Research article

Risk Analysis for The Occurrence of Bovine Spongiform Encephalopathy Through Animal Importation in Bangladesh

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Abstract | Bovine Spongiform Encephalopathy (BSE) is primarily an emerging zoonotic disease of cattle and other ruminants. It has originated from adaptation and recycling of the sheep scrapie agent called scrapie associated prion protein (PrP^{sc}). Although Bangladesh did not experience a BSE outbreak so far, Bangladesh has not yet been declared BSE free by OIE due to lack of scientific risk evaluation for BSE. The scientific data were reviewed, hazards were scheduled and surveys were conducted - on import of livestock and its commodities. The analysis was done by the "OIE Risk Analysis Framework 2006 and Scientific Steering Committee (SSC) 2003",consists of hazard identification, risk assessment and risk management. Importation of live cattle from Spain was identified as external hazard. This hazard had negligible risk for the introduction of infectious prion protein in the cattle population of Bangladesh. Scrapie was never prevalent in Bangladesh and offal's, slaughtered waste do not use in the animal feed industry. Therefore, risk from the internal challenge was also negligible. Finally, it was concluded that, introduction of PrP^{sc} into cattle population via animal importation was very negligible.

Keywords: Risk analysis, BSE, Animal import, Bangladesh

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INTRODUCTION

BSE has been found in cattle in 28 countries around the world. In England, mad cow disease epidemic has killed over 18, 3841 cattle, which has devastated the British cattle industry and ruined countless farmers. From Britain the epidemic has spilled to the rest of the Europe, affecting over 4738 cattle in other countries by mid-2013. British policymaker faced serious political crisis in home and abroad when scientist discovered the fact that BSE has spread to cattle through feeding of contaminated meat and bone meal from scrapie affected sheep or cattle with previously unidentified BSE (Alban et al., 2000). British and European people stopped eating beef. Different countries; particularly developed countries banned importation of live animal and feeds from England. British government forced to kill thousands of BSE infected and contact cattle at risk of being infected. Even though, they did not recover from this malady. Mad cow disease has jumped the species barrier, killing humans and drew significant public attention around the world in 1996, it was found that, the disease is linked with a human disease "variant of Creutzfeld Jakob Disease" (vCJD) (Belay and Schonberger, 2002). Since then, there have been approximately 180 cases of vCJD in Europe, linked to humans eating of contaminated beef products infected with BSE. Since then BSE, has become the potential threat to human and animal health and food/feed safety, (Tom et al., 2002; Prusiner, 2000; Evans, 2004; Ralph et al., 2004; Vanopdenbosch and Roels, 2004; Chowdhury, 2005) As per WTO Sanitary and Phytosani-

tary (SPS) Agreement on trade in animal and animal products, different countries, particularly developed countries have banned importation of feeds and live animals from countries that have experienced with mad cow disease. Not only that, troubles are being faced by the mad cow disease free countries to export bovine origin materials (feeds, gelatin, tallow etc.) to developed countries, because importing countries want to know the authentic status of mad cow disease in the country of origin (Prusiner, 2000; Vanopdenbosch and Roels, 2004; Chowdhury, 2005). Due to lack of official GBR classification of BSE risk status, different private companies of Bangladesh are facing problems with exportation of livestock byproducts, e.g. bone chips, gelatin, omasum, etc., in different countries, particularly in Europe. In Bangladesh, ± 50,000 poor people were involved in collecting bones either from dead or from slaughtered animals. Most of these people are women's and children's. They sold animals bones in the bone crushing industries. In Bangladesh there were 27 crushing industries produced bone chips for industrial use or export (DLS, 2016). Now a day's troubles are being faced by the industries in exportation due to lack of BSE free certificates by the OIE (OIE, 2006). Thus, risk assessment for the occurrence of BSE in Bangladesh is required to get such status and to restart exportation of livestock byproducts in different countries. Animal importation of the country is highly related to the occurrence of Bovine spongiform encephalopathy in Bangladesh. Therefore, a survey was conducted to investigate the status of animal importation in the country as well as risk analysis for the occurrence of BSE in Bangladesh.

