29(12): 651-60.

[14] **El-Awady, M. K . ; El-Hosseiny, L. A. ; Ismail, S. M. ; Abdel-Aziz, M. T. and El-Demellawy, M. A. (2000):** Comparison between *Toxoplasma gondii*

DNA and during pregnancy .*Journa l Eastern Mediterranean Health* . 6(5): 1-7.

[15] **El-Hady, H. M. (1991):** Toxoplasmosis among pregnant women in Abha,Saudi Arabia .*Journal of gyption Society*. 21(3): 811-81

[16] **Elsheikha, H. M. (2008):** Congenital toxoplasmosis : priorities for further health promotion action . Puplic Health ; 122:335-53.

[17] **El-Zaidi, G. M. (2007):** Seroepidemological study on toxoplasmosis in women in some areas of El-Jabal El-Akhdar district . MSC. Thesis, Omar Al-Mukhtar University .

[18] **Emelia, O. ; Zaahaida, M. ; Sulaiman, O. ; Rohela, M. ; Saadatnia, G. ; Yeng, C. and Rahman, N. (2010):** An assay for selection of sera with circulating *Toxoplasma gondii*antigens . *Journal immunoassay immunochemical* . 31(1): 79-91.

[19] **Esquivel, C. A. ; Suarez, M. F. ; Briones, A. R. ;Torres, L. F. ;Ayala, J. A. ; Piedra, L. G. ; Marales, E. D. ; Martinez, S. E. ; Liesenfeld, O. ; Conde, J. A. and Garcia, A. M. (2007):** Seroepidemiology of infection with *Toxoplasma gondii* in healthy blood donors of Durango, Mexico. *BMC Infectious Diseases*. 7(75): 1471-2334.

[20] **Fayer, R. ; Dubey, J. P. and Lindsay, D. (2004):** Zoonotic protozoa : from land to sea. Trends Parasitol. 20:531-536.

[21] **Flegr, J. and Hrdy, I. (1994):** Influence of chronic toxoplasmosis on some human personality factors. Folla parasitological . 41: 122-126.

[22] **Fouladvand, M. ; Barazesh, A. ; Naeimi, B. ; Zandi, K. and Tajbakhsh, S. (2009):**Seroepidemiological study of toxoplasmosis in Childbearingage women in Bushehr City, south west of Iran in 2009. *African Journal of Biotechnology* . 9(36): 5809-5812.

[23] **Galvan-Ramirez, M. L. ; Guillen-Vargas, C. ; Saavedraduran, R. andIslos-Rodriguez, A. (1998):** Analysis of *Toxoplasma gondii* antigenswith sera from toxoplasmosis patients . *Revista da SociedadeBrasilieradameddicinaTropical* . 31: 271-277.

[24] **Gashout, A. ; Lazrag, T. ; Gashut, H. and Swedan, T . (2008) :** Qualitative assessment of risk for spontaneous abortion associated with *Toxoplasma* and rubella immunity appraisal. *The Libyan journal of infectious Diseases* . 2(1): 52-55 .

[25] **Gharavil, M. J. ; Rahnam , N. and Jahani, M. R. (2005) :**Seroepidemiological Survey of *Toxoplasma* Infections of Mentally Retarded Children . *Iranian Journal Publ Health*. 34(1): 19-22.

[26] **Ghorbani, M. ; Edrissian, G. H. and Assad, N. (1978) :** Serological survey of Toxoplasmosis in northern part of Iran , using indirect fluorescent antibody technique. Trans. R. Soc. Trop . Med. Hyg. 72(4):368-371.

[27] **Griffin, L. and Williams, K. A. (1983):** Serological and parasitological survey of boold donors in Kenya for Toxoplasmosis. Trans. R. Soc. Trop. Med. Hyg. 77(6): 763-766.

[28] **Hide, G. ; Morley, E. ; Hughes, J. M. ; Gerwash, O. ; Elmahaishi, M. ; Elmahaishi, K. ; Thomasson, D. ; Wright, E. A. ;Williams, R. ; Murphy, R. and Smith, J. E. (2010) :** Centre for Parasitology and Disease Research, School of Environment and Life Sciences, University of Salford, Salford, M5 4WT, UK. Misurata Central Hospital, PO Box 65 Misurata, Libya . Faculty of Biological Sciences, University of Leeds, Leeds, LS2 9JT, UK.

[29] **Hill, D. and Dubey, J. P. (2002):** *Toxoplasma gondii*: transmission, Diagnosis and prevention . *Clinical Microbiology and Infection journal*.8: 634–640.

[30] **Hunter, A. and Reichmann , G. (2001):** Immunology of *Toxoplasma* infection pp .43-57.

[31] **Ishaku , S. B. ; Ajogi, I. ;Umoh , J. U. ;Lawal , I . and Randawa , A. J. (2009) :** Seroprevalence and risk factors for *Toxoplasma gondii* infection among antenatal women in Zaria , Nigeria. *Research Journal of medicine and medical sciences* . 4(2): 483-488.

[32] **Jumaian, N. F. (2005):**Seroprevalenceandrisk factors for *Toxoplasma* infection in pregnant women in Jordan .*Eastern Mediterranean Health Journal* . 2005 .11(1-2):45-5.

