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KNOWLEDGE OF TOXOPLASMOSIS AMONG GENERAL PRACTITIONER DOCTORS WHO PROVIDE PRENATAL CARE IN PRIMARY HEALTH CARE CENTERS IN BAGHDAD AL-RUSSAFA HEALTH DIRECTORATE

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ABSTRACT

Background: Toxoplasmosis is a globally prevalent zoonotic disease caused by *Toxoplasma gondii*, an obligate intracellular protozoan. It is transmitted to humans through ingestion of oocysts from contaminated water, soil, and food, or through consumption of cysts in infected meat and animal by-products. Vertical transmission during pregnancy can result in congenital toxoplasmosis, leading to severe fetal and neonatal complications such as hydrocephalus, cerebral calcifications, mental retardation, chorioretinitis, microphthalmia, strabismus, deafness, and intrauterine death. The highest risk of severe outcomes occurs with maternal infection in the first and second trimesters. Diagnosis primarily relies on serological testing for anti-toxoplasma antibodies. **Aim of the Study:** This study aimed to assess the knowledge of toxoplasmosis among general practitioners providing prenatal care in Primary Health Care Centers in Baghdad/Al-Rusafa Health Directorate. **Subjects and Methods:** A descriptive cross-sectional study was conducted using a convenient sample of general practitioners from January to April 2016. **Results:** Among the participants, 99% had fair to good knowledge of general toxoplasmosis information, 91% had fair to good knowledge about diagnosis, while 9% had poor knowledge. Similarly, 92% had fair to good knowledge about treatment, whereas 8% had poor knowledge. Notably, 99% demonstrated good knowledge regarding prevention. **Conclusion:** While most doctors had adequate knowledge of general aspects and prevention, gaps were noted in diagnosis and treatment. Enhancing knowledge through Information, Education, and Communication (IEC) materials, continuous medical education programs, and training courses on toxoplasmosis management is recommended.

KEYWORDS: Knowledge, Toxoplasmosis, General Practitioners, Prenatal Care, Primary Health Care Centers.

INTRODUCTION

Toxoplasmosis is a systemic coccidian protozoan disease caused by *Toxoplasma gondii*, an obligate intracellular parasite.[1,2] It is a widespread infection, affecting an estimated 500 million people worldwide, with incidence rates ranging from 12% to 90%.[3] The seroprevalence of toxoplasmosis varies significantly between regions. High seroprevalence rates (>50%) are observed in areas where raw meat consumption is common, such as France (54%), as well as in tropical regions of Latin America and sub-Saharan Africa, where climatic conditions favor oocyst survival. In the United States, approximately 15% of women of childbearing age (15–44 years) are infected, while in Canada, studies estimate seroprevalence rates between 20% and 40%.[2] In the United Kingdom, seroprevalence is reported at 7.7%–9.1%, while in India and Brazil, rates range from 45% to 76%.[3] Seroprevalence among pregnant women has been studied in various countries. In the United Kingdom, 20%–23% of pregnant women show serological evidence of prior infection, while the rate is 60% in New Zealand.[4] In Ghana, 73.6% of pregnant women test positive, while lower rates are recorded in Brazil (2%) and Mexico (2.3%).[3] Studies in Iraq and the Arab world indicate a seroprevalence of 77.1% among pregnant women in Baghdad, 29.2% among women with abortion in Baghdad, 31.6% in Saudi Arabia, 26.5% in Egypt, and 15.5% in Iran.[3] The primary modes of toxoplasmosis transmission include ingestion of raw or undercooked meat, exposure to oocyst-contaminated cat feces, and vertical transmission from mother to fetus. In pregnancy, the most common routes of infection are consuming contaminated meat or water and exposure to soil (e.g., gardening without gloves) and cat litter. However,