MATERIALS AND METHODS

Risk Analysis

The analysis was done by the OIE guided risk analysis model 2006 (Figure 1).

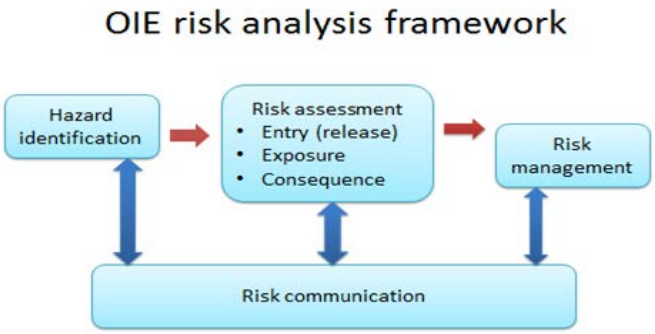

Figure 1: OIE risk analysis framework (OIE, 2006)

Hazard Identification: Hazard identification is the first step in the risk analysis. The scientific papers on BSE epidemiology and its origin were reviewed, hazards were scheduled and surveys were done on livestock production system, import and use of livestock commodity to identify the hazards present in Bangladesh context. The data were analyzed to identify the actual hazard for the occurrence of BSE in the country as per OIE guidelines.

Risk Assessment:

Entry or external challenge assessment or release pathways

The term external challenge or risk refers both the likelihood and the amount of the BSE-agent entering into a defined geographical area in a given time period through infected cattle or MBM. External challenge or risk or entry (release) challenge level was defined briefly by using the following Table 1 as proposed by Scientific Steering committee (EU-SSC, 2003) of the European Union.

It has to be underlined that the above figures in the Table 1 and the multiplier are only indicative. It is obvious that the final external challenge associated with imported cattle and their impact will largely depend on a number of factors including their age at slaughter. Excluding imported animals from the feed chain would reduce the challenge that the excluded animals represent to a negligible level. Accordingly imported animals that are slaughtered before reaching an age of 24 months would represent a lower challenge than imported animals used for breeding and then rendered at an age high enough to be approaching the end of the incubation period. If available, this and similar information are used to modulate the criteria in the Table 1.

Table 1: Determinants or Definition of BSE challenge or risk levels

External Challenge	Cattle (No. of heads) imports		
	1988-93 from UK	UK – imports before 88 and 94 – 97 * 10, after 97*100	Imports from other countries with BSE *100
Extremely High	≥ 10 000		
Very High	1 000 - < 10 000		
High	1 00 - < 1 000		
Moderate	20 - < 100		
Low	10 - <20		
Very Low	5 - < 10		
Negligible	0 - < 5		

In other countries affected by BSE and in the UK at other periods, the risk that exposed cattle were carrying the BSE-agent or that MBM was contaminated with BSE was lower. Accordingly, the challenge posed by the same amount of imports would be much lower or the same level of challenge would only occur at higher imports. To adapt the thresholds accordingly, the following multipliers were used.

Import from UK in other periods:

Cattle: before 1988 and from 1994 to 1997: multiply all thresholds by 10;

1998 and after: multiply all thresholds by 100;

Import from other countries than UK affected by BSE: regardless

of period and whenever there is reason to assume that BSE was already present at time of export:
Cattle: multiply all thresholds by 100

Exposure Assessment or Exposure pathways or Internal Challenge Assessment:
The extent of risk from the imported materials depends on the use and recycling of the imported BSE hazardous materials as it is estimated by released pathways. These in turn depend on the stability of the livestock production system. Stability is defined as the ability of cattle husbandry system to prevent the introduction and to reduce the spread of the BSE agent within its borders. A "stable" system would eliminate BSE over time; "unstable" system would amplify it (EU-SSC, 2000, 2002, 2003).

The most important stability factors are those which reduce the risk of recycling of BSE

Exclusion of those tissue/organs from rendering where BSE infectivity could be particularly high ("SRM-removal").

Excluding fallen-stock from the feed chain will also reduce the amount of BSE infectivity that could enter the feed chain and is necessary for a fully efficient SRM-removal.

