Escherichia coli O157:H7 in livestock in Japan

J. Sekiya
Deputy Director, Animal Health Division, Livestock Industry Bureau, Ministry of Agriculture, Forestry and Fisheries, 1-2-1 Kasumigaseki, Chiyoda-ku, Tokyo 100, Japan

Summary

The largest ever outbreak in Japan of Escherichia coli O157 infection in humans occurred in 1996. As a result, surveys were conducted later the same year to evaluate the sources and pathogenesis of this bacillus in livestock animals at the farm and in abattoirs. One of the surveys resulted in the isolation of E. coli O157 in 0.62% of cattle on randomly selected farms. Although no confirmation has been made with regard to the source of E. coli O157 infection and its pathogenicity in livestock animals, preventive measures are being applied at both farm and processing levels.

Keywords


Introduction

Enterohaemorrhagic Escherichia coli is reported to be carried in the intestines of several species of livestock, including cattle and sheep. There have been no reports which indicate that animals carrying E. coli show any clinical signs and no reports have confirmed the pathogenicity of the bacillus in animals. The largest outbreak in Japan of E. coli O157 occurred in 1996, starting in May in a town in Okayama prefecture, south-western Japan and spreading to most parts of Japan: the greatest number of victims was recorded in Sakai City. By 6 January 1997, a total of 9,372 cases (of which 11 were fatal) had been reported in 47 prefectures. Following the outbreak, surveys were performed at abattoirs, meat processing plants and farms. The results of these surveys are presented below.

Livestock as carriers of Escherichia coli O157

1993-1994 survey

A direct culture method survey (4) conducted from July 1993 to January 1994, using faecal samples collected from cattle in abattoirs, revealed E. coli O157 isolates in 0.12% of samples (Table I).

1996 survey – livestock in abattoirs

This survey of faecal samples was conducted from 1 July 1996 to 15 September 1996, under the instruction of the Ministry of Health and Welfare. The samples were collected from cattle in abattoirs and swab samples were collected from cattle carcasses (7). Positive results for E. coli O157 were recorded in 1.4% of the faecal samples and 0.3% of swab samples (Table II).

Table I

<table>
<thead>
<tr>
<th>No. of samples</th>
<th>Season</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Summer</td>
<td>Winter</td>
</tr>
<tr>
<td>Tested</td>
<td>2,507</td>
<td>2,407</td>
</tr>
<tr>
<td>From which E. coli was isolated (%)</td>
<td>114 (4.5)</td>
<td>80 (3.3)</td>
</tr>
<tr>
<td>From which E. coli serotypes O26, O111, O128, O143 and O157 and verotoxin-producing E. coli (VTEC) were isolated</td>
<td>117</td>
<td>85</td>
</tr>
<tr>
<td>From which VTEC was isolated (%)</td>
<td>8 (0.3)</td>
<td>3 (0.1)</td>
</tr>
<tr>
<td>From which E. coli serotype O157:H7 was isolated (%)</td>
<td>5 (0.20)</td>
<td>1 (0.04)</td>
</tr>
</tbody>
</table>
The bacillus seemed to be most effectively identified in swab samples collected from the perianal and breast areas (Table III) using the immuno-magnetic beads method (Table IV).

Of the enterohaemorrhagic E. coli bacilli isolated, 95% were serotype 0157:H7. Of the verotoxins (VT) isolated, 47% were VT1&2 and 53% were VT2 (Table V).

A total of 1,035 samples were collected from imported meat, of which five samples were found positive using the immuno-magnetic beads method.

1996 survey – livestock on farms
A survey was conducted on the various farm habitats of E. coli 0157:H7 from 6 August to 28 October 1996. Faecal samples from 5,200 cattle and 1,031 pigs, as well as samples from the farm environment (such as compost, manure and waste water), collected from randomly selected farms, were subjected to isolation testing. The enrichment culture method was applied to isolate the bacillus (5, 6). E. coli O157:H7 was isolated from 0.62% (or 32 samples) of cattle faecal samples but not from any of the samples taken from pigs. All samples taken from the environment gave negative results.

Meat in abattoirs and processing plants
Since 26 July 1996, soon after the nationwide outbreak of E. coli O157 infection, voluntary tests have been conducted on carcasses in abattoirs and processing plants in an attempt to isolate the bacillus. By 22 January 1997, tests had been performed on 11,326 carcasses from 333 abattoirs (of which 0.02% gave positive results) and 11,132 carcasses from cattle, 2,619 isolates from pigs and 615 isolates from chickens were subjected to antigenic categorisation: no E. coli O157:H7 was revealed.
10,532 processing plants (of which 0.02% showed positive results) (3). One of 435 samples collected from imported meat gave positive results.

Conclusion

Although there is still no confirmation of the source and pathogenesis of the *E. coli* O157 outbreak, the following measures have been taken to prevent further outbreaks of the infection:

a) **Amendment of the Abattoir Law Enforcement Regulations:** To prevent contamination of carcasses and meat in slaughtering and processing, the Ministry of Health and Welfare issued a ministerial order to amend the Abattoir Law Enforcement Regulations on 25 December 1996 (2). The amended regulations set stricter standards for hygienic maintenance of the abattoir environment, and hygienic handling of animals and carcasses in abattoirs, for example, by binding the oesophagus and rectum with rubber bands, and by dipping knives into hot water at more than 83°C.

b) **Improved management of livestock on farms:** An administrative instruction was issued by the Director General of the Livestock Industry Bureau of the Ministry of Agriculture, Forestry and Fisheries, advocating hygiene measures for the shipment of animals. This instruction discourages transportation of animals showing symptoms of diarrhoea; farmers are required to ensure the thorough removal of faeces by washing before shipment to abattoirs commences (1).

A hazard analysis critical control point (HACCP) system is being developed by prefectural governments for the quality assurance of animals on farms. In addition, diagnostic equipment is being installed to enable the Livestock Hygiene Service Centres to identify the antigenic and genetic characteristics of *E. coli* O157 and other agents.

---

**Escherichia coli O157:H7 chez les animaux de rente au Japon**

J. Sekiya

Résumé

En 1996, le Japon a connu le plus important foyer de toxi-infection alimentaire due à *Escherichia coli* O157 de son histoire. Des enquêtes ont donc été réalisées, cette année-là, afin d'évaluer l'origine de la contamination et le caractère pathogène de ce bacille chez les animaux de rente à différents niveaux. L'une de ces enquêtes a permis d'isoler *E. coli* O157 chez 0,62 % des bovins appartenant à des élevages pris au hasard. Même si aucune confirmation n'a pu être apportée quant à la source de l'infection par *E. coli* O157 ou à son pouvoir pathogène chez les animaux de rente, des mesures préventives ont été instaurées aussi bien au niveau des élevages que des circuits de conditionnement de la viande.

**Mots-clés**

Escherichia coli O157:H7 en el ganado en Japón

J. Sekiya

Resumen
En 1996 tuvo lugar el mayor brote de infección humana por Escherichia coli O157 de la historia del Japón. A raíz de aquel episodio se llevaron a cabo, aquel mismo año, una serie de estudios para estimar la presencia y la patogenicidad de ese bacilo en el ganado en varias fases del proceso productivo. Uno de tales estudios deparó el aislamiento de E. coli O157 en el 0,62% de los bovinos de granjas seleccionadas al azar. Aunque no se dispone de confirmación alguna en lo que concierne a la fuente de la infección por E. coli O157 y a su patogenicidad sobre el ganado vacuno, se están aplicando medidas preventivas tanto a nivel de las granjas como del procesamiento.

Palabras clave

References