studies indicate that cat ownership itself poses minimal risk.[2] The clinical presentation of toxoplasmosis ranges from asymptomatic cases to flu-like symptoms, including low-grade fever, malaise, and lymph node enlargement, while severe cases may involve hepatosplenomegaly and maculopapular rash.[1] Among pregnant women, 90% remain asymptomatic, and the disease is generally no more severe than in non-pregnant individuals.[2] The incidence of congenital toxoplasmosis is estimated at 1 in 1,000 to 1 in 8,000 live births in the United States[4], 1 in 1,000 to 1 in 2,000 in the United Kingdom, and higher in France, where attack rates of 2%–6% are reported.[5] Transplacental transmission occurs in approximately one-third of infected pregnancies, with the risk increasing as pregnancy progresses. Early gestational infections are less likely to result in fetal infection but can cause severe outcomes, including spontaneous abortion, intrauterine death, stillbirth, prematurity, chorioretinitis, blindness, and neurological defects.[1] The highest risk of severe congenital disease occurs with maternal infection between the second and sixth months of pregnancy.[6] Later infections typically result in neonatal seropositivity without clinical disease. Diagnosis primarily relies on serological testing for anti-toxoplasma antibodies. Acute maternal infection is detected by measuring IgM antibody levels, which appear early and decline faster than IgG antibodies after recovery.[2] Prevention strategies, including primary, secondary, and tertiary measures, play a crucial role in reducing disease incidence and severity.[2] This study aims to assess the knowledge of toxoplasmosis among general practitioners providing prenatal care in Primary Health Care Centers.

METHOD

A descriptive cross-sectional study was conducted in 47 Primary Health Care (PHC) centers across seven out of nine health districts in Baghdad Al-Russafa Health Directorate. The excluded districts were Al-Madaeen and Al-Isteqlal, as they primarily serve graduate doctors. The study was carried out from January 23 to April 23, 2016.

Study Population and Sample Size

The study targeted general practitioner doctors providing prenatal care in PHC centers. A convenient sample of 160 doctors was selected from a total of 277 general practitioners in the seven health districts. The sample size was determined using Steven Thambson's formula, considering a 5% margin of error and a 50% prevalence assumption. Ten doctors declined participation, leaving a final sample size of 150 doctors.

Data Collection and Instrument

Data were collected using a structured, self-administered questionnaire developed from various research studies and textbooks, with input from the researcher's supervisor and community medicine specialists. The questionnaire (Appendix A) included socio-demographic variables such as age, gender, years since graduation, and postgraduate study attempts. Additionally, it assessed doctors' knowledge regarding toxoplasmosis, including general information, diagnosis, treatment, and prevention.

Inclusion and Exclusion Criteria

Inclusion criteria: General practitioner doctors in PHC centers under the Baghdad Al-Russafa Health Directorate.

Exclusion criteria: Specialist doctors and PHC centers in Al-Isteqlal and Al-Madaeen districts.

Ethical Considerations

Approval was obtained from Baghdad Al-Russafa Health Directorate (Appendix C). Each participant was informed about the study's objectives, and their consent was obtained. Confidentiality and privacy were maintained throughout the study.

Statistical Analysis

Data were analyzed using SPSS version 22. Results were presented as frequencies, percentages, means, standard deviations, and ranges. The Pearson Chi-square test (χ^2) was used to assess differences in categorical data, with Yates' correction or Fisher's Exact test applied when necessary. A **p-value ≤ 0.05** was considered statistically significant.

Study Limitations

1. Limited time for data collection.
2. Some doctors were unavailable due to duties outside the PHC centers.
3. Some doctors were uncooperative and refused participation.
4. Limited research on doctors' knowledge of toxoplasmosis in pregnant women.

RESULTS

General Information Knowledge Score: 71% had a fair score, 28% had a good score, and 1% had a poor score. Diagnosis Knowledge Score: 62% had a fair score, 29% had a good score, and 9% had a poor score. Treatment Knowledge Score: 65% had a fair score, 27% had a good score, and 8% had a poor score. Preventive Methods Knowledge Score: 99% had a good score, and 1% had a fair score. No poor scores were recorded. Total Knowledge Score: 74% had a fair score, while 26% had a good score. Table 1.

The study included doctors aged 27-60 years, with a majority being females (68.7%). The duration since graduation ranged from 2-36 years. 41.3% of doctors had attempted postgraduate exams, with specialization in family and community medicine (27.4%), obstetrics and gynecology (24.2%), medicine (17.8%), and other branches (30.6%). Table 2.

General information: 71% had a fair score, 28% had a good score, and 1% had a poor score. Diagnosis: 62% had a fair score, 29% had a good score, and 9% had a

poor score. Treatment: 65% had a fair score, 27% had a good score, and 8% had a poor score. Prevention: 99% had a good score, 1% had a fair score, and no poor scores were recorded. Total knowledge score: 74% had a fair score, while 26% had a good score. Table 3.

Fair knowledge was highest (78.6%) in the 40-49 years age group, while good knowledge was highest (31.3%) in ≥50 years. Females had a higher proportion of good scores (29.1%), while males had more fair scores (74.5%). Doctors in family medicine had the highest good scores (35.3%), while medicine specialists had the highest fair scores (81.8%). Table 4.