Collection of animals import and specific risk materials (SRM_s) related data

Collection of Cattle and other animals import related data: To calculate the risk as per Table 1 and 2 cattle and other animals import related data were collected from, Department of Livestock Services (DLS), Krishi Khamar Sarak, Farmget, Dhaka, Central Cattle Breeding Station (CCBS), Savar, Dhaka, National Board of Revenue (NBR), Segunbagicha, Dhaka and Personal communication with the owner of the Gochihata Dairy & Fish Farm (Table- 4 - 7).

Collection of Specific risk materials (SRM_s) removal related data:
Slaughter house survey: A Slaughter house survey was conducted to investigate the fate of animal's byproducts and specific risk materials (SRM_s).

Selection of area for slaughter house survey
According to Yang (1965) a sample of representative slaughter house should be chosen in such way that the information from it meets the purpose of the survey. For the collection of information about the fate of the SRMs in Bangladesh, total 143 Butcher were interviewed from the slaughter house of five city corporations (Barisal, Dhaka, Gazipur, Khulna and Rajshahi), Seven district headquarters (Bagerhat, Jessore, Munsigonj, Mymensingh, Naogon, Satkhira and Sirajgonj) and 17 upazila (Mongla, Chorfashon, Agailjhora, Serpur, Savar, Sarsa, Sreepur, Rupsha, Bhoirob, Sreemongol, Sirajdikhan, Muktagacha, Dhamoirhat, Bera, Poba, Tala, Tarash) (Table 3).

Selection of the Butchers
The butchers were selected randomly who regularly slaughtered at least one or two cattle per day and were ready to give information when necessary from the selected study area. Ten respondents were selected from the each city corporation area, six respondents were selected from district headquarter and three respondents were selected from each upazila of the study area (Table 3).

Preparation of Survey schedule
A pretested questionnaire contained the information's in regard to identification and general information of the respondent, general information of different cuts, information about meat offal's and information's about SRMs were used

RESULTS

Animal importation

Cattle Importation: From 1973 to 2014 Bangladesh imported 4832166 nos. of cattle from Australia, India, Pakistan and Spain (Table 4). Most of these (99.98%) was imported from India and were used in meat purpose. Cattle from Australia, Pakistan and Spain were used for breeding purpose. Among these countries, Spain was the only BSE risk country (OIE web. Site: http://www.oie.int/animal-health-in-the-world/offical-disease-status/bse/list-of-bse-risk-status/). The Queen of Spain gifted 72 cattle to Bangladesh in 1992. The gifted cattle were used for breeding purpose in Central Cattle Breeding Station (CCBS), Savar, Dhaka; most of these (97.22%) died and buried using standard method. Use of these live cattle will be discussed in the exposure pathway.

Buffalo Import: From 2012 – 2014, 145695 nos. of buffalos were imported into Bangladesh only from neighboring country, India through different land ports which are presented in Table 5. BSE has not been reported in the neighboring countries.

Sheep and Goat import: From 2012 – 2014, 8401 nos. of sheep and goats were imported into Bangladesh only from neighboring India through different land ports (Table 6).

Import of horse and camel: From 2012 – 2014, 504 nos. of other animals, most of these were horse and camels imported into Bangladesh only from neighboring India through different land ports (Table 7). From 2012 – 2014, import of buffalo, horse, sheep, goat and cattle did not pose any threat as India has already been declared as negligible

Table 2: Exposure or internal challenge level

Stability	Level	Effect on BSE infectivity	Most important stability factor		
			Feeding	Rendering	SRM removal
Stable: The system will reduces BSE infectivity	Optimally stable	Very fast	OK	OK	OK
	Very stable	Fast	Two of the three factors OK one reasonably OK		
	Stable	Slow	Two or 1 OK and two reasonably OK		
Neutrally stable		+ - Constant	3 reasonably OK or 1 OK		
Unstable: The system will amplify BSE infectivity	Unstable	Slow	2 reasonably OK		
	Very unstable	Fast	1 reasonable OK		
	Extremely unstable	Very fast	None even reasonable OK		

