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Prevalence and risk factors for *Salmonella* spp. and *Campylobacter* spp. caecal colonization in broiler chicken and turkey flocks slaughtered in Quebec, Canada

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Abstract

We conducted an observational study to estimate prevalence and risk factors for *Salmonella* spp. and *Campylobacter* spp. caecal colonization in poultry. Eighty-one broiler chicken and 59 turkey flocks selected among flocks slaughtered in the province of Quebec, Canada, were included in the study. Flock status was evaluated by culturing pooled caecal contents from about 30 birds per flock. Exposure to potential risk factors was evaluated with a questionnaire. Odds ratios were computed using multivariable logistic regression.

The prevalence of *Salmonella*-positive flocks was 50% (95% CI: 37, 64) for chickens and 54% (95% CI: 39, 70) for turkeys, respectively. Odds of *Salmonella* colonization were 2.6 times greater for chicken flocks which failed to lock the chicken house permanently. In turkeys, odds of *Salmonella* colonization were 4.8–7.7 times greater for flocks which failed to be raised by $\leq$2 producers with no other visitors allowed onto the premises, or origin from a hatchery.

The prevalence of *Campylobacter*-positive flocks was 35% (95% CI: 22, 49) for chickens and 46% (95% CI: 30, 62) for turkeys. Odds of colonization were 4.1 times higher for chicken flocks raised on farms with professional rodent control and 5.2 times higher for flocks with manure heap $>$200 m from the poultry house, and also increased with the number of birds raised per year on the farm and with the age at slaughter. For turkeys, odds of *Campylobacter* flock colonization were 3.2 times greater in flocks having a manure heap at $\leq$200 m from poultry house and 4.2 times greater in flocks drinking unchlorinated water.

Keywords: *Campylobacter*; *Salmonella*; Risk factors; Prevalence; Turkey; Chicken; Canada

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1. Introduction

Salmonella spp. and *Campylobacter* spp. are two of the most important food-borne zoonotic pathogens (Allos, 2001; Schlundt et al., 2004). There is evidence that poultry products are one of the most important source of human infection for both organisms (Corry and Atabay, 2001; Hald et al., 2004; Schlundt et al., 2004).

Contamination of poultry carcasses with *Salmonella* or *Campylobacter* seems to be mostly linked to flock contamination during rearing and/or transportation to slaughter (McGarr et al., 1980; Rigby et al., 1980, 1982; Corry et al., 2002; Heyndrickx et al., 2002; Berndtson et al., 1996a; Rivoal et al., 1999). Risk factors for flock colonization by *Salmonella* include season, hatchery of origin, feedmills and various hygienic measures (Renwick et al., 1992; Angen et al., 1996; Rose et al., 1999; Skov et al., 1999; Cardinale et al., 2004b). For *Campylobacter*, several pathways have been suggested to explain flock colonization during rearing, including vertical transmission, contamination from previous flock and exposure to potential sources of the bacterium such as other animals on the farm, insects, rodents, environment, litter and drinking water (Lindblom and Kaijser, 1986; Annan-Prah and Janc, 1988; Pearson et al., 1993; Gregory et al., 1997; Petersen and Wedderkopp, 2001; Hiett et al., 2002a,b; Cardinale et al., 2004a). However, most of the studies were conducted on chicken flocks; little information is available on turkey flocks.

Our objectives were to estimate the prevalence of *Salmonella* and *Campylobacter* colonizations in chicken and turkey flocks slaughtered in Quebec. Potential risk factors for colonization were also studied.

2. Material and methods

2.1. Slaughterhouse selection

From April 24, 2003 to February 23, 2004, chickens were sampled in the four largest commercial processing plants in Quebec. Each plant was visited once during each 4-week period, in a random order (using a random-number generator). For practical follow-up reasons, sampling was usually done on Thursday for the first half of the study, and on Tuesday for the second half. During the same period, turkeys were sampled every week in the only commercial processing plant in Quebec. Sampling was planned for Tuesday, but if not enough flocks were available it was postponed to the following Wednesday or Thursday. The target sample size was fixed at 80 flocks for both chickens and turkeys, calculated to estimate the 95% confidence interval (CI) of colonization prevalence with a maximal error of 10%, assuming a prevalence of 30%.

2.2. Flock selection

At each visit to the slaughterhouses, two flocks located in different production sites (i.e. farm address) were selected whenever possible. A flock was defined as a group of birds from the same hatchery raised in a broiler house during the same period of time. Only one flock raised per production site was allowed for selection in the study. Producers were selected among those known to be shipping broiler-chicken, broiler-turkey, or heavy-turkey flocks to slaughter on the sampling day, with slaughtering of the flock planned between 7:00 and 14:00. Before sampling, producers were asked if they agreed to participate to the study, which involved filling out a