

The Seroprevalence of Human Toxoplasmosis in Oman

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خلاصة : لقد أثار مرض التوكسوبلازما او الاصابة بطغليل المقوسة القونديه (*Toxoplasma gondii*) اهتمام الدوائر العلمية والصحية خلال العقد المنصرم لماله من عواقب وخيمة على مرضى العوز المناعي والحوامل . فالاصابة بهذا المرض قد تؤدي لوقاة مرضى العوز المناعي كما أنها تؤدي للإجهاض وحدوث عاهات وتشوهات مأساوية للجنين من بينها فقدان البصر والتخلف العقلي وما شابهها . لقد تم في هذا البحث دراسة الضد النوعي IgG للمقوسة القونديه على أمصال أخذت من أطفال ومتبرعين بالدم وحوامل من مختلف الاعمار بسلطنة عمان . لقد اجريت الدراسة المصلية بثلاث طرق تشخيصيه . هي طريقة التراص المباشر (Direct Agglutination) وطريقة اليزا (ELISA IgG) وطريقة المياتوكسو (Toxo IgG) (MEIA) . لقد وجد أن متوسط النسبة العامة للضد النوعي IgG (21) للمجموعات الثلاثة . وسجلت أعلى نسبة للاصابة بين الحوامل (29.5) يأتي بعدها الاطفال بنسبة (21) وأخيراً المتبرعون بالدم بنسبة (10.5) . كما ان التحاليل الاحصائية للنسب المختلفة للاصابة لم تثبت فروقات هامة وواضحة بين الاعمار أو الجنس . كما أنها لم تثبت فروقات تشخيصيه واضحة لأفضلية إحدى الطرق التشخيصيه الثلاثة . لقد وضح من هذه الدراسة أنه يمكن إجراء المسوحات المصلية للتوكسوبلازما بأي من الطرق التشخيصيه الثلاثة ولكن يفضل استعمال طريقة اليزا والمياتوكسو لفحص المرضى نظراً لوجود بعض الحالات الايجابية الكاذبه بطريقة التراص المباشر . لقد أوضحت هذه الدراسة مع غيرها من الدراسات الاخرى . أن الاصابة بطغليل المقوسة القونديه حالة واسعة الانتشار في السلطنة . وأن معظم الافراد يتعرضون للاصابة وهم اطفال مع ندرة وجود حالات خطيرة بين الافراد والنساء الحوامل .

ABSTRACT: The prevalence of *Toxoplasma* IgG antibodies was studied in three age groups (children, blood donors and pregnant women) in Oman. The highest prevalence rate was shown by pregnant women (39.5%), followed by children (21%) and lastly by blood donors (10.5%). Prevalence rates were analysed by age groups and showed no significant difference. Furthermore, a comparative sensitivity analysis between the three tests, ELISA IgG, DA and MEIA Toxo IgG was performed. There was no significant difference between them.

Animal and human toxoplasmosis is a cosmopolitan protozoan infection but more common in warm moist areas (Sun, 1988; Wilson and McAuley, 1991). The symptoms of the disease in immunocompetent individuals are usually overshadowed by fever and ill health manifestations attributed to other causative agents. However, infection of immunodeficient patients (i.e. AIDS) may be fatal (Barker and Holliman, 1992). Also, because infection of pregnant women by *Toxoplasma gondii* can cause severe diseases in the foetus and newborn such as abortion, stillbirth, mental retardation and blindness, routine mandatory screening of pregnant women for *Toxoplasma* infection was implemented by some countries (Luyasu *et al.*, 1992; Friese *et al.*, 1992).

Surveys have shown wide variations in the prevalence and transmission modes of toxoplasmosis (Aganga *et al.*, 1988; Jackson and Hutchison, 1989; Skinner *et al.*, 1990; AbdelHameed, 1991). To the best of our knowledge, little information is available on human or animal toxoplasmosis in the Middle East in general

(Hussein *et al.*, 1988; Niazi *et al.*, 1988) or Oman in particular (Idris and Ruppel, 1994; Elbualy *et al.*, 1995).

The aim of this study was to determine the seroprevalence of *T. gondii* IgG antibodies among some Omanis (children, pregnant women and blood donors) and to conduct a comparative sensitivity study between Enzyme-linked immunosorbent assay (ELISA), Microparticle Enzyme Immunoassay (MEIA) and Direct Agglutination (DA) test.