Feeding: OK= evidence provided that it is highly unlikely that any cattle received MBM, Reasonably Ok= voluntary feeding unlikely but cross contamination cannot be excluded, Rendering: OK= only plants that reliable operate at 133^{0} 20^{min} 3^{bar}-standard, Reasonably Ok = all plants processing high risk material (SRM), fallen stock, material not fit for human consumption) operating at 133^{0} 20^{min} 3^{bar}-standard, low risk material is processed at more gentle conditions, SRM Removal: OK= SRM–removal from imported and domestic cattle in place, well implemented and evidence provided. Fallen stock I excluded from the feed chain, Reasonably Ok= SRM–removal from imported and domestic cattle in place but not well implemented of documented. If in addition to a reasonable OK SRM removal fallen-stock is excluded from rendering, the SRM removal might be considered "OK"

Table 3: Number of respondent and distribution of slaughter houses

Sl. no	Slaughter house of	Number of Market	Number of respondent in each area	Total number of respondents
1	City corporation market	5	10	50
2	District headquarter market	7	6	42
3	Upazila market	17	3	51
	Total	29	-	143

Table 4: Cattle imported in Bangladesh during 1973-2014.

Country	Year of import (no of head)										Total
	1973	1987	1990	1989	1993	1995	2006	2012	2013	2014	
Australia	125	0	0	0	150	254	25	0	24	2	580
India*	-	-	-	-	-	-	-	1287800	1796904	1746514	4831218
Pakistan	0	100	100	96	0	0	0	0	0	0	296
Spain	0	0	0	72	0	0	0	0	0	0	72
Total	125	100	100	246	150	254	25	1287800	1796928	1746516	4832166

Source: Official record of the Department of Livestock Services, Farmgate, Dhaka; Central cattle breeding Station, Savar Dhaka; Personal communication with Maj. (Rt). Aktaruzzaman, owner the Gochihata Dairy & Fish Farm; *National Board of Revenue, Segunbagicha, Dhaka. - Data were not available.

Table 5: Importation of Buffaloes form India to Bangladesh through different land ports during the period 2012-2014

Sl. no	Land ports	Year of import			Total
		2012	2013	2014	
1	Chittagong	1629	3971	4497	10097
2	Sylhet	418	61	248	727
3	Rongpur	10675	2875	2510	16060
4	Khulna	4688	119067	160397	284152
5	Jessore	2969	4161	38613	45743
6	Rajshahi	91816	35043	18836	145695

Source: Official record of NBR, Dhaka.

Table 6: Importation of Sheep /Goat from India to Bangladesh through different land ports.

Sl.no	Land ports	Year and import			Total import
		2012	2013	2014	
1	Chittagong	1283	1800	841	3924
2	Sylhet	0	0	0	0
3	Rongpure	51	0	0	51
4	Khulna	0	4	20	24
5	Jessore	273	108	109	490
6	Rajshahi	1695	966	1251	3912
Total		3302	2878	2221	8401

Source: Official record of NBR, Dhaka.

Table 7: Importation of other (Horses and Camels) animals from India to Bangladesh, through different land ports

Sl.no	Land ports	Year and import			Total import
		2012	2013	2014	
1	Chittagong	0	0	0	0
2	Sylhet	0	0	0	0
3	Rongpure	139	72	103	314
4	Khulna	21	9	11	41
5	Jessore	1	11	87	99
6	Rajshahi	20	17	13	50
Total		181	109	214	504

Source: Official record of NBR, Dhaka.