[33] **Lopes , F. M. ; Breganó , R. M. ; Gonçalves, D.D. ;Freire, R.L. ; Karigyo, C. J . ; Wedy ,G .F. ; Matsuo , T. ; Reiche, E. M . ; Capobiango , J .D. ; Morimoto, H. K. ; Inoue , I.T. ; Garcia, J. L. and Navarro , I .T. (2009) :** Factors associated with seropositivityfor anti- *Toxoplasma gondii* antibodies in pregnant women of Londrina , Paraná, Brazil . *Mem Inst Oswaldo Cruz, Rio de Janeiro* .104(2) : 378- 382.

[34] **Kassem, H. H. And Morsy, T. A. (1991):** The prevalence of anti *Toxoplasma* antibodies among pregnant women in Benghazi, Libya .*Journal Egyptian Society of Parasitology* .21(1): 69-74.**Khadre, M. A. and Nageh, M. M . (1987):** Serological survey for Toxoplasmosis in Tripoli, S.P.L.A.J. Libya . *Trans Royal Society of Tropica l medicine and Hygiene* 81(5) :761-3.

[35] **Montonya , J. G. and Liesenfeld, O. (2004) :** Toxoplasmosis . *Lancet* **,** 363: 1965-1976 .

[36] **Montonya, J. G. and Remington, J. (2008):** Management of *Toxoplasma gondii* infection during Pregnancy . *Clinical Infectious Diseases Journal*. 47: 554–66 .

[37]**Naot , Y. ; Desmonts, G. and Remington, J. S. (1981):**IgM enzyme linked immunosorbent assay test for the diagnosis of congenitle *Toxoplasma* infection . *The Journal of Pediatrics*. 98(1): 32-36.

[38] **Nash, J. Q. ; Chissel, S. ; Jones, J. ; Warburton, F. ; Verlander, N. Q. (2005) :** Risk factors for toxoplasmosis in pregnant women in Kent, United Kingdom . Epidemiol Infect ; 133: 475- 83.

[39] **Ramirez, M. G. ; Vargas, G. S. ; Sandoval, M. V. and Mancilla, J. L. (1999):** Presence of anti- Toxoplasma antibodies in humans and their cats in the urban zone of Guadalajara. Rev.SocBrasil. Med. Tropical. 32(5): 483-488

[40] **Ribeiro, A. C. ; Mutis, M. S. and Fernandes, O. (2008):** Association of the presence of residual anti-*Toxoplasma gondii*IgM in pregnant women and their respective family groups in Miracema, North west Rio de Janeiro, Brazil . *Mem Inst . Oswaldo . Cruz , RiodeJaneiro,*103(6): 591-594.

[41] **Robert-Gangneux, F. ; Murat , J. Fricker, H. ; Brenier, P. M. P. ; Gangneux, J. B. and Pelloux, H. (2011):** Maternal Trends. *parasitology* **.**27(12):530-6.

[42] **Robert-Gangneux**, **F. ; Yera, H. ; Herve, D. and Guiguen, C . (2009) :** Congenital toxoplasmosis after apreconceptional or periconceptional Maternal infection . *Pediatric Infectious Disease Journal* .28(7):660-1

[43] **Saeij, J. P. ; Boyle, J. P. and Boothroyd, J. C. (2005):** Differences among the three major strains of *Toxoplasma gondii* and their specific interactions with the infected host . *Trends* in *Parasitology Journal*. 21(10): 476.

[44] **Salhjoo, K. ; Jahromi, A. S. and Parnian-Rad, A. (2010):** Anti-*Toxoplasma gondii* Antibodies in Haemodialysis Patients. *American Journal of Infectious Diseases* 6. (1) :13-17 .

[45] **Spalding, S. M. ; Amendoeira, M. R. ; Klein, C. H. and Ribeiro, L. C. (2005) :** Serological Screening and toxoplasmosis exposure factors among pregnant women in South of Brazil . *Rev Soc Bras Med Trop*. 38: 173-177.

[46] **Studenicova, C. ; Bencaiova, G. and Holkova, R. (2006):** Seroprevalence of *Toxoplasma gondii* antibodies in a healthy population from Slovakia . *European Journal of Internal Medicine*.17 (1): 470–473.

[47] **Swalem, A. M. and Feturi, A. (1994):** Prevalence of antibodies to *T.gondii* in Benghazi. *Garyounis Med . Journal*. 17 (1-2): 14-20.

[48] **Todd, D. ; Lam, K. C. ; Bonald, C. K. and Wong, F. (1980):** Prevalence of *T.gondii* antibodies in the Chinese population of Hong Kong. Trans. R. Soc. Trop. Med. Hyg. 74(3): 351-354.

[49] **Vyas, A. and Sapolsky, R. (2010)** . Manipulation of host behavior by *T.gondii* : what is the minimum a proposed proximate mechanism should explain . *Folia parasitological journal* . 57(2):88-94.

[50] **Zardiu, O. ; Adorisio, E. ; Harare, O. and Nuti, M. (1980):** Serological survey of toxoplasmosis in Somalia. Trans. R. Soc. *Trop. Med. Hyg*. 74(5): 577-581.

★★★