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Occurrence of *Vibrio parahaemolyticus* in Fishery Products from the Southwestern Coast of Korea

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Abstract Fishery products were collected in seafood markets located on the southwestern coast of Korea between 2000 and 2004 and examined for the presence of *Vibrio parahaemolyticus*. This strain was detected in 138 of 843 samples (16.4%) that included clams, eels, crabs, octopuses, and cockles. The number of positive findings for *V. parahaemolyticus* among fishery products was the highest in clams at 23.6% followed by eels at 22.1%, crabs at 21.1%, octopuses at 18.0%, and cockles at 14.3%. *V. parahaemolyticus* was detected with overall frequencies of 15.3, 14.8, 13.8, 21.6, and 18.6% from 2000 to 2004, respectively. The monthly occurrence of the organism rapidly increased to over 20% between June and October. The monthly cases of food borne disease caused by *V. parahaemolyticus* in Korea over the last five years began to increase in August and reached its peak in September. However, the potential for outbreaks of food borne disease caused by *V. parahaemolyticus* was relatively minor between November and April. Consequently, this study shows that fishery products harvested from June to October must be handled sanitarily in Korea.

Keywords: *Vibrio parahaemolyticus*, food borne disease, fishery products, Korea

Introduction

Vibrio strains of bacteria are ever-present in marine and estuarine environments and are commonly present in or on shellfish and other seafood (1-5). Epidemiological studies have confirmed that *Vibrio parahaemolyticus* is a global agent in gastroenteritis, and results of ecological studies demonstrate that it can be isolated in seafood, as well as estuarine, neritic, and brackish waters (6-10). Food poisoning especially that caused by *V. parahaemolyticus* has increased globally in the last few years (5). This microorganism has been recognized as an important cause of food borne illness from consuming raw or undercooked seafood (5, 7, 11). Symptoms associated with the illness include watery stools, abdominal cramps, nausea, and vomiting (7).

In coastal environments, a close relationship between the consumption of raw seafood and the occurrence of human intestinal and extra-intestinal infections contribute to the attention given to *V. parahaemolyticus* (12). Seafood products harvested from contaminated waters and improperly preserved are known to play an important role in *Vibrio* infections (13). However, knowledge of the spread of *V. parahaemolyitcus* in seafood from Korea is somewhat limited, and data is very sparse.

In this study, we report on the distribution of potentially pathogenic *V. parahaemolyticus* strains in fishery products harvested from the southwestern coast of Korea during the period of 2000 to 2004.

Materials and Methods

Media and rapid detection kit API 20NE systems were obtained from bioMérieux Co. (Marcy l'Etoile, France) and triple sugar iron agar (TSI) from Difco Co. (Sparks, MD, USA). All other systems were purchased from Merck Co. (Darmstadt, Germany).

Isolation of *V. parahaemolyticus* Fishery products were collected from coastal sites (Mokpo, Yosu, Wando, Gunsan, Buan) located along the southwestern coast of Korea during the period of 2000 to 2004. Following collection, samples were delivered immediately to the laboratory in cool boxes (4°C). In order to prepare the samples for isolation of harbored bacteria, flesh samples of approximately 25 g were excised using a sterile scalpel. The 25 g sample pieces were then homogenized in 225 mL of 3% NaCl containing an alkaline peptone solution (pH 8.6) using a stomacher (Promedia SH-001; Elmex, Tokyo, Japan). The homogenate obtained from this process was then incubated from 18-24 hr at 37°C. A spoonful of enriched broth water was spread on a thiosulfate citrate bile salt (TCBS) agar plate and incubated for 24 hr at 37°C. Green colonies on TCBS agar plate were selected and screened for the production of oxidase and fermentation activity on TSI slant agar. More complete genus identification including biochemical characteristics was obtained using an API 20NE kit.

Results and Discussion

Detection frequencies of *V. parahaemolyticus* Among the fishery products examined, as shown in Fig. 1, the highest rate of detection was found in clams (23.6%), followed by eels (22.1%), crabs (21.1%), octopuses (18.0 %), and cockles (14.3%). During the sampling period, as shown in Fig. 2, *V. parahaemolyticus* strains were isolated in a total of 138 (16.4%) out of 843 samples examined; specifically, 35 (15.3%) were isolated in 2000, 36 (14.8%) in 2001, 16 (13.8%) in 2002, 27 (21.6%) in 2003 and 24 (18.6%) in 2004. In contrast, Baek *et al.* (14) reported that the distribution of *V. parahaemolyticus* in seawater, sea fish, and mud in western coastal areas in Korea between

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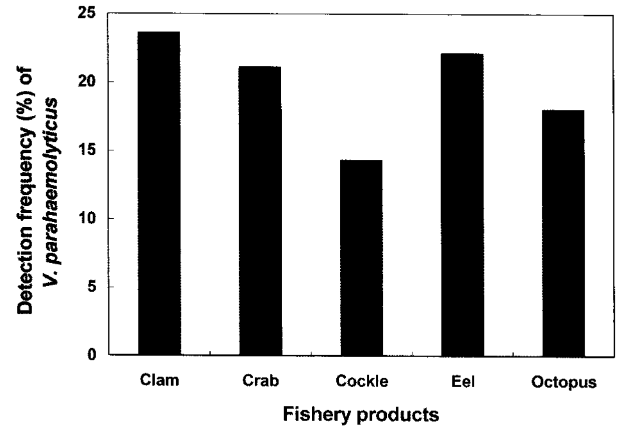

Fig. 1. Prevalence of *V. parahaemolyticus* from fishery products in Korea over a five-year period.

