

# Occupational distribution of Leptospiral (SEL) antibodies in West Malaysia

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## Introduction

LEPTOSPIROSIS IS HIGHLY endemic in West Malaysia, especially in the rural areas (Tan, 1970a). About 30 different pathogenic serotypes leptospire have been isolated (Alexander et al., 1957) and clinical cases have been extensively reported in civilian (Turner et al., 1959; Tan, 1970b) as well as in military groups (McCrumb et al., 1957; Alexander, 1957).

A serological survey to determine the status of leptospirosis in various occupational groups was conducted throughout West Malaysia from 1961 through 1971, the results of which are presented in this article.

## Materials and Methods

A total of 4,646 sera was obtained from afebrile persons of 18 occupational groups in various states of West Malaysia. Some of these were collected and sent to the laboratory by the staff of health

centres, clinics, hospitals, veterinary departments and military camps, and the others were taken personally by the author and her assistant who visited the various states for this purpose.

The technique employed for the serological survey was the Sentsized-Erythrocyte-Lysis (SEL) test described by Chang et al. (1957). The antigen or Erythrocyte Sensitising Substance (ESS) was prepared from the AM strain of *Leptospira biflexa*. The SEL test has been evaluated as an epidemiological tool for human leptospirosis serological surveys (Tan, 1969), and the significant titre was found to be 1:80.

## Results and Discussion

Table 1 shows the distribution of SEL antibodies among 18 occupational groups in West Malaysia, the total incidence of which was 12.7% or 592/4,646.

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Table 1

**SEL Antibody Distribution among 18 occupational groups in West Malaysia (in order of frequency)**

Group	No. examined	No. pos.	% pos.
Oil palm estate workers	92	30	32.6
Hospital staff	47	12	25.5
Rubber estate workers	427	99	23.2
Town cleansing labourers	459	82	17.9
Malaysian armed forces	290	50	17.2
School children	176	30	17.0
Tin miners <sup>1</sup>	122	20	16.4
Farmers	204	30	14.7
Anti-malarial labourers	246	32	13.0
Padi planters	259	37	14.2
Shop-owners	172	21	12.2
Policemen	154	18	11.7
Veterinary staff	463	54	11.6
School teachers	53	5	9.4
Housewives	1201	64	5.3
Office workers	120	6	5.0
Tin miners <sup>2</sup>	136	2	1.5
Fishermen	25	0	0
<b>Total</b>	<b>4,646</b>	<b>592</b>	<b>12.7</b>

1. Of open cast, dredge and gravel pump mines
2. Of a lode or underground mine.

The highest rate of infection was found among workers in **oil palm estates**. Here, the main rat species is the *R. jalorensis* rat which, although normally arboreal in habitat, is strongly attracted in great numbers to ground level when the fruit is cut down and stored. Although the incidence of leptospirosis in this rat species was found to be only 3% (Smith et al., 1961) their sheer abundance in numbers in these estates more than facilitates transmission of leptospirosis to the workers the majority of whom live, as well as, work there.

The antibody prevalence ratio in **rubber estate workers** was also high (23.2% or 99/427), but it was found to vary considerably among different estates depending on their acreage and hence, their relative proximity to secondary forest with highly infected ground rats (Tan, 1970a). Of five rubber estates studied, very high antibody ratios were found in three of them and very low, in the remaining two (Table 2). Here, the main rat species is also *R. jalorensis* but unlike the conditions in the oil palm estates, these tree rats are not attracted to ground level by the products of the rubber tree in the same way as they are by the oil palm fruit and are therefore not expected to be an important source of leptospirosis to the rubber estate workers. The extremely high infection rates found in the

Table 2

**Leptospiral SEL Antibody studies in five rubber states in West Malaysia**

Locality	State	No. Examined	Positive	Per Cent
GUA MUSANG	KELANTAN	37	17	45.9
PUCHONG	SELANGOR	50	22	44.0
TANGKAK	JOHORE	54	23	42.6
SUNGEI CHOH	SELANGOR	60	2	3.3
BATU TIGA	SELANGOR	80	0	0
<b>TOTAL</b>		<b>281</b>	<b>64</b>	<b>22.8</b>

above-mentioned three estates must therefore be attributed to factors other than those directly related to the rubber industry.

