ISSN 2348-313X (Print)
International Journal of Life Sciences Research ISSN 2348-3148 (online)
Vol. 8, Issue 4, pp: (23-26), Month: October - December 2020, Available at: www.researchpublish.com

Staphylococcal Food Poisoning in an Indigenous Tribe in the Philippines

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Abstract: **On December 2019, approximately 65 individuals from an Indigenous People (IP) group in the Philippines gathered to celebrate "Halad", a local term for a feast of thanks giving. Within hours of food consumption, 38 individuals experienced acute abdominal pain, diarrhea, nausea and vomiting. It was a coincident that during this time, our group composed of medical health workers and researchers was in the area doing an immersion to study their practices. 4 members of our team also experienced the same symptoms. No one from the patients want to be brought to the hospital since we are at the mountainous far flung area, so our team created a triage area to examine the patients; diagnostic area to collect stool specimen; nursing care area to provide immediate treatment; and evidence team to gather pertinent sample related to the incident. The trace-back investigation implicated that one of the food served during the "Halad" is positive in culture for enterotoxigenic *Staphylococcus aureus* as the source of contamination. This staphylococcal food poisoning case resulted from effect of food contamination allowing growth and synthesis of staphylococcal enterotoxin A (SEA) was found by ELISA in canned sardines which was added to the ferns to make up a fresh "fern salad" consumed by the people.**

Keywords: **Staphylococcal Food Poisoning, Enterotoxin A, Indigenous People, Fern salad.**

1. BACKGROUND

Food-borne diseases are major concerns worldwide. As stated by Le Loir et al. (2003), 66% of the food-borne outbreaks are due to bacteria. One of these bacteria is Staphylococcus aureus which produces Staphylococcal Enterotoxin A (SEA) that causes gastroenteritis. Staphylococci are normally present on human skin and mucous membranes with approximately 20-30% for persistent and 60% for intermittent colonization (Kluytmans *et al*., 2005). It was reported that Staphylococcal food-borne disease was the second most common cause of food-borne illness. In the study of Holmberg and Blake (1984) proteinaceous foods remain distinguished in causing Staphylococcal Food Poisoning (SFP). The SEA having a molecular weight between 28,000 and 35,000 daltons, belongs to the heterogeneous group of water-soluble but heat-stable globular proteins. As mentioned by Halpin-Dohnalek & Marth (1989), strains of Staphylococcus produces enterotoxin as affected by physical and chemical factors. Outbreaks are most often associated with processed foods, poultry products, sauces, dairy products, and bakery products. Staphylococcal food poisoning is frequently an underreported gastrointestinal illness since it is relatively mild and usually not life-threatening, but it is widespread worldwide. There are several outbreak of gastroenteritis due to SEA. As reported by Holmberg and Blake (1984), in a school district in the United States, food poisoning due to 2% chocolate milk containing SEA; Do Carmo et al. (2004), also studied the 4000 patients who experienced acute gastroenteritis after attended a gathering to celebrate a Catholic priest's ordination in Minas Gerais, Brazil; and an extensive outbreak of staphylococcal food poisoning occurred in Kansai district in Japan, as stated by Asao (2003).

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2. MATERIALS AND METHODS

Patient Data and Consultation Form

All 65 individuals with or without any of these symptoms: diarrhea, vomiting, abdominal distress and nausea are directed towards the triage area for proper examination by the physician. Symptoms experienced, time of onset, and food taken are well noted.

Sample Collection and Testing

Stool samples were collected from symptomatic individuals. It undergoes fecalysis and culture. Venous blood specimen was collected from individuals with symptoms and tested for CBC and preserved for additional serological testing.

Food Sample Testing

Representative (2 sampling) of the foods served on the occasion were collected. It includes the rice cooked in banana leaves, fern salad, roasted ducks and chickens, mixed fruits, sautéed mixed vegetables, condiments, and spring water.

Enterotoxin Testing

Cultured *Staphylococcus aureus* was tested for the presence of Staphylococcal Enterotoxin using a commercially available polyvalent enzyme-linked immunoassays (ELISA) that detect SEA-SEE.

3. RESULTS

Table 1: Patients' Distribution According to Sex and Symptomatology

Sex	Number	Asymptomatic	Symptomatic	Percentage
Male	42	14	28	67%
Female	23	13	10	43%
Total	65	27	38	58%

Table 1 shows the distribution of patients according to sex and symptomatology. It shows that 38 out of 65 individuals (f=58%) has symptoms and most of them are males (67%).

Table 2: Frequency of Symptoms Experienced by the Patients

Symptoms	Number	Frequency	Mean Time of Onset	Mean Length of Time
Diarrhea	24	37%	After 3 hours	Up to 8 hours
Nausea	38	58%	After 1 hour	Up to 6 hours
Vomiting	18	28%	After 3 hours	Up to 5 hours
Abdominal pain	38	58%	After 1 hour	Up to 6 hours
Fever	4	6%	After 8 hours	Up to 36 hours

The frequency of symptoms experienced by the patients are presented in Table 2. It depicts that most of the patients suffer from nausea and abdominal pain (f=58%) for up to 6 hours, followed by diarrhea (37%) for 8 hours, and vomiting (28%) for up to 5 hours. There are 4 patients who got low-grade fever that last up to 36 hours on average.

