

SEROPREVALENCE OF TOXOPLASMA GONDII AND ITS ASSOCIATED RISK FACTORS AMONG FEMALE STUDENTS OF APPLIED MEDICAL COLLEGE IN TAIF UNIVERSITY

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Abstract

Toxoplasmosis is a protozoal infection which is caused by *toxoplasma gondii* and it is a common health problem worldwide. The parasite has the ability to resist and adapt with different environmental conditions. As a result, it can be found at different sites contaminating and causing infection by multiple pathways including; water, soil, food, and dust. The disease represents a global burden, where the seropositive prevalence has increased from (20%) to (77%) making it an important condition that should be sought. The aim of this study was to detect the seroprevalence of *Toxoplasma gondii* among female students of applied medical science in Taif University as well as detection of associated risk factors and level of awareness about *Toxoplasma gondii*. Cross sectional study was conducted on 40 apparently healthy female students who agreed to participate by signing written consent, by collecting 3ml of venous blood from each participant for serological detection of IgG *Toxoplasma* antibody by ELISA test. Sociodemographic data, personal hygiene, life style and behavioral factors were collected by a structured questionnaire, designed according to objective of the study. Out of 40 studied participant female students, 3 (7.5%) were positive for *Toxoplasma* IgG antibody. The data obtained by questionnaires revealed strong association between some risk factors as contact with cats, eating outside home and eating raw egg and unwashed fruits and vegetables with *Toxoplasma* IgG seropositivity. Also questionnaire data revealed that 8 (20%) participants not heard about *Toxoplasma*, 18 (45%) participants have no knowledge about routs of infection of *Toxoplasma* and 25 (62.5%) have no knowledge about symptom and complication of toxoplasmosis. Our study concluded that: The seroprevalence of *Toxoplasma gondii* IgG antibody among apparently healthy (asymptomatic) university female students was 7.5%. The commonest associated risk factors was contact with cats, eating outside home and bad eating habits as eating raw eggs and eating unwashed fruits and vegetables. There was defect in the awareness and knowledge about *Toxoplasma* routs of infection, as well as effects and complications

Key words: *Toxoplasma gondii* - IgG antibody – ELISA – prevalence - risk factors

INTRODUCTION

Toxoplasma gondii (*T.gondii*) is an obligate intracellular living parasite, one of the most common parasites caused widespread zoonotic disease called Toxoplasmosis. Toxoplasmosis affects warm-blooded animals, including humans. (Avelar et al, 2017). The prevalence can vary from region to region, depending on the analysis used, methods of the research, climate, and the population included in the study. The general prevalence is assumed to be from 25-30% of all the world's human population. Although, it is widely variable from one region to another, the prevalence can be as low as 10% and can go as high as 80%. Tropical areas of Latin-America and African countries have scored the highest rates, while lower rates are found in North America, in Northern Europe, in South East Asia, and in Sahelian countries of Africa. On the other hand, moderate prevalences (30 to 50%) have been found in the countries of Central and Southern Europe (Pappas et al., 2009).

In Saudi Arabia, different serological studies have been done to detect the prevalence of *Toxoplasma gondii* among different sets of population with more focus on female gender and pregnant women. In Najran city, 20.8% of the studied women were found to have anti-*T.gondii* antibodies in their blood using ELISA. On the south west of Saudi Arabia, the studied seroprevalence concluded that 45% of the females tested positive for either IgM or IgG tests (Almushait et al., 2012).

T.gondii infection have a wide distribution due to presence of several way of transmission of parasite with possibility of infection to multiple hosts. Numerous factors influence this infection, including environmental, socioeconomic, eating drinking habits, hygiene and sanitation. The most common cause of the disease is to eat meat that is not cooked well of many different animals containing tissue cysts, poor washing of a knife was used in cutting raw meat has also been reported (Elsafi et al., 2015).

T. gondii can infect numerous mammals including humans, who are mainly infected by three routes. The first route is food-borne transmission, where a human is infected by eating raw or undercooked meat contaminated with the parasitic cyst. The second route is animal-to-human, where a human is infected by ingesting oocysts via contact with infected cat feces, or by touching contaminated soil or consuming food or water contaminated with oocysts. The third route is congenital transmission (Dong et al., 2018)

The main risk factors associated with toxoplasmosis in humans are the consumption of raw/undercooked meat of infected animals, ingestion of greens and water contaminated with oocysts, or even, the accidental ingestion of free oocysts in the environment. As a zoonosis, there is a concern that *T. gondii* infection may be common among people who have close contact with animals including birds. Apart from the foodborne route of infection (which may depend on their lifestyle/hygienic practices while at work), abattoir workers and meat sellers are at risk of *T. gondii* infection from accidental inoculation through skin abrasion or cut. (Cong et al.,2018).