Table 8: External Challenge level for live cattle imports

	Imports from UK (no. head)				Imports from other BSE infected countries (no. head)			
Level	**Before 1988**	**1988 - 1993**	**1994- 1997**	**1998 – to date**	**Before 1988**	**1988 - 1993**	**1994- 1997**	**1998 – to date**
Extremely High	> 100000	> 10000	> 100000	> 1000000	> 10000000	> 1000000	> 10000000	> 10000000
Very High	10000 - <100000	1000 - <10000	10000 - <100000	100000 - <1000000	1000000 - <10000000	100000 - <1000000	1000000 - <10000000	1000000 - <10000000
High	1000 - <10000	100 - <1000	1000 - <10000	10000 - <100000	100000 - <1000000	10000 - <100000	100000 - <1000000	100000 - <1000000
Moderate	200 - <1000	20 - <100	200 - <1000	2000 - <10000	20000- <100000	2000 - <10000	20000- <100000	20000- <100000
Low	100 - <200	10 - <20	100 - <200	1000 - <2000	10000 - <20000	1000 - <2000	10000 - <20000	10000 - <20000
Very Low	50 - <100	5 - <10	50 - <100	500 - <1000	5000 - <10000	500 - <1000	5000 - <10000	5000 - <10000
Negligible	0 - < 50	0 - < 5	0 - < 50	0 - < 500	0 - < 5000	0 - < 500	0 - < 5000	0 - < 5000

Bangladesh imported 72 cattle from Spain in 1989

BSE risk country by OIE.

Table 3.4: Importation of other (Horses and Camels) animals from India to Bangladesh, through different land ports

Fate of imported animals

Fate of imported cattle:

Fate of cattle imported from Australia

580 cattle were imported in between 1973 to 2014 from Australia (Table 4). These cattle are being reared in central cattle breeding station (CCBS), Savar, Dhaka and in the farm of private entrepreneurs for breeding purpose under the direct supervision of Department of Livestock Services (DLS). Culling cattle were used for human consumption.

The dead animals were buried at the farm premises according to the farm provision and country tradition. In absence of rendering system in Bangladesh, no imported animals from Australia were used in animal feed chain. Fate of the cattle imported from Australia in Private entrepreneurs also took the same measures as government agency. However, none of the imported cattle diagnosed as BSE infected. BSE were also not prevalent in Australia and has been declared as negligible risk country by the OIE.

Fate of cattle imported from India

Indian cattle enter into the Bangladesh only by paying duty to the custom authority without any prior permission or clearance of competent authority like Department of Livestock Services (DLS) or Ministry of Fisheries and Livestock. For that reasons, there was no Indian cattle imported related data were available in DLS. Indian animal import related data were collected from NBR; around 5 million cattle were imported from India to Bangladesh in last 3 years (Table 4). The cattle entered into Bangladesh from India were usually unproductive and aged; these cattle were used only for human consumption. In absence of rendering system or rendering mills in Bangladesh there were no chance of any cattle organs or cattle tissues to enter into the rendering process for animal feed chain. BSE were also not prevalent in India and has been declared as negligible risk country by the OIE.

Fate of cattle imported from Pakistan

From Pakistan 296 Shahiwal cattle were imported into Bangladesh in between 1987 to 2014 for breeding purpose for CCBS, Savar, and Dhaka (Table 4). In 1987, 100 cattle were imported into Bangladesh, then in 1990 another 100 cattle were imported and finally in 1992 Bangladesh imported 96 cattle for breeding purpose. Culling cattle were used for human consumption and dead animals were buried at farm premises. No dead animals was rendered for animal feed or feed ingredients. BSE were also not prevalent in Pakistan and has been declared as negligible risk country by the OIE.

Fate of cattle imported from Spain

The Queen of Spain gifted 72 cattle for Bangladesh in 1989. These 72 cattle were introduced into Bangladesh during the BSE risk period of Spain. Cattle from Spain could have represented an external challenge for BSE to the Bangladesh. These 72 cattle were reared in CCBS, Savar, Dhaka and used for breeding purpose. The fate of these 72 cattle were investigated and it was found that 65 of which was died with in 1990 due to acute infections or heat stroke etc. Only seven cattle were survived and used in breeding purpose, of these, 5 died after 5 – 6 years later also due to some acute infections. However, none of these dead cattle showed neurological diseases or syndrome. During the investigation 30 offspring record of Spanish cattle from the CCBS, Savar, Dhaka, were collected. And none of these showed neurological symptoms specific for BSE. Two culled cattle were used for human consumption. All the dead cattle were buried in the farm premises as per standard method. The culled cattle were not used as raw materials of rendering mills or not used in animal feed chain in Bangladesh. There were 30 offspring records available, none of which developed BSE like symptoms.