Table 3: Diagnostic Test Results

	Staphylococcus aureus (HG)*		*Salmonella & Shigella*		Other Bacteria	
Procedure	Positive	Negative	Positive	Negative	Positive	Negative
Culture						
a. Patients Stool	38	0	0	38	0	38
b. Rice	0	2	0	2	0	2
c. Fern salad	2	0	0	2	0	2
d. Fern sprouts	0	2	0	2	0	2
e. Canned sardines	2	0	0	2	2**	0
f. Roasted duck	0	2	0	2	0	2
g. Roasted chicken	0	2	0	2	0	2

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h. mixed fruits	0	2	0	2	0	2
i. Condiments	0	2	0	2	0	2
j. Spring water	0	2	0	2	0	2
	Amoebiasis		Giardiasis		Other Parasites	
Procedure	Positive	Negative	Positive	Negative	Positive	Negative
Fecalysis	0	38	0	38	2***	36
	WBC Count		Neutrophil Count		Lymphocyte Count	
Procedure	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal
CBC	34	4	34	4	36	2

**Heavy Growth* ***Coagulase-negative Staphylococci* ****Roundworm egg*

Table 3 discusses the results of diagnostic tests done on various samples to trace back the cause of food poisoning. It illustrates that 38 stool specimen from symptomatic patients are all positive for *Staphylococcus aureus*, and negative for other bacteria. On the food samples collected, with 2 sampling each, it shows that the fern salad and canned sardines is positive for *Staphylococcus aureus*. All food samples are negative for *Salmonella* and *Shigella* but the canned sardines was also noted to harbor *coagulase-negative Staphylococci*. CBC result shows that, there are 4 patients with high WBC and neutrophil count, while 2 patients has low lymphocyte count.

4. DISCUSSION

We investigated this case of poisoning that takes place among the indigenous people living in a remote mountainous area that is far from the rural areas. The first finding is that 58% (38 out of 65) of the members of the tribe have developed symptoms. Upon checking the data, all of these 38 symptomatic individuals are teenagers and adults while the 27 asymptomatic are children below 12 years old. We found out that it was a practice of this tribe that during "Halad" celebration, children are not allowed to join the clusters of patriots, instead they are group separately. This is the reason why these children have not eaten the foods taken by the adults. As stated by Garcia (2019), indigenous people from a native tribe in the Philippines still exercise a traditional culture. They have their own Practices in terms of health, science, and education that is far from the modern activities done by people living in rural area.

On symptomatology, the medical doctor from our team initially give her diagnosis that the patients are suffering from food poisoning. This is evident from the symptoms experienced by the patients. They have suffered from diarrhea, nausea, abdominal pain and vomiting that lasted from 1-8 hours. Few patients (4/38) have fever with onset after 8 hours after consumption and lasted for 36 hours. Symptoms of SFP are manifested within 2-8 hours of ingestion and include nausea, vomiting, abdominal cramping with or without diarrhea that typically resolve within 24-48 hours. (Argudin *et al*., 2010).

Results of laboratory testing shows that 38 stool samples are positive in culture for *Staphylococcus aureus*. However, the team have not proceeded with enterotoxin testing due to lack of available resources in the area. Nevertheless, the team have come-up with in-deep investigation to the source of contamination. The trace-back investigation implicated that one of the food served during the "Halad" is positive in culture for *Staphylococcus aureus* as the source of contamination. We found out that the "fern salad" with canned sardines prepared by one of the natives harbor the biologic hazard. Further testing shows that the fern leaves are negative for the bacteria while the canned sardines was positive. Upon checking, the source of canned sardines is the tribe chieftain and there are remaining 2 boxes of canned sardines stored in the house. We notice that it was already 11 months past the expiration date. We submitted sample to a more advance laboratory and we confirmed that it was positive for Staphylococcal Enterotoxin A using a commercially available polyvalent enzyme-linked immunoassays (ELISA) that detect SEA-SEE. It was also positive for coagulase-negative Staphylococci that are identified as non-human pathogen. Gutierrez et al. (2012), stated that once the food is contaminated with *S. aureus*, growth and production of enterotoxin can occur, especially if processing does not follow the good manufacturing conditions. Staphylococcal enterotoxins are heat stable and not denatured unless exposed to high temperatures for long periods, *i.e.*, autoclave at 121°C (250°F) at 15 PSI for 60 minutes (CDC, 2007).

Other laboratory diagnostic testing shows that patients stool sample are negative for amoeba and Giardia but 2 samples are observed to have roundworm egg. On CBC result, 4 patients have been noted to have high WBC and neutrophil count. These patients are those with fever. They are given some medications and fever is gone after 36 hours while CBC result becomes normal on the repeat testing done after 72 hours.

This case have been presented to the local officials and health center with the official conclusion that the case is a food poisoning due to Staphylococcal Enterotoxin A. We recommend some mitigation factors and provides education and awareness to the whole tribe.

ACKNOWLEDGMENTS

The team members have personally funded this case study and never accepted any support and funding from any person or organization.

Disclosure statement

The authors declare no conflicts of interest.

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