Factors for Occurrence of Extended-Spectrum β-Lactamase-Producing 
Escherichia coli in Broilers

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ABSTRACT. To clarify the factors for occurrence of extended-spectrum β-lactamase (ESBL)-producing Escherichia coli in broilers, two flocks (1 day of age) fed a diet with or without antibiotics were kept in a broiler house sanitized with disinfectants. ESBL-producing E. coli, however, was detected at a concentration of over 10^6 CFU/g of feces at 9 days of age to 49 days of age in both broiler flocks. Therefore, this indicated that the antibiotics other than cephalosporins used in this study had no effect due to co-selection on the numbers of ESBL-producing E. coli in broiler flocks during this period. When a flock was kept with diet containing antibiotics for 49 days in a laboratory animal room, no ESBL-producing E. coli was detected in the flock. These results suggest that the occurrence of ESBL-producing E. coli may not be related to feeding with antibiotics and that the contamination of broiler houses with ESBL-producing E. coli might be an important factor.

Key Words: antibiotics, broiler, Escherichia coli, extended-spectrum β-lactamase-producing, occurrence.


Extended-spectrum β-lactamase (ESBL)-producing bacteria have antibiotic resistance to third generation cephalosporins such as cefotaxime (CTX). Reports on Escherichia coli carrying broad-spectrum β-lactamases isolated from food-producing animals and humans have been published worldwide [8]. ESBL-producing Klebsiella pneumoniae, E. coli and Proteus mirabilis have been implicated in numerous outbreaks of nosocomial infections over the last 2 decades [3, 10, 13]. CTX-M-2-producing E. coli from cattle in Japan has been reported [11], and the Japanese Veterinary Antimicrobial Resistance Monitoring Program (JVARM) reported isolation of ESBL-producing E. coli from poultry in Japan [6]. In addition, a potential increase in the ESBL-producing E. coli isolated from broilers was also reported [4]. Our previous study [5] clarified the high prevalence of ESBL-producing commensal enteric bacteria in broilers in Japan. However, use of third-generation cephalosporins on broilers is not permitted in Japan. The factors of occurrence of ESBL-producing E. coli in broiler are still unclear. The aim of this study was to clarify these factors.

Two flocks with 16 broilers each (Chunky, 1 day of age) were newly introduced to a hygienic broiler house sanitized with disinfectants. Although this windowless broiler house had been maintained in all-in-all-out system and sanitized with disinfectants immediately after all the broilers were marketed, ESBL-producing E. coli strains had been isolated from broiler feces collected in this broiler house in the last two examinations. A flock fed a diet with antibiotics (sali

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that there were ESBL-producing and did not produce ESBL. In this context, it was revealed except in the same broiler feces. In this study, no ESBL producers to cephalosporins, with the exception of ESBL producers, susceptible to cephalosporins and enteric bacteria resistant intake of broilers promotes the growth of ESBL producers. Therefore, it was not clarified whether antibiotic intake of broilers had no effects on co-selection of ESBL-producing E. coli in the broiler flock. The source of the ESBL producers in the broiler feces was not clarified. However, we found that a small number of ESBL-producing E. coli in broiler feces grew to large numbers by 49 day of age. Contamination of the broiler house with the bacterium might be a more important factor for the occurrence than intake of antibiotics.

In a laboratory animal room that had never been used to keep broilers, a flock with 12 broilers (1 day of age) fed the diet with antibiotics was kept for 49 days, and their feces were monitored for ESBL-producing E. coli by the same method described above. CTX-susceptive E. coli was detected until 49 days of age, and there was no E. coli on ChromoCult Coliform Agar ES with CTX and CHROMagar ESBL.

Therefore, this suggests that there are differences between the environments of the laboratory animal room and the broiler house. Raising flocks in hygienic environments might be important for inhibition of infection with ESBL-producing E. coli.

Smet et al. described that ESBL-producing bacteria grew in an environment without CTX [12]. The present study also indicated the same results. In addition, Murase et al. reported that genetically related strains of E. coli were isolated from broilers being raised at a broiler farm without antibiotics [9]. However, strains having various patterns of drug resistance appeared at a broiler farm without antibiotics. It seemed that mobile genetic elements such as R-plasmid affected the drug resistance patterns. Analysis by pulsed-field gel electrophoresis of ESBL-producing E. coli and CTX-sensitive E. coli would produce additional information. Further studies on a large scale and in newly opened farms are required to prevent contamination of ESBL-producing E. coli in broilers.

REFERENCES


