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The risk of leptospirosis in United Kingdom fish farm workers

Results from a 1981 serological survey

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SUMMARY

Less than one per cent of serum samples taken from 257 fish farmers in 1981 had agglutinating antibodies to strains of *Leptospira interrogans* of serogroup Icterohaemorrhagiae at a titre of 30 or greater. Compared with the results from other serological surveys, this agglutinating antibody prevalence suggests that fish farming does not have a high occupational risk for leptospirosis. Between 1961 and 1981 the incidence in fish farmers was about 33 per 100000 person years at risk. During the same period the incidence in the general adult male population was 0·137 per 100000 person years at risk, so that fish farming had a moderately increased risk of Icterohaemorrhagiae serogroup infection (relative risk = 243). No one particular risk factor within fish farming could be reliably identified and therefore recommendations to reduce the risk can only be general.

INTRODUCTION

In late 1980 and early 1981 three cases of leptospirosis including one death, due to strains of serogroup Icterohaemorrhagiae, occurred amongst fish farmers in the United Kingdom. A preliminary serological survey of the workers on the farm where two of the cases occurred and on two other farms in the same area suggested an appreciable occupational risk of leptospiral infection (Robertson *et al.* 1981). Two of the three farms were heavily infested with rats, the natural host reservoir for leptospires of the Icterohaemorrhagiae serogroup. Only one previous case of leptospirosis in a fish farmer had been reported in the United Kingdom; this was in 1968 when an Essex man recovered from serologically confirmed leptospirosis, serogroup Icterohaemorrhagiae.

The three cases of leptospirosis within a small occupational group in a three-month period, caused by leptospires of a group that contains some of the most virulent

serovars, the heavy rat infestation of fish farms and the serological evidence of possible past infection in other workers suggested a high risk of leptospirosis in the fish farming industry. An investigation to estimate the level of this risk was therefore undertaken.

METHODS

A seroepidemiological survey of over 200 fish farm workers on 82 licensed farms in the south and south-east of England was planned. The population selected included all the fish farmers in the counties covered by the East and South East Region of the Employment Medical Advisory Service, the Thames Water Authority and the Isle of Man. Later a few Scottish fish farmers were also included in the survey. These areas were chosen because medical staff were available and willing to visit each fish farm in order to interview the workers and to obtain blood specimens.

The blood specimens were posted directly to the Leptospira Reference Unit for examination. The Microscopic Agglutination Test (MAT), the reference test for leptospirosis (WHO 1982), was carried out on the serum from each specimen beginning at a dilution of 1 in 10 through to 1 in 10000 using a full range of antigen pools each containing reference strains repesenting the 19 recognized serogroups of *L. interrogans*. A result was considered positive when 50% agglutination was observed and, where positive, the result, recorded as the antibody titre, was the highest dilution which gave rise to a positive reaction.

Information was collected from each participating fish farmer on age, sex, type of fish farm work, duration of fish farming, previous jaundice, frequency of prolonged fever and contact with animals, using a standardized interview record schedule. A second schedule was used to gather fish farm information on such variables as farm size, year of establishment, type of fish farmed, gutting and cleaning practice, amount of fish feed stocks, total number of workers, the duration of their employment and staff turnover in the previous two years.

RESULTS

Of the 82 fish farms in the survey areas, 67 (82%) were visited. Some of the 15 omitted were no longer in business and others could not be visited at a time when a doctor was available. A few farm owners refused to cooperate. Two Scottish fish farms were also visited, making a total in the survey of 69 farms.

Blood specimens were collected from 257 of the 312 current workers, a response rate of 82 per cent. Of the others a few were away at the time of the visit and others refused to allow a specimen to be taken. All adult age groups were represented in the study sample of which 89% of the participants were male. The age and sex distribution of the non-responders was similar to that of the responders. Just over half had been fish farming for 5 years or less and a few (16%) had farmed for 10 or more years. There was no appreciable difference in the duties undertaken by the various categories of fish farmers.

For most of the 19 farmers who said they were jaundiced in the past, the cause was unknown. Since they began fish farming 31 could recall a feverish illness which lasted three days or more; over three-quarters said the actiology of the fever was

Table 1. *Results of the microscopic agglutination test for leptospirosis on 257 fish farmers in 1981*

	Titre			
	10		1000	
	Negative	Positive	Positive	Total
Serogroup Icterohaemorrhagiae	254	2	1	257

Table 2. *Known occupational incidence rates for leptospirosis*

Occupation	Reported by		Serogroup or diagnosis	Estimated incidence per 100000 person years
Aberdeen fish cleaning workers	Davidson & Smith	(1936)	Icterohaemorrhagiae	1600
London sewer workers	Alston & Brown	(1937)	Icterohaemorrhagiae	700
Glasgow sewer workers	Stuart	(1939)	Icterohaemorrhagiae	3700
New Zealand dairy farmers	Christmas *et al.*	(1974)	Hebdomadis/Pomona	11000
New Zealand meat inspectors	Blackmore, Bell & Schollum	(1979)	Pomona/Tarassovi	560
New Zealand dairy farmers (milkers)	Mackintosh *et al.*	(1980)	Hebdomadis/Pomona	540
United Kingdom veterinarians	Constable & Harrington	(1982)	'Leptospirosis'*	31
			'Weil's disease'*	8
Hawaii prawn farmers	Anderson *et al.*	(1982*a*)	Icterohaemorrhagiae/ Canicola/Australis	540
Hawaii taro farmers	Anderson *et al.*	(1982*b*)	Icterohaemorrhagiae	2200

* Diagnosis as reported.

unknown. The three surviving cases of leptospirosis, known about prior to the survey, had all been jaundiced and had had a prolonged fever.

