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Quantitative estimation of *Campylobacter* cross-contamination in carcasses and chicken products at an abattoir

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ABSTRACT

This study aimed to investigate *Campylobacter* contamination in carcasses and chicken products derived from a *Campylobacter*-negative flock when the flock is slaughtered immediately after a *Campylobacter*-positive flock. The first 2 flocks slaughtered on 10 different dates were investigated at an abattoir. Eighteen of the 20 flocks tested were positive for *Campylobacter*. A *Campylobacter*-negative flock was slaughtered immediately after a *Campylobacter*-positive flock on only 1 of the 10 slaughter dates. In this case, *Campylobacter* was detected in the carcasses and chicken products originating from the *Campylobacter*-negative flock, and all the *flaA* genotypes of these isolates were identical to those present in the caecal contents, carcasses, and chicken products from the *Campylobacter*-positive flock. The *Campylobacter* concentrations in the products originating from the *Campylobacter*-negative flock were: close to the enumeration limit (1.7 $\log_{10}$ cfu/carcass) in the carcass samples; and below the enumeration limit (2.0 $\log_{10}$ cfu/g) in the liver samples. The mean *Campylobacter* concentrations in the carcasses and liver products originating from the 18 *Campylobacter*-positive flocks were 3.8 $\log_{10}$ cfu/carcass and 2.6 $\log_{10}$ cfu/g, respectively. While 91% (246/270) of chicken products originating from *Campylobacter*-positive flocks were positive for *Campylobacter*, chicken products originating from the remaining *Campylobacter*-negative flock were free from *Campylobacter* cross-contamination by slaughter prior to a *Campylobacter*-positive flock. These results prove that slaughtering *Campylobacter*-negative flocks does not introduce *Campylobacter* into the abattoirs and indicate that although carcasses and chicken products originating from the *Campylobacter*-negative flock were cross-contaminated with *Campylobacter* from the *Campylobacter*-positive flock slaughtered immediately before, the *Campylobacter* contamination levels were lower than those in carcasses and chicken products from *Campylobacter*-positive flocks. Based on these findings, the reduction of *Campylobacter* prevalence in broiler flocks should be taken as an effective control measure for preventing introduction of *Campylobacter* into abattoirs and consequently for reducing *Campylobacter* prevalence in chicken products in addition to the good hygienic practice at abattoirs and logistic slaughter.

1. Introduction

Human campylobacteriosis is one of the most important foodborne diseases worldwide, and consumption of raw or undercooked poultry meat contaminated with *Campylobacter* has been identified as a risk factor for such an illness (EFSA Panel on Biological Hazards, 2011; Kapperud, Skjerve, Bean, Ostroff, & Lassen, 1992; Pearson et al., 2000). Kubota et al. (2011) estimated that 1210 cases of foodborne campylobacteriosis per 100,000 population occurred each year in Miyagi Prefecture in Japan. In 2009, risk assessment conducted by the Food Safety Commission (FSC) in Japan for *Campylobacter* in poultry indicated the following most effective risk management options: (i) slaughter of *Campylobacter*-negative flocks before *Campylobacter*-positive flocks (logistic slaughter) and (ii) maintenance of an adequate concentration range (1–5 mg/L) of free available chlorine (FAC) in chilled water tanks (FSC, 2009). These 2 approaches can reduce the risk of human *Campylobacter* infection by 44% and 21%, respectively. The risk assessment used the study of a probabilistic risk assessment model for *Campylobacter* infection from poultry meat and it estimated that approximately 100 million people

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were infected with *Campylobacter* per year in Japan (Kasuga, 2011). In contrast, Nauta et al. (2009) reviewed several quantitative risk assessments of *Campylobacter* in broiler meat conducted in countries other than Japan and concluded that logistic slaughter has a negligible effect on the reduction of campylobacteriosis risk in all risk assessments. The different conclusions regarding the effect of logistic slaughter may be attributed to several data gaps in the risk assessment carried out in Japan. For example, neither *Campylobacter* prevalence nor concentration in chicken products originating from *Campylobacter*-negative flocks cross-contaminated by *Campylobacter*-positive flocks during the slaughtering process were used for the risk assessment conducted by FSC. A more refined assessment will be possible when these data gaps are filled. Therefore, we had previously investigated whether chicken products originating from a *Campylobacter*-negative flock become cross-contaminated by a *Campylobacter*-positive flock that was slaughtered immediately before, at an abattoir in Japan. Our results showed that 198 out of 600 (33.0%) bulk packed chicken products originating from 24 broiler flocks were contaminated with *Campylobacter* and that 14 chicken products originating from a *Campylobacter*-negative flock were cross-contaminated by a *Campylobacter*-positive flock during the slaughtering process (Sasaki et al., 2012). However, the *Campylobacter* concentration in chicken products cross-contaminated by the *Campylobacter*-positive flock was not investigated in that study. Since quantitative data will be necessary and useful for conducting a quantitative risk assessment, the present study aimed to obtain the concentration of *Campylobacter* in carcasses and chicken products cross-contaminated by the *Campylobacter*-positive flock that was slaughtered immediately before the flock was tested.

