

# Serological Survey of Toxoplasmosis in the Transvaal

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## SUMMARY

Thirty-seven per cent of 606 samples of human sera collected from four ethnic groups in South Africa gave a positive *Toxoplasma* indirect fluorescent antibody test at a dilution of 1/16 or higher. The incidences in Indians (58%) and Coloureds (43%) were significantly higher than in Blacks (29%) and Whites (33%). These differences were regarded as being due to cultural rather than to socio-economic factors. Some evidence for the importance of contact with felines in the epidemiology of toxoplasmosis is presented.

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Several studies have been published on the epidemiology of toxoplasmosis in various parts of tropical Africa.<sup>1</sup> Information on the incidence of this infection in man in South Africa is restricted to a toxoplasmin skin test survey of hospitalised Black patients,<sup>2</sup> serological tests on patients with suspected toxoplasmosis<sup>3</sup> and a small number of cases of acute and chronic infection.<sup>4-10</sup>

In view of the limited data available, a survey to establish the incidence of toxoplasmosis in the Transvaal based on serological evidence was undertaken. Of the tests available the Sabin-Feldman methylene blue dye (MBD) test could not be used in our laboratory because of the risk of infection with live organisms. The indirect fluorescent antibody (IFA) test, which uses killed organisms as a source of antigen, has been shown to be as reliable as, and equivalent to, the MBD test,<sup>11,12</sup> and was therefore chosen as the most suitable method for the present survey.

## METHODS

The majority of samples were obtained from human sera sent to the South African Institute for Medical Research for routine serological testing (mainly employment and antenatal screening) or from blood donors. In addition, 29 (White) sera were collected from exhibitors at a cat show and 10 from Indian medical students. Clinical toxoplasmosis was not suspected in any of these sources.

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Sera were inactivated at 56°C for 30 minutes, and stored at -20°C until tested. IFA tests using commercially prepared antigen (Wellcome Reagents Ltd, Beckenham, England) were performed on multispot slides, using initial serum dilutions of 1/8, 1/16 and 1/64, according to standard methods.<sup>13</sup>

Specimens were examined under a Reichert fluorescent microscope with dark-field illumination at a magnification of 600 times, and organisms showed a complete ring of fluorescence were read as positive. Only those sera giving a positive reaction at a dilution of 1/16 or higher were recorded as having a significant titre of antibody. Weak positives were clarified by comparison with the 1/8 dilution, and all specimens giving a positive reaction at 1/64 dilution were further titrated to give an end-point. Each slide was read independently by two of the authors (MRJ and PRM) and in the few cases of discrepancy the sera were retested. Reproducibility of results in our laboratory was established by random retesting of specimens.

## RESULTS

Of the 806 samples investigated, 296 (37%) were found to give a positive *Toxoplasma* IFA test at a dilution of 1/16 or higher. The results were assessed in relation to ethnic group, age and sex.

The highest incidence of antibodies occurred in the Indian population (58%), and the lowest in Blacks (29%). There was no significant difference (Table I) between the incidence in Blacks and Whites ( $\chi^2 = 0.9 @ 1^\circ f, 0.4 > P > 0.3$ ), but significant differences were found between the incidence in these two groups combined and the incidence in Coloureds ( $\chi^2 = 10.4 @ 1^\circ f, 0.005 > P > 0.001$ ) and in Indians ( $\chi^2 = 12.7 @ 1^\circ f, P < 0.001$ ).

TABLE I. TOXOPLASMA FLUORESCENT ANTIBODY TITRES IN DIFFERENT ETHNIC GROUPS

| Titre       | Black | White | Coloured | Indian | Total |
|-------------|-------|-------|----------|--------|-------|
| 1/16        | 36    | 62    | 92       | 18     | 208   |
| 1/64        | 26    | 13    | 14       | 6      | 59    |
| 1/128       | 11    | 4     | 8        | 1      | 24    |
| 1/256       | 1     | 0     | 2        | 0      | 3     |
| 1/512       | 1     | 0     | 1        | 0      | 2     |
| Totals      | 75    | 79    | 117      | 25     | 296   |
| Sample size | 255   | 236   | 272      | 43     | 806   |
| Percentage  | 29    | 33    | 43       | 58     | 37    |

+ve

IFA titres in different age groups (Table II) show an increasing incidence of antibodies up to the 41-50-year age group (46%), which then decreases in the 51+-year age group (35%).

TABLE II. TOXOPLASMA FLUORESCENT ANTIBODY TITRES FOR DIFFERENT AGE GROUPS

| Titre                 | Age (years) |            |            |           |           | Unknown    | Total      |
|-----------------------|-------------|------------|------------|-----------|-----------|------------|------------|
|                       | 0-20        | 21-30      | 31-40      | 41-50     | 51+       |            |            |
| 1/16                  | 21          | 60         | 36         | 28        | 13        | 50         | 208        |
| 1/64                  | 4           | 16         | 9          | 5         | 3         | 22         | 59         |
| 1/128                 | 6           | 2          | 3          | 2         | 3         | 8          | 24         |
| 1/256                 | 0           | 0          | 1          | 0         | 0         | 2          | 3          |
| 1/512                 | 0           | 0          | 0          | 1         | 0         | 1          | 2          |
| <b>Totals</b>         | <b>31</b>   | <b>78</b>  | <b>49</b>  | <b>36</b> | <b>19</b> | <b>83</b>  | <b>296</b> |
| <b>Sample size</b>    | <b>102</b>  | <b>225</b> | <b>128</b> | <b>79</b> | <b>54</b> | <b>218</b> | <b>806</b> |
| <b>Percentage +ve</b> | <b>30</b>   | <b>35</b>  | <b>38</b>  | <b>46</b> | <b>35</b> | <b>38</b>  | <b>37</b>  |