Fair knowledge was highest (80%) in <30 years age group, while good knowledge was highest (35.4%) in ≥50 years. Males had higher fair scores (70.2%), while females had higher good scores (32%). Obstetrics and gynecology specialists had the highest good scores (53.4%), while medicine specialists had the highest poor scores (18.2%). Table 5.

Fair knowledge was highest (75%) in 40-49 years, while good knowledge was highest (30%) in <30 years. Females had higher good scores (31.1%), while males had higher fair scores (66%). Significant difference was found between gender and treatment knowledge (p=0.009). Good knowledge was highest (40%) in obstetrics and gynecology, while medicine specialists had the highest poor scores (27.3%). Table 6.

Fair knowledge was highest (82.1%) in 40-49 years, while good knowledge was highest (33.3%) in ≥50 years. Males had more fair scores (80.9%), while females had more good scores (29.1%). Family and community medicine specialists had the highest good scores (35.3%), while medicine specialists had the highest fair scores (100%). Table 7.

Table 1: Combined Knowledge Score Distribution.

Knowledge Category	Poor (%)	Fair (%)	Good (%)
General Information (T=88)	1	71	28
Diagnosis Score (T=36)	9	62	29
Treatment Score (T=28)	8	65	27
Prevention Score (T=18)	0	1	99
Total Score (T=170)	0	74	26

Table 2: Distribution of studied sample according to socio- demographic characters.

socio- demographic charecters		No.	%
Age (years)	<30	10	6.6
	30---39	64	42.7
	40---49	28	18.7
	=>50	48 Total 150	32.0
	Mean±SD(Range)	41.6±9.8 (27-60)	
Gender:	Male	47	31.3
	Female	103 Total 150	68.7
Time from graduation (years):	<10	44	29.3
	10---19	43	28.7
	20---29	42	28.0
	=>30	21 Total 150	14.0
	Mean±SD(Range)	16.8±9.5 (2-36)	
Have any trial for exam to post graduation:	Yes	62	41.3
	No	88 Total 150	58.7
Type of study:	Family & Com Medicine	17	27.4
	Medicine	11	17.8
	Obstet&Gyn	15	24.2
	Other	19 Total 62	30.6
	Total	150	100

Table 3: Distribution of studied sample according to their knowledge score about toxoplasmosis.

Knowledge score	Mean±SD (Range)
General information Score (T=88)	60.8±8.6 (44-88)
Diagnosis Score (T=36)	24.1±4.7 (18-36)
Treatment Score (T=28)	17.9±3.8 (14-28)
Prevention Score (T=18)	16.9±1.4 (9-18)
Total score (T=170)	119.8±13.2 (85-170)

Table 4: Distribution of studied sample according to their knowledge score about general information's of toxoplasmosis.

Socio demographic characters		General information score (T=88)								P value
		Poor No.	(<44) %	Fair No.	(44-65) %	Good No.	(=>66) %	Total No.	%	
Age (years)										
<30		--	--	7	70	3	30	10	100	
30---39		1	1.6	**45**	**70.3**	18	28.1	64	100	0.832
40---49		--	--	**22**	**78.6**	6	21.4	28	100	
=>50		--	--	33	68.7	**15**	**31.3**	48	100	
Gender:										
Male		--	--	**35**	**74.5**	12	25.5	47	100	0.717
Female		1	1.0	**72**	**69.9**	**30**	**29.1**	103	100	
Time from graduation (years):										
<10		1	2.3	30	68.2	13	29.5	44	100	
10---19		--	--	**33**	**76.7**	10	23.3	43	100	
20---29		--	--	**29**	**69.0**	**13**	**31.0**	42	100	0.869
=>30		--	--	15	71.4	6	28.6	21	100	
Post-graduation	yes	1	1.6	**45**	**72.6**	16	25.8	62	100	0.616
exam trial:	No	--	--	**62**	**70.5**	**26**	**29.5**	88	100	
Type of study:										
Fam & Com Medicine		--	--	**11**	**64.7**	6	35.3	17	100	
Medicine		--	--	9	**81.8**	2	18.2	11	100	
Obstet&Gyn		**1**	**6.7**	11	73.3	3	20.0	15	100	0.706
Other		--	--	**14**	**73.7**	5	26.3	19	100	

Table 5: Distribution of studied sample according to their knowledge score about diagnosis of toxoplasmosis.