Many rubber estates, especially the small ones, are closely adjacent to forest areas and are likely to be invaded by the highly infected rats from them. Most of the workers, in the course of their daily duties, trudge through the estate bare-footed. After a period of rainfall, the water on the ground, if previously contaminated with infected rat urine, may well serve as an effective vehicle for the transmission of leptospirosis through the worker's feet, the skin of which is often far from intact. This situation is, in fact, true of the three estates which showed high antibody prevalence ratios. Secondary forests are, indeed, situated near or around these estates, whereas the last two estates, with extremely low antibody ratios, stretch for miles across the country with hardly a secondary forest in sight. Another possible means of infection is through infected house rats and scrub or grassland rats, which commonly enter homes from their normal habitat. The quarters of the estate workers, situated in the estates, themselves, are therefore easily accessible to them.

**Hospital staff members** appeared also to be highly infected (25.5% or 12/47). Whether the infection was acquired from the hospital environment or from their own homes is not known, but the easily available facilities for medical and laboratory investigation could have increased the chances of detection of the disease in this group.

**Town cleansing labourers** deal with refuse collection and sweeping of roads and drains. As expected, they were quite highly infected (17.9% or 82/459). The **anti-malarial labourers** have a slightly lower prevalence ratio of 13.0% or 32/246.

Two groups of **Malaysian soldiers** were studied in 1970 (Tan & Lopes, 1972). They comprised (i)

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those in service for six months to 20 years and (ii) those newly recruited for only two to three weeks. Of the first group, 12.1% or 17/140 showed significant titres of SEL antibodies, whereas 22.0% or 33/150 were positive in the second group. The overall rate was 17.2% or 50/290. These results were contrary to expectation but may be explained by the fact that most of the new recruits were from rural areas where leptospirosis abound and therefore showed a higher antibody ratio. The experienced soldier, on the other hand, is exposed to leptospirosis only when he is posted to an infected area and even then, because he is taught the basic elements of personal hygiene and is required to observe certain precautionary measures, is less likely than the village youth to become infected with the disease.

The incidence of clinical leptospirosis in Malaysian soldiers (4.6% or 2/43) was very much lower than that of the British soldiers (30% or 28/93) examined in 1960-61. Only 4.9% or 10/204 of the British soldiers had significant levels of SEL antibody.

**Schoolchildren**, especially those living in rural areas, are relatively highly infected (17.0% or 30/176). **School teachers**, on the other hand, have a low rate of infection (9.4% or 5/53). This is easily appreciated as it reflects the care-free way of life led by the former group compared with the latter, since village children think nothing of drinking from or bathing in nearby streams and rivers, and usually run around bare-footed.

The **tin miners** examined belonged to two categories: (i) those engaged in open cast, dredge and gravel pump mines which employ water in the mining process; and (ii) those who work in lode or underground mines which extend to depths varying from 200 to 1,600 feet and which are relatively dry. The much higher rate of infection in the first category (16.4%) as compared with the second (1.5%) may be attributed to the wetter conditions of work in the first group. The resident medical officer of the lode mine studied, Dr. B. Freman, suggested that the very low prevalence of leptospirosis in his mine might be due to the usage of herbicides along streams and drainage channels in routine anti-malarial work (personal communication).

**Farmers and padi planters** were both only moderately infected. The padi planters in the state of Kelantan were studied in connection with the pH values and chemical composition of the soil in the ricefields (Tan, 1970c). Clinical leptospirosis was not as frequent as expected in this group of workers although the infection rate was about 12%

in this state. The pH values of soil and water samples were very low (mean pH: 4.8 to 5.9) and the soil type was mainly clay, which has been found in the laboratory to adsorb leptospires (Smith & Turner, 1961). Although the rodent host species most frequently found in the Malaysian ricefields, viz. *R. argentiventer*, had a high leptospiral excretion rate, when the inlet and outlet water of a ricefield was checked for leptospires during a 5½-month period of observation, the outlet water yielded only half the number of isolates as the inlet water (Baker, unpublished findings). This may be due to the water and soil conditions which were unfavourable for the survival and multiplication of the leptospires excreted into the ricefield. The low frequency of clinical leptospirosis in ricefield workers may therefore be attributed to acquired immunity through continued infection by leptospires which have not only been reduced in dosage but also in virulence.

Shops in West Malaysia, especially those dealing in sundry goods and groceries, are often infested with rats. The incidence of leptospirosis in house rats have been found to be 34% for *R. norvegicus* and 3% for *R. diardi*, (Smith et al., 1961). As these shops usually also serve as places of residence for the owners, it is not surprising the shopowners show a relatively high leptospiral infection rate (12.2%).

The **police force** of various states was also studied for SEL antibody prevalence. Of 154 examined, 18 or 11.7% were positive. As most of the policemen were from rural areas, it is not certain whether the infection was acquired from their kampongs (or villages) or through trudging across country terrain during the course of their duties.