2. Materials and methods

2.1. Slaughtering and processing of broilers

A broiler production company voluntarily participated in this study. The abattoir was located in the Kanto region of the eastern part of Japan. Fig. 1 summarizes the flow of broiler processing in the abattoir. After processing of broilers, 2 kg of each chicken breast

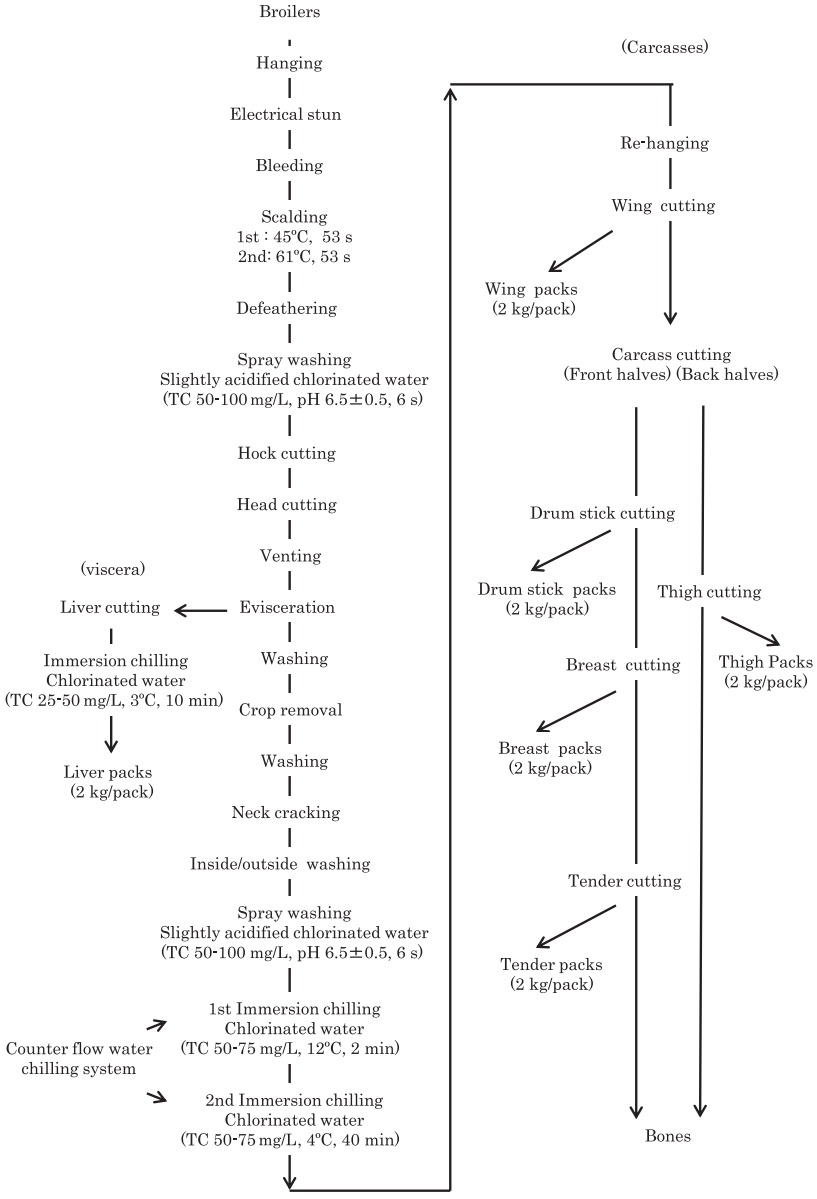

Fig. 1. Flow diagram of broiler processing in the abattoir investigated. TC, the total chlorine concentration.