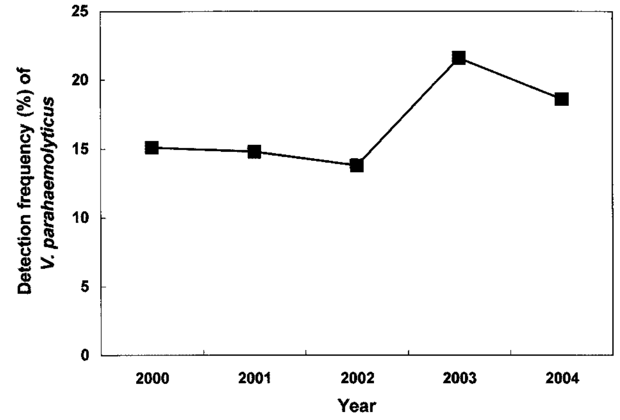

Fig. 2. Annual prevalence of *V. parahaemolyticus* in Korean fishery products over a five-year period.

1992 and 1994 ranged from 7.2 to 13.8%. Lee *at al.* (15) reported that in 1997 the average isolation rate of *V. parahaemolyticus* from sea products sold at markets in Korea was 4.4%. Compared to the previous studies on *V. parahaemolyticus*, our results showed a significantly larger number of positive findings.

Relationship between detection frequency and the case of food borne disease caused by *V. parahaemolyticus* Figure 3 illustrates the cases of food borne disease caused by *V. parahaemolyticus* from 2000 through 2004 in Korea (16). As shown in Fig. 2 and 3, the rate of detection of *V. parahaemolyticus* correlated well with the incidence of food borne disease caused by the same microorganism over the same five year period in Korea. As shown in Fig. 4, a direct relationship was found between yearly cases of food borne disease caused by *V. parahaemolyticus* and yearly detection frequencies of this pathogen in fishery products.

Seasonal trend of detection frequencies Figure 5 shows the detection frequency of *V. parahaemolyticus* to be 5.7, 3.2, and 3.2% in April, May, and November, respectively. The detection frequency increased from June through October with values of 20.5, 25.2, 26.1, 31.5, and 25.4% for each successive month. These results are consistent with reports that the minimum environmental temperature necessary for the detection of this organism in shellfish is 20°C (6), and that warm weather combined with a stagnant environment and a high concentration of organic nutrients provides ideal conditions for the growth of *V. parahaemolyticus* (3). These conditions would increase the opportunities for exposure to this organism via consumption of contaminated seafood. In most geographical areas where *V. parahaemolyticus* is known to occur, the incidence of the organism follows a distinct seasonal cycle with the highest counts recorded in the warm season and the lowest counts during the cold season (7, 11). Our findings show that the incidence of *V. parahaemolyticus* began to increase at the beginning of the summer, generally June, reached its peak in September, and then diminished from November on, the cold season.

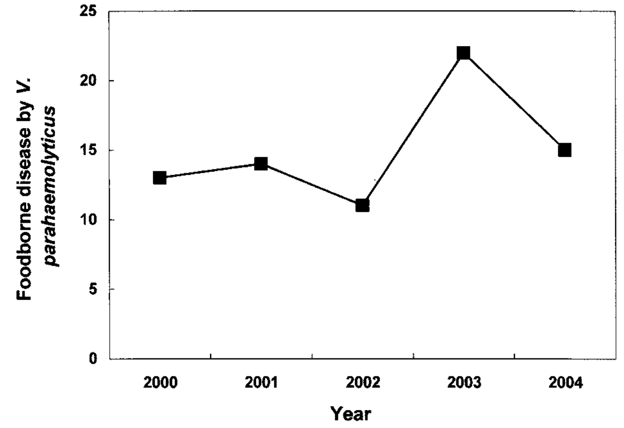

Fig. 3. Annual cases of food borne disease in Korea caused by *V. parahaemolyticus* over a five-year period (16).

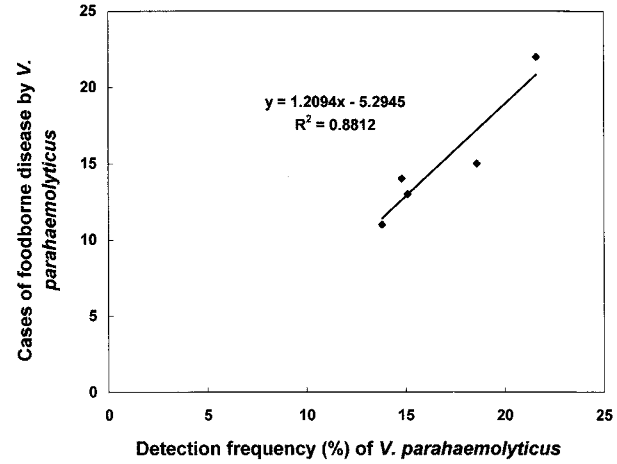

Fig. 4. Relationship between cases of food borne disease caused by *V. parahaemolyticus* and detection frequency of *V. parahaemolyticus* in Korean fishery products.