Among the ethnic groups (Table III) the White population generally followed this pattern, whereas in the Black population the maximum incidence (26%) occurred in the 21-30-year age group. In the Indian population the maximum incidence (79%) occurred in the 0-20-year age group, and in the Coloured population an incidence of about 43% was found in each age group.

TABLE III. INCIDENCE OF TOXOPLASMA ANTIBODIES IN EACH ETHNIC GROUP — AGE DIFFERENCES\*

| Age group | White    | Black    | Coloured | Indian   |
|-----------|----------|----------|----------|----------|
| 0-20      | 16% (13) | 17% (49) | 43% (23) | 79% (15) |
| 21-30     | 31% (51) | 26% (73) | 42% (84) | 47% (17) |
| 31-40     | 48% (23) | 18% (22) | 39% (80) | 100% (3) |
| 41-50     | 44% (18) | 14% (5)  | 47% (55) | — (1)    |
| 51+       | 27% (22) | 17% (6)  | 43% (21) | 60% (5)  |

\* Sample size in brackets.

The incidence in males was consistently higher than in females (Table IV), although this difference was not significant ( $\chi^2 = 1.62$  @ 1°f,  $0.3 > P > 0.2$ ). Among the White, Black and Coloured groups, the incidence in males was about 5% higher than in females, while in the smaller Indian group the difference was 34%.

Sixteen of the 29 sera (55%) from cat-show exhibitors were positive at a dilution of 1/16 or higher.

## DISCUSSION

Various studies on the epidemiology of toxoplasmosis have demonstrated that, apart from congenital transmission, infection may be acquired from either the consumption of raw or undercooked meat containing cysts, or the ingestion of oöcysts excreted in the faeces of the domestic cat.<sup>11</sup>

TABLE IV. TOXOPLASMA FLUORESCENT ANTIBODY TITRES — SEX DIFFERENCES

| Titre                 | Female     | Male       | Unknown  | Total      |
|-----------------------|------------|------------|----------|------------|
| 1/16                  | 114        | 94         | 0        | 208        |
| 1/64                  | 23         | 36         | 0        | 59         |
| 1/128                 | 12         | 11         | 1        | 24         |
| 1/256                 | 2          | 1          | 0        | 3          |
| 1/512                 | 1          | 1          | 0        | 2          |
| <b>Totals</b>         | <b>152</b> | <b>143</b> | <b>1</b> | <b>296</b> |
| <b>Sample size</b>    | <b>439</b> | <b>364</b> | <b>3</b> | <b>806</b> |
| <b>Percentage +ve</b> | <b>35</b>  | <b>39</b>  |          | <b>37</b>  |

However, the relative importance of these sources has not been determined.

A number of MBD test surveys carried out in several tropical African countries have recorded a wide variation in the incidence of *Toxoplasma* antibodies, ranging from 12% (11/94) in Uganda<sup>15</sup> to 83% (20/24) in parts of Nigeria.<sup>16</sup> The results recorded here with the IFA test (37%, 296/806) fall well within these limits.

Our finding of 29% (75/255) positive in South African Blacks accords well with that reported by Schneider *et al.*<sup>2</sup> of 31% (65/209) positive in a toxoplasmin skin test survey on a similar ethnic group.

Annual reports of the SAIMR<sup>3</sup> have indicated incidences of between 27% and 38% in patients with suspected toxoplasmosis, using the MBD test. The relatively high general incidence shown in our study is explained by the large number of Coloureds and Indians included in our survey, compared with their numbers in the general population.

The peak age incidence of 31-50 years in the general population does not differ from that reported elsewhere. However, earlier peak age incidences which are found in the Black (21-30 years), Indian and Coloured (0-20 years) populations possibly indicate an earlier or more extensive contact with the infective agent in these communities.

Socio-economic factors do not seem to be important in determining the incidence of *Toxoplasma* antibodies, since similar incidences were found in Whites and Blacks (Table I), despite their wide socio-economic differences. Evidence incriminating cultural factors can be drawn from the results of the Indian community, where the incidence of *Toxoplasma* antibodies in males far exceeds that in females. In view of the relatively small sample size, this finding and the apparently high incidence of toxoplasmosis in the Indian group as a whole warrants further investigation.

Since contact with raw meat is more frequent among the Black population, which had the lowest incidence of *Toxoplasma* antibodies, such contact cannot be incriminated as an important source of infection in South Africa.

The incidence of antibodies in sera collected from cat-show exhibitors (55%) was higher than that recorded for the general population (37%), or from the White group (35%), suggesting that contact with this animal may be important in the epidemiology of toxoplasmosis.

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