Socio demographic characters		Diagnosis score (T=36)								P value
		Poor No.	(<18) %	Fair No.	(18-26) %	Good No.	(=>27) %	Total No.	%	
Age (years)										
<30		--	--	8	**80.0**	2	20.0	10	100	
30---39		**8**	**12.5**	**39**	60.9	17	26.6	64	100	0.625
40---49		2	7.1	19	67.9	7	25.0	28	100	
=>50		3	6.3	28	58.3	**17**	**35.4**	48	100	
Gender:										
Male		4	8.5	**33**	**70.2**	10	21.3	47	100	0.381
Female		9	8.7	**61**	**59.3**	**33**	**32.0**	103	100	
Time from graduation (years):										
<10		4	9.1	25	56.8	15	34.1	44	100	
10---19		**5**	**11.6**	**32**	**74.4**	6	14.0	43	100	0.308
20---29		2	4.8	25	59.5	**15**	**35.7**	42	100	
=>30		2	9.5	12	57.2	7	33.3	21	100	
Post-graduation	yes	5	8.1	36	58.1	21	33.8	62	100	0.497
exam trial:	No	**8**	**9.1**	**58**	**65.9**	22	25	88	100	
Type of study:										
Fam & Com Medicine		**1**	**5.9**	**10**	**58.8**	6	35.3	17	100	
Medicine		2	18.2	7	63.6	2	18.2	11	100	0.186
Obstet&Gyn		2	13.3	5	33.3	**8**	**53.4**	15	100	
Other		--	--	**14**	**73.7**	5	26.3	19	100	

Table 6: Distribution of studied sample according to their knowledge score about treatment of toxoplasmosis.

Socio demographic characters		Treatment score (T=28)								P value
		Poor No.	(<14) %	Fair No.	(14-20) %	Good No.	(=>21) %	Total No.	%	
Age (years)										
<30		1	10.0	6	60.0	**3**	**30.0**	10	100	
30---39		5	7.8	**42**	**65.6**	**17**	**26.6**	64	100	0.649
40---49		--	--	**21**	**75.0**	7	25.0	28	100	
=>50		**6**	**12.5**	29	60.4	13	27.1	48	100	
Gender:										
Male		**8**	**17.0**	**31**	**66**	8	17.0	47	100	**0.009**
Female		4	3.9	**67**	**65.0**	**32**	**31.1**	103	100	
Time from graduation (years):										
<10		**4**	**9.1**	26	59.1	14	31.8	44	100	
10---19		2	4.6	**35**	**81.4**	6	14.0	43	100	0.107
20---29		3	7.1	28	66.7	11	26.2	42	100	
=>30		**3**	**14.2**	9	42.9	9	42.9	21	100	
Post-graduation	yes	**7**	**11.3**	**42**	**67.7**	13	21.0	62	100	0.245
exam trial:	No	5	5.7	**56**	**63.6**	**27**	**30.7**	88	100	
Type of study:										
Fam & Com Medicine		2	11.8	**10**	**58.8**	5	29.4	17	100	
Medicine		**3**	**27.3**	8	72.7	--	--	11	100	0.077
Obstet&Gyn		--	--	9	60.0	**6**	**40.0**	15	100	
Other		2	10.5	**15**	**79**	2	10.5	19	100	

Table 7: Distribution of studied sample according to their total knowledge score about toxoplasmosis.

Socio demographic characters		Total score (T=170)								P value
		Poor No.	(<85) %	Fair No.	(85-127) %	Good(=>128) No.%		Total No.	%	
Age (years)										
<30		--	--	**8**	**80**	**2**	**20**	10	100	
30---39		--	--	**48**	**75.0**	**16**	**25.0**	64	100	
40---49		--	--	**23**	**82.1**	5	17.9	28	100	0.470
=>50		--	--	32	66.7	**16**	**33.3**	48	100	
Gender:										
Male Female		--	--	38	80.9	9	19.1	47	100	0.196
		--	--	**73**	**70.9**	**30**	**29.1**	103	100	
Time from graduation (years):										
<10		--	--	32	72.7	12	27.3	44	100	
10---19		--	--	**35**	**81.4**	8	18.6	43	100	
20---29		--	--	31	73.8	11	26.2	42	100	0.414
=>30		--	--	13	61.9	8	38.1	21	100	
Post-graduation	yes	--	--	**48**	**77.4**	14	22.6	62	100	0.423
exam trial:	**No**	--	--	**63**	**71.6**	25	28.4	88	100	
Type of study: Fam & Com				**11**	**64.7**	**6**	**35.3**	17	100	
Medicine		--	--	**11**	**100**	--	--	11	100	
Medicine Obstet&Gyn		--	--	10	66.7	5	33.3	15	100	0.099
Other		--	--	**16**	**84.2**	3	15.8	19	100	