Overall assessment of external challenge

From the Table 4, it is found that only 72 nos. of cattle were imported from BSE risk country (Spain) in 1989. Table 8 has been generated from Table 1 (described in Methods and Material) to calculate the risk level for Bangladesh and the risk was determined by plotting data on the specific plot. It was found that the risk for live cattle during 1973 to 2014 was estimated as negligible risk [from Table 4 it is found that in 1989 importation of 0 – 500 cattle from other than UK is considered as negligible risk (Table 8). From this assessment it was predicted that opportunity for the introduction of PrP^{sc} into Bangladesh through live cattle is negligible. However, the actual risk depends on the exposure of the imported live cattle and MBM to the feed chain.

Results of slaughter house survey

Animal slaughtering practice: The survey revealed that meat production, supply and distribution in terms of handling, slaughtering and dressing of meat animal, takes place in a much disorganized way in Bangladesh. Animals are slaughtered randomly and indiscriminately. There are few slaughter houses confined to the big cities. The authorized and unauthorized butchers are slaughtering animals in small town and villages either in the road side, bush, and open field. The hygienic practice of ante-mortem and postmortem examination were not conducted. The dressed carcasses were made into various cuts and sold to the consumers. The butchers expressed that the blood, hides, male and female genital organ, gall bladder, mandible, scapula, horn, hooves and ear were not sold for human consumption. Blood left in place or buried in slaughtered places. Hides were sold for industrial purpose and horns, hooves, scapula, skull (after processing of head) and mandible collected by local people. The collected materials (bones and hooves etc.) were sold to the agent of local bone crushing industry. The livelihood of local poor people depends on collecting and selling of slaughtered waste materials.

Fate of Specified Risk Materials (SRM) for BSE

The interview of butchers also revealed that the dorsal root ganglia, spinal cord, tonsils were sold with meat, brain, and the lower part of intestines were sold separately for human consumption. Eyes were rejected and remained scattered in the slaughtered area or threw into dust bin. Researcher

found that only Bengal Meat collected penis & omasums for export purpose. During the survey, researcher found that omasums were collected for export purpose only in Dhaka city corporation area. Although it was found that the true rendering is not in place in Bangladesh. However, SRMs are normally used for different purposes. None of these SRMs are entered into animal feed chain. Therefore, the system is identified as stable system that is the means of reduction of the PrPsc very fast, if any.

DISCUSSION

This study identified one important external hazards or challenges in regard to animal importation for the occurrence of BSE in Bangladesh is imported live cattle from Spain. Live imported cattle were used in breeding purpose and never exposed to animal feed chain. Therefore, the risk was estimated negligible from this external challenge. This study also identified few minimal internal hazards. Since external challenge is negligible, effect of internal challenges also identified negligible. The risks were calculated based on the OIE Risk Analysis Frame work - 2006 and guidelines of Scientific Steering committee -2003 of the European Union (EU). These framework and guidelines are used by different European and Non EU countries to assess their risks and accepted by the OIE. Therefore, we hope our analysis was in accordance with the OIE guidelines. Hazard identification is the first crucial step in risk analysis. This section therefore examines the potential hazards posed to Bangladesh and its livestock industries for the bovine spongiform encephalopathy (BSE). According to proven scientific evidence, it is suggested that BSE has been emerged from the scrapie, a prion disease prevailing in sheep over 200 years in sporadic nature. The disease was spilled to cattle in England when the cattle were continuously fed with MBM containing sheep derived infectious prion protein and named bovine spongiform encephalopathy (BSE). Later, the disease was identified in other European countries and few non-European countries. The movement of clinically normal but infected cattle is a risk factor for the introduction of BSE into new countries if rendered material from such cattle enters the cattle feed supply (Wells et al., 1998; Wells et al., 2007). And therefore it was claimed that the disease has causal link with the contaminated MBM and infected cattle originated from England and further it was recycled through rendering of infected animal offals in the exporting countries.

