

Bovine Spongiform Encephalopathy in Japan

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Identified cases of Japanese cows infected with bovine spongiform encephalopathy

Bovine spongiform encephalopathy (BSE) is a progressive neurological disorder of cattle that results from infection by prions, which are abnormally folded proteins. BSE is communicable to humans, and the theory that variant Creutzfeldt-Jakob disease (vCJD), a novel human prion disease, is caused by eating BSE-contaminated food is widely accepted. Research indicates that the first probable infections of BSE in cows occurred during the 1970s, with two cases of BSE identified in 1986 in the United Kingdom 1.

The first BSE case in Japan was identified in September 2001, and since then, 36 cases of BSE have been reported (Table 1). Among these, cases eight and 24 were recognized as atypical BSE because the prions were different from the typically observed prions. Since the introduction of BSE in Japan, BSE has been suspected in a total of 1,032 cows. However, none of these were found to be positive for the BSE prion 2.

Table 1. Cases of bovine spongiform encephalopathy (BSE) in Japan

Case number	Date identified	Breed, sex	Date of birth	Calving age (months)	Number of BSE-suspected cows	Notes
1	9/10/2001	Holstein, female	3/26/1996	65	59	
2	11/21/2001	Holstein, female	4/4/1996	67	81	
3	12/2/2001	Holstein, female	3/26/1996	68	96	
4	5/13/2002	Holstein, female	3/23/1996	73	52	
5	8/23/2002	Holstein, female	12/5/1995	80	37	atypical BSE
6	1/20/2003	Holstein, female	2/10/1996	83	33	
7	1/23/2003	Holstein, female	3/28/1996	81	17	
8	10/6/2003	Holstein, male (castrated)	10/13/2001	23	116	
9	11/4/2003	Holstein, male (castrated)	1/13/2002	21	134	
10	2/22/2004	Holstein, female	3/17/1996	95	0	
11	3/9/2004	Holstein, female	4/8/1996	94	16	dead cow
12	9/13/2004	Holstein, female	7/3/1999	62	5	
13	9/23/2004	Holstein, female	2/18/1996	103	8	
14	10/14/2004	Holstein, female	10/8/2000	48	62	dead cow
15	2/26/2005	Holstein, female	8/5/1996	102	6	dead cow
16	3/27/2005	Holstein, female	3/23/1996	108	1	
17	4/8/2005	Holstein, female	9/11/2000	54	11	dead cow
18	5/12/2005	Holstein, female	8/31/1999	68	31	
19	6/2/2005	Holstein, female	4/16/1996	109	7	
20	6/6/2005	Holstein, female	8/12/2000	57	18	
21	12/10/2005	Holstein, female	2/13/2000	69	9	dead cow
22	1/23/2006	Holstein, female	9/1/2000	64	45	dead cow
23	3/15/2006	Holstein, female	7/8/2000	68	19	
24	3/17/2006	Japanese Black, female	2/10/1992	169	3	atypical BSE
25	4/19/2006	Holstein, female	4/18/2000	71	13	
26	5/13/2006	Holstein, female	8/11/2000	68	11	dead cow
27	5/19/2006	Holstein, female	8/20/2000	68	9	dead cow
28	8/11/2006	Holstein, female	11/21/1999	80	19	dead cow
29	9/28/2006	Holstein, female	6/24/2000	75	26	dead cow
30	11/13/2006	Holstein, female	6/28/2001	64	17	dead cow
31	12/8/2006	Holstein, female	11/12/1999	84	15	
32	2/5/2007	Holstein, female	8/26/2001	65	30	
33	7/2/2007	Japanese Black, female	6/21/2000	84	8	dead cow
34	12/21/2007	Japanese Black, female	7/1/1992	185	3	
35	3/24/2008	Japanese Black, female	10/12/2000	89	9	dead cow
36	1/30/2009	Holstein, female	8/5/2000	101	6	dead cow

Source: Ministry of Health, Labour and Welfare.

Among researchers, it is widely recognized that the ability to detect BSE for cows aged 24 months or less is quite limited with today's technology: i.e., even if cows aged 24 months or less are actually infected with BSE, it is often barely (or not) detectable. Thus, cases eight and nine surprised researchers throughout the world, and accordingly, the credibility of these two cases has been questioned. In fact, a research team from the Ministry of Health, Labour and Welfare (MHLW) failed in re-proving infection of BSE for those two cases 3. However, because this failure in itself was not sufficient to conclude that those two cases are in fact incredible; the credibility of these cases is still being debated among researchers.

