

Abstract

The situation of *Campylobacter* species (C spp.) and *Listeria* species (L spp.) contamination in retail chicken meat was clarified, and its relationship with hazard analysis and critical control points (HACCP) certification was examined in this study.

In Chapter 1, 90 samples of chicken meat (categories: general broiler ('General'), Meigara-brand (Meigara), and Jidori Japanese local (Jidori) chicken) were purchased from 16 stores in Tokyo from 2017 to 2018. In total, 232 strains of C spp. and 175 strains of L spp. were isolated from the meats. Among the C spp., *C. jejuni* (Cj) accounted for the majority of the strains, and among the L spp. contaminated rate was high of *L. innocua* (Li) and *L. grayi*. Contamination by only L spp. was three times more frequent than that by only C spp. The contamination rates were high in Jidori and Meigara, and low in 'General'. Bacteria of both genera were isolated from 43% of the samples, and the combination of Cj and Li was the most common combined contamination. *L. monocytogenes* (Lm) was found to contaminate meat only together with either Cj or *C. coli*. The current situation of contamination by bacteria of both genera was clarified from these results.

In Chapter 2, 219 strains were randomly selected from among preserved Lm strains and examined for benzalkonium chloride (BC) resistance. BC resistance was found in the 633C3, 772C2, 868C4, and 824C3 strains, and the minimal inhibitory concentrations were 32 µg/ml in 633C3, 772C2, and 868C4, and 8 µg/ml in 824C3. Furthermore, it was shown that BC-resistant Lm strains have been in Japan since at

least 2004, and their frequency has increased since 2017.

In Chapter 3, contamination by both bacteria was analyzed in 17 species of Jidori and Meigara in relation to the distribution channels and HACCP certification. Contamination by *L* spp. was confirmed in 13 routes, and in seven of the routes, the contamination rate was more than 80%. Contamination by *C* spp. was confirmed in 17 routes, and the isolation rate of *L* spp. was high in six routes that had a contamination rate of more than 70%. Different processing plants had different contamination rates and bacterial species even though the same meat shop, indicating route-dependent contamination. High contamination rates were revealed, i.e., the contamination rate of *L* spp. was 80% in eight categories of meats, and that of *C* spp. was 100% in nine categories of meats. Regarding HACCP certification, stores that acquired the certification tended to have lower isolation rates of *C* spp. than stores that did not. Regardless of certification acquisition, the isolation rate of *C* spp. was significantly higher in stores handling Jidori and Meigara, and a lower contamination rate was found in chicken produced from windowless rearing. The high contamination rates in both Jidori and Meigara were therefore considered to reflect these factors.

In this study, the current situation of *C* spp. and *L* spp. contamination was examined in retail chicken, which were classified into 'General', Meigara, and Jidori categories, and the occurrence of combined contamination was clarified. It was also shown that BC-resistant *Lm* strains have been in Japan since at least 2004, and their frequency has been increasing in recent years. Furthermore, it was clarified that the

contamination depended on the distribution channels, and in particular, delays in the implementation of sanitation measures in distribution channel and breeding system appear to be responsible for the higher contamination rates in Meigara and Jidori.