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Zoonotic infections in Northern Ireland farmers

C. F. STANFORD[1], J. H. CONNOLLY[2], W. A. ELLIS[3], E. T. M. SMYTH[4], P. V. COYLE[2], W. I. MONTGOMERY[5] AND D. I. H. SIMPSON[6]

[1] *Royal Victoria Hospital, Belfast BT12 6BA*
[2] *Regional Virus Laboratory, Royal Victoria Hospital Belfast*
[3] *Department of Agriculture, Northern Ireland*
[4] *Department of Bacteriology, Royal Victoria Hospital Belfast*
[5] *School of Biology and Biochemistry, Queens University of Belfast*
[6] *Department of Microbiology & Immunobiology, Queens University of Belfast*

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SUMMARY

Evidence of past zoonotic infection was investigated serologically in randomly selected Northern Ireland farmers. The percentage of farmers with antibody was: *Brucella abortus* (0·7), *Leptospira interrogans* serovars (8·1), *Borrelia burgdorferi* (14·3), *Toxoplasma gondii* (73·5), *Coxiella burnetii* (28·0), *Chlamydia psittaci* (11·1) and Hantavirus (1·2).

The results show that Northern Ireland farmers have been exposed in the past to zoonotic infections. It is not known if these infections contributed to ill health in farmers but it is now time for the health of farm workers and their medical services to be reassessed.

INTRODUCTION

Farming is a continually evolving industry with increasing emphasis upon intensive methods of animal husbandry. In the course of their work, farmers come into contact with these animals together with other domestic and wild animals in the general environment of the farm. They are thus at risk of developing zoonotic diseases.

Northern Ireland is largely a rural community and has a population of 1·5 million people. There are 42375 registered farm holdings with approximately 60000 people involved in agriculture. Agriculture is the main private employer in the province. There are approximately 10 million poultry, 2 million sheep, 1·4 million cattle, 0·6 million pigs, 8 thousand goats and 5 thousand horses. There is thus a considerable number of people in the 'at risk' category for zoonosis.

In 1986 we undertook a serological study of previous infection with *Brucella abortus*, *Leptospira interrogans* serovars, *Borrelia burgdorferi*, *Coxiella burnetii*, *Toxoplasma gondii*, *Chlamydia psittaci* and Hantavirus in the farmers of Northern Ireland to assess the zoonotic risks in this group of workers.

METHODS

A total of 510 farms were randomly selected by the Northern Ireland Department of Agriculture. A letter was sent to the farm owner advising that they would be contacted and the farm visited within 2 weeks. Farmers were included in the study if they were actively engaged in farming and agreed to take part in the study. One person, usually the farm owner, was sampled on each farm. Nine farmers had died and another six were in hospital, predominantly for cardiovascular reasons. Thirty-four farmers had retired from active farming. Twenty-five farmers could not be contacted, often because they had other day time occupations and 29 refused to take part in the study. Thus 79·8% of those suitable for the study participated. A 10 ml sample of blood was taken from each volunteer and the serum separated and stored at −20 °C. The number of blood samples tested for each of the antibodies is recorded in the results section. The number of sera tested depended on the volumes available.

B. abortus antibodies were measured by both direct and indirect agglutination methods [1]. Leptospira antibodies were measured using the microscopic live antigen agglutination test [2]. The sera were screened for antibody to serovars representing the seven serogroups of *L. interrogans* found in N. Ireland namely: serovar hardjo (Sejroe group), icterohaemorrhagiae, canicola, pomona, ballum, autumnalis and bratislava (Australis group). *Coxiella burnetii* phase 2 and *Chlamydia psittaci* antibodies were both measured using the complement fixation test and the microtiter system [3]. Psittacosis/lymphogranuloma venereum (PLGV) group antigen was used for detection of *Chl. psittaci* antibody. *T. gondii* antibodies were measured by the indirect haemagglutination test [4]. Antibodies to *B. burgdorferi* and Hantavirus were both measured by the indirect immunofluorescence test [5].

Correlation coefficients were calculated for the relationship between the age of the farmers and the presence of antibody to toxoplasma and Q fever antigens.

RESULTS

The mean age of the farmers was 49·2 years old (range 18–83). One hundred and fifteen of the farms were described as arable or mixed, 137 predominantly beef producers, 140 milk producers and 15 sheep or hill farms. For winter storage farmers frequently used more than one type of bedding. Most farmers used straw (335) but some of these also used other bedding for storage, i.e. hay (14), other vegetable material, mostly rushes or sawdust and wood shavings (56) or no bedding material (open slats) (77). More than one method for bedding was used by 18·4% of these farmers.