In Japan, only one patient has been diagnosed with vCJD. The patient died in 2004 and his infection of vCJD was identified in 2005. The MHLW announced that the patient most likely had been infected with vCJD during his stay in the United Kingdom 4. While no cows have been found to be infected with BSE in the last five years, and while the World Organization for Animal Health (OIE) recognized Japan as having a negligible BSE risk in May 2013, Japanese consumers are still worried about the risks of BSE.

Removal of specified risk material

Among scientists, removing specified risk materials (SRMs) from food is recognized as the most efficient way to prevent consumers from being infected with vCJD. SRM is the general term designated for tissues of ruminant animals that are not approved for human ingestion, because scientists have determined that BSE-causing prions concentrate there.

In October 2001, one month after the first BSE case in Japan, the MHLW specified the head (except the cheek meat and tongue), the spinal cord, and the distal ileum of cows as SRMs. By revising the Ordinance for Enforcement of the Slaughterhouse Act, the MHLW required slaughterhouses to remove SRMs from cow bodies and dispose of them safely and hygienically.

In May 2002, the OIE determined that the dorsal root ganglia contain high concentrations of BSE-causing prions, and that, thus, the dorsal root ganglia should not be included in food sold for human consumption. Following the OIE's decision, the MHLW admitted that the risk of concentration of BSE-causing prions in the dorsal root ganglia was the same as in other SRMs. However, removal of only the dorsal root ganglia from meat is technically difficult. An alternative is to remove the entire spinal column during the meat processing, thereby automatically removing the dorsal root ganglia from the finished meat products. However, since meat is often marketed in the form of carcasses, it is unrealistic to require slaughterhouses to remove the spinal column from meat. Based on this, in February 2004, the MHLW implemented a practical rule for the treatment of spinal columns: distributing meat with the spinal columns attached, before the final stage of selling meat to consumers was allowed, but they specified that, when selling the meat to consumers, the spinal columns must be removed. Likewise, in producing, processing, and cooking meat, the spinal columns must not be used as an ingredient.

BSE test for cows

In addition to the removal of SRMs, the MHLW introduced a unique countermeasure to combat the consumers' anxiety regarding BSE: screening of all cows (hereafter

abbreviated as SAC). Since October 2001, regardless of their age, all cows brought in slaughterhouses had to be tested for BSE 5.

Allegedly, the MHLW's intention of introducing SAC was to reinforce the safeness and enhance the appeal of domestic beef to consumers from an emotional aspect rather than a scientific aspect (note 6). Many scientists have criticized the use of SAC since its ability to detect BSE is low, in particular for young cows. Additionally, SAC is accompanied with heavy financial and labor burdens. Operation of SAC itself requires money for chemical reagents and trained personnel, and in addition to these direct expenses, SAC brings various additional burdens to slaughterhouses. For example, it may take many hours until the outcomes of SAC become available, and managers of slaughterhouses often experience heavy stress due to this. Moreover, not only the carcasses, but also the internal organs of the cows must be kept in the slaughterhouse until they are "proven" BSE free. In the case of carcasses, even before the outbreak of BSE, they were generally stored in freezers in the slaughterhouses for one day after slaughtering. Thus, the marketing system for beef carcasses did not change by the implementation of SAC. However, the treatment poses a problem for the internal organs. Previously, the internal organs went to the market immediately after slaughtering because their quality deteriorates quickly. When SAC was implemented, slaughterhouses were forced to install special storage facilities to preserve the quality of the internal organs, which involved considerable expenses for the slaughterhouses.

When SAC was first introduced in October 2001, the MHLW provided subsidies for all cows brought to the slaughterhouses. However, in August 2005, the MHLW tried to abolish SAC by exempting cows aged 20 months or less brought to slaughterhouses from the compulsory BSE test. Accordingly, the target of the MHLW's subsidies for the BSE test was narrowed down to cows brought to slaughterhouses at age 21 months or over. However, this decision frustrated many Japanese consumers, who supported the SAC initiative. While the MHLW did not change its decision, after receiving increasing pressure from consumers, many local governments continued SAC at their own discretion, despite heavy financial burdens.

