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Comparative Study on the Epidemiology of Food-Borne Disease Outbreaks in Korea and Japan

Sun Young Hwang, Bo Youn Moon, Yong-Ho Park, Myeong-Jin Lee[1], Hyeong-Ae Bang[2], Kook-Hwan Rhim[2], Jin-Seok Kim[3], Nong-Hun Che[3], Won-Chang Lee[3]*

College of Veterinary Medicine, Seoul National University, Seoul, Korea
[1]Public Health in Department of Nutritional Sciences, Otemae College of Nutrition, Osaka, Japan
[2]College of Health Science, Korea University, Seoul, Korea
[3]College of Veterinary Medicine, Konkuk University, Seoul 143-701, Korea

한국과 일본의 식중독 발생 역학의 비교연구

황선영 · 문보연 · 박용호 · 이명진[1] · 방형애[2] · 임국환[2] · 김진석[3] · 최농훈[3] · 이원창[3]*

서울대학교 수의과대학, [1]Otemae College of Nutrition, [2]고려대학교 보건과학대학, [3]건국대학교 수의과대학

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ABSTRACT – The epidemiology of reported food-borne disease (FBD) outbreaks from 2001 to 2008 in Korea and Japan were compared in this study. The outbreak rate of FBD in Japan was significantly higher although the average number of patient in each outbreak in Korea was much higher. In both countries, summer was the season when most FBD outbreaks occurred. The comparison study revealed that FBD outbreaks in spring were more frequent in Korea, and outbreaks in winter were more frequent in Japan. Almost half of FBD outbreaks were observed at restaurants in both countries while FBD outbreaks at schools and work-places in Korea were much higher than in Japan. The most frequent cause of bacterial FBDs in Korea was pathogenic *Escherichia coli* followed by *Salmonella* species. On the other hand, *Campylobacter jejuni* was the most frequent source of bacterial FBDs in Japan. Norovirus, which is related to uncontrolled hand hygiene and involvement of ill food workers, was the main cause of viral FBDs in both countries. In conclusion, there are common epidemiological characteristics as well as several differences in FBD outbreaks of Korea and Japan. These are suggested to be originated from the characteristic of climate, food sources, and life styles in two countries. Establishment of stricter control and surveillance system for FBD outbreaks are required for prevention and reduction of FBD outbreaks in both countries.

Key words: food-borne diseases, epidemiology, Korea, Japan

Introduction

Food-borne disease (FBD) is one of the major health problems worldwide caused by etiological agents, which are usually infectious or toxic in nature, entering into the body through ingested foods[1,2]. Prevalence of FBDs has changed remarkably along with significant shifts, especially in the food preparation industry and life styles, during the past decades[1,3]. Moreover, the growing rates of outbreaks are causing some FBDs to be considered as emerging threats to public health[4]. As the rate of FBD outbreaks increases, many public health authorities are required to concentrate more on the importance of global food safety[5,6].

Korea and Japan are very close to each other not only in terms of geographic location but also food culture. For example, both countries use chopsticks, and consume rice and raw fish. Comparing the epidemiology of FBD outbreaks in these two countries provides information for performing risk assessments and establishing food safety policies. In this study, we investigated recent cases of FBD outbreaks and compared the epidemiology and major risk factors in Korea and Japan.

Materials and Methods

Data collection

The surveillance data of Korean FBD outbreaks from 2001

*Correspondence to: Won-Chang Lee, College of Veterinary Medicine, Konkuk University, Seoul 143-701, Korea
Tel: +82-16-223-9096, E-mail: lwcdvm@yahoo.co.kr

to 2008 were obtained from the Food Poisoning Statistical System of Korea Food and Drug Administration (KFDA)[7], Ministry of Health and Welfare, Republic of Korea. Japanese data were obtained from the Annual Report of Food Poisoning Outbreaks of Ministry of Health, Labor and Welfare (MHLW), Japan[8]. The data included information about prevalence of FBDs, numbers of patients, seasonal outbreaks, the location where outbreaks occurred, and etiological pathogenic agents.