Number of tests for of *Toxoplasma* IgG antibodies have been introduced to help the serological diagnosis (Liesenfeld et al., 2001).

The aim of the study was to determine the general prevalence of seropositive *T.gondii* among female students in college of applied medical sciences in Taif university, to evaluate the level of awareness about toxoplasmosis and to determine the common risk factors among female students

Subjects and methods

A cross sectional study was conducted during the period from October 2018 to April 2019, in college of applied medical science. Our cases include 40 apparently healthy female students of applied medical college who agreed to participate. 3 ml. of venous blood from each participant were drawn in plain, pre labeled, dry clean test tubes. Sociodemographic data, personal hygiene, life style and behavioral factors and obstetric history if present were collected by a structured questionnaire, designed according to objective of the study. The required data and blood samples were collected after a written informed consent from all participating students. Our questionnaire included 3 parts, in the first part we asked about sociodemographic data, in the second part we asked about personal hygiene, life style and behavioral factors and in the third part we asked about participant general knowledge about toxoplasmosis. The questionnaire guided the face to-face interviews conducted by the investigators, who briefed the participants about the study objectives. The questions were answered orally by the interviewees and recorded by the investigators in order to facilitate the understanding of

the subject matter. Serological detection of *Toxoplasma* IgG antibody by ELISA immunoassay kit.

Statistical analysis: The data gathered by checklist and the results of ELISA immunoassay laboratory test analyzed using the Statistical Package for Social Science (SPSS) version 22 statistical programs.

Results

A total of 40 female students attending college of applied medical science, who agreed to participate aged between 19 and 25 years old (mean age = 21.6 years) were included in this study. 6 students were less than 20 years old and 34 students were above 20 years old. Regarding residence of study participants, 28 (70%) students live in urban areas while 12 (30%) students live in rural areas. The questionnaire data revealed that the awareness of participants about *Toxoplasma* was as follow: 32 (80%) participants heard about *Toxoplasma* while 8 (20%) of them not heard about it. As regard awareness of participant about mode of infection of *Toxoplasma* 22 (55%) have knowledge about it and 18 (45%) not have. Also as regard knowledge about symptom and complications of *Toxoplasma* only 15 (37.5%) know about and 25 (62.5%) not have any knowledge about.

Table (1) frequency of *Toxoplasma* knowledge among study participants

<i>Toxoplasma</i> awareness	Yes	No
Hearing about <i>Toxoplasma</i>	32 (80%)	8 (20%)
Knowledge about <i>Toxoplasma</i> routs of infection	22 (55%)	18 (45%)
Knowledge about symptoms and complication of <i>Toxoplasma</i>	15 (37.5%)	25 (62.5%)

Table (2) frequency of Personal hygiene, life style and behavioral risk factors among study participants

Personal hygiene, life style and behavioral risk factors	Yes	No
Contact with cats directly	8 (20%)	32 (80%)
Owning cat	5 (12.5%)	35 (87.5%)
Eating raw egg	6 (15%)	34 (85%)
Eating outside frequently	18 (45%)	22 (55%)
Use of the same knife for slicing meat and cutting fruits and vegetables	6 (15%)	34 (85%)
Contact with the garden and soil	14 (35%)	26 (65%)
Frequent travelling	9 (22.5%)	31(77.5%)
Having domestic helper	13 (32.5%)	27 (67.5%)
Cleaning house and exposure to dust	23 (57%)	17 (43%)
Eating unwashed fruits and vegetables	2 (5%)	38 (95%)

Regarding *Toxoplasma* IgG seropositivity, out of 40 female students, 3 (7.5 %) was positive to *T. gondii*-specific IgG antibodies while the 37 (92.5%) participant were sero negative.

