



## Beef from the United States: Is It Safe?

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Bovine spongiform encephalopathy (BSE), or Mad Cow Disease, has been an issue of intense debate and argument over the past twenty years. The United Kingdom epidemic which peaked in 1993 caused much international concern, resulting in increased regulation of screening, testing and extermination of infected and possibly infected animals (1). Various embargos between countries were established prohibiting the import of meat products, and there continues to be much embroiled debate regarding the matter. Some countries continue to ban import of international beef, going so far as question political leadership based on the status of trading relations, despite the lack of data to support a need for such hyper vigilance (2).

BSE is a progressive neurodegenerative disease in cattle that ultimately leads to degeneration of the central nervous system. It is believed to spread via a conformational change of susceptible proteins, known as "prions," which is an abbreviation for "proteinaceous infectious particle" (3). The infectious agent is believed to be abnormally misfolded protease-resistant proteins, which trigger a conformational change of other normal cellular prions that normally exist in the plasma membrane of mammalian neurons (3). A study published in January 2007 questions whether the infective agent in transmissible spongiform encephalopathies (TSE) is a virion particle, rather than a protein (4). There remains much to be determined regarding the potential susceptibility due to possible mutations of these prion sequences, what physiologic purpose they normally serve, and what role the proteins play in the pathogenesis of TSE.

The analogous disease in humans, known as variant Creutzfeldt-Jakob disease (vCJD), is believed to be caused by exposure to the abnormal prions found in cattle infected with BSE. Transmission to humans is thought to occur via ingestion of cattle products contaminated with BSE (5). Similarly to BSE, vCJD has an incubation time lasting years, and those affected undergo a similar spongiform transformation of their central nervous system ultimately leading to death (3).

The United Kingdom epidemic was largely due to the practice of making livestock feed out of mammalian byproducts, a practice which was then banned by the European Union in 1994 (1). Due to the availability and relatively low cost of soy

products, using mammalian byproducts for ruminant feed was not as common a practice in the United States. In 1997, the United States Food and Drug Administration instituted a ruminant to ruminant feed ban (6).

The profound number of infected cattle found in the United Kingdom (180,000+) and nearby countries (Republic of Ireland, 1,600+, France 1,000+, Portugal 1,000+, Spain 700+, Switzerland 400+, Germany 300+) far outnumber the 4 confirmed cases found in the United States, of which one was found to be an animal that had been imported from Canada (7,8).

In 2014, the United States was the fifth highest consumer of beef and veal per capita, fifth to Hong Kong, Argentina, Uruguay, and Brazil. In that year, the per capita consumption of beef in the United States was found to be 53.84 kg (9). As reported by the National Creutzfeldt-Jakob Disease Surveillance Unit from the University Edinburgh, there have been a total of three reported cases of vCJD in the United States. However, there are strong evidence supporting two of three were exposed to the BSE agent while they were in United Kingdom (10). Third case was an immigrant who had been raised in Saudi Arabia, and had then moved to the United States in late 2005. According to the case report, the patient had most likely been infected while living in Saudi Arabia (10).

In 2014, the United States was second-largest exporter after Australia in terms of beef export value. Beef export value of the United States in 2014 was \$7.13 billion, which is the increase of nearly \$1 billion compared to the previous year. Export volume also increased by 2% from the previous year (11). While some countries such as Japan and South Korea continue to restrict the beef that is imported from the United States after the first case of BSE was reported in the United States in 2003, other countries reopened their borders in a matter of months (2). Beef exports to Mexico rebounded within a year, and export to Canada increased as well (2).

In April of 2006, the United States Department of Agriculture released an analysis of 7 years of BSE surveillance data, which concluded that the prevalence of BSE is less than 1 case per 10 million adult cattle (12). The analysis further stated that the most likely number of cases is 4 to 7 infected animals out of 42 mil-

lion cattle, or 0.000017% (13). The USDA continues to test for BSE via a surveillance program which complies with the science-based international guidelines set forth by the World Animal Health Organization, testing at a level far exceed higher than the recommended level (14).

If one were to exclude vegetarians who are thought to compose 3.4% of the population which is currently believed to be 320 million, one can roughly conclude that the number of meat consumers in the United States is just shy of 309 million (15,16). Our voracious appetites are reflected by our staggering ability to consume beef as measured per capita, yet reported cases of vCJD in the United States are in essence very rare. With the stringent surveillance of cattle reared in the United States and the miniscule rate of possible BSE infection as noted above, one can therefore conclude that the United States is in effect a safe exporting source of international beef.

## DISCLOSURE

The authors have no potential conflicts of interest to disclose.

## AUTHOR CONTRIBUTION

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