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LEPTOSPIROSIS IN NEW ZEALAND PIG HERDS

An epidemiological study and a computer simulation model  
of endemic leptospiral infection  
in New Zealand pig herds,  
with  
particular reference to  
*Leptospira interrogans* serovar *pomona*.

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Ingeborg Bolt  
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### ABSTRACT

A serological survey of pig sera from six regional areas throughout New Zealand indicated that 60% had titres to *Leptospira interrogans* serovar *pomona* and 13% to serovar *tarassovi*. Pig sera from the North Island districts had higher titres to *pomona* than those from the South Island districts, however the converse was true for titres to *tarassovi*. A serological survey of bacon weight pigs at slaughter revealed that 60% had titres to *pomona*, 53% to *bratislava*, while titres to *tarassovi* were undetectable. There was no significant linear association between the magnitude of corresponding *pomona* and *bratislava* titres. *Pomona* was isolated from 53% of pigs kidneys, however attempts to isolate *bratislava* were unsuccessful. The median prevalence of infection in bacon pigs from farms with endemic *pomona* infection, at the time of slaughter was 80%. A retrospective study of farming practices revealed that vaccination of breeding pigs had no effect on the infection status of their grower pigs at slaughter. It was also found that farms which reared their grower pigs to pork weight for slaughter were free of leptospiral infection, as were farms with less than fifty breeding sows.

Cross sectional serological and cultural prevalence studies of grower pigs on farms with endemic *pomona* infection revealed that pigs less than ten weeks of age were not leptospiruric and had low or undetectable titres to *pomona*. Pigs between ten and twenty weeks of age showed an increasing prevalence of both leptospiruria and *pomona* titres. Further prospective studies indicated that piglets acquire passive immunity from their dams, which has a half life of around sixteen days. The majority of pigs less than fourteen weeks of age appear to be resistant to infection, thereafter the level of their passive immunity wanes and they become infected and leptospiruric. The weekly incidence of leptospiruria for pigs in an infected grower house was usually between 10% and 20%. Following infection, the intensity of leptospiruria was greatest in the first three to four weeks and it lasted for at least six weeks. Infection is believed to occur by both direct and indirect transmission of leptospire between infected and susceptible pigs. It was shown that grower pigs are at the centre of the endemic cycle of infection which is perpetuated by the transmission of infection from older infected pigs to younger susceptible pigs. This cycle of endemic infection can persist independently of the breeding herd.

Experimental evidence following the artificial exposure of grower pigs to either serovar *pomona* or *bratislava* supported an hypothesis that the occurrence of *bratislava* titres were associated with early infection of pigs with serovar *pomona*. The heterologous titres were believed to be a serological cross reaction with homologous IgM antibody to which pigs had been exposed.

Experimental evidence demonstrated that leptospire could survive in droplets of less than 50  $\mu\text{m}$ , however hamsters exposed to a leptospiral aerosol containing droplets of less than 50  $\mu\text{m}$  failed to become infected. Infection via the intranasal route in both hamsters and pigs showed that the infective dose of *pomona* was between  $10^4$  and  $10^6$  leptospire, indicating the intranasal route as a natural route for infection. Transmission of infection could therefore occur directly by infective droplets lodging in the nasal cavity.

The vaccination of pigs, commencing at ten weeks of age on a farm with endemic *pomona* infection, revealed that multiple inoculations of a commercially available bacterin can be used to control the level of endemic infection within a grower pig herd. There was evidence to suggest that persistent passive immunity in young pigs could interfere with the efficacy of vaccination.

A computer simulation model of endemic *pomona* infection in a pig herd [Simulated Leptospiral Infection within a Pig herd, SLIP89] was developed using the results of investigations described in this thesis by sequentially breaking down the cycle of endemic *pomona* infection into a series of logical events. The model repeats a number of predetermined independent and dependant events for each pig within a simulated herd. The outcome of each event is randomly determined from an appropriately selected probability distribution. Each cycle of repetition represents one week in time. The outcome generated by the simulation can be used to observe varying patterns of infection which are due to either the element of chance or the alteration of key variables within the model. The results generated by the SLIP89 must be viewed with the structure and limitations of the model in mind.

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