Materials and Methods

SAMPLE COLLECTION: A total of 322 serum samples from healthy male (306) and female (16) blood donors, 18 to 51 years of age, were collected from the Blood Bank Unit at Khoula Hospital, Muscat, Oman. Information on age, sex, tribe and residence were obtained from the blood bank records. In addition, 100 serum samples from children, 1 day to 15 years of age, and 200 sera from pregnant women, 15 to 45 years old, were obtained from the

Microbiology Laboratory, Sultan Qaboos University Hospital, Oman. Available data on sex and age were recorded. All the serum samples were stored at -20°C at the Microbiology Laboratory, SQU Hospital, until tested.

SEROLOGICAL ASSAYS: All sera from blood donors and pregnant women were examined for *Toxoplasma* IgG antibodies using Enzyme-linked immunosorbent assay (ELISA) (Toxenz G-96, Northumberland, England). Out of the 200 sera from pregnant women, 20 samples were in small quantities and not available for other tests. The remaining 180 samples were further screened for IgG antibodies specific for *T. gondii* antigens by a direct agglutination test in microtitre plates (Toxo Screen DA

Bio Merieux, France). Titres ≥ 40 were considered as positive. The 180 sera were also examined by using the Microparticle Enzyme Immunoassay (MEIA) for toxoplasmosis IgG on the automated IMX system (Abbott, USA) following the manufacturer's instructions. In addition, 100 sera from children were examined by DA test.

Results

The seroprevalence rates of *Toxoplasma* IgG antibodies in different age groups of blood donors, pregnant women and children are shown in Tables 1-3 respectively.

TABLE 1

Seroprevalence of T. gondii among blood donors tested by ELISA.

Age Groups (years)	18-23	24-29	30-35	36-41	42-47	48-53	All ages
Total No. Examined	101	84	68	45	16	8	322
No. Positive	8	11	8	4	1	2	34
Percentage of +ve	7.9%	13.1%	11.8%	8.9%	6.3%	25.0%	10.6%

TABLE 2

Seroprevalence of T. gondii among pregnant women tested by ELISA.

Age Groups (years)	15-20	21-26	27-32	33-38	39-44	≥ 45	All ages
Total No. Examined	27	62	54	38	13	6	200
No. Positive	9	22	25	17	5	1	79
Percentage of +ve	33.3%	35.3%	46.3%	44.7%	38.5%	16.6%	39.5%

TABLE 3

Prevalence of agglutinating IgG antibodies against T. gondii among children by age and sex.

Age Groups (years)	Males:		Females:		Total:	
	Number*	(Percentage)	Number*	(Percentage)	Number*	(Percentage)
0 - 4	5/28	(17.9%)	4/24	(16.7%)	9/52	(17.3%)
5 - 9	5/23	(21.7%)	3/9	(33.3%)	8/32	(25.0%)
10 - 14	3/11	(27.3%)	1/5	(20.0%)	4/16	(25.0%)
TOTAL	13/62	(21.0%)	8/38	(21.0%)	21/100	(21.0%)

* Number positive/number tested.

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Of the blood donors, pregnant women and children, 34/322 (10.6%), 79/200 (39.5%) and 21/100 (21.0%) were found to have detectable IgG antibodies against *T. gondii* respectively. The overall prevalence of seropositivity was 134/622 (21.5%). Chi-square analysis showed no significant difference at 5% level between positive or negative samples with respect to the different age groups of blood donors ($\chi^2 = 3.64$, $P > 0.05$), pregnant women ($\chi^2 = 3.64$, $P > 0.05$) and children ($\chi^2 = 0.89$, $P > 0.05$)

Table 3 shows the distribution of positive sera in children by sex. For all ages, the prevalence in males (21%) is not significantly different from the prevalence of 21% in females ($\chi^2 = 1.54$, $P > 0.05$). Results of serological screening of IgG antibodies against toxoplasmosis in

TABLE 4

Seropositivity of T. gondii in pregnant women, tested by ELISA, DA and MEIA techniques.

METHOD	ELISA	DA	MEIA
Total number tested	180	180	180
Negative	107	104	114
Border line	8	0	0
Positive	65	76	66
Percentage +ve	36.1%	42.1%	36.7%

TABLE 5

Prevalence of Toxoplasma antibodies in some surveys done in Africa, Middle East and Asia.

