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THERMOPHILIC CAMPYLOBACTER  
IN ANIMALS AND MAN

A thesis presented in partial fulfilment  
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## ABSTRACT

During the course of the work reported in this thesis, more than 2,000 samples and isolates from animals and from humans, were examined for the presence of intestinal thermophilic Campylobacter. This figure does not include samples and isolates examined during the course of experimental studies.

Culture of either rectal swabs from pigs or cloacal swabs from poultry usually provides an accurate assessment of the prevalence of distal gastro-intestinal (G.I.) tract infection by C. coli and C. jejuni, provided that the swabs are kept at 4°C and cultured within 6 hours. Cultures of isolates of C. jejuni can be preserved for at least 21 months if stored in FBP broth or PBS at -70°C.

The major site of colonisation by C. coli in pigs, is the distal part of the G.I. tract and the proximal G.I. tract in the case of C. jejuni. In poultry, the major sites of colonisation by both C. jejuni and C. coli are the distal ileum and the large intestine, especially the caeca.

Surveys of pigs showed that 60 - 100% of post weaning pigs are infected with C. coli. In neonates the rates of infection increase with age, and infected sows are the major source of infection for piglets. C. jejuni is rarely isolated from pigs.

Twenty eight percent (28%) of all poultry flocks examined were infected with intestinal thermophilic Campylobacter. In infected broiler flocks the rate of infection is almost 100%, while in older birds lower rates were found. Of all the isolates examined, 86% were C. jejuni and 14% C. coli.

All poultry carcasses and edible viscera, derived from infected broiler flocks, are contaminated with Campylobacter. The levels of contamination of these products by both C. jejuni and C. coli are approximately  $10^6$  and  $10^4$  cfu per whole carcass and packet of edible viscera respectively. Poultry chilled products for sale in supermarkets were also heavily contaminated by these two species of Campylobacter which remained viable for the 'shelf life' of the products (ten days).

The prevalence of infection by intestinal thermophilic Campylobacter in gulls was 59%, in ducks 29%, and in rats 60%. Infected sparrows were not detected. With the exception of an isolate from one pig, C. laridis is a species apparently host specific for sea birds, and isolates from gulls of what, on conventional taxonomic criteria, would be classified as C. coli are shown on more detailed examination to be C. laridis.

The level of excretion in faeces of Campylobacter in most infected pigs is between  $10^2 - 10^5$  cfu/g, in poultry approximately  $10^8$  cfu/g, in rats  $10^5$  cfu/g, and in gulls  $10^3$  cfu/g.

The infectivity of C. jejuni isolated from poultry for experimental chickens is in the region of  $5 \times 10^2$  cfu and that of C. coli approximately  $5 \times 10^5$ . Both species of Campylobacter were a 100 to 1000-fold less infective for rats. Infection in both chickens and rats was self-limiting and attempts to reinfect chickens with the same species or organism, were usually unsuccessful. C. laridis was not infective for either chickens or rats at dose rates of up to  $10^9$  organisms.

Campylobacter infections are the most common notified human enteric infection in New Zealand with an annual incidence rate of 31/100,000. Approximately 94% of the human cases of campylobacteriosis are due to C. jejuni and 6% to C. coli. People between 1 to 4, and 15 to 35 years of age are the most commonly affected, and patients who no longer have clinical signs of infection may shed up to  $10^8$  cfu of C. jejuni/g of faeces. By use of a bacterial restriction endonuclease<sup>DNA</sup> technique (BRENDA), up to 80 different types of C. jejuni and C. coli were identified from 338 isolates from humans. One hundred and ninety four (61%) of the 316 isolates of C. jejuni from humans had similar BRENDA patterns to isolates of C. jejuni from animals. Poultry appear to be the major source of C. jejuni, and possibly C. coli, for humans, while pigs apparently are an insignificant source of C. coli for humans. Rats can be infected with strains of C. jejuni which can infect poultry, humans and other animals. BRENDA types recovered from gulls and ducks were not similar to any of the isolates from humans or other animals examined.

Some strains of C. jejuni and C. coli developed an in-vitro resistance to nalidixic acid. This is an important finding in relation to conventional taxonomic criteria for differentiating C. laridis from other intestinal thermophilic Campylobacter. Isolates of 'C. coli' from gulls are phenotypic variants of C. laridis which may be either resistant, or non resistant, to nalidixic acid. Only by determining whether or not, anaerobic growth in the presence of TMAO occurs, can C. coli be differentiated from C. laridis.

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