Relationship between monthly detection frequency and monthly cases of foodborne disease caused by *V. parahaemolyticus* As shown in Fig. 6, in Korea over the

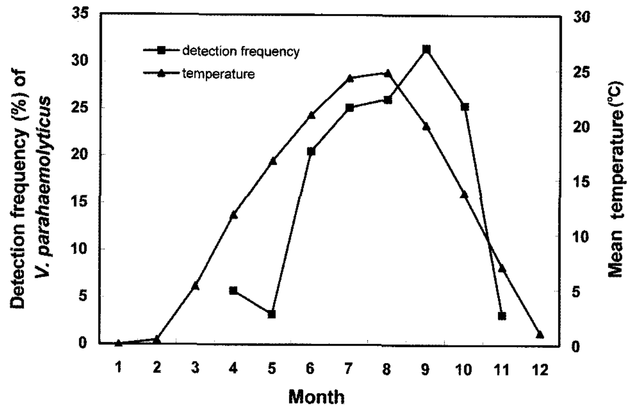

Fig. 5. Monthly detection frequency of *V. parahaemolyticus* in Korean fishery products over a five-year period.

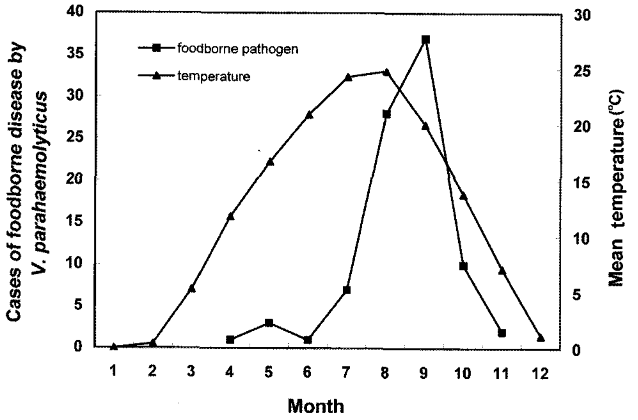

Fig. 6. Monthly cases of food borne disease in Korea caused by *V. parahaemolyticus* over a five-year period.

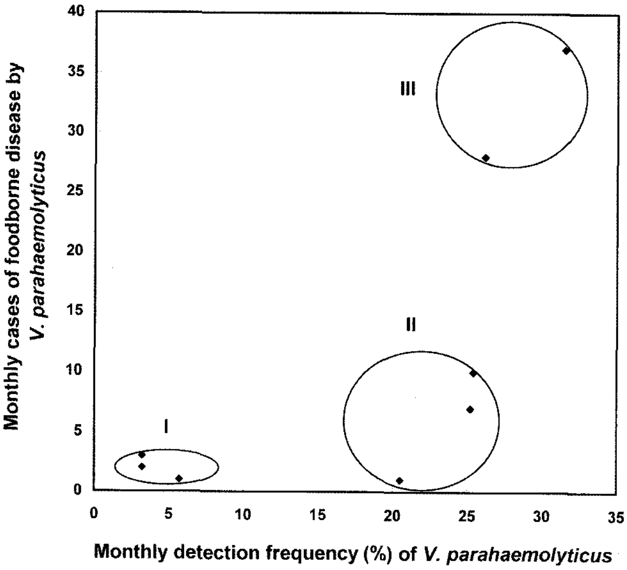

Fig. 7. Relationship between monthly cases of food borne disease caused by *V. parahaemolyticus* and monthly detection frequency of *V. parahaemolyticus* in Korean fishery products.

last five years, monthly cases of food borne disease caused by *V. parahaemolyticus* also began to increase in August and reached a peak in September. As shown in Fig. 7, the relationship between monthly cases of food borne disease caused by *V. parahaemolyticus* and monthly detection frequency of this pathogen were classified in three monthly groups. In group III (August and September), the connection between detection frequency and the incidence of food borne disease is clear. However, in the case of group II (June, July, and October), the detection frequency was high but cases of the food borne disease were relative low. Finally, in group I (April, May, and November), the frequency of detection and cases of food borne disease caused by *V. parahaemolyticus* were both low.

In conclusion, this study shows that the possibility of future outbreaks of food borne disease caused by *V. parahaemolyticus* in Korea is relatively minor between January and April. However, fishery products harvested from June through October must be handled sanitarily; otherwise the incidence of food borne disease caused by *V. parahaemolyticus* may increase remarkably. In particular, attention should be focused on food borne disease caused by *V. parahaemolyticus* from the ingestion of raw and unprocessed fishery products because the greatest incidence of food borne disease caused by *V. parahaemolyticus* is recorded in August and September.

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