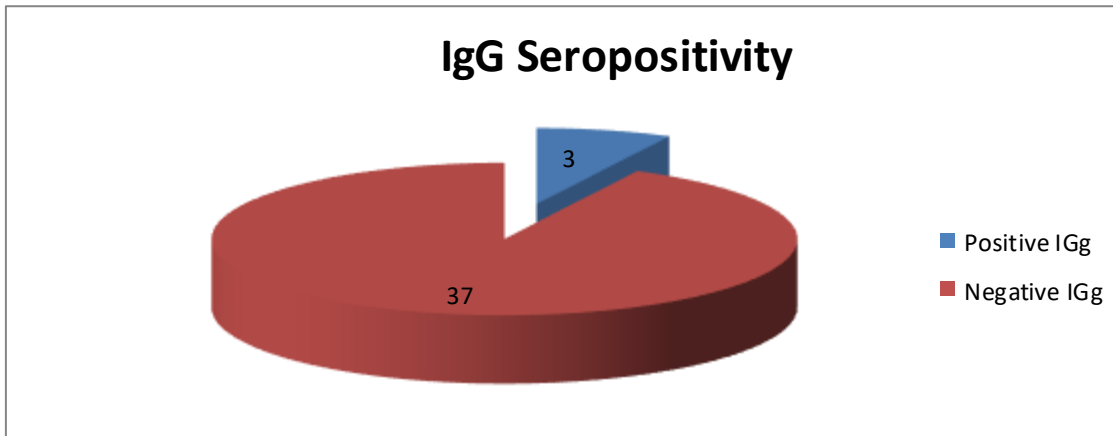


Figure (1) distribution of IgG seropositivity among the study participants

The association of studied sociodemographic, personal hygiene and behavioral risk factors with IgG seropositivity in seropositive participants were as follow:

There is strong association between cats owning or contact and toxoplasma seropositivity. Also there is strong association between eating outside as well as eating raw eggs and seropositivity. The other associated risk factors were eating unwashed fruits or vegetables, use of same knife for slicing meat and vegetables. The other risk factors have no association with seropositivity for toxoplasma, as frequent travelling, having domestic helper and cleaning house & exposure to dust.