The table summarizes the serological results. Only a few farmers had *B. abortus* antibody. Only one of the three who had direct antibody at a titre of $\geqslant 64$ had a titre of 128 or more as did 8 of the 21 with indirect antibody. Thirty-one farmers (8·1%) had antibody to *L. interrogans*, the most common being to the serovar hardjo. Antibody to this serovar was present in 6·4% of milk producers, 2·9% of beef producers and 1·9% of mixed or arable farmers. None of the six farmers with bratislava antibody was keeping pigs at the time of the survey and none of the

Table. 1. *The number of Northern Ireland farmers with antibody to* Brucella abortus, *serovars of* Leptospira interrogans, Borrelia burgdorferi, Toxoplasma gondii, Coxiella burnetii *phase 2,* Chlamydia psittaci *and Hantavirus*

Antigen	No. of farmers tested	Serum dilutions tested	Number (%) seropositive
Brucella abortus			
direct	405	⩾ 1:64	3 (0·7)
indirect	405	⩾ 1:64	21 (5·1)
Leptospira interrogans	382	⩾ 1:10	31 (8·1)
hardjo			15 (3.9)
icterohaemorrhagiae			10 (2·6)
canicola			0 (0)
pomona			0 (0)
ballum			3 (0·7)
autumnalis			0 (0)
bratislava			6 (1·5)
Borrelia burgdorferi	342	⩾ 1:256	49 (14·3)
Toxoplasma gondii	407	⩾ 1:32	299 (73·5)
Coxiella burnetti – phase 2	406	⩾ 1:10	114 (28·0)
PLGV (*Chlamydia psittaci*)	341	⩾ 1:20	38 (11·1)
Hantavirus	320	⩾ 1:16	4 (1·2)

three with ballum antibody kept horses. Four farmers had antibody to more than one serovar: two with icterohaemorrhagiae and bratislava, one with icterohaemorrhagiae and hardjo and one with icterohaemorrhagiae, ballum and bratislava. Forty-nine farmers (14·3%) had a *B. burgdorferi* antibody titre of 256 or greater. Antibody to *T. gondii* was present in 73·5% and there was no significant correlation with age ($P = 0{\cdot}96$). *Cox. burnetii* phase 2 antibody was detected in 28·0% and again there was no significant correlation with the age of the farmer ($P = 0{\cdot}74$). *Chlamydia psittaci* antibody was detected in 11·1% of farmers.

Only four farmers had antibody to Hantavirus and three of these used sawdust or wood shavings as animal bedding. In view of this antibody result, one of us (W.I.M.) visited three of the four farmers and trapped a total of 27 mice. Two of these were found to have antibody to Hantavirus while the others were negative. One was a housemouse (*Mus musculus*) trapped in a barn and the other a wood mouse (*Apodemus sylvaticus*) trapped in a ditch. Rats (*Rattus norvegicus* and *R. rattus*) and Pygmy shrews (*Sorex minutus*) were not caught.

DISCUSSION

The results show that many farmers in Northern Ireland have serological evidence of past zoonotic infections, as might be expected from the risk factors of contact with farm and wild animals.

A relatively small proportion of farmers had evidence of past contact with *B. abortus* antigens and none was in the range of titres seen with recent clinical infection. Brucella infection has greatly decreased with reported cases in the United Kingdom diminishing from 186 in 1976 to 4 in 1985 [6]. In Northern Ireland the number of brucella-infected herds has dropped from 500/year in 1974

to zero in 1988. Thus, unless European vigilance for the disease decreases, acute brucellosis should disappear.

Prior to the 1970s most of the reported cases of leptospirosis were in sewerage workers, fish cleaners or miners, all of whom were in contact with water contaminated by rat urine [6]. These infections were predominantly with the serovar icterohaemorrhagiae with the classical symptoms of meningitis, nephritis and hepatitis. Now in the United Kingdom [6, 7], as in New Zealand [8] and Israel [9], the Sejroe strain from cattle (serovar hardjo) is the one most commonly reported and is associated more frequently with influenza-like symptoms. A study of farmers in different parts of England [6] showed that 5% of 709 blood samples had antibody to serovar hardjo (11·5% in dairy farmers, 3·7% in beef producers and 1·6% in arable farmers). The overall prevalence in Northern Ireland farmers of 3·9% is similar and there is the same emphasis on dairy farmers. The Australis strains (serovar bratislava) are maintained in pigs and horses and have been reported as a cause of clinical infection in man in Eastern Europe although not in the United Kingdom. This strain has been recovered from an asymptomatic carrier who had contact with pigs in Northern Ireland and it is of interest that 1·5% of the farmers had evidence of past infection with this serovar.