In Bangladesh, scrapie was never reported in the sheep population (Halder et al., 2009) and also rendering mill is not present in the country. Therefore, only possibility to emerge BSE in the cattle population in Bangladesh is the external challenges, i.e., only through (i) imported live cattle and cattle that has already been exposed to contaminate MBM but did not show any clinical signs and (ii) imported MBM from the BSE infected countries. As per OIE Frame Work the actual risk depends on its exposure to the population and its consequences. These are discussed below:

Importation of live cattle to Bangladesh 1973-2014 was characterized especially by two ways. One is official ways by the Department of Livestock Services (DLS), on the other hand legal and illegal trade of cattle from neighbor countries. Customs authority acknowledged the importation by receiving taxation. The live animals were also imported from Australia, India, Pakistan and Spain during the aforementioned period. Cattle from Australia, Pakistan and Spain were used for breeding purpose. However, among the exporting countries India, Pakistan and Australia are recognized as negligible risk country and therefore, cattle imported from these countries in relation to the occurrence of BSE in the native cattle population is not pertinent to BSE risk. Among these countries Spain was the only 'BSE' risk country (http://www.oie.int/animal-health-in-the-world/official-disease-status/bse/list-of-bse-risk-status/). The Queen of Spain gifted 72 cattle for Bangladesh in 1989. These cattle were introduced into Bangladesh during the BSE risk period of Spain. Cattle from Spain could have represented an external challenge for BSE to the Bangladesh. These cattle were reared in CCBS, Savar, Dhaka, for breeding purpose. During the period of data collection, the researcher investigated the death record and disposal causes of those 72 cattle. It was found that among 72 cattle, 70 cattle were died due to different acute diseases and 2 cattle were sold in auction for human consumption. However, there was no death case due to neurological diseases or syndrome among Spanish cattle. According to the farm record, there was no death case due to BSE among the Spanish cattle either imported from Spain or its offspring. Two culled and sold cattle were used for human consumption and rest seventy dead cattle were disposed by burial methods in farm premises. Both the dead and culled cattle were not used as raw materials of rendering mills or not used in animal feed chain in Bangladesh. Therefore, it can be summarized that introduction of BSE risk into cattle population of Bangladesh from imported cattle is negligible, though, risk analysis in regard to MBM import and utilization should be accomplished very soon by further study to clear the fact. Our neighbor India imported live cattle from Denmark (1990, 1998), Germany 1986, 1987 and 1999), Israel (1996), Spain (1988) (Ozawa, 2003). All these are BSE risk countries. After risk analysis, India has been identified as negligible risk country by OIE. Bangladesh only imported cattle from Spain and even record of these animals are well documented. Therefore, Bangladesh can be considered as BSE negligible risk country.

CONCLUSION

It is concluded that, introduction of BSE risk into cattle population of Bangladesh from imported cattle is negligible, though, risk analysis in regard to MBM import and utilization should be accomplished by further study to clear the fact. Though, our neighbor country India imported live cattle from different BSE risk countries but has been identified as negligible risk country by OIE. Bangladesh only imported cattle from Spain and even record of these animals are well documented. Therefore, Bangladesh can be considered as BSE negligible risk country

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CONFLICT OF INTEREST

No conflict of interest among author's.

NOVELTY STATEMENT

This study revealed that, risk from the internal challenge was also negligible i.e introduction of PrPsc into cattle population via animal importation in Bangladesh was very negligible. Based upon the findings of this study Department of Livestock Services (DLS), Ministry of Livestock and Fisheries, Govt. of the People 's Republic of Bangladesh can take initiatives to announce the Bangladesh as a BSE free country from OIE/ WOAH which would be a new door of exportation of animal products and by products in the international market.

AUTHORS CONTRIBUTION

Md. Nazrul Islam was conducted this study, writing manuscript and reviewed. Md. Saiful Islam Siddiqui is contributed to reviewd the manuscript, data analysis and interpretation. Md Rafiqul Islam and Emdadul Haque Chowdhury were contributed in the supervision of the study, resources, project administration and funding.

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