Data analysis

The outbreak rate of FBD was calculated as the number of outbreaks per 100,000 people per year. The average numbers of patients in each outbreak were also estimated. Comparison of those values between Korea and Japan was performed with paired t-tests and one-way analysis of variance (ANOVA). The seasonal prevalence of outbreaks, the place where outbreaks occurred, and etiological factors of FBD outbreaks were compared between the two countries by Chi-square tests (X2-test) and estimating 95% confidence intervals (CI). Analyses were performed with the Analyze-it program (Analyze-it Software Ltd., Leeds, United Kingdom) and results were considered to be statistically significant at $P < 0.05$ or $P < 0.01$.

Results and Discussion

From 2001 to 2008, the outbreak rate of FBD was 15.8 and 24.9 in Korea and Japan, respectively (Table 1). Statistically, the prevalence in Japan was significantly higher than that in Korea. On the other hand, the average number of patients in each FBD outbreak in Korea (36.1) was significantly higher than that in Japan (18.5) (Table 1). These disparities may reflect food-related cultural differences between the two countries.

In both countries, FBD outbreaks occurred most frequently in summer. One the other hand, the outbreak rate in spring was higher in Korea than Japan and vice versa in winter (Table 1). It is well known that most FBD outbreaks are affected by seasonal or climatic conditions because high temperatures and humidity increase the chance of proliferation and toxin production of pathogenic bacteria in incompletely cooked meals[3]. In both countries, more strictly controlled times and temperatures for cooking would reduce the incidence of outbreaks.

The places where outbreaks occurred were also analyzed and compared (Table 1). Both in Korea and Japan, almost half of FBD outbreaks were observed at restaurants in hotels, cafeterias, and various food stores. Recently, more and more social meetings including weddings, funeral services, and birthday parties are held in restaurants. These changes in life style might be one reason for the growing rate of FBD outbreaks in restaurants.

In comparison, FBD outbreaks at schools and work-places in Korea were much higher than those in Japan (Table 1). Outbreaks in school are usually associated with various risk factors and the sensitive immune systems of children[10]. Usually, a catering system provides food materials or meals and each school or work-place is responsible for the final preparation. It was reported that careless kitchen manners, such as bare-hand preparation of food, were related to FBD outbreaks[11]. Stricter control and inspection systems such as Hazard Analysis and Critical Control Point (HACCP)[12] should be established in both Korea and Japan.

It is known that bacterial and viral species are major agents of FBDs[10]. As shown in Table 2, pathogenic bacteria were the most common cause of FBDs in the two countries, accounting for 45.3% and 66.5% of the total outbreaks in Korea and Japan, respectively.

The most frequent cause of bacterial FBDs in Korea was pathogenic *Escherichia coli* (11.0%) followed by *Salmonella* spp. (10.9%) and *Vibrio parahaemolyticus* (9.4%). Since these enteric bacteria are the representative indicators of fecal contamination, it is suggested that education and disease control systems for hygiene practices of food handlers are critical. The high prevalence of *Vibrio parahaemolyticus* might be caused by consumption of raw fish during the summer season.

On the other hand, *Campylobacter jejuni* was the most

Table 1. Risk factor comparison of food-borne disease outbreaks in Korea and Japan from 2001-2008

	Korea	Japan
Rate of outbreaks[a]	15.8	23.0**
Patients in each outbreak[b]	36.1**	18.5
Seasonal outbreaks (%)		
Spring	452 (26.5)**	2,436 (19.1)
Summer	609 (35.8)	4,328 (33.7)
Autumn	417 (24.5)	3,349 (26.3)
Winter	225 (13.2)	2,653 (20.9)**
Total outbreaks	1,703 (100)	12,726 (100)
Places of origin (%)		
Homes	104 (6.1)	1,317 (10.4)*
Restaurants	804 (47.2)	5,824 (45.8)
Schools (lunch)	335 (19.7)**	210 (1.6)
Work-places	142 (8.3)**	403 (3.2)
Others	263 (15.5)**	171 (1.3)
Unknown	55 (3.2)	4,798 (37.7)**
Total outbreaks	1,703 (100)	12,723 (100)

[a] FBD outbreak rate per 100,000 people per year
[b] Average numbers of patients in each outbreak
Chi-squared analysis indicates a significant difference at $*p < 0.05$ and $**p < 0.01$.

