

Research Note

Age-dependent, Naturally Occurring Immunoglobulin M Antibody Levels to *Toxoplasma gondii* in a Human Population

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(Accepted for publication: December 4, 1990)

Key words: *Toxoplasma gondii*, natural antibody, immunoglobulin M, seroepidemiology

The presence of naturally occurring antibodies to *Toxoplasma gondii* has been demonstrated by using several sero-tests; direct agglutination (Fulton & Turk, 1959), complement fixation (Fulton & Fulton, 1965), indirect immunofluorescent antibody (Sulzer & Hall, 1967), Western blotting analysis (Potasman *et al.*, 1986), and enzyme-linked immunosorbent assay (ELISA; Konishi, 1989). In a previous survey (Konishi, *in press*), varying immunoglobulin (Ig) M antibody levels were observed in an adult Japanese group negative for IgG antibodies. It was suggested that natural IgM antibodies almost undetectable at birth, develop until 1 year of age and thereafter are maintained throughout life. When adult sera of different age groups were compared, high IgM antibody levels tended to appear more frequently in younger individuals. However, subsequent statistical analyses failed because of a limited number of samples. In the present report, another survey with enough samples for a close analysis, was performed to relate IgM antibody levels to age.

A total of 1,898 serum samples were collected from inhabitants aged 18–91 years in Miki City, Japan. This population was previously described by Konishi and Takahashi (1987). IgG and IgM antibodies to *Toxoplasma* were determined by a

conventional ELISA essentially as previously described (Konishi & Takahashi, 1983). The positive controls for IgG and IgM antibodies were obtained from a chronically infected person and an acutely ill patient, respectively. Significance of differences was evaluated by the Fisher-Behrens test according to the method described by Campbell (1967).

Sera from 1,283 individuals showed IgG antibody levels of <0.1 in ELISA value, composed of 330 males and 953 females. Frequency distribution of IgM antibody levels for each age group (Fig. 1) consistently indicated binomial patterns with a peak at ELISA values of 0.1–0.3. There was also a tendency that higher IgM antibody levels were more frequently observed in younger populations. To ascertain this age-antibody relation more closely, comparison of mean ages was made (Table 1). In a population with IgG antibody levels of <0.1, the mean age of individuals with IgM antibody levels of 0.8–1.4 was significantly lower than that of the corresponding total population both in male and female, while the mean age of females with IgM antibody levels of 0.0–0.2 was significantly higher than that of the total population. A similar result was obtained in females with IgG antibody levels of ≥ 0.1 .

In the previous study (Konishi, *in press*), serum samples used were negative for rheumatoid factor (RF) and antinuclear antibodies (ANA), which are reported to cause nonspecific reactions in conventional ELISA for detecting IgM antibody (Araujo *et al.*, 1971; Camargo *et al.*, 1972;

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Naot *et al.*, 1981). In addition, no infection in the survey population was confirmed with paired samples collected from the same individuals one year after, which showed ELISA values of <0.1 for IgG antibodies. Although the serum samples

of the present population were not checked for these factors, the distribution pattern (Fig. 1) was almost the same as the previous data. The proportion of sera with RF and/or ANA was regarded as small enough, and as was reported with the same population (Konishi & Takahashi, 1987), yearly incidence of newly acquired infection was estimated to be $<1\%$.

Statistical analysis of mean ages indicated significant differences between groups with low and high IgM antibody levels (Table 1). Although this study was designed from a 'synchronic' but not a 'diachronic' aspect, the result suggested that the natural IgM antibody level may decrease with age. Considering that most paired sera collected at yearly intervals showed constant IgM antibody levels without changing ELISA values of ≥ 0.1 (Konishi *in press*), the decrease in IgM antibody level seems to be so gradual that the change cannot be detected within a one-year period. In frequency distribution of antibody levels (Fig. 1), the decrease was noted mainly in younger individuals with relatively high IgM antibody levels and most people still had natural IgM antibodies at ages ≥ 60 years.

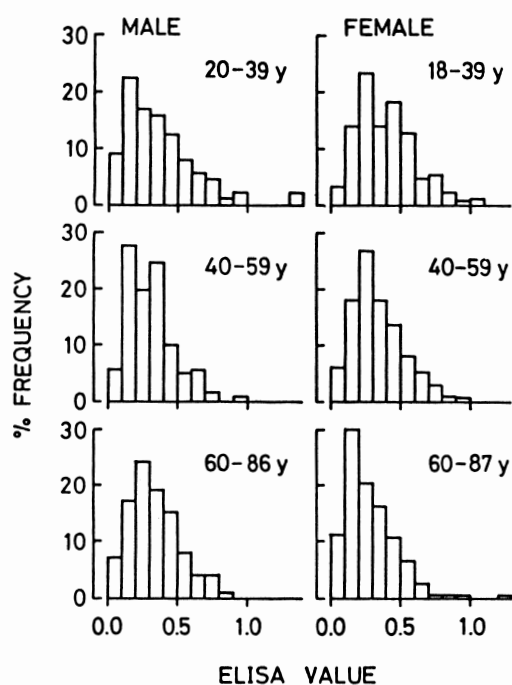


Fig. 1. Percent frequency distribution of ELISA values for IgM antibodies in 3 age groups of male and female populations with IgG antibody levels of <0.1 . The number of sera was 89 (20-39 years), 142 (40-59 years), and 99 (60-86 years) in males, and 278 (18-39 years), 479 (40-59 years), and 196 (60-87 years) in females.

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Table 1. Comparison of mean ages in relation to IgG and IgM antibody levels to *Toxoplasma* in 1,898 serum samples from Miki inhabitants.

Sex	IgG antibody level	IgM antibody level					Total
		0.0-0.2	0.2-0.4	0.4-0.6	0.6-0.8	0.8-1.4	
Male	<0.1	49.5 (99)*	52.5 (135)	51.5 (62)	48.0 (27)	39.9 (7)†	50.8 (330)
	≥ 0.1	60.3 (68)	58.8 (78)	62.2 (51)	58.6 (19)	67.1 (8)	60.3 (224)
Female	<0.1	52.7 (244)‡	47.9 (390)	45.7 (225)†	43.4 (73)‡	40.6 (21)†	48.1 (953)
	≥ 0.1	59.7 (93)‡	53.4 (149)	52.2 (82)	51.4 (47)	46.7 (20)†	54.1 (391)

* Mean age (No. of samples).

† Significant difference from data of the total population ($P < 0.05$).

‡ Significant difference from data of the total population ($P < 0.01$).

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