In 1986 there were 68 cases of Lyme disease reported in the United Kingdom and Ireland [10]; 86% of the deer tested in that study had antibodies to *B. burgdorferi*. There have been only three cases of Lyme disease reported in Northern Ireland and although there may be about 2500 wild deer, the number and distribution of herds are restricted. The tick *Ixodes ricinus* which transmits the disease is widely distributed in Northern Ireland and unidentified borrelia have been isolated from a calf and ticks. The prevalence of *B. burgdorferi* infection in wild animals in Northern Ireland is unknown. In more wooded regions of Europe, e.g. the Tyrol, the prevalence of antibody in humans to *B. burgdorferi* is 20·1% [11]. Our finding of antibody at a litre of $\geqslant 256$ in 14·3% of Northern Ireland farmers is similar and further studies of the overall prevalence in Northern Ireland are being undertaken (S. A. Hawkins, personal communication).

Humans mostly acquire *T. gondii* infection by ingesting foodstuffs contaminated by oocysts from cats' faeces or by eating raw or undercooked meat and poultry products containing viable toxoplasma cysts. There is also a risk from ovine abortion products. About 20–30% of young females and about 60% of Northern Ireland men and women in their fifth decade have antibody to *T. gondii*. The 73·5% prevalence of antibody in the farmers irrespective of age is thus relatively high. In Ontario [12] the prevalence stabilizes from the age of 25 at 50% and in South Australia [13] from the age of 30 it stabilizes at 40%. Farmers in Japan have a prevalence of 28·8% [14]. Since consumption of raw or undercooked meat is not common in Northern Ireland it is possible that the infection is acquired on the farm from an early age.

Man usually acquires Q fever infection by inhaling infected dust, or aerosols, handling infected carcasses or drinking raw milk infected with *Cox. burnetii*. Sheep and cattle are the usual sources but it may be spread by dogs, parturient cats or wild rabbits [15–17]. The placenta of infected animals is heavily contaminated. A survey of 601 farm workers in Northern Ireland in 1968 [15] showed that 23·1% had *C. burnetii* antibody in their sera. From 1962 to 1989 a total of 443 clinically

ill cases of Q fever have been diagnosed serologically in Northern Ireland, including 82 farmers or farm labourers and 17 farmers' wives. The present finding of Q fever antibody in 28·0% of the farmers shows that the prevalence of infection is similar to that in the 1968 study although the infection is now more widespread geographically.

Chlamydial infection due to *Chl. psittaci* is generally acquired from birds including poultry and pigeons but pregnant women may also acquire the infection from sheep (enzootic ovine abortion agent). More recently human to human transmission with the TWAR agent has been recorded [18]. In Northern Ireland about 21 clinically ill patients are diagnosed serologically each year and a survey carried out by the Northern Ireland Regional Virus Laboratory in 1986 showed that 16 of 341 patient blood samples (4·7%) from all over Northern Ireland had antibody to PLGV antigen. The finding of 38 (11·1%) of the 341 farmers with antibody shows that the prevalence of infection is greater in this group than in the general Northern Ireland population but is similar to the 13% antibody prevalence of farmers in North-West England [19].

It is probable that Hantavirus is transmitted by contact with fomites soiled with rodent urine or from aerosols generated in enclosed spaces [20]. The finding of antibody to Hantavirus in 1·2% of Northern Ireland farmers is the first evidence of this disease in Ireland [21]. It is of interest that three of the four farmers with Hantavirus antibody used sawdust or wood shavings for cattle bedding, a proportion greatly in excess of that used by the non-infected farmers. The Bank vole (*Clethrionomys glareolus*) is present only in the South-West of Ireland [22] and although it is cited as the source of infection in Scandinavia and Eastern Russia [23] it is unlikely to be involved in Northern Ireland. *Apodemus agrarius* was the other rodent described as being a source of human infection and thus it seems that in Northern Ireland the *Apodemus* species are involved together with the housemouse (*Mus musculus*).

These results show that farmers do become infected from the large reservoir of infectious agents in the domesticated and wild animals with which they are in contact. It is doubtful if this prevalence of infection would be acceptable in any other industry. Perhaps it is now time for the health of farmers and their medical services to be reassessed.

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