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Risk factors for *Campylobacter* spp. colonization in broiler flocks in Iceland

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Abstract

We sampled 1091 Icelandic broiler flocks at slaughter from May 2001 to December 2003 to determine the prevalence of, and investigate risk factors for the presence of, *Campylobacter* spp. at the flock level. Approximately 15% of the flocks were positive for *Campylobacter* spp.; most (95%) of the infected flocks being raised during the months of April–September. Based on the data from the latter months, and using multivariable logistic regression with random effects for herd, we found that the odds of a flock being positive for *Campylobacter* spp. increased with age and flock size. Additionally, vertical ventilation systems were strongly associated with positive flocks (OR = 5.3). After controlling for these variables, we found no evidence of an effect of: year; company; *Campylobacter* being carried over from one flock to the next; time interval between flocks; using

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(at the hatcheries) eggs laid on the floor; density of bird housing, or the number of catch lots a flock was divided into for slaughtering purposes on the risk of a *Campylobacter*-positive flock.

Keywords: *Campylobacter* spp.; Broiler flocks; Risk factors; Logistic regression; Ventilation system; Iceland

1. Introduction

Campylobacter spp. is an important agent of gastrointestinal disease in humans, heading the list of foodborne infections in many developed countries (Blaser, 1997; Allos, 2001; Frost, 2001). In a few cases, a more severe illness, the Guillain-Barré syndrome, has been associated with *Campylobacter* infection (Allos, 1997; Buzby et al., 1997; Hadden and Gregson, 2001).

Poultry meat is the main risk factor identified for human infection with *Campylobacter* spp. (Kapperud et al., 1992; Altekruse et al., 1999; Hudson et al., 1999; Allos, 2001), although other researchers point at different sources including milk and water (Hanninen et al., 2000; Corry and Atabay, 2001; Frost, 2001). Due to the difficulties associated with reducing the contamination of poultry carcasses at abattoirs, intervention measures at the farm level have been suggested as the most effective method to decrease *Campylobacter* prevalence in chicken meat (Herman et al., 2003). *Campylobacter* colonization in poultry is asymptomatic, suggesting that this bacterium is well adapted to the gut environment of the host. Commercially raised chickens rarely test positive for *Campylobacter* before 2 or 3 weeks of age, but they are capable of shedding large numbers of this organism in feces shortly after being colonized (Sahin et al., 2002; Newell and Fearnley, 2003). Once *Campylobacter* is introduced into a flock, it spreads quickly, and previous studies have found within-flock prevalences ranging between 60 and 100% (Gregory et al., 1997; Evans and Sayers, 2000; Heuer et al., 2001; Shreeve et al., 2002; Stern et al., 2003).

Campylobacter spp. colonization in commercial poultry flocks is widespread in many countries. Studies in Europe indicate flock prevalences ranging from 18% to over 90%, with northern countries showing a lower proportion of positive flocks (Newell and Fearnley, 2003).

Campylobacter colonization in poultry usually follows a seasonal pattern, with a peak in the warmer months (Jacobs-Reitsma et al., 1994; Wedderkopp et al., 2000, 2001; Refregier-Petton et al., 2001; Bouwknegt et al., 2004). An exception to this finding has been reported in the United Kingdom, where several researchers found no seasonal effect (Humphrey et al., 1993; Evans and Sayers, 2000), although a seasonal variation in the concentration of *Campylobacter* in poultry has been described (Wallace et al., 1997). The reason behind this seasonal effect is largely unknown, although a possible role of migratory birds or insects has been suggested (Jacobs-Reitsma, 1997).

The possible sources and transmission routes of *Campylobacter* for poultry flocks have been investigated extensively, but no definitive factor(s) have been identified that explain the occurrence of the organism in commercial poultry flocks. Risk factors associated with horizontal transmission include lack of biosecurity measures (Humphrey et al., 1993; Jacobs-Reitsma et al., 1994; van de Giessen et al., 1996, 1998; Gibbens et al., 2001;