Prevalence and Risk Factors Associated with Bacterial Food Poisoning in College Students at the Primary Care Unit

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Abstract

Food poisoning is defined as illness caused by the consumption of contaminated food, of which bacteria is a major cause. Khon Kaen province has the fourth highest rate of food poisoning in Thailand. A previous study in the province found raw meat contaminated with *Escherichia coli*, *Salmonella enterica*, and *Staphylococcus aureus*. The most commonly contaminated meat was pork, followed by beef and chicken. Despite this, there is insufficient awareness and concern regarding fsood poisoning among undergraduate students in the area, more than half of whom had experienced illness caused by consumption of local food. As there have been few studies conducted to examine food poisoning in college students in northeast Thailand, this retrospective descriptive study aimed to determine the prevalence and risk factors associated with bacterial food poisoning in these students at a primary care unit. Data were gathered from outpatient records, outbreak investigation data, and the electronic database at Primary Care Unit 123, Khon Kaen University, Srinagarind Hospital between August 2015 and July 2018.

The data of 155 participants, most of whom were female, were included in the study. The prevalence of bacterial food poisoning confirmed by rectal swab culture was 26.5%. The most common cause of illness was *Vibrio Parahaemolyticus* (39.0%), followed by *Plesiomonas shigelloides* (22.0%), *Vibrio Parahaemolyticus* with *Plesiomonas shigelloides* (12.2%), and *Salmonella* spp. (9.8%). Mucus in the stool (OR=8.40, 95% C.I=1.24-56.81) and consumption of papaya salad (OR=2.77, 95% C.I=1.22-6.27) were statistically significant risk factors for bacterial food poisoning in this group.

Keywords: *food poisoning, college student, primary care, factor, stool culture*

Introduction

Food poisoning is defined as an illness caused by the consumption of contaminated food. Bacteria is the cause of such outbreaks in about 75% of cases[1]. In the United States, most illnesses are caused by norovirus, and 39% are caused by bacteria, including nontyphoidal *Salmonella* spp., *Clostridium perfringens,* and *Campylobacter* spp.[2]. In 2018, there were 122,006 reported cases of food poisoning in Thailand, most commonly in patients aged 15-24, primarily caused by *Vibrio parahaemolyticus* and *Salmonella* spp. Khon Kaen province has the fourth highest rate of food poisoning in Thailand[3,4]. A previous study in the province found raw meat contaminated with *Escherichia coli, Salmonella enterica,* and *Staphylococcus aureus*. The most commonly contaminated meat was pork, followed by beef and chicken[5]. Despite this, there is insufficient awareness and concern regarding food poisoning among undergraduate students in the area, more than half of whom had experienced illness caused by the consumption of local food. Although about 27% of students in the area required medical care because of foodborne illness, approximately 35% continue to eat raw food[6]. As there have been few studies conducted to examine food poisoning in college students in northeast Thailand, this study aimed to determine the prevalence and risk factors associated with bacterial food poisoning

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in these students at a primary care unit.

Method

Study design

This retrospective descriptive study was conducted using data from outpatient documentation at the Primary Care Unit 123, Khon Kaen University, Srinagarind Hospital (PCU 123 KKU), the routine national infectious diseases report (R506 report) and Srinagarind Hospital's electronic database from August 2015 to July 2018. This study was approved by the Center for Ethics in Human Research, Khon Kaen University (Sub office) (Reference No. HE611391).

Participants

We included data from 155 participant's in the study. The inclusion were as follows: 1) the patient was a college student 18 years of age or older, 2) the patient was clinically diagnosed with bacterial food poisoning, and 3) rectal swab culture results were available. Any cases in which there were insufficient data were excluded from the study

Data collection

Outpatient documentation from PCU 123 KKU, data from the routine national infectious diseases report (R506 report), and data from the Srinagarind Hospital electronic database were reviewed. Microsoft Excel 2016 was used to record the data.

Statistical analysis

SPSS Statistics version 26.0 was used for data analysis. Descriptive analysis was presented as percentages, medians, and interquartile ranges. A Chi-square Test and Fisher's Exact Test were used to examine the relationship between each independent variable and rectal swab culture results by crude OR with 95% confidence interval. The significance level was set at 0.05.

Results

The 155 patients included in the study. All were from 18 to 26 years old with a median of 21 years old. Most (65.8%) were female, and 12.3%, 11.0%, and 10.3% belonged to the Faculty of Science, Faculty of Agriculture, and Faculty of Humanities and Social Science, respectively. Most experienced abdominal pain (85.8%) and fatigue (71.0%). Watery stool (58.1%), mushy stool (53.5%), strong-smelling stool (19.4%), and mucus in the stool (3.2%) were common fecal symptoms. A total of 9.0%, 3.9%, and 3.2% of patients had previously used acetaminophen, Salol et Menthol Mixture, and activated charcoal, respectively. Only 3.2% of patients had taken antibiotics before visiting the primary care unit. Patients reported having eaten high-risk foods including papaya salad (20.6%), Thai barbecue (18.7%), and noodles (18.1%). Approximately 112 patients (70.0%) had moderate dehydration.