Table 2. Etiological factor comparison of food-borne diseases in Korea and Japan from 2001-2008

Causes	Korea		Japan	
	95% CI[a]	Outbreak (%)	95% CI[a]	Outbreak (%)
Bacteria	771 (45.3)	42.9-47.7	8,457 (66.5)	65.7-67.3
Salmonella spp.	186 (10.9)	9.4-12.4	1,894 (14.9)**	14.3-15.4
Staphylococcus aureus	143 (8.4)**	7.1-9.7	530 (4.2)	3.9-4.6
Clostridium botulinum	-	-	2 (0.0)	-
Clostridium perfringens	18 (1.0)	0.5-1.5	244 (1.9)*	1.9-2.1
Vibrio parahaemolyticus	159 (9.4)	8.0-10.8	1,092 (8.6)	8.1-9.1
pathogenic *Escherichiacoli*	187 (11.0)**	9.6-12.4	569 (4.5)	4.1-4.9
Bacillus cereus	26 (1.5)*	0.9-2.1	116 (0.9)	0.7-1.1
Yersinia enterocolitica	-	-	13 (0.1)	-
Camphylobacter spp.	19 (1.1)	0.6-1.6	3,910 (30.7)**	29.9-31.5
Other bacteria	33 (1.9)**	1.3-2.6	87 (0.7)	0.6-0.9
Virus	266 (15.6)	13.9-17.3	2,529 (19.9)	19.2-19.9
Norovirus	250 (14.7)	13.3-16.1	2,512 (19.7)	19.0-20.4
Other virus	16 (0.9)**	0.5-1.3	17 (0.1)	-
Chemical toxin	4 (0.2)	-	103 (0.8)*	0.7-1.0
Natural toxin	14 (0.8)	0.4-1.2	984 (7.7)**	7.3-8.3
Others	-	-	49 (0.4)	0.3-0.5
Unknown	648 (38.1)**	35.8-40.4	601 (4.7)	4.3-5.1
Total	1,703 (100)		12,723 (100)	

[a]95% CI: Confidence interval of 95% of the rate

Chi-squared analysis indicates a significant difference at $*p < 0.05$ and $**p < 0.01$.

frequent source of FBDs in Japan. Campylobacteriosis is one of the common FBDs which induces illness through the ingestion of contaminated food such as unpasteurized milk, and undercooked poultry and meat products[13]. The second most prevalent bacterial source was *Salmonella* spp. which also originates from poultry or egg products. Those two bacteria were also reported as the major causes of FBDs in European Union and United States[14,15,16]. Strict control and surveillance systems on dairy and poultry products are required to reduce the rate of FBDs caused by *Campylobacter* spp. and *Salmonella* spp.[5].

Viral FBDs totaled 15.6% in Korea and 19.9% in Japan and were caused mostly by *Norovirus* in Korea as well as Japan. *Norovirus* is one of the most common causes of acute gastroenteritis worldwide[6]. It is reported that many *Norovirus* infections are oyster-associated or food handler-associated outbreaks[17]. *Norovirus* outbreaks should be controlled by improving hand hygiene, using environmental disinfections, and excluding ill food workers.

Outbreaks caused by chemical and natural toxins were more frequent in Japan (0.8% and 7.7%, respectively) than in Korea (0.2% and 0.8%, respectively). Unknown etiologies however, in Korea (38.1%), were significantly higher than those in Japan (4.7%). Improvement of epidemiological surveillance systems for FBD outbreaks is required in Korea.

In conclusion, there are common epidemiological characteristics as well as several differences in FBD outbreaks of Korea and Japan. These are suggested to be originated from the characteristic of climate, food sources, and life styles in two countries. Establishment of stricter control and surveillance system by the public health authorities should be considered for prevention and reduction of FBD outbreaks in both countries. Moreover, continuing surveillance and monitoring of FBD outbreaks are required to establish efficient and effective food hygiene and safety policies in both countries.

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