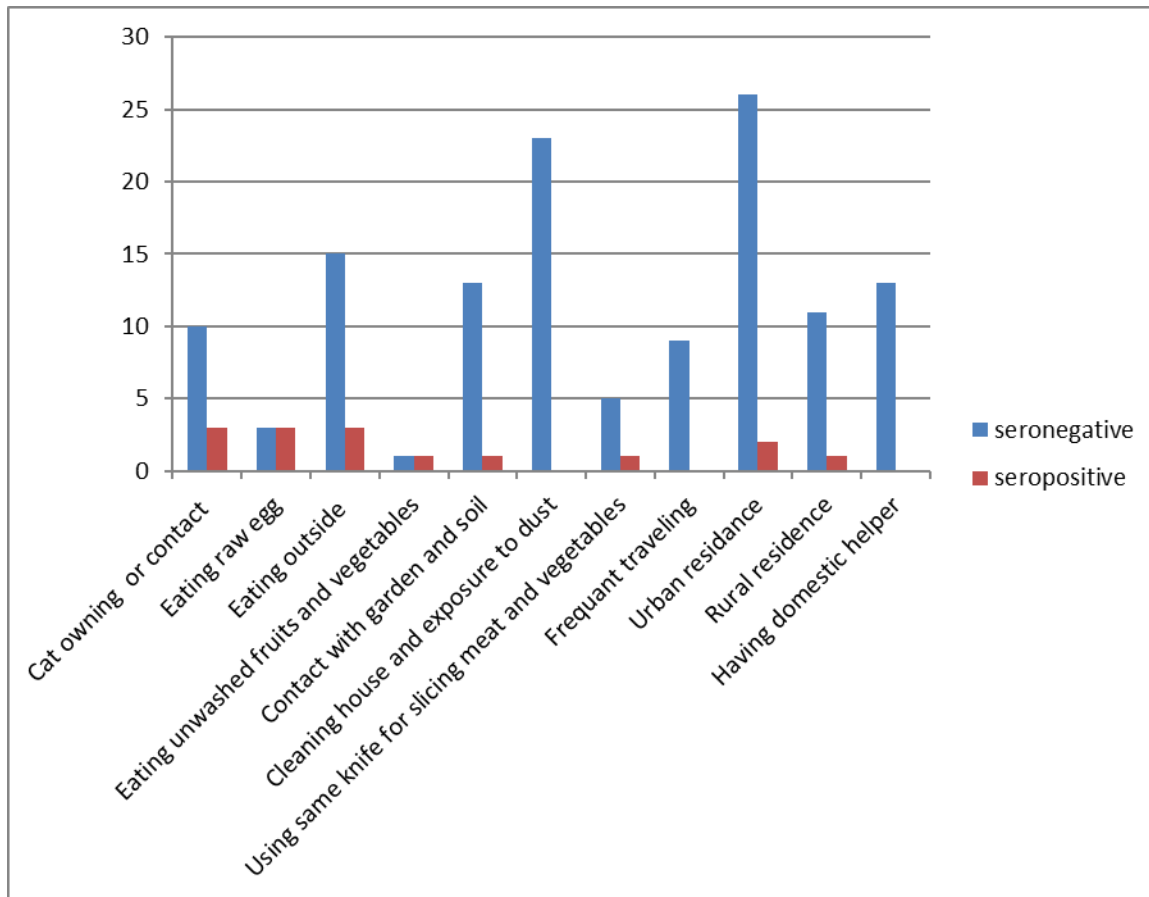


Figure (2) association of personal hygiene, life style and behavioral risk factors with *Toxoplasma* seropositivity among study participants

Discussion

Toxoplasmosis is considered one of the most common parasitic zoonosis in the world, which occur as a result of to apicomplexan protozoan *T. gondii*. Toxoplasmosis rarely cause significant disease. However, sometimes it may cause a deadly sickness as *T. gondii* can pass the blood- brain barrier & cause persistent infection in a drug-resistant stage (Alday et al.,2017).

As a result of *T.gondii* prevalence in the globe it is considered of a great concern in public health. Riyadh (2018) mentioned in his Meta-analysis that *T. gondii* seroprevalence between 2000 and 2017 among Saudi women of reproductive age was 27.8% which is lower than the neighbouring countries.

Our study was a cross sectional study conducted in College of Applied Medical Science /Taif University in order to assess the general prevalence of seropositive *T.gondii* among female students, level of awareness and the common risk factors.

The study found that *T. gondii*-specific IgG antibodies (which indicate previous infection) were positive in 7.5% of the participants which is less than seroprevalence found in other regions of Saudi Arabia. For example, Elsafi et al, 2015 and Almogren et al, 2011 investigated the seroprevelance of *T. gondii* IgG antibodies among females in the Eastern province and Riyadh and found it to be 28.5% and 38.8% respectively. In addition, Riyadh

and Al Amer, 2017 done a study among female medical students at a university in Northern Saudi Arabia and found that 9.4% had a positive *T. gondii*-specific IgG antibodies. The noticed difference between the seroprevalence of our study and Riyadh A. Alzaheb, et al in compare to other studies done in various region in the kingdom can be attributed to the age group participated in the studies as our study only enrolled young female students. In addition, the medical background of the participated females may have a role in reduction of the seroprevalence in compare to the other females. Our study revealed that 80% of the females know about *Toxoplasma* and 55% of them have knowledge about its route of transmission which increases their awareness. In general, the seroprevalence of *T.gondii* found in Saudi Arabia in different age group and regions is lower than the rate reported in neighboring countries such as Yemen (45.4%), Jordan (47.1%) and Iran (75.7%). **Alanazi et al, 2017 and El Deeb et al, 2012** mentioned that the low prevalence of *T. gondii* IgG antibodies among the Saudi females can be attributed to local climatic conditions, nutritional behaviour, residence locations, and levels of close contact with animals. Of the multiple factors investigated in our article, the study revealed that close contacts to cats, eating in restaurant, raw egg, unwashed fruits and vegetables and using the same knife for meat and vegetables have an association with having a positive *T.gondii* IgG antibodies. **Riyadh and Al Amer, 2017** mentioned that consumption of raw, unwashed fruit or vegetables was positively associated with toxoplasmosis. **Wam et al, 2016** found that consumption of raw or under-cooked meat was observed to be an independent risk factor of *T. gondii* infection. In addition, they mentioned that consumption of unwashed vegetables and fruits was significant factor. Another study was done by **Andiappan et al, 2014** and found that age group, occupation and sources of drinking water showed a significant association with toxoplasmosis. Therefore, it is important to raise the level of awareness regarding how this disease can spread among people and educate the community in order to have a better healthy life. We recommended that further research on a large scale is needed to detect accurate prevalence rate of *Toxoplasma* in Taif city and to support future public health strategies. Our results highlight the need to raise awareness of toxoplasmosis, specifically with regard to the routs of infections, risk factors, effect and complication for prevention and control of *Toxoplasma*.