Only 3 of the 257 sera, collected in 1981 and tested by the microscopic agglutination test, reacted to the Icterohaemorrhagiae serogroup antigen pool and in two of these the antibody levels were low (Table 1). These 3 sera included 2 of the 3 fish farmers known to have suffered from leptospirosis; the serum from the patient who was ill in 1968 was still reactive at a dilution of 1 in 10 and the serum from the recent case, taken a few weeks after the patient's recovery, cross-reacted with a number of serogroups including Icterohaemorrhagiae at a dilution of 1 in 1000. The serum from the third known case of leptospirosis, the fish farmer who was ill in 1980, gave trace reactions at dilutions of 1 in 10 and 1 in 30.

Table 3. *Incidence of leptospirosis (Serogroup Icterohaemorrhagiae) in England, Wales and the Isle of Man*, 1961–1981

	Cases	Person years at risk	Incidence per 100000 person years
Fish farmers	4	12000*	33·333
General adult male population (15 years and over)	457†	333 million	0·137

* Estimated.

† Includes a small number of adult females and children.

DISCUSSION

The sample of fish farmers chosen in the survey was not random but nevertheless was probably representative of fish farming nationally; the areas surveyed were those where leptospirosis had occurred, and therefore any bias introduced by the non-random sample would tend towards an overestimate of the serological prevalence of antibodies. When the laboratory findings in the fish farmers were known, a serological survey in a suitable control group was considered to be unnecessary.

Agglutinating antibodies tend to decrease steadily during and after the convalescent period of leptospiral infection, but low levels may still be detected by the microscopic agglutination test for many months or even years after the patient has recovered. Residual antibody titres as low as 10 may therefore be significant of past infection.

One of 257 fish farmers had unequivocal evidence of leptospirosis infection, and this farmer's blood specimen was examined within four weeks of his illness. Of two others known to have been infected in the past, one had low levels of residual antibody. Other cross-sectional serological surveys (Anderson *et al.* 1982*a*, *b*; Blackmore, Bell & Schollum, 1979; Mackintosh *et al.* 1980; Smith & Davidson, 1936; Stuart, 1939) of high-risk occupations for leptospirosis have found agglutinating antibodies at a titre of 24 or greater in over 10% of persons. Not surprisingly many of these occupations also had a high documented incidence of leptospirosis (Table 2). The much lower prevalence of residual antibodies in fish farmers suggest that this occupation does not have the same level of risk as the known high-risk occupations.

There were 313 fish farms operating in England, Wales and the Isle of Man in 1981 compared with about 78 in 1971. As the number of past worker person years at risk per farm in a ten-year period was estimated from the survey results to be 25 person years, it was possible to calculate the total person years exposure to fish farming between 1961 and 1981 (Gill, 1983). The figure of 12000 person years at risk included a 20% allowance for fish farms which had closed for financial or other reasons. Amongst fish farm workers there were four leptospirosis cases, the three included in the survey and the earlier death, between 1961 and 1981, so the incidence of serogroup Icterohaemorrhagiae infection was 33 per 100000 person years at risk (Table 3). During the same period, the incidence of serogroup Icterohaemorrhagiae infection in the general adult male population was about

0·137 per 100000 person years at risk (Table 3); this risk was moderately overestimated because the numerator of 457 infections included some female cases and a few children.

Comparison of these incidences demonstrated that leptospirosis, serogroup Icterohaemorrhagiae, was a hazard of fish farming with a relative risk of 243, 95% confidence limits: 172–344 (Miettinen, 1974), and an attributable risk of 99·6%. However, an incidence of 500 per 100000 person years at risk, a suggested lower level for what might be called a high-risk occupation for leptospirosis (Table 2), represents a relative risk compared with the general British male working population of about 3650. On this scale the risk estimated for fish farmers was only moderately increased.

In assessing the importance of a particular risk, account should be taken of which particular leptospiral serogroup an occupational group is predominantly exposed to. Some of the identified high-risk groups throughout the world (Table 2), at the present time are exposed primarily to serogroup Hebdomadis, which has a lower case fatality rate than serogroup Icterohaemorrhagiae. From this point of view a moderate risk of Icterohaemorrhagiae serogroup infections in fish farmers may be as important as a high risk of infection with a different serogroup in another occupation.

Since it was not possible to identify any particular factor within fish farming which contributed most to the risk of infection apart from rat infestation, the general principles of regular reduction of the rat population, the rat-proofing of fish feed stores, avoidance of immersion in ponds and the wearing of protective clothing when working in areas likely to be contaminated by rat urine, are all recommended.

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