COUNTRY	METHOD	SAMPLE	PREVALENCE%	AUTHOR(S)
Algeria	IFT	Adults (?)	52.2	Schneider <i>et al</i> (1977)*
Jordan	Skin and dye tests,	Women	37.0	Morsy & Michael (1980)*
	CFT, IHA, ELISA	Healthy adults Aborting women	22.8-26.1 58.2	Abdel Hafeez <i>et al</i> (1986)
Somalia	Dye test	Adults in Mogadishu rural area	29.0	Zardi <i>et al</i> (1978) ¹
Niger	IFAT	All ages	18.2	Develoux <i>et al</i> (1988) ²
Mauritania	IFAT	Children 6-13 years	14.2	Monjour <i>et al</i> (1983) ³
		14-18 years	20.1	
Nigeria	IFT+LA	Adult blood donors	20.6	Ogumba & Thomas (1979)*
	dye test	All ages	58.9	Arene (1986) ⁴
Libya	LA	All ages - males	52.0	Khadre & El Nageh (1987) ⁵
		females	43.0	
Burundi	ELISA + IFAT	All ages	41.1	Excler <i>et al</i> (1988) ⁶
Sudan	Dye test	10-75 years	61.0	Carter & Fleck (1966) ⁷ Abdel-Hameed (1991)
	TMT + ELISA-IgG	All ages	41.7	
Iran	IFT	All ages	29.0	Sedaght <i>et al</i> (1978)
	IFA	All ages	12.8	Ghorbani <i>et al</i> (1981)
	IFA	Healthy all ages	49.6	Hoghooghi-Rad & Afraa (1993)
		Toxosuspect	72.3	
Kenya	IHA	Blood donors	54.0	Griffin & Williams (1983)
	Dye test		43.0	
Oman	DA	Children	62.0	Idris & Ruppel (1994) Elbualy <i>et al</i> (1995)
	ELISA	Adults	54.0	
		Pregnant women	42.3	

* In Griffin & Williams, 1983

1-7 In Abdel-Hameed, 1991

pregnant women by ELISA, DA and MEIA are shown in Table 4. When compared to each other, the three assays agree within a range of 86-98.5% and statistically there is no significant difference ($\chi^2 = 1.67$, $P > 0.05$). Table 5 shows the prevalence of *Toxoplasma* antibodies in some surveys done in Africa, Middle East and Asia.

Discussion

Currently the most widely used screening test for toxoplasmosis is ELISA. When compared to the dye test, it is reported to give a higher sensitivity. The DA test which is simple to perform and does not require sophisticated and expensive equipment agrees well with the dye test. In the present study, the MEIA, which is the most recent and technically easier to perform and least time consuming, was compared to ELISA and DA. The agreement between ELISA and MEIA is 98.5%. The agreement between ELISA and MEIA to DA is 86% and 87% respectively (Table 4). The three techniques may be used for *Toxoplasma* serosurveys, however, ELISA and MEIA are considered better routine diagnostic tests for patients, as false positives may occur with DA.

The average prevalence of *Toxoplasma* antibodies obtained in this study (21.5%) is quite low when compared to other studies (Table 5). Different regions of Oman showed significantly variable and comparatively higher prevalence rates (Idris and Ruppel, 1994; Elbualy *et al.*, 1995). Hygienic conditions, socio-economic status, food habits and environment can have a great influence on the transmission of toxoplasmosis (Zardi *et al.*, 1980).

Several studies have indicated that seroprevalence to toxoplasmosis increases with age (Hinz, 1991). However, our data in the three groups do not indicate a consistent rise of prevalence with age. Idris and Ruppel (1994) reported a seroprevalence of 62% among school children 8 to 16 years of age and 54% prevalence among adults in Dhofar, Southern Oman. The present study revealed a prevalence of 21% among children one day to six years of age. Idris and Ruppel (1994) suggested that most infections are acquired during childhood which agrees with the present findings.

Sex differences in the prevalence of toxoplasmosis has been reported. In some cases the prevalence was higher in females; in others, it was higher in males and some found no sex differences. The present study shows no sex difference in the prevalence of toxoplasmosis in the sample of children. The higher prevalence among pregnant women, compared to the blood donors, 95% of whom were males, could be explained by the females possibly being more exposed to cysts during meat preparation. The low prevalence of *Toxoplasma* antibodies among healthy blood donors is difficult to explain.

The results of this study and that conducted by Idris

and Ruppel (1994) and Elbualy *et al.*, (1995) suggest that toxoplasmosis is common in Oman, with most infections being acquired during childhood, yet severe and/or congenital cases are rarely reported.

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