

Latent Infection by *Toxoplasma gondii* in Korea¹

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Toxoplasmosis is a disease of a variety of species of mammals and birds, and occurs in many parts of the world. Since Wolf and Cowen(1931) first described human infection in the U.S.A., a considerable number of human infections have been reported by many workers in various parts of the world. However, there has not been any definite conclusion about the mode of infection.

Recently, Eyles et al. (1959) investigated over 2,300 animals principally of 20 species of domestic and wild animals by means of the dye-test and by parasitological studies in the Memphis area. He found, as a general rule, that domesticated animals showed a much higher incidence than did wild animals. In fact, no infections were demonstrated in wild animals. From such observations, it may be presumed that *Toxoplasma* infection of humans is closely related to domestic rather than to wild animals, although there has been no definite host found as yet.

With this in mind, the authors carried out the following studies in Korea with emphasis on the meat handlers of the peninsula and the predominantly fish handlers of the off-shore islands.

MATERIALS AND METHODS

Antigen (*Toxoplasma* 1 : 1000) was supplied from the National Institute of Health, U.S.A., and from Eli, Lilly & Co. Control solutions of antigen were also supplied from these respective sources. Employees of slaughter houses were selected as the

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meat handlers. For fishermen, we selected two offshore islands (Bang-Cheuk-Do, Deuk-Jok-Do), which are 80 miles apart off the west coast of Korea. Although most of the fishermen have domestic animals, their main livelihood was fishing.

Students and ordinary ward patients were selected as controls. We inoculated 0.1 cc of antigen into each subject, as well as a control solution, the former on the right forearm and the latter on the left. The results were checked 24 hours after the inoculation. To be positive, the erythema or induration should be over 10 mm in diameter on the antigen side only. All of the cases except some of the Deuk-Jok-Do islanders were tested with the N.I.H. antigen. On Deuk-Jok-Do island 30 people were examined with the Lilly antigen in September, 1959, and showed 8 positive reactions. In May, 1960, the remaining islanders, including 13 cases from the former group, were examined, and we found that the skin reactions were the same with the two antigens.

RESULTS

As a general rule, the group over age 30 showed a much higher incidence of positive reactors than did the younger group (Table 1). Among 137 fishermen, those below the age of 30 showed

Table 1. *Toxoplasma* Skin Tests by Age, including all groups—Normal, Meat Handlers and Fishermen

| Age | Number examined | Results | |
|-------|-----------------|----------|-------------|
| | | Negative | Positive(%) |
| 3-20 | 163 | 161 | 2 (1.2) |
| 21-30 | 53 | 51 | 2 (4.0) |
| 31-40 | 67 | 57 | 10 (15.0) |
| 41-78 | 90 | 83 | 7 (8.7) |
| Total | 373 | 352 | 21 (5.8) |

positive reactions in 1.2%, whereas 16% of those over 30 years were positive. The sexes also showed a marked difference. Males were positive seven times as often as females (Table 2). The butchers and fishermen examined showed positive reactions

Table 2. Toxoplasmin Skin Tests by Sex, including all groups — Normal, Meat Handlers and Fishermen

| Sex | Number examined | Results | |
|--------|-----------------|----------|-------------|
| | | Negative | Positive(%) |
| Male | 269 | 249 | 20(7.6) |
| Female | 104 | 103 | 1(1.0) |

about 8 to 9 times as frequently as in the normal group. The relatively high incidence in fishermen suggests that some of the sea fish may be responsible for Toxoplasma infection as well as animals. Although the range of ages was similar on the two islands, the Bang-Cheuk-Do islanders showed a much lower incidence than Deuk-Jok-Do islanders. The main sea fish caught by these islanders were Hair tail and Yellow corvenia (Table 3).

Table 3. Toxoplasmin Skin Tests by Occupation

| Occupation | Number examined | Results | |
|---------------|-----------------|----------|-------------|
| | | Negative | Positive(%) |
| Normal | 145 | 143 | 2(1.3) |
| Butchers | 91 | 84 | 7(7.8) |
| Fishermen | 137 | 125 | 12(9.5) |
| Bang-Cheuk-Do | 46 | 45 | 1 |
| Deuk-Jok-Do | 91 | 80 | 11 |

DISCUSSION

Of those skin tested in the present survey, the cases positive to Toxoplasmin showed a very low incidence as compared to earlier reports from abroad. In Japan, Kitamura (1956) reported 27—67% in the 10—49 year age group. Sabin (1948) reported positive skin reactions in 5—45% in those aged 5—55 in the U.S.A. Gard (1951) also found a 48% incidence in those from 20—50 in Stockholm, Sweden. The positive ratio increased as the age approached 40, while the group over 40 years old showed an incidence almost half that of the lower age groups. This figure was in contrast to the results of Gibson et al. (1956), who found 33.8% positive at the ages of 20—29 and 50% at the ages of 40—60, and who also found 22.5% of males positive and 21% of females.

In the present survey, sex showed a marked difference between male and female, a ratio of 7.6 : 1.0. Although it cannot be definitely ascertained as yet, it is presumed that the mode of life would have some bearing on this. In Korea, the older age group and females generally have their activities limited to the home.

It has long been realized that Toxoplasma infects many species of animals including domestic stock, but direct transmission of the disease from animal to man has not been proved as yet. Farrel (1952) found the organism in diseased hogs, and Sanger (1953) isolated the organism from milk and from the muscles of infected cows. The data suggests the possibility that man may become infected from meat and milk. According to the above findings, the possibility of infection from animal to man is presumed to be by ingestion of improperly cooked meat and the consumption of raw milk (Jacobs 1954, Slim 1955). In our studies, the relatively high prevalence of latent infection of Toxoplasma among the butcher group suggests that domestic animals, especially cattle, would be one of the important agent of Toxoplasma infection in Korea. This may be the first survey of Toxoplasmosis in Korean fishermen. It is interesting that this group also showed almost the same incidence as in the butcher group. They also showed a much higher rate in the group over 30 years of age (16%) than in below 30 years (1.3%). It is presumed that some fish may transmit the Toxoplasma parasite to human beings.

SUMMARY

1. Toxoplasmin skin tests on 373 Koreans gave positive results in 5.6%.
2. Males were infected 7 times as often as females.
3. The butcher (7.8%) and fishermen (9.5%) groups showed a higher incidence than the average group (1.3%).

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