Since 2013, the MHLW has raised the minimum age of cows for the compulsory BSE test twice. First, in April 2013, the minimum age was raised to 31 months. The majority of Japanese beef comes from cows slaughtered between the age of 21 and 30 months, and in theory, this consequently meant a drastic scale-down of the administered BSE tests. In practice, however, no change in BSE tests occurred, as the local governments still continued SAC. In addition, the MHLW continued providing subsidies for BSE tests for all cows aged 21 months or over brought to slaughterhouses. However, in July 2013, a practical change occurred after the MHLW changed the minimum age for the compulsory BSE test from 31 months to 48 months, and limited the subsidies for BSE tests to cows aged 48 months or over. Furthermore, the MHLW persuaded local governments to give up SAC. Accepting the persuasion from the MHLW, most local governments now only test for BSE in cows aged 48 months or over.

Regulation on meat-and-bone meal

There is a general agreement among scientists that BSE was spread by feeding prion-infected meat-and-bone meal to young calves. In 1996, the Ministry of Agriculture, Forestry, and Fisheries (MAFF) announced that meat-and-bone meal should not be fed to

cattle. However, at the time, this was not legally binding. In October 2001, the MAFF formally banned feeding meat-and-bone meal to cattle. Among the 36 BSE cases reported in Japan, only 1 cow (case 9; Table 1) was born after this legal ban.

Regulation on pithing

Pithing, a method in which a hole is created through the frontal bone and a wire, called a pithing rod, is inserted into the hole to break up the brain and spinal cord, is commonly used during the slaughtering process. The use of a pithing rod prevents the legs of the slaughtered cows from springing up in convulsions, thus ensuring workers' safety during the slaughtering.

However, pithing is associated with an increased risk of pieces of the broken-up brain and spinal cord attaching to carcasses. Since the brain and spinal are SRMs, pithing increases the risk of consumers being subjected to prions and infected with vCJD. Accordingly, pithing was prohibited in the European Union in 2000. Although the MHLW was aware of the risk of pithing, pithing continued to exist in Japan until 2009, when it was banned by the MHLW (Table 2). This was largely because some of the Japanese slaughterhouses were old and required extensive periods of time to install alternative slaughtering facilities.

Table 2 Number of slaughterhouses that did or did not employ pithing

Date	Pithing	No pithing	Total
Oct. 2004	45	115	160
Sep. 2005	68	93	161
Feb. 2006	79	82	161
Oct. 2006	95	64	159
Mar. 2007	109	47	156
Oct. 2007	120	34	154
Mar. 2008	144	10	154
Oct. 2008	148	6	154
Apr. 2009	154	0	154

Source: Ministry of Health, Labour and Welfare.

The outbreak of BSE-infected cows in 2001 awakened Japanese consumers' anxiety about the safeness of domestic beef, and demands for domestic beef sharply declined. In order to support the domestic beef prices, the MAFF launched a program of procuring domestic beef that had been processed before the implementation of SAC in October 2001.

Snow Brand Food, one of the most popular food companies in Japan at the time, committed an illegal act on this program: they intentionally mislabeled foreign beef as domestic and sold it to the MAFF. This illegal act was revealed in January 2002 and resulted in an outbreak of consumer complaints against Snow Brand Food, and in deep distrust of the overall safeness of domestic beef 7.

In order to remove this distrust, the MAFF proclaimed the Beef Traceability Law in June 2003. This law aims to introduce greater transparency in the domestic beef market by two steps. First, all cattle breeders must label each cow with an ear tag containing a 10-digit

identification number and report the cow's history of birth, growth, breed, and slaughter to the National Livestock Breeding Center (NLBC). Second, wholesalers and retailers must keep the records of all beef trades, including the identification numbers. Under this system, consumers can obtain detailed information on beef by searching the NLBC homepage. The first and second steps were implemented in December 2003 and December 2004 respectively, and this system has proven to be helpful in identifying BSE-suspected beef and cows once a case of BSE infection is reported.

Footnotes:

1. <http://www.dcd.gov/ncidod/drd/bse/>
2. A calf of the 24th BSE-infected cow is kept alive without receiving the BSE test for the purpose of studying the potential BSE development in the calf.
3. Ozawa, Y. "A counterargument to Yamauchi and Shinagawa's counterargument to 'BSE: a comparative study between Europe and Japan'," J. Vet. Med. Sci. 69(9):2007.
4. "Infected at the United Kingdom? The first vCJD case in Japan," February 4, 2005, Asahi Shimbun.
5. In addition to cows shipped to slaughterhouses, cows aged 24 months or over that die at stock farms must also receive the BSE test.
6. Ozawa, *ibid* (note 3).
7. This scandal resulted in a severe reduction of Snow Brand Food sales, and the company consequently went into liquidation in 2002.

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