DISCUSSION

The effectiveness of primary health care units depends on the knowledge of doctors, particularly in managing mother-to-child (MTC) transmitted diseases such as toxoplasmosis. Early diagnosis and treatment can prevent severe fetal complications, highlighting the importance of adequate medical training in prophylaxis, diagnosis, and clinical management.[7] In this study, 74.7% of doctors correctly identified toxoplasmosis as an infectious systemic protozoan, a higher percentage than in a study by Mansour E. in Iran (55.8%).[8] Additionally, 97.3% of doctors recognized cats as the definitive host, aligning with a Brazilian study (97.4%) by Laura B.[7], but higher than reports from Iran (64%)[8] and another Brazilian study (60.4%).[9] Only 26.6% of doctors identified sheep as an intermediate host, compared to 12.1% in Laura B.'s study.[7] Most doctors (88%) knew that ingestion of contaminated vegetables and fruits

transmits toxoplasmosis, which is higher than 54.6% in an Iranian study.[8] Nearly all doctors (96%) identified placental transmission, a significant increase from the 54.6% in Mansour E.'s study.[8] However, only 23.3% recognized that neonatal transmission increases in the third trimester, consistent with Laura B.'s study (23.5%) [7] but lower than Ana P.'s findings (72.7%).[9] Conversely, 86.7% of doctors correctly noted that first-trimester infections pose the highest risk, compared to 65.8% in Laura B.'s study.[7] Most doctors (73.3%) understood that pregnant women are usually asymptomatic, similar to Laura B.'s study (73.9%).[26] Additionally, 88.6% of doctors recognized that symptoms could include fever and lymph node enlargement, contrasting with 13.9% in Laura B.'s study.[7] About 90% of doctors associated toxoplasmosis with recurrent abortion, much higher than 45% in the Iranian study.[8] Regarding diagnosis, 84% of doctors knew that IgM antibodies indicate acute infection, compared to 52.2% in Brazil.[7] While 70.7% understood IgM declines faster than IgG, only 51.3% knew that IgG remains detectable for life. Additionally, 73.4% recognized that IgG-positive, IgM-negative results indicate past infection, a higher proportion than 36.4% in Ana P.'s study.[9] Most doctors (85.3%) knew that spiramycin is the safest treatment during pregnancy, but fewer were aware of pyrimethamine and sulfadiazine usage (16.7% and 32%, respectively). While 70.7% understood that spiramycin prevents placental transmission, only 37.3% knew how long a woman should wait before attempting pregnancy after infection. Additionally, 72% recognized that breastfeeding is safe for infected mothers. Prevention knowledge was strong, with 99.3% of doctors acknowledging the importance of handwashing, similar to 95.5% in Ana P.'s study.[9] Most doctors (97.3%) recognized that avoiding contact with cats reduces infection risk, consistent with 97.4% in Laura B.'s study.[7] Other preventive measures included wearing gloves while gardening (98%), avoiding unwashed vegetables (93.3%), and avoiding undercooked meat (87.4%), which were comparable to previous studies.[8,9] The majority of doctors had fair to good knowledge scores: 99% for general information, 91% for diagnosis, 92% for treatment, and 100% for prevention. This contrasts with Laura B.'s study, where doctors scored lower on prevention but higher in clinical and diagnostic aspects.[7] No significant relationships were found between total knowledge score and gender, time since graduation, or postgraduate study attempts ($p > 0.05$). However, female doctors had a higher percentage of good scores (29.1%) than males, though lower than 63.9% in Laura B.'s study.[7] More experienced doctors (>30 years since graduation) had the highest knowledge scores (38.1%), differing from Brazil, where newer graduates (<10 years) scored higher (55.6%).[7] Additionally, those without postgraduate study trials had better scores (28.4%), unlike the Brazilian study, where specialists had significantly higher scores (86.1%).[7,10]

CONCLUSION

The study reveals good knowledge among doctors regarding the definitive and intermediate hosts, transmission routes, and prevention of toxoplasmosis but limited understanding of the incubation period, communicability, and congenital transmission risks. While most doctors correctly identified clinical features and fetal complications, gaps were noted in knowledge of serological tests, amniocentesis indications, and treatment options beyond spiramycin. Additionally, there was limited awareness of the waiting period before pregnancy after infection. Overall, doctors had fair to good knowledge of general aspects and prevention but showed deficiencies in diagnosis and treatment.

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