References

- Alanazi, F., Hassan, T. and Alanazi, W. (2017). Seroprevalence of *Toxoplasma gondii* among pregnant Saudi woman in Arar, Northern Borders Province, Saudi Arabia. *Kasr Al Ainy Medical Journal*, 23(2), p.104-108.
- Alday, H. and Doggett, J. (2017). Drugs in development for toxoplasmosis: advances, challenges, and current status. *Drug Design, Development and Therapy*, Volume 11, pp.273-293.
- Almogren, A. (2011). Antenatal screening for *Toxoplasma gondii* infection at a tertiary care hospital in Riyadh, Saudi Arabia. *Annals of Saudi Medicine*, 31 (6), p.569.

- Almushait, M., Dajem, S., Elsherbiny, N., Eskandar, M., Al Azraqi, T. and Makhlof, L. (2012). Seroprevalence and risk factors of *Toxoplasma gondii* infection among pregnant women in south western, Saudi Arabia. *Journal of Parasitic Diseases*, 38(1), pp.4-10.
- Alzaheb, R. and Al-Amer, O. (2017). The Seroprevalence and Risk Factors of Toxoplasmosis Among Female Undergraduate University Students in Saudi Arabia. *Oman Medical Journal*, 32(6), pp.486-491..
- Andiappan, H., Nissapatorn, V., Sawangjaroen, N., Chemoh, W., Lau, Y., Kumar, T., Onichandran, S., Suwanrath, C. and Chandeying, V. (2014). *Toxoplasma* infection in pregnant women: a current status in Songklanagarind hospital, southern Thailand. *Parasites & Vectors*, 7(1), p.239.
- Avelar, M., Martinez, V, Moura, D, Barros, I, Primo, A, Duarte, A, Soares, N. and Lima, F. (2017). Association between seroprevalence of IgG anti-*Toxoplasma gondii* and risk factors for infection among pregnant women in Climério de Oliveira Maternity, Salvador, Bahia, Brazil. *Revista do Instituto de Medicina Tropical de São Paulo*, vol (59)
- Cong, W., Elsheikha, H., Zhou, N., Peng, P., Qin, S., Meng, Q. and Qian, A. (2018). Prevalence of antibodies against *Toxoplasma gondii* in pets and their owners in Shandong province, Eastern China. *BMC Infectious Diseases*, vol (18) pp.571-577
- Dong, H., Su, R., Lu, Y., Wang, M., Liu, J., Jian, F. and Yang, Y. (2018). Prevalence, Risk Factors, and Genotypes of *Toxoplasma gondii* in Food Animals and Humans (2000–2017) From China. *Frontiers in Microbiology*, vol (9) pp.258-265.
- El Deeb, H., Salah-Eldin, H., Khodeer, S. and Allah, A. (2012). Prevalence of *Toxoplasma gondii* infection in antenatal population in Menoufia governorate, Egypt. *Acta Tropica*, 124(3), pp.185-191.
- Elsafi, S., AL-Mutairi, W., Al-Jubran, K., Abu Hassan, M. and Al Zahrani, E. (2015). Toxoplasmosis seroprevalence in relation to knowledge and practice among pregnant women in Dhahran, Saudi Arabia. *Pathogens and Global Health*, vol.(8), pp.377-382.
- Liesenfeld, O., Montoya, J., Tathineni, N., Davis, M., Brown, B., Cobb, K., Parsonnet, J. and Remington, J. (2001). Confirmatory serologic testing for acute toxoplasmosis and rate of induced abortions among women reported to have positive *Toxoplasma* immunoglobulin M antibody titers. *American Journal of Obstetrics and Gynecology*, 184(2), pp.140-145.
- Pappas G, Roussos N, Falagas ME.(2009). Toxoplasmosis snapshots: global status of *Toxoplasma gondii* seroprevalence and implications for pregnancy and congenital toxoplasmosis. *Int. J. Parasitol.* 39:1385–1394.
- Riyadh A Alzaheb.(2018). Seroprevalence of *Toxoplasma gondii* and its associated risk factors among women of reproductive age in Saudi Arabia: a systematic review and meta-analysis, *International Journal of Women's Health*, 10, pp. 537–544.
- Wam C, Sama LF, Ali IM, ebile WA, Aghangu LA, Tume CB.(2016). Seroprevalence of *Toxoplasma gondii* IgG and IgM antibodies and associated risk factors in women of childbearing age in Njinikom, NW Cameroon, *BMC res Notes Aug,9(1)*, pp.406