Osong Public Health Res Perspect 2014 5(1), 34–39
http://dx.doi.org/10.1016/j.phrp.2013.12.004
pISSN 2210-9099 eISSN 2233-6052

ORIGINAL ARTICLE

Emerging Pathogens and Vehicles of Food- and Water-borne Disease Outbreaks in Korea, 2007–2012

Shinje Moon [a,1], Il-Woong Sohn [b,1], Yeongseon Hong [c], Hyungmin Lee [a], Ji-Hyuk Park [a], Geun-Yong Kwon [a], Sangwon Lee [a], Seung-Ki Youn [a,*]

[a]*Division of Epidemic Intelligence Service, Korea Centers for Disease Control and Prevention, Osong, Korea.*
[b]*Division of Health and Korean Medicine, Jeollanamdo Provincial Government, Muan, Korea.*
[c]*Department of Public Health, Sahmyook University Graduate School, Seoul, Korea.*

Received: December 2, 2013
Revised: January 13, 2014
Accepted: January 20, 2014

KEYWORDS:
epidemiology,
Escherichia coli,
food-borne outbreaks,
norovirus,
surveillance

Abstract
Objectives: Food- and water-borne disease outbreaks (FBDOs) are an important public health problem worldwide. This study investigated the trends in FBDOs in Korea and established emerging causal pathogens and causal vehicles.
Methods: We analyzed FBDOs in Korea by year, location, causal pathogens, and causal vehicles from 2007 to 2012. Information was collected from the FBDOs database in the Korean Centers for Disease Control and Prevention.
Results: During 2007–2012, a total of 1794 FBDOs and 48,897 patients were reported. After 2007, FBDOs and patient numbers steadily decreased over the next 2 years and then plateaued until 2011. However, in 2012, FBDOs increased slightly accompanied by a large increase in the number of affected patients. Our results highlight the emergence of norovirus and pathogenic *Escherichia coli* other than enterohemorrhagic *E. coli* (EHEC) in schools in 2012. We found that pickled vegetables is an emerging causal vehicle responsible for this problem.
Conclusion: On the basis of this study we recommend intensified inspections of pickled vegetable manufacturers and the strengthening of laboratory surveillance of relevant pathogens.

1. Introduction

Food-borne diseases are an important public health problem [1]. Although it is impossible to estimate the worldwide burden of food-borne diseases [2], numerous food-borne disease outbreaks have been reported to the national surveillance and reporting systems in diverse countries such as the USA, European countries, China, and Japan [3–6]. In Korea 200–300 food- and water-borne disease outbreaks (FBDOs) are annually

*Corresponding author.
E-mail: yunki7777@naver.com

[1]These authors contributed equally to this article.

reported to the national surveillance and reporting system. However, there is little information to describe epidemiological characteristics of FBDOs in Korea including causal pathogens, causal vehicles, and outbreak places. Therefore, identifying epidemiological characteristics of FBDOs in Korea can provide additional epidemiological information of FBDOs in eastern Asia and contribute to finding global trends of FBDOs. Furthermore, considering that the epidemiological information is essential to make more efficient national policy to prevent infectious diseases, identification of epidemiologic characteristics of FBDOs is significant. Thus, this study aimed to identify the epidemiologic characteristics of FBDOs in Korea by analyzing epidemiologic data on FBDOs reported to the Korea Centers for Disease Control and Prevention (KCDC) during 2007–2012.

2. Materials and methods

2.1. Data collection

A total of 253 local public health centers are responsible for most of the epidemiological investigation of outbreaks caused by infectious diseases [7] in Korea. However, when large-scale outbreaks occur that cannot be controlled by local public health resources, Epidemiological Intelligence Service officers from the 16 provincial offices or KCDC usually conduct the epidemiological investigation [8]. Most epidemiological investigation reports and all the reports about FBDOs by microorganisms are submitted to the database electronically. All FBDOs reports were reviewed by EIS officers in KCDC to decide official results. The official results regarding causal pathogens and causal vehicles are based on the KCDC investigation report *Epidemiological Investigation Guideline for Water and Food-borne Disease* [7]. The database, the official results, and the epidemiological investigation summaries of the FBDOs are all available on the Internet [9]. In this study, we excluded FBDOs that occurred outside Korea.

2.2. Definition

An FBDO is defined as the occurrence of two or more cases of a similar illness resulting from a common food [7]. The causal pathogen is confirmed by standard laboratory confirmative criteria. If the laboratory results do not meet the confirmative criteria, the causal pathogen is suspected by reasonable assessment of the relevant epidemiological investigations such as checking incubation period [10,11]. The causal vehicle is confirmed when the same microorganism is isolated from the vehicles and illnesses. If the microorganism is not isolated from the illnesses, the causal vehicles are suspected by the results of statistical analysis or the laboratory results of the vehicles with an appropriate incubation period. Because most foods contained diverse ingredients, we simplified the causal vehicles into six groups by the main ingredient: meat, seafood, fresh vegetables, pickled vegetables, water, and others. In this study, positive results include both confirmed cases and suspected cases.

3. Results

3.1. National surveillance during 2007–2012

A total of 2862 FBDOs were reported between 2007 and 2012. Of these,1794 FBDOs affecting 48,897 patients occurred domestically and 1068 FBDOs occurred outside Korea. During 2007, 440 FBDOs and 9830 patients were reported. Thereafter, FBDOs and patient numbers steadily decreased over the next 2 years and then plateaued until 2011. However, in 2012, FBDOs increased slightly accompanied by a large increase in the number of affected patients: 350 FBDOs with 8543 illnesses in 2008; 224 FBDOs with 6827 illnesses in 2009; 256 FBDOs with 7259 illness in 2010; 236 FBDOs with 7039 illnesses in 2011; and 288 FBDOs with 9408 illnesses in 2012.

3.2. Epidemiological characteristics of the places where the FBDOs occurred

Over the study period FBDOs occurred most frequently in public restaurants (881 FBDOs with an average of 16.1 patients/outbreak). However, school catering services caused the greatest number of patients. Although only 293 FBDOs were reported in schools over the 6 years, the scale of FBDOs was much higher at 79.6 patients/outbreak. Reports of FBDOs in public restaurants decreased dramatically after 2009, whereas FBDOs in schools increased gradually with the largest numbers of patients occurring from 2010 onwards (Figure 1).

3.3. Causal pathogens

The causal pathogens were identified in 1025 of the 1794 FBDOs (57%) over the 6 years. The main causal pathogens were as follow: norovirus, pathogenic *Escherichia coli* other than enterohemorrhagic *E. coli* (EHEC), *Salmonella* species, and *Vibrio parahaemolyticus*. The most common causal pathogen was norovirus, followed by pathogenic *E. coli* other than EHEC, *Salmonella* species, and *V. parahaemolyticus*.

In public restaurants, norovirus, which caused 28 FBDOs in 2007, became the most common causal pathogen in 2008 (33 FBDOs). However, it decreased rapidly and caused fewer than 10 FBDOs/year after 2009. Pathogenic *E. coli* other than EHEC caused 21 FBDOs in 2007 but after 2008 caused approximately 10 FBDOs/year. *V. parahaemolyticus* was the most common causal pathogen in 2007 and drastically decreased