Representative samples of blood, ranging in number from 26 to 81, were obtained from members of the **veterinary staff** from ten states in West Malaysia. The overall incidence was 11.6% or 54/463. However, the rates varied considerably from state to state, the infection being highest (44.4%) in Selangor and the lowest, (2.3%) in Johore. The possible reasons for these variations are being studied, mainly in connection with the incidence of leptospirosis in the animals handled by this group of workers.

**Housewives and office workers**, who are mainly from urban areas, showed low prevalence ratios, as expected.

No evidence of infection was found among **fishermen**. However, the number studied was too small for a valid conclusion.

**Clinical Leptospirosis by Occupation**

In West Malaysia, the number of clinical leptospiral cases severe enough to be hospitalised (and eventually laboratory-confirmed as leptospirosis) has been small compared to the number of infected persons detected by antibody surveys. In the ten-year clinical appraisal of leptospirosis in West Malaysia (Tan, 1970b), out of 1,993 suspected cases examined, only 559 cases (28%) were confirmed positive. This works out to an average of about 56 cases annually or 0.59 cases per 100,000 population per year, based on the estimated population of West Malaysia as at 31st December, 1970, which was 9.36 million.

The relatively low clinical rate may be attributed to infection by serotypes, the majority of which give rise to subclinical or mild forms of leptospirosis. In addition, SEL antibodies are acquired as early as four to six years of age, especially by children in rural areas. These antibodies persist throughout the older age groups at much the same levels (Table 3). As SEL antibodies last for about two years only (Tan, 1969), this indicates constant re-infection throughout life, even up to 60 years and above, the repeated booster effect conferring a high state of immunity to the general population.

**Table 3**  
Leptospiral SEL Antibody ratios in different age groups

Age groups	No. examined	Positive	Per cent
0 - 10	193	19	9.8
11 - 20	781	99	12.7
21 - 30	1,571	191	12.2
31 - 40	1,080	111	10.3
41 - 50	673	90	13.4
51 - 60	331	42	12.7
60 or more	190	16	8.4
Total	4,819	568	11.8

Analysis of the 559 cases of clinically confirmed leptospirosis showed that only in 307 cases (54.9%) were the occupation of the patient recorded in his data form, although it had been repeatedly stressed that this particular information was important (Table 4). This was most unfortunate, as much of the reliability of the occupational distribution figures was lost. However, bearing this in mind, on examination of the available data, it was found that the "general labourers" who deal with cleansing, anti-malarial work and forestry were most susceptible to the severe effects of the disease. Next in

order of frequency were the rubber estate workers, schoolchildren and soldiers, who were mainly of Caucasian origin. Very few Malaysian soldiers were affected. Contrary to expectation, the padi planter, the vegetable farmer and the veterinary worker were not among the highly affected groups. Possible reasons for the relative low clinical rate in padi planters have been discussed in the foregoing. Oil palm estate workers were not represented here in spite of their high exposure to the disease. However, some of them could have been included under the "unknown" category.

**Table 4**  
Distribution of 559 cases of Leptospirosis according to occupation (1958-1968)

Occupation	No. of cases	Per cent of total positive
General labourers	94	16.8
Rubber estate workers	53	9.5
School children	37	6.6
Army personnel (mainly Caucasian)	28	5.0
Housewives	23	4.1
Police	16	2.9
Shop owners	12	2.2
Padi Planters	8	1.4
Tin miners (miscellaneous)	7	1.2
Office workers	7	1.2
Farmers	7	1.2
Field research workers	6	1.1
Medical staff	6	1.1
Veterinary workers	1	0.2
Miscellaneous	2	0.4
Total	307	54.9
Unknown/unemployed	252	45.1
Grand total	559	100.0

**Summary**

A survey for leptospiral (SEL) antibodies was conducted throughout West Malaysia from 1961 through 1971 on 18 occupational groups. A total of 4,646 sera was tested of which 592 or 12.7% were positive.

High antibody rates (23.2% to 32.6%) were found among oil palm estate and rubber estate workers and hospital staff. Moderately high rates (13.0% to 17.9%) were observed in labourers, the army, tin miners (of open cast, dredge and gravel pump mines), farmers and padi planters. Moderate rates (11.6% to 12.2%) were found among shop-owners, policemen and the veterinary staff and low rates (1.5% to 9.4%), were detected in school

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teachers, housewives, office workers and tin miners of underground or lode mines.

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