The prevalence of bacterial food poisoning was 26.5%. The most common causes of illness were *Vibrio Parahaemolyticus* (39.0%), *Plesiomonas shigelloides* (22.0%), *Vibrio Parahaemolyticus* with *Plesiomonas shigelloides* (12.2%), and *Salmonella* spp. (9.8%), as shown in Table 1.

Table 1 Rectal swab culture results in college students at the primary care unit

Results of rectal swab culture (n = 41)	No. (%)
Vibrio Parahaemolyticus	16 (39.0)
Plesiomonas shigelloides	9 (22.0)
Vibrio Parahaemolyticus with Plesiomonas shigelloides	5 (12.2)
Salmonella spp.	4 (9.8)
Aeromonas spp.	3 (7.3)
Vibrio cholera	2 (4.9)
Shigella Flexneri group B	1 (2.4)
Plesiomonas shigelloides with Salmonella spp.	1 (2.4)

One hundred twenty patients were prescribed antibiotics (77.4%; 78.8% of those with negative rectal swab cultures 75.6% of those with positive cultures), all of whom received norfloxacin. Durations of antibiotic treatment were five days (45.8%), three days (18.1%), and seven days (8.4%).

Mucus in stool and consumption of papaya salad were significantly associated with bacterial food poisoning. Students with mucus in their stool were about eight times more likely to have bacterial food poisoning than those without (OR=8.40, 95% C.I=1.24-56.81). And students with history of consumption of papaya salad were about three times more likely to have bacterial food poisoning than those without (OR=2.77, 95% C.I=1.22-6.27).

Discussion

In 2018, 1,230,314 patients were diagnosed with food poisoning without confirmation via diagnostic test in Thailand, the majority of whom were female. The mortality rate was approximately 0.01 per 100,000 population[7]. We found that most cases were caused by *Vibrio parahaemolyticus*, a common cause of seafood-borne illness in many Asian countries[8], which is consistent with the findings of another study conducted in Khon Kaen. However, the second and third most common causes in the previous study were Escherichia coli and Salmonella spp.[9], respectively, whereas those in our study were Plesiomonas shigelloides and Vibrio parahaemolyticus with *Plesiomonas shigelloides*, respectively, followed by *Salmonella* spp. This may have been due to the fact that the previous study included all patients, including those in the inpatient department, where ours only included college students in the outpatient clinic of the primary care unit. In the previous study, diarrhea was the most common symptom for *Vibrio parahaemolyticus* infection and was associated with abdominal cramps, nausea, and vomiting. The food vehicle for *Vibrio parahaemolyticus* infection was seafood or cross-contamination with seafood, especially raw fish or shellfish.[8,10,11]

The second most common cause of bacterial food poisoning in our study was *Plesiomonas shigelloides.* Plesiomonads can colonize in cows, pigs, poultry, and – in tropical areas – fish and shellfish[12]. The consumption of raw and undercooked food is common in Southeast Asia[13,14]. In our study, the consumption of papaya salad statistically significant increase the risk of bacterial food poisoning. Although we did not find an association between the consumption of seafood and bacterial food poisoning, some types of papaya salad contain seafood. Moreover, previous studies found that the microbiological quality indices for *Staphylococcus aureus* and *Escherichia coli* contamination in green papaya salad exceed the standard limits and that coliform bacteria was most-commonly found in this type of food[15,16] Another study found the consumption of chicken rice, food containing coconut milk, fried rice, and leftover food to be associated with food poisoning. [4].According to the Thailand treatment guidance of acute diarrhea for community pharmacist, antibiotics should be prescribed when patients have mucous or blood in the stool with a history of fever (higher than 38.5 °C). A 3-5 day course of 400 mg of norfloxacin b.i.d. is recommended as first-line treatment[17]. However, only 62.1% of patients were prescribed three-to-five-day antibiotic treatment. All of the patients who did undergo antibiotic treatment received norfloxacin.

Bacterial enteropathogens produce acute watery diarrhea, so this condition is clinically nonspecific. However, the passage of bloody stools suggests possible bacterial colitis, which is often caused by *shigella*, *campylobacter*, nontyphoid *salmonella*, and Shiga toxin-producing *E. Coli*[18]. Diarrhea, abdominal cramps, nausea, vomiting, headache, fever, and chills are symptoms of *Vibrio parahaemolyticus* infection. In the most severe cases, watery diarrhea is associated with mucus, blood, and tenesmus[11]. Although a previous study found that stool with visible mucous and did not indicate a specific infecting agents, stool examination is still useful in the diagnosis of patients with diarrhea[19].

Conclusion

About one-fourth of the clinical diagnoses of bacterial food poisoning were confirmed via rectal swab culture. A history of consumption of papaya salad and mucus in the stool were associated with bacterial food poisoning.

Acknowledgments: The authors would like to a thank the staff at the PCU 123 KKU for their assistance in our study.

Ethical Clearance: Taken from the Center for Ethics in Human Research, Khon Kaen University (Sub office) (Reference No. HE611391).

Source of Funding: The authors received no specific funding for this work.

Conflict of Interest: The authors declare no conflict of interest.

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