Review

Threats from farm animals to food and human security

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This paper discussed the threats from farm animals to food and human security. In response to these threats, a radical reform plan was adapted by several countries and the plan includes restructure of the organization of governing agencies, implementation of a traceability system from the farm sector to end users, application of hazard control measures, as well as tightening the food import control system.

Key Words: food security, government organization, traceability, GAP, import control

INTRODUCTION

Increased demands of animal products increases the close proximity of farmers to animals.[1] Animal production value shared 35.3 percent of the total agriculture production value in 2008. Swine production has become the number one agricultural industry in terms of value since 1986, valued at 2.14 million USD in 2008. Poultry production is next after swine. Meat consumption per capita was 76 kg in Taiwan during past five years. This included 40 kg pork, 33 kg poultry and 3 kg red meats. In developing and developed countries, zoonotic diseases including mad-cow disease, food and mouth disease and avian flu, residue and pathogens are all significant treats to human life.[2-4] The spread of food insecurity is not only had adverse effects on public health but also on international trade. This paper compares the control measures taken by many countries to solve the challenge found in the animal food supply chain.

CHALLENGES IN ZOONOTIC INFECTION AND FOOD SAFETY SCARES

Hundreds of millions of people depend on livestock for their livelihoods but at the same time, diseases are transmited from farm animals to human.[5] A number of serious zoonotic infections caused major levels of morbidity for farmers and subsequently have a negative impact on the human population.[6] Starting from 2003, the avian influenza outbreak has caused many human lives (Table 1). Other than what is found in the European community, diseases of animal origin that cause threats not only to animal production, but also to human health, are emerging at the rate of perhaps two per year.[6] The avian influenza outbreak pushed many Southeast Asia governments to introduce good surveillance and a rapid, coordinated response plans to deal with outbreaks.[6] however, the same principles that several governments adopted were not applied to tackle other disease outbreaks such as Foot-and-mouth disease, classic swine fever and hemorrhagic septicemia which are significant examples impaired human security in Asia. It was suggested that the strategies used to contain avian influenza could be applied more broadly.[6]

REORGANIZATION OF GOVERNMENT AGENCY

Mad-cow disease, dioxin incidence and other food security issues have triggered the reform of the European Union and a single, independent food safety agency was established to face the challenge of food safety treats.[7] Similar reorganizations were also observed in Canada, Demark, Irish, Australia and these countries restructured from multi-cooperative government agencies into one single agency in charge of production, distribution, trading and consumption.[8] In addition, many governments also establish independent agency to perform risk assessment and sometimes, to supervise the effectiveness of the official authority managing country food safety.[8] It symbolized better government agency coordination in controlling the “from farm to table” animal product supply chain.

TRACEABILITY SYSTEM AND APPLICATION OF TECHNOLOGY

Traceability is the basis in the identification of the source and establishment posing food risk whenever there is an outbreak. It has become a voluntary certification system in Taiwan, Korea, China or compulsory requirements in Japan and European Union.[8] Taiwan promulgated the Agricultural Production and Certification Act and good agricultural practices (GAPs) to implement the voluntary certification system under the ISO/IEC 65 scheme. GAPs consist of requirements for production, food processing, delivery, sales and consumers and it follow the "farm to

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Table 1. Cumulative Number of Confirmed Human Cases of Avian Influenza A/(H5N1) Reported to WHO‡

Country	2003		2004		2005		2006		2007		2008		2009		Total†	
	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths
Azerbaijan	0	0	0	0	0	0	8	5	0	0	0	0	0	0	8	5
Bangladesh	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Cambodia	0	0	0	0	4	4	2	2	1	1	1	0	0	0	8	7
China	1	1	0	0	8	5	13	8	5	3	4	4	7	4	38	25
Djibouti	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Egypt	0	0	0	0	0	0	18	10	25	9	8	4	26	4	77	27
Indonesia	0	0	0	0	20	13	55	45	42	37	24	20	0	0	141	115
Iraq	0	0	0	0	0	0	3	2	0	0	0	0	0	0	3	2
Lao People's Democratic Republic	0	0	0	0	0	0	0	0	2	2	0	0	0	0	2	2
Myanmar	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
Nigeria	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1
Pakistan	0	0	0	0	0	0	0	0	3	1	0	0	0	0	3	1
Thailand	0	0	17	12	5	2	3	3	0	0	0	0	0	0	25	17
Turkey	0	0	0	0	0	0	12	4	0	0	0	0	0	0	12	4
Vietnam	3	3	29	20	61	19	0	0	8	5	6	5	4	4	111	56
Total	4	4	46	32	98	43	115	79	88	59	44	33	37	12	432	262

†Total number of cases includes number of deaths.
‡WHO reports only laboratory-confirmed cases. All dates refer to onset of illness.
Source: WHO, 2009, Confirmed Human Cases of Avian Influenza A (H5N1). Global Alert and Response (GAR)

Fig 1. Carcass washing machine

Table 2. Comparisons of fecal contaminations before and after carcass wash

Contamination rate[1]		Carcass Wash Water	
		90psi	Non-pressured
Before Wash	Feces	16.70%[a]	13.30% [b]
After Wash	Feces	0% [c]	0% [c]

Results with different letter are statistical significantly different (p<0.05)

table" approach. In addition, it is merged with HACCP-based risk analysis techniques in requiring the establishments to control risks which include residue, pathogens and others.

Researches also demonstrated that application of technologies could control hazards; ensure proper cleaning and sanitizing, hygiene control of food contact surface, temperature and sanitation control in the carcass chilling tanks.[10,11] Fecal and feed contaminations were the sources of pathogens. Pressured water with tri-sodium phosphate (TSP) iss a technique (Figure 1) that effectively (p<0.05) controls the fecal and feed contaminations (Tables 2 and 3) and significantly reduced *E. coli* from 1,172 to 23 and 2 CFU/mL, separately.[10] The dominant micorflora with regard to chicken not receiving pressured TSP treatment was *Pseudomonas* spp, *Flavobacterium* spp., *Enterobacteriaceae, Staphylococcus* spp., and *Micrococcus* spp.

Table 3. Comparisons of feed contaminations before and after carcass wash.

Contamination rate[1]		Carcass Wash Water	
		90psi	Non-pressured
Before Wash	Feed	14.70%[a]	13.0% [b]
After Wash	Feed	0%[c]	6.60%[d]

Results with different letter are statistical significantly different (*p*<0.05)

Table 4. Effects of carcass washing on the changes of micro flora of chicken

	Natural	TSP
Staph. lentus	5	0
Staph. xylosus	5	6.25
Staph. aureus	5	0
Microccus	5	6.25
Streptococcus	17.8	37.5
Lactobacillus	17.4	37.5
Flavobacterium Cytophaga	8.7	0
Aer.hydrophila gr.	4.3	0
Staph.hominis	4.3	0
Flavorbacterium	4.3	0
Staph.lugdunensis	6.2	0
Enterobacteriaceae	10	6.25
others	7	6.25
Total	100	100

The predominant microflora of TSP washed chicken was *Streptococcus* and *Lactobacillus* (Table 4).

IMPORT CONTROL

Comparisons of import control of Taiwan, Russia, Australia, Korea, China and Hong Kong indicated that countries vary in import control in many aspects. These include the issue of import permit, prior import notice, foreign establishment inspection, issuance of health certificate, re-inspection, agencies performing inspection/testing, inspection rate, testing criteria, inspection time period, and terms of release.[3,7,8]

CONCLUSIONS

The food supply chain is in the new global security environment and there is a need to be ever mindful of new and emerging risks. An awareness of these new risks and the need to sustain a culture of security awareness across all countries is recognized. The appropriateness of government organization, traceability, new technologies, individual country import control, and cooperation among countries becomes more resilient in the face of these threats to assure food and human security in the global food system.

AUTHOR DISCLOSURES

Bao-Ji Chen, Chung-Ping Ho and Nai-Yun Huang, no conflicts of interest.

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從家畜禽飼育至糧食及人類安全的威脅

本文討論家畜禽飼養及屠宰過程，對糧食及人類安全所造成的威脅。對於此威脅，先進國家採取許多改革措施，例如重組政府組織，設立主管食品安全機構，執行確保由農場到消費者之食品安全措施，建構產銷履歷制度，應用重點危害控管措施，並強化進口糧食管制系統。

關鍵字：糧食安全、政府組織、產銷履